

Bioassays of the City of

Clearwater East & Northeast Wastewater Treatment Facilities

Clearwater, Pinellas County, Florida

NPDES #FL0021865 & FL0031607

Sampled 7/21/92

September 1992

Biology Section
Division of Technical Services

Bioassays of the City of

Clearwater East & Northeast Wastewater Treatment Facilities

Clearwater, Pinellas County, Florida

NPDES #FL0021865 & FL0031607

Biology Section
Bureau of Laboratories
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Introduction

Clearwater East and Northeast Advanced Wastewater Treatment Facilities, Clearwater, Pinellas County, Florida, NPDES #FL0021865 & #FL0031607, tests performed on 22 to 24 July, 1992.

The address for these combined facilities is 3141 Gulf-to-Bay Boulevard at Courtney Campbell Causeway in Clearwater. The design capacities of the Clearwater East Advanced WWTF and Clearwater Northeast Advanced WWTF are 5.0 mgd and 13.5 mgd, respectively.

The treatment process for both the East WWTF and Northeast WWTF consists of mechanical bar screens and grit removal, followed by a Bardenpho advanced wastewater treatment process. The Bardenpho process consists of primary anoxic tanks, aeration tanks, secondary anoxic tanks, re-aeration, and clarification. At each facility, the treated effluent is passed through a sand filter and chlorine contact chamber. The effluent from the Northeast WWTF is discharged through a pipeline to the East WWTF where the chlorinated effluents are combined, dechlorinated, and post-aerated prior to discharge into Tampa Bay (NPDES files).

The toxicity tests discussed in this report were performed in accordance with methods described by Weber, 1991, *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms*, 4th Edition, EPA/600/4-90/027.

Results and Discussion

The FDER Biology Section performed two 48-hour static acute definitive toxicity bioassays with a sample of combined effluent from these facilities. The bioassay organisms used for these tests were the water flea, *Ceriodaphnia dubia*, and the bannerfin shiner, *Notropis leedsi*. The test results indicated that the sample was toxic to the water flea, *C. dubia*, producing a 48-hour LC_{50} of 70%. The results did not indicate toxicity to the fish, *N. leedsi*.

Total residual chlorine measured in the sample was 0.02 mg/L. Total ammonia was not detected in the sample. Further chemical analyses were performed on separate samples from each facility and indicated the presence and amounts of the metals and organic compounds listed in Tables 3 and 4. Silver was detected in samples from each facility: 0.15 µg/L in the East WWTF sample and 0.8 µg/L in the Northeast WWTF sample. The surface water criterion for silver is ≤0.05 µg/L for Class II waters. Silver levels as low as 0.4 µg/L have been found to be acutely toxic to some freshwater invertebrates (EPA Aquatic Toxicity Information Retrieval database). Pesticides and herbicides were not detected in the sample.

Conclusion

The sample of effluent from this facility, which was collected on 21 July, 1992, was toxic to *C. dubia*, producing a 48-hour LC_{50} of 70%. We suggest that silver may have contributed to the toxicity.

Table 1. Concentration Series and Volumes Used for the 48-hour Acute Static Definitive Bioassays on combined effluent from the Clearwater East and Northeast WWTF, performed on 22 to 24 July, 1992.

Ceriodaphnia dubia (water flea)

Concentration	Dilution Water	Sample	Total Volume
Control	20 mL	0 mL	20 mL
25%	15 mL	5 mL	20 mL
50%	10 mL	10 mL	20 mL
75%	5 mL	15 mL	20 mL
100%	0 mL	20 mL	20 mL

Notropis leedsi (bannerfin shiner)

Concentration	Dilution Water	Sample	Total Volume
Control	500 mL	0 mL	500 mL
25%	375 mL	125 mL	500 mL
50%	250 mL	250 mL	500 mL
75%	125 mL	375 mL	500 mL
100%	0 mL	500 mL	500 mL

Table 2. LC_{50} Data for the Bioassay of the Combined Effluent from Clearwater East and Northeast WWTF, sampled on 21 July, 1992.

