

Bioassays of

Monroe County Public Service Building Wastewater Treatment Plant

Stock Island, Monroe County, Florida

NPDES #FL0030562

Sampled 5/16/94

July 1994

Biology Section
Division of Administrative and Technical Services

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Monroe County Public Service Building Wastewater Treatment Plant

Stock Island, Monroe County, Florida

NPDES #FL0030562

Biology Section
Bureau of Laboratories
July 1994

Introduction

Monroe County Public Service Building WWTP, Stock Island, Monroe County, Florida, NPDES #FL0030562, tests performed on 18 to 20 May 1994.

This facility is located on Junior College Road on Stock Island and has a capacity of 12,000 GPD. The facility is an extended aeration wastewater treatment plant. Chlorination is used for disinfection. Dechlorination is accomplished by addition of sodium sulfite tablets. The average flow of 3000 GPD is discharged via Cow Creek Channel to the Gulf of Mexico (facility summary provided by Nancy Brooking, FDEP Marathon).

The toxicity tests discussed in this report were performed in accordance with methods described by Weber, 1993, *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms*, 4th Edition, EPA/600/4-90/027F.

Results and Discussion

The FDEP Biology Section performed one definitive and one screening 48-hour static acute toxicity bioassay on a sample of effluent from this facility. The salinity of the sample was about 1.8 ppt, therefore, the test species were the mysid shrimp, *Mysidopsis bahia* (definitive bioassay) and the inland silverside, *Menidia beryllina* (screening bioassay).

To accommodate the salinity requirement of 1–32 ppt for *Menidia*, the control water for the *Menidia* test was adjusted to 1.8 ppt using an artificial sea salt mixture (Forty Fathoms®) to match the salinity of the effluent as collected. The salinity of the effluent sample was not adjusted for the *Menidia* test. To accommodate the salinity require of 5–30 ppt for *Mysidopsis bahia*, artificial sea salts were used to adjust the salinity of both the control water and an aliquot of the effluent to the minimum 5 ppt for the mysid test.

The initial dissolved oxygen concentration of the sample, as received in the laboratory, was 2.8 mg/L. To achieve a minimum D.O. $\geq$ 4.0 mg/L as required for test initiation, the sample was aerated until late afternoon, at which time the D.O. remained below 4.0 mg/L and the tests could not be initiated. Usually a sample with low D.O. can be aerated to acceptable levels in only a few minutes. The lengthy time required for aeration of this sample indicated that an oxygen demand had to be fulfilled first.

The sample was aerated overnight and the D.O. was 7.3 mg/L the next morning at test initiation. To sustain the required D.O. level, all test jars were aerated for the duration of the tests as well.

Although the sample exceeded its holding time due to the aeration required, the test results indicate that the sample was toxic to both test species. The LC_{50} for the mysid definitive test was 285% (Probit method). The *Menidia* screening test had a non-calculated $LC_{50} < 100\%$ since 80% mortality occurred in 100% effluent.

Total residual chlorine of the sample was < 0.03 mg/L in the laboratory and 0.35 mg/L in the field. Prior to sample aeration, total and unionized ammonia concentrations were 12.25 mg/L and 1.60 mg/L, respectively, and 10.8 mg/L and 1.41 mg/L, respectively, after the initial 24 hours of sample aeration. Unionized ammonia levels as low as 0.08 mg/L and 0.5 mg/L have been found to be acutely toxic to some freshwater fish and invertebrates, respectively. However, saltwater fish appear to be more sensitive to unionized ammonia than freshwater fish (EPA, *Quality Criteria for Water*, 1986).

Further chemical analyses were performed on the sample and several metals and organic compounds were identified (Table 2). The metals and organics do not appear to be present in concentrations known to be acutely toxic to the test species. Pesticides were not detected.

Conclusion

The sample of effluent collected from this facility on 16 May 1994 was toxic to both *Mysidopsis bahia* and *Menidia beryllina*. The sample holding time was exceeded as a result of the initial 24 hours of aeration required for the sample to achieve a minimum D.O. ≥ 4.0 mg/L. Exceeding holding times and aeration normally reduce toxicity. The cause of toxicity was attributed to the unionized ammonia.

