

BIOASSAYS OF THE SEMINOLE ELECTRIC COOPERATIVE

PALATKA, PUTNAM COUNTY, FLORIDA

NPDES #FL0036498

JULY 12, 1988

Biology Section
Division of Environmental Programs

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Biology Section
Bureau of Laboratories
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EXECUTIVE SUMMARY

Seminole Electric Cooperative, Palatka, Putnam County, Florida, NPDES #FL0036498, 13 to 15 April, 1988

Three separate acute toxicity bioassays and one Microtox® assay were performed on a sample from the Seminole Electric Cooperative facility in April, 1988. The sample was not toxic to the test organisms, Ceriodaphnia dubia, Daphnia pulex, and Notropis leedsi. The sample was also non-toxic to the Microtox® assasy test organism, Photobacterium phosphoreum, producing an EC_{50} > 100%.

Due to the non-toxic nature of the sample, chemical analyses were not performed.

INTRODUCTION

The Seminole Electric Cooperative generates power for the City of Palatka and portions of Putnam County. Figure 1 shows the approximate location of the facility in Palatka. The plant is a coal fired plant using cleaned Kentucky coal in two 600 megawatt generator units. The main plant discharge through Outfall #001 has a flow rate of approximately 5 MGD consisting of 4 MGD blowdown water from 2 cooling towers and 1 MGD from the plant's waste treatment facility. This waste treatment consists of washdown water and water from other operations. Approximately 18,000 GPD come from the plant's sewage treatment facility which serves a daily population of approximately 375 people. These flows combine in a surge tank and are discharged to the St. Johns River.

In October, 1987, the Biology Section performed bioassays on a sample from the Seminole Electric Cooperative facility. The results of these bioassays indicated the the sample was toxic to the test organism, Ceriodaphnia dubia, producing an LC_{50} of 55.8% sample concentration. This toxicity was attributed to the synergistic effects of several metals, including, copper (299 ug/l), cadium (2.7 ug/l), and zinc (32.3 ug/l) found in the sample (FDER 1987).

To again evaluate the existence and extent of toxicity in the cooling water effluent the Northeast District of FDER requested bioassays to be performed. Three static acute screening toxicity bioassays and one Microtox® assays were performed during April, 1988. Results are presented in this report. Those involved in peforming the tests and in preparation of the report were: J. M. Faircloth and R. B. Frydenborg.

