

Bioassays of

Village of Tequesta Reverse Osmosis Concentration Treatment/Disposal

Tequesta, Palm Beach County, Florida

NPDES #FL0168572

Sampled 2/13/01

October 2001

Biology Section

Division of Resource Assessment & Management

Comprehensive Quality Assurance Plan #870346G

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Village of Tequesta Reverse Osmosis Concentration Treatment/Disposal

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Biology Section
Bureau of Laboratories
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Introduction

Village of Tequesta Reverse Osmosis Concentrate Treatment/Disposal, Old Dixie Highway, Tequesta, Palm Beach County, Florida, NPDES #FL0168572, tests performed on 14 to 16 February 2001.

This reverse osmosis drinking water plant has a design flow of 1.3 MGD and an average flow of 0.65 MGD. The reject water is treated by injection of hydrogen peroxide to remove excess hydrogen sulfide. After treatment, the effluent is discharged into the Class III marine waters of Jupiter Inlet.

This facility has mixing zones for fluoride, combined radium 226 and 228, and dissolved oxygen. Each mixing zone is permitted at 145 feet (44.2 meters) on either side from Outfall D001 (facility summary provided by Bob Hennes, FDEP, West Palm Beach).

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 and temperature, the effluent had a salinity of approximately 16.9 parts per thousand (ppt). The test species used for these bioassays were the inland silverside minnow, *Menidia beryllina*, and the mysid shrimp, *Americamysis bahia*. The test results did not indicate toxicity to the *M. beryllina* within 48 hours. However, the test results did indicate that the sample was toxic to *A. bahia* producing 60 percent mortality within 48 hours (Table 1).

The control water was natural seawater (NSW) diluted to 18 ppt for the *M. beryllina* test and 23 ppt for the *A. bahia* test. The sample was adjusted to an apparent salinity of 18 ppt for the *M. beryllina* test and 23 ppt for the *A. bahia* test to ensure that the minimum required seawater ions (one ppt for *M. beryllina*, six ppt for *A. bahia*) were present. Salinity adjustments for effluents that have salinity above six ppt are not usually performed. The salinity adjustment for this facility sample was a result of misinterpretation of the standard operating procedures. The test results did not indicate acute toxicity to the *M. beryllina* within 48 hours. However, the test results did indicate that the salinity-adjusted sample was acutely toxic to *A. bahia* producing 20 percent mortality within 48 hours (Table 1). The addition of salts may have decreased the potential toxicity of this sample to *A. bahia*.

Total residual chlorine of the sample was not measured in the field and was detected at 0.24 mg/L in the lab. This is likely due to interference since chlorination is not part of the treatment process. An aliquot of the salt-adjusted sample was dechlorinated using sodium thiosulfate and tested along with the salt-adjusted sample. An additional control was prepared by using the respective salt-adjusted control for *M. beryllina* and *A. bahia* and treated with the same ratio of sodium thiosulfate as the sample. The purpose of the additional sodium thiosulfate controls was to test for any toxic effects of dechlorination. No toxic effects were observed in any of the controls. The sodium thiosulfate-treated sample showed more mortality (60%) than the salt-adjusted sample without sodium thiosulfate. The reason for the increased toxicity was not determined. Since the addition of sodium thiosulfate did not reduce the toxicity relative to the salinity-adjusted sample without sodium thiosulfate, we can still conclude that

chlorine was not a source of toxicity in the original sample. The total and unionized ammonia were 4.82 mg/L and 0.094mg/L, respectively. Further chemical analyses were performed on the sample, and several metals were identified (Table 2).

The chemistry results confirmed that the ion makeup of the sample was not in seawater proportions and that the apparent 16.9 ppt salinity of the sample was due to elevated levels of ground-water ions. The observed mortality in the *A. bahia* test is likely due to the seawater-ion imbalance of the sample. Previous research conducted by the FDEP Biology Section demon-strated that *A. bahia* is much more sensitive to seawater-ion imbalances than is *M. beryllina.* (Wolfe, *et al*. 1995. Protocols for determining Major-Seawater-Ion Toxicity in Membrane-Technology Water-Treatment Concentrate. Florida Department of Environmental Protection, Bureau of Laboratories. 96pp.) The calcium concentration was measured at 612 mg/L at 16.9 ppt salinity (salinity based on conductivity and temperature). This is approximately 200 percent greater than the normal background concentration for calcium in seawater of this salinity. The elevated calcium concentration is one possible source of toxicity in this sample, but other unidentified sources of toxicity cannot be ruled out without performing the major-seawater-ion imbalance toxicity testing protocols cited above.