Organism	**Method of Data Analysis**	**48 Hour LC_{50} (95% Confidence Intervals)**
Dechlorinated effluent		
Ceriodaphnia dubia	Trimmed Karber Spearman	70.34% (65.20, 75.89%)
Notropis leedsi	not calculated	>100% [a]

[a] The LC_{50} is > 100% since all the organisms lived in the highest test concentration (100%).

Table 3. Results of chemical analyses on the sample of effluent from the Clearwater East WWTF, Pinellas County, collected on 21 July, 1992.

Metals

Aluminum	65	µg/L [a]
Cadmium	0.1	µg/L [t]
Calcium	74.4	mg/L [a]
Copper	6	µg/L [t]
Iron	28	µg/L [a]
Magnesium	6.5	mg/L [a]
Silver	0.15	µg/L [t]
Zinc	44	µg/L [a]

Base-Neutral & Acid Extractables

Tentative Identification	*Estimated Concentration*	
Aromatics	1	µg/L
Aliphatics	41	µg/L
Unknown	6	µg/L

Table 4. Results of chemical analyses on the sample of effluent from the Clearwater Northeast WWTP, Pinellas County, collected on 21 July, 1992.

Metals

Aluminum	96	µg/L
Calcium	71	mg/L
Iron	13	µg/L
Magnesium	5	mg/L
Silver	0.8	µg/L [t]
Zinc	30	µg/L

Base-Neutral & Acid Extractables

Bis (2-ethylhexyl) phthalate	5	µg/L [k]

Tentative Identification	*Estimated Concentration*	
Aliphatics	11	µg/L
Unknown	2	µg/L

a Value reported is the mean of two or more determinations.
k Actual valve is known to be less than given value.
t Value reported is less than the practical quantitation limit.

Table 5. Data recorded during the 48-hour static acute definitive bioassays of a sample of combined effluent from the City of Clearwater East and Northeast WWTF, Pinellas County, Florida, NPDES #Fl0021865 & Fl0031607, on 22 to 24 July, 1992.

Facility:	Clearwater East & Northeast WWTP (combined)		NPDES #	FL0021865 & FL0031607	Facility Type: Wastewater Treatment
Location:	Clearwater		Contact/District:	Kathy Hicks / SW	
County:	Pinellas		Test type:	static acute definitive	
Sample Collection Date:	7/21/92	Time: 1100	# tests:	2	Receiving Water: Tampa Bay
Test Beginning Date:	7/22/92	Time: 1330	Chlorination Type:	dechlorinated	
Test Ending Date:	7/24/92	Time: 1330	Dechlor Method:	Plant dechlorination unit	Page 1 of 2

Total Residual Cl2	mg/l	Method
Field:	not measured	
Lab:	0.02	Hach DR-100

Ammonia	Total (mg/l)	Unionized (mg/l)
Control Water (fish):	0.00	0.00
Cond. Control Water (daphnids):	0.00	0.00
100% Sample:	0.00	0.00

Alk & Hardness	Alkalinity (mg/l)	Hardness (mg/l)
Control Water (fish):	118	122
Cond. Control Water (daphnids):	60	70
100% Sample:	212	194

Organism: ***Ceriodaphnia dubia*** Life stage: < 24 Hours

LC50: 70% Trimmed Spearman Karber method (95% C.I. = 65%, 76%)

