

Bioassays of

Bellinger Shipyards, Inc. Wastewater Treatment Plant

Jacksonville, Duval County, Florida

NPDES #FL0031232

Sampled 3/9/98

July 1998

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

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Biology Section
Bureau of Laboratories
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Introduction

Bellinger Shipyards, Inc., WWTP, 13911 Atlantic Blvd., Jacksonville, Duval County, Florida, NPDES #FL0031232, tests performed on 10 to 12 March, 1998.

This industrial facility's wastewater treatment system has a design flow of 0.02 MGD. Wastewater is treated by the extended-aeration process with tertiary filtration. Wastewater is chlorinated for disinfection, then dechlorinated with sodium sulfide tablets prior to being discharged to the Intracoastal Waterway (facility summary provided by Belinda Bishop, FDEP, Jacksonville).

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. Two additional bioassays were performed on an aliquot of sample which had been dechlorinated in the laboratory by the addition of 1.5 mL of 0.025 N sodium thiosulfate per liter of sample. The test species used for these bioassays were the water flea, *Ceriodaphnia dubia*, and the bannerfin shiner, *Cyprinella leedsi*. The chlorinated sample proved toxic, producing 100% mortality in both test species within 24 hours. The dechlorinated test showed toxicity to *Ceriodaphnia dubia* (25% mortality) but did not show toxicity to *Cyprinella leedsi* (Table 1).

The total residual chlorine (TRC) concentration of the 100% whole effluent sample was 0.43 mg/L in the field and 1.2 mg/L in the laboratory. The TRC concentration of the dechlorinated aliquot of sample was < 0.03 mg/L. TRC levels as low as 0.028 mg/L have been found to be acutely toxic to some freshwater fish and invertebrates (USEPA, 1986. Quality Criteria for Water. EPA 440/15-86-001). Total ammonia was not detected in the sample. Further chemical analyses were performed on the sample and numerous metals and several organic compounds were identified (Table 2). Several metals exceeded their respective State of Florida Class III marine surface water criterion (Table 3). The copper concentration (35.9 µg/L) equaled or exceeded concentrations which have been shown to produce mortality in *Ceriodaphnia dubia* (USEPA *AQUIRE* toxicity database, 1997).

Conclusion

The sample of effluent collected from this facility on March 10, 1998, showed toxicity to both test species, producing 100% mortality within 24-hours. The dechlorinated aliquot of sample was toxic to *Ceriodaphnia dubia* but not to *Cyprinella leedsi*. We attribute the toxicity of the sample to the total residual chlorine and copper in the sample.

Table 1. Data recorded during the 48-hour acute screening bioassays of a sample of effluent from the Bellinger Shipyards, Inc., WWTP, Jacksonville, Duval County, Florida, NPDES Permit #FL0031232, performed on 10 to 12 March, 1998.

Facility:	Bellinger Shipyards, Inc.			NPDES #	FL0031232	Facility Type:	Wastewater Treatment Plant
Location:	13911 Atlantic Blvd., Jacksonville			Contact/District:	Tim McKelvey/Northeast		
County:	Duval			Test type:	static acute screen		
Sample Collection Date:	3/9/98	Time:	1500	# tests:	2	Receiving Water:	Intracoastal waterway
Test Beginning Date:	3/10/98	Time:	1530	Chlorination Type:	Chlorinated		
Test Ending Date:	3/12/98	Time:	1530				Page 1 of 1

Total Residual CL2	mg/L	Method
Field:	0.43	-
Lab:	1.2	DR-100

Ammonia	Total (mg/L)	Unionized (mg/L)
Ammonia	Total (mg/L)	Unionized (mg/L)
Control Water (fish):	<0.017	<0.017
Control Water (20% DMW) (cladocerans):	<0.017	<0.017
100% Sample:	<0.017	<0.017

Alk & Hardness	Alkalinity (mg/L)	Hardness (mg/L)
Control Water (fish):	120	126
Control Water (20% DMW) (cladocerans):	70	94
100% Sample:	76	301

