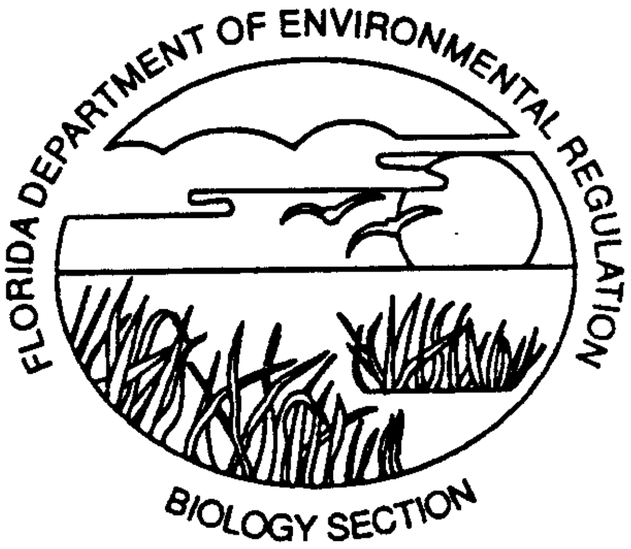


Bioassays of City of

Boca Raton Wastewater Treatment Plant

Boca Raton, Palm Beach County, Florida

NPDES #FL0026344

Sampled 5/28/91

June 20, 1991

Biology Section
Division of Administrative and Technical Services

Bioassays of City of

Boca Raton Wastewater Treatment Plant

Boca Raton, Palm Beach County, Florida

NPDES #FL0026344

Biology Section
Bureau of Laboratories
June 20, 1991

Introduction

Boca Raton Wastewater Treatment Plant, Boca Raton, Palm Beach County, Florida, NPDES #FL0026344, on 28 to 30 May, 1991.

This facility is located at 1501 West Glades Road and serves a population of approximately 150,000. The effluent is chlorinated and piped several miles to the Atlantic Ocean, where it is discharged through a 30" pipe one mile from shore in approximately 100' of water. The facility uses an activated sludge process to treat domestic wastes and light industrial waste. The design flow is 10 MGD and the volume treated approaches this amount.

The toxicity tests discussed in this report were performed in accordance with methods described by Peltier and Weber, 1985, *Methods for Measuring the Acute Toxicity of Effluents to Aquatic Organisms*, 3rd Edition, and by the FDER Biology Section, 1985, *Quality Assurance Manual for Performing Acute Toxicity Tests*, 2nd Edition.

Results and Discussion

The Biology Section performed static acute toxicity bioassays on a sample of effluent from this facility. The bioassay organisms used for these tests were the water flea, *Ceriodaphnia dubia*, and the fish, *Notropis leedsi*. The tests were performed on the chlorinated effluent and an aliquot of the effluent which was dechlorinated in the lab with sodium thiosulfate. The chlorinated effluent proved toxic to both test species producing LC_{50}'s of < 100%. The dechlorinated effluent proved toxic to *C. dubia*, producing an LC_{50} of 31.89%. The dechlorinated sample was not toxic to *N. leedsi*.

The total residual chlorine concentration in the sample was 0.6 mg/L (Hach). The total and unionized ammonia concentrations were 10.0 mg/L and 0.13 mg/L, respectively. Samples of effluent were not taken from the facility for further chemical analyses.

We attribute part of the toxicity noted in the sample to the total residual chlorine concentration in the sample and part to an additional unknown toxic constituent(s) in the sample.

Conclusion

The sample of effluent from this facility was toxic on 28 May, 1991. The toxicity was partially attributed to the total residual chlorine concentration in the sample. The additional cause(s) of toxicity is unknown.

Table 1. Concentration Series and Volumes Used for The Static Acute Bioassays of the City of Boca Raton WWTP.

