DEPARTMENT OF ENVIRONMENTAL PROTECTION

FLORIDA

Bioassays of

Florida Keys Community College Wastewater Treatment Plant

Stock Island, Monroe County, Florida

NPDES #FL0033928

Sampled 2/7/94

June 1994

Biology Section
Division of Technical Services

Bioassays of

Florida Keys Community College Wastewater Treatment Plant

Stock Island, Monroe County, Florida

NPDES #FL0033928

Biology Section
Bureau of Laboratories
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Introduction

Florida Keys Community College WWTP, Stock Island, Monroe County, Florida, NPDES #FL0033928, tests performed on 8 to 10 February, 1994.

This wastewater treatment facility is located at 5901 Junior College Road West on Stock Island and has a capacity of 15,000 GPD. Treatment of wastewater consists of extended aeration with clarification, chlorination to meet basic disinfection requirements, and dechlorination. Treated effluent is discharged to the Gulf of Mexico (facility summary provided by Gus Rios and Nancy Brooking, FDEP Marathon). At the time of sampling, the facility operated without a valid DEP permit. The previous permit expired on 1/11/94.

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 toxicity bioassays on a sample of effluent collected after dechlorination from this facility. The salinity of the sample upon arrival was 1.5 ppt. Therefore, the test species chosen were the mysid shrimp, *Mysidopsis bahia,* and the inland silverside, *Menidia beryllina*. The control water for the *Menidia* screening test was adjusted to a salinity of 1.5 ppt using well water and hypersaline brine (made from an artificial sea salt mixture, Forty Fathoms®). No mortality occurred in the *Menidia* screening test, therefore the LC_{50} was > 100% effluent.

The salinity of the control water/diluent and aliquot of the sample for the mysid definitive test was adjusted to 5 ppt using artificial sea salts. The definitive test results indicated acute toxicity to the mysids with an LC_{50} < 25% effluent. The data from the two 100% effluent replicates are unusable since those were accidentally tested at 3 ppt, which is outside the allowable range for mysids (5–30 ppt ± 10%). However, the high mortality in all the lower concentrations confirmed the toxicity seen in the whole effluent.

The initial D.O. of the sample was 1.0 mg/L. Despite being collected after dechlorination at the facility, total residual chlorine of the sample was 2.0 mg/L in the laboratory prior to aeration and < 0.03 mg/L after aeration prior to test initiation. Total and unionized ammonia concentrations were 0.626 mg/L and 0.02 mg/L, respectively.

Further chemical analyses were performed on the sample and several metals were identified (Table 2). Except for copper, the concentrations of the metals present appear too low to be acutely toxic to mysids. Pesticides and organics were not detected.

Although the surface water criterion for copper is ≤ 2.9 µg/L for Class III marine waters, copper was present in the sample at 74 µg/L. Acute toxicity

data for copper were not available for mysids, however, other marine arthropods (barnacles and copepods) showed 48-hr LC_{50}'s of 10 to 100 µg/L. The 96-hr LC_{50}'s for *Acartia tonsa* and copepods were 17 to 64 µg/L. From these data, the level of copper measured in the effluent sample may be acutely toxic to mysids.

Conclusion

The sample of effluent collected from this facility on 7 February, 1994, was toxic to *Mysidopsis bahia* with an $LC_{50} < 25\%$ effluent. The cause of toxicity was attributed to copper and unknown constituents.

Table 1. Concentration series and volumes used for the 48-hour static acute bioassays of the Florida Keys Community College WWTP effluent performed on 8 to 10 February, 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 of the effluent from the Florida Keys Community College WWTP, sampled on 7 February, 1994.

Pesticides & Herbicides

none detected

Base-Neutral & Acid Extractables

none detected

Metals

Cadmium	2.0	µg/L [J]
Calcium	138	mg/L
Copper	74	µg/L
Iron	335	µg/L
Magnesium	25.9	mg/L
Nickel	7	µg/L [I]
Silver	10.9	µg/L [J]
Zinc	102	µg/L

[I] Value reported is less than the minimum quantitation limit, and greater than or equal to the minimum detection limit.

[J] Estimated value. (For this facility, the sample was analyzed three times for these analytes. Although the QA/QC recovery for silver and cadmium was outside the control limits after the third attempt, the recovery was low for each analyte which suggests that the actual concentrations of these two metals present were actually higher than reported).

Table 3. Data recorded during the 48-hour static acute bioassays of a sample of effluent from Florida Keys Community College WWTP, Stock Island, Key West, Monroe County, Florida, NPDES# FL0033928, performed on 8 to 10 February, 1994.

