2. METHODS

2.1 7-D TOPSMELT (*ATHERINOPS AFFINIS*) SURVIVAL AND GROWTH TOXICITY TEST

A static-renewal 7-d toxicity test and reference toxicant test using topsmelt (A. *affinis*) was conducted in accordance with EVS Environment Consultants Standard Operating Procedures (SOP) 1100-5 (EVS, 2004) with modifications based on U.S. Environmental Protection Agency (USEPA, 1995). Test conditions and methods are summarized in Table 1.

This 7-day test exposes topsmelt larvae to different concentrations of a given sample. Fish are fed on a daily basis and both survival and growth endpoints are measured at test termination. These observations are assessed in comparison to the pooled negative and brine controls.

2.2 ECHINODERM (*DENDRASTER EXCENTRICUS*) FERTILIZATION TOXICITY TEST

The echinoderm (*Dendraster excentricus*) fertilization toxicity test was conducted in accordance with Environment Canada (1992 with 1997 amendments). Test conditions and methods summarized in Table 2.

This fertilization test involves exposing echinoderm sperm to a series of test concentrations for ten minutes, echinoderm eggs are then added allowing fertilization to occur for ten minutes. Following the ten minutes exposure time the eggs are preserved and the number of fertilized and unfertilized eggs in each replicate are counted. These observations are assessed in comparison to the pooled negative and brine controls.

2.3 STATISTICAL ANALYSIS

Statistical analyses for all tests were conducted using the computer software program TOXCALC (version 5.0.23; Tidepool Scientific Software, 1994).

2.4 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

This study followed a comprehensive QA/QC Program to ensure full documentation and minimize possible errors in computation and reporting of results. The following general

QA/QC guidelines were applied in this test: use of negative controls, use of positive controls, use of brine controls, replication, instrument calibration, water quality maintenance and record-keeping, and use of standard operating procedures (SOPs). To ensure the highest quality of data and reporting, all data and statistical analyses were reviewed by a member of our QA/QC Committee prior to reporting the results.

Table 1. 7-d Topsmelt (*Atherinops affinis)* survival and growth toxicity test methods

TEST PARAMETER	TEST CONDITION
Test type	Static-renewal
Test duration	7 d
Test chamber	600-mL beaker
Test solution volume	200 mL
Number of replicate chambers per treatment	5
Number of organisms per test chamber	5
Age of test organisms at test initiation	10 d
Food	Newly hatched *Artemia* nauplii (<24 hours old)
Feeding Regime	Fed 0.5 mL/ beaker twice daily of concentrated nauplii suspension (prepared to provide 200 nauplii in 0.5 mL); no feeding at test termination
Sample manipulations (e.g. pre-aeration, pH adjustment, filtration)	Salinity-adjusted
Control/dilution water	UV-sterilized and 0.5µm-filtered natural sea water from Vancouver Aquarium, BC
Dilutions	4.4, 9.0, 18.0, 36.0, 71.0% (v/v)
Renewal of dilutions	Daily
Aeration	None
Water quality parameters and frequency	Temperature, pH, dissolved oxygen, and salinity daily
Temperature	20 ± 1°C
Salinity	30 ± 2 (sample adjusted with hypersaline brine [HSB]. Preparation of HSB and salinity adjustment as per EC guidance document on salinity adjustment –July 1997)
Lighting	Overhead full-spectrum fluorescent lights; 538 – 1076 lux; 16:8 light:dark photoperiod
Reference toxicant	Initiated concurrently with sample using copper to generate LC50 and IC50 values; results compared to lab mean ± 2 SD
Endpoints	Survival and growth (dry weight)
Test validity	≥ 80% mean control survival; ≥ 0.85 mg/fish mean dry weight for surviving control fish
Reference protocol	US EPA (1995), EPA/600/R-95/136

Table 2. Echinoderm (*Dendraster excentricus*) fertilization toxicity test methods

TEST PARAMETER	TEST CONDITION
Test type	Static
Test duration	10:10 min
Test chamber	16 X 125 mm test tubes
Test solution volume	10 mL
Number of replicate chambers per treatment	4
Number of eggs per test chamber	2000
Age of test organisms	< 4 hours after spawning
Sample manipulations (e.g. pre-aeration, pH adjustment, filtration)	Salinity adjusted
Control/dilution water	UV-sterilized and 0.5µm-filtered natural sea water from Vancouver Aquarium, BC
Dilutions	4.7, 9.4, 18.8, 37.5, 75.1% (v/v)
Renewal of dilutions	None
Aeration	None during testing
Water quality parameters and frequency	Temperature, pH, dissolved oxygen, and salinity
Temperature	15 ± 1°C
Salinity	30 ± 2 (sample adjusted with hypersaline brine [HSB]. Preparation of HSB and salinity adjustment as per EC guidance document on salinity adjustment –July 1997)
Lighting	Ambient laboratory illumination (moderate intensity)
Reference toxicant	Initiated concurrently with test; same test methods as above using SDS to generate an EC50 value; results compared to lab mean ± 2 SD
Endpoint	Fertilization of eggs
Test validity	≥ 50% and ≤ 100% mean control fertilization
Reference protocols	Environment Canada (1992), (EPS/1/RM/27 with 1997 amendments)

3. RESULTS

3.1 7-D TOPSMELT (*ATHERINOPS AFFINIS*) SURVIVAL AND GROWTH TOXICITY TEST

The test results are summarized in Table 1 and the raw statistical analyses are provided in Appendix A.

The highest concentration tested was approximately 71.0% due to salinity adjustment. The mean survival in both the negative and brine controls was 100%.Mean dry weight in the pooled controls was 0.95mg. The negative and brine controls were not significantly different for the growth and survival endpoints (p =1.00 and p =0.72, respectively).

The *A. affinis* survival and growth toxicity test showed no adverse effects on survival or growth in all tested concentrations relative to the pooled controls ($p \leq 0.05$). For the survival and growth endpoints the NOEC was 71.0, and the LOEC was >71.0% (v/v). The LC50 for survival was >71.0% (v/v). The IC50 and IC25 for growth were both >71.0% (v/v)

3.2 ECHINODERM (*DENDRASTER EXCENTRICUS*) FERTILIZATION TOXICITY TEST

The test results are summarized in Table 2 and the raw statistical analyses are provided in Appendix B.

The highest concentration tested was 75.1% due to salinity adjustment. Mean fertilization in the pooled controls was 76.6%. The negative and brine controls were not significantly different (p =0.68).

The *D. excentricus* fertilization toxicity test exhibited adverse effects on egg fertilization in all except the lowest [4.7%(v/v)] test concentrations relative to the pooled controls ($p \leq 0.05$). The NOEC was 4.7 and LOEC was 9.4 %(v/v). The IC50 and IC25 (95% confidence limits) values were 50.7 (48.1 – 53.6) and 17.5 (11.6 – 22.6) %(v/v), respectively.

3.2 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

The tests met all passing criteria for test validity as outlined in the respective protocols. Water quality parameters during the test were all within the acceptable range of values. Point estimates for the reference toxicant tests were all within the laboratory mean ± 2 standard deviations, indicating that the tests were within acceptable limits of variability.

Table 3. Summary of results for the 7-d Topsmelt (*Atherinops affinis)* survival and growth toxicity test

TEST CONCENTRATION (% v/v)	SURVIVAL (%)(MEAN ± SD)	GROWTH (DRY WEIGHT MG) (MEAN ± SD)
D-Control	100.0 ± 0.0	0.93 ± 0.06
Brine Control	100.0 ± 0.0	0.96 ± 0.18
Pooled Controls	100.0 ± 0.0	0.95 ± 0.13
4.4	100.0 ± 0.0	1.06 ± 0.26
9.0	100.0 ± 0.0	0.87 ± 0.06
18.0	100.0 ± 0.0	0.97 ± 0.17
36.0	96.0 ± 8.9	0.92 ± 0.13
71.0	100.0 ± 0.0	0.87 ± 0.16
TEST ENDPOINT	**SURVIVAL (% v/v)**	**GROWTH (% v/v)**
NOEC	71.0	71.0
LOEC	>71.0	>71.0
LC50	>71.0	na
IC50	na	>71.0
IC25	na	>71.0

*Indicates significant difference ($p \leq 0.05$) relative to the pooled controls.
SD – Standard Deviation; na – not applicable.

Table 4. Summary of results for the Echinoderm (*Dendraster excentricus*) fertilization toxicity test

TEST CONCENTRATION (% v/v)	PROPORTION FERTILIZED (%) (MEAN ± SD)
Negative Control	77.0 ± 2.4
Brine Control	76.2 ± 2.5
Pooled Control	76.6 ± 2.3
4.7	75.0 ± 2.6
9.4	61.2 ± 1.0*
18.8	57.0 ± 1.8*
37.5	49.2 ± 1.0*
75.1	25.8 ± 1.5*
TEST ENDPOINT	**PROPORTION FERTILIZED %(v/v)**
NOEC	4.7
LOEC	9.4
IC50 (95% CL)	50.7 (48.1 – 53.6)
IC25 (95% CL)	17.5 (11.6 – 22.6)

*Indicates significant difference ($p \leq 0.05$) relative to the pooled controls.
SD – Standard Deviation; CL – Confidence Limits.

4. REFERENCES

Environment Canada. 1992. Biological test method: fertilization of echinoids (sea urchins and sand dollars). Environmental Protection Series, Report EPS 1/RM/27, December 1992. Environment Canada, Conservation and Protection, Ottawa, ON. 68 pp + appendices. Amended November 1997.

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APPENDIX A

Raw Data and Statistical Analyses:

Atherinops affinis

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST DATA SUMMARY

Client: Azimuth (Polaris) | EVS Analysts: AWD, JKS
EVS Project No.: 09-5302-54
EVS Work Order No.: 0400384 | Test Initiation Date: Aug 25, 2004

Sample	Initial Sample	Refresh Samples	
	Day 0	Day 2	Day 4
Identification	G-Creek 082404	→	→
Amount Received	1 x 20L	→	→
Date Collected	24-Aug-04	→	→
Date Received	27-Aug-04	→	→
Temperature (°C)	20.0 B 20.0	20.0 D 20.0	20.0 D 20.0
pH	7.6 D 8.1	7.6 D 8.2	7.5 D 8.3
DO (mg/L)	10.1 D 7.4	10.0 D 7.5	11.0 D 7.5
Conductivity (µmhos/cm)	9230	—	—
Salinity (ppt)	5.2 D 28	5.1 D 28	5.2 D 28
Ammonia (mg/L N)			
Chlorine (mg/L Cl)			
Other	D Salinity adj. to 30±2 ppt w/ 90ppt HSB		

DILUTION/CONTROL WATER (initial water quality)
Water Type: UV Sterilized S.W.
Temperature (°C): 20.0
pH: 7.8
Dissolved Oxygen (mg/L): 7.4
Salinity: 28

TEST SPECIES INFORMATION
Source: ABS (Aquatic Bio Systems)
Date Received: Aug 26 2004
Age (on Day 0): 10-d
Reference Toxicant: Copper
Current Reference Toxicant Result (incl. 95% CL)
Reference Toxicant Test Date: Aug 25, 2004
7-d survival LC50: 121 (107-137) ug/L
7-d growth IC50: 128 (85-152) (41-153) ug/L
Reference Toxicant Warning Limits (mean ± 2SD) and CV
7-d survival LC50: 132 ± 48 ug/L CV: 18%
7-d growth IC50: 138 ± 51 ug/L CV: 20%

TEST CONDITIONS
Temperature Range (°C): 20.0 - 21.0
pH Range: 7.8 - 8.3
Dissolved Oxygen Range (mg/L): 6.4 - 7.6
Salinity (ppt): 28
Photoperiod (L:D h): 16:8
Aeration Provided?: No
Other: —

TEST RESULTS

Endpoint	Conc. Units	NOEC	LOEC	LC50 (95% CL)	IC50 (95% CL)	IC25 (95% CL)
Survival	% (v/v)	71	>71	>71		
Growth		71	>71		>71	>71

Other:

Data Verified By: [signature] | Date Verified: Oct-27/04

EVS ENVIRONMENT CONSULTANTS

7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client: Azimuth (Polaris) | Sample ID: G-Creek @ 082404

EVS Project No.: 09-0302-54 | Test Initiation Date/Time: Aug 25, 2004 @ 1230 L

EVS Work Order No.: 0400384 | Source/Date Received: ABS / Aug 26, 2004

Concentration % (v/v)	Temperature (°C)													
	0	1 old	1 new	2		3		4		5		6		7
Control	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	21.0	20.0	20.5	20.0	20.0	20.5
Brine Control	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	21.0	20.0	20.5	20.0	20.5	20.0
4.4	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	21.0	20.0	20.5	20.0	20.5	20.5
9.0	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	21.0	20.0	20.5	20.0	20.5	20.5
18	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	21.0	20.0	20.5	20.0	20.5	20.5
36	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	21.0	20.0	20.5	20.0	20.5	20.5
71	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	21.0	20.0	20.6	20.0	20.0	20.5
Tech. Initials	~	~	~	~	~	~	~	JW	JW	~	~	JW	JW	JW

Concentration % (v/v)	pH													
	0	1		2		3		4		5		6		7
Control	7.8	8.0	8.0	8.1	7.9	8.0	7.9	8.0	7.9	7.9	7.9	7.9	7.9	7.9
Brine Control	7.8	8.0	8.0	8.1	7.9	8.0	7.9	8.0	7.9	7.9	7.9	7.9	7.9	7.9
4.4	7.7	8.1	8.1	8.1	8.1	8.0	8.1	8.0	8.1	8.0	8.1	7.9	7.9	8.0
9.0	7.8	8.3	8.1	8.2	8.1	8.0	8.2	8.0	8.1	8.1	8.1	8.0	7.9	8.0
18	7.8	8.2	8.1	8.2	8.2	8.0	8.2	8.0	8.1	8.1	8.1	8.0	8.0	8.1
36	7.9	8.3	8.2	8.2	8.2	8.0	8.2	8.1	8.2	8.1	8.1	8.1	8.0	8.1
71	8.1	8.3	8.3	8.3	8.2	8.0	8.3	8.2	8.3	8.2	8.2	8.2	8.1	8.1
Tech. Initials	~	~	~		~	~	~	JW	JW	A	~	JW	JW	JW