Salinity	(ppt)
Control Water (fish):	0
Control Water (20% DMW) (cladocerans):	0
100% Sample:	0

Organism: ***Ceriodaphnia dubia*** Life stage: < 24 hours old

	Sample/Diluent	SURVIVAL # Alive			pH			Temperature[A]			Dissolved Oxygen			Conductivity Uncorrected µmhos/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	0/20	5	5	5	8.1	-	8.0	23.6	-	24.1	8.5	-	7.9	170	190
Control B	0/20	5	5	5	-	-	8.0	-	-	24.1	-	-	7.9	-	185
Control C	0/20	5	5	5	-	-	8.0	-	-	24.1	-	-	7.9	-	195
Control D	0/20	5	5	5	-	-	8.0	-	-	24.0	-	-	7.9	-	200
Decl100% A	20/0	5	5	5	7.9	-	8.0	23.6	-	23.9	8.4	-	7.9	1090	1150
Decl100% B	20/0	5	4	3	-	-	8.0	-	-	23.9	-	-	7.8	-	1200
Decl100% C	20/0	5	3	2	-	-	8.0	-	-	23.9	-	-	7.8	-	1260
Decl100% D	20/0	5	5	5	-	-	8.0	-	-	23.9	-	-	7.8	-	1295
100% A	20/0	5	0	-	7.9	8.0	-	23.5	24.0	-	8.3	7.5	-	1100	1190[B]
100% B	20/0	5	0	-	-	8.0	-	-	24.0	-	-	7.6	-	-	1195[B]
100% C	20/0	5	0	-	-	8.0	-	-	24.0	-	-	7.6	-	-	1190[B]
100% D	20/0	5	0	-	-	8.1	-	-	23.6	-	-	7.6	-	-	1185[B]

Decl = Dechlorinated sample

[A] Temperature of test incubator # 1 and test room were continuously recorded on strip chart recorders. Incubator temperature range for the test period was 23.9-25.0°C. [B] 24-hour reading. Test room temperature range for the test period was 23.5-24.5°C.

Organism: ***Cyprinella leedsi*** Age: 12 days

	Sample/Diluent	SURVIVAL # Alive			pH			Temperature[C]			Dissolved Oxygen			Conductivity Uncorrected µmhos/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	7.7	8.2	8.3	24.0	25.1	25.2	8.6	7.8	7.7	244	260
Control B	0/500	5	5	5	7.8	8.2	8.3	23.9	24.4	24.8	8.6	7.7	7.8	247	255
Control C	0/500	5	5	5	7.8	8.2	8.3	23.9	24.4	24.6	8.4	7.9	7.9	247	255
Control D	0/500	5	5	5	7.8	8.2	8.3	23.9	24.4	24.5	8.6	7.9	7.9	247	255
Decl 100% A	500/0	5	5	5	7.8	7.9	7.9	24.9	24.2	24.7	8.4	7.8	7.0	1145	1170
Decl 100% B	500/0	5	5	5	7.8	7.9	7.9	25.0	24.3	25.2	8.3	7.5	7.2	1150	1195
Decl 100% C	500/0	5	5	5	7.8	7.9	7.9	25.0	24.4	24.8	8.1	7.5	7.0	1151	1185
Decl 100% D	500/0	5	5	5	7.9	7.9	7.9	24.9	25.0	24.6	8.3	7.0	6.9	1151	1180
100% A	500/0	5	0	-	7.8	7.9	-	24.8	24.6	-	8.4	7.3	-	1080	1155[D]
100% B	500/0	5	0	-	7.8	7.8	-	24.9	24.4	-	8.3	7.1	-	1137	1145[D]
100% C	500/0	5	0	-	7.8	7.8	-	24.9	24.6	-	8.4	7.2	-	1144	1155[D]
100% D	500/0	5	0	-	7.8	7.8	-	24.9	24.4	-	8.4	6.8	-	1145	1145[D]

Decl = Dechlorinated sample

[C] Temperature of test incubator # 3 and test room were continuously recorded on strip chart recorders. Incubator temperature range for the test period was 25.0-26.5°C. [D] 24-hour reading. Test room temperature range for the test period was 23.5-24.5°C.