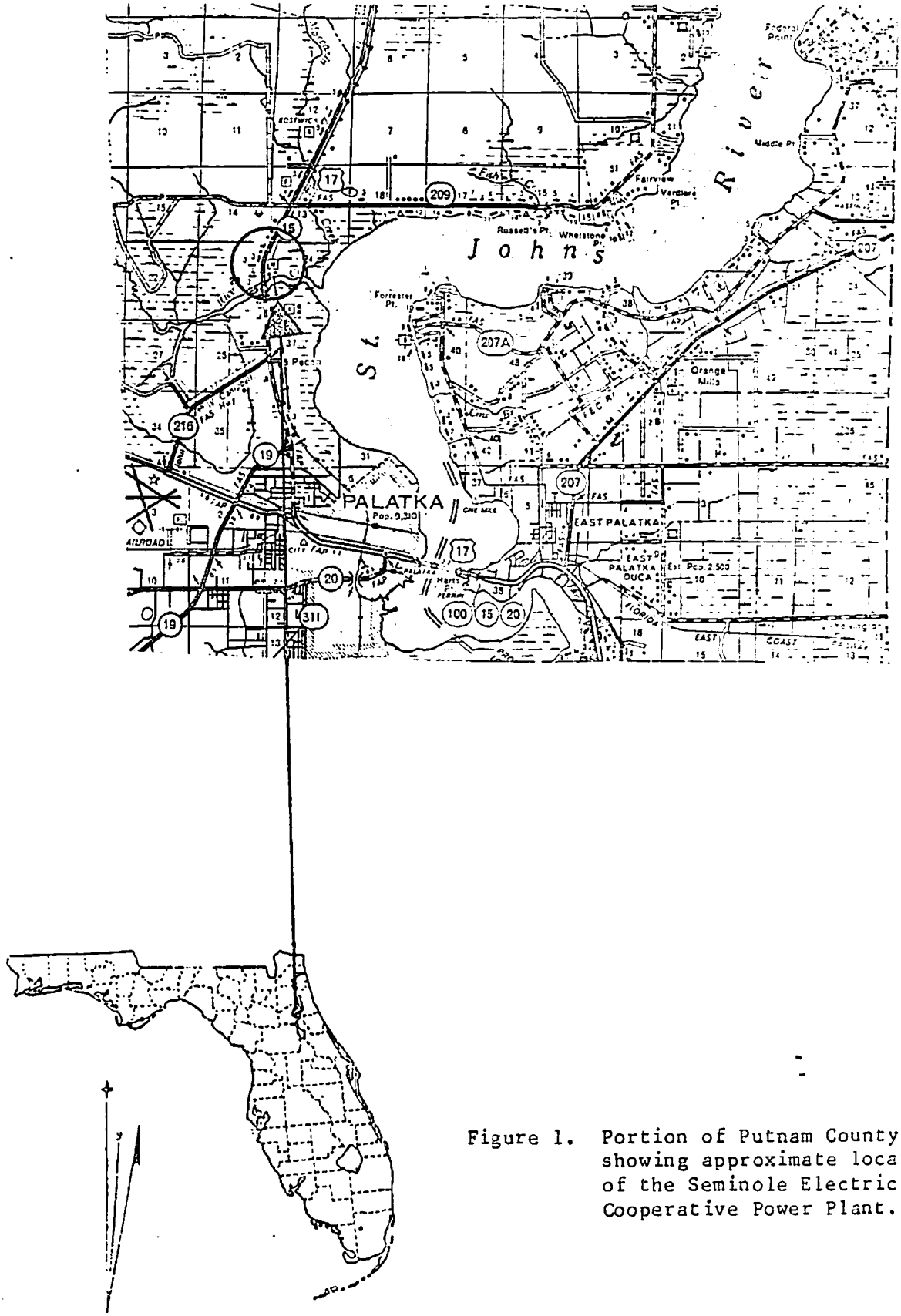


Figure 1. Portion of Putnam County showing approximate location of the Seminole Electric Cooperative Power Plant.

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).

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 June, 1987. This culture has been maintained since its arrival 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® and Cerophyl® twice daily, once daily on weekends, and are kept at a constant temperature of 22° ± 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.

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 30 and 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 Tetra-Min® 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 Tetra Min®. The fish used in this test were 21 days old at the time of the test.

Photobacterium phosphoreum, a luminescent marine bacterium, is maintained as a freeze-dried culture, purchased from Microbics Corporation. Lot number M-606 was used in this assay. Immediately prior to the assay, the culture is rehydrated with 1.0 ml of specially purified water (Microtox® Reconstitution Solution).

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.

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

Three static acute toxicity screening bioassays and one Microtox® assay were performed on a sample of water from the surge tank spigot of the Seminole Electric Cooperative power plant in Palatka. The sample was collected from the surge tank because the facility was not discharging. The tests were performed from 1000 hours on 13 April to 1000 hours on 15 April, 1988.

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 collected by Mr. Lee Banks of the Northeast District Office of the FDER at 0910 hours on 12 April, 1988, using standard wastewater sampling procedures. The samples were iced and transported to the DER laboratory in Tallahassee for analyses within 25 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° $\pm$ 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.

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 97%, 49.5%, 24.75%, 12.38%, and 0%. An incubation temperature of 15°C was maintained throughout the assay. Ten microliters 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.

Freshwater Tests

Freshwater for dilution of the recovered water samples 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, of each concentration and a control, were used to test with the water fleas, Ceriodaphnia dubia and Daphnia pulex. Flint glass jars of either 60 ml (for C. dubia) or 250 ml (for D. pulex) capacity were used as test chambers, and either 50 ml or 200 ml of the appropriate test concentration was placed in each chamber. Ceriodaphnia were siphoned into a large culture dish and neonates were transferred by glass pipette, and loaded 10 per chamber, resulting in 20 per test concentration. Daphnia were siphoned into a large culture dish to isolate the proper size and age organisms (neonates). To accomplish this, the Daphnia were siphoned through a stainless steel screen. The trapped adults were then discarded. These neonates were then transferred by glass pipette, examined for injury, and were loaded 10 per chamber, resulting in 20 per test concentration. Water fleas were not fed during these tests.

Two replicates, of 100% sample and a control, were used for the the Notropis leedsi (bannerfin shiner) bioassay. The fish were transferred individually or by twos, into wide mouth quart jars containing 500 ml each of the appropriate test concentration, and were loaded 5 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 33 S-C-T meter) of each test concentration was recorded at the beginning and end of the test. The salinity of the 100% sample was measured at the beginning 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 controls and the 100% reclaimed water test concentration at the beginning and end 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 in a small beaker. The sample was adjusted to 2% salinity with reagent

RESULTS AND DISCUSSION

The water sample collected from the Seminole Electric cooperative facility was not acutely toxic to the bioassay test organisms, Ceriodaphnia dubia, Daphnia pulex, and Notropis leedsi. The sample was also non-toxic to the Microtox® assay test organism, Photobacterium phosphoreum. The bioassay and Microtox® assay results indicate that the sample from Seminole Electric Cooperative was not toxic on 12 April, 1988.

