

Bioassays of

Marineland Reverse Osmosis Water Treatment Plant

Marineland, Flagler County, Florida

NPDES #FL0043532

Sampled 10/21/96

January 1997

Biology Section

Division of Administrative & Technical Services

Comprehensive Quality Assurance Plan #870346G

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NPDES #FL0043532

Biology Section
Bureau of Laboratories
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Introduction

Marineland Reverse Osmosis Water Treatment Plant, Marineland, Flagler County, Florida, NPDES # FL0043532, tests performed on 22 to 24 October, 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 Intracoastal 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 toxicity bioassays on a sample of effluent from this facility. Based on conductivity, the salinity of the sample was approximately 7.3 ppt, therefore, the test species used for these bioassays were the mysid shrimp, *Mysidopsis bahia*, in the definitive test and the inland silverside minnow, *Menidia beryllina* in the screening test.

The control water and the dilulent used for these bioassays were adjusted to a salinity of 7.3 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 a 48-hour LC_{50} of 38.7% (95%CI= 34.6%–43.3%); however, there was only 5% 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 D. E. P. report. 96 pp.). The concentrating of toxic compounds in the source water to acutely toxic levels in the concentrate was also observed during that study.

Conclusion

The sample of effluent collected from this facility on 21 October, 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 22 to 24 October, 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:	10/21/96	Time: 1115	# tests:	2	Receiving Water: Atlantic Intracoastal
Test Beginning Date:	10/22/96	Time: 1405	Chlorination Type:	non-chlorinated	Waterway via a *Spartina* marsh
Test Ending Date:	10/24/96	Time: 1410			**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:	<0.017	0.00

Alk & Hardness	Alkalinity (mg/L)	Hardness (mg/L)
Control Water (fish):	135	-
Control Water (mysids):	135	-
100% Sample:	105	-

Salinity	(ppt)
Control Water (fish):	7.3
100% Sample:	7.3
Control Water (mysids):	7.3

Organism: ***Mysidopsis bahia*** Life stage: 2 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	8.4	8.2	8.0	23.8	24.2	24.5	7.4	7.6	6.8	11.98	13.47
Control B	0/500	5	5	5	8.4	8.2	8.0	23.7	24.3	24.8	7.4	7.6	6.8	12.08	13.55
Control C	0/500	5	5	5	8.4	8.2	8.0	23.7	24.4	24.4	7.3	7.6	6.6	12.25	13.39
Control D	0/500	5	5	5	8.4	8.2	8.0	23.8	24.6	24.4	7.4	7.5	6.7	12.26	13.17
20% A	0/500	5	5	5	8.2	8.0	8.0	24.1	24.5	24.4	7.5	7.1	7.0	12.39	13.43
20% B	0/500	5	4	4	8.2	8.1	8.0	24.1	24.3	24.2	7.5	7.3	7.0	12.45	13.35
20% C	0/500	5	4	4	8.2	8.1	8.0	24.1	24.3	24.6	7.5	7.3	6.8	12.45	13.27
20% D	0/500	5	4	4	8.2	8.1	8.1	24.1	24.1	24.6	7.5	7.3	6.9	12.46	13.39
30% A	0/500	5	3	3	8.1	8.0	8.1	24.1	24.6	24.3	7.6	7.2	7.1	12.56	13.30
30% B	0/500	5	4	4	8.1	8.0	8.1	24.2	24.4	24.0	7.6	7.2	7.1	12.56	13.14
30% C	0/500	5	5	5	8.1	8.0	8.0	24.2	24.1	24.5	7.6	7.2	6.8	12.57	13.35
30% D	0/500	5	5	5	8.1	8.0	8.0	24.3	23.9	24.1	7.6	7.3	6.7	12.60	13.27
44% A	0/500	5	1	0	7.9	8.0	8.1	24.9	24.6	24.3	7.5	7.3	7.2	12.80	13.46
44% B	0/500	5	4	3	7.9	8.1	8.1	24.9	24.2	24.1	7.5	7.3	7.2	12.80	13.34
44% C	0/500	5	2	2	7.9	8.1	8.1	24.9	24.0	24.1	7.5	7.5	7.1	12.79	13.45
44% D	0/500	5	2	1	8.0	8.1	8.1	24.9	23.8	24.2	7.5	7.5	7.2	12.80	13.33
67% A	0/500	5	0	-	7.8	8.0	-	25.1	24.9	-	7.7	7.3	-	12.86	13.22 [B]
67% B	0/500	5	0	-	7.8	8.0	-	25.1	24.4	-	7.6	7.3	-	12.85	13.05 [B]
67% C	0/500	5	0	-	7.8	8.0	-	25.1	24.3	-	7.6	7.3	-	12.85	12.98 [B]
67% D	0/500	5	0	-	7.8	8.0	-	25.0	24.1	-	7.6	7.4	-	12.82	13.07 [B]
100% A	500/0	5	0	-	7.6	8.1	-	24.6	24.7	-	8.1	7.3	-	12.06	12.67 [B]
100% B	500/0	5	0	-	7.5	8.1	-	24.6	24.7	-	9.2	7.4	-	12.05	12.42 [B]
100% C	500/0	5	0	-	7.4	8.1	-	24.6	24.7	-	9.2	7.4	-	12.05	12.39 [B]
100% D	500/0	5	0	-	7.4	8.1	-	24.6	24.6	-	9.3	7.4	-	12.04	12.41 [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 23-25°C.