Ceriodaphnia dubia (water flea)

Concentration	Dilution Water	Sample	Total Volume
Control	20.0 mL	0.0 mL	20 mL
6.0%	18.8mL	1.2 mL	20 mL
12.0%	17.6 mL	2.4 mL	20 mL
25.0%	15.0 mL	5.0 mL	20 mL
50.0%	10.0 mL	10.0 mL	20 mL
100.0%	0.0 mL	20.0 mL	20 mL

Notropis leedsi (bannerfin shiner)

Concentration	Dilution Water	Sample	Total Volume
Control	500 mL	0 mL	500 mL
6.0%	470 mL	30 mL	500 mL
12.0%	440 mL	60 mL	500 mL
25.0%	375 mL	125 mL	500 mL
50.0%	250 mL	250 mL	500 mL
100.0%	0 mL	500 mL	500 mL

Table 2. Data recorded during the static acute definitive bioassay of a sample of dechlorinated effluent from the City of Boca Raton WWTP, Boca Raton, Palm Beach County, Florida, NPDES# FL0026344 on 28 to 30 May, 1991.

Facility:	**City of Boca Raton WWTP**		NPDES #	**FL0026344**	Facility Type: **sewage treatment**
Location:	1501 W. Glades Road, Boca Raton		Contact/District:	P. Phillips / SE-WPB	
County:	Palm Beach County		Test type:	Static Acute Definitive	
Sample Collection Date:	**5/28/91**	Time: 0725	# tests:	2	Receiving Water: Atlantic Ocean
Test Beginning Date:	5/28/91	Time: 1430	Chlorination Type:	**Dechlorinated**	
Test Ending Date:	5/30/91	Time: 0930	Dechlor method:	lab, sodium thiosulfate	**Page 1 of 2**

Organism: ***Ceriodaphnia dubia*** Life stage: <24 hours
LC50: 31.89% Binomial: 31.89% Moving Average: 27.44% Probit: -

Concentrations	SURVIVAL # at 0 hr	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	4	8.6	8.7	8.8	8.0	8.2	8.1	21.2	22.0	21.3	174	178
Control	5	5	5	-	-	-	-	-	-	-	-	-	-	-
Control	5	5	4	-	-	-	-	-	-	-	-	-	-	-
Control	5	5	5	-	-	-	-	-	-	-	-	-	-	-
6%	5	5	4	8.6	8.7	8.8	7.9	8.2	8.3	21.3	22.0	21.3	216	223
6%	5	5	5	-	-	-	-	-	-	-	-	-	-	-
6%	5	5	4	-	-	-	-	-	-	-	-	-	-	-
6%	5	5	5	-	-	-	-	-	-	-	-	-	-	-
12%	5	5	5	8.6	8.7	8.9	7.9	8.3	8.3	21.3	22.0	21.3	245	258
12%	5	5	5	-	-	-	-	-	-	-	-	-	-	-
12%	5	4	4	-	-	-	-	-	-	-	-	-	-	-
12%	5	5	5	-	-	-	-	-	-	-	-	-	-	-
25%	5	5	4	8.6	8.6	8.8	7.8	8.3	8.4	21.3	22.0	21.3	330	343
25%	5	4	4	-	-	-	-	-	-	-	-	-	-	-
25%	5	5	4	-	-	-	-	-	-	-	-	-	-	-
25%	5	5	5	-	-	-	-	-	-	-	-	-	-	-
50%	5	4	0	8.2	8.7	8.9	7.7	8.3	8.4	21.2	22.0	21.3	470	478
50%	5	4	0	-	-	-	-	-	-	-	-	-	-	-
50%	5	3	0	-	-	-	-	-	-	-	-	-	-	-
50%	5	5	0	-	-	-	-	-	-	-	-	-	-	-
100%	5	0	0	7.9	8.7	-	7.5	8.3	-	20.9	22.0	-	750	770*
100%	5	0	0	-	-	-	-	-	-	-	-	-	-	-
100%	5	0	0	-	-	-	-	-	-	-	-	-	-	-
100%	5	0	0	-	-	-	-	-	-	-	-	-	-	-

* 24 hour conductivity

Total Residual Cl2	mg/l	Method
Field:	1.2	meter
Lab:	0.6	Hach
Lab:	0.8	Iodometric

Ammonia	Total (mg/l)	Unionized (mg/l)
Control Water (fish):	-	-
Cond. Control Water (daphnids):	-	-
100% Sample:	10.00	0.13

Alk & Hardness	Alkalinity (mg/l)	Hardness (mg/l)
Control Water (fish):	104	117
Cond. Control Water (daphnids):	53	79
100% Sample:	114	130

