APPENDIX 20

GARROW LAKE EFFLUENT DISCHARGE

MONITORING DATA

Bruce J. Donald
Reclamation Manager

March 31, 2004

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 – 2003 ANNUAL Metal Mining Effluent Regulations Summary Report

Please find attached a **revised** Polaris Mine annual MMER summary report as the original report submitted January 27, 2004 was not complete and contained errors. There were no non-compliant concentrations related to Schedule 4 limits and no non-compliant results of the acute lethality tests during the year.

The following is included in our revised 2003 Annual Submission:

1. Requirements under Schedule 6
   - Identification of Site, Owner, Location, etc.
   - Non-Compliance information
   - Table 1 – Monthly Mean Concentrations, pH Range and Volume of Effluent
   - Table 2 – Results of Acute Lethality Tests and Daphnia Magna Monitoring Tests

2. Requirements under Part 1 Section 8
   - Results of studies conducted under Part 1, Section 4 (Effluent Characterization)
   - Results of studies conducted under Part 1, Section 5 (Sublethal Toxicity Testing)
   - Part 1, Section 6 Required Frequency of Effluent Characterization
   - Results of studies conducted under Part 1, Section 7 (Water Quality Monitoring)

During 2003, Teck Cominco conducted only one series of sublethal effluent testing in error contrary to the requirements of Part 1, Section 6 of the MMER. The report contains a letter from our consultants explaining the error. Teck Cominco intends to comply with section of the regulations as part of our monitoring program planned for 2004 and 2005.

The monitoring data required to be reported in electronic format has been emailed to you along with an electronic copy of this report (emailed March 31, 2004).

Please note that the location of the final discharge point previously submitted had a typographical error which has been corrected in this report.

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 MMER Annual Report
cc: Walter Kuit (Teck Cominco Limited)
Joe Dahoy (Cascade Management)
Patrick Allard (Azimuth Consulting Group)

SCHEDULE 6

(Section 22)

SCHEDULE 6

(Section 22)

Mine Name : Polaris Mine

Mine Operator: Cominco Mining Partnership and Teck Cominco Ltd.

Mine Address: Box 188, Resolute, NU X0A 0B0

Telephone: (867) 253-2201 (Site Manager, Joe Dahoy)

E-mail: joe.dahoy@teckcominco.com

Location of Final Discharge Point:
Garrow Lake Siphons at 75^0 22' 32" N, 96^0 48' 37" W.

Reporting Period: January 1, 2003 to December 31, 2003

Date of Report: **Revised** March 31, 2003

Non-Compliance Information:

There were no non-compliant effluent discharges during 2003. All effluent sample results were within Schedule 4 limits.

There were no non-compliant acute lethality tests during 2003.

SCHEDULE 6

TABLE 1

MONTHLY MEAN CONCENTRATIONS, pH RANGE AND VOLUME OF EFFLUENT (1)(2)

MONTH	As (mg/L)	Cu (mg/L)	CN (mg/L)	Pb (mg/L)	Ni (mg/L)	Zn (mg/L)	TSS (mg/L)	Ra (Bq/L)	pH	Effluent Volume ($m^{3)}$
January	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]
February	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]
March	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]
April	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]
May	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]
June	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]
July	0.000	0.001	0.005	0.006	0.001	0.055	3.00	0.005	7.77 - 7.84	1,555,704
August	0.001	0.001	0.005	0.001	0.002	0.137	4.25	0.005	7.85 - 8.10	2,909,048
September	0.001	0.001	0.005	0.002	0.003	0.165	8.67	0.007	7.94 - 8.06	2,824,710
October	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]
November	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]
December	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]	ND[1]

Note [1] - "ND" refers to any measurement not taken because there was no deposit from the final discharge point.

Note [2] - "NMR" refers to any measurement not taken because no measurement was required in accordance with the conditions set out in Section 13 of the regulations.

SCHEDULE 6
TABLE 2

RESULTS OF ACUTE LETHALITY TESTS AND DAPHNIA MAGNA MONITORING TESTS

DATE SAMPLE COLLECTED	EFFLUENT ACUTELY LETHAL TO RAINBOW TROUT (Yes or No)	EFFLUENT ACUTELY LETHAL TO DAPHNIA MAGNA (Yes or No)
30-Jul-03	No	No
20-Aug-03	No	No
16-Sep-03	No	No

REQUIREMENTS UNDER SECTION 4 OF PART 1

EFFLUENT CHARACTERIZATION

Monthly Sampling of Effluent in Garrow Creek for EEM

(Lat 75°22'32", Long 96°48'37")

	Conventional Water Chemistry and Water Quality Parameters									
Sample Date	Lab pH	Field pH	Field Temperature	Dissolved Oxygen	Hardness	Alkalinity	Ammonia	Cyanide	Nitrate	TSS
2003-07-29	7.84	7.69	0.30	10.53	459	46	0.08	*0.005*	0.102	*3*
2003-08-19	8.10	8.70	1.22	4.94	1130	103	0.03	*0.005*	0.225	8
2003-09-16	7.96	8.75	0.19	3.95	1540	122	0.04	NA	0.217	5

	Dissolved Metal Concentrations										
Sample Date	Aluminum	Cadmium	Iron	Mercury	Molybdenum	Arsenic	Copper	Lead	Nickel	Zinc	Radium ^{226}
2003-07-29	*0.1*	0.00016	0.02	*0.00005*	*0.002*	*0.0004*	0.00057	0.00319	0.00115	0.0625	*0.005*
2003-08-19	*0.1*	0.00037	0.03	*0.00005*	*0.002*	*0.0010*	0.00097	0.00046	0.00265	0.1460	*0.005*
2003-09-16	*0.1*	0.00047	0.04	*0.00005*	*0.005*	*0.0010*	0.00099	0.00046	0.00365	0.1860	*0.005*

NA - Not Available (no sample).

Note[1] - All concentrations are in mg/L, except pH which is in pH units and temperature which is in °C

Concentrations in *red italics* were set to the detection limit.

POLARIS MINE ANNUAL MMER REPORT

REQUIREMENTS UNDER SECTION 5, PART 1

APPENDIX A

i. Information specified in Schedule 5 of the MMER (June 2002) for Reference Method EPAW 95-EPA West Coast: 7-day Topsmelt Survival and Growth Test.

APPENDIX B

i. Information specified in Schedule 5 of the MMER (June 2002) for Reference Method EPS 1/Rm/27-EC: 92 hr Echinoderm (sand dollar) Fertilization Test (Annual)

APPENDIX C

i. Information specified in Schedule 5 of the MMER (June 2002) for Reference Method EPA/600/4-91-003, Method 1009.0: Algae (*Champia parvula*) 7-day Sublethal Growth Test (Annual).