Due to the non-toxic nature of the sample, chemical analyses were not performed.

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

Ceriodaphnia dubia (water flea)

Concentration	Dilution Water	Sample	Total Volume
Control	50.0 ml	--------	50 ml
30.0%	35.0 ml	15.0 ml	50 ml
60.0%	20.0 ml	30.0 ml	50 ml
100.0%	-------	50.0 ml	50 ml

Daphnia pulex (water flea)

Concentration	Dilution Water	Sample	Total Volume
Control	200.0 ml	--------	200 ml
30.0%	140.0 ml	60.0 ml	200 ml
60.0%	80.0 ml	120.0 ml	200 ml
100.0%	--------	200.0 ml	200 ml

Notropis leedsi (bannerfin shiner)

Concentration	Dilution Water	Sample	Total Volume
Control	500 ml	--------	500 ml
100.0%	------	500 ml	500 ml

Table 2. Data recorded during 48 hour static acute screening bioassays using Ceriodaphnia dubia, Daphnia pulex, and Notropis leedsi of Seminole Electrict Cooperative Power Plant, NPDES #FL0036498, on 13 to 15 April, 1988.

Facility: Seminole Electric Cooperative
Location: Putnam County
Sample Collection Date: 4/12/88 Time: 910
Test Beginning Date: 4/13/88 Time: 1000
Test Ending Date: 4/15/88 Time: 1000
NPDES # FL0036498
Contact/District: NE/Mark Sittig
Test type: Static Screening
tests: 3
Chlorination Type: None Detected
Facility Type: Industrial
Receiving Water: St. Johns River

Parameter		
Total Residual Cl2:	None Detected	
Method:	HACH	
By:	RBF	
Salinity:	1.8	
Ammonia:	Control Water	100% Sample
Unionized NH3:	0.00	0.02
Total NH3:	0	0.44

Organism: *Ceriodaphnia dubia* Age/Life stage: Neonates
LC50: Binomial: Moving Average: Probit: LC1:
non-toxic

Concentrations	SURVIVAL # at 0 hour	Live at 24 hr	Live at 48 hr	Dissolved Oxygen 0 hour	24 hour	48 hour	pH 0 hour	24 hour	48 hour	Temperature 0 hour	24 hour	48 hour	Conductivity 0 hour	48 hour
Control	10	10	10	9	8	8.9	8	8.4	8.3	19	20.3	19.4		
Control	10	10	10	9	8	8.9	8	8.4	8.3					
30%	10	10	10	9.2	8.2	9	7.9	8.4	8.3	19.2	19.8	19.5		
30%	10	10	10	9.2	8.2	8.9	7.9	8.4	8.3					
60%	10	10	10	9.3	8.4	9	7.9	8.3	8.2	19.6	19.8	19.5		
60%	10	10	10	9.3	8.4	9	7.9	8.3	8.2					
100%	10	10	10	9.5	8.4	8.9	7.7	8.2	8.1	20	19.8	19.5		
100%	10	10	10	9.4	8.4	8.9	7.7	8.2	8.1					

	Control water	100% sample
Alkalinity:	135	70
Hardness:	132	545

Organism: *Daphnia pulex* Age/Life stage: Neonates
LC50: Binomial: Moving Average: Probit:
non-toxic

Concentrations	SURVIVAL # at 0 hour	Live at 24 hr	Live at 48 hr	Dissolved Oxygen 0 hour	24 hour	48 hour	pH 0 hour	24 hour	48 hour	Temperature 0 hour	24 hour	48 hour	Conductivity 0 hour	48 hour
Control	10	9	9	9	8.4	8.9	8.1	8.4	8.3	19.5	19.6	19.3		
Control	10	10	10	9	8.4	8.9	8.1	8.4	8.3				260	228
30%	10	10	10	9.1	8.5	8.9	8.1	8.4	8.2	19.7	19.4	19.3		
30%	10	10	10	9.1	8.5	8.9	8.1	8.4	8.2				1000	1010
60%	10	10	9	9.4	8.7	8.9	8	8.3	8.1	20	19.3	19.3		
60%	10	10	9	9.4	8.6	8.9	8	8.3	8.1				1680	1720
100%	10	10	10	9.5	8.4	8.8	7.7	8.1	8	20.3	19.5	19.5		
100%	10	10	10	9.6	8.4	8.9	7.7	8.1	8				2550	2550