Conclusion

The sample of effluent collected from this facility on February 13, 2001, showed no acute toxicity to the test species *M. beryllina* within 48 hours of test initiation. However, the test results did show slight acute toxicity to the test species *A. bahia*. The addition of salts may have decreased the potential toxicity of this sample to *A. bahia* .The elevated calcium concentration is one source of toxicity in this sample, but other unidentified sources of toxicity cannot be ruled out without performing the major-seawater-ion imbalance toxicity testing protocols cited above.

Table 1. Data recorded during the 48-hour acute screening bioassays of a sample of effluent from the Village of Tequesta Reverse Osmosis Concentrate Treatment/Disposal, Old Dixie Highway, Tequesta, Palm Beach County, Florida, NPDES# FL0168572 performed on 14 to 16 February 2001.

Facility:	**Village of Tequest RO**	**NPDES #**	**FL0168572**	Facility Type:	**Reverse**	**Analysts:**	Della Parker-Hanson
Location:	Old Dixie Highway	Contact/District:	T. Davis/South District		**Osmosis Plant**		Yasser Kattan
County:	Palm Beach	Test type:	static acute screen				Joshua Ayres
Sample Collection Date:	2/13/01 Time: 1300	# tests:	2	Receiving Water:	Jupiter Inlet		Shannon Gerardi
Test Beginning Date:	2/14/01 Time: 1615	Chlorination Type:	non-chlorinated				
Test Ending Date:	2/16/01 Time: 1435				**Page 1 of 2**	**Reviewer:**	Steve Wolfe

Organism: ***Menidia beryllina*** Life stage: 13 days

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	8.0	8.0	8.0	25.3	24.4	24.6	7.0	6.6	6.8	28.5	28.3
Control B	0/500	5	5	5	8.0	8.0	8.0	25.3	24.3	24.6	7.1	6.8	6.9	28.5	28.9
Control C	0/500	5	5	5	8.0	8.1	8.1	25.2	24.2	24.7	7.1	6.8	6.7	28.6	29.6
Control D	0/500	5	5	5	8.0	8.0	8.1	25.1	24.3	25.1	7.1	6.6	6.8	28.6	29.2
Salt Ctrl A	0/500	5	5	5	8.1	8.1	8.1	25.2	25.4	24.6	7.2	6.6	6.8	28.4	29.8
Salt Ctrl B	0/500	5	5	5	8.1	8.1	8.1	25.1	24.6	25.1	7.1	6.5	6.8	28.5	29.9
Salt Ctrl C	0/500	5	5	5	8.1	8.1	8.1	25.2	24.9	24.4	7.2	6.6	6.8	28.7	29.0
Salt Ctrl D	0/500	5	5	5	8.1	8.2	8.1	25.2	25.2	24.3	7.2	6.6	6.7	28.7	28.6
Salt Ctrl A [A]	0/500	5	5	5	8.1	8.1	8.1	25.3	25.4	24.3	7.1	6.6	6.8	29.2	28.8
Salt Ctrl B [A]	0/500	5	5	5	8.1	8.1	8.1	25.3	24.9	24.9	7.0	6.6	6.8	29.2	30.3
Salt Ctrl C [A]	0/500	5	5	5	8.1	8.1	8.1	25.1	25.1	24.9	7.0	6.7	6.6	29.0	30.2
Salt Ctrl D [A]	0/500	5	5	5	8.1	8.1	8.1	25.1	24.9	24.9	7.1	6.5	6.4	29.1	29.7
Salt adj.100% A	500/0	5	5	5	7.5	8.0	8.2	25.3	24.9	24.6	6.7	6.5	6.6	28.7	28.7
Salt adj.100% B	500/0	5	5	5	7.5	8.1	8.2	25.3	24.8	24.8	6.7	6.6	6.6	28.6	29.1
Salt adj. 100% C	500/0	5	5	5	7.5	8.1	8.2	25.3	24.7	24.5	6.7	6.7	6.7	28.5	29.2
Salt adj. 100% D	500/0	5	5	5	7.5	8.1	8.3	25.3	24.7	24.5	6.7	6.8	6.8	28.7	28.1
Salt adj. 100% A [A]	500/0	5	5	5	7.5	8.1	8.2	25.4	24.8	24.3	6.8	6.9	6.8	28.8	28.7
Salt adj. 100% B [A]	500/0	5	5	5	7.5	8.1	8.3	25.4	24.9	24.4	6.7	6.7	6.8	28.8	28.8
Salt adj.100% C [A]	500/0	5	5	5	7.5	8.1	8.3	25.4	24.9	24.4	6.7	6.6	6.7	28.8	28.5
Salt adj. 100% D [A]	500/0	5	5	5	7.5	8.1	8.3	25.3	24.8	24.9	6.7	6.4	6.7	28.8	29.3

[A] These replicates are treated with sodium thiosulfate.

