Florida

Department of Environmental Protection

Bioassays of

Grand Olde Plaza Shopping Center
Sewage Treatment Plant

Clay County, Florida

No NPDES Number

Sampled 4/19/93

August 1993

Biology Section
Division of Technical Services

Bioassays of

Grand Olde Plaza Shopping Center Sewage Treatment Plant

Clay County, Florida

No NPDES Number

Biology Section
Bureau of Laboratories
August 1993

Introduction

Grand Olde Plaza Shopping Center Sewage Treatment Plant, Clay County, Florida, no NPDES #, tests performed on 20 to 22 April, 1993.

This facility is located at County Road 218 and State Road 21 near Middleburg in Clay County. It is a 0.04 MGD extended-aeration plant. Treatment consists of clarification, aeration, chlorination, dechlorination, and filtration through two slow sand filters. Effluent is discharged from a pipe at the sand filters to a swale to a stormwater ditch to the south branch of Black Creek. This facility does not have a NPDES permit to discharge to surface waters.

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 FDEP Biology Section performed two 48-hour static acute screening bioassays on a sample of chlorinated effluent from this facility. Two additional bioassays were performed on an aliquot of effluent which was dechlorinated in the laboratory with sodium thiosulfate. The test species used for the bioassays were the water flea, *Ceriodaphnia dubia*, and the bannerfin shiner, *Cyprinella leedsi* (formerly *Notropis leedsi*). The test results indicate that the chlorinated effluent and the dechlorinated aliquot were toxic to *C. dubia*, producing an $LC_{50} < 100\%$. Neither aliquot showed toxicity to *C. leedsi*.

The total residual chlorine of the sample was 0.1 mg/L in the laboratory. Total residual chlorine was not detected in the field. Total residual chlorine concentrations as low as 0.028 mg/L have been found to be acutely toxic to the cladoceran, *Daphnia magna* (EPA, *Quality Criteria for Water*, 1986). The total and unionized ammonia concentrations were 0.94 mg/L and 0.01 mg/L, respectively.

Further chemical analyses performed on the sample indicated the presence of the metals shown in Table 2. The copper concentration of 22 µg/L exceeds the surface water standard of 17.7 µg/L. Copper levels as low as 17 µg/L have been found to be acutely toxic to *C. dubia* (EPA *AQUIRE* toxicity database). The pesticide, diazinon (0.64 µg/L), was detected in the sample. Diazinon concentrations as low as 0.50 µg/L have been found to be acutely toxic to *C. dubia* (*AQUIRE*).

We attribute the toxicity in the sample to the chlorine, copper, and diazinon constituents of the sample. The diazinon and copper concentrations were probably sufficient to cause the toxicity observed in the dechlorinated tests.

Conclusion

The sample of effluent collected from this facility on 19 April, 1993 was toxic to *C. dubia*. The cause of toxicity is attributed to the total residual chlorine, copper, and the diazinon constituents of the sample.

Table 1. Concentration series and volumes used for the 48-hour static acute screening bioassays of the Grand Olde Plaza Shopping Center STP effluent performed on 20 to 22 April, 1993.

Ceriodaphnia dubia (water flea)

Concentration	Dilution Water	Sample	Total Volume
Control	20 mL	0 mL	20 mL
100 %	0 mL	20 mL	20 mL

Cyprinella leedsi (bannerfin shiner, formerly *Notropis leedsi*)

Concentration	Dilution Water	Sample	Total Volume
Control	500 mL	0 mL	500 mL
100 %	0 mL	500 mL	500 mL

Table 2. Results of chemical analyses of the effluent from Grand Olde Plaza Shopping Center STP, sampled on 19 April, 1993.

Metals		
Aluminum	519	µg/L
Calcium	45.5	mg/L
Copper	22	µg/L
Iron	166	µg/L
Magnesium	8.7	mg/L
Zinc	46	µg/L
Pesticides & Herbicides		
Diazinon	0.64	µg/L
Base-Neutral & Acid Extractables		
2,4,6-trichlorophenol	7.0	µg/L [T]

[T] Value reported is less than the practical quantitation limit.