Organism: ***Menidia beryllina*** Age: 12 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	8.4	8.2	8.2	23.8	24.8	23.7	7.3	7.6	7.7	12.42	12.82
Control B	0/500	5	5	5	8.4	8.2	8.2	23.8	25.0	23.7	7.4	7.6	7.7	12.39	12.98
Control C	0/500	5	5	5	8.4	8.2	8.2	23.8	24.8	24.0	7.4	7.6	7.6	12.33	13.01
Control D	0/500	6	6	6	8.4	8.2	8.2	23.8	24.8	23.8	7.4	7.6	7.6	12.40	12.94
100% A	500/0	5	5	5	7.4	8.0	8.2	24.7	24.7	24.1	9.2	7.7	7.6	12.06	12.51
100% B	500/0	5	5	4	7.4	8.0	8.2	24.7	24.5	23.9	9.3	7.7	7.5	12.06	12.39
100% C	500/0	5	5	5	7.4	8.0	8.2	24.7	24.5	24.4	9.3	7.8	7.5	12.04	12.50
100% D	500/0	5	5	5	7.4	7.9	8.2	24.6	24.6	24.3	9.2	7.7	7.4	12.00	12.49

[C] Temperature of test room was continously recorded on a strip chart recorder.
Room temperature range for the test period was 23-25°C.

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Marineland R/O
County: FLAGLER
Contact / District: Ed Cordova / Northeast
NPDES Permit #: FL00 43532
LIMS Sample #: 157274 LIMS Job #: 96-OCT-22-11
sample log 10-28-96

Sample Collection: Date 10/21/96 Time 1215
Test Beginning: Date 10/22/96 Time 1405
Test Ending: Date 10/24/96 Time 1410
Organism Batch #: 295 Diluent Batch #: 35
Organism Age: 2days
Test Organism: Mysidopsis bahia

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

Test Number: 1 of 2

Remarks:
TSK 48-hr LC_{50} = 38.72%
95% CI (34.64 - 43.27)

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	22.6 @ 22.5	8.8 @ 22.6 °C	963 @ 1079 9920 @ 10285 @ 23.3 °C
24 hr	7.0 @ 7.0 9.0 @ 9.0	23.4 @ 23.4	8.3 @ 24.7 °C	976 @ 1079 9730 @ 9966 @ 24.1 °C
48 hr	7.0 @ 7.0 9.0 @ 9.0	22.0 @ 22.0	8.6 @ 22.9 °C	968 @ 1079 9040 @ 9966 @ 23.7 °C

