

Bioassays of

Marineland Reverse Osmosis Water Treatment Plant

Marineland, Flagler County, Florida

NPDES #FL0043532

Sampled 8/5/96

November 1996

Biology Section
Division of Administrative and Technical Services
Comprehensive Quality Assurance Plan #870346G

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Introduction

Marineland Reverse Osmosis Water Treatment Plant, Marineland, Flagler County, Florida, NPDES # FL0043532, tests performed on 6 to 8 August, 1996.

This reverse osmosis water treatment facility has a design flow of 0.100 MGD and a mean flow of 0.052 MGD. The resulting concentrate is aerated prior to being intermittently discharged to a *Spartina* marsh adjacent to the Atlantic Intra-coastal waterway (facility summary provided by the Biology Section Bioassessment Group, FDEP, Tallahassee).

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. Based on conductivity, the salinity of the sample was approximately 7.7 ppt, therefore, the test species used for these bioassays were the mysid shrimp, *Mysidopsis bahia*, and the inland silverside minnow, *Menidia beryllina*.

The control waters for the mysid test and the fish test were adjusted to a salinity of 7.7 ppt using artificial saltwater (ASW) diluted with deionized water to match the apparent salinity of the effluent as collected. The salinity of the effluent was not adjusted.

The test results indicated that the sample was toxic to *Mysidopsis bahia*, producing 95% mortality in 24-hours and 100% mortality in 48-hours; however, there was no mortality in the *Menidia beryllina* test (Table 1).

Total residual chlorine and total ammonia were not detected in the sample. Further chemical analysis were not performed on the sample. Due to the lack of chemistry data, we cannot determine the cause of the observed mortality in the *Mysidopsis bahia* test. Previous research on reverse osmosis facilities that employ membrane technology indicated that seawater-ion imbalance can contribute to mortality in *Mysidopsis bahia* and demonstrated that *Mysidopsis bahia* is much more sensitive to seawater-ion imbalances than is *Menidia beryllina*. (Wolfe, *et al.* 1995. Protocols for determining Major-Seawater-Ion Toxicity in Membrane-Technology Water-Treatment Concentrate. Florida Department of Enviromental Protection, Bureau of Laboratories. 96 pp.). The concentrating of toxic compounds in the source water to acutely toxic levels in the concentrate was also observed during the study. Based on the referenced study, we suggest that seawater-ion imbalance may be partially or wholly responsible for the observed mortality.

Conclusion

The sample of effluent collected from this facility on 5 August, 1996, showed acute toxicity to *Mysidopsis bahia*, but did not show toxicity to *Menidia beryllina*. Seawater-ion imbalance may be partially or wholly responsible for the observed mortality.

Table 1. Data recorded during the 48-hour acute toxicity screening bioassays of a sample of effluent from the Marineland RO Water Treatment Plant, Flagler County, Florida, NPDES#FL0043532, performed on 06 to 08 August, 1996.

Facility:	**Marineland Reverse Osmosis Water Treatment Plant**	**NPDES #**	**FL0043532**	Facility Type:	**Reverse Osmosis**
Location:	Flagler County south of St. Johns County	Contact/District:	Ed Cordova/ Northeast		
County:	Flagler	Test type:	static acute screen		
Sample Collection Date:	7/22/96 Time: 1015	# tests:	2	Receiving Water:	Atlantic Intracoastal
Test Beginning Date:	7/23/96 Time: 1555	Chlorination Type:	non-chlorinated		Waterway via a *Spartina* marsh
Test Ending Date:	7/25/96 Time: 1545				**Page 1 of 1**

Total Residual CL2	mg/L	Method
Field:	not measured	
Lab:	<0.03	DR-100

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

Alk & Hardness	Alkalinity (mg/L)	Hardness (mg/L)
Control Water (fish):	85	-
Control Water (mysids):	85	-
100% Sample:	105	-

Salinity	(ppt)
Control Water (fish):	2.4
100% Sample:	2.4
Control Water (mysids):	6.0

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

	Sample/Diluent	SURVIVAL # Alive			pH			Temperature[A]			Dissolved Oxygen			Conductivity Uncorrected mmhos/cm	
Concentrations	Volume(mL)	0 hr	24 hr	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	0/500	5	5	5	8.5	8.2	8.1	24.5	23.7	23.5	7.4	7.4	7.8	13.48	13.40
Control B	0/500	5	5	5	8.5	8.2	8.0	24.5	23.6	23.4	7.4	7.5	7.8	13.50	13.40
Control C	0/500	5	5	5	8.5	8.2	8.0	24.5	23.6	23.4	7.6	7.5	7.8	13.50	13.40
Control D	0/500	5	5	5	8.5	8.2	8.1	24.5	23.7	23.4	7.5	7.5	7.8	13.49	13.46
100% A	500/0	5	0	0	7.3	7.9	8.0	24.9	23.6	23.4	7.7	7.4	7.4	13.44	13.15[B]
100% B	500/0	5	0	0	7.3	7.8	8.0	24.9	23.5	23.3	7.7	7.4	7.6	13.46	13.09[B]
100% C	500/0	5	1	0	7.3	7.8	8.0	24.9	23.4	23.4	7.7	7.5	7.5	13.46	13.17
100% D	500/0	5	0	0	7.3	7.9	8.0	24.8	23.6	23.4	7.8	7.6	7.6	13.42	13.19[B]

[A] Temperature of test room was continously recorded on a strip chart recorder. [B] 24 hour conductivity measurements.
Room temperature range for the test period was 24-25°C.