WQ Instruments Used: Temp. Calibrated Hg Thermometer pH H-A-52

Comments

Test Set Up By: AWN | Data Verified By: [signature] | Date Verified: Oct 20/04

EVS ENVIRONMENT CONSULTANTS

7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client: Azimuth (Polaris) | Sample ID: G-Creek 082404

EVS Project No.: 09-0302-54 | Test Initiation Date/Time: Aug 25th 2004 @ 1230h

EVS Work Order No.: 0400384 | Source/Date Received: ABS / Aug 26th 2004

Concentration %o (v/v)	Salinity (ppt)							
	0	1	2	3	4	5	6	7
Control	28	28	28	28	28	28	28	28
Brine Control	28	28	28	28	28	28	28	28
4.4	28	28	28	28	28	28	28	28
9.0	28	28	28	28	28	28	28	28
18	28	28	28	28	28	28	28	28
36	28	28	28	28	28	28	28	28
71	28	28	28	28	28	28	28	28
Tech. Initials	~	~	~	~	AWS	JWS	JWS	AS

Concentration %o (v/v)	Dissolved Oxygen (mg/L)													
	0	1		2		3		4		5		6		7
Control	7.4	6.5	7.5	6.9	7.5	7.0	7.5	7.0	7.5	6.4	7.4	7.6	6.5	6.6
Brine Control	7.4	6.6	7.5	6.8	7.5	6.9	7.5	6.9	7.5	6.6	7.4	7.5	6.4	6.4
4.4	7.4	6.7	7.5	6.7	7.5	6.9	7.5	6.9	7.5	6.7	7.5	7.6	6.6	6.5
9.0	7.4	6.6	7.5	6.8	7.5	6.9	7.5	7.0	7.5	6.8	7.5	7.6	6.6	6.5
18	7.4	6.4	7.5	6.8	7.5	6.9	7.5	6.9	7.5	6.8	7.6	7.5	6.7	6.5
36	7.4	6.5	7.6	6.9	7.5	6.9	7.5	6.9	7.5	6.8	7.5	7.5	6.8	6.4
71	7.4	6.5	7.6	6.8	7.5	6.9	7.5	6.9	7.5	6.7	7.4	7.5	6.7	6.5
Tech. Initials	~	~	~	~	~	~	AWS	JWS	AWS	~	~	JWS	JWS	~

WQ Instruments Used: Salinity II-A-030304 DO II-A-3

Comments

Test Set Up By: AWS | Data Verified By: [signature] | Date Verified: Oct-20/04

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client: Azimuth (Polaris) | Sample ID: G-Creek 082404
EVS Project No.: 09-0302-54 | Test Species/Batch: A. affinis / Aug 17-04
EVS Work Order No.: 0400384 | Test Initiation Date/Time: Aug 25, 2004 @ 1230h
No. of Organisms/Volume: 5/200mL

% (v/v) Concentration	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
Control	A	A 31	5	5	5	5	5	5	5	
	B	32	5	5	5	5	5	5	5	
	C	33	5	5	5	5	5	5	5	
	D	34	5	5	5	5	5	5	5	
	E	35	5	5	5	5	5	5	5	
Brine	A	36	5	5	5	5	5	5	5	
	B	37	5	5	5	5	5	5	5	
	C	38	5	5	5	5	5	5	5	
	D	39	5	5	5	5	5	5	5	
	E	40	5	5	5	5	5	5	5	
4.4	A	41	5	5	5	5	5	5	5	
	B	42	5	5	5	5	5	5	5	
	C	43	5	5	5	5	5	5	5	
	D	44	5	5	5	5	5	5	5	
	E	45	5	5	5	5	5	5	5	
9.0	A	546	5	5	5	5	5	5	5	
	B	547	5	5	5	5	5	5	5	
	C	548	5	5	5	5	5	5	5	
	D	549	5	5	5	5	5	5	5	
	E	680	5	5	5	5	5	5	5	
Technician Initials		JvS	~	~	JvS	~	~	JvS	JvS	

Sample Description: clear, colorless
Data Verified By: Galphy | Date Verified: Oct 20/04

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client: Azimuth (Polaris)
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400384

Sample ID: G. Creek 082404
Test Species/Batch: A. affinis / Aug 9-04
Test Initiation Date/Time: Aug 25, 2004 @ 1230h
No. of Organisms/Volume: 5/200mL

% (v/v) Concentration	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
18	A	46	5	5	5	5	5	5	5	
	B	47	5	5	5	5	5	5	5	
	C	48	5	5	5	5	5	5	5	
	D	49	5	5	5	5	5	5	5	
	E	50	5	5	5	5	5	5	5	
36	A	51	5	5	5	5	5	5	5	
	B	52	5	5	5	5	5	5	5	
	C	53	5	5	5	5	5	5	4	
	D	54	5	5	5	5	5	5	5	
	E	55	5	5	5	5	5	5	5	
71	A	61	5	5	5	5	5	5	5	
	B	62	5	5	5	5	5	5	5	
	C	63	5	5	5	5	5	5	5	
	D	64	5	5	5	5	5	5	5	
	E	65	5	5	5	5	5	5	5	
	A	6								
	B	7								
	C	8								
	D	9								
	E	10								
Technician Initials		JCS	M	—	JCS	C	~	JCS	JCS	

Sample Description: clear, colorless
Data Verified By: Ralph K
Date Verified: Oct 20/04

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TOXICITY TEST – DRY WEIGHT DATA

Client: Azimuth (Polaris)
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400384

Start Date (Day 0): August 25, 2004
Sample ID: G-Creek 082404
Balance Type/Serial Number: Sartorius BP211D

Sample ID % (v/v)	Rep.	Pan No.	Pan Weight (mg) [1]	Final Weight (mg) (pan + biomass) [1]	Number of Survivors	Number Weighed	Comments (e.g., confirmation weights, organisms lost in transfer)	Tech. Init.
Control	A	A31	1228.40	1233.24	5	5	pre-WT: 1228.42 mg	
	B	32	1229.96	1234.81	5	5		
	C	33	1231.09	1235.98	5	5		
	D	34	1226.23	1230.46	5	5	reweighed 1230.49 mg ✓	
	E	35	1218.59	1223.06	5	5		
Brine control	A	36	1226.59	1231.11	5	5		
	B	37	1234.73	1239.03	5	5		
	C	38	1220.42	1226.76	5	5		
	D	39	1232.69	1237.55	5	5		
	E	40	1236.53	1240.57	5	5		
4.4%	A	41	1227.94	1232.63	5	5		
	B	42	1224.25	1231.84	5	5		
	C	43	1235.61	1240.72	5	5	reweighed 1240.68 mg ✓	
	D	44	1219.66	1223.97	5	5		
	E	45	1225.29	1230.00	5	5	pre-WT: 1225.29 mg	

1. Re-confirm weights for 10% of final weights and record under "Comments"; relative percent difference (RPD) between pairs of weights should be ≤10% of organism weight.

Data Verified By: [signature]
Date Verified: Oct. 20/04

EVS ENVIRONMENT CONSULTANTS

7-d *Atherinops affinis* SURVIVAL AND GROWTH TOXICITY TEST – DRY WEIGHT DATA

Client: Azimuth (Polaris)
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400384

Start Date (Day 0): August 25, 2004
Sample ID: G-Creek 082404
Balance Type/Serial Number: Sartorius BP 211D

Sample ID % (J/J)	Rep.	Pan No.	Pan Weight (mg) [1]	Final Weight (mg) (pan + biomass) [1]	Number of Survivors	Number Weighed	Comments (e.g., confirmation weights, organisms lost in transfer)	Tech. Init.
18	A	A 46	12.17.86	1222.46	5	5		
	B	47	1225.29	1228.77	5	5		
	C	48	1236.54	1242.18	5	5		
	D	49	1239.09	1244.52	5	5		
	E	50	1241.45	1246.42	5	5	reweighed: 1246.43 mg ✓	
36	A	51	1227.42	1230.87	5	5		
	B	52	1224.43	1228.50	5	5		
	C	53	1239.89	1243.83	4	4		
	D	54	1231.71	1236.86	5	5		
	E	55	1236.12	1240.57	5	5		
8.8	A	56	1233.41	1237.89	5	5		
	B	57	1232.69	1236.99	5	5		
	C	58	1218.75	1223.49	5	5		
	D	59	1238.08	1237.03	5	5		
	E	60	1222.96	1227.12	5	5	prewt: 1222.96 mg	

1. Re-confirm weights for 10% of final weights and record under "Comments"; relative percent difference (RPD) between pairs of weights should be ≤10% of organism weight.

Data Verified By: Ralph K

Date Verified: Oct 20/04

EVS ENVIRONMENT CONSULTANTS

7-d *Atherinops affinis* SURVIVAL AND GROWTH TOXICITY TEST – DRY WEIGHT DATA

Client: Azimuth (Polaris)
Start Date (Day 0): August 25, 2004
EVS Project No.: 09-0302-54
Sample ID: G-Creek 082404
EVS Work Order No.: 0400384
Balance Type/Serial Number: Sartorius BP211D

Sample ID	Rep.	Pan No.	Pan Weight (mg) [1]	Final Weight (mg) (pan + biomass) [1]	Number of Survivors	Number Weighed	Comments (e.g., confirmation weights, organisms lost in transfer)	Tech. Init.
0% (4/5)								
72 71	A	A 61	1236.40	1239.74	5	5		~~TD~~
	B	62	1236.44	1240.25	5	5		
	C	63	1219.08 ~~1223.84~~	1224.54	5	5	reweighed 1224.57 mg	
	D	64	1228.47	1233.11	5	5		
	E	65	1243.42	1247.95	5	5	pre-wt: 1243.44 mg	
	A	6						
	B	7						
	C	8						
	D	9						
	E	0						
	A	1						
	B	2						
	C	3						
	D	4						
	E	5						

1. Re-confirm weights for 10% of final weights and record under "Comments"; relative percent difference (RPD) between pairs of weights should be ≤10% of organism weight.

Data Verified By: Ralph Ty
Date Verified: Oct 20/04

Test: LF-Larval Fish Growth and Survival Test
Test ID: 0400384
Species: AA-Atherinops affinis
Protocol: EPAW 95-EPA West Coast
Sample ID: G_CREEK
Sample Type: EFF2-Industrial
Start Date: 8/27/2004 End Date: 9/3/2004
Lab ID: BCEVS-EVS Environment Consultants

Pos	ID	Rep	Group	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	No. Fish Weighed	Total Wgt(mg)	Tare Wgt(mg)
	1	1	D-Control	5							5	5	1233.24	1228.4
	2	2	D-Control	5							5	5	1234.81	1229.96
	3	3	D-Control	5							5	5	1235.98	1231.09
	4	4	D-Control	5							5	5	1230.46	1226.23
	5	5	D-Control	5							5	5	1223.06	1218.59
	6	1	Brine Control	5							5	5	1231.11	1226.59
	7	2	Brine Control	5							5	5	1239.03	1234.73
	8	3	Brine Control	5							5	5	1226.76	1220.42
	9	4	Brine Control	5							5	5	1237.55	1232.69
	10	5	Brine Control	5							5	5	1240.57	1236.53
	11	1	4.400	5							5	5	1232.63	1227.94
	12	2	4.400	5							5	5	1231.84	1224.25
	13	3	4.400	5							5	5	1240.72	1235.61
	14	4	4.400	5							5	5	1223.97	1219.66
	15	5	4.400	5							5	5	1230	1225.29
	16	1	9.000	5							5	5	1237.89	1233.41
	17	2	9.000	5							5	5	1236.99	1232.69
	18	3	9.000	5							5	5	1223.49	1218.75
	19	4	9.000	5							5	5	1237.03	1233.08
	20	5	9.000	5							5	5	1227.12	1222.96
	21	1	18.000	5							5	5	1222.48	1217.86
	22	2	18.000	5							5	5	1228.77	1225.29
	23	3	18.000	5							5	5	1242.18	1236.54
	24	4	18.000	5							5	5	1244.52	1239.09
	25	5	18.000	5							5	5	1246.42	1241.45
	26	1	36.000	5							5	5	1230.87	1225.42
	27	2	36.000	5							5	5	1228.5	1224.43
	28	3	36.000	5							4	4	1243.83	1239.89
	29	4	36.000	5							5	5	1236.86	1231.71
	30	5	36.000	5							5	5	1240.57	1236.12
	31	1	71.000	5							5	5	1239.74	1236.4
	32	2	71.000	5							5	5	1240.25	1236.44
	33	3	71.000	5							5	5	1224.54	1219.08
	34	4	71.000	5							5	5	1233.11	1228.47
	35	5	71.000	5							5	5	1247.95	1243.42

Comments: Azimuth - Polaris Mine; G-Creek, 09-0302-54 ;0400384

Reviewed by: Oct 17/04

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	8/27/2004	Test ID: 400384	Sample ID: G_CREEK-082404
End Date:	9/3/2004	Lab ID: BCEVS-EVS Environment Cc	Sample Type: EFF2-Industrial
Sample Date:	8/24/2004	Protocol: EPAW 95-EPA West Coast	Test Species: AA-Atherinops affinis
Comments:	Azimuth - Polaris Mine; G-Creek, 09-0302-54 ;0400384		

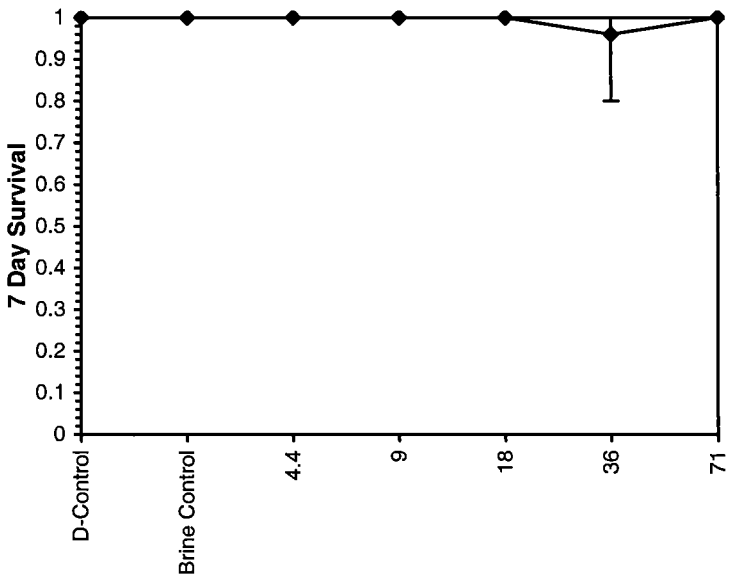
Conc-%	1	2	3	4	5
D-Control	1.0000	1.0000	1.0000	1.0000	1.0000
Brine Control	1.0000	1.0000	1.0000	1.0000	1.0000
4.4	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
18	1.0000	1.0000	1.0000	1.0000	1.0000
36	1.0000	1.0000	0.8000	1.0000	1.0000
71	1.0000	1.0000	1.0000	1.0000	1.0000

			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical
D-Control	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5		
Brine Control	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5		
4.4	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	27.50	16.00
9	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	27.50	16.00
18	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	27.50	16.00
36	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	25.00	16.00
71	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	27.50	16.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.41613	0.9	-3.8705	19.8512
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 1.00)	0	2.30601		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	71	>71		1.40845

Dose-Response Plot



Statistical comparison were against the D-control.