Facility:	**Florida Keys Community College WWTP**	**NPDES #**	**FL0033928**	Facility Type:	**Wastewater**
Location:	Stock Island, Key West	Contact/District:	Nancy Brooking / Marathon		**Treatment Plant**
County:	Monroe	Test type:	static acute screen & definitive		
Sample Collection Date:	**2/7/94** Time: 1100	# tests:	1 each	Receiving Water:	Gulf of Mexico
Test Beginning Date:	2/8/94 Time: 1600	Chlorination Type:	**Sample collected**		
Test Ending Date:	2/10/94 Time: 1600		**after dechlorination**	**Page 1 of 1**	

Total Residual Cl2	mg/L	Method
Field:	none detected	-
(prior to aeration) Lab:	2.0	DR-100
(after aeration) Lab:	< 0.03	DR-100

Ammonia	Total (mg/L)	Unionized (mg/L)
Control Water:	<0.017	0.00
100% Sample:	0.626	0.02

Alk & Hardness	Alkalinity (mg/L)	Hardness (mg/L)
Control Water :	55	-
100% Sample:	180	430

Salinity	(ppt)	*for Mysidopsis*
Control Water:	5.0	
25, 50, 75% Sample:	5.0	
100% Sample:	3.0 a	

Salinity	(ppt)	*for Menidia*
Control Water:	1.5	
100% Sample:	3.0 a	

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

LC50 < 25%

	SURVIVAL			*After aeration pH			Temperature			*After aeration 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	8.2	8.4	8.5	22.4	23.3	22.8	8.0	8.5	8.5	8.59	8.94
Control	5	5	5	8.2	8.4	8.5	-	-	22.8	8.0	8.5	8.5	8.58	9.03
25%	5	2	1	8.1	8.3	8.3	22.8	23.2	22.8	7.3	8.5	8.5	8.64	8.92
25%	5	0	0	8.1	8.3	8.4	-	-	22.8	7.3	8.5	8.5	8.62	8.94
50%	5	1	1	8.0	8.2	8.2	23.1	23.2	22.8	6.3	8.5	8.4	8.67	8.84
50%	5	2	1	7.9	8.2	8.2	-	-	22.8	5.2	8.4	8.4	8.64	8.82
75%	5	2	2	7.8	8.1	8.1	23.3	23.2	22.8	5.6	8.4	8.3	8.68	8.80
75%	5	1	1	7.8	8.1	8.1	-	-	22.9	4.9	8.4	8.3	8.68	8.81
100%	5	2	0	7.7	7.7	7.9	23.4	23.3	23.0	5.6	7.6	8.1	8.61	a 5.44
100%	5	2	0	7.7	7.8	7.8	-	-	23.0	6.3	7.6	8.1	8.64	a 5.44

Organism: ***Menidia beryllina*** Age: 12 days

	SURVIVAL			*After aeration pH			Temperature			*After aeration 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	8.2	8.4	8.5	22.5	23.2	23.1	8.1	8.8	8.3	2.68	2.77
Control	5	5	5	8.2	8.4	8.5	22.5	-	23.0	8.2	8.8	8.3	2.71	2.79
100%	5	5	5	7.7	7.7	7.9	23.3	23.1	23.1	6.7	7.8	8.2	a 5.29	a 5.38
100%	5	5	5	7.7	7.8	7.9	23.4	-	23.1	6.6	7.8	8.1	a 5.67	a 5.72

a effluent which had been adjusted up to 5 ppt for the mysids was accidently mixed with the 1.5 ppt effluent for Menidia when the sample needed further aeration prior to test initiation. The mistake was not discovered until the next day.

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Florida Keys Community College
Location:
County: MONROE
Contact/District: NANCY BROOKING / MARATHON
NPDES Permit #: FL00 33928 Outfall #:
94-Feb-08-18 69 440

Sample Collection: Date 2/7/94 Time 11:00
Test Beginning: Date 2/8/94 Time 1600
Test Ending: Date 2/10/94 Time 1600
Organism Batch #: 2 Diluent Batch #: 2
Organism Age: 4 days
Test Organism: Mysidopsis bahia

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

Test Number: 1 of 2

Instrument Calibrations: pH meter # 7851 | Temperature °C 90H018262 | D.O. mg/L 90H018262 | Conductivity µmhos/cm G9005749

Remarks: [C] INITIAL SALINITY = 1.4 ppt
Initial D.O. 1.0 mg/L
Entire sample aerated to 7.6 D.O. before pouring for tests.
Test/Sample aerated + measured before loading organisms.
— mysid test: effluent + control H_2O adjusted to 5ppt w/40F.