Table 1. Concentration series and volumes used for the 48-hour static acute bioassays of the Monroe County Public Service Building WWTP effluent performed on 18 to 20 May, 1994.

Mysidopsis bahia (mysid shrimp)

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

Menidia beryllina (inland silverside)

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 on the effluent from Monroe County Public Service Building WWTP, sampled on 16 May, 1994.

Metals

	Effluent			Class III marine standards	
Aluminum	220	µg/L	A	≤ 1500	µg/L
Calcium	91.8	mg/L	A	none	
Copper	13	µg/L	A *	≤ 2.9	µg/L
Iron	264	µg/L	A	≤ 300	µg/L
Magnesium	9.3	µg/L	A	none	
Mercury	0.27	µg/L	*	≤ 0.025	µg/L
Silver	1.8	µg/L	A *	≤ 0.05	µg/L
Zinc	108	µg/L	A *	≤ 86	µg/L

Pesticides & Herbicides

None Detected

Base-Neutral & Acid Extractables

Phenol	110	µg/L	

Tentatively Identified Compounds

Dimethyl disulfide	34	µg/L	J
Pentanoic acid	24	µg/L	J
1-methyl-4-(1-methyl-ethylidene) cyclohexane	29	µg/L	J
Fenchone	38	µg/L	J
D-fenchyl alcohol	41	µg/L	J
Camphor	58	µg/L	J
Endo-borneol	94	µg/L	J
1-alpha-terpineol	151	µg/L	J
1H-indole	70	µg/L	J
Hexadecanoic acid	94	µg/L	J
Octadecanoic acid	188	µg/L	J

Unidentifiable organic compounds (total)	120	µg/L	J
Unidentifiable aliphatic	16	µg/L	J
Unidentifiable alcohol	8.5	µg/L	J

A Value reported is the mean of two or more determinations.
J Estimated value.
* Value exceeded Class III marine surface water quality criterion, 17-302.530 FAC.

Table 3. Data recorded during the 48-hour static acute bioassays of a sample of effluent from the Monroe County Public Service Building WWTP, Stock Island, Monroe County, Florida, NPDES# FL0030562, performed on 18 to 20 May, 1994.

Facility:	Monroe County Public Service Building WWTP		NPDES #	FL0030562	Facility Type:	Sewage Treatment Plant
Location:	Stock Island		Contact/District:	G. Rios, N. Brooking/S		
County:	Monroe		Test type:	static acute		
Sample Collection Date:	5/16/94	Time: 1000	# tests:	2	Receiving Water:	Cow Key Channel
Test Beginning Date:	5/18/94*	Time: 0900	Chlorination Type:	Sample collected		to Gulf of Mexico
Test Ending Date:	5/20/94	Time: 0930		after dechlorination	Page 1 of 1	

*Sample aerated 24 hours before suitable (≥ 4.0 mg/L) dissolved oxygen level obtained.

Total Residual Cl2	mg/L	Method
Field:	0.35	-
Lab:	< 0.03	DR-100

Ammonia	Total (mg/L)	Unionized (mg/L)
Control Water:	< 0.017	0.00
100% Sample:	12.25	1.60

Alk & Hardness	Alkalinity (mg/L)	Hardness (mg/L)
Control Water:	145	-
100% Sample:	630	-

Salinity	mysids (ppt) *	Menidia (ppt) *
Artificial Sea Water:	5.0	1.8
100% Sample:	5.0	1.8

* Salinity converted from conductivity readings.

Organism: ***Mysidopsis bahia*** Life stage: 4 days

LC50 = 285% Probit (no C. I.)