Reviewed by: Oct-20/04

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	8/27/2004	Test ID:	400384	Sample ID:	G_CREEK-082404
End Date:	9/3/2004	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	EFF2-Industrial
Sample Date:	8/24/2004	Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Azimuth - Polaris Mine; G-Creek, 09-0302-54 ;0400384				

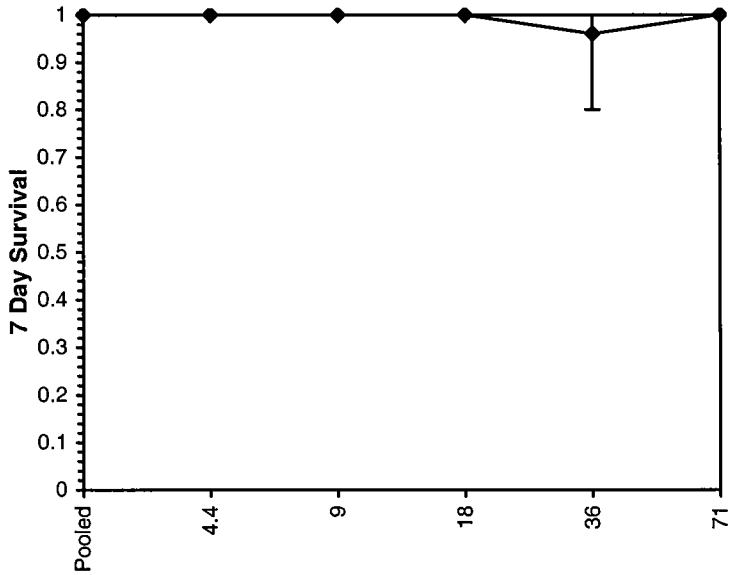
Conc-%	1	2	3	4	5
D-Control	1.0000	1.0000	1.0000	1.0000	1.0000
Brine Control	1.0000	1.0000	1.0000	1.0000	1.0000
4.4	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
18	1.0000	1.0000	1.0000	1.0000	1.0000
36	1.0000	1.0000	0.8000	1.0000	1.0000
71	1.0000	1.0000	1.0000	1.0000	1.0000

			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical
Pooled	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	10		
4.4	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	40.00	21.00
9	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	40.00	21.00
18	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	40.00	21.00
36	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	35.00	21.00
71	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	40.00	21.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.38831	0.91	-4.1486	23.0852
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 1.00)	0	2.30601		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Wilcoxon Rank Sum Test	71	>71		1.40845

Dose-Response Plot



Statistical comparison were against the pooled control.

Reviewed by: Oct 20/04

Larval Fish Growth and Survival Test-7 Day Growth (US)

Start Date:	8/27/2004	Test ID:	400384	Sample ID:	G_CREEK-082404
End Date:	9/3/2004	Lab ID:	BCEVS-EVS Environment C	Sample Type:	EFF2-Industrial
Sample Date:	8/24/2004	Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis

Comments: Azimuth - Polaris Mine; G-Creek, 09-0302-54 ;0400384

Conc-%	1	2	3	4	5
D-Control	0.9680	0.9700	0.9780	0.8460	0.8940
Brine Control	0.9040	0.8600	1.2680	0.9720	0.8080
4.4	0.9380	1.5180	1.0220	0.8620	0.9420
9	0.8960	0.8600	0.9480	0.7900	0.8320
18	0.9240	0.6960	1.1280	1.0860	0.9940
36	1.0900	0.8140	0.7880	1.0300	0.8900
71	0.6680	0.7620	1.0920	0.9280	0.9060

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.9312	0.0585	0.9312	0.8460	0.9780	6.283	5				0.9938	1.0000
Brine Control	0.9624	0.1811	0.9624	0.8080	1.2680	18.820	5					
4.4	1.0564	0.2642	1.0564	0.8620	1.5180	25.007	5	-1.252	2.360	0.2361	0.9938	1.0000
9	0.8652	0.0604	0.8652	0.7900	0.9480	6.980	5	0.660	2.360	0.2361	0.9177	0.9235
18	0.9656	0.1704	0.9656	0.6960	1.1280	17.643	5	-0.344	2.360	0.2361	0.9177	0.9235
36	0.9224	0.1328	0.9224	0.7880	1.0900	14.396	5	0.088	2.360	0.2361	0.9177	0.9235
71	0.8712	0.1631	0.8712	0.6680	1.0920	18.721	5	0.600	2.360	0.2361	0.8712	0.8766

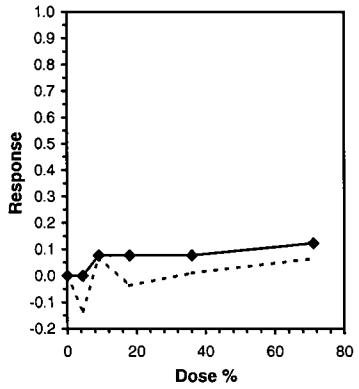
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.94863	0.9	0.95961	2.51611
Bartlett's Test indicates equal variances (p = 0.05)	11.0427	15.0863		
The control means are not significantly different (p = 0.72)	0.36654	2.30601		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	71	>71		1.40845	0.23609	0.25353	0.02479	0.02502	0.44403	5, 24

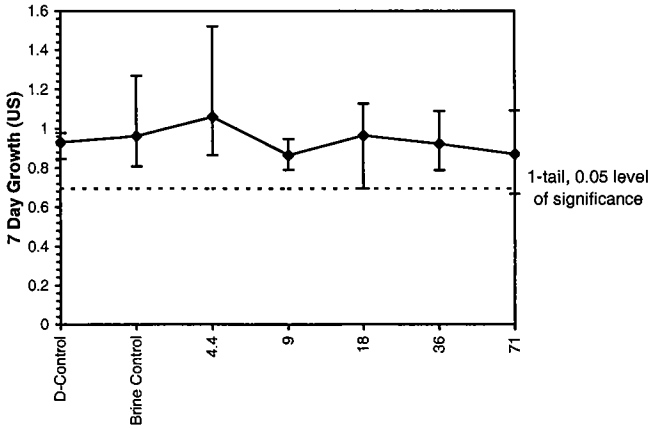
Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)	Skew
IC05	7.405			
IC10	53.535			
IC15	>71			
IC20	>71			
IC25	>71			
IC40	>71			
IC50	>71			

% (v/v)



Dose-Response Plot



Statistical comparison were against the D-control.

Reviewed by: Oct-20/04

Larval Fish Growth and Survival Test-7 Day Growth (US)

Start Date:	8/27/2004	Test ID:	400384	Sample ID:	G_CREEK-082404
End Date:	9/3/2004	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	EFF2-Industrial
Sample Date:	8/24/2004	Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis

Comments: Azimuth - Polaris Mine; G-Creek, 09-0302-54 ;0400384

Conc-%	1	2	3	4	5
D-Control	0.9680	0.9700	0.9780	0.8460	0.8940
Brine Control	0.9040	0.8600	1.2680	0.9720	0.8080
4.4	0.9380	1.5180	1.0220	0.8620	0.9420
9	0.8960	0.8600	0.9480	0.7900	0.8320
18	0.9240	0.6960	1.1280	1.0860	0.9940
36	1.0900	0.8140	0.7880	1.0300	0.8900
71	0.6680	0.7620	1.0920	0.9280	0.9060

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
Pooled	0.9468	0.1280	0.9468	0.8080	1.2680	13.514	10				1.0016	1.0000
4.4	1.0564	0.2642	1.0564	0.8620	1.5180	25.007	5	-1.258	2.462	0.2146	1.0016	1.0000
9	0.8652	0.0604	0.8652	0.7900	0.9480	6.980	5	0.936	2.462	0.2146	0.9177	0.9163
18	0.9656	0.1704	0.9656	0.6960	1.1280	17.643	5	-0.216	2.462	0.2146	0.9177	0.9163
36	0.9224	0.1328	0.9224	0.7880	1.0900	14.396	5	0.280	2.462	0.2146	0.9177	0.9163
71	0.8712	0.1631	0.8712	0.6680	1.0920	18.721	5	0.868	2.462	0.2146	0.8712	0.8698

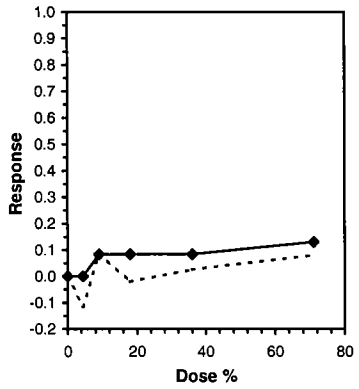
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.94174	0.91	1.04686	2.00659
Bartlett's Test indicates equal variances (p = 0.18)	7.64107	15.0863		
The control means are not significantly different (p = 0.72)	0.36654	2.30601		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	71	>71		1.40845	0.21455	0.22661	0.02493	0.02531	0.44385	5, 29

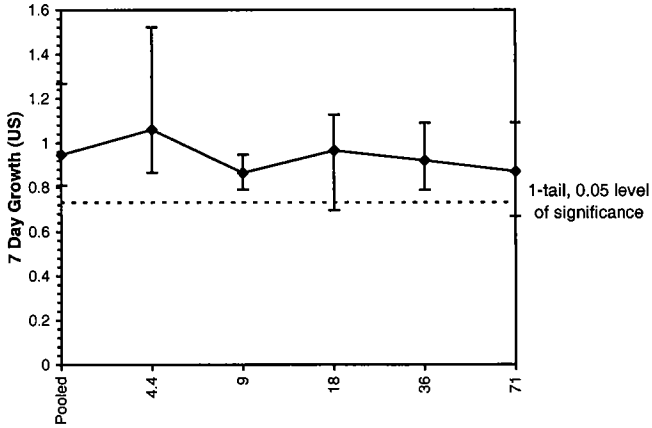
Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)	Skew
IC05	7.147			
IC10	48.255			
IC15	>71			
IC20	>71			
IC25	>71			
IC40	>71			
IC50	>71			

% (v/v)



Dose-Response Plot



Statistical comparison were against the pooled control.

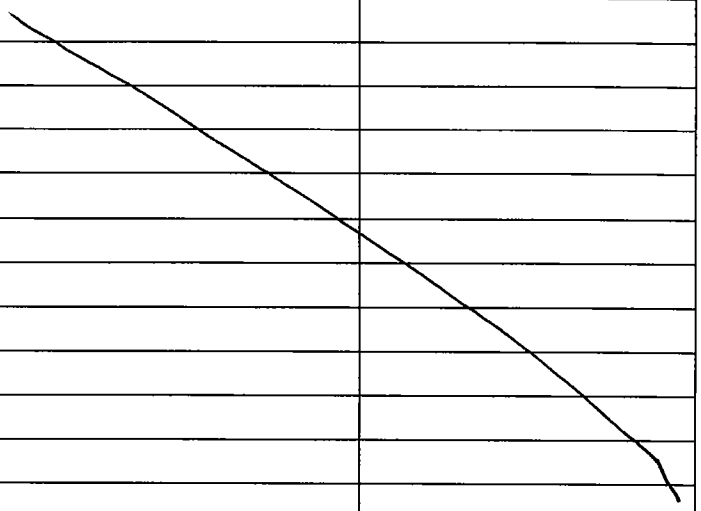
Reviewed by Oct 20/04

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST DATA SUMMARY

Client Azimuth (Polaris)
EVS Project No. 09-0302-54
EVS Work Order No. 0400384

EVS Analysts AWD. JxS. AxF
Test Initiation Date Aug 27, 2004

Sample	Initial Sample	Refresh Samples	
	Day 0	Day 2	Day 4
Identification	04-Cu-001		
Amount Received	1 x 1 L		
Date Collected	15-March-04		
Date Received			
Temperature (°C)			
pH			
DO (mg/L)			
Conductivity (µmhos/cm)			
Salinity (ppt)			
Ammonia (mg/L N)			
Chlorine (mg/L Cl)			
Other			



DILUTION/CONTROL WATER (initial water quality)
Water Type Filtered, UV sterilized S.W.
Temperature (°C) 20.0
pH 7.8
Dissolved Oxygen (mg/L) 7.4
Salinity 28

TEST SPECIES INFORMATION
Source ABS (Aquatic Biosystems)
Date Received Aug 26, 2004
Age (on Day 0) 10-d
Reference Toxicant Copper
Current Reference Toxicant Result (incl. 95% CL)
Reference Toxicant Test Date Aug 27, 2004
7-d survival LC50 121 (107-137) mg/L Cu
7-d growth IC50 128 (85-150) mg/L Cu
Reference Toxicant Warning Limits (mean ± 2SD) and CV
7-d survival LC50 132 ± 48 mg/L CV: 18%
7-d growth IC50 131 ± 52 mg/L CV: 20%

TEST CONDITIONS
Temperature Range (°C) 20.0 - 21.0
pH Range 7.8 - 8.2
Dissolved Oxygen Range (mg/L) 6.4 - 7.7
Salinity (ppt) 28
Photoperiod (L:D h) 16:8
Aeration Provided? No
Other -