Organism: ***Menidia beryllina*** Age: 10 days

	Sample/Diluent	SURVIVAL # Alive			pH			Temperature[C]			Dissolved Oxygen			Conductivity Uncorrected mmhos/cm	
Concentrations	Volume(mL)	0 hr	24 hr	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	0/500	5	5	5	8.5	8.2	8.1	24.5	23.4	23.5	7.6	7.4	7.9	13.48	13.35
Control B	0/500	5	5	5	8.5	8.2	8.1	24.5	23.3	23.4	7.6	7.4	7.9	13.50	13.32
Control C	0/500	5	5	5	8.5	8.2	8.1	24.5	23.3	23.4	7.6	7.5	8.0	13.47	13.34
100% A	500/0	5	5	5	7.2	7.8	8.0	24.8	23.4	23.5	8.1	7.5	7.8	13.41	13.28
100% B	500/0	5	5	5	7.2	7.8	8.0	24.9	23.3	23.5	8.0	7.5	7.8	13.45	13.19
100% C	500/0	5	5	5	7.2	7.8	8.0	24.9	23.3	23.5	8.0	7.6	7.9	13.44	13.18

[C] Temperature of test room was continously recorded on a strip chart recorder.
Room temperature range for the test period was 24-25°C.

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Marineland
County: FLAGLER
Contact / District: Ed Cordova / Northeast
NPDES Permit #: FL0043532
LIMS Sample #: 147816 LIMS Job #: 96-AUG-06-16-01
sample log 8/19/96 DW

Sample Collection: Date 8-5-96 Time 1020
Test Beginning: Date 8-6-96 Time 1520
Test Ending: Date 8-8-96 Time 1520
Organism Batch #: 215 Diluent Batch #: 28
Organism Age: 4 days
Test Organism: Mysidopsis bahia

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
0 hr	7.0 @ 7.0 9.0 @ 9.0	24.5 @ 24.4	8.3 @ 24.4 °C	988 @ 1006 9540 @ 9989 @ 24.1 °C
24 hr	7.0 @ 7.0 9.0 @ 9.0	23.8 @ 23.8	8.4 @ 24.1 °C	999 @ 1006 983 @ 9987 @ 24.4 °C
48 hr	7.0 @ 7.0 9.0 @ 9.0	23.6 @ 23.5	8.4 @ 23.8 °C	105.4 @ 101.5 992 @ 1006 @ 24.9 °C 9710 @ 9989

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	B1	5	5	5	8.5	8.2	8.1	24.5	23.7	23.5	7.4	7.4	7.8	13.48	13.33	13.40
Control B	B2	5	5	5	8.5	8.2	8.0	24.5	23.6	23.4	7.4	7.5	7.8	13.50	13.33	13.40
Control C	B3	5	5	5	8.5	8.2	8.0	24.5	23.6	23.4	7.6	7.5	7.8	13.50	13.35	13.40
Control D	B4	5	5	5	8.5	8.2	8.1	24.5	23.7	23.4	7.5	7.5	7.8	13.49	13.40	13.46
100% A	B5	5	0	8*	7.3	7.9	8.0	24.9	23.6	23.4	7.7	7.4	7.4	13.44	13.15	13.27
100% B	B6	5	0	0	7.3	7.8	8.0	24.9	23.5	23.3	7.7	7.4	7.6	13.46	13.09	13.15
100% C	B7	5	1	0	7.3	7.8	8.0	24.9	23.4	23.4	7.7	7.5	7.5	13.46	13.13	13.17
100% D	B8	5	0	0	7.3	7.9	8.0	24.8	23.6	23.4	7.8	7.6	7.6	13.42	13.19	13.24
Measured/Loaded by:		TM	TM	ND	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF
Recorded by:		DW	TM	ND	ND	DN	LM	ND	DN	LM	ND	DN	LM	ND	DN	LM

* 0 [illegible]

Investigators' Signatures
Marshall Faircloth
Dennis Nicholson
Tina Mikulski
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reviewer

form updated 4/01/96

Salt Water

Water Quality Parameters	Well Water	20% Min Water	Sample	Method	Measured by
Field Total Residual Cl2 (mg/L):			Not measured		
Lab Total Residual Cl2 (mg/L):	<0.03	—	<0.03	DR100	DB
Alkalinity (mg/L as $CaCO_3$):	85	—	105	HACH	DB
Hardness (mg/L as $CaCO_3$):	—	—	—		
Total ammonia (mg/L as N):	<.017	—	.02	Orion	LM