	SURVIVAL			pH			Temperature			Dissolved Oxygen**			Conductivity (mmhos/cm)	
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	8.4	8.3	8.2	23.5	22.8	22.3	7.7	7.7	8.1	8.8	9.2
Control	5	5	5	8.4	8.3	8.2	-	-	22.2	7.9	7.6	8.0	8.8	9.3
25%	5	4	4	8.4	8.2	8.3	23.5	22.5	22.3	8.0	7.1	8.3	8.8	9.3
25%	5	5	5	8.4	8.3	8.3	-	-	22.4	8.0	7.7	8.4	8.8	9.4
50%	5	5	5	8.4	8.3	8.4	23.4	22.5	22.4	8.0	7.6	8.5	8.8	9.3
50%	5	5	5	8.4	8.3	8.4	-	-	22.3	7.9	7.7	8.5	8.8	9.5
75%	5	5	5	8.5	8.5	8.4	23.3	22.5	22.3	7.7	7.9	8.6	8.9	9.3
75%	5	5	5	8.5	8.5	8.4	-	-	22.2	7.7	8.0	8.5	8.9	9.4
100%	5	4	2	8.5	8.4	8.3	23.5	22.6	22.4	7.3	7.9	8.0	8.9	9.4
100%	5	4	4	8.5	8.4	8.5	-	-	22.4	7.3	7.8	7.9	8.9	9.5

Organism: ***Menidia beryllina*** Age: 8 days

LC50 <100% (not calculated)

	SURVIVAL			pH			Temperature			Dissolved Oxygen**			Conductivity (mmhos/cm)	
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 A	5	5	4	8.5	8.4	8.4	23.3	22.8	22.5	8.3	8.2	8.3	3.4	3.6
Control B	5	5	5	8.5	8.4	8.4	-	-	22.4	8.3	8.3	8.5	3.4	3.7
100% A	5	5	1	8.5	8.4	8.5	22.8	22.8	22.6	6.5	8.0	8.6	3.5	3.9
100% B	5	5	1	8.4	8.4	8.5	-	-	22.5	7.5	8.0	8.5	3.5	4.0

** All test jars aerated continously for duration of test. Initial D.O. 2.8 mg/L. 0-hour D.O.'s measured after 24-hours of aeration, prior to loading test organisms.

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Monroe County Public Service Bldg
Location: Effluent
County: Monroe
Contact/District: G Rios / South
NPDES Permit #: FL00 3 0562 Outfall #: 94-MAY-17-03 80110

Sample Collection: Date 5/16/94 Time 1000
Test Beginning: Date 5/18/94* Time 0900
Test Ending: Date 5/20/94 Time 0930
Organism Batch #: 19 Diluent Batch #: —
Organism Age: 4 days old
Test Organism: Mysidopsis bahia

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

Test Number: 1 of 2

Remarks: LC50 = 28.5% (no CI) Probit
Control water made with well water and 40F salts (To 5‰)
Effluent salinity adjusted to 5‰ with same 40F salts

Instrument Calibrations:	pH	Temperature °C	D.O. mg/L	Conductivity µmhos/cm
	meter # 7851	90H018262	90H018262	G9005749
0 hr	7.0 @ 7.0 9.0 @ 9.0	23.8 @ 23.9	8.3 @ 24.7	960 @ 1,000 9560 @ 10,000 @ 24.1 °C
24 hr	7.0 @ 7.0 9.0 @ 9.0	23.5 @ 23.5	8.4 @ 23.7	960 @ 1,000 9670 @ 10,000 @ 23.8 °C
48 hr	7.0 @ 7.0 9.0 @ 9.0	23.0 @ 23.1	8.5 @ 23.4	970 @ 1,000 9680 @ 10,000 @ 23.0 °C

* Initial D.O. 2.8 mg/L. SAMPLE HAD D.O. OF 1.0 mg/L AFTER AERATING TIL 4PM ON 5-17-94. AERATED SAMPLE FOR 24H PRIOR TO TEST INITIATION.