TEST RESULTS

Endpoint	Conc. Units	NOEC	LOEC	LC50 (95% CL)	IC50 (95% CL)	IC25 (95% CL)
Survival	mg/L	100	180	121 (107-137)		
Growth		56	100		128 (85-150)	93 (53-124)

Other

Data Verified By [signature] Date Verified Oct. 27/04

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client: Azimuth (Polaris) | Sample ID: Cu Ref/tox
EVS Project No.: 09-0302-54 | Test Initiation Date/Time: Aug 25, 2004 / 1245 (26th)
EVS Work Order No.: 0400384 | Source/Date Received: ABS / Aug 18, 2004

Concentration µg/L	Temperature (°C)													
	0	1		2		3		4		5		6		7
Control	20.0	20.5	20.0	20.5	20.0	20.0	20.5	20.0	20.5	20.0	20.5	20.0	21.0	20.5
32.0	20.0	20.5	20.0	20.5	20.0	20.0	20.5	20.0	20.5	20.0	20.5	20.0	21.0	20.5
56.0	20.0	20.5	20.0	20.5	20.0	20.0	20.5	20.0	20.5	20.0	20.5	20.0	21.0	20.5
100.0	20.0	20.5	20.0	20.5	20.0	20.0	20.5	20.0	20.5	20.0	20.5	20.0	21.0	20.5
180.0	20.0	20.5	20.0	20.5	20.0	20.0	20.5	20.0	20.5	20.0	20.5	20.0	21.0	20.5
320.0	20.0	20.5	20.0	20.5	20.0	20.0	20.5	—						
Tech. Initials														

Concentration µg/L	pH													
	0	1		2		3		4		5		6		7
Control	7.8	8.0	8.0	8.0	7.9	8.0	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9
32.0	7.8	8.0	8.0	8.0	7.9	8.0	7.9	8.0	7.9	7.9	7.8	7.9	7.8	7.8
56.0	7.8	8.1	8.0	7.9	7.9	8.0	7.9	8.0	7.9	7.9	7.9	7.9	7.8	7.8
100.0	7.8	8.1	8.0	8.1	7.9	8.0	7.9	8.0	7.9	8.0	7.9	7.9	7.8	7.9
180.0	7.8	8.1	8.0	8.0	7.9	8.0	7.9	8.0	7.9	7.9	7.9	7.9	7.9	7.9
320.0	7.8	8.0	8.0	8.0	7.9	8.0	7.9	—						
Tech. Initials														

WQ Instruments Used: Temp. Calibrated Hg Thermometer pH II-A-52
Comments

Test Set Up By: AWD | Data Verified By: [signature] | Date Verified: Oct. 20/04

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TEST – WATER QUALITY DATA

Client: Azimuth (Polaris) | Sample ID: Cu Ref Tox

EVS Project No.: 09-0302-54 | Test Initiation Date/Time: Aug 27, 2004 @ 1245

EVS Work Order No.: 0400384 | Source/Date Received: ABS / Aug 26, 2004

Concentration µg/L	Salinity (ppt)							
	0	1	2	3	4	5	6	7
control	28	28	28	28	28	28	28	28
32.0	28	28	28	28	28	28	28	28
56.0	28	28	28	28	28	28	28	28
100.0	28	28	28	28	28	28	28	28
180.0	28	28	28	28	28	28	28	28
320.0	28	28	28	28	28	~~28~~	—	—
Tech. Initials	^	^	^	JAS	^	^	JAS	JAS

Concentration µg/L	Dissolved Oxygen (mg/L)													
	0	1		2		3		4		5		6		7
control	7.4	6.7	7.5	6.6	7.5	6.9	7.5	7.0	7.7	6.7	7.4	7.6	6.7	6.6
32.0	7.4	6.4	7.5	6.7	7.5	6.9	7.5	6.9	7.5	6.6	7.4	7.6	6.8	6.7
56.0	7.4	6.5	7.5	6.6	7.5	6.9	7.5	7.0	7.5	6.6	7.4	7.6	6.9	6.8
100.0	7.4	6.5	7.5	6.7	7.5	7.0	7.5	7.1	7.5	6.7	7.4	7.6	6.7	6.7
180.0	7.4	6.6	7.5	6.7	7.5	7.0	7.5	7.0	7.5	6.4	7.4	7.7	6.7	6.7
320.0	7.4	6.6	7.5	6.7	7.5	7.1	7.5	7.0	7.5	—				
Tech. Initials	^	^	^	^	^	JAS	^	^	^	^	^	JAS	JAS	JAS

WQ Instruments Used: Salinity II-A-030304 DO II-A-3

Comments

Test Set Up By: AWD | Data Verified By: Qualified | Date Verified: Oct-20/04

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client: Azimuth (Polaris)
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400384

Sample ID: Cu Reftox
Test Species/Batch: A. affinis / Aug 17-04
Test Initiation Date/Time: Aug 25, 2004 @ 1245 L
No. of Organisms/Volume: 5/200mL

Concentration 49/L	Rep.	Pan No.	Number of Survivors – Day of Test 1	2	3	4	5	6	7	Comments
Control	A	A 1	5	5	5	5	5	5	5	
	B	2	5	5	5	5	5	5	5	
	C	3	5	5	5	5	5	5	5	
	D	4	5	5	5	5	5	5	5	
	E	5	5	5	5	5	5	5	5	
320	A	6	5	5	5	5	5	4	4	
	B	7	5	5	5	5	5	5	5	
	C	8	5	5	5	5	5	5	5	
	D	9	5	5	5	5	5	5	5	
	E	0	5	5	5	5	5	5	5	
560	A	11	5	5	5	5	5	5	5	
	B	12	5	5	5	5	5	5	5	
	C	13	5	5	5	5	5	5	5	
	D	14	5	5	5	5	5	5	5	
	E	15	5	5	5	5	5	5	5	
1000	A	16	4	4	4	4	4	4	4	
	B	17	5	5	5	5	5	5	5	
	C	18	5	5	5	5	5	5	5	
	D	19	4	2	2	2	2	2	2	
	E	20	4	4	4	4	4	3	3	
Technician Initials		JWS	~	~	JWS	~	~	AXF/JWS	JWS	

Sample Description: clear, colorless
Data Verified By: Ralph K
Date Verified: Oct-27/04

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* TOXICITY TEST – DAILY SURVIVAL DATA

Client: Azimuth (Polaris)
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400384

Sample ID: Cu reftox
Test Species/Batch: A. affinis / Aug 24-04
Test Initiation Date/Time: Aug 25, 2004 @ 1245
No. of Organisms/Volume: 5/200mL

Concentration	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
49/L	A	A21	2	2	2	2	2	2	2	
	B	22	2	0	0	~				
1800	C	23	5	3	3	3	3	2	0	
	D	24	1	1	1	1	1	0		
	E	25	2	1	1	0	~			
	A	26	0	~						
	B	27	0							
3200	C	28	2	2	~					
	D	29	15	1	~					
	E	30	0	~						
	A	1								
	B	2								
	C	3								
	D	4								
	E	5								
	A	6								
	B	7								
	C	8								
	D	9								
	E	0								
Technician Initials		JWS	~	~	JWS	~	~	AMP/SKS	JWS	

Sample Description: clear, colorless
Data Verified By: Galyik
Date Verified: Oct. 27/04

EVS ENVIRONMENT CONSULTANTS
7-d *Atherinops affinis* SURVIVAL AND GROWTH TOXICITY TEST – DRY WEIGHT DATA

Client: Azimuth (Polaris)
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400384

Start Date (Day 0): August 27, 2004
Sample ID: Cu Reftox
Balance Type/Serial Number: Sartorius BP211D

Sample ID	Rep.	Pan No.	Pan Weight (mg) [1]	Final Weight (mg) (pan + biomass) [1]	Number of Survivors	Number Weighed	Comments (e.g., confirmation weights, organisms lost in transfer)	Tech. Init.
791L								AW/SA
Control	A	A 1	1236.92	1240.48	5	5		
	B	2	1234.84	1239.67	5	5		
	C	3	1233.83	1238.43	5	5		
	D	4	1234.81	1239.99	5	5	pre-wt: 1234.82 reweighed: 1240.01 mg ✓	
	E	5	1236.88	1241.27	5	5		
320	A	6	1236.55	1239.45	4	4		
	B	7	1223.58	1227.87	5	5		
	C	8	1228.35	1233.01	5	5		
	D	9	1236.84	1240.60	5	5	reweighed: 1240.62 mg ✓	
	E	10	1230.58	1235.34	5	5		
560	A	11	1240.99	1244.89	5	5		
	B	12	1240.22	1243.80	5	5		
	C	13	1232.03	1236.09	5	5		
	D	14	1222.70	1228.06	5	5	reweighed 1228.01 mg ✓	
	E	15	1227.91	1232.58	5	5		

1. Re-confirm weights for 10% of final weights and record under "Comments"; relative percent difference (RPD) between pairs of weights should be ≤10% of organism weight.

Data Verified By: Qalfish
Date Verified: Oct. 20/04

EVS ENVIRONMENT CONSULTANTS

7-d *Atherinops affinis* SURVIVAL AND GROWTH TOXICITY TEST – DRY WEIGHT DATA

Client: Azimuth (Polaris) | Start Date (Day 0): August 27, 2004

EVS Project No.: 09-0302-54 | Sample ID: Cu Ref/tox

EVS Work Order No.: 0400384 | Balance Type/Serial Number: Sartorius BP 211D

Sample ID 49/L	Rep.	Pan No.	Pan Weight (mg) [1]	Final Weight (mg) (pan + biomass) [1]	Number of Survivors	Number Weighed	Comments (e.g., confirmation weights, organisms lost in transfer)	Tech. Init.
100.0	A	A16	1231.06	1234.17	23 4	23 4		~
	B	17	1232.73	1336.19	5	5		
	C	18	1227.40	1232.10	5	5		
	D	19	1225.62	1227.27	2	2		
	E	20	1229.98	1233.36	3	3		
180.0	A	21	1233.34	1235.48	2	2	pre-wt: 1233.29	
	B	22	1226.36		0			
	C	23	1228.36					
	D	24	1229.37					
	E	25	1226.55					
320.0	A	26	1219.08					
	B	27	1224.60					
	C	28	1229.45					
	D	29	1236.52					
	E	30	1236.61					

1. Re-confirm weights for 10% of final weights and record under "Comments"; relative percent difference (RPD) between pairs of weights should be ≤10% of organism weight.

Data Verified By: Qalfish | Date Verified: Oct 20/04

Test: LF-Larval Fish Growth and Survival Test
Test ID: RTAACu39
Species: AA-Atherinops affinis
Protocol: EPAW 95-EPA West Coast
Sample ID: REF-Ref Toxicant
Sample Type: CU-Copper
Start Date: 8/27/2004 End Date: 9/3/2004
Lab ID: BCEVS-EVS Environment Consultants

Pos	ID	Rep	Group	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	No. Fish Weighed	Total Wgt(mg)	Tare Wgt(mg)
	1	1	D-Control	5							5	5	1240.48	1236.92
	2	2	D-Control	5							5	5	1239.67	1234.84
	3	3	D-Control	5							5	5	1238.43	1233.83
	4	4	D-Control	5							5	5	1239.99	1234.81
	5	5	D-Control	5							5	5	1241.27	1236.78
	6	1	32.000	5							4	4	1239.45	1236.55
	7	2	32.000	5							5	5	1227.87	1223.58
	8	3	32.000	5							5	5	1233.01	1228.35
	9	4	32.000	5							5	5	1240.6	1236.84
	10	5	32.000	5							5	5	1235.34	1230.58
	11	1	56.000	5							5	5	1244.89	1240.99
	12	2	56.000	5							5	5	1243.8	1240.22
	13	3	56.000	5							5	5	1236.09	1232.03
	14	4	56.000	5							5	5	1228.06	1222.7
	15	5	56.000	5							5	5	1232.58	1227.91
	16	1	100.000	5							4	4	1234.17	1231.06
	17	2	100.000	5							5	5	1236.19	1232.73
	18	3	100.000	5							5	5	1232.1	1227.4
	19	4	100.000	5							2	2	1227.27	1225.62
	20	5	100.000	5							3	3	1233.36	1229.98
	21	1	180.000	5							2	2	1235.48	1233.34
	22	2	180.000	5							0	0	0	0
	23	3	180.000	5							0	0	0	0
	24	4	180.000	5							0	0	0	0
	25	5	180.000	5							0	0	0	0
	26	1	320.000	5							0	0	0	0
	27	2	320.000	5							0	0	0	0
	28	3	320.000	5							0	0	0	0
	29	4	320.000	5							0	0	0	0
	30	5	320.000	5							0	0	0	0

Comments: 09-0302-54, 0400384

Reviewed by: Galfich 04-20104

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	8/27/2004	Test ID:	RTAACu39	Sample ID:	REF-Ref Toxicant
End Date:	9/3/2004	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	CU-Copper
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	09-0302-54, 0400384				

Conc-ug/L	1	2	3	4	5
D-Control	1.0000	1.0000	1.0000	1.0000	1.0000
32	0.8000	1.0000	1.0000	1.0000	1.0000
56	1.0000	1.0000	1.0000	1.0000	1.0000
100	0.8000	1.0000	1.0000	0.4000	0.6000
180	0.4000	0.0000	0.0000	0.0000	0.0000
320	0.0000	0.0000	0.0000	0.0000	0.0000

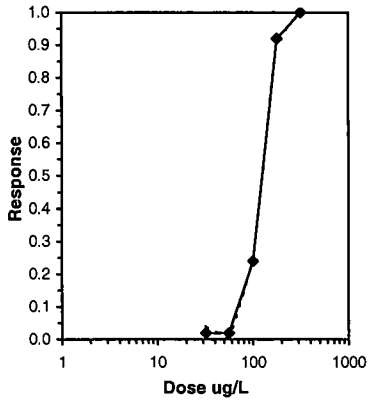
			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-ug/L	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
D-Control	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5			0	25
32	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	25.00	17.00	1	25
56	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	27.50	17.00	0	25
100	0.7600	0.2608	1.0737	0.6847	1.3453	26.959	5	20.00	17.00	6	25
*180	0.0800	0.1789	0.3174	0.2255	0.6847	64.711	5	15.00	17.00	23	25
320	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	5			25	25