	SURVIVAL			pH			Temperature			Dissolved Oxygen			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	8.3	-	8.1	23.6	-	24.1	9.2	-	8.8	146	170
Control	5	5	5	-	-	8.1	-	-	-	-	-	8.8	-	-
Control	5	5	5	-	-	8.1	-	-	-	-	-	8.8	-	-
Control	5	5	5	-	-	8.1	-	-	-	-	-	8.8	-	-
25%	5	5	5	8.0	-	8.4	23.5	-	24.1	9.2	-	8.9	340	386
25%	5	5	5	-	-	8.4	-	-	-	-	-	8.9	-	-
25%	5	5	5	-	-	8.4	-	-	-	-	-	8.9	-	-
25%	5	5	5	-	-	8.4	-	-	-	-	-	8.9	-	-
50%	5	5	5	7.9	-	8.5	23.5	-	24.0	9.3	-	9.0	532	596
50%	5	5	5	-	-	8.5	-	-	-	-	-	9.0	-	-
50%	5	5	5	-	-	8.5	-	-	-	-	-	9.0	-	-
50%	5	5	5	-	-	8.5	-	-	-	-	-	9.0	-	-
75%	5	5	2	7.8	-	8.6	23.2	-	23.9	9.4	-	9.0	710	802
75%	5	5	1	-	-	8.6	-	-	-	-	-	9.0	-	-
75%	5	5	4	-	-	8.6	-	-	-	-	-	9.0	-	-
75%	5	5	1	-	-	8.6	-	-	-	-	-	9.0	-	-
100%	5	2	0	7.7	-	8.6	23.1	-	23.7	9.4	-	9.1	889	1010
100%	5	1	0	-	-	8.6	-	-	-	-	-	9.1	-	-
100%	5	1	0	-	-	8.6	-	-	-	-	-	9.1	-	-
100%	5	2	0	-	-	8.6	-	-	-	-	-	9.1	-	-

Table 5 (continued).

Facility:	Clearwater East & Northeast WWTP (combined)			NPDES #	FL0021865 & FL0031607	Facility Type:	Wastewater Treatment
Location:	Clearwater			Contact/District:	Kathy Hicks / SW		
County:	Pinellas			Test type:	static acute definitive		
Sample Collection Date:	7/21/92	Time:	1100	# tests:	2	Receiving Water:	Tampa Bay
Test Beginning Date:	7/22/92	Time:	1330	Chlorination Type:	dechlorinated		
Test Ending Date:	7/24/92	Time:	1330	Dechlor Method:	Plant dechlorination unit	Page 2 of 2	

Total Residual Cl2	mg/l	Method
Field:	not measured	
Lab:	0.02	Hach DR-100

Ammonia	Total (mg/l)	Unionized (mg/l)
Control Water (fish):	0.00	0.00
Cond. Control Water (daphnids):	0.00	0.00
100% Sample:	0.00	0.00

Organism: ***Notropis leedsi*** Age: 11 days
LC50: -

	SURVIVAL			pH			Temperature			Dissolved Oxygen			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	7.8	8.1	8.4	23.5	23.4	23.3	9.2	8.7	8.8	-	-
Control	5	5	5	7.8	8.1	8.4	-	-	-	9.2	8.7	8.8	243	245
25%	5	5	5	7.8	8.2	8.4	23.2	23.3	23.3	9.1	8.6	8.9	-	-
25%	5	5	5	7.8	8.2	8.4	-	-	-	9.1	8.6	9.0	410	404
50%	5	5	5	7.8	8.2	8.4	22.8	23.3	23.3	9.2	8.6	8.9	-	-
50%	5	5	5	7.8	8.2	8.4	-	-	-	9.2	8.6	8.9	580	590
75%	5	5	5	7.8	8.2	8.4	22.6	23.3	23.2	9.4	8.7	8.8	-	-
75%	5	5	5	7.8	8.2	8.4	-	-	-	9.4	8.7	8.8	744	752
100%	5	5	5	7.7	8.2	8.4	22.3	23.3	23.2	9.6	8.6	8.8	-	-
100%	5	5	5	7.7	8.2	8.4	-	-	-	9.6	8.6	8.9	894	928

Alk & Hardness	Alkalinity (mg/l)	Hardness (mg/l)
Control Water (fish):	118	122
Cond. Control Water (daphnids):	60	70
100% Sample:	212	194

DER Biology Section — Acute Bioassay Bench Sheet

Sample Source: CLEARWATER COMBINED EFFLUENT
Address/City: EAST + NE
County: PINELLAS
Contact/District: KATHY HICKS
NPDES Permit #: FL0021865 + Outfall #: 0031607
Test Number: 1 of 2 Test Type: Screening (Definitive) Static | Static Renewal | Flow-through

Sample Collection: Date 7-21-92 Time 1100
Test Beginning: Date 7-22-92 Time 1330
Test Ending: Date 7/24/92 Time 1330
Test Organism: C. DUBIA
Life Stage/Age: < 24 HRS

92-JUL-22-33 37807

Remarks:
COMBINED EFFLUENT FROM CITY OF EAST CLEARWATER AND NORTHEAST CLEARWATER AFTER PLANT DECHLORINATION.