Table 3. Data recorded during the 48-hour acute screening bioassays of a chlorinated sample of effluent from the Grand Olde Plaza Shopping Center STP, Clay County, Florida, No NPDES#, performed on 20 to 22 April, 1993.

Facility:	**Grand Olde Plaza Shopping Center STP**		**NPDES #**	**None**	Facility Type: **STP**
Location:			Contact / District:	Kristen Smeltzer/SW	
County:	Clay		Test type:	static acute screen	
Sample Collection Date:	**4/19/93**	Time: 1345	# tests:	2	Receiving Water: **Black Creek**
Test Beginning Date:	**4/20/93**	Time: 1430	Chlorination Type:	**Chlorinated**	
Test Ending Date:	**4/22/93**	Time: 1515			**Page 1 of 1**

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

	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	8.2	-	8.1	23.0	-	22.2	7.0	-	8.4	165	175
Control	5	5	5	-	-	8.2	-	-	-	-	-	8.4	-	175
Control	5	5	5	-	-	8.2	-	-	-	-	-	8.4	-	170
Control	5	5	5	-	-	8.2	-	-	-	-	-	8.4	-	190
100%	5	1	0	7.5	-	8.8	23.0	-	22.1	6.6	-	8.3	870	860
100%	5	0	0	-	-	8.8	-	-	-	-	-	8.4	-	880
100%	5	0	0	-	-	8.8	-	-	-	-	-	8.4	-	920
100%	5	1	0	-	-	8.8	-	-	-	-	-	8.4	-	920

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

	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	7.7	8.2	8.3	22.4	22.8	22.1	6.9	7.2	8.4	240	240
Control	5	5	5	7.7	8.2	8.3	-	-	-	6.9	7.2	8.4	240	240
100%	5	5	5	7.3	8.1	8.4	22.8	22.9	22.1	6.8	7.2	8.2	935	925
100%	5	5	5	7.3	8.1	8.4	-	-	-	6.8	7.2	8.2	940	925

Total Residual Cl2	mg/l	Method
Field:	-	
Lab:	0.10	DR-100

Ammonia	Total (mg/l)	Unionized (mg/l)
Control Water (fish):	< 0.017	0.00
20% Dilute Mineral Water (cladocerans):	< 0.017	0.00
100% Sample:	0.94	0.01

Alk & Hardness	Alkalinity (mg/l)	Hardness (mg/l)
Control Water (fish):	125	125
20% Dilute Mineral Water (cladocerans):	70	80
100% Sample:	260	165

Salinity (ppt)	
Control Water:	0
100% Sample:	0

Table 4. Data recorded during the 48-hour acute screening bioassays of a dechlorinated sample of effluent from the Grand Olde Plaza Shopping Center STP, Clay County, Florida, No NPDES#, performed on 20 to 22 April, 1993.

Facility:	**Grand Olde Plaza Shopping Center STP**		**NPDES #**	**None**	**Facility Type: STP**
Location:			Contact / District:	Kristen Smeltzer/SW	
County:	Clay		Test type:	static acute screen	
Sample Collection Date:	**4/19/93**	Time: 1345	# tests:	2	Receiving Water: Black Creek
Test Beginning Date:	4/20/93	Time: 1430	Chlorination Type:	**Sample dechlorinated**	
Test Ending Date:	4/22/93	Time: 1430		**after collection**	**Page 1 of 1**

Total Residual Cl2	mg/l	Method
Field:	-	
Lab:	< 0.03	DR-100

Ammonia	Total (mg/l)	Unionized (mg/l)
Control Water (fish):	< 0.017	0.00
20% Dilute Mineral Water (cladocerans):	< 0.017	0.00
100% Sample:	0.94	0.01

Alk & Hardness	Alkalinity (mg/l)	Hardness (mg/l)
Control Water (fish):	125	125
20% Dilute Mineral Water (cladocerans):	70	80
100% Sample:	260	165