"continued"

Table 2. Continued

Facility:	**City of Boca Raton WWTP**		NPDES #	FL0026344	Facility Type: **sewage treatment**
Location:	1501 W. Glades Road, Boca Raton		Contact/District:	P. Phillips / SE-WPB	
County:	Palm Beach County		Test type:	Static Acute Definitive	
Sample Collection Date:	**5/28/91**	Time: 0725	# tests:	2	Receiving Water: Atlantic Ocean
Test Beginning Date:	5/28/91	Time: 1430	Chlorination Type:	**Dechlorinated**	
Test Ending Date:	5/30/91	Time: 0930	Dechlor method:	lab, sodium thiosulfate	**Page 2 of 2**

Total Residual Cl2	mg/l	Method
Field:	1.2	meter
Lab:	0.6	Hach
Lab:	0.8	Iodometric

Ammonia	Total (mg/l)	Unionized (mg/l)
Control Water (fish):	-	-
Cond. Control Water (daphnids):	-	-
100% Sample:	10.00	0.13

Alk & Hardness	Alkalinity (mg/l)	Hardness (mg/l)
Control Water (fish):	104	117
Cond. Control Water (daphnids):	53	79
100% Sample:	114	130

Organism: ***Notropis leedsi*** Age: 24 days
LC50: - Binomial: - Moving Average: - Probit: -

	SURVIVAL			Dissolved Oxygen			pH			Temperature			Conductivity	
Concentrations	# at 0 hr	Live at 24 hr	Live at 48 hr	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	48 hour
Control	5	5	5	8.8	8.0	8.1	7.8	8.0	8.2	21.2	21.0	20.9	-	-
Control	5	5	5	8.8	8.1	8.2	7.8	8.0	8.2	-	-	-	243	247
6%	5	5	5	8.8	8.0	8.1	7.8	7.9	8.2	21.1	21.0	20.8	-	-
6%	5	5	5	8.8	8.1	8.1	7.8	8.0	8.2	-	-	-	274	278
12%	5	5	5	8.7	7.8	7.9	7.8	8.0	8.2	21.1	21.0	20.7	-	-
12%	5	5	5	8.8	7.9	7.8	7.8	8.0	8.1	-	-	-	305	308
25%	5	5	5	8.5	7.8	7.9	7.7	8.0	8.1	21.1	21.1	20.7	-	-
25%	5	5	5	8.5	7.5	7.6	7.7	7.9	8.1	-	-	-	378	379
50%	5	5	5	8.3	7.6	7.6	7.7	7.9	8.1	21.0	21.0	20.7	-	-
50%	5	5	5	8.3	7.6	7.5	7.7	7.9	8.1	-	-	-	512	511
100%	5	5	5	8.0	7.7	7.7	7.5	7.9	8.1	21.0	21.0	20.8	-	-
100%	5	5	5	8.0	7.7	7.7	7.5	7.9	8.1	-	-	-	782	786

Table 3. Data recorded during the static acute definitive bioassay of a sample of chlorinated effluent from the City of Boca Raton WWTP, Boca Raton, Palm Beach County, Florida, NPDES# FL0026344 on 28 to 30 May, 1991.

Facility:	**City of Boca Raton WWTP**		NPDES #	FL0026344	Facility Type: **sewage treatment**
Location:	1501 W. Glades Road, Boca Raton		Contact/District:	P. Phillips / SE-WPB	
County:	Palm Beach County		Test type:	Static Screen	
Sample Collection Date:	**5/28/91**	Time: 0725	# tests:	2	Receiving Water: Atlantic Ocean
Test Beginning Date:	5/28/91	Time: 1430	Chlorination Type:	**Chlorinated**	
Test Ending Date:	5/30/91	Time: 0930			**Page 1 of 1**

Total Residual Cl2	mg/l	Method
Field:	1.2	meter
Lab:	0.6	Hach
Lab:	0.8	Iodometric

Ammonia	Total (mg/l)	Unionized (mg/l)
Control Water (fish):	-	-
Cond. Control Water (daphnids):	-	-
100% Sample:	10.00	0.13

Alk & Hardness	Alkalinity (mg/l)	Hardness (mg/l)
Control Water (fish):	104	117
Cond. Control Water (daphnids):	53	79
100% Sample:	114	130