LC_{50} = 70.3% TSK

Instrument Calibrations:

	pH	DO	Temp	Cond
0 hr	7.0, 7.0, 10	8.4 @ 25°C	24.2 @ 24.3°C	987 @ 1K @ 24.2°C; 9870 @ 10K
24 hr	7.0, 7.0, 10	8.4 @ 25°C	24.5 @ 24.5°C	1377 @ 24.2°C
48 hr	7.0, 7.0, 10	8.4 @ 25°C	24.2 @ 24.2°C	1378 @ 24.3°C

		Number Live			pH			Temp. (°C)			DO (mg/L)			Cond. (µmhos/cm)		
Conc.	Chamber #	0	24	48	0	24	48	0	24	48	0	24	48	0	24	48
control	A	5	5	5	8.3		8.1	23.6		24.1	9.2		8.8	146		170
control	B	5	5	5			8.1						8.8			
control	C	5	5	5			8.1						8.8			
control	D	5	5	5			8.1						8.8			
25%	A	5	5	5	8.0		8.4	23.5		24.1	9.2		8.9	340		386
25%	B	5	5	5			8.4						8.9			
25%	C	5	5	5			8.4						8.9			
25%	D	5	5	5			8.4						8.9			
50%	A	5	5	5	7.9		8.5	23.5		24.0	9.3		9.0	532		596
50%	B	5	5	5			8.5						9.0			
50%	C	5	5	5			8.5						9.0			
50%	D	5	5	5			8.5						9.0			
75%	A	5	5	2	7.8		8.6	23.2		23.9	9.4		9.0	710		802
75%	B	5	5	1			8.6						9.0			
75%	C	5	5	4			8.6						9.0			
75%	D	5	5	1			8.6						9.0			
100%	A	5	2	0	7.7		8.6	23.1		23.7	9.4		9.1	889		1010
100%	B	5	1	0			8.6						9.1			
100%	C	5	1	0			8.6						9.1			
100%	D	5	2	0			8.6						9.1			
Measured/Loaded by:		KP	MF	MF	MF		MF	MF		MF	MF		MF	MF		MF
Recorded by:		KP	MF	MF	KP		MF	KP		MF	KP		MF	KP		MF

Investigators' Signatures

Kim Pearce
Marshall Faulstitch

Reviewer

Water-quality Parameters

	Well Water	Cond. Water	Sample	Method	Measured by
Field Tot. Resid. Cl2:					
Lab Tot. Resid. Cl2:	0.0	0.0	0.02	DR-100	KP
Alkalinity:	118	60	212	Hach	KP
Hardness:	122	70	194	Hach	KP
Total Ammonia:	0.0	0.0	0.0	Orion	MF

Ammonia Meter Slope: -56.4
Ammonia Blank: 0.0
Salinity Sample: 0 ppt

DER Biology Section — Acute Bioassay Bench Sheet

Sample Source: CLEARWATER COMBINED
Address/City: EAST + NORTHEAST EFFLUENT
County: PINELLAS
Contact/District: KATHY HICKS - SW
NPDES Permit #: FL0021865 + 0031607 Outfall #: _____
Test Number: 2 of 2 Test Type: Screening (Definitive)
(Static) Static Renewal | Flow-through

Sample Collection: Date 7-21-92 Time 1100
Test Beginning: Date 7-22-92 Time 1330
Test Ending: Date 7/24/92 Time 1330
Test Organism: N. LEEDSI
Life Stage/Age: 11 DAYS

Remarks:

Instrument Calibrations:

	pH	DO	Temp	Cond
0 hr	7@7; 10@10	8.4@25°C	24.2@24.2°C	987 @ 1K @ 24.2°C 9870 @ 10K
24 hr	7@7; 10@10	8.4@25°C	24.5@24.5°C	1377@ 24.2°C
48 hr	7@7.1; 10@10	8.4@25°C	24.7@24.7°C	1378@ 24.2°C

Conc.	Chamber #	Number Live 0	24	48	pH 0	24	48	Temp. (°C) 0	24	48	DO (mg/L) 0	24	48	Cond. (µmhos/cm) 0	24	48
control	8	5	5	5	7.8	8.1	8.4	23.5	23.4	23.3	9.2	8.7	8.8			
control	57	5	5	5	7.8	8.1	8.4				9.2	8.7	8.8	243	242	245
25%	26	5	5	5	7.8	8.2	8.4	23.2	23.3	23.3	9.1	8.6	8.9			
25%	87	5	5	5	7.8	8.2	8.4				9.1	8.6	9.0	410	404	404
50%	18	5	5	5	7.8	8.2	8.4	22.8	23.3	23.3	9.2	8.6	8.9			
50%	50	5	5	5	7.8	8.2	8.4				9.2	8.6	8.9	580	583	590
75%	3	5	5	5	7.8	8.2	8.4	22.6	23.3	23.2	9.4	8.7	8.8			
75%	4	5	5	5	7.8	8.2	8.4				9.4	8.7	8.8	744	745	752
100%	21	5	5	5	7.7	8.2	8.4	22.3	23.3	23.2	9.6	8.6	8.8			
100%	65	5	5	5	7.7	8.2	8.4				9.6	8.6	8.9	894	917	928
Measured/Loaded by:		MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF
Recorded by:		MF	MF	MF	KP	MF	MF	KP	MF	MF	KP	MF	MF	KP	MF	MF

Investigators' Signatures
Kim Pearce
Marshall Faircloth

Reviewer

Water-quality Parameters

	Well Water	Cond. Water	Sample	Method	Measured by
Field Tot. Resid. Cl2:					
Lab Tot. Resid. Cl2:	0.0	0.0	0.02	DR-100	KP
Alkalinity:	118	60	212	Hach	KP
Hardness:	122	70	194	Hach	KP
Total Ammonia:	0.0	0.0	0.0	Orion	MF

Ammonia Meter Slope: -56.4
Ammonia Blank: 0.0
Salinity Sample: 0 ppt

DATE: 7/22/92 TEST NUMBER: 1 DURATION: 48 HR

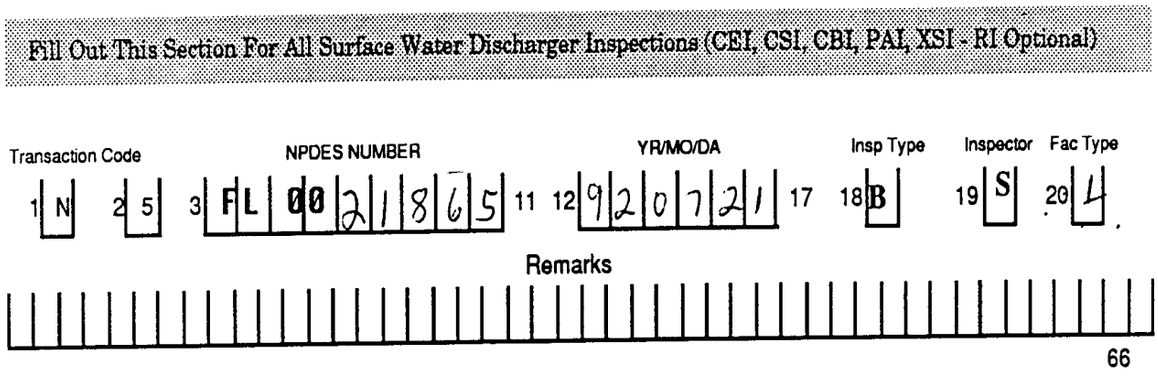
CHEMICAL: CLEARWATER E & NE COMBINED EFFLUENTS SPECIES: C. DUBIA

RAW DATA:

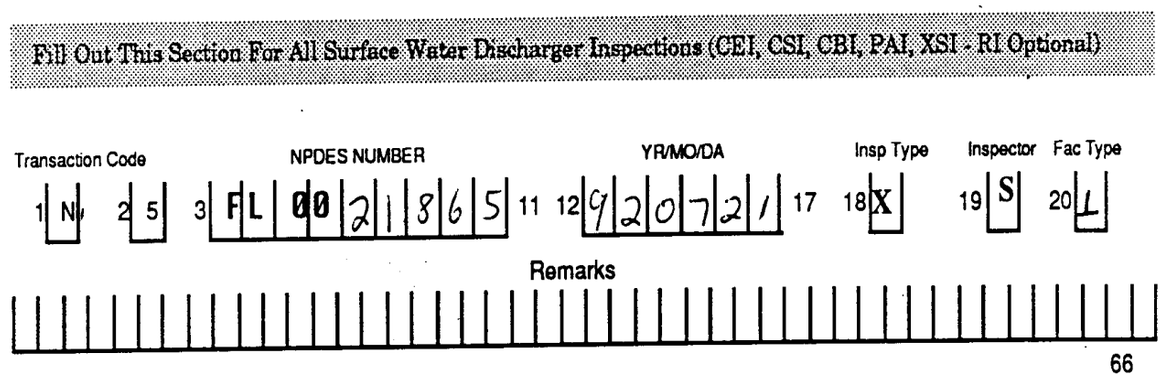
CONCENTRATION(%)	25.00	50.00	75.00	100.00
NUMBER EXPOSED:	20	20	20	20
MORTALITIES:	0	0	12	20
SPEARMAN-KARBER TRIM:		0.00%		

SPEARMAN-KARBER ESTIMATES: LC50: 70.34
95% LOWER CONFIDENCE: 65.20
95% UPPER CONFIDENCE: 75.89

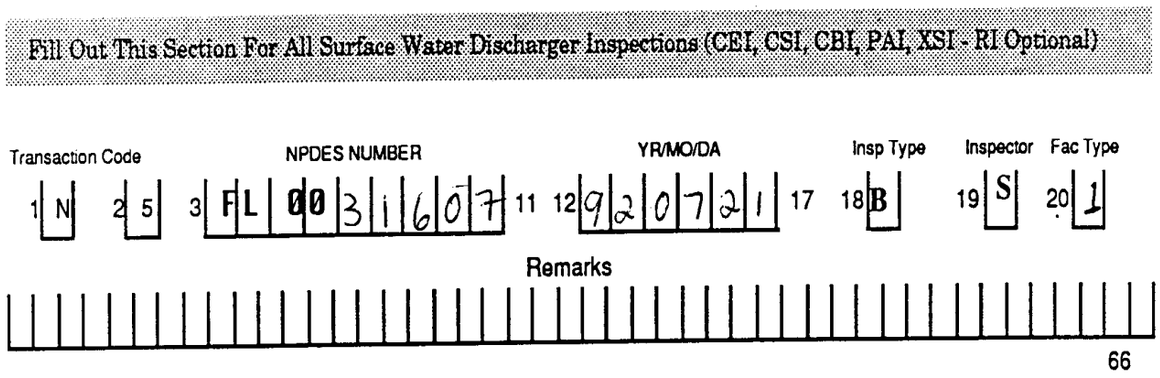
The Bioassay of the Clearwater East WWTP, NPDES# FL0021865, effluent sampled on July 21, 1992.



The Priority Pollutants Analysis for the Bioassay of the Clearwater East WWTP, NPDES# FL0021865, effluent sampled on July 21, 1992.



The Bioassay of the Clearwater Northeast WWTP, NPDES# FL0031607, effluent sampled on July 21, 1992.



The Priority Pollutants Analysis for the Bioassay of the Clearwater Northeast WWTP, NPDES# FL0031607, effluent sampled on July 21, 1992.