Salinity (ppt)	
Control Water:	0
100% Sample:	0

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

	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	8.2	-	8.3	23.0	-	22.1	7.1	-	8.3	165	170
Control	5	5	5	-	-	8.3	-	-	-	-	-	8.3	-	175
Control	5	5	5	-	-	8.3	-	-	-	-	-	8.4	-	170
Control	5	5	5	-	-	8.3	-	-	-	-	-	8.4	-	170
100%	5	3	0	7.5	-	8.8	23.1	-	22.1	6.7	-	8.2	870	890
100%	5	3	0	-	-	8.8	-	-	-	-	-	8.2	-	900
100%	5	2	0	-	-	8.8	-	-	-	-	-	8.2	-	865
100%	5	3	0	-	-	8.8	-	-	-	-	-	8.2	-	860

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

	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	7.7	8.2	8.2	22.2	22.8	22.0	7.3	7.3	8.5	240	240
Control	5	5	5	7.7	8.2	8.2	-	-	-	7.3	7.3	8.5	240	240
100%	5	5	5	7.4	8.1	8.4	22.9	22.8	21.9	6.9	7.2	8.1	935	910
100%	5	5	5	7.4	8.1	8.4	-	-	-	6.9	7.2	8.1	940	920

Table 5. 48-hour LC_{50} Data for Bioassay of Grand Olde Plaza Shopping Center STP effluent performed on 20 to 22 April, 1993.

Organism	Method of Data Analysis	48-Hour LC_{50}
Chlorinated effluent		
Ceriodaphnia dubia	non-calculated	< 100% [a]
Dechlorinated effluent		
Ceriodaphnia dubia	non-calculated	< 100% [a]

[a] The LC_{50} is < 100% since all the organisms died in the lowest test concentration (100%). Test ran for 48 hours.

DER Biology Section — Acute Bioassay Bench Sheet

Sample Source: Grand Olde Plaza S.C
Location: Grand Olde Plaza SC Effluent
County: Duval
Contact/District: Kristen Smeltzer / NE
NPDES Permit #: FL00 Outfall #: 54105
93 APR 20 03

Sample Collection: Date 4-19-93 Time 13:45
Test Beginning: Date 4/20/93 Time 14:30
Test Ending: Date 4/22/93 Time 15:15
Organism Batch #: Diluent Batch #: 2
Organism Age: <24hrs.
Test Organism: Ceriodaphnia dubia

Test Type: (Screening) | Definitive
(Static) | Static Renewal | Flow-through

Test Number: 3 of 4

Remarks:

Instrument Calibrations: pH Temperature °C D.O. mg/L Conductivity µmhos/cm

0 hr 7.0 @ 7.0 23.6 @ 23.7 8.4 @ 23.5 980 @ 1,000 @23.6
9.0 @ 9.0 9870 @ 10,000

24 hr 7.0 @ 7.0 23.2 @ 23.3 8.4 @ 23.6 980 @ 1,000 @23.6
9.0 @ 9.0 21.7 TR 21.8 TR 8.7 22.0 9890 @ 10,000

48 hr 7.0 @ 7.0 ~~22.4~~ @ ~~22.6~~ ~~8.6~~ @ ~~23.0~~ 980 @ 1,000 @23.7
9.0 @ 9.0 9870 @ 10,000

		Number Live			pH			Temperature (°C)			D.O. (mg/L)			Cond. (mmhos/cm) 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	8.2		8.1	23.0		22.2	7.0		8.4	165		175
Control	B	5	5	5			8.2						8.4			175
Control	C	5	5	5			8.2						8.4			170
Control	D	5	5	5			8.2						8.4			190
100%	A	5	1	0	7.5		8.8	23.0		22.1	6.6		8.3	870		860
100%	B	5	0	0			8.8						8.4			880
100%	C	5	0	0			8.8						8.4			920
100%	D	5	1	0			8.8						8.4			920
Measured/Loaded by:		MF	TM	TM	TR		TM	TR		TM	TR		TM	TR		TM
Recorded by:		TR	TM	TM	TM		TR	TM		TR	TM		TR	TM		TR