Table 2. Results of chemical analyses on the effluent from the Bellinger Shipyards, Inc., sampled on March 9, 1998.

Metals

Aluminum	130	µg/L
Cadmium	0.2	µg/L[I]
Calcium	79.4	mg/L
Copper	35.9	µg/L
Iron	787	µg/L
Lead	4.68	µg/L
Magnesium	22.9	mg/L
Nickel	54	µg/L
Selenium	68	µg/L[I]
Silver	1.43	µg/L
Zinc	103	µg/L[J]

Base, Neutral, & Acid Extractable Organics

Diethyl phthalate	2.9	µg/L[I]
Dimethyl phthalate	1.4	µg/L[I]

Herbicides and Pesticides

none detected

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

[J] Estimated value.

Table 3. Metals detected in the sample of effluent from the Bellinger Shipyards, Inc., WWTP, which exceeded their respective State of Florida Class III marine surface water criterion (FAC 62-302.530).

	Copper	Iron	Nickel	Silver	Zinc
Sample Concentration	35.9[A]	787[A]	54[A]	1.43[A]	103[A]
Standard	≤ 2.9	≤ 300	≤ 8.3	≤ 0.05	≤ 86

All standards and concentrations are in µg/L.

[A] Exceeds standards.

FDEP Biology Section — Acute Bioassay Bench Sheet

mf 3/11/98

Sample Source: Bellinger Shipyard
County: Duval
Contact / District: Tim McKelvey / Northeast
NPDES Permit #: FL0031232
LIMS Sample #: 311901 LIMS Job #: TCH 98-03-10-30
sample log: 3/10/98 DW

Sample Collection: Date 3-9-98 Time ~~1450~~ 1500
Test Beginning: Date 3-10-98 Time 1530
Test Ending: Date 3-12-98 Time 1530
Organism Batch #: 13 Diluent Batch #: 11
Organism Age: <24 hours
Test Organism: Ceriodaphnia dubia

Test Type: (Screening) Definitive
(Static) Static Renewal Flow-through
Temperature range: room 23.5-24.5°C
incubator 23.9-25.0°C
Test Number: 1 of 2
Remarks: D = dead, M = missing

An aliquot of the sample was dechlorinated with 1.5mL/L of 0.025N sodium thiosulfate

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	21.6 @ 21.6	8.3 @ 24.1 °C	96.9 @ 963 964 @ 1005 @ 23.5 °C
24 hr	7.0 @ 7.0 9.0 @ 9.0	23.0 @ 23.1	8.2 @ 25.1 °C	97.9 @ 96.3 982 @ 1005 @ 25.2 °C
48 hr	7.0 @ 7.0 9.0 @ 9.0	21.9 @ 22.0	8.2 @ 24.9 °C	998 @ 96.3 985 @ 1005 @ 23.5 °C

Conc.	Chamber #	Number Live 0 hr	Number Live 24 hr	Number Live 48 hr	pH 0 hr	pH 24 hr	pH 48 hr	Temperature (°C) 0 hr	Temperature (°C) 24 hr	Temperature (°C) 48 hr	D.O. (mg/L) 0 hr	D.O. (mg/L) 24 hr	D.O. (mg/L) 48 hr	UNCORRECTED Cond. (mmhos/cm) 0 hr	UNCORRECTED Cond. (mmhos/cm) 24 hr	UNCORRECTED Cond. (mmhos/cm) 48 hr
Control A	A	5	5	5	8.1		8.0	23.6		24.1	8.5		7.9	170		180
Control B	B	5	5	5			8.0			24.1			7.9			185
Control C	C	5	5	5			8.0			24.1			7.9			195
Control D	D	5	5 A	5			8.0			24.0			7.9			200
100% A	A	5	10 5	5	7.7		8.0	23.6		23.9	8.4		7.9	1090		1150
100% B	B	5	10 4	10 3			8.0			23.9			7.8			1200
100% C	C	5	10 3	10 2			8.0			23.9			7.8			1260
100% D	D	5	10 5	5			8.0			23.9			7.8			1295
100% ~~dead~~ A	A	5	5 0		7.7	5.0		23.5	24.0		8.3	7.5		1100	1190	
100% ~~dead~~ B	B	5	4 0			5.1			24.0			7.6			1195	
100% ~~dead~~ C	C	5	5 0			8.0			24.0			7.6			1190	
100% ~~dead~~ D	D	5	5 0			5.1			23.6			7.6			1155	
Measured/Loaded by		DW	MF	MF	DW	MF	MF	DW	MF	MF	DW	MF	MF	DW	MF	MF
Recorded by		DW	DW & MF	MF	DW	DW	DAW	DW	DW	DAW	DW	DW	DAW	DW	DW	DAW