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.87543	0.888	0.19148	2.19139
Equality of variance cannot be confirmed				

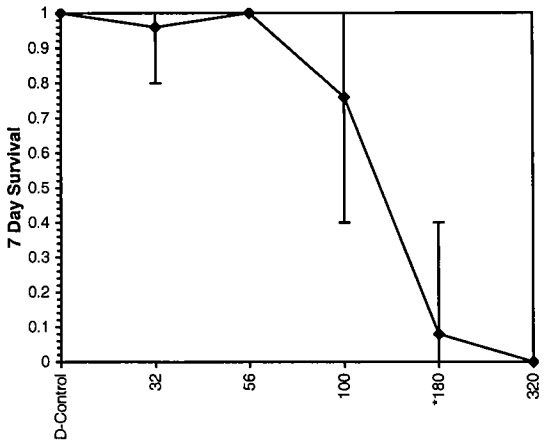
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	100	180	134.164	

Trimmed Spearman-Karber

Trim Level	EC50	95% CL		
0.0%				
5.0%	121.21	107.05	137.25	
10.0%	122.51	106.69	140.68	
20.0%	124.90	100.06	155.92	
Auto-2.0%	121.16	107.14	137.03	ug/L Cu



Dose-Response Plot



Reviewed by: Oct 20/04

Larval Fish Growth and Survival Test-7 Day Growth (US)

Start Date:	8/27/2004	Test ID:	RTAACu39	Sample ID:	REF-Ref Toxicant
End Date:	9/3/2004	Lab ID:	BCEVS-EVS Environment C	Sample Type:	CU-Copper
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	09-0302-54, 0400384				

Conc-ug/L	1	2	3	4	5
D-Control	0.7120	0.9660	0.9200	1.0360	0.8980
32	0.5800	0.8580	0.9320	0.7520	0.9520
56	0.7800	0.7160	0.8120	1.0720	0.9340
100	0.6220	0.6920	0.9400	0.3300	0.6760
180	0.4280	0.0000	0.0000	0.0000	0.0000
320	0.0000	0.0000	0.0000	0.0000	0.0000

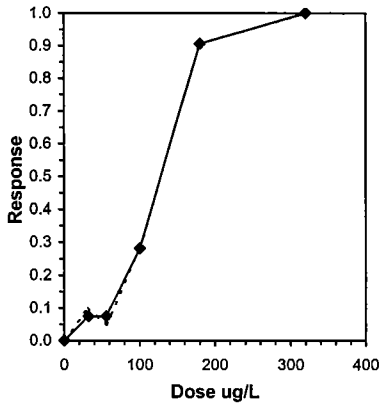
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-ug/L	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.9064	0.1208	0.9064	0.7120	1.0360	13.330	5				0.9064	1.0000
32	0.8148	0.1529	0.8148	0.5800	0.9520	18.764	5	0.859	2.300	0.2451	0.8388	0.9254
56	0.8628	0.1413	0.8628	0.7160	1.0720	16.373	5	0.409	2.300	0.2451	0.8388	0.9254
*100	0.6520	0.2178	0.6520	0.3300	0.9400	33.401	5	2.387	2.300	0.2451	0.6520	0.7193
*180	0.0856	0.1914	0.0856	0.0000	0.4280	223.607	5	7.701	2.300	0.2451	0.0856	0.0944
320	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	5				0.0000	0.0000

Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.97983		0.888		0.24836	0.34826
Bartlett's Test indicates equal variances (p = 0.81)					1.6194		13.2767			
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Dunnett's Test	56	100	74.8331		0.24513	0.27045	0.56964	0.0284	9.0E-07	4, 20

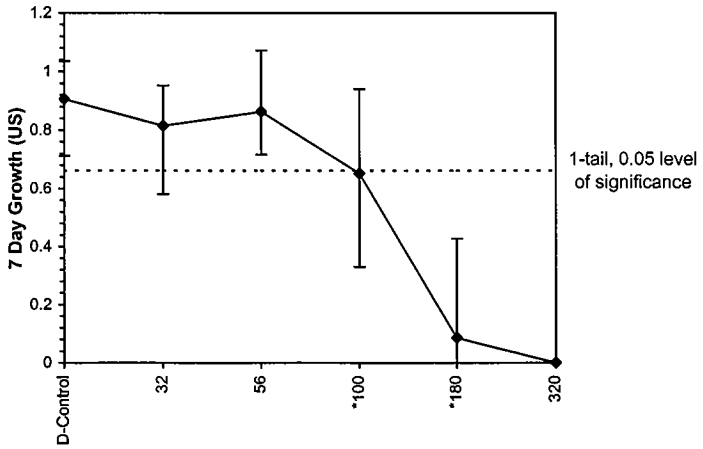
Linear Interpolation (200 Resamples)

Point	ug/L	SD	95% CL(Exp)		Skew	
IC05*	21.45	21.58	1.69	91.64	0.6918	
IC10	61.43	22.13	0.00	103.56	-0.1239	
IC15	72.10	20.41	1.19	118.52	-0.5135	
IC20	82.78	15.91	41.12	121.23	-0.0104	
IC25	93.45	13.98	53.16	124.15	0.0254	
IC40	115.28	11.42	71.83	139.88	-0.3487	
IC50	128.08	10.81	84.76	150.27	-0.4718	ug/L Cu

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



Reviewed by: Oct-20/04

APPENDIX B

Raw Data and Statistical Analyses:

Dendraster excentricus

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST DATA SUMMARY

Client: AZIMUTH CONSULTING GROUP
EVS Project No.: 09-0302-54/04-1424-044
EVS Work Order No.: 0400385
EVS Analysts: KES / AKN
Test Initiation Date: 27 AUGUST 2004

SAMPLE

Identification: G-CREEK-082404
Amount Received: 5X20L
Date Collected: 24 AUGUST 2004
Date Received: 27 AUGUST 2004
Temperature (°C): 15.0
pH: 8.0
Dissolved Oxygen (mg/L): 10.0 ① 8.5
Conductivity (µmhos/cm): 9240
Salinity (ppt): 5 ① 28
Ammonia (mg/L N): —
Chlorine (mg/L Cl): —
Other: ① Salinity adjustment

TEST SPECIES

Organism: Dendraster excentricus
Source: Westcoast Sealab Supplies / 27 Aug 2004
Date Received: 27 August 2004
Reference Toxicant: SDS
Current Reference Toxicant Result
Reference Toxicant Test Date: 27 August 2004
IC50 (and 95% CL): 2.3 (2.1-2.4) mg/L SDS
Reference Toxicant Warning Limits (mean ± 2SD) and CV
3.9 ± 4.6 mg/L SDS; CV% = 60

DILUTION/CONTROL WATER (initial water quality)

Water Type: UV Sterilized, 0.5µm filtered SW
Temperature (°C): 16.0
pH: 8.0
Dissolved Oxygen (mg/L): 8.3
Salinity (ppt): 28
Other: —

TEST CONDITIONS

Temperature Range (°C): 15.0 - 16.0
pH Range: 8.0 - 8.1
Dissolved Oxygen Range (mg/L): 8.2 - 8.5
Salinity Range (ppt): 28
Sperm:Egg Ratio: 2000:1
Test Duration: 10:10
Other: —

TEST RESULTS

IC50: 50.7 (48.1 — 53.6) % v/v
IC25: 17.5 (11.6 - 22.6) % v/v
NOEC: 4.7 % v/v
LOEC: 9.4 % v/v

Data Verified By: [signature]
Date Verified: Oct. 26/04

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST INITIAL WATER QUALITY

Client: Azimuth Consulting Group
EVS Project No.: 09-0302-54/04-1424-044
EVS Work Order No.: 0400385
Logbook: Echinoid #13 Pages: 53-57

Test Initiation Date/Time: 27 August 2004 @ 13:34
Test Species: Dendraster excentricus
Source/Date Received: Westwind Sealab Supplies/27 August 2004
Test Duration: 10:10

Sample ID Q-CREEK 082404	Conc/Rep % V/V	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
CONTROL		16.0	8.0	28	8.3	
BRINE CTL		16.0	8.1	28	8.3	
	4.7	16.0	8.0	28	8.2	
	9.4	16.0	8.0	28	8.3	
	18.8	16.0	8.0	28	8.3	
	37.5	15.5 16.0	8.0	28	8.2	
	75.1	15.0 16.0	8.0	28	8.5	
Tech. Init.	Kaf	Kaf	Kaf	Kaf	Kaf	

WQ Instruments Used: Temp. Calibrated Hg thermometer pH II-A-51 Salinity II-A-030303 DO II-A-011202

Data Verified By: Ralph Date Verified: Oct. 26/04

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client: AZIMUTH CONSULTING GROUP
EVS Project No.: 09-0302-54/04-1424-044
EVS Work Order No.: 0400385
Logbook: Echinoid #13 Pages: 53-57

Test Initiation Date/Time: 27 AUGUST 2004 @ 13:34
Test Species: Dendraster excentricus
Source/Date Received: Westwind Sealab Supplies/27 August 2004
Test Duration: 10:10
Sperm:Egg Ratio: 2000:1

Sample ID (% v/v)	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
4.7	A	78	22		
	B	74	26		
	C	76	24		
	D	72	28		
9.4	A	61	39		
	B	62	38		
	C	62	38		
	D	60	40		
18.8	A	56	44		
	B	58	42		
	C	~~41~~ 59	41		
	D	55	45		
37.5	A	49	51		
	B	50	50		
	C	50	50		
	D	48	52		
75.1	A	25	75		
	B	27	73		
	C	24	76		
	D	27	73		
CONTROL SEA WATER	A	77	~~29~~ 23		
	B	80	20		
	C	74	26		
	D	77	23		

Data Verified By: Qalfish
Date Verified: Oct. 26/04

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNT (SAMPLES)

Client: Azimuth Consulting Group.
EVS Project No.: 09-0302-54/04-1424-044
EVS Work Order No.: 0400385
Logbook: Echinoid #13 Pages: 53 – 57

Test Initiation Date/Time: 27 August 2004 @ 13:34
Test Species: Dendraster excentricus
Source/Date Received: Westwind Sealab Supplies/27 August 2004
Test Duration: 10:10
Sperm:Egg Ratio: 2000:1

Sample ID	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
BRINE CONTROL	A	76	24		KF
	B	73	27		↓
	C	79	21		↓
	D	77	23		↓
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				

Data Verified By: Ralph Ky Date Verified: Oct. 21/04

Test: SC-Sperm Cell Fertilization test					Test ID: 0400385		
Species: DE-Dendraster excentricus					Protocol: EPS1/RM/27-EC 92 (Sperm Cell)		
Sample ID: G CREEK-082404					Sample Type: EFF2-Industrial		
Start Date: 8/27/2004 10:10			End Date: 8/27/2004		Lab ID: BCEVS-EVS Environment Consultants		
Pos	ID	Rep	Group	Total Counted	Number Fertilized	Number Unfertilized	Notes
	1	1	D-Control	100	77	23	
	2	2	D-Control	100	80	20	
	3	3	D-Control	100	74	26	
	4	4	D-Control	100	77	23	
	5	1	B-Control	100	76	24	
	6	2	B-Control	100	73	27	
	7	3	B-Control	100	79	21	
	8	4	B-Control	100	77	23	
	9	1	4.700	100	78	22	
	10	2	4.700	100	74	26	
	11	3	4.700	100	76	24	
	12	4	4.700	100	72	28	
	13	1	9.400	100	61	39	
	14	2	9.400	100	62	38	
	15	3	9.400	100	62	38	
	16	4	9.400	100	60	40	
	17	1	18.800	100	56	44	
	18	2	18.800	100	58	42	
	19	3	18.800	100	59	41	
	20	4	18.800	100	55	45	
	21	1	37.500	100	49	51	
	22	2	37.500	100	50	50	
	23	3	37.500	100	50	50	
	24	4	37.500	100	48	52	
	25	1	75.100	100	25	75	
	26	2	75.100	100	27	73	
	27	3	75.100	100	24	76	
	28	4	75.100	100	27	73	

Comments: Azimuth Consulting Group (Polaris), 09-0302-54 (0400385)

Reviewed by: Oct 26/04

Sperm Cell Fertilization test-Proportion Fertilized

Start Date:	8/27/2004 10:10	Test ID:	400385	Sample ID:	G CREEK-082404
End Date:	8/27/2004	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	EFF2-Industrial
Sample Date:	8/24/2004	Protocol:	EPS1/RM/27-EC 92 (Sperm (	Test Species:	DE-Dendraster excentricus
Comments:	Azimuth Consulting Group (Polaris), 09-0302-54 (0400385)				

Conc-%	1	2	3	4
D-Control	0.7700	0.8000	0.7400	0.7700
B-Control	0.7600	0.7300	0.7900	0.7700
4.7	0.7800	0.7400	0.7600	0.7200
9.4	0.6100	0.6200	0.6200	0.6000
18.8	0.5600	0.5800	0.5900	0.5500
37.5	0.4900	0.5000	0.5000	0.4800
75.1	0.2500	0.2700	0.2400	0.2700

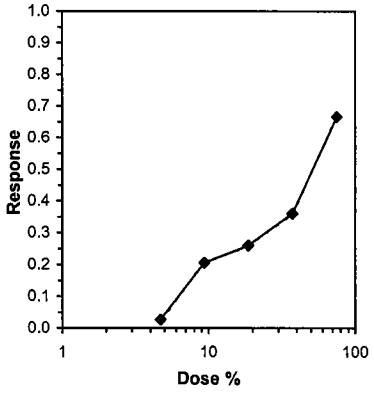
			Transform: Untransformed						1-Tailed		Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.7700	0.0245	0.7700	0.7400	0.8000	3.181	4				0.7700	1.0000
B-Control	0.7625	0.0250	0.7625	0.7300	0.7900	3.279	4					
4.7	0.7500	0.0258	0.7500	0.7200	0.7800	3.443	4	1.546	2.410	0.0312	0.7500	0.9740
*9.4	0.6125	0.0096	0.6125	0.6000	0.6200	1.563	4	12.175	2.410	0.0312	0.6125	0.7955
*18.8	0.5700	0.0183	0.5700	0.5500	0.5900	3.203	4	15.460	2.410	0.0312	0.5700	0.7403
*37.5	0.4925	0.0096	0.4925	0.4800	0.5000	1.944	4	21.450	2.410	0.0312	0.4925	0.6396
*75.1	0.2575	0.0150	0.2575	0.2400	0.2700	5.825	4	39.616	2.410	0.0312	0.2575	0.3344