Conc.	Chamber #	Number Live 0 hr	24 h	48 h	pH 0 hr	24 h	48 h	Temperature (°C) 0 hr	24 h	48 h	D.O. (mg/L) 0 hr	24 h	48 h	UNCORRECTED Cond. (mmhos/cm) Cond. (µmhos/cm) 0 hr	24 h	48 h
Control A	85	5	5	5	8.4	8.5	8.2	23.5	22.8	22.3	7.7	7.7	8.1	8.8	90	9.2
Control B	63	5	5	5	8.4	8.3	8.2			22.2	7.9	7.6	8.0	8.8	9.1	9.3
25% A	163	5	4	4	8.4	8.2	8.3	23.5	22.5	22.3	8.0	7.1	8.3	8.8	9.0	9.3
25% B	74	5	5	5	8.4	8.3	8.3			22.4	8.0	7.7	8.4	8.8	9.2	9.4
50% A	25	5	5	5	8.4	8.3	8.4	23.4	22.5	22.4	8.0	7.6	8.5	8.8	9.0	9.3
50% B	76	5	5	5	8.4	8.3	8.4			22.3	7.9	7.7	8.5	8.8	9.1	9.5
75% A	15	5	5	5	8.5	8.5	8.4	23.3	22.5	22.3	7.7	7.9	8.6	8.9	9.1	9.3
75% B	87	5	5	5	8.5	8.5	8.4			22.2	7.7	8.0	8.5	8.9	9.2	9.4
100% A	26	5	4	2	8.5	8.4	8.3	23.5	22.6	22.4	7.3	7.9	8.0	8.9	9.2	9.4
100% B	2	5	4	4	8.5	8.4	8.5			22.4	7.3	7.8	7.9	8.9	9.3	9.5
Measured/Loaded by:		MF	MF	TM	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF
Recorded by:		MF	TM	TM	TR	TM	TM	TR	TM	TM	TR	TM	TM	TR	TM	TM

all test jars aerated for duration of test.

Total Ammonia After 24-hr Aeration: 10.5

Investigators' Signatures

Tobin A. Rader
Tina Mikulski
Marshall Faircloth
Kim Pearce
Reviewer

form updated 7/8/93

Water Quality Parameters	(Salt Water) Well Water	20% Min Water	Sample	Method	Measured by
Field Total Residual Cl2:			0.35	—	N. BROOKING
Lab Total Residual Cl2:	<0.03	—	<0.3	DR-LOD	TR
Alkalinity:	145	—	630	Hach	TM
Hardness:	—	—	—	—	—
Total Ammonia:	<0.017	—	12.25	Orion	TM

Ammonia Meter #98136 Ammonia Meter Slope: -59.3 Ammonia Blank: <0.017 Control Salinity: 5 ppt Sample Salinity: 5 ppt

UNIONIZED 1.60

Sample Source: Monroe County Public Service Bldg
Location:
County: Monroe
Contact/District: G. Rios / South
NPDES Permit #: FL00 30562 94-MAY-17-03 Outfall #: 80110

Sample Collection: Date 5/16/94 Time 1000
Test Beginning: Date 5/18/94* Time 0900
Test Ending: Date 5/20/94 Time 0930
Organism Batch #: 19 Diluent Batch #: —
Organism Age: 8 days old
Test Organism: Menidia beryllina

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

Test Number: 2 of 2

Remarks: Control water made with well water and 40F (Hyper saline brine) To 1.8‰ Effluent salinity was not adjusted.

Instrument Calibrations:	pH	Temperature °C	D.O. mg/L	Conductivity µmhos/cm
meter #	7851	90H018262	90H018262	G9005749
0 hr	7.0 @ 7.0 9.0 @ 9.0	23.8 @ 23.9	8.3 @ 24.7	960 @ 1,000 9560 @ 10,000 @ 24.1 °C
24 hr	7.2 @ 7.0 9.0 @ 9.0	23.5 @ 23.5	8.4 @ 23.7	960 @ 1,000 9670 @ 10,000 @ 23.8 °C
48 hr.	7.0 @ 7.0 9.0 @ 9.0	23.0 @ 23.1	8.5 @ 23.4	970 @ 1,000 9685 @ 10,000 @ 23.0 °C

* SAMPLE STILL HAD D.O. OF 1.0 AFTER AERATING TIL 4PM ON 5/17/94.
* SAMPLE AERATED FOR ~24H PRIOR TO TEST INITIATION.