Chlorinated Samples

* chlorinated sample, not dechlorinated mf 3/11/98

A Data recorded in incorrect place mf 3/11/98 corrected data inserted mf 3/11/98

Investigators' Signatures

Marshall Faircloth

Tim McKelvey

Tim Overwright

reviewer

form updated 4/1/97

Water Quality Parameters (Verified by MF)	Salt Water / Well Water	20% Min Water	Sample	Method	Measured by
Field Total Residual Cl2 (mg/L)			~~1.2~~ 0.43 mf 3/11/98		Tim McKelvey
Lab Total Residual Cl2 (mg/L)		<0.03	1.2	DR-100	DAW
Alkalinity (mg/L as $CaCO_3$)		70	76	Hach	DAW
Hardness (mg/L as $CaCO_3$)		94	301	Hach	DAW
Total ammonia (mg/L as N)		<0.017	<0.017	Orion	mf

Ammonia Meter #98136 Ammonia Meter Slope -58.0 Ammonia Blank <0.017 Control Salinity ~~40~~ ppt mf Oppt not <0.1 3/11/98 Sample Salinity 40 ppt

FDEP Biology Section — Acute Bioassay Bench Sheet

mf 3/11/98

Sample Source: Bellinger Shipyard
County: Duval
Contact / District: Tim McKelvey / Northeast
NPDES Permit #: FL00 31232
LIMS Sample #: 31/901 LIMS Job #: 1998-03-10-30
sample log: 3/10/98 DW

Sample Collection: Date 3-9-98 Time ~~1450~~ 1500
Test Beginning: Date 3-10-98 Time 1545
Test Ending: Date 3-12-98 Time 1530
Organism Batch #: 16 Diluent Batch #: well H2O
Organism Age: 12 days
Test Organism: Cyprinella leedsi

Test Type: (Screening) / Definitive
(Static) / Static Renewal / Flow-through
Temperature range: room 23.5-24.5 °C
incubator 25.0-26.5 °C
Test Number: 2 of 2

Remarks: D = dead, M = missing
An aliquot of the sample was dechlorinated with 1.5 mL/L of 0.025N sodium thiosulfate.