Ammonia Meter #98136 Ammonia Meter Slope: -56.8 Ammonia Blank: <.017 Control Salinity: 7.7 ppt Sample Salinity: 7.7 ppt

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Marineland
County: FLAGLER
Contact / District: Ed Cordova / Northeast
NPDES Permit #: FL0043532
LIMS Sample #: 147816 LIMS Job #: 96-AUG-06-16-01
sample log 8/9/96 DV

Sample Collection: Date 8-5-96 Time 1020
Test Beginning: Date 8-6-96 Time 1520
Test Ending: Date 8-8-96 Time 1520
Organism Batch #: 30 Diluent Batch #: 28
Organism Age: 10 days
Test Organism: Menidia beryllina

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	24.5 @ 24.4	8.3 @ 24.4 °C	988 @ 1006 9540 @ 9989 @ 24.1 °C
24 hr	7.0 @ 7.0 9.0 @ 9.0	23.3 @ 23.8	8.4 @ 24.1 °C	999 @ 1006 9530 @ 9981 @ 24.4 °C
48 hr	7.0 @ 7.0 9.0 @ 9.0	23.6 @ 23.5	8.4 @ 23.8 °C	992 @ 1006 9710 @ 9989 @ 24.9 °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	B9	5	5	5	8.5	8.2	8.1	24.5	23.4	23.5	7.6	7.4	7.9	13.48	13.24	13.35
Control B	B10	5	5	5	8.5	8.2	8.1	24.5	23.3	23.4	7.6	7.4	7.9	13.50	13.23	13.32
Control C	B11	5	5	5	8.5	8.2	8.1	24.5	23.3	23.4	7.6	7.5	8.0	13.47	13.27	13.34
100% A	B13	5	5	5	7.2	7.8	8.0	24.8	23.4	23.5	8.1	7.5	7.8	13.41	13.12	13.28
100% B	B14	5	5	5	7.2	7.8	8.0	24.9	23.3	23.5	8.0	7.5	7.8	13.45	13.07	13.19
100% C	B15	5	5	5	7.2	7.8	8.0	24.9	23.3	23.5	8.0	7.6	7.9	13.44	13.10	13.18
Measured/Loaded by:		DW	TM	ND	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF
Recorded by:		DW	TM	ND	ND	DN	LM	ND	DN	LM	ND	DN	LM	ND	DN	LM

Investigators' Signatures Dennis Nicholson
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form updated 4/01/96

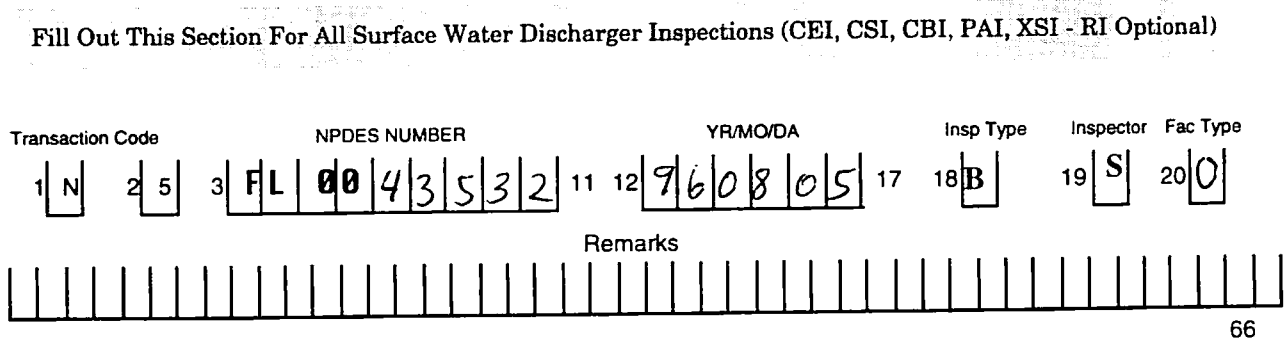
Salt Water: Well Water / 20% Min Water

Water Quality Parameters

	Sample	Method	Measured by
Field Total Residual Cl2 (mg/L):	NOT measured		
Lab Total Residual Cl2 (mg/L):	<0.03	DR100	DB
Alkalinity (mg/L as $CaCO_3$):	105	HACH	DB
Hardness (mg/L as $CaCO_3$):	—		
Total ammonia (mg/L as N):	.02	Orion	LM

Ammonia Meter #98136 Ammonia Meter Slope: -56.6 Ammonia Blank: <.017 Control Salinity: 27 ppt Sample Salinity: 27 ppt

The Bioassay of the Marineland RO Plant effluent sampled on August 05, 1996, NPDES # FL0043532.



The Priority Pollutants Analysis for the Bioassay of the Marineland RO Plant effluent sampled on August 05, 1996, NPDES # FL0043532.