[B] Temperatures of room and test incubator were continuously recorded on a strip chart recorder.
Room Temperature range for the test period was 24.0-26.0°C.
Incubator #3 temperature range for the test period was 23.0-25.5°C.

Data Transcription Verification	
date:	10/4/01
by:	Della Parker-Hanson Joshua Ayres

Total Residual CL2	mg/L	Method
Field:	-	-
Lab:	0.24	Hach

Ammonia	Total (mg/L)	Unionized (mg/L)
NSW:	<0.051	<0.051
Salt-adjusted Sample:	4.82	0.094

Alk & Hardness	Alkalinity (mg/L)	Hardness (mg/L)
NSW:	129	-
100% Sample:	470	-

Salinity[C]	(ppt)
NSW (adjusted):	18
100% Sample:	16.9
Adjusted sample:	18

[C] Salinity based on conductivity and temperature measurements.

continued

Table 1.
concluded

Data recorded during the 48-hour acute screening bioassays of a sample of effluent from the Village of Tequesta Reverse Osmosis Concentrate Treatement/Disposal, Old Dixie Highway, Tequesta, Palm Beach County, Florida, NPDES# FL0168572 performed on 14 to 16 February 2001.

Facility:	**Villiage of Tequesta RO**	**NPDES #**	**FL0168572**	Facility Type:	**Reverse**	**Analysts**	Shannon Gerardi
Location:	Old Dixie Highway	Contact/District:	T. Davis/South District		**Osmosis Plant**		Della Parker-Hanson
County:	Palm Beach	Test type:	static acute screen				Yasser Kattan
Sample Collection Date:	2/13/01 Time: 1300	# tests:	2	Receiving Water:	Jupiter Inlet		Joshua Ayres
Test Beginning Date:	2/14/01 Time: 1550	Chlorination Type:	non-chlorinated				Travis Hill
Test Ending Date:	2/16/01 Time: 1440				**Page 2 of 2**	**Reviewer:**	Steve Wolfe

Organism: ***Americamysis bahia*** Life stage: 3 days

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	8.0	8.1	8.0	25.7	25.0	24.8	6.9	6.7	6.4	36.8	37.7
Control B	0/500	5	5	5	8.0	8.1	8.0	25.6	25.0	24.8	6.9	6.6	6.3	36.9	37.1
Control C	0/500	5	5	4	8.1	8.0	8.0	25.6	25.1	24.7	6.9	6.6	6.4	36.9	36.6
Control D	0/500	5	5	5	8.1	8.0	8.0	25.6	25.2	24.6	6.9	6.4	6.4	37.0	36.5
Salt Ctrl A	0/500	5	5	3	8.2	8.1	8.0	25.7	25.8	24.4	6.8	6.5	6.4	36.7	36.2
Salt Ctrl B	0/500	5	5	5	8.2	8.1	8.1	25.6	25.4	24.3	6.8	6.2	6.5	36.6	37.5
Salt Ctrl C	0/500	5	5	5	8.2	8.1	8.1	25.6	25.4	24.2	6.9	6.2	6.4	36.7	38.2
Salt Ctrl D	0/500	5	5	5	8.2	8.1	8.1	25.6	25.4	24.3	6.9	6.2	6.3	36.6	36.0
Salt Ctrl A [A]	0/500	5	5	5	8.2	8.1	8.1	25.7	25.1	24.2	6.8	6.2	6.2	36.9	37.7
Salt Ctrl B [A]	0/500	5	5	5	8.2	8.1	8.1	25.7	25.0	24.1	6.8	6.2	6.3	36.8	37.6
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Salt adj.100% B	500/0	5	4	4	7.6	8.0	8.2	25.8	25.1	24.3	6.6	6.3	6.0	36.7	36.3
Salt adj. 100% C	500/0	5	5	5	7.6	8.1	8.3	25.7	25.1	24.4	6.6	6.3	6.0	36.6	36.0
Salt adj. 100% D	500/0	5	3	3	7.6	8.1	8.3	25.7	25.1	24.3	6.7	6.2	6.2	36.7	35.1
Salt adj. 100% A [A]	500/0	5	3	3	7.6	8.1	8.3	25.7	25.2	24.3	6.7	6.3	6.4	37.1	36.5
Salt adj. 100% B [A]	500/0	5	3	2	7.6	8.1	8.2	25.6	25.3	24.4	6.7	6.2	6.1	37.0	36.3
Salt adj.100% C [A]	500/0	5	2	2	7.6	8.1	8.2	25.6	25.3	24.5	6.7	6.4	5.9	37.0	36.6
Salt adj. 100% D [A]	500/0	5	3	1	7.6	8.1	8.3	25.6	25.2	24.5	6.7	6.1	6.1	37.0	36.4