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.96771	0.884	-0.0461	-0.3022
Bartlett's Test indicates equal variances (p = 0.47)	4.56528	15.0863		
The control means are not significantly different (p = 0.68)	0.42857	2.44691		

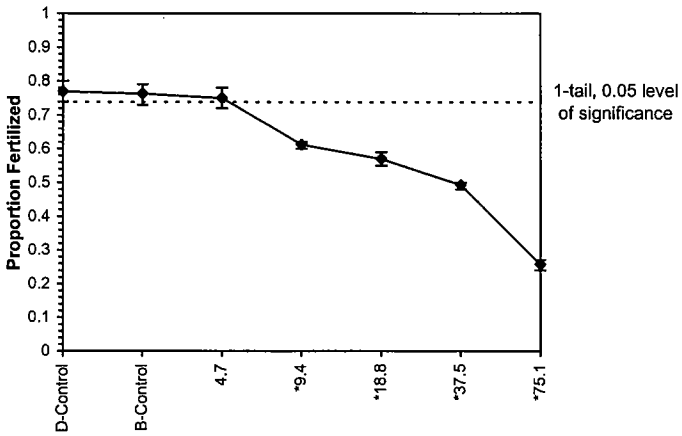
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	4.7	9.4	6.6468	21.2766	0.03118	0.04049	0.14215	0.00033	5.1E-18	5, 18

Log-Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew	
IC05	5.180	0.661	1.565	6.056	-2.4799	
IC10	6.314	0.363	5.072	7.317	-0.3761	
IC15	7.655	0.380	6.468	8.804	-0.0227	
IC20	9.242	0.946	8.159	13.672	1.6390	
IC25	16.673	2.353	10.367	23.598	0.0429	
IC40	41.060	0.897	38.450	44.063	-0.0075	
IC50	51.581	0.976	49.063	54.697	0.0961	%v/v



Dose-Response Plot



Statistical comparisons were against the D-control

Reviewed by: Oct-26/04

Sperm Cell Fertilization test-Proportion Fertilized

Start Date:	8/27/2004 10:10	Test ID:	400385	Sample ID:	G CREEK-082404
End Date:	8/27/2004	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	EFF2-Industrial
Sample Date:	8/24/2004	Protocol:	EPS1/RM/27-EC 92 (Sperm (	Test Species:	DE-Dendraster excentricus
Comments:	Azimuth Consulting Group (Polaris), 09-0302-54 (0400385)				

Conc-%	1	2	3	4
D-Control	0.7700	0.8000	0.7400	0.7700
B-Control	0.7600	0.7300	0.7900	0.7700
4.7	0.7800	0.7400	0.7600	0.7200
9.4	0.6100	0.6200	0.6200	0.6000
18.8	0.5600	0.5800	0.5900	0.5500
37.5	0.4900	0.5000	0.5000	0.4800
75.1	0.2500	0.2700	0.2400	0.2700

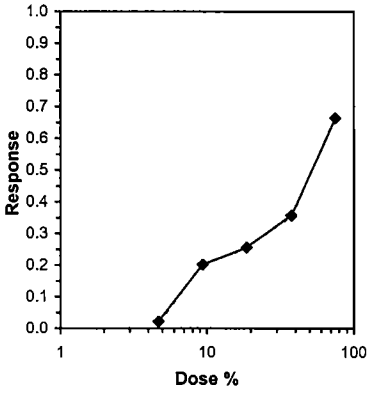
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
Pooled	0.7663	0.0233	0.7663	0.7300	0.8000	3.036	8				0.7663	1.0000
4.7	0.7500	0.0258	0.7500	0.7200	0.7800	3.443	4	1.390	2.508	0.0293	0.7500	0.9788
*9.4	0.6125	0.0096	0.6125	0.6000	0.6200	1.563	4	13.156	2.508	0.0293	0.6125	0.7993
*18.8	0.5700	0.0183	0.5700	0.5500	0.5900	3.203	4	16.793	2.508	0.0293	0.5700	0.7439
*37.5	0.4925	0.0096	0.4925	0.4800	0.5000	1.944	4	23.424	2.508	0.0293	0.4925	0.6427
*75.1	0.2575	0.0150	0.2575	0.2400	0.2700	5.825	4	43.533	2.508	0.0293	0.2575	0.3361

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.98075	0.896	-0.1412	-0.2089
Bartlett's Test indicates equal variances (p = 0.44)	4.83474	15.0863		
The control means are not significantly different (p = 0.68)	0.42857	2.44691		

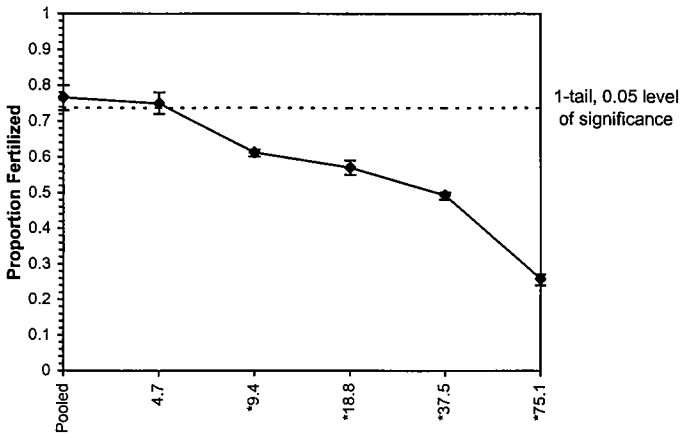
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	4.7	9.4	6.6468	21.2766	0.02931	0.03826	0.16613	0.00036	1.9E-21	5, 22

Log-Logit Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew	
IC05	5.346	0.452	3.380	6.032	-1.8281	
IC10	6.555	0.307	5.439	7.178	-0.4707	
IC15	7.892	0.273	6.858	8.579	-0.3014	
IC20	9.379	0.715	8.461	12.502	1.9342	
IC25	17.460	2.031	11.554	22.636	0.0330	
IC40	40.999	0.628	38.998	42.863	0.1265	
IC50	50.738	0.809	48.086	53.622	0.1685	%v/v



Dose-Response Plot



Statistical comparisons were against the ~~B-control~~
Pooled Control

Reviewed by: Qualified
Oct-26/04

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST DATA SUMMARY

Client: Azimuth Consulting Group
EVS Project No.: 09-0302-54/04-1424-044
EVS Work Order No.: 0400385
EVS Analysts: KES, AKN
Test Initiation Date: 27 AUGUST 2004

SAMPLE

Identification: SDS RefTox Stock Sol^n
Amount ~~Received~~ Prep'd: 1X1L
Date ~~Collected~~ Prep'd: 26 April 2004
Date Received: n/a
Temperature (°C):
pH:
Dissolved Oxygen (mg/L):
Conductivity (µmhos/cm):
Salinity (ppt):
Ammonia (mg/L N):
Chlorine (mg/L Cl):
Other:

TEST SPECIES

Organism: Dendraster excentricus
Source: Westwind Sealab Supplies
Date Received: 27 August 2004
Reference Toxicant: SDS
Current Reference Toxicant Result
Reference Toxicant Test Date: 27 August 2004
IC50 (and 95% CL): 2.3 (2.1-2.4) mg/L SDS
Reference Toxicant Warning Limits (mean ± 2SD) and CV
3.9 ± 4.6 mg/L SDS, CV% = 60

DILUTION/CONTROL WATER (initial water quality)

Water Type: UV Sterilized, 0.5µm filtered SW
Temperature (°C): 16.0
pH: 8.0
Dissolved Oxygen (mg/L): 8.3
Salinity (ppt): 28
Other: —

TEST CONDITIONS

Temperature Range (°C): 16.0
pH Range: 8.0
Dissolved Oxygen Range (mg/L): 8.3
Salinity Range (ppt): 28
Sperm:Egg Ratio: 2000:1
Test Duration: 10:10
Other: —

TEST RESULTS

IC 50: 2.3 (2.1-2.4) mg/L SDS
IC 25: 1.3 (1.2-1.4) mg/L SDS
NOEC: <1 mg/L SDS
LOEC: 1 mg/L SDS

Data Verified By: [signature]
Date Verified: Oct. 26/04

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST INITIAL WATER QUALITY

Client Azimuth Consulting Group
EVS Project No. 09-0302-54 / 04-1424-044
EVS Work Order No. 0400385
Logbook Echinoid #13 Pages 53 - 57

Test Initiation Date/Time 27 August 2004 @ 13:34
Test Species Dendraster excentricus
Source/Date Received Westcoast Sealab Supplies / 27 Aug 2004
Test Duration 10:10

Sample ID	Conc/Rep	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
SDS mg/L	CONTROL	16.0	8.0	28	8.3	
	1.0	16.0	8.0	28	8.3	
	1.8	16.0	8.0	28	8.3	
	3.2	16.0	8.0	28	8.3	
	5.6	16.0	8.0	28	8.3	
	10.0	16.0	8.0	28	8.3	
Tech. Init.	KAF	KAF	KAF	KAF	KAF	

WQ Instruments Used: Temp. Calibrated Hg thermometer pH II-A-51 Salinity II-A-030303 DO II-A-011202
Data Verified By Ralph K Date Verified Oct 21/04

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST – EGG COUNTS (CONTROLS)

Client: Azimuth Consulting Group
Test Initiation Date/Time: 27 August 2004 @13:34
EVS Project No.: 09-0302-54/04-1424-044
Test Species: Dendraster excentricus
EVS Work Order No.: 0400385
Test Duration: 10:10
Logbook: Echinoid #13 Pages: 53-57
Sperm:Egg Ratio: 2000:1

Concentration SDS mg/L	Replicate	No. Fertilized Eggs	No. Unfertilized Eggs	Comments	Tech. Initials
Reference Toxicant					
1.0	A	70	30		[illegible]
	B	72	28		↓
	C	69	31		
	D	68	32		↓
1.8	A	45	55		[illegible]
	B	47	53		↓
	C	46	54		
	D	49	51		↓
3.2	A	25	75		[illegible]
	B	26	74		↓
	C	24	76		
	D	27	73		↓
5.6	A	10	90		[illegible]
	B	14	86		↓
	C	9	91		
	D	10	90		↓
10.0	A	2	98		[illegible]
	B	2	98		↓
	C	1	99		
	D	2	98		↓
Control Seawater					
	A	~~81~~ 77	23		[illegible]
	B	~~76~~ 80	20		↓
	C	74	26		
	D	77	23		↓

Data Verified By: [signature] Date Verified: Oct. 21/04

Test: SC-Sperm Cell Fertilization test					Test ID: rtscsds9		
Species: DE-Dendraster excentricus					Protocol: EPS1/RM/27-EC 92 (Sperm Cell)		
Sample ID: REF-Ref Toxicant					Sample Type: SDS-Sodium dodecyl sulfate		
Start Date: 8/27/2004 10:10			End Date: 8/27/2004		Lab ID: BCEVS-EVS Environment Consultants		
Pos	ID	Rep	Group	Total Counted	Number Fertilized	Number Unfertilized	Notes
	1	1	D-Control	100	77	23	
	2	2	D-Control	100	80	20	
	3	3	D-Control	100	74	26	
	4	4	D-Control	100	77	23	
	5	1	1.0	100	70	30	
	6	2	1.0	100	72	28	
	7	3	1.0	100	69	31	
	8	4	1.0	100	68	32	
	9	1	1.8	100	45	55	
	10	2	1.8	100	47	53	
	11	3	1.8	100	46	54	
	12	4	1.8	100	49	51	
	13	1	3.2	100	25	75	
	14	2	3.2	100	26	74	
	15	3	3.2	100	24	76	
	16	4	3.2	100	27	73	
	17	1	5.6	100	10	90	
	18	2	5.6	100	14	86	
	19	3	5.6	100	9	91	
	20	4	5.6	100	10	90	
	21	1	10.0	100	2	98	
	22	2	10.0	100	2	98	
	23	3	10.0	100	1	99	
	24	4	10.0	100	2	98	

Comments: Azimuth Consulting Group 09-0302-54 (0400385)

Reviewed by: 04/21/06

Sperm Cell Fertilization test-Proportion Fertilized

Start Date:	8/27/2004 10:10	Test ID:	rtscsds9	Sample ID:	REF-Ref Toxicant
End Date:	8/27/2004	Lab ID:	BCEVS-EVS Environment C	Sample Type:	SDS-Sodium dodecyl sulfate
Sample Date:		Protocol:	EPS1/RM/27-EC 92 (Sperm	Test Species:	DE-Dendraster excentricus
Comments:	Azimuth Consulting Group 09-0302-54 (0400385)				

Conc-mg/L	1	2	3	4
D-Control	0.7700	0.8000	0.7400	0.7700
1	0.7000	0.7200	0.6900	0.6800
1.8	0.4500	0.4700	0.4600	0.4900
3.2	0.2500	0.2600	0.2400	0.2700
5.6	0.1000	0.1400	0.0900	0.1000
10	0.0200	0.0200	0.0100	0.0200

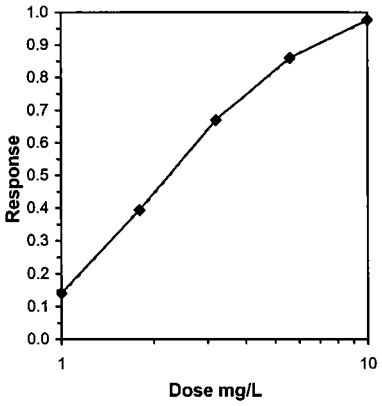
			Transform: Untransformed						1-Tailed		Isotonic	
Conc-mg/L	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.7700	0.0245	0.7700	0.7400	0.8000	3.181	4					
*1	0.6975	0.0171	0.6975	0.6800	0.7200	2.448	4	5.813	2.410	0.0301		
*1.8	0.4675	0.0171	0.4675	0.4500	0.4900	3.653	4	24.254	2.410	0.0301		
*3.2	0.2550	0.0129	0.2550	0.2400	0.2700	5.063	4	41.292	2.410	0.0301		
*5.6	0.1075	0.0222	0.1075	0.0900	0.1400	20.627	4	53.118	2.410	0.0301		
*10	0.0175	0.0050	0.0175	0.0100	0.0200	28.571	4	60.334	2.410	0.0301		

Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.94353		0.884		0.48689	0.03974
Bartlett's Test indicates equal variances (p = 0.33)					5.73659		15.0863			
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Dunnett's Test	<1	1			0.03006	0.03904	0.38532	0.00031	3.5E-22	5, 18

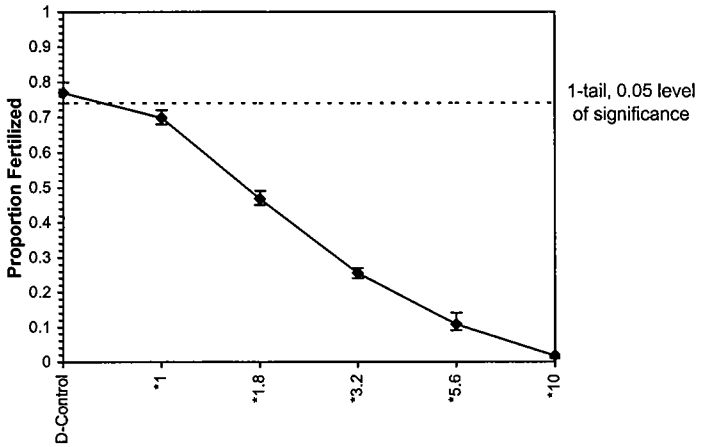
Log-Linear Interpolation (200 Resamples)

Point	mg/L	SD	95% CL(Exp)		Skew	
IC05*	0.2818	0.0398	0.1777	0.4281	0.4398	
IC10*	0.6429	0.1027	0.3830	1.0315	0.5219	
IC15	1.0278	0.0806	0.6655	1.1534	-1.2547	
IC20	1.1671	0.0441	1.0139	1.2853	-0.3348	
IC25	1.3159	0.0419	1.1718	1.4292	-0.2285	
IC40	1.8295	0.0507	1.6670	1.9678	-0.0985	
IC50	2.2774	0.0469	2.1219	2.4035	-0.2200	mg/L SDS

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



Reviewed by: Oct-21/04

APPENDIX C

Chain-of-Custody Form

CHAIN-OF-CUSTODY/TEST REQUEST FORM

Please see instructions for completion on back. Shaded areas to be completed by EVS Laboratory upon sample receipt.

EVS environment consultants
195 Pemberton Avenue
North Vancouver, BC
Canada V7P 2R4
Tel: 604-986-4331
Fax: 604-662-8548
www.evsenvironment.com

Client Name: AZIMUTH CONSULTING FOR TECK COMINCO
Address: 218-2902 West Broadway, Vancouver BC, V6K 2G8
Client Contact Name: Cheryl Mackintosh/Bruce Donald
Phone: 604-730-1220
Fax: 604-739-9070
Sampled By: ~~Randy Baker~~ C. Mackintosh
Ship to: EVS Environment Consultants, 195 Pemberton Ave. North Vancouver, BC, V7P 2R4
Attn: Edmund Canaria
Shipping Date: Aug. 25, 2004

Aug. 24/2004

Collection Date (dd/mmm/yy)	Time (24-h clock)	Sample Identification	Type of Each Sample [1]	Material Safety Data Sheet Attached? (✓)	Sample Collection Method G = grab; C = composite	Number of Sample Containers x Volume of Sample Container (i.e., 1 x 20 L)	Sample Container Type by Code [2]	Test(s) Requested: Rainbow trout 96-hr LC50	Daphnia magna 48-hr LC50	7-day Topsmelt	Echinoderm 48h fertilization			Notes? (e.g. preserved, saltwater, freshwater, may contain sewage) [3]	Receipt Sample Temp (°C)	Condition/Integrity [4]
For composite sample record date & time starting and ending																
24/Aug/04	15:00	G-Creek ~~081704~~ 082404	E		dump	5x20L	CC	✓	✓	✓	✓			Freshwater ~2.4 ppt	15.4	

EVS Receipt Check List

EVS Project #: 09-108-01
EVS Workorder #: 0400382/383/384/385 RBT / DAPH / TOPSM / ECH
Sample Storage Location: 4°C ☒, chemical ☐, Other ______
Supporting documentation/other information attached, if applicable

1. Signatures & dates correct? Y N
2. Chain of custody fully completed? Y N
3. Containers arrived in good condition (unbroken)? Y N
4. Container labels completed (i.e., dates, ID's)? Y N
5. Container labels agreed with custody papers? Y N
6. Sample receipt temperature within acceptable range? Y N
7a. Sediment testing going to be initiated within 14 days? Y N
7b. If no, are samples under Nitrogen? If not, why? Y N
8. Chain of custody generated upon receipt ☐
9. Sample containers originate from EVS ☐

PO/Reference No.: TC-03-03
Project Title: Polaris MMER
Results Needed By:
Comments/Instructions: (1) The sample ID was changed from G-Creek 081704 to G-Creek 082404 by the client's request.

A) Released By: C. Mackintosh Date: Aug. 25/04
Company: Azimuth Time: 9:00am
Courier name: First air / FedEx
Shipping containers secured by: (Tape) (Straps) Lock Other ______ (circle one) METAL STRIPS
Custody seals used? Yes No

B) Received by: AXF Date: 27 AUG 04
Company: EVS Time: 0945
Shipping containers received secure? (Yes) No
Custody seals intact? (Yes) No N/A

C) Released By: Date:
Company: Time:
Courier name:
Shipping containers secured by: Tape Straps Lock Other ______ (circle one)
Custody seals used? Yes No

D) Received by: Date:
Company: Time:
Shipping containers received secure? Yes No
Custody seals intact? Yes No N/A

1 Receiving Water (RW); Effluent (E); Elutriate (ELU); Sediment (SED); Chemical (CHEM); Stormwater (SW); Other (Please Specify)
2 Collapsible Carboy (CC); Glass Jar (GJ); Jerry Can (JC); Plastic HDPE (P); Plastic Bucket (PB); Other (Please Specify)
3 Please note any conditions the lab should be aware of for safety and storage concerns
4 Acceptable (A); Unacceptable (U). Please note specifics (e.g., broken, leaking, lid not on) under Comments/Instructions

Revision Date: Sept. 25, 2000

Distribution of copies:
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APPENDIX F

Letter from Environment Canada to Teck Cominco Metals, Ltd. re: Polaris 2004 Annual Report (dated August 9, 2005)

Environment Canada | Environnement Canada
Prairie & Northern Region
Environment Canada
Rm 200, 4999 98th Ave.
Edmonton, AB T6B 2X3

Bruce Donald
Cominco Mining Partnership & Teck Cominco Metals Ltd.
Bag 2000
Kimberley, BC
V1A3E1

August 9, 2005

Dear Bruce Donald,

RE: Polaris 2004 Annual Report

In our review of the Polaris 2004 Annual Effluent and Water Quality Report, due March 31, 2005, it was noted that some Environmental Effects Monitoring (EEM) information does not appear to have been provided as required under Metal Mining Effluent Regulations (Schedule 5, Part 1). Please see the appended list of deficiencies relating to effluent characterization, water quality monitoring and sublethal toxicity testing for your facility.

If missing information was collected but not included in the above report, please submit this information to Environment Canada by September 30, 2005. Please ensure that all deficiencies are addressed in future reports. Failure to provide all information required under the Environmental Effects Monitoring Program will result in non-compliance.

Please be reminded that guidance is provided on the National EEM Website to assist you, at http://www.ec.gc.ca/eem/English/Publications/web_publication/ec_water/.
If you have any questions, please do not hesitate to contact me [Phone (780) 951-8754, jenny.ferone@ec.gc.ca].

Sincerely,

Paula Siwik (for)
Jenny Ferone, Regional EEM Coordinator

cc Peter Blackall
Chuck Brumwell
Ken Russell

Polaris (7834-3-37/C263-9)
2004 Annual Effluent and Water Quality Review

General:

- Methods, detection limits, and QA/QC need to be included in the future.
- Latitude/longitude and description of reference and exposure areas need to be included in hard copy.
- No units given in the hard copy for measured parameters in the Effluent or Water Quality tables.

Effluent Characterization:

- Collected and analyzed four effluent samples, but due to short discharge period (July and August only) only two were more than one month apart. Remaining two were only three days short of being one month apart.
- No methods described or detection limits, no QA/QC data or description.

Water Quality:

- Only two water sampling dates were more than one month apart due to short sampling period (July and August). Three samples were analyzed.
- No latitude or longitude of reference or exposure sampling areas in hard copy; No description of the ref or exp area – both described as Garrow Bay.
- No methods described or detection limits, no QA/QC data or description.

Sublethal Toxicity:

Please note that laboratories performing sublethal tests should provide all information required on the Environment Canada checklists (Annex C of the Metal Mining Guidance Document).

- A subset of the sublethal reports submitted by mines in the Prairie and Northern Region were sent for independent verification by Environment Canada toxicologists. This subset includes the test results submitted by your facility. We will inform you of any additional sublethal deficiencies identified by our reviewers once they have finished their review.
- For first sampling LC50 reported twice for fish species.
- First and second sampling: No LC50 done for sand dollar.
- All comments below are for both sampling dates (July 27 and August 24) unless otherwise stated

Atherinops affinis

- Information on labeling/coding of sample was not reported.
- Temperature of sample upon arrival at lab was not reported.
- The date that the sample was received at the lab was not reported.
- Dates or days during test when sub-samples or multiple samples were used, was not reported.
- The date for test completion was not reported.
- Temperature, DO, pH, and salinity of test solution and controls were not reported for each 24hr exposure period. They were only reported for the start of the test.
- Only give the final average mortality for each test concentration instead of the mortality as noted during each 24hr observation period

- Only give the average dry weight of each concentration instead of for each replicate of each concentration – also no indication if preserved in formalin/ethanol or not. If not preserved then 2 test concentration have weights <0.85mg (17.3% & 69%).
- No preparation procedure of salinity adjustment was reported.

Champia parvula

- Information on labeling and coding of sample was not reported.
- The date for sample receipt at the lab was not reported.
- The date for test completion was not reported.
- Procedure and preparation of the hypersaline brine was not reported.
- The type and quantity of chemicals (if any) added to the control/dilution water was not reported.
- Temperature, DO, pH and salinity of test solutions and controls were not reported for the start and 48hr of the exposure period or for the beginning and end of the recovery period.
- No note if there was anything unusual about the test organism prior to the test or if there was anything unusual about the test itself.
- Only the mean # of cystocarps per plant for each test concentration was reported. Needed to report the mean # of cystocarps per plant in each test vessel (in each replicate of each conc. and controls).
- No indication of quantitative statistic used to determine IC25 value.

Dendraster excentricus

- Information on labeling/coding of sample, the date it was received and its temperature upon arrival at lab were all not reported.
- There was no mention of the condition of the adult organisms prior to use.
- No note if there was anything unusual about the test organisms prior to use or anything unusual about the test itself.
- No procedure for salinity adjustment was reported – only statement that they followed EC guidance document.
- Only 100eggs/ vessel were used – should have been 2000 for the 10mL test volume.
- No indication of quantitative statistic used to determine the IC25 value.

APPENDIX G

Letter from Azimuth Consulting Group, Inc. to Environment Canada re: Clarification of reporting issues outlined in August 9, 2005 letter (dated September 14, 2005)

Azimuth Consulting Group Inc.
218-2902 West Broadway
Vancouver, BC
Canada V6K 2G8

Phone: 604-730-1220
Fax: 604-739-8511
www.azimuthgroup.ca

Jenny Ferone
Regional EEM Coordinator
Prairie & Northern Region
Environment Canada
Rm 200, 4999 98th Ave.
Edmonton, AB, T6B 2X3

September 14, 2005

Dear Ms. Ferone,

Re: Clarification of reporting issues outlined in Environment Canada's letter to Teck Cominco regarding the Polaris 2004 EEM Annual Report

This letter is being written on behalf of Teck Cominco Metals Ltd. in response to Environment Canada's letter to Teck Cominco, dated August 9, 2005, regarding purported deficiencies in the Polaris 2004 Annual Effluent and Water Quality Report. Azimuth staff prepared the report and will be addressing the issues outlined in your letter by providing a revised 2004 EEM Annual Report. However, there are a few questions and clarifications that we would like to draw to your attention, to ensure that we include all required information in the revised report and that there are no misunderstandings or further deficiencies. Our specific responses to each of the points raised in the review letter are as follows:

General:

- Methods, detection limits and QA/QC will be included in all future reports
- Latitude and longitude and a description of the reference and exposure areas will be provided in the hard copy
- Units for water quality will be provided

Effluent Characterization:

- Effluent was collected and tested within allowable time periods, given the short duration of effluent discharge at Polaris.
- Methods, detection limits and QA/QC will be provided in the hard copy

Water Quality:

- Sampling of water quality was optimized to collect as many samples as possible, given short duration of discharge
- Latitude and longitude of exposure and reference areas were provided in the electronic copy; these will also be provided in the hard copy
- Methods, detection limits and QA/QC will be provided in the hard copy

Sublethal Toxicity:

- *"The first sampling LC50 reported twice for fish species."* We presume the reviewers referring to the topsmelt tests. If so, we conducted 3 acute lethality tests on topsmelt in 2004. Results of all three tests are reported in the EEM under point *iii* of the Results. These values are listed as >72.6%, >69.0% and >71.0%.
- *"First and second sampling: No LC50 done for sand dollar."* The sand dollar test is strictly a sublethal fertilization test, and no LC50 is measured.