APPENDIX A

7-d Topsmelt Growth and Survival Toxicity Test

Reporting Requirements for Reference Method EPA/600/R-95/136

Effluent Sample

i. Name & location of operation generating the effluent
   - Polaris Mine, Little Cornwallis Island, Nunavut
   - Final Discharge Point for Garrow Lake is geo referenced as 75° 22' 32" N, 97° 48' 37" W.

ii. Date & time of sampling
   - Samples for yearly sublethal toxicity testing were collected:
     Wednesday August 20, 2003 - 12:30 AM

iii. Type of sample
   - Final effluent water

iv. Brief description of sampling point
   - 20m downstream of the siphon discharge point at Garrow Lake dam

v. Sampling method
   - Water was collected from at least 15cm below the surface using a water pump with silicon tubing
   - Water was collected from the upstream direction
   - The pump was flushed with site water for at least one minute prior to sample collection
   - 4 x 20L sample bottles were filled

vi. Name of person submitting samples
   - Dennis Lu (Gartner Lee)

Test Organisms Imported from External Supplier

i. Species of test organism
   - Topsmelt (*Atherinops affinis*)

ii. Name and city of testing laboratory
   - EVS Environment Consultants, North Vancouver, BC

iii. Source of test species
   - Aquatic Bio Systems (ABS), Fort Collins, Colorado

iv. Date test species acquired on
   - August 21, 2003

v. Indications of deviations from EC guidance on the importation of test organisms
   - No deviations from EC requirements

vi. Percent mortality of fish in 24-hour period preceding the test
   - <10% mortality

vii. Age at start of test
   - 10 days post-hatch

viii. Unusual appearance, behaviour, or treatment of larvae before their use in the test
   - Nothing unusual, no excessive crowding of larvae, larvae appear healthy, disease-free, stress free,

ix. Confirmation that larvae are actively feeding and swimbladders are not inflated
   - Larvae actively feeding and swimbladders not inflated

x. Confirmation that temperature change was <3°C and dissolved oxygen was maintained at >6mg/L during transport
   - Temperature change was <2°C and dissolved oxygen supersaturated mg/L during transport

xi. Test organism acclimation rate at the testing laboratory
   - Holding water conditions upon arrival were DO=supersaturated, pH=7.3, T=22°C
   - Organisms were acclimated slowly overnight
   - Addition of EVS lab seawater at intervals of 30 – 60min to reach acceptable conditions
   - Organisms were acclimated to DO=8mg/L, salinity=28ppt,T=20°C

Reporting Requirements for Reference Method EPA/600/R-95/136

Test Facilities and Conditions

i. Test type & method
   - 7-day Topsmelt (*Atherinops affinis*) Survival and Growth Toxicity Test
   - Static renewal
   - Sample water was renewed daily
   - Reference Method - EPA/600/R-95/136 (EPAW 95-EPA West Coast)

ii. Indications of deviations from requirements in Sections 11 of Method EPA/600/R-95/136 (EPAW 95-EPA West Coast)
   - No deviations from requirements
   - Salinity controls were run
   - Sample water salinity was 5.3ppt

iii. Date and time for start of definitive test
   - Friday August 22, 2003 - 5:00 PM

iv. Test vessel description
   - 600mL beaker

v. Person(s) performing the test and verifying the results
   - Kevin Goodearle, Julianna Kalocai, Sioe Lie Kwee, Rachel DeWynter, Edmund Canaria, and Armando Tang

vi. pH, temperature, dissolved oxygen, and conductivity of unadjusted, undiluted effluent
   - pH - 7.9, T - 20.0°C, DO - 11.0mg/L, C - 9570µmhos/cm, (salinity - 5.3 ppt)

vii. Confirmation that no adjustment of sample or solution pH occurred
   - No pH adjustment

viii. Indication of aeration of test solutions before introduction of fish
   - Pre-aeration at 6.5mL/min/L for 30mins due to supersaturation of sample with O_2 when sample was heated to 20°C
   - DO was reduced from 11.0mg/L to 7.8 mg/L

ix. Indication that EC guidance document for salinity adjustment was followed
   - No deviations from EC guidance document on preparation of hypersaline brine
   - 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 from 5.3ppt to 30ppt

x. Type and source of control/dilution water
   - UV-sterilized, 0.45µm-filtered natural seawater from the Vancouver Aquarium

xi. Concentrations and volumes tested
   - Concentrations (% effluent volume / total volume) tested and total volumes used were:
   - Control (0%) - 200 mL
   - Salinity Control (0%) - 200 mL
   - 4.5% - 200mL
   - 9.0% - 200mL
   - 18.1% - 200mL
   - 36.2% - 200mL
   - 72.3% - 200mL

xii. Number of replicated per concentration
   - 5 replicates per concentration

xiii. Number of organisms added to each test vessel
   - 5 fish per vessel

xiv. Manner and rate of exchange of test solutions
   - Daily renewal

Reporting Requirements for Reference Method EPA/600/R-95/136

xv. Measurements of dissolved oxygen, pH and temperature
- DO: 6.6 - 7.8 mg/L, pH: 7.7 - 8.2, T: 19.0 - 20.0 °C, salinity: 29 - 31 ppt

Results

i. Number and % of mortalities of fish in each test solution
- Totals from all 5 replicates are presented:
- Control (0%) - 1/25 = 4%
- Salinity Control - 0/25 = 0%
- 4.5% - 0/25 = 0%
- 9.0% - 0/25 = 0%
- 18.1% - 0/25 = 0%
- 36.2% - 0/25 = 0%
- 72.3% - 1/25 = 4%

ii. Average dry weight per original fish in test vessel
- Means from all 5 replicates are presented:
- Control (0%) - 1.18 mg
- Salinity Control - 1.14 mg
- 4.5% - 1.13 mg
- 9.0% - 1.32 mg
- 18.1% - 1.09 mg
- 36.2% - 1.11 mg
- 72.3% - 1.14 mg

iii. Estimate of 7-d LC_{50} (95% CL)
- 7-d LC_{50} concentration > 72.3% effluent (highest concentration tested due to dilution for salinity adjustment)
- Quantal statistic methods not applicable

iv. Estimate of 7-d IC_{25} (95% CL) for growth
- 7-d IC_{25} concentration > 72.3% effluent (highest concentration tested due to dilution for salinity adjustment)
- Quantal statistic methods not applicable

v. Current reference toxicity tests (95% CL) for 7-d LC_{50} for survival and 7-d IC_{50} for growth
- Reference toxicity tests for Toxicant: Copper
- Test conducted on August 22, 2003, same day as effluent test
- Reference toxicant test was conducted on the same batch of externally supplied topsmelt used in the effluent test and under the same experimental conditions as the effluent test
- 7-d LC_{50} survival = 122mg/L Cu, 95% CL = 111-135mg/L
- 7-d IC_{50} growth = 122mg/L Cu, 95% CL = 106-132mg/L

vi. Reference toxicity warning limits (+/- SD) for 7-d LC_{50} for survival and 7-d IC_{50} for growth
- Reference toxicity tests for Toxicant: Copper
- 7-d LC_{50} survival = 139 ± 63mg/L Cu,
- 7-d IC_{50} growth = 136 ± 52mg/L Cu

APPENDIX B

92-h Echinoderm Fertilization Test

Reporting Requirements for Reference Method EPS1/RM/27-EC 92 (Sperm Cell)

Effluent Sample

i. Name & location of operation generating the effluent
   - Polaris Mine, Little Cornwallis Island, Nunavut
   - Final Discharge Point for Garrow Lake is geo referenced as 75° 22' 32" N, 97° 48' 37" W.

ii. Date & time of sampling
   - Samples for yearly sublethal toxicity testing were collected:
     Wednesday August 20, 2003 - 12:30 AM

iii. Type of sample
   - Final effluent water

iv. Brief description of sampling point
   - 20m downstream of the siphon discharge point at Garrow Lake dam

v. Sampling method
   - Water was collected from at least 15cm below the surface using a water pump with silicon tubing
   - Water was collected from the upstream direction
   - The pump was flushed with site water for at least one minute prior to sample collection
   - 4 x 20L sample bottles were filled

vi. Name of person submitting samples
   - Dennis Lu (Gartner Lee)