	Control water	100% sample
Alkalinity:	135	70
Hardness:	132	545

Organism: *Notropis leedsi* Age/Life stage: 21 days
LC50: Binomial: Moving Average: Probit:
non-toxic

Concentrations	SURVIVAL # at 0 hour	Live at 24 hr	Live at 48 hr	Dissolved Oxygen 0 hour	24 hour	48 hour	pH 0 hour	24 hour	48 hour	Temperature 0 hour	24 hour	48 hour	Conductivity 0 hour	48 hour
Control	5	5	5	8.6	8.1	8	7.6	8	8	20.4	19.7	19.7		
Control	5	5	5	8.7	8.1	8	7.6	8	8				220	210
100%	5	5	5	9.7	7.8	8.4	7.7	8	7.8	21	19.6	19.5		
100%	5	5	5	9.8	7.8	8.4	7.7	8	7.8				2650	2620

	Control water	100% sample
Alkalinity:	125	70
Hardness:	120	545

Table 3. Microtox test results , Seminole Electric Co-op , Palatka, Putnam County, NPDES # FL0036498 on 4/13/88.

Microtox Test Culture lot # M-606

Final Reclaimed Water

% Sample	Non-chlorinated	
	5-min	15-min
0	93	48
0	71	37
0	79	41
12.38	79	44
12.38	84	47
12.38	82	45
24.75	86	50
24.75	73	42
24.75	79	45
49.5	85	50
49.5	91	54
49.5	93	54
99	90	55
99	93	55
99	91	55

EC-50 Non-chlorinated (15 minute , 15 degree C) > 100 %.

EC50 (15 minute, 15 degrees 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, Biology Section. 1985. Quality Assurance Manual for Performing Acute Toxicity Tests (Second Edition). FDER.

_____. 1988. Bioassays of the Seminole Electric Cooperative, Palatka, Putnam County, Florida. NPDES #FL0036498. FDER. 11 p.

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.

Saint Croix
Effluent Characterization
Project No. 68-01-6938

Test Number: 1-3
Test Type: Effluent / Receiving Water (Screening) Conventional
Other:

Test Beginning: Date 4/1/88 Time 0910
Test Ending: Date 4/8/88 Time 1000
Test Organism: Ceriodaphnia dubia
Age/Life Stage: Neonate

Sample Identification	Number of Live Organisms					Dissolved Oxygen (mg/l)					pH					Temperature °C					Alkalinity/Hardness (mg/l as $CaCO_3$)				
	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
Initial	95	10	10			9.0	8.0	8.9			8.0	8.4	8.3			19.0	20.3	19.4							
Control	37	10	10			9.0	8.0	8.9			8.0	8.4	8.3								135		134		
30%	81	10	10			9.2	8.2	9.0			7.9	8.4	8.3			19.2	19.8	19.5			70		54		
30%	20	10	10			9.2	8.2	8.9			7.9	8.4	8.3												
60%	47	10	10			9.3	8.4	9.0			7.9	8.3	8.2			19.6	19.8	19.5							
60%	49	10	10			9.3	8.4	9.0			7.9	8.3	8.2												
100%	92	10	10			9.5	8.4	8.9			7.7	8.2	8.1			20.0	19.8	19.5							
100%	36	10	10			9.4	8.4	8.9			7.7	8.2	8.1												
Initial of Investigator		RBF	mf	mf		RBF	RBF	RBF			RBF	RBF	RBF			RBF	mf	RBF							

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

Control Water: 0
100% Sample: 0.4
Other:

Hour 0

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

Signature: Wendell Frederick
Printed: Wendell Frederick

Instrument Calibrations:

	pH Meter:	DO Meter:	S-C-T Meter:
0 Hours	7.7 7.9	9.0 21°C	10:10 ; 28.0 30
24 Hours	7.07 8.09	9.0 21°C	
48 Hours	7.07 8.09	9.0 21°C	14:10 28.2 30
72 Hours			
96 Hours			

Total Residual Chlorine:
Field data: ____ Method: ____
Lab: CI Method: Bart CBF
Lab: ____ Method: ____
Reviewed by:
Date: 7/11/88

De-chlorinated:
Measurements by: ____

Remarks: Obs Conc, 12.4@ 20°C
48 Hour 12.2@ 20

Seminole Electric
Palatka, Putnam County
Lee Hedges NPS
Effluent Serial Number 001
NPDES Permit Number FL0036498