Investigators' Signatures

Tina Mikulski
Tobin Rader
Marshall Swindoll

Reviewer

form updated 10/20/92

Water Quality Parameters	Salt Water/ (Well Water)	20% Min Water	Sample	Method	Measured by
Field Total Residual Cl2:					
Lab Total Residual Cl2:	<0.03	<0.03	.10	DR-100	TM
Alkalinity:	125	70	290	Hach	TR
Hardness:	125	80	160	Hach	TR
Total Ammonia:	<0.017	<0.017	0.941	Orion	MF

Cl_2 Blank: <0.03 Ammonia Meter Slope: -548 Ammonia Blank: <0.017 Sample Salinity: 0 ppt

DER Biology Section — Acute Bioassay Bench Sheet

Sample Source: Grand Olde Plaza SC
Location: Grand Olde Plaza Shopping Center Effluent
County: Duval
Contact/District: Kristen Smeltzer / NE
NPDES Permit #: FL00 Outfall #:
93 APR 20 03 54105

Sample Collection: Date 4-19-93 Time 13:45
Test Beginning: Date 4/20/93 Time 14:30
Test Ending: Date 4/22/93 Time 14:30
Organism Batch #: 17 Diluent Batch #: Well
Organism Age: 11 days
Test Organism: Notropis leedsi

Test Type: (Screening) | Definitive
(Static) | Static Renewal | Flow-through

Test Number: 2 of 4

Remarks:

de Cl

Instrument Calibrations:

	pH	Temperature °C	D.O. mg/L	Conductivity µmhos/cm
0 hr	7.0 @ 7.0; 9.0 @ 9.0	23.6 @ 23.7	8.4 @ 23.5	980 @ 1,000; 9870 @ 10,000 @ 23.6
24 hr	7.0 @ 7.0; 9.0 @ 9.0	23.2 @ 23.3	8.4 @ 23.6	980 @ 1,000; 9890 @ 10,000 @ 23.6
48 hr	7.0 @ 7.0; 9.0 @ 9.0	~~23.4~~ 21.7 TR @ ~~22.6~~ 21.8 TR	~~8.6~~ 8.7 @ ~~23.0~~ 22.0	980 @ 1,000; 9870 @ 10,000 @ 23.7

Conc.	Chamber #	Number Live 0	24	48	pH 0	24	48	Temperature (°C) 0	24	48	D.O. (mg/L) 0	24	48	Cond. (µmhos/cm) 0	24	48
Control	76	5	5	5	7.7	8.2	8.2	22.2	22.8	22.0	7.3	7.3	8.5	240	240	240
Control	413	5	5	5	7.7	8.2	8.2				7.3	7.3	8.5	240	240	240
100%	88	5	5	5	7.4	8.1	8.4	22.9	22.8	21.9	6.9	7.2	8.1	935	920	910
100%	147	5	5	5	7.4	8.1	8.4				6.9	7.2	8.1	940	930	920
Measured/Loaded by:		TM	TM	TM	TR	TM	TM	TR	TM	TM	TR	TM	TM	TR	TM	TM
Recorded by:		TR	TM	TM	TM	TR	TR	TM	TR	TR	TM	TR	TR	TM	TR	TR

Investigators' Signatures
Tina Mihulka
Tobin Rader

Reviewer

Water Quality Parameters

	Salt Water/ Well Water	20% Min Water	Sample	Method	Measured by
Field Total Residual Cl2:					
Lab Total Residual Cl2:	<0.03	<0.03	<0.03	DR400	TM
Alkalinity:	125	70	260	Hach	TR
Hardness:	125	80	165	Hach	TR
Total Ammonia:	<0.017	<0.017	~~<0.017~~ 0.94 TR	Orion	MF

Cl_2 Blank: <0.03 Ammonia Meter Slope: -54.8 Ammonia Blank: <0.017 Sample Salinity: 0 ppt

form updated 10/20/92