Test Organisms

i. Species of test organism
   - Sandollar Echinoid (*Dendraster excentricus*)

ii. Name and city of testing laboratory
   - EVS Environment Consultants, North Vancouver, BC

iii. Source of test species
   - M-REP, Escondido, California
   - All adults providing gametes are from the same population and source
   - Gametes are spawned in-house at EVS

iv. Date test species acquired on
   - August 22, 2003

v. Holding time and conditions for adults
   - Adults received at the testing laboratory the day of the test, shipped overnight

vi. Indications of deviations from EC guidance on the importation of test organisms
   - No deviations from EC requirements

vii. Weekly percent mortality of adults being held over 7d preceding test
   - <2% per day over the 7 days preceding the test

viii. Age of test organisms
   - < 4 hours after spawning

ix. Unusual appearance, behaviour, or treatment of adults or gametes before test start
   - Organisms appear healthy

Test Facilities and Conditions

i. Test type & method
   - Echinoderm (*Dendraster excentricus*) Fertilization Toxicity Test
   - Static
   - Reference Method – EPS/1/RM/27 with 1997 amendments

ii. Test duration
   - 10:10 min (10min sperm + 10min sperm & egg)

iii. Date and time for start of definitive test

Reporting Requirements for Reference Method EPS1/RM/27-EC 92 (Sperm Cell)

- Friday August 22, 2003 - 5:00 PM

iv. Test vessel description
- 16 x 125mm test tubes

v. Person(s) performing the test and verifying the results
- Kevin Goodearle, Julianna Kalocai, Sioe Lie Kwee, Rachel DeWynter, Edmund Canaria, and Armando Tang

vi. Indication of rate and duration of pre-aeration of test solutions before initiation of test
- No pre-aeration

vii. Confirmation that no adjustment of sample or solution pH occurred
- No pH adjustment

viii. Procedure for sample filtration
- No sample filtration

ix. Procedure for preparation of hypersaline brine (HSB) as per EC guidance document on salinity adjustment – July 1997
- No deviations from EC guidance for salinity adjustment

x. Procedure for salinity adjustment as per EC guidance document on salinity adjustment – July 1997
- No deviations from EC guidance for salinity adjustment
- Salinity adjusted from 5ppt to 29ppt

xi. Type and source of control/dilution water
- UV-sterilized, 0.45µm-filtered natural seawater from the Vancouver Aquarium

xii. Concentrations and volumes tested
- Concentrations (% effluent volume / total volume) tested and total volumes used were:
- Control (0%) - 10mL
- Salinity Control (0%) - 10mL
- 4.6% - 10mL
- 9.1% - 10mL
- 18.2% - 10mL
- 36.5% - 10mL
- 73.0% - 10mL

xiii. Number of replicated per concentration
- 4 replicates per treatment concentration

xiv. Number of organisms per container
- 2000 eggs per 10mL vessel

xv. Measurements of pH and dissolved oxygen in sample water before use
- pH - 8.3, DO - 8.4mg/L

xvi. Measurements of pH, temperature, dissolved oxygen, and salinity during test
- pH - 7.9-8.4, T - 15.0-15.5°C, DO - 8.1-8.4mg/L, salinity - 29ppt

Results

i. Number and % of fertilized eggs in each test concentration
- (Number is equal to percent since totals were 100)
- Control (0%): #F = 51, 50, 52, 54 #UF = 49, 50, 49, 46
- Salinity Control: #F = 51, 52, 50, 51 #UF = 49, 48, 50, 49
- 4.6%: #F = 35, 40, 29, 45 #UF = 65, 60, 71, 55
- 9.1%: #F = 36, 28, 33, 25 #UF = 64, 72, 67, 75
- 18.2%: #F = 22, 24, 18, 20 #UF = 78, 78, 82, 80
- 36.5%: #F = 12, 8, 7, 10 #UF = 88, 92, 93, 90
- 73.0%: #F = 1, 0, 2, 0 #UF = 99, 100, 98, 100

Reporting Requirements for Reference Method EPS1/RM/27-EC 92 (Sperm Cell)

ii. Estimate of IC_{25} (95% CL) for fertilization success
- IC_{25} concentration = 3.8 (1.1 - 7.2)% v/v effluent
- Quantal statistic method = log linear interpolation

iii. Current reference toxicity tests (95% CL) for IC_{50} for fertilization
- Reference toxicity tests for Toxicant: Sodium Dodecyl Sulfate
- Test conducted on August 22, 2003, same day as effluent test
- Reference test conducted under same conditions
- IC_{50} for fertilization = 1.3mg/L SDS, 95% CL = 1.1-1.5mg/L

APPENDIX C

7-d Sublethal *Champia* (Algae) Toxicity Test

Reporting Requirements for Reference Method EPA/600/4-91/003 Method 1009.0

Effluent Sample

i. Name & location of operation generating the effluent
   - Polaris Mine, Little Cornwallis Island, Nunavut
   - Final Discharge Point for Garrow Lake is geo referenced as 75° 22' 32" N, 97° 48' 37" W.

ii. Date & time of sampling
   - Samples for yearly sublethal toxicity testing were collected:
     Wednesday August 20, 2003 - 12:30 AM

iii. Type of sample
   - Final effluent water

iv. Brief description of sampling point
   - 20m downstream of the siphon discharge point at Garrow Lake dam

v. Sampling method
   - Water was collected from at least 15cm below the surface using a water pump with silicon tubing
   - Water was collected from the upstream direction
   - The pump was flushed with site water for at least one minute prior to sample collection
   - 1 x 4L sample bottles were filled

vi. Name of person submitting samples
   - Dennis Lu (Gartner Lee)

vii. Temperature of water upon receipt at lab
   - 13°C

Test Organisms

i. Species of test organism
   - Algae (*Champia parvula*)

ii. Name and city of testing laboratory
   - Saskatchewan Research Council [SRC], Saskatoon, SK

iii. Source of 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

Test Facilities and Conditions

i. Test type & method
   - *Champia parvula* sexual reproduction test
   - Static, non-renewal
   - 2-day exposure, followed by 5-7 day recovery period for cystocarp development
   - Reference Method - EPA/600/4-91/003, Method 1009.0

ii. Date and time for start of definitive test
   - Friday August 22, 2003 – 10:00 AM

iii. Test vessel description
   - 270mL transparent polystyrene cups with polystyrene lids

iv. Person(s) performing the test and verifying the results
   - Mary Moody

v. Indication of pre-aeration of test solutions
   - No pre-aeration

vi. Confirmation that no pH adjustment of sample or solution occurred
   - No pH adjustment

Reporting Requirements for Reference Method EPA/600/4-91/003 Method 1009.0

vii. Indication that EC guidance document for salinity adjustment was followed
- 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: 642mL effluent + 258mL HSB + 9mL test nutrient solution
- Salinity of samples adjusted from 5ppt to 30ppt

viii. Type and source of control/dilution water
- Natural seawater collected at the Pacific Environmental Center, Environment Canada, North Vancouver, BC
- Filtered to 0.2µm and autoclaved prior to use
- Salinity adjusted as per EC guidance document to 30ppt with HSB from the same source

ix. Concentrations and volumes of test solutions
- Concentrations (% effluent volume / total volume) tested and total volumes used were:
- Control (Natural Seawater) (0%) - 100mL, 4.5cm depth
- Salinity Control Brine (0%) - 100mL, 4.5cm depth
- 4.5% - 100mL, 4.5cm depth
- 8.9% - 100mL, 4.5cm depth
- 17.8% - 100mL, 4.5cm depth
- 35.6% - 100mL, 4.5cm depth
- 71.3% - 100mL, 4.5cm depth

x. Number of replicated per concentration
- 3 replicates per concentration

xi. Number of organisms per test chamber
- 5 female branches + 2 male branches per chamber

xii. Measurements of pH, temperature, dissolved oxygen, and salinity of sample before use
- pH - 7.93, T - 23.5°C, DO - 9.4mg/L, salinity - 5ppt

xiii. Measurements of pH, temperature, dissolved oxygen, and salinity of sample during test
- DO: 7.8 - 8.0 mg/L, pH: 7.74 - 8.98, T: 23°C, salinity: 30ppt