Organism: ***Ceriodaphnia dubia*** Life stage: <24 hours
LC50: <100%

	SURVIVAL			Dissolved Oxygen			pH			Temperature			Conductivity	
Concentrations	# at 0 hr	Live at 24 hr	Live at 48 hr	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	24 hour
*Control	5	5	4	8.6	8.7	8.8	8.0	8.2	8.1	21.2	22.0	21.3	174	179
Control	5	5	5	-	-	-	-	-	-	-	-	-	-	-
Control	5	5	4	-	-	-	-	-	-	-	-	-	-	-
Control	5	5	5	-	-	-	-	-	-	-	-	-	-	-
100%	5	0	**	7.4	8.7	-	7.4	8.3	-	21.0	22.0	-	759	793
100%	5	0	**	-	-	-	-	-	-	-	-	-	-	-
100%	5	0	**	-	-	-	-	-	-	-	-	-	-	-
100%	5	0	**	-	-	-	-	-	-	-	-	-	-	-

*dechlorinated test control used **test terminated at 24 hours

Organism: ***Notropis leedsi*** Age: 24 days
LC50: <100%

	SURVIVAL			Dissolved Oxygen			pH			Temperature			Conductivity	
Concentrations	# at 0 hr	Live at 24 hr	Live at 48 hr	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	24 hour
*Control	5	5	5	8.8	8.0	8.1	7.8	8.0	8.2	21.2	21.0	20.9	-	-
Control	5	5	5	8.8	8.1	8.2	7.8	8.0	8.2	-	-	-	243	246
100%	5	0	**	7.4	7.6	-	7.4	7.8	-	20.7	21.0	-	-	-
100%	5	0	**	7.4	7.7	-	7.4	7.8	-	-	-	-	771	783

*dechlorinated test control used **test terminated at 24 hours

Table 4. LC_{50} Data for the Bioassay of the City of Boca Raton WWTP.

Organism	Method of Data Analysis	48 Hour LC_{50} (95% Confidence Intervals)
Chlorinated discharge		
Ceriodaphnia dubia	not calculated	<100%[a]
Notropis leedsi	not calculated	<100%[a]
Dechlorinated discharge		
Ceriodaphnia dubia	Binomial	31.89% (25.00%, 50.00%)[b]
	Moving Average	27.34% (22.08%, 34.18%)
	Probit	c

a The LC_{50} is <100% since all the organisms died in the lowest test concentration (100%).

b This LC_{50} is reported in the text since it is the most statistically conservative value of the data set.

c 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.

DER Biology Section — Acute Bioassay Bench Sheet

Sample Source: CITY OF BOCA RATON
Address/City: [illegible]
County: Palm Beach
Contact/District: PAUL PHILLIPS / SE-WPB
NPDES Permit #: FL0[illegible] Outfall #: 001

Sample Collection: Date 5-28-91 Time 7:25
Test Beginning: Date 5-28-91 Time 1430
Test Ending: Date 5/30/91 Time 0920
Test Organism: CERIODAPHNIA DUBIA
Life Stage/Age: <24 hours

Test Number: 1 of 2 Test Type: Screening | (Definitive) (Static) | Static Renewal | Flow-through

Remarks: CHLORINATED SAMPLE

Instrument Calibrations:

	pH	DO	Cond	Temp
0 hr	7.0, 9.09	8.7 @ 22.5	@ 1405 1405 @ 1349	22.2 @ 25
24 hr	7.0, 7.9	8.6 @ 22°C	1396	24.1 @ 23, 21.7 @ 24
48 hr	7.0, 7.9	8.5 @ 22°C	1396	21.7 @ 25