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	21.6 @ 21.6	8.3 @ 24.1 °C	96.9 @ 96.3 964 @ 1005 @ 23.5 °C
24 hr	7.0 @ 7.0 9.0 @ 9.0	23.0 @ 23.1	8.2 @ 25.1 °C	979 @ 963 982 @ 1005 @ 25.2 °C
48 hr	7.0 @ 7.0 9.0 @ 9.0	21.9 @ 22.0	8.2 @ 24.9 °C	998 @ 963 985 @ 1005 @ 23.5 °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
Control A	F1	5	5	5	7.7	8.2	8.3	24.0	25.1	25.2	8.6	7.5	7.7	244	255	260
Control B	F2	5	5	5	7.5	8.2	8.3	23.9	24.4	24.8	8.6	7.7	7.8	247	250	255
Control C	F3	5	5	5	7.8	8.2	8.3	23.9	24.4	24.6	8.4	7.9	7.9	247	255	255
Control D	F4	5	5	5	7.8	8.2	8.3	23.9	24.4	24.5	8.6	7.9	7.9	247	250	255
100% A	F5	5	~~5~~ 4	5	7.9	7.9	7.9	24.9	24.2	24.7	8.4	7.5	7.0	1142	1135	1170
100% B	F6	5	~~5~~ 4	5	7.8	7.9	7.9	25.0	24.3	25.2	8.3	7.5	7.2	1150	1155	1195
100% C	F7	5	~~5~~ 4	5	7.8	7.9	7.9	25.0	24.4	24.8	8.1	7.5	7.0	1151	1155	1185
100% D	F8	5	~~5~~ 4	5	7.9	7.9	7.9	24.9	25.0	24.6	8.3	7.0	6.9	1151	1165	1180
100% ~~dup~~ A	F9	5	~~5~~ 4	~~5~~ 4	7.8	7.9		24.5	24.6		8.4	7.3		1158	1155	
100% ~~dup~~ B	F10	5	~~5~~ 4	~~5~~ 4	7.8	7.8		24.9	24.4		8.3	7.1		1137	1145	
100% ~~dup~~ C	F11	5	~~5~~ 4	~~5~~ 4	7.8	7.8		24.9	24.6		8.4	7.2		1144	1155	
100% ~~dup~~ D	F12	5	~~5~~ 4	~~5~~ 4	7.8	7.8		24.9	24.4		8.4	6.8		1145	1145	
* dechlorinated sample. MF 6/1/98			A results recorded in wrong place. Correct data inserted MF 6/1/98													
Measured/Loaded by:		DW	FW	DAW	DAW	MF	MF	DAW	MF	MF	DAW	MF	MF	DAW	MF	MF
Recorded by:		DW	FW	DAW	FW	FW	DAW	FW	FW	DAW	FW	FW	DAW	FW	FW	DAW

Chlorinated Sample / Dechlorinated Sample

Investigators' Signatures
Marshall Fairchild
Tim McKelvey
Daniel Cunningham

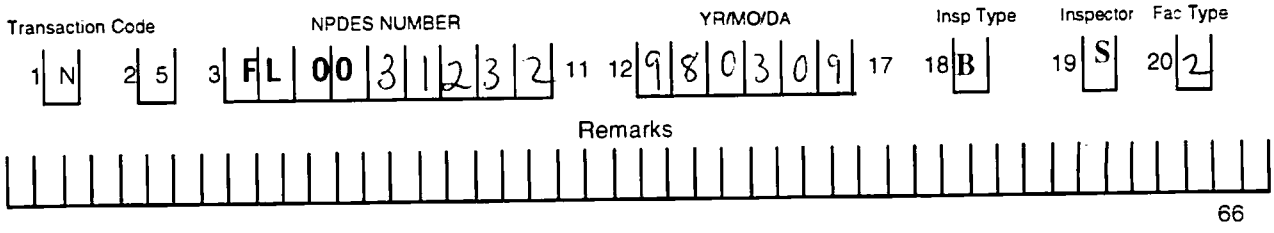
Water Quality Parameters (verified by MF)	Salt Water: Well Water / 20% Min Water	Sample	Method	Measured by
Field Total Residual Cl2 (mg/L):		0.43	—	Tim McKelvey
Lab Total Residual Cl2 (mg/L):	<0.03	1.2	DR-100	DAW
Alkalinity (mg/L as $CaCO_3$):	120	76	Hach	DAW
Hardness (mg/L as $CaCO_3$):	126	301	Hach	DAW
Total ammonia (mg/L as N):	<0.017	<0.017	Orion	MF

Ammonia Meter #98136 Ammonia Meter Slope: -58.0 Ammonia Blank: <0.017 Control Salinity: 0 ppt Sample Salinity: <1.0 ppt

reviewer

The Bioassay of the Bellinger Shipyards, Inc., WWTP effluent sampled on March 9, 1998, NPDES #FL0031232.

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



The Priority Pollutants Analysis for Bioassay of the Bellinger Shipyards, Inc., WWTP effluent sampled on March 9, 1998, NPDES #FL0031232.

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