Results

i. Number and % mortality of female plants after recovery in each test solution
- Totals from all 3 replicates are presented:
- Control (0%): 0 (0%) mortality
- Salinity Control (0%): 0 (0%) mortality
- 4.5%: 0 (0%) mortality
- 8.9%: 0 (0%) mortality
- 17.8%: 0 (0%) mortality
- 35.6%: 0 (0%) mortality
- 71.3%: 0 (0%) mortality

ii. Mean number of cystocarps per plant in each test concentration
- Control (0%): 57.4; 49.6; 44.2
- Salinity Control (0%): 66.4; 44.0; 45.2
- 4.5%: 52.2; 51.4; 57.4
- 8.9%: 61.2; 63.6; 41.2
- 17.8%: 30.4; 34.4; 18.6
- 35.6%: 6.6; 6.0; 7.6
- 71.3%: 0.0; 2.4; 1.4

Reporting Requirements for Reference Method EPA/600/4-91/003 Method 1009.0

iii. Estimate of IC_{25} (95% CL) for cystocarp development
- IC_{25} concentration = 13.6 (9.0-16.0)% effluent v/v
- Quantal statistic method was linear interpolation

iv. Current reference toxicity tests (95% CL) for IC_{50} for cystocarp development
- Reference toxicity tests for Toxicant: Sodium Dodecyl Sulfate
- Test conducted on July 29, 2003, within 30 days of effluent test
- Reference toxicant test was conducted under the same experimental conditions as the effluent test
- IC_{50} cystocarp development = 1.19mg/L SDS, 95% CL = 1.14-1.23mg/L

v. Reference toxicity warning limits (+/- 2SD) for IC_{50} for cystocarp development
- Reference toxicity tests for Toxicant: SDS
- 7-d IC_{50} growth = 1.47 (1.17-1.84) mg/L SDS

REQUIREMENTS UNDER SECTION 6 OF PART 1

SUBLETHAL TOXICITY TESTING FREQUENCY

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

Phone: 604-730-1220
Fax: 604-739-8511

Our File #: TC-03-03

March 18, 2004

Sidney F. Bruinsma
Enforcement/Emergencies Officer, Nunavut
Northern Division, Environmental Protection Branch
Environment Canada
Box 1870, Iqaluit
Nunavut X0A 0H0

Dear Mr. Bruinsma:

Re: Polaris Mine EEM – Missed Sublethal Toxicity Test Sampling Event

Further to our recent discussion, we are pleased to document the issues and circumstances surrounding the missed 2003 sampling event for sublethal toxicity testing (SLTT) of effluent at Teck Cominco's Polaris Mine.

First, Azimuth Consulting Group (Azimuth) takes full responsibility for the missed sampling event, which resulted from an oversight on our part. Our staff have considerable experience conducting environmental effects monitoring (EEM) programs under the Pulp and Paper Effluent Regulations (PPER), which have been in place for some years. We understand the importance of the SLTT as an EEM investigative tool and would not knowingly miss a sampling event. The oversight comes from our interpretation of the new Metal Mining Effluent Regulations (MMER) and how they apply to the Polaris Mine, which has a unique discharge situation (i.e., limited to approximately 60 days per calendar year). Under both the PPER and MMER, two sampling events are required for the SLTT. However, if the discharge period is less than 120 days, the PPER require only one sampling event. We mistakenly assumed that these terms would also apply to the MMER, which provide less detail pertaining to the requirements of this test than the PPER. This issue was compounded by the unique discharge characteristics and receiving environment of the Polaris Mine, which make the MMER more difficult to interpret and apply compared to mines discharging under more usual conditions.

We became aware of the missed SLTT event during a December 2003 workshop intended to present results of 2003 reconnaissance studies carried out at the mine and to seek feedback from the Technical Advisory Committee (TAP) on our proposed study design for the Polaris Mine. Following our presentation, Ms. Sandra Blenkinsopp pointed out that two sampling events were indeed required under MMER. She then indicated that Environment Canada would contact us to further discuss the implications of this matter.

We agree that the missed SLTT event is unfortunate and will ensure that this test is carried out twice during the 2004 and 2005 discharge periods.

Please do not hesitate to contact us if you have any questions or require further clarification.

Sincerely,

Azimuth Consulting Group Inc.

Patrick Allard, M.Sc., R.P.Bio.

cc: Randy Baker (Azimuth)
Bruce Donald (Teck Cominco)

REQUIREMENTS UNDER SECTION 7 OF PART 1

WATER QUALITY MONITORING

Monthly Sampling of Exposure Station in Garrow Bay at mouth of Garrow Creek

(Lat 75°22'15", Long 96°48'30")

	Conventional Water Chemistry and Water Quality Parameters									
Sample Date	Lab pH	Field pH	Field Temperature	Dissolved Oxygen	Hardness	Alkalinity	Ammonia	Cyanide	Nitrate	TSS
2003-07-29	7.86	7.75	0.47	10.29	456	46	0.04	*0.005*	0.098	4
2003-08-19	8.13	8.36	1.08	5.01	1120	104	0.03	*0.005*	0.229	8
2003-09-16	7.85	8.38	-0.76	5.45	3620	117	0.03	*0.005*	0.159	10

	Dissolved Metal Concentrations										
Sample Date	Aluminum	Cadmium	Iron	Mercury	Molybdenum	Arsenic	Copper	Lead	Nickel	Zinc	Radium ^{226}
2003-07-29	*0.1*	0.00015	0.03	*0.00005*	*0.002*	*0.0004*	0.00080	0.00435	0.00121	0.0594	*0.005*
2003-08-19	*0.1*	0.00038	0.05	*0.00005*	*0.002*	*0.001*	0.00106	0.00108	0.00304	0.1490	*0.005*
2003-09-16	*0.1*	0.00024	0.03	*0.00005*	0.006	0.001	0.00059	0.00043	0.00169	0.0881	0.005

Note[1] - All concentrations are in mg/L, except pH which is in pH units, Radium ^{226} which is in Bq/L and temperature which is in °C

Concentrations in *red italics* were set to the detection limit.

Monthly Sampling of Reference Station in Garrow Bay (1 km NE of Exposure Station)

(Lat 75°22'40", Long 96°47'12")

	Conventional Water Chemistry and Water Quality Parameters									
Sample Date	Lab pH	Field pH	Field Temperature	Dissolved Oxygen	Hardness	Alkalinity	Ammonia	Cyanide	Nitrate	TSS
2003-07-29	7.67	7.13	-0.27	9.27	989	33	0.03	*0.005*	*0.005*	*3*
2003-08-19	7.87	8.32	0.18	5.50	5830	115	*0.02*	*0.005*	*0.005*	32
2003-09-16	7.78	8.35	-1.36	3.42	5930	113	0.08	*0.005*	*0.005*	9

	Dissolved Metal Concentrations										
Sample Date	Aluminum	Cadmium	Iron	Mercury	Molybdenum	Arsenic	Copper	Lead	Nickel	Zinc	Radium ^{226}
2003-07-29	*0.1*	*0.00002*	0.01	*0.00005*	*0.002*	*0.0004*	0.00023	0.00032	0.00021	0.0010	*0.005*
2003-08-19	*0.1*	0.00003	*0.01*	*0.00005*	0.010	0.0020	0.00044	0.00021	0.00033	0.0007	*0.005*
2003-09-16	*0.1*	0.00003	0.02	*0.00005*	0.011	*0.0010*	0.00028	0.00052	0.00026	0.0011	*0.005*

Note[1] - All concentrations are in mg/L, except pH which is in pH units, Radium ^{226} which is in Bq/L and temperature which is in ^{o}C

Concentrations in *red italics* were set to the detection limit.