	pH	Temperature °C	D.O. mg/L	Conductivity µmhos/cm
0 hr	7.0 @ 7.0 9.0 @ 9.0	22.5 @ 22.6	8.7 @ 21.7	979 @ 1,000 9450 @ ~~10,000~~ 9395 @ 23.3 °C
24 hr	7.0 @ 7.0 9.0 @ 9.0	23.5 @ 23.5	8.4 @ 23.8	1005 @ 1,000 9670 @ ~~10,000~~ 9895 @ 23.7 °C
48 hr	7.0 @ 7.0 9.0 @ 9.0	23.0 @ 23.0	8.4 @ 23.4	987 @ 1,000 9510 @ 10,000 @ 23.4 °C

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) 0 hr	24 h	48 h
Control A	37	5	5	5	8.2	8.4	8.5	22.4	23.3	22.8	8.0	8.5	8.5	8.59	8.86	28.94
Control B	70	5	5	5	8.2	8.4	8.5			22.8	8.0	8.5	8.5	8.58	8.89	9.03
25% A	120	5	2	1	8.1	8.3	8.3	22.8	23.2	22.8	7.4	8.5	8.5	8.64	8.87	8.92
25% B	413	5	0	0	8.1	8.3	8.4			22.8	7.4	8.5	8.5	8.62	8.86	8.94
50% A	183	5	2 (1 DOA)	1	7.9	8.2	8.2	23.1	23.2	22.8	6.1	8.5	8.4	8.67	8.81	8.84
50% B	26	5	2	1	7.9	8.2	8.2			22.8	6.1	8.4	8.4	8.64	8.77	8.82
75% A	63	5	2	2	7.8	8.1	8.1	23.3	23.2	22.8	4.8	8.4	8.3	8.68	8.77	8.80
75% B	48	5	1	1	7.8	8.1	8.1			22.9	4.8	8.4	8.3	8.68	8.80	8.81
100% A	65	5	2	0	7.7	7.7	7.9	23.4	23.3	23.0	0.8	7.6	8.1	8.61	5.41*	5.44* KP
100% B	883	5	2	0	7.7	7.8	7.8			23.0	0.8	7.6	8.1	8.64	5.41*	5.44* KP
		jar #	37		8.2			jars		37	8.0			*		
		pH's	70		8.2			D.O.'s		70	8.0			5ppt 100% effluent		
		after	120		8.1			after		120	7.3			was accidently		
		further	413		8.1			aeration		413	7.3			mixed w/ 1.4 ppt		
		aeration	183		8.0			KP		183	6.3			effluent for		
		KP/DW	26		7.9					26	5.2			further aeration		
			63		7.8					63	5.6			after cond measured		
			48		7.8					48	4.9			and before fmysids		
			65		7.7					65	5.6			were loaded KP		
			883		7.7					883	6.3					2/9/94
Measured/Loaded by:		DW	TM	DW	TR	TM	DW	TR	TM	DW	TR	TM	DW	TR	TM	DW
Recorded by:		KP	DW	DW	DW	DW	MF	DW	DW	MF	DW	DW	MF	DW	DW	MF

mistake not noticed till next day

Investigators' Signatures
Tobin C. Rader
David Whitley
Kim Pearce
Tina Mikulski
Reviewer
form updated 7/8/93

Recorded wrong Initial 2/10/94 MF

Salt Water / Well Water / 20% Min Water

Water Quality Parameters	Sample	Method	Measured by
Field Total Residual Cl2:	none detected		NB.
Lab Total Residual Cl2: <0.03	2.0	DR100	TR/MF
Alkalinity: 55	180	Hach	TR
Hardness: —	430	Hach	TR
Total Ammonia: <0.017	0.26	Orion	MF *

Ammonia Meter #98136 Ammonia Meter Slope: -54.0 Ammonia Blank: <0.017 Control Salinity: 5 ppt Sample Salinity: 5 ppt KP

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Florida Keys Community College
Location:
County: MONROE
Contact/District: NANCY BROOKING / MARATHON
NPDES Permit #: FL00 33928 Outfall #: 69440
94-Feb-08-18

Sample Collection: Date 2/7/94 Time 11:00
Test Beginning: Date 2/5/94 Time 1600
Test Ending: Date 2/10/94 Time 1600
Organism Batch #: 4 Diluent Batch #: 2
Organism Age: 12 days
Test Organism: Menidia beryllina

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

Test Number: 2 of 2

Remarks:
INITIAL Cl^- SALINITY = ~~to~~ 1.5 4 ppt
Initial D.O 1.0 mg/L
Entire sample aerated
INITIAL TRC WAS 2.0 mg/L IN LAB, PRIOR TO AERATION.
AFTER AERATION, AND PRIOR TO TEST INITIATION, LAB TRC WAS <0.03 mg/L.