Conc.	Chamber #	Number Live 0 hr	24 h	48 h	pH 0 hr	24 h	48 h	Temperature (°C) 0 hr	24 h	48 h	D.O. (mg/L) 0 hr	24 h	48 h	UNCORRECTED Cond. (mmhos/cm) / Cond. (µmhos/cm) 0 hr	24 h	48 h
Control A	57	5	5	4	8.5	8.4	8.4	23.3	22.8	22.5	8.3	8.2	8.3	~~3.5~~	3.6	3.6
Control B	65	5	5	5	8.5	8.4	8.4			22.4	8.3	8.3	8.5	~~3.6~~	3.7	3.7
100% A	4	5	3	1	8.5	8.4	8.5	22.8	22.8	22.6	6.5	8.0	8.6	~~3.5~~	3.8	3.9
100% B	77	5	3	1	8.4	8.4	8.5			22.5	~~4.5~~	8.0	8.5	~~3.5~~	3.9	4.0
											7.5			3.4 TR		
											TR			3.4 TR		
											Given up on reading			3.5 TR		
														3.5 TR		
														Wrong #'s TR 5-18-94		

all test jars aerated for duration of test.

Total Ammonia after 24 h duration @ 10.8 Hach 1.41

Measured/Loaded by: MF TM TM | MF MF MF | MF MF MF | MF MF ME | MF ME ME
Recorded by: MF TM TM | TR MF TM | TR TM TM | TR TM TM | TR TM TM

Investigators' Signatures
Tobin G. Rader
Tina Mikulosky
Marshal Faulkner

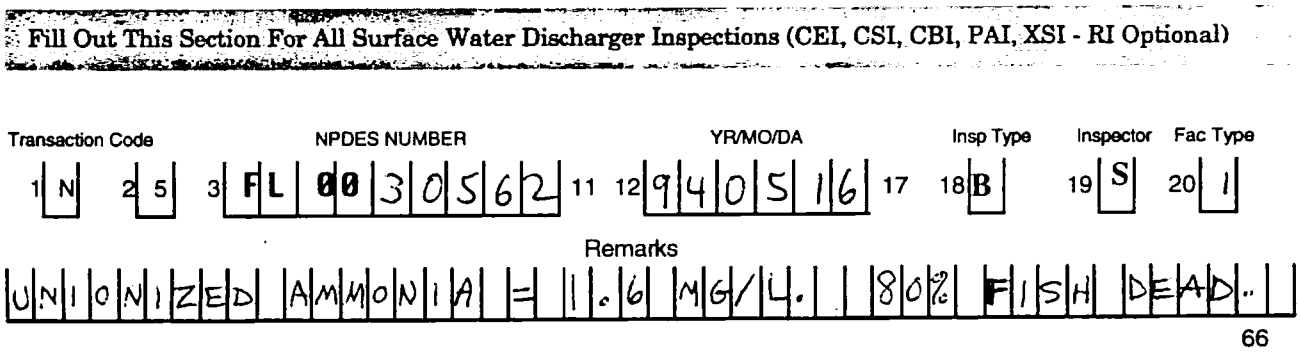
Reviewer

form updated 7/8/93

Water Quality Parameters	(Salt Water/) Well Water	20% Min Water	Sample	Method	Measured by
Field Total Residual Cl2:			0.35	—	N. BROOKING
Lab Total Residual Cl2:	<0.03	—	<0.03	DR-100	TR
Alkalinity:	130	—	630	Hach	TM
Hardness:	—	—	—	—	—
Total Ammonia:	<0.017	—	12.25	Orion	TM

Ammonia Meter #98136 Ammonia Meter Slope: -59.3 Ammonia Blank: <0.017 Control Salinity: 1.8 ppt Sample Salinity: 1.8 ppt

The Bioassay of the Monroe County Public Service Building WWTP effluent sampled on May 16, 1994, NPDES# FL0030562.



The Priority Pollutants Analysis for the Bioassay of the Monroe County Public Service Building WWTP effluent sampled on May 16, 1994, NPDES# FL0030562.