[A] These replicates are treated with sodium thiosulfate.

[B] Temperatures of room and test incubator were continuously recorded on a strip chart recorder.
Room Temperature range for the test period was 24.0-26.0°C.
Incubator #3 temperature range for the test period was 23.0-25.5°C.

Data Transcription Verification	
date:	10/4/01
by:	Della Parker-Hanson Joshua Ayres

Total Residual CL2	mg/L	Method
Field:	-	-
Lab:	0.24	Hach

Ammonia	Total (mg/L)	Unionized (mg/L)
NSW:	<0.051	<0.051
Salt-adjusted Sample:	4.82	0.094

Alk & Hardness	Alkalinity (mg/L)	Hardness (mg/L)
NSW:	129	-
100% Sample:	470	-

Salinity[C]	(ppt)
NSW (adjusted):	23
100% Sample:	16.9
Adjusted sample	23

[C] Salinity based on conductivity and temperature measurements.

Table 2. Results of chemical analyses on the effluent from Village of Tequesta Reverse Osmosis Concentrate Treatment/Disposal sampled on February 13, 2001.

Metals

Calcium	612	mg/L	
Chromium	0.77	µg/L	[I]
Copper	2.9	µg/L	[I]
Iron	34	µg/L	[I]
Magnesium	619	mg/L	
Nickel	5.5	µg/L	[I]

Pesticides and Herbicides

None detected

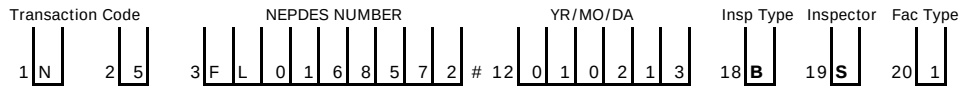
Base, Neutral, & Acid Extractable Organics

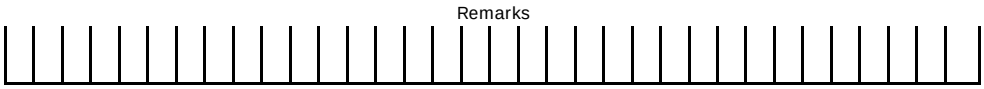
None detected

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

The Bioassay of Village of Tequesta RO effluent sampled on February 13, 2001, NPDES #FL0168572.

Fill Out This Section For All Surface Water Discharger Inspections(CEI, CSI, CBI, PAI, XSI-RI Optional)

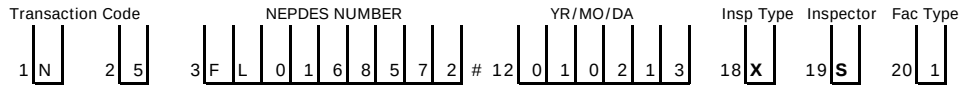


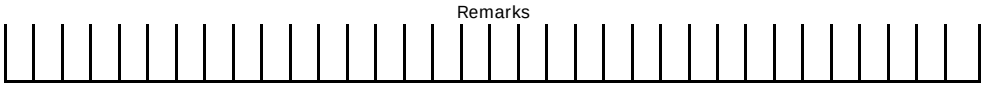


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The Priority Pollutants Analysis for Bioassay of Village of Tequesta RO effluent sampled on February 13, 2001, NPDES #FL0168572.

Fill Out This Section For All Surface Water Discharger Inspections(CEI, CSI, CBI, PAI, XSI-RI Optional)





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