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	22.5 @ 22.6	8.7 @ 21.07	979 @ 1,000 9450 @ ~~10,000~~ 9895 @ 23.3 °C
24 hr	7.0 @ 7.0 9.0 @ 9.0	23.5 @ 23.5	8.4 @ 23.8	1005 @ 1,000 9670 @ 10,000 @ 23.7 °C
48 hr	7.0 @ 7.0 9.0 @ 9.0	23.0 @ 23.0	8.4 @ 23.4	987 @ 1,000 9510 @ 10,000 @ 23.4 °C

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	41	5	5	5	8.2	8.4	8.5	22.5	23.2	23.1	8.1	8.8	8.3	268	2.76	2.77	KP
Control B	25	5	5	5	8.2	8.4	8.5	22.5		23.0	8.2	8.8	8.3	2.71	2.77	2.79	KP
100% A	85	5	5	5	7.7	7.7	7.9	23.3	23.1	23.1	6.7	7.8	8.2	5.29	5.33	5.33	KP
100% B	18	5	5	5	7.7	7.8	7.9	23.4		23.1	6.6	7.8	8.1	5.67	5.61	5.72	KP
														*	*	*	
control water with 40 Zathams Salts, to well water. KP																	
* Entire sample was aerated to 8.0 mg/L D.O. prior to test initiation or salinity adjustment. One hour later D.O was 1.0 mg/L so re-aerated. The difference in control salinity and test salinity due to the accidental mixing of effluent with an aliquot that had already been salt adjusted for mysid test. Aliquots were mixed in sample jug to re-aerate prior to loading fish and mysids into the 100% sample. mistake was not noticed til next day. KP 2/9/94																	
Measured/Loaded by:		KP DW	DW	MF	KP	TM	DW	KP	TM	DW	KP	TM	DW	KP	TM	DW	
Recorded by:		KP	DW	MF	DW	DW	MF	KP	DW	MF	KP	DW	MF	KP	DW	MF	

Investigators' Signatures Kim Pearce
Robin A. Rader
David O. White
Tina Mikulski
Marshall Faircloth
Reviewer

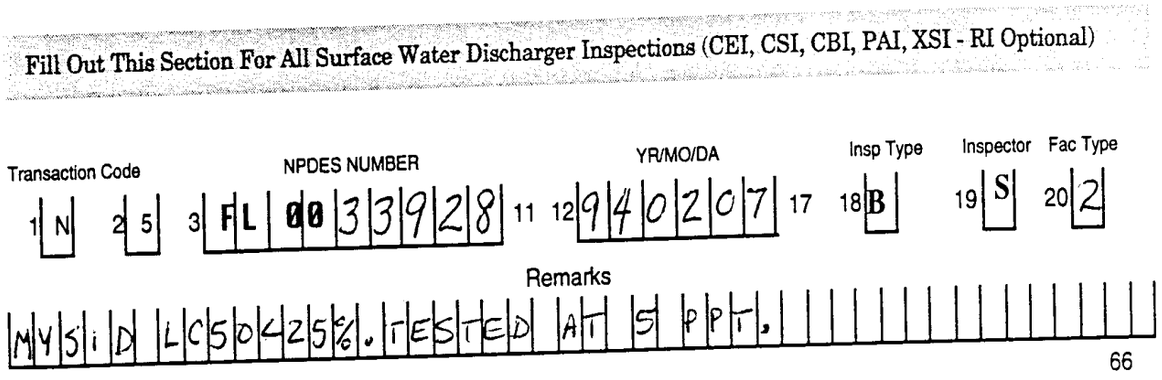
(Salt Water) Well Water | 20% Min Water

Water Quality Parameters	Sample	Method	Measured by
Field Total Residual Cl2:	none detected		NB
Lab Total Residual Cl2:	2.0	DR-100	TR/MF
Alkalinity:	180	Hach	TR
Hardness:	430	Hach	TR
Total Ammonia:	0.626	Orion	MF

Ammonia Meter #98136 Ammonia Meter Slope: -54.0 Ammonia Blank: <0.017 Control Salinity: 1.4 ppt Sample Salinity: 3* ppt

form updated 7/8/93

The Bioassay of Florida Keys Community College WWTP effluent sampled on 7 February, 1994, NPDES #FL0033928.



The Priority Pollutants Analyses for the Bioassay of Florida Keys Community College WWTP effluent sampled on 7 February, 1994, NPDES #FL0033928.