Bruce J. Donald
Reclamation Manager

May 13, 2004

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 – 2004 1st Quarter Metal Mining Effluent Regulations Report

Despite having a designated discharge location for effluent identified under Section 9 of the MMER, there was no discharge from the Garrow Lake Tailings Impoundment Area during the period January 1, 2004 to March 31, 2004. While there is no data to report, I have completed the monitoring report as required by the regulations and have attached it to this letter.

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

Yours truly,

Bruce Donald

Attachments: 1st Quarter 2004 Monitoring Report

cc:
Walter Kuit (Teck Cominco Limited)
Polaris Mine Site Files
Randy Baker (Azimuth Consulting Group)

POLARIS MINE – MMER MONITORING REPORT

1st QUARTER 2004

APPENDIX A

i. Information specified by Section 8.1 of Reference Method EPS 1/Rm/13

APPENDIX B

i. Information specified by Section 8.1 of Reference Method EPS 1/Rm/14

APPENDIX C

i. Concentration & monthly mean concentrations of each deleterious substance of Schedule 4
ii. pH of the effluents samples as required by subsection 12(1)
iii. Description of sample collection method
iv. Total volume of effluent deposited during each month of the quarter as per section 19
v. Mass loading of the deleterious substances set out in Schedule 4 and as per section 20

APPENDIX D

i. Results of the effluent characterization as per paragraph 15(1)(a)

APPENDIX A

Reporting Requirements for Reference Method EPS 1/RM/13

Section 8.1.1 Effluent

i. Name & location of operation generating the effluent
   - Polaris Mine, Little Cornwallis Island, Nunavut
   - Final Discharge Point for Garrow Lake is geo referenced as 75° 22' 32" N, 96° 48' 37" W.

ii. Date & time of sampling
   - No sampling conducted as there was no effluent discharge during the quarter.

iii. Type of sample
   - No sampling conducted as there was no effluent discharge during the quarter

iv. Brief description of sampling point
   - Discharge point of siphon at Garrow Lake dam

v. Sampling method
   - No sampling conducted as there was no effluent discharge during the quarter

vi. Name of person submitting samples
   - No sampling conducted as there was no effluent discharge during the quarter

Section 8.1.2 Test Facilities and Conditions

i. Test type & method
   - No testing conducted as there was no effluent discharge during the quarter

ii. Indications of deviations from requirements in Sections 2 to 7 of Method EPS 1/RM/13
   - No deviations to report as there was no testing conducted during the quarter

iii. Name and city of testing laboratory
   - No laboratory used during the quarter

iv. Percent mortality of fish in stock tank(s)
   - None to report. There were no tests conducted during the period

v. Species of test organism
   - None to report as there were no tests conducted during the period

vi. Date and time for start of definitive test
   - None to report as there were no tests conducted during the period

vii. Person(s) performing the test and verifying the results
   - No tests performed during the quarter

viii. pH, temperature, dissolved oxygen, and conductivity of unadjusted, undiluted effluent
   - No data to report as there were no tests conducted during the period

ix. Confirmation that no adjustment of sample or solution pH occurred
   - No adjustment to report as there were no tests conducted during the period

x. Indication of aeration of test solutions before introduction of fish
   - None to report as there were no tests conducted during the period

xi. Concentrations and volumes tested
   - No data to report as there were no tests conducted during the period

xii. Measurements of dissolved oxygen, pH and temperature
   - No data to report as there were no tests conducted during the period

xiii. Number of fish added to each test vessel
   - No fish added as there were no tests conducted during the period

xiv. Mean and range of fork length of control fish at end of test
   - No data to report as there were no tests conducted during the period

xv. Mean wet weight of individual control fish at end of the test
   - No data to report as there were no tests conducted during the period

xvi. Estimated loading density of fish in test solutions
   - No data to report as there were no tests conducted during the period

Reporting Requirements for Reference Method EPS 1/RM/13 - Continued

Section 8.1.3 Results

i. Number of mortalities of fish in each test solution
   - None to report. No tests conducted during the period

ii. Number of control fish showing atypical/stressed behaviour
   - None to report. No tests conducted.

iii. Mean mortality rate in solutions of effluent and control water
   - None to report. No tests conducted

iv. Estimate of 96-h LC50 in multi-concentration tests
   - No data to report. No tests conducted

v. Most recent 96-h LC50 for reference toxicity test(s)
   - No data to report. No tests conducted

APPENDIX B

Reporting Requirements for Reference Method EPS 1/RM/14

Section 8.1.1 Effluent

i. Name & location of operation generating the effluent
   - Polaris Mine, Little Cornwallis Island, Nunavut
   - Final Discharge Point for Garrow Lake is geo referenced as 75° 22' 32" N, 96° 48' 37" W.

ii. Date & time of sampling
   - No sampling conducted as there was no effluent discharge during the quarter.

iii. Type of sample
   - No sampling conducted as there was no effluent discharge during the quarter

iv. Brief description of sampling point
   - Discharge point of siphon at Garrow Lake dam

v. Sampling method
   - No sampling conducted as there was no effluent discharge during the quarter

vi. Name of person submitting samples
   - No sampling conducted as there was no effluent discharge during the quarter

Section 8.1.2 Test Facilities and Conditions

i. Test type & method
   - No testing conducted as there was no effluent discharge during the quarter

ii. Indications of deviations from requirements in Sections 2 to 7 of Method EPS 1/RM/13
   - No deviations to report as there was no testing conducted during the quarter

iii. Name and city of testing laboratory
   - No laboratory used during the quarter

iv. Species of test organism
   - None to report as there were no tests conducted during the period

v. Date and time for start of definitive test
   - None to report as there were no tests conducted during the period

vi. Person(s) performing the test and verifying the results
   - No tests performed during the quarter

vii. pH, temperature, dissolved oxygen, and conductivity of unadjusted, undiluted effluent
   - No data to report as there were no tests conducted during the period

viii. Confirmation that no adjustment of sample or solution pH occurred
   - No adjustment to report as there were no tests conducted during the period

ix. Indication of any adjustment of hardness of effluent sample
   - No adjustment to report as there were no tests conducted during the period

x. Indication of any aeration of sample
   - No indication to report as there were no tests conducted during the period

xi. Concentrations and volumes tested
   - No data to report as there were no tests conducted during the period

xii. Measurements of dissolved oxygen, pH and temperature
   - No data to report as there were no tests conducted during the period

xiii. Estimates of time to first brood, average number of neonates per brood, and percent mortality during the seven-day period prior to the test
   - No data to report as there were no tests conducted during the period

xiv. Number of neonates per test vessel and milliliters of solution per daphnid
   - No data to report as there were no tests conducted during the period

Reporting Requirements for Reference Method EPS 1/RM/14 - Continued

Section 8.1.3 Results

i. Number of dead and/or immobile daphnids in each test solution including controls
   - No data to report. No tests conducted during the period.

ii. For single-concentration test the number of daphnids dead in each of three replicate effluent solutions and in each of three replicate control solutions at end of test. Also report the mean value.
   - No data to report. No tests conducted during the period.

iii. Estimate of 48-h LC50 and 95% confidence limits in multi-concentration tests, 48-h EC50 for immobilization and 95% confidence limits, indication of statistical method on which results are based.
   - No data to report. No tests conducted during the period

iv. Most recent 48-h LC50 for reference toxicant test(s), reference chemical(s), date test initiated, historic geometric mean LC50 and warning limits.
   - No data to report. No tests conducted during the period.

APPENDIX C

2004 1st QUARTER MMER REPORT

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]								pH[1]	Collection Method
		Arsenic	Copper	Cyanide	Lead	Nickel	Zinc	TSS	Radium 226[1]		
05-Jan-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
12-Jan-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
19-Jan-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
26-Jan-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
02-Feb-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
09-Feb-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
16-Feb-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
23-Feb-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
01-Mar-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
08-Mar-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
15-Mar-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
22-Mar-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
29-Mar-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 deposit of 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
January/04	nd[2]	nd[2]	na[2]	na[2]	na[2]	na[2]	na[2]	nd[2]
February/04	nd[2]	n[2]	n[2]	n[2]	n[2]	n[2]	n[2]	nd[2]
March/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 deposit of effluent 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]	
05-Jan-04	nd[2]	0	0	0	0	0	0	0	0	0
12-Jan-04	nd[2]	0	0	0	0	0	0	0	0	0
19-Jan-04	nd[2]	0	0	0	0	0	0	0	0	0
26-Jan-04	nd[2]	0	0	0	0	0	0	0	0	0
02-Feb-04	nd[2]	0	0	0	0	0	0	0	0	0
09-Feb-04	nd[2]	0	0	0	0	0	0	0	0	0
16-Feb-04	nd[2]	0	0	0	0	0	0	0	0	0
23-Feb-04	nd[2]	0	0	0	0	0	0	0	0	0
01-Mar-04	nd[2]	0	0	0	0	0	0	0	0	0
08-Mar-04	nd[2]	0	0	0	0	0	0	0	0	0
15-Mar-04	nd[2]	0	0	0	0	0	0	0	0	0
22-Mar-04	nd[2]	0	0	0	0	0	0	0	0	0
29-Mar-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 deposit of effluent 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]		
January/04	0	0	0	0	0	0	0	0	0	0
February/04	0	0	0	0	0	0	0	0	0	0
March/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

APPENDIX D

RESULTS OF EFFLUENT CHARACTERIZATION

AS PER PARAGRAPH 15(1)(a)

No effluent samples were collected during the 1st Quarter of 2004 as there was no effluent discharge.
No Acute Lethality Testing conducted during the quarter as there was no effluent being discharged.

Bruce J. Donald
Reclamation Manager

August 11, 2004

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 – 2004 2nd Quarter Metal Mining Effluent Regulations Report

Despite having a designated discharge location for effluent identified under Section 9 of the MMER, there was no discharge from the Garrow Lake Tailings Impoundment Area during the period April 1, 2004 to June 30, 2004. While there is no data to report, I have completed the monitoring report as required by the regulations and have attached it to this letter.

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

Yours truly,

Bruce Donald

Attachments: 2nd Quarter 2004 Monitoring Report

cc:
Walter Kuit (Teck Cominco Limited)
Randy Baker (Azimuth Consulting Group)

POLARIS MINE – MMER MONITORING REPORT

2nd QUARTER 2004

APPENDIX A

i. Information specified by Section 8.1 of Reference Method EPS 1/Rm/13

APPENDIX B

i. Information specified by Section 8.1 of Reference Method EPS 1/Rm/14

APPENDIX C

i. Concentration & monthly mean concentrations of each deleterious substance of Schedule 4
ii. pH of the effluents samples as required by subsection 12(1)
iii. Description of sample collection method
iv. Total volume of effluent deposited during each month of the quarter as per section 19
v. Mass loading of the deleterious substances set out in Schedule 4 and as per section 20

APPENDIX D

i. Results of the effluent characterization as per paragraph 15(1)(a)

APPENDIX A

Reporting Requirements for Reference Method EPS 1/RM/13

Section 8.1.1 Effluent

i. Name & location of operation generating the effluent
   - Polaris Mine, Little Cornwallis Island, Nunavut
   - Final Discharge Point for Garrow Lake is geo referenced as 75° 22' 32" N, 96° 48' 37" W.

ii. Date & time of sampling
   - No sampling conducted as there was no effluent discharge during the quarter.

iii. Type of sample
   - No sampling conducted as there was no effluent discharge during the quarter

iv. Brief description of sampling point
   - Discharge point of siphon at Garrow Lake dam

v. Sampling method
   - No sampling conducted as there was no effluent discharge during the quarter

vi. Name of person submitting samples
   - No sampling conducted as there was no effluent discharge during the quarter

Section 8.1.2 Test Facilities and Conditions

i. Test type & method
   - No testing conducted as there was no effluent discharge during the quarter

ii. Indications of deviations from requirements in Sections 2 to 7 of Method EPS 1/RM/13
   - No deviations to report as there was no testing conducted during the quarter

iii. Name and city of testing laboratory
   - No laboratory used during the quarter

iv. Percent mortality of fish in stock tank(s)
   - None to report. There were no tests conducted during the period

v. Species of test organism
   - None to report as there were no tests conducted during the period

vi. Date and time for start of definitive test
   - None to report as there were no tests conducted during the period

vii. Person(s) performing the test and verifying the results
   - No tests performed during the quarter

viii. pH, temperature, dissolved oxygen, and conductivity of unadjusted, undiluted effluent
   - No data to report as there were no tests conducted during the period

ix. Confirmation that no adjustment of sample or solution pH occurred
   - No adjustment to report as there were no tests conducted during the period

x. Indication of aeration of test solutions before introduction of fish
   - None to report as there were no tests conducted during the period

xi. Concentrations and volumes tested
   - No data to report as there were no tests conducted during the period

xii. Measurements of dissolved oxygen, pH and temperature
   - No data to report as there were no tests conducted during the period

xiii. Number of fish added to each test vessel
   - No fish added as there were no tests conducted during the period

xiv. Mean and range of fork length of control fish at end of test
   - No data to report as there were no tests conducted during the period

xv. Mean wet weight of individual control fish at end of the test
   - No data to report as there were no tests conducted during the period

xvi. Estimated loading density of fish in test solutions
   - No data to report as there were no tests conducted during the period

Reporting Requirements for Reference Method EPS 1/RM/13 - Continued

Section 8.1.3 Results

i. Number of mortalities of fish in each test solution
   - None to report. No tests conducted during the period

ii. Number of control fish showing atypical/stressed behaviour
   - None to report. No tests conducted.

iii. Mean mortality rate in solutions of effluent and control water
   - None to report. No tests conducted

iv. Estimate of 96-h LC50 in multi-concentration tests
   - No data to report. No tests conducted

v. Most recent 96-h LC50 for reference toxicity test(s)
   - No data to report. No tests conducted

APPENDIX B

Reporting Requirements for Reference Method EPS 1/RM/14

Section 8.1.1 Effluent

i. Name & location of operation generating the effluent
   - Polaris Mine, Little Cornwallis Island, Nunavut
   - Final Discharge Point for Garrow Lake is geo referenced as 75° 22' 32" N, 96° 48' 37" W.

ii. Date & time of sampling
   - No sampling conducted as there was no effluent discharge during the quarter.

iii. Type of sample
   - No sampling conducted as there was no effluent discharge during the quarter

iv. Brief description of sampling point
   - Discharge point of siphon at Garrow Lake dam

v. Sampling method
   - No sampling conducted as there was no effluent discharge during the quarter

vi. Name of person submitting samples
   - No sampling conducted as there was no effluent discharge during the quarter

Section 8.1.2 Test Facilities and Conditions

i. Test type & method
   - No testing conducted as there was no effluent discharge during the quarter

ii. Indications of deviations from requirements in Sections 2 to 7 of Method EPS 1/RM/13
   - No deviations to report as there was no testing conducted during the quarter

iii. Name and city of testing laboratory
   - No laboratory used during the quarter

iv. Species of test organism
   - None to report as there were no tests conducted during the period

v. Date and time for start of definitive test
   - None to report as there were no tests conducted during the period

vi. Person(s) performing the test and verifying the results
   - No tests performed during the quarter

vii. pH, temperature, dissolved oxygen, and conductivity of unadjusted, undiluted effluent
   - No data to report as there were no tests conducted during the period

viii. Confirmation that no adjustment of sample or solution pH occurred
   - No adjustment to report as there were no tests conducted during the period

ix. Indication of any adjustment of hardness of effluent sample
   - No adjustment to report as there were no tests conducted during the period

x. Indication of any aeration of sample
   - No indication to report as there were no tests conducted during the period

xi. Concentrations and volumes tested
   - No data to report as there were no tests conducted during the period

xii. Measurements of dissolved oxygen, pH and temperature
   - No data to report as there were no tests conducted during the period

xiii. Estimates of time to first brood, average number of neonates per brood, and percent mortality during the seven-day period prior to the test
   - No data to report as there were no tests conducted during the period

xiv. Number of neonates per test vessel and milliliters of solution per daphnid
   - No data to report as there were no tests conducted during the period

Reporting Requirements for Reference Method EPS 1/RM/14 - Continued

Section 8.1.3 Results

i. Number of dead and/or immobile daphnids in each test solution including controls
   - No data to report. No tests conducted during the period.

ii. For single-concentration test the number of daphnids dead in each of three replicate effluent solutions and in each of three replicate control solutions at end of test. Also report the mean value.
   - No data to report. No tests conducted during the period.

iii. Estimate of 48-h LC50 and 95% confidence limits in multi-concentration tests, 48-h EC50 for immobilization and 95% confidence limits, indication of statistical method on which results are based.
   - No data to report. No tests conducted during the period

iv. Most recent 48-h LC50 for reference toxicant test(s), reference chemical(s), date test initiated, historic geometric mean LC50 and warning limits.
   - No data to report. No tests conducted during the period.

APPENDIX C

2004 2nd QUARTER MMER REPORT

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]								pH[1]	Collection Method
		Arsenic	Copper	Cyanide	Lead	Nickel	Zinc	TSS	Radium 226[1]		
05-Apr-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
12-Apr-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
19-Apr-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
26-Apr-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
03-May-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
10-May-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
17-May-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
24-May-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
31-May-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
07-Jun-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
14-Jun-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
21-Jun-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
28-Jun-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
April/04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
May/04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
June/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]	
05-Apr-04	nd[2]	0	0	0	0	0	0	0	0	0
12-Apr-04	nd[2]	0	0	0	0	0	0	0	0	0
19-Apr-04	nd[2]	0	0	0	0	0	0	0	0	0
26-Apr-04	nd[2]	0	0	0	0	0	0	0	0	0
03-May-04	nd[2]	0	0	0	0	0	0	0	0	0
10-May-04	nd[2]	0	0	0	0	0	0	0	0	0
17-May-04	nd[2]	0	0	0	0	0	0	0	0	0
24-May-04	nd[2]	0	0	0	0	0	0	0	0	0
31-May-04	nd[2]	0	0	0	0	0	0	0	0	0
07-Jun-04	nd[2]	0	0	0	0	0	0	0	0	0
14-Jun-04	nd[2]	0	0	0	0	0	0	0	0	0
21-Jun-04	nd[2]	0	0	0	0	0	0	0	0	0
28-Jun-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]		
April/04	0	0	0	0	0	0	0	0	0	0
May/04	0	0	0	0	0	0	0	0	0	0
June/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

APPENDIX D

RESULTS OF EFFLUENT CHARACTERIZATION

AS PER PARAGRAPH 15(1)(a)

No effluent samples were collected during the 2nd Quarter of 2004 as there was no effluent discharge.
No Acute Lethality Testing conducted during the quarter as there was no effluent being discharged.

Bruce J. Donald
Reclamation Manager

August 11, 2004

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 – 2004 2nd Quarter Metal Mining Effluent Regulations Report

Despite having a designated discharge location for effluent identified under Section 9 of the MMER, there was no discharge from the Garrow Lake Tailings Impoundment Area during the period April 1, 2004 to June 30, 2004. While there is no data to report, I have completed the monitoring report as required by the regulations and have attached it to this letter.

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

Yours truly,

Bruce Donald

Attachments: 2nd Quarter 2004 Monitoring Report

cc:
Walter Kuit (Teck Cominco Limited)
Randy Baker (Azimuth Consulting Group)

POLARIS MINE – MMER MONITORING REPORT

2nd QUARTER 2004

APPENDIX A

i. Information specified by Section 8.1 of Reference Method EPS 1/Rm/13

APPENDIX B

i. Information specified by Section 8.1 of Reference Method EPS 1/Rm/14

APPENDIX C

i. Concentration & monthly mean concentrations of each deleterious substance of Schedule 4
ii. pH of the effluents samples as required by subsection 12(1)
iii. Description of sample collection method
iv. Total volume of effluent deposited during each month of the quarter as per section 19
v. Mass loading of the deleterious substances set out in Schedule 4 and as per section 20

APPENDIX D

i. Results of the effluent characterization as per paragraph 15(1)(a)

APPENDIX A

Reporting Requirements for Reference Method EPS 1/RM/13

Section 8.1.1 Effluent

i. Name & location of operation generating the effluent
   - Polaris Mine, Little Cornwallis Island, Nunavut
   - Final Discharge Point for Garrow Lake is geo referenced as 75° 22' 32" N, 96° 48' 37" W.

ii. Date & time of sampling
   - No sampling conducted as there was no effluent discharge during the quarter.

iii. Type of sample
   - No sampling conducted as there was no effluent discharge during the quarter

iv. Brief description of sampling point
   - Discharge point of siphon at Garrow Lake dam

v. Sampling method
   - No sampling conducted as there was no effluent discharge during the quarter

vi. Name of person submitting samples
   - No sampling conducted as there was no effluent discharge during the quarter

Section 8.1.2 Test Facilities and Conditions

i. Test type & method
   - No testing conducted as there was no effluent discharge during the quarter

ii. Indications of deviations from requirements in Sections 2 to 7 of Method EPS 1/RM/13
   - No deviations to report as there was no testing conducted during the quarter

iii. Name and city of testing laboratory
   - No laboratory used during the quarter

iv. Percent mortality of fish in stock tank(s)
   - None to report. There were no tests conducted during the period

v. Species of test organism
   - None to report as there were no tests conducted during the period

vi. Date and time for start of definitive test
   - None to report as there were no tests conducted during the period

vii. Person(s) performing the test and verifying the results
   - No tests performed during the quarter

viii. pH, temperature, dissolved oxygen, and conductivity of unadjusted, undiluted effluent
   - No data to report as there were no tests conducted during the period

ix. Confirmation that no adjustment of sample or solution pH occurred
   - No adjustment to report as there were no tests conducted during the period

x. Indication of aeration of test solutions before introduction of fish
   - None to report as there were no tests conducted during the period

xi. Concentrations and volumes tested
   - No data to report as there were no tests conducted during the period

xii. Measurements of dissolved oxygen, pH and temperature
   - No data to report as there were no tests conducted during the period

xiii. Number of fish added to each test vessel
   - No fish added as there were no tests conducted during the period

xiv. Mean and range of fork length of control fish at end of test
   - No data to report as there were no tests conducted during the period

xv. Mean wet weight of individual control fish at end of the test
   - No data to report as there were no tests conducted during the period

xvi. Estimated loading density of fish in test solutions
   - No data to report as there were no tests conducted during the period