Conc.	Chamber #	Number Live 0	24	48	DO (mg/l) 0	24	48	pH 0	24	48	Temp. (°C) 0	24	48	Cond. (µmhos/cm) 0	24	48
CONTROL	A	5	5	4	8.6	8.7	8.5	8.0	8.2	8.1	21.2	22.0	21.3	174	179	179
CONTROL	B	5	5	5												
CONTROL	C	5	5	4												
CONTROL	D	5	5	5												
DeCl6%	A	5	5	4	8.6	8.7	8.5	7.9	8.2	8.3	21.3	22.0	21.3	216	220	220
6%	B	5	5	5												
6%	C	5	5	4												
6%	D	5	5	5							21.5					
DeCl12%	A	5	5	5	8.6	8.7	8.1	7.9	8.3	8.3	21.3	22.0	21.3	245	255	258
12%	B	5	5	5												
12%	C	5	4	4												
12%	D	5	5	5												
DeCl25%	A	5	5	4	8.6	8.6	8.1	7.8	8.3	8.4	21.3	22.0	21.3	330	342	343
25%	B	5	4	4												
25%	C	5	5	4												
25%	D	5	5	5												
DeCl50%	A	5	4	0	8.2	8.7	8.9	7.7	8.3	8.4	21.2	22.0	21.3	471	482	477
50%	B	5	5	0												
50%	C	5	3	0												
50%	D	5	5	0												
DeCl100%	A	5	0	—	7.9	8.7	—	7.5	8.3	—	20.9	22.0	—	750	773	—
100%	B	5	0	—												
100%	C	5	0	—												
100%	D	5	0	—	AP											
100% Cl	A	5	0	—	7.9	8.7	—	7.4	8.3	—	21.0	22.0	—	750	773	—
CHLOR-	B	5	0	—	7.4											
NATED	C	5	0	—												
	D	5	0	—												
Measured/Loaded by		MF	MF	MF	DF	KP	KP	DF	KP	KP	MF	KP	KP	KP	KP	KP
Recorded by		MF	MF	MF	KP	KP	KP	KP	KP	KP	KP	KP	KP	KP	KP	KP

Investigators' Signatures

Water-quality Parameters

	Well Water	Cond. Water	Sample	Method	Measured by
Field Tot. Resid. Cl					
Lab Tot. Resid. Cl					
Alkalinity	104	52			
Hardness	176				

DER Biology Section — Acute Bioassay Bench Sheet

Sample Source: CITY OF BOCA RATON — Sample Collection: Date 5-29-91 Time 7:25

Address/City: — Test Begin/Setup: Date 5-29-91 Time 14:30

County: — Test Ending: Date 5/31/91 Time 09:20

Contact/District: PAUL PHILLIPS SE-WPB — Test Organism: MYSIDOPSIS BAHIA

NPDES Permit #: — Outfall #: 001 — Test Salinity: 30 ppt

Test Number: 2 of 2 — Test Type: Screening / Definitive / Static / Static Renewal / Flow-through

Remarks: CHLORINATED SAMPLE

Conc.	Chamber #	Number Live 0	24	48	DO (mg/l) 0	24	48	Temp °C 0	24	48	Sal. ppt 0	24	48	Cond. mmhos/cm 0	24	48
CONTROL	37	5	5	5	8.5	8.0	8.1	21.1	21.0	20.9						
CONTROL	84	5	5	5	8.8	8.1	8.2									
1 6%	53	5	5	5	8.5	8.0	8.1									
2 6%	190	5	5	5	8.7	8.1	8.1									
3 12%	112	5	5	5	8.7	7.8	7.9									
4 12%	92	5	5	5	8.8	7.9	7.8									
5 25%	62	5	5	5	8.5	7.8	7.7									
6 25%	8	5	5	5	8.5	7.5	7.6									
7 50%	4	5	5	5	8.3	7.6	7.6									
8 50%	44	5	5	5	8.3	7.6	7.5									
9 100%	29	5	5	5	8.0	7.7	7.5									
10 100%	67	5	5	5	8.0	7.7	7.5									
CONTROL	39	5	0	—	7.4	7.6	—	20.7	21.0	—						
CONTROL	1	5	0	—	7.4	7.7	—									

Measured/Labeled by: MF MF MF MF KP MF MF KP MF MF MF MF MF MF MF MF MF MF

Recorded by: MF MF MF MF MF MF MF MF MF MF MF MF MF MF MF MF MF MF

Investigators' Signatures

Reviewer

Water Quality Parameters

	Salinity	Method	Measured by
Field Tot. Residual Cl			
Lab Tot. Residual Cl			P. PHILLIPS
Ammonia	124	53	
Hardness	117	79	
Total Alkalinity			