Atherinops affinis

- Information on labeling and coding of samples will be reported
- Temperature on sample receipt at the lab will be reported.
- Date of sample receipt at the lab will be reported
- Dates or days when sub- or multiple samples were used will be reported
- Date for test completion will be reported
- *"Temperature, DO, pH, and salinity of test solution and controls were not reported for each 24hr exposure period…"* The laboratory (EVS) hand writes temperature, DO and pH on hard copy forms and does not enter these electronically. PDF copies of these forms will be provided with our hard copy report.
- *"Only give the final average mortality for each test concentration instead of the mortality as noted during each 24hr observation period."* As above, these are written by hand in hard copy by the lab. PDF copies will be provided with the final report.
- *Comment regarding the dry weights of each replicate for each test concentration… "If not preserved then 2 test concentration have weights <0.85mg (17.3%, and 69%)."* Dry weights will be reported for each replicate of each concentration. Note that the 0.85mg test validity benchmark only refers to the **controls**. If there is a sublethal effect, such as slower growth, exposed animals will necessarily weigh less than the control and may weigh less than 0.85 mg.
- *"No preparation procedure of salinity adjustment was reported."* Information regarding salinity adjustment was presented under point *ix* under Test Facilities and Conditions. The following text was included:

    ix. Indication that EC guidance document for salinity adjustment was followed

    - *The following was done for all 3 tests:*
        - *No deviations from EC guidance document on preparation of hypersaline brine (HSB)*

- *HSB prepared from natural seawater concentrated to 90ppt (by freezing/refreezing to remove frozen layer and concentrate salts)*
- *No deviations from EC guidance document for salinity adjustment of sample*
- *HSB was added to samples to salinity adjust them to 30ppt*

We presume that this level of information is sufficient. If not, please let us know what additional information is required. Note that for the topsmelt and echinoderm tests, the lab reports state: *"Salinity: 30±2 (sample adjusted with hypersaline brine [HSB]. Preparation of HSB and salinity adjustment as per EC guidance document on salinity adjustment – July 1997)"*

Champia parvula

- Information on labeling and coding will be provided in the revised final report
- Date for sample receipt at the lab will be reported
- Date for test completion will be reported
- *"Procedure and preparation of the hypersaline brine was not reported."* Under point *vii*. of Test Conditions and Facilities we indicate:
  - *No deviations from EC guidance document on preparation of hypersaline brine*
  - *HSB prepared from natural seawater at 90ppt*
  - *No deviations from EC guidance document for salinity adjustment of sample*
  - *Salinity adjustment: 600mL effluent + 250mL HSB + 8.5mL test nutrient solution*
  - *Salinity of samples adjusted from 4ppt to 30ppt*

The lab report indicated for hypersaline brine that it was *"Prepared from natural seawater, at 90 ppt salinity.* As per EC guidance document on salinity adjustment"*. We presume that this is a sufficient level of detail. If not, please advise us what additional information the laboratory can provide to satisfy this comment.

- *"No note if there was anything unusual about the test organism prior to the test or if there was anything unusual about the test itself".* We will include appropriate observations about the test in future reports. With regards to the organisms, under point *iii* of Test Organisms we indicated that *"[test species]…*
  - *Sexually mature male and female branches*
  - *Obtained from USEPA, Hatfield Marine Science Center, Newport Oregon, 1995*
  - *Appear in good health*
  - *Females have trichogynes, males have sori with spermatia*

  We presume this is a sufficient level of detail. If not, please advise us on what additional information the laboratory can provide to satisfy this comment.
- *"No indication of quantitative statistic used to determine the IC25 value."* Under point *iii*. of Results, we stated *"Quantal statistic method was linear interpolation"* We presumed this was sufficient. Please advise if the reviewer wishes us to elaborate on this method.

Dendraster excentricus

- Information on labeling/coding, date of receipt, temperature at arrival at laboratory will be provided
- *"There was no mention of the condition of the adult organisms prior to use."* Under point *xi* (Test Organisms) it is stated that *"organisms appear healthy"*. We presumed this was sufficient information. If not, please elaborate on what additional level of detail is required.
- Future reports will note if there is anything unusual observed about the organisms or the test.
- *"No procedure for salinity adjustment was reported – only statement that they followed EC guidance document"* Under point *ix* (Test Facilities and Conditions) we make the following comments on hypersaline brine and salinity adjustment.
    - *x. Procedure for preparation of hypersaline brine (HSB) as per EC guidance document on salinity adjustment – July 1997*
        - *Test 1: na*
        - *Test 2: 30 ppt adjusted with hypersaline brine (HSB). Preparation of HSB and salinity adjustment as per EC guidance document on Salinity adjustment – July 1997*
        - *Test 2: 30 ppt adjusted with hypersaline brine (HSB). Preparation of HSB and salinity adjustment as per EC guidance document on Salinity adjustment – July 1997*
    - *xi. Procedure for salinity adjustment as per EC guidance document on salinity adjustment – July 1997*
        - *No deviations from EC guidance for salinity adjustment*
        - *Test 1: na*
        - *Test 2: salinity adjusted from 2.8 to 28 ppt*
        - *Test 3: salinity adjusted from 5 to 28 ppt*

  We presume that this is a sufficient level of detail and was according to EC guidance. For both topsmelt and echinoderm tests the original lab report methods for salinity state *"30±2 (sample adjusted with hypersaline brine [HSB]. Preparation of HSB and salinity adjustment as per EC guidance document on salinity adjustment – July 1997)"* Please advise if your reviewers would like us to obtain more information from the laboratory.
- The laboratory does use 2000 eggs/10 mL, although a subset of 100 eggs are evaluated to determine the overall fertilization rate. We will clarify this.
- Quantitative statistic for determining IC25 will be provided.

We have raised a few issues where further guidance from your office is required. These are stated above as assumptions where clarification is requested from your office. We have incorporated all other appropriate additional information requested by the reviewers into a revised 2004 Polaris Annual Report. Once we have received a response from your office we will finalize this revised report. If we do not have a response from your office by Monday September 26, 2005, we will finalize the report

following our assumptions as stated in this letter, and submit the revised report by the September 30, 2005 deadline.

We would also like to communicate to Environment Canada that the electronic and hardcopy versions of the EEM report are not harmonized, as different information is requested for the two reports. As it is currently, the addition of the electronic report results in a duplication of effort and confuses the reporting requirements, rather than resulting in a more streamlined reporting process.

Sincerely,

Cheryl Mackintosh, M.R.M., R.P.Bio.

Azimuth Consulting Group Inc.
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Vancouver, BC, V6K 2G8
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APPENDIX H

Polaris Mine – Revised 2004 3rd Quarter Metal Mining Effluent Regulations Report (dated March 22, 2005)

March 22, 2005

Prairie & Northern Region
Environment Canada
Room 200, 4999 98th Ave.
Edmonton, AB T6B 2X3

Attention: Peter Blackall, Regional Director of Environmental Protection

Dear Sir;

Re: Polaris Mine – Revised 2004 3rd Quarter Metal Mining Effluent Regulations Report

Please find attached a **revised** Polaris Mine 3rd Quarter MMER regulatory data tables. The reason for the revision is to ensure consistency between the data entered electronically online through the RISS system, and the hard copy Annual and 3rd Quarter reports provided. As explained in the original 3rd Quarter report cover letter, effluent from Garrow Lake ceased flowing by mid-August but surface run off from adjacent slopes maintained minimal water flow at the designated final discharge point into August. By August 17, there was water at the final discharge point in a pool, but flow was too low to be measured. As a result, regulatory concentration data in the 3rd Quarter had originally been submitted with average daily flows of 0 m^3 per day for the weeks of Aug. 17, Aug. 24, and Aug. 31, 2004. However, we continued to collect effluent, water quality and acute and sublethal toxicity samples on these latter three dates. Upon submitting the regulatory data into the online RISS system for the annual report, these August concentration data were not accepted with a flow rate of zero. Thus a nominal flow rate of 1 m^3 per day was entered. As a result the loadings data set is slightly different from the data submitted in the original 3rd Quarter report. Note that these low flow conditions during August, as well as their implications for effluent sampling, were discussed with Environment Canada representatives early in August.

If you have any questions regarding the annual report or aspects of the application of the MMER to the Polaris Mine, please feel free to contact me at any time.

Yours truly,

Original signed by B. Donald
Bruce Donald

Attachments: Revised 2003 3rd Quarter Regulatory Data
cc: Walter Kuit (Teck Cominco Limited)
Randy Baker (Azimuth Consulting Group)

2004 3rd QUARTER MMER REPORT - REVISED

LOCATION - FINAL DISCHARGE POINT FROM GARROW LAKE (GARROW LAKE DAM SIPHONS)

CONCENTRATIONS OF EFFLUENT FOR MMER SCHEDULE 4 SAMPLED WEEKLY

Sample Taken During The Week of	Date Sample Taken	DELETERIOUS SUBSTANCE (mg/L)[1] Arsenic	Copper	Cyanide	Lead	Nickel	Zinc	TSS	Radium 226[1]	pH[1]	Collection Method
5-Jul-04	7-Jul-04	0.00100	0.00265	0.0050	0.00269	0.00442	0.1980	117	0.0200	8.05	Grab
12-Jul-04	13-Jul-04	0.00200	0.00070	0.0050	0.00032	0.00204	0.1060	5.7	0.0070	7.90	Grab
19-Jul-04	20-Jul-04	0.00200	0.00043	0.0050	0.00084	0.00088	0.0435	3.0	0.0050	7.86	Grab
26-Jul-04	27-Jul-04	0.00100	0.00052	0.0050	0.00157	0.00207	0.0429	3.0	0.0050	7.87	Grab
2-Aug-04	3-Aug-04	0.00020	0.00082	0.0050	0.00280	0.00338	0.0349	3.3	0.0060	8.00	Grab
9-Aug-04	10-Aug-04	0.00100	0.00100	0.0055	0.00120	0.00748	0.0482	3.0	0.0050	8.04	Grab
16-Aug-04	17-Aug-08	0.00020	0.00121	0.0050	0.00177	0.00644	0.0418	5.3	0.0100	7.95	Grab
23-Aug-04	24-Aug-04	0.00020	0.00134	0.0050	0.00119	0.00967	0.0498	4.4	0.0080	7.84	Grab
30-Aug-04	31-Aug-04	0.00020	0.00137	0.0050	0.00261	0.01340	0.0794	14.5	0.0080	7.90	Grab
6-Sep-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
13-Sep-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
20-Sep-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
27-Sep-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]

Note[1] - All concentrations are in mg/L except Radium 226 which is Bq/L and pH which is in pH units

Note [2] - "nd" refers to no effluent discharge to sample

MONTHLY MEAN CONCENTRATIONS OF EFFLUENT FOR MMER SCHEDULE 4

MONTH OF	MONTHLY MEAN CONCENTRATION[1] OF DELETERIOUS SUBSTANCE[3] Arsenic	Copper	Cyanide	Lead	Nickel	Zinc	TSS	Radium 226
July/04	0.0015	0.00107	0.0050	0.00135	0.00235	0.0976	32	0.0093
August/04	0.0004	0.00115	0.00510	0.00191	0.00807	0.0508	6.1	0.0074
September/04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]

Note[1] - All concentrations are in mg/L except Radium 226 which is Bq/L

Note [2] - "nd" refers to no effluent discharge to sample

Note[3] - Monthly Mean Concentrations - the MEAN value of the concentrations measured in all water samples collected during each month when a deleterious substance is deposited.

MASS LOADING OF DELETERIOUS SUBSTANCE FOR EACH DAY SAMPLED

Sample Taken During The Week of	Date Sample Taken	DAILY MASS LOADING OF DELETERIOUS SUBSTANCE (kg/day)[1]								Average Daily Flow Rate (m^3/day)
		Arsenic	Copper	Cyanide	Lead	Nickel	Zinc	TSS	Radium 226[1]	
5-Jul-04	7-Jul-04	0.018	0.048	0.091	0.049	0.080	3.588	2120	362,440	18,122
12-Jul-04	13-Jul-04	0.752	0.264	1.880	0.120	0.767	39.850	2143	2,631,608	375,944
19-Jul-04	20-Jul-04	0.205	0.044	0.512	0.086	0.090	4.458	307	512,395	102,479
26-Jul-04	27-Jul-04	0.028	0.015	0.141	0.044	0.058	1.211	85	141,090	28,218
2-Aug-04	3-Aug-04	0.005	0.022	0.132	0.074	0.089	0.923	87	158,700	26,450
9-Aug-04	10-Aug-04	0.026	0.026	0.142	0.031	0.194	1.248	78	129,470	25,894
16-Aug-04	17-Aug-08	0.000	0.000	0.000	0.000	0.000	0.000	0	0	1
23-Aug-04	24-Aug-04	0.000	0.000	0.000	0.000	0.000	0.000	0	0	1
30-Aug-04	31-Aug-04	0.000	0.000	0.000	0.000	0.000	0.000	0	0	1
6-Sep-04	nd[2]	0	0	0	0	0	0	0	0	0
13-Sep-04	nd[2]	0	0	0	0	0	0	0	0	0
20-Sep-04	nd[2]	0	0	0	0	0	0	0	0	0
27-Sep-04	nd[2]	0	0	0	0	0	0	0	0	0

Note[1] - Mass Loading is in kilograms per day of the deleterious substance deposited except Radium 226 which is in Bq per day

Note[2] - "nd" refers to no effluent discharge to sample

MASS LOADING PER CALENDAR MONTH FOR EACH DELETERIOUS SUBSTANCE

CALENDAR MONTH OF	MASS LOADING[1] FOR DELETERIOUS SUBSTANCE (kg/month)[2]								Average Weekly Flow Rate[3] (m^3/week)	Total Monthly Volume[4] (m^3/month)
	Arsenic	Copper	Cyanide	Lead	Nickel	Zinc	TSS	Radium 226[2]		
July/04	7.77	2.87	20.33	2.31	7.71	380.58	36,078.15	28,268,381	131,191	4,066,913
August/04	0.19	0.29	1.70	0.65	1.76	13.46	1,022.95	1,786,654	10,469	324,551
September/04	0	0	0	0	0	0	0	0	0	0

Note[1] - Total Mass Loading for Calendar month calculated by multiplying the Average Daily Mass Loading for the Month x # days in the month

Note[2] - Mass loading units are in kg per month except Radium 226, which is in Bq permonth

Note[3] - Average Weekly Flow Rate calculated by multiplying Average Daily Flow Rate x 7 days per week

Note[4] - Total Monthly Volume calculated by multiplying Average Daily Flow Rate for the month x days in month