A-2 meter salinity not set to 20 ppt. 10/23 DC

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. (µmhos/cm) 24 h	UNCORRECTED Cond. (µmhos/cm) 48 h
Ctr A	D1	5	5	5	8.4	8.2	8.0	23.8	24.2	24.5	7.4	8.2 24	6.8	11.98	12.98	13.47
Ctr B	D2	5	5	5	8.4	8.2	8.0	23.7	24.3	24.8	7.4	8.2 24	6.8	12.05	12.97	13.55
Ctr C	D3	5	5	5	8.4	8.2	8.0	23.7	24.4	24.4	7.3	8.2 24	6.6	12.35	13.02	13.39
Ctr D	D4	5	5	5	8.4	8.2	8.0	23.8	24.6	24.4	7.4	8.2 24.5	6.7	12.26	12.83	13.17
20% A	D5	5	5	5	8.2	8.0	8.0	24.1	24.5	24.4	7.5	7.1	7.0	12.39	13.02	13.43
20% B	D6	5	4	4	8.2	8.1	8.0	24.1	24.3	24.2	7.5	7.3	7.0	12.45	12.96	13.35
20% C	D7	5	4	4	8.2	8.1	8.0	24.1	24.3	24.6	7.5	7.3	6.8	12.45	12.84	13.27
20% D	D8	5	4	4	8.2	8.1	8.1	24.1	24.1	24.6	7.5	7.3	6.9	12.46	12.97	13.39
30% A	D9	5	3	3	8.1	8.0	8.1	24.1	24.6	24.3	7.6	7.2	7.1	12.52	13.04	13.50
30% B	D10	5	4	4	8.1	8.0	8.1	24.2	24.4	24.0	7.6	7.2	7.1	12.50	12.93	13.14
30% C	D11	5	5	5	8.1	8.0	8.0	24.2	24.1	24.5	7.6	7.2	6.8	12.51	12.97	13.35
30% D	D11	5	5	5	8.1	8.0	8.0	24.3	24.9	24.1	7.6	7.3	6.7	12.60	12.81	13.27
44% A	D13	5	1	0 dead	7.9	8.0	8.1	24.9	24.4	24.3	7.5	7.3	7.2	12.85	13.05	13.46
44% B	D14	5	4	3 10	7.7	8.1	8.1	24.9	24.2	24.1	7.5	7.3	7.2	12.85	13.06	13.55
44% C	D15	5	2	2	7.9	8.1	8.1	24.9	24.2	24.1	7.5	7.3	7.1	12.79	13.01	13.47
44% D	D16	5	3	1 10	8.0	8.1	8.1	24.9	24.3	24.2	7.5	7.5	7.2	12.85	13.00	13.53
60% A	D17	5	0	—	7.9	8.0	—	24.9	24.4	—	7.7	7.3	—	12.86	13.03	—
60% B	D18	5	0	—	7.8	7.9	—	25.1	24.4	—	7.6	7.3	—	12.88	13.02	—
60% C	D19	5	0	—	7.8	7.9	—	25.1	24.3	—	7.6	7.3	—	12.87	13.03	—
60% D	D20	5	0	—	7.8	7.9	—	25.1	24.4	—	7.6	7.4	—	12.86	13.03	—
100% A	D21	5	0	—	7.6	7.7	—	24.6	24.7	—	7.7	7.3	—	12.84	13.03	—
100% B	D22	5	0	—	7.5	7.7	—	24.4	24.7	—	7.2	7.4	—	12.85	12.93	—
100% C	D23	5	0	—	7.4	7.7	—	24.6	24.7	—	7.2	7.4	—	12.85	13.04	—
100% D	D24	5	0	—	7.4	7.7	—	24.6	24.7	—	7.3	7.4	—	12.84	12.91	—
Measured/Loaded by:		MF	DW	DW	ND	ND	JS	ND	ND	JS	ND	ND	JS	ND	ND	JS
Recorded by:		MF	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW

Investigators' Signatures

Water Quality Parameters (Salt Water)

	Well Water	20% Min Water	Sample	Method	Measured by
Field Total Residual Cl2 (mg/L):			Not measured		
Lab Total Residual Cl2 (mg/L):	<.03	<.03	<.03	DR-100	JS
Alkalinity (mg/L as $CaCO_3$):	135	—	105	Hach	DW by MF
Hardness (mg/L as $CaCO_3$):	—	—	—	Not measured	
Total ammonia (mg/L as N):	<0.017	—	<0.017	Orion	MF

Ammonia Meter #98136 Ammonia Meter Slope: -59.5 Ammonia Blank: <0.017 Control Salinity: 7.3 ppt Sample Salinity: 7.3 ppt

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form updated 4/01/96

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Marineland R/O
County: Flagler
Contact / District: Ed Cordova / Northeast
NPDES Permit #: FL0043532
LIMS Sample #: 157274 LIMS Job #: 96-OCT-22-11
sample log 10-28-96

Sample Collection: Date 10/21/96 Time 1115
Test Beginning: Date 10/22/96 Time 1420
Test Ending: Date 10/24/96 Time 1415
Organism Batch #: 41 Diluent Batch #: 35
Organism Age: 12 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	22.6 @ 22.5	8.6 @ 22.6 °C	963 @ 1079 9820 @ 10285 @ 23.3 °C
24 hr	7.0 @ 7.0 9.0 @ 9.0	23.4 @ 23.4	8.3 @ 24.7 °C	976 @ 1079 9730 @ 9966 @ 24.1 °C
48 hr	7.0 @ 7.0 9.0 @ 9.0	22.0 @ 22.0	8.6 @ 22.9 °C	968 @ 1079 9640 @ 9966 @ 23.7 °C

		Number Live			pH			Temperature (°C)			D.O. (mg/L)			UNCORRECTED Cond. (mmhos/cm) Cond. (µmhos/cm)		
Conc.	Chamber #	0 hr	24 h	48 h	0 hr	24 h	48 h	0 hr	24 h	48 h	0 hr	24 h	48 h	0 hr	24 h	48 h
Ctl A	C1	5	5	5	8.4	8.2	8.2	23.8	24.8	23.7	7.3	7.6	7.7	12.42	12.84	12.82
Ctl B	C2	5	5	5	8.4	8.2	8.2	23.8	25.0	23.9	7.4	7.6	7.7	12.39	12.98	12.98
Ctl C	C3	5	5	5	8.4	8.2	8.2	23.8	24.8	24.0	7.4	7.6	7.6	12.33	12.92	13.01
Ctl D	C4	~~6~~	~~6~~	6	8.4	8.2	8.2	23.8	24.8	23.8	7.4	7.6	7.6	12.40	12.87	12.94
100% A	C5	5	5	5	7.4	8.0	8.2	24.7	24.7	24.1	9.2	7.7	7.6	12.06	12.31	12.51
100% B	C6	5	5	4 [1C]	7.4	8.0	8.2	24.7	24.5	23.9	9.3	7.7	7.5	12.06	12.28	12.34
100% C	C7	5	5	5	7.4	8.0	8.2	24.7	24.5	24.4	9.3	7.8	7.5	12.04	12.26	12.50
100% D	C8	5	5	5	7.4	7.9	8.2	24.6	24.6	24.3	9.2	7.7	7.4	12.00	12.35	12.49
		* Check count error MF 10-23-96														
Measured/Loaded by:		MF	MF	DJ	ND	ND	JS	ND	ND	JS	ND	ND	JS	ND	ND	JS
Recorded by:		MF	MF	DJ	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW

Investigators' Signatures

Water Quality Parameters (Salt Water)

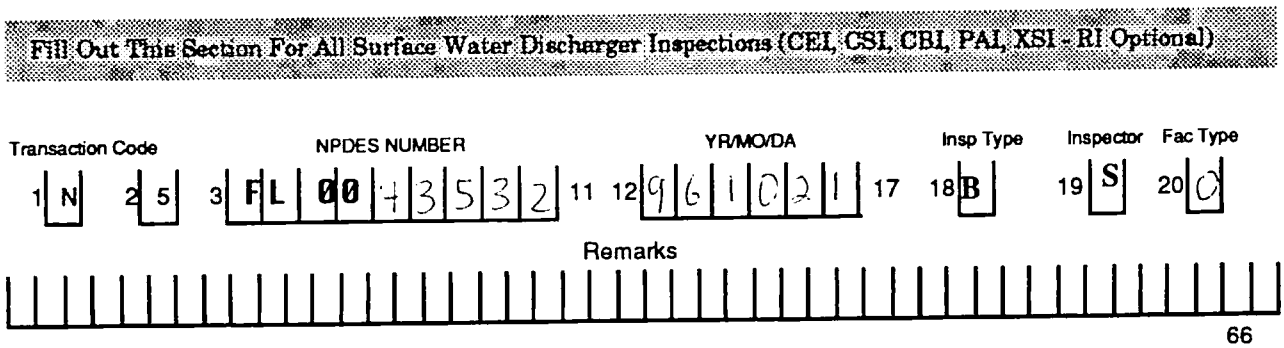
	Well Water	20% Min Water	Sample	Method	Measured by
Field Total Residual Cl2 (mg/L):			NOT MEASURED		
Lab Total Residual Cl2 (mg/L):	<.03	<.03	<.03	DR-100	JS
Alkalinity (mg/L as $CaCO_3$):	135	—	105	HACH	DW/MF
Hardness (mg/L as $CaCO_3$):	—	—	—	NOT MEASURED	
Total ammonia (mg/L as N):	<0.017	—	<0.017	Orion	MF

Ammonia Meter #98136 Meter Slope: -59.5 Ammonia Blank: <0.017 Control Salinity: 7.3 ppt Sample Salinity: 7.3 ppt

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form updated 4/01/96

The Bioassay of the Marineland RO Plant effluent sampled on October 21, 1996, NPDES # FL0043532.



The Priority Pollutants Analysis for the Bioassay of the Marineland RO Plant effluent sampled on October 21, 1996, NPDES # FL0043532.