3 3
Static / Renewal / Continuous / Conventional

4/13/88 0900
4/13/88 1000
Test Duration 120 hrs
Age/Life Stage 2 days

Replicate 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	43	5	5	5			8.6	8.1	8.0			7.6	8.0	8.0			20.4	19.7	19.7							
control	131	5	5	5			8.7	8.1	8.0			7.6	8.0	8.0								220		210		
100%	13	5	5	5			9.7	7.8	8.4			7.7	8.0	7.8			21.0	19.4	19.5							
100%	2	5	5	5			9.8	7.9	8.4			7.7	8.0	7.8								2650		2620		
Initial of Investigator		RCT	MT	AF			[illegible]	MT	JMF			RCT	RAF	JMF			RCT	MT	JMF			RCT		JMF		

Alkalinity Hardness (mg/l as $CaCO_3$)

Control Water: 125 | 124
100% Sample: 70 | 54
Other:
Measured by: MT

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

Control Water: 0
100% Sample: 0.4
Other:

Hour 0

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

Signatures:
Ronald Finkelstein
Ronald Frydenborg

Instrument Calibrations:

	pH Meter:	DO Meter:	S-C-T Meter:
0 Hours			
24 Hours			
48 Hours			
72 Hours			
96 Hours			

Remarks:

Total Residual Chlorine:
Field data: _____ Method: _____
Lab: _____ Method: _____
Lab: _____ Method: _____

De-chlorinated:
Measurements by: _____

Salinity 13

Reviewed by: [signature]

Date: 7/11/88

Industry/Toxicant: Sewage Effluent
Address: Bluffton, Ohio (Local)
Contact/District: Toledo/NE
Effluent Serial Number: 001
NPDES Permit Number: OH0036498

FISHKILL DATA FORM

Test Number: 2 of 3
Test Type: Effluent Renewal, Screening, Conventional
Other:

Sample Collection: Date 4/1/85 Time 0710
Test Beginning: Date 4/1/85 Time 1320
Test Ending: Date 4/15/85 Time 1000
Test Organism: Pimephales promelas
Age/Life Stage: Juvenile

Conc. or %	Test Contained 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	8	10	10	10			9.0	8.4	8.9			8.1	8.4	8.3			19.5	19.6	19.3							
Control	63	10	10	10			9.0	8.4	8.9			8.1	8.4	8.3								260		228		
30	65	10	10	10			9.1	8.5	8.9			8.1	8.4	8.2			19.7	19.4	19.3							
30	13	10	10	10			9.1	8.5	8.9			8.1	8.4	8.2								1060		1010		
60	1117	10	10	10			9.4	8.7	8.9			8.0	8.3	8.1			20.0	19.3	19.3							
60	43	10	10	10			9.4	8.6	8.9			8.0	8.3	8.1								1660		1720		
100	27	10	10	10			9.5	8.4	8.8			7.7	8.1	8.0			20.3	19.5	19.5							
100	53	10	10	10			9.6	8.4	8.9			7.7	8.1	8.0								2550		2550		
Initial of Investigator		mf	mf	mf			RBF	RBF	RBF			RBF	RBF	RBF			RBF	mf	RBF			RBF		mf		

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

Control Water: 135 / 132
100% Sample: 70 / 545
Other:
Measured by: mf

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

Control Water: 0
100% Sample: 0.440
Other:

Hour 0

Measured by: mf

Signature: Russell Frydenborg
Russell Frydenborg

Instrument Calibration:
pH Meter:
D.O. Meter:
Conductivity Meter:
Thermometer:

Total Residual Chlorine:
Field date: Method:
Lab: Method:
Lab: Method:

Technician:

Reviewed by:

Date: 7/11/85

083

MICROTOX™ Data Reduction Sheet

SOURCE: Seminole Electric Stimulatory

GRAPH CALC EC 50 (15 MIN, 15 °C) = >100 (%SAMPLE) mg/L

SAMPLE DATA:

SAMPLE TYPE (EFFLUENT, LEACHATE, ETC.): effluent non Cl2

DATE ASSAYED: 4 13 88 TIME: 9:00 AM

VISUAL COLOR: none 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: none

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

REMARKS:

MICROTOX™ 99% TEST

SAMPLE CUVETTE	% SAMPLE	READINGS 5 MIN	READINGS 15 MIN	I5	I15	NOTES
A1	0	93	48	X	X	
B1		71	37			
C1		79	41			
A2	12.38	71	44	-.006	-.074	
B2		84	47			
C2		82	45			
A3	24.75	86	50	.021	-.080	
B3		73	42			
C3		79	45			
A4	49.5	85	50	-.097	-.203	
B4		91	54			
C4		93	54			
A5	99	90	55	-.113	-.236	
B5		93	55			
C5		91	55			
EC_{50} (MIN, ° C)						

REVIEWED BY:

DATE: 7/11/88