Reporting Requirements for Reference Method EPS 1/RM/13 - Continued

Section 8.1.3 Results

i. Number of mortalities of fish in each test solution
   - None to report. No tests conducted during the period

ii. Number of control fish showing atypical/stressed behaviour
   - None to report. No tests conducted.

iii. Mean mortality rate in solutions of effluent and control water
   - None to report. No tests conducted

iv. Estimate of 96-h LC50 in multi-concentration tests
   - No data to report. No tests conducted

v. Most recent 96-h LC50 for reference toxicity test(s)
   - No data to report. No tests conducted

APPENDIX B

Reporting Requirements for Reference Method EPS 1/RM/14

Section 8.1.1 Effluent

i. Name & location of operation generating the effluent
   - Polaris Mine, Little Cornwallis Island, Nunavut
   - Final Discharge Point for Garrow Lake is geo referenced as 75° 22' 32" N, 96° 48' 37" W.

ii. Date & time of sampling
   - No sampling conducted as there was no effluent discharge during the quarter.

iii. Type of sample
   - No sampling conducted as there was no effluent discharge during the quarter

iv. Brief description of sampling point
   - Discharge point of siphon at Garrow Lake dam

v. Sampling method
   - No sampling conducted as there was no effluent discharge during the quarter

vi. Name of person submitting samples
   - No sampling conducted as there was no effluent discharge during the quarter

Section 8.1.2 Test Facilities and Conditions

i. Test type & method
   - No testing conducted as there was no effluent discharge during the quarter

ii. Indications of deviations from requirements in Sections 2 to 7 of Method EPS 1/RM/13
   - No deviations to report as there was no testing conducted during the quarter

iii. Name and city of testing laboratory
   - No laboratory used during the quarter

iv. Species of test organism
   - None to report as there were no tests conducted during the period

v. Date and time for start of definitive test
   - None to report as there were no tests conducted during the period

vi. Person(s) performing the test and verifying the results
   - No tests performed during the quarter

vii. pH, temperature, dissolved oxygen, and conductivity of unadjusted, undiluted effluent
   - No data to report as there were no tests conducted during the period

viii. Confirmation that no adjustment of sample or solution pH occurred
   - No adjustment to report as there were no tests conducted during the period

ix. Indication of any adjustment of hardness of effluent sample
   - No adjustment to report as there were no tests conducted during the period

x. Indication of any aeration of sample
   - No indication to report as there were no tests conducted during the period

xi. Concentrations and volumes tested
   - No data to report as there were no tests conducted during the period

xii. Measurements of dissolved oxygen, pH and temperature
   - No data to report as there were no tests conducted during the period

xiii. Estimates of time to first brood, average number of neonates per brood, and percent mortality during the seven-day period prior to the test
   - No data to report as there were no tests conducted during the period

xiv. Number of neonates per test vessel and milliliters of solution per daphnid
   - No data to report as there were no tests conducted during the period

Reporting Requirements for Reference Method EPS 1/RM/14 - Continued

Section 8.1.3 Results

i. Number of dead and/or immobile daphnids in each test solution including controls
   - No data to report. No tests conducted during the period.

ii. For single-concentration test the number of daphnids dead in each of three replicate effluent solutions and in each of three replicate control solutions at end of test. Also report the mean value.
   - No data to report. No tests conducted during the period.

iii. Estimate of 48-h LC50 and 95% confidence limits in multi-concentration tests, 48-h EC50 for immobilization and 95% confidence limits, indication of statistical method on which results are based.
   - No data to report. No tests conducted during the period

iv. Most recent 48-h LC50 for reference toxicant test(s), reference chemical(s), date test initiated, historic geometric mean LC50 and warning limits.
   - No data to report. No tests conducted during the period.

APPENDIX C

2004 2nd QUARTER MMER REPORT

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]								pH[1]	Collection Method
		Arsenic	Copper	Cyanide	Lead	Nickel	Zinc	TSS	Radium 226[1]		
05-Apr-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
12-Apr-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
19-Apr-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
26-Apr-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
03-May-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
10-May-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
17-May-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
24-May-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
31-May-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
07-Jun-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
14-Jun-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
21-Jun-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
28-Jun-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
April/04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
May/04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
June/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]	
05-Apr-04	nd[2]	0	0	0	0	0	0	0	0	0
12-Apr-04	nd[2]	0	0	0	0	0	0	0	0	0
19-Apr-04	nd[2]	0	0	0	0	0	0	0	0	0
26-Apr-04	nd[2]	0	0	0	0	0	0	0	0	0
03-May-04	nd[2]	0	0	0	0	0	0	0	0	0
10-May-04	nd[2]	0	0	0	0	0	0	0	0	0
17-May-04	nd[2]	0	0	0	0	0	0	0	0	0
24-May-04	nd[2]	0	0	0	0	0	0	0	0	0
31-May-04	nd[2]	0	0	0	0	0	0	0	0	0
07-Jun-04	nd[2]	0	0	0	0	0	0	0	0	0
14-Jun-04	nd[2]	0	0	0	0	0	0	0	0	0
21-Jun-04	nd[2]	0	0	0	0	0	0	0	0	0
28-Jun-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]		
April/04	0	0	0	0	0	0	0	0	0	0
May/04	0	0	0	0	0	0	0	0	0	0
June/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

APPENDIX D

RESULTS OF EFFLUENT CHARACTERIZATION

AS PER PARAGRAPH 15(1)(a)

No effluent samples were collected during the 2nd Quarter of 2004 as there was no effluent discharge.
No Acute Lethality Testing conducted during the quarter as there was no effluent being discharged.

Bruce J. Donald
Reclamation Manager

November 17, 2004

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 – 2004 3rd Quarter Metal Mining Effluent Regulations Report

Please find attached the Metal Mining Effluent Report for the Polaris Mine for the 3rd Quarter of 2004. Discharge from Garrow Lake is no longer controlled by siphoning as Garrow Dam was removed earlier this year. As a result the timing of flow and a wide fluctuation in the flow rates was experienced this year. Flow initiated at the beginning of July, later than expected due to an unseasonably cold winter and spring. Flow continued through July and August.

The associated water quality sampling and environmental effects monitoring were conducted as required but with some complications. To ensure we captured two sub-lethal toxicity tests this year, we initiated testing with our first water sampling event of the season. However, on our first attempt, there were problems with the laboratory specimens (the Echinoderms were stimulated to spawn and only one of 39 partially spawned so the test was not initiated) and the Champia parvula sexual reproduction tests were not conducted due to problems at the commercial laboratory. Sandra Blenkinsopp was kept informed of these issues as they arose. We subsequently conducted two additional sub-acute toxicity tests which were successfully processed. The available results from all three sub-acute sampling events are presented in this report.

The first water sample of the discharge season taken on July 7th 2004 at the final discharge point was out of compliance with respect to Total Suspended Solids (TSS). Laboratory results