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Bioassays of

Key West Wastewater Treatment Plant

Key West, Monroe County, Florida

NPDES #FL0025976

Sampled 2/6/95

April 1995

Biology Section

Division of Administrative and Technical Services

Comprehensive Quality Assurance Plan #870346G

Bioassays of

Key West Wastewater Treatment Plant

Key West, Monroe County, Florida

NPDES #FL0025976

Biology Section
Bureau of Laboratories
April 1995

Introduction

Key West Wastewater Treatment Plant, Key West, Monroe County, Florida, NPDES #FL00245976, tests performed on 7 to 9 February, 1995.

This wastewater treatment plant is located on Fleming Key in Key West. Treatment of influent by the extended aeration process includes screening, grit removal, activated sludge processing, aeration and clarification. Effluent is disinfected with chlorine and dechlorinated with sulfur dioxide prior to discharge to the Atlantic Ocean. The discharge often exceeds the permitted capacity of 7.2 MGD due to severe inflow and infiltration problems in the collection system, especially during periods of high tide and heavy rain. The South District (FDEP) issued a Notice of Violation, OGC case 94-3735-44-DW, on January 31, 1995, in order to require corrective actions to address the collection system infiltration problems (facility summary provided by Gus Rios, Nancy Brooking, and Justine Hibberd, 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 two 48-hour static acute screening toxicity bioassays on a sample of effluent from this facility.

The salinity of the sample was approximately 9.4 ppt, therefore, the test species used for these bioassays were the mysid shrimp, *Mysidopsis bahia*, and inland silverside minnow, *Menidia beryllina*. Control water for these tests was adjusted to a similar salinity using an artificial sea salt mixture (Forty Fathoms®). The salinity of the effluent was not adjusted for this test.

Test results indicated that the sample was toxic to both test species with the *Menidia* test showing 10% mortality at 48 hours in the 100% sample and the mysid test showing 100% mortality in the 100% sample (Table 1) at 48 hours.

Total residual chlorine of the sample was ≤ 0.03 mg/L in the laboratory and 1.27 mg/L in the field. Total and unionized ammonia concentrations were 9.26 mg/L and 0.17 mg/L, respectively, at test initiation. By 48-hours, the unionized ammonia concentrations had increased to approximately 0.6 mg/L in each 100% sample test due to the increase in pH which occurred during the test period. Further chemical analyses were performed on the sample and several metals and a pesticide were identified (Table 2). The individual constituents of the sample do not appear to be present in concentrations known to be toxic (producing an LC_{50}) to the test species. The copper (130 µg/L) concentration exceeds the marine surface water criterion of ≤ 2.9 µg/L (FAC 62-302-520).

Conclusion

The sample of effluent collected from this facility on February 6, 1995, exhibited toxicity to the *Menidia*, producing 10% mortality in 100% sample, and to the mysids, producing 100% mortality in 100% sample. We attribute the toxicity in the sample to: the possible synergistic effects of the metal constituents of the sample; to the increase in the unionized ammonia concentration during the test period; and to unknown constituent(s) of the sample.

Table 1. Data recorded during the 48-hour acute screening bioassays of a sample of effluent from the Key West Wastewater Treatment Plant, Key West, Monroe County, Florida, NPDES# FL0025976, performed on 7 to 9 February, 1995.

Facility:	**Key West Wastewater Treatment Plant**	**NPDES #**	**FL0025976**	Facility Type:	**Wastewater Treatment Plant**
Location:	Fleming Key, Key West	Contact/District:	G. Rios/S		
County:	Monroe	Test type:	static acute screen		
Sample Collection Date:	**2/6/95** Time: 1030	# tests:	2	Receiving Water:	Atlantic Ocean
Test Beginning Date:	2/7/95 Time: 1430	Chlorination Type:	**Chlorinated**		
Test Ending Date:	2/9/95 Time: 1430	Sample collected after plant dechlorination		**Page 1 of 1**	

Organism: ***Menidia beryllina*** Life stage: 11 days and 13 days old

Concentrations	Sample/Diluent Volume(mL)	SURVIVAL # Alive 0 hr	24 hr	48 hr	pH 0 hour	24 hour	48 hour	Temperature [A] 0 hour	24 hour	48 hour	Dissolved Oxygen 0 hour	24 hour	48 hour	Conductivity uncorrected mmhos/cm 0 hour	48 hour
Control A	0/500	5	5	5	8.4	8.4	8.4	22.9	20.7	19.7	8.0	8.2	8.2	15.7	14.9
Control B	0/500	5	5	5	8.4	8.4	8.4	22.9	-	19.5	8.0	8.1	8.3	15.7	14.9
Control C	0/500	5	5	5	8.4	8.4	8.4	22.8	-	19.4	8.1	8.2	8.5	15.7	14.9
Control D	0/500	5	5	5	8.4	8.4	8.4	22.8	-	19.4	8.1	8.3	8.5	15.6	15.0
100% A	500/0	5	5	4	7.5	8.0	8.2	23.3	20.8	19.8	7.2	7.6	7.9	15.5	14.7
100% B	500/0	5	5	5	7.5	8.0	8.2	23.1	-	19.7	7.2	7.6	7.8	15.0	14.7
100% C	500/0	5	5	4	7.5	8.0	8.2	21.8	-	19.6	7.3	7.6	7.8	14.9	14.7
100% D	500/0	5	5	5	7.5	8.0	8.2	21.5	-	19.6	7.5	7.6	7.8	14.7	14.7

[A] Temperature of test room was continously recorded on a strip chart recorder.
Room temperature range for the test period was 21-23°C.

Organism: ***Mysidopsis bahia*** Age: 3 days
LC_{50}: ≤100% not calculated

Concentrations	Sample/Diluent Volume(mL)	SURVIVAL # Alive 0 hr	24 hr	48 hr	pH 0 hour	24 hour	48 hour	Temperature [B] 0 hour	24 hour	48 hour	Dissolved Oxygen 0 hour	24 hour	48 hour	Conductivity uncorrected mmhos/cm 0 hour	48 hour
Control A	0/500	5	5	5	8.4	8.4	8.4	23.1	20.6	19.6	8.0	8.2	8.0	15.8	15.0
Control B	0/500	5	5	5	8.4	8.4	8.4	23.0	-	19.4	8.0	8.2	8.1	15.8	14.9
Control C	0/500	5	5	4	8.4	8.4	8.4	23.0	-	19.4	8.1	8.2	8.2	15.8	15.0
Control D	0/500	5	5	5	8.4	8.4	8.4	23.0	-	19.5	8.1	8.2	8.4	15.8	15.1
100% A	500/0	5	5	0	7.5	8.0	8.2	20.9	20.5	19.6	7.7	8.0	7.8	14.7	14.7
100% B	500/0	5	5	0	7.5	8.0	8.2	20.9	-	19.5	7.6	8.0	7.7	14.7	14.6
100% C	500/0	5	4	0	7.5	8.0	8.2	20.9	-	19.4	7.7	8.0	8.0	14.7	14.6
100% D	500/0	5	5	0	7.5	8.0	8.2	23.8	-	19.6	7.2	7.9	8.0	15.5	14.6

[B] Temperature of test room was continously recorded on a strip chart recorder.
Room temperature range for the test period was 21-23°C.

Total Residual CL2	mg/L	Method
Field:	1.27	-
Lab:	< 0.03	DR-100

Ammonia	Total (mg/L)	Unionized (mg/L)
Control Water:	< 0.017	<0.017
100% Sample:	9.26	0.17

Alk & Hardness	Alkalinity (mg/L)	Hardness (mg/L)
Control Water:	168	-
100% Sample:	174	-

Salinity*	(ppt)
Control Water:	9.7
100% Sample:	9.4

*Salinity converted from conductivity/temperature measurements.

Table 2. Results of chemical analyses on the effluent from the Key West Wastewater Treatment Plant sampled on February 6, 1995.

Metals		
Calcium	153	mg/L [A]
Copper	130	µg/L [A]
Iron	77	µg/L [A]
Magnesium	337	mg/L [A]
Silver	0.3	µg/L [I]
Zinc	77	µg/L [A]
Pesticides		
Diazinon	0.15	µg/L [T]
Base-Neutral & Acid Extractables		
none detected		

[A] Value reported is the mean of two or more determinations.
[T] Value reported is less than the criterion of detection.
[I] Value reported is less than the minimum quantitation limit, and greater than or equal to the minimum detection limit.

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Key West
County: Monroe
Contact / District: Gus Rios / 5
NPDES Permit #: FL0025976
LIMS Sample #: 98592 LIMS Job #: 95- FEB -0709

Sample Collection: Date 02/06/95 Time 1030
Test Beginning: Date 02/08/95 Time 1430
Test Ending: Date 2/9/95 Time ~~1330~~ 1430
Organism Batch #: 748 Diluent Batch #: 4
Organism Age: 11 and 13 days old
Test Organism: Menidia beryllina A. Civitan Time written instead of mi LSP&T Inc MF 2/9/95

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

Test Number: 1 of 2

Remarks:

Instrument Calibrations:

	pH	Temperature °C	D.O. mg/L	Conductivity µmhos/cm
meter #	7851	90H018262	90H018262	G9005749 JN
0 hr	7.0 @ 7.0 9.0 @ 9.0	19.7 @ 19.8	8.8 @ 21.8 °C	104.1 @ 98.2 910 @ 1000 @ 21.7 °C
24 hr	7.0 @ 7.0 9.0 @ 9.0	19.0 @ 19.1	9.1 @ 19.6 °C	930 @ 1000 9240 @ 10000 9310 @ 10000 @ 21.8 °C
48 hr	7.0 @ 7.0 9.0 @ 9.0	19.1 @ 19.1	9.2 @ 19.2 °C	980 @ 1000 9680 @ 10000 @ 19.8 °C

Conc.	Chamber #	Number Live 0 hr	Number Live 24 h	Number Live 48 h	pH 0 hr	pH 24 h	pH 48 h	Temperature (°C) 0 hr	Temperature (°C) 24 h	Temperature (°C) 48 h	D.O. (mg/L) 0 hr	D.O. (mg/L) 24 h	D.O. (mg/L) 48 h	UNCORRECTED Cond. (mmhos/cm) 0 hr	UNCORRECTED Cond. (mmhos/cm) 24 h	UNCORRECTED Cond. (mmhos/cm) 48 h
CTL A	76	5	5	5	8.4	8.4	8.4	22.9	20.7	19.7	~~15~~ *	8.2	8.2	15.7	15.1	14.9
CTL B	79	5	5	5	8.4	8.4	8.4	22.9		19.5	8.0	8.1	8.3	15.7	15.1	14.9
CTL C	174	5	5	5	8.4	8.4	8.4	22.8		19.4	8.1	8.2	8.5	15.7	15.1	14.9
CTL D	503	5	5	5	8.4	8.4	8.4	22.8		19.4	8.1	8.3	8.5	15.6	15.2	15.0
100% A	4	5	5	4	7.5	8.0	8.2	23.3	20.8	19.8	7.2	7.6	7.9	15.5	14.8	14.7
100% B	17	5	5	5	7.5	8.0	8.2	23.1		19.7	7.2	7.6	7.8	15.0	14.8	14.7
100% C	149	5	5	4	7.5	8.0	8.2	21.8		19.6	7.3	7.6	7.8	14.9	14.9	14.7
100% D	348	5	5	5	7.5	8.0	8.2	21.5		19.6	7.5	7.6	7.8	14.7	14.9	14.7
											* 8.0 wrote cond. in wrong blank					
Recorded by:		TR	TM	MF	JN	JRS	TR	JN	JRS	TR	JN	JRS	TR	JN	JRS	TR
Measured/Loaded by:		TM	TM	MF	TM	TM	MF	TM	TM	MF	TM	TM	MF	TM	TM	ME

Investigators' Signatures

Reviewer

form updated 10/05/94

Water Quality Parameters

	Salt Water: Well Water	20% Min Water	Sample	Method	Measured by
Field Total Residual Cl2 (mg/L):			1.27	—	J. Hibberd
Lab Total Residual Cl2 (mg/L):	<0.03	—	<0.03	DR100	TM
Alkalinity (mg/L as $CaCO_3$):	168	—	174	Hach	JN
Hardness (mg/L as $CaCO_3$):	—	—	—	—	—
Total ammonia (mg/L as N):	<0.017	—	9.26	Orion	TM

Ammonia Meter #98136 Meter Slope: -56.6 Ammonia Blank: <0.017

Control B. ~~9.7~~ 9.7 MF 2/7/95 ~~9.7~~ ppt Salinity: B. wrong data written MF 2/7/95

Sample MF 2/7/95 C ~~9.7~~ 9.4 ppt Salinity: C. wrong data written MF 2/7/95

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Key West
County: Monroe
Contact / District: Gus Rios / 5
NPDES Permit #: FL00 25976
LIMS Sample #: 8592 LIMS Job #: 95-FEB-07-09

Sample Collection: Date 02/06/95 Time 1030
Test Beginning: Date 02/07/95 Time 1430
Test Ending: Date 2/9/95 Time 1430
Organism Batch #: 4 Diluent Batch #: 4
Organism Age: 3 days
Test Organism: Mysidopsis bahia

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

Test Number: 2 of 2

Remarks:

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	19.7 @ 19.8	8.8 @ 21.8 °C	98.2 @ 104.1 910 @ 1000 @ 21.7 °C
24 hr	7.0 @ 7.0 9.0 @ 9.0	19.0 @ 19.1	9.1 @ 19.6 °C	930 @ 1000 (9240 @ 10000) 9310 @ 10000 @ 21.8 °C
48 hr	7.0 @ 7.0 9.0 @ 9.0	19.1 @ 19.1	9.2 @ 19.2 °C	980 @ 1000 9680 @ 10000 @ 19.8 °C

Conc.	Chamber #	Number Live 0 hr	Number Live 24 h	Number Live 48 h	pH 0 hr	pH 24 h	pH 48 h	Temperature (°C) 0 hr	Temperature (°C) 24 h	Temperature (°C) 48 h	D.O. (mg/L) 0 hr	D.O. (mg/L) 24 h	D.O. (mg/L) 48 h	UNCORRECTED Cond. (mmhos/cm) Cond. (µmhos/cm) 0 hr	24 h	48 h
Control A	333	5	5	5	8.4	8.4	8.4	23.1	20.6	19.6	8.0	8.2	8.0	15.8	15.1	15.0
Control B	438	5	5	5	8.4	8.4	8.4	23.0		19.4	8.0	8.2	8.1	15.8	15.1	14.9
Control C	26	5	5	4	8.4	8.4	8.4	23.0		19.4	8.1	8.2	8.2	15.8	15.2	15.0
Control D	630	5	5	5	8.4	8.4	8.4	23.0		19.5	8.1	8.2	8.4	15.8	15.3	15.1
100% A	~~A~~ 63	5	5	0	7.5	8.0	8.2	20.9	20.5	19.6	7.7	8.0	7.8	14.7	14.8	14.7
100% B	136	5	5	0	7.5	8.0	8.2	20.9		19.5	7.6	8.0	7.7	14.7	14.7	14.6
100% C	48	5	4	0	7.5	8.0	8.2	20.9		19.4	7.7	8.0	8.0	14.7	14.8	14.6
100% D	1265	5	5	0	7.5	8.0	8.2	23.8		19.6	7.2	7.9	8.0	~~16.6~~	14.8	14.6
														15.5*		
Recorded by:		TR	Tm	MF	JN	JRS	TR	JN	JRS	TR	JN	JRS	TR	JN	JRS	TR
Measured/Loaded by:		Tm	Tm	MF	TM	Tm	MF	TM	Tm	MF	TM	Tm	MF	TM	Tm	MF

* temperature was higher than other samples

Investigators' Signatures

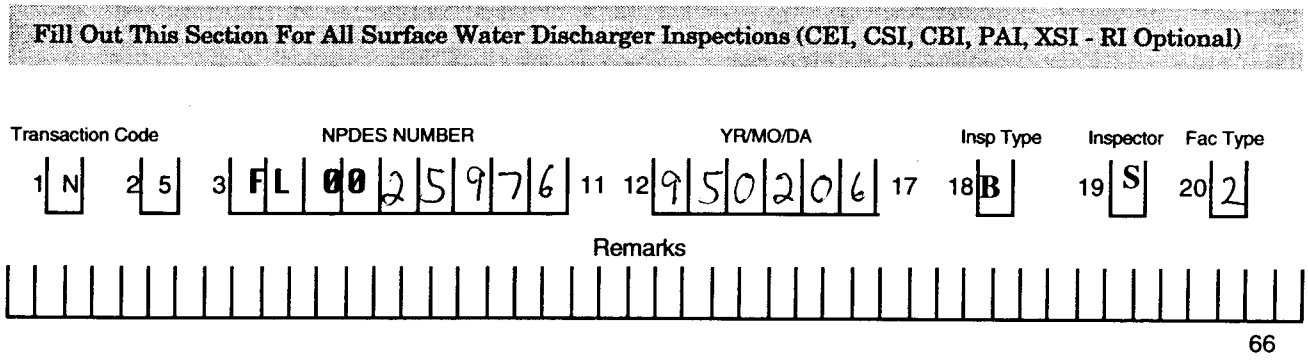
Reviewer

form updated 10/05/94

Water Quality Parameters	Salt Water Well Water	20% Min Water	Sample	Method	Measured by
Field Total Residual Cl2 (mg/L):			1.27	—	J. Hibbard
Lab Total Residual Cl2 (mg/L):	<0.03	—	<0.03	DR100	TM
Alkalinity (mg/L as $CaCO_3$):	168	~	174	Hach	JN
Hardness (mg/L as $CaCO_3$):	—	—	~	—	—
Total ammonia (mg/L as N):	<0.017	—	9.26	Orion	TM

Ammonia Meter #98136 Ammonia Meter Slope: -56.6 Ammonia Blank: <0.017 Control Salinity: 9.7 ppt Sample Salinity: 9.4 ppt

The Bioassay of the Key West Wastewater Treatment Plant effluent sampled on February 6, 1995, NPDES #FL0025976.



The Priority Pollutants Analysis for the Bioassay of the Key West Wastewater Treatment Plant effluent sampled on February 6, 1995, NPDES #FL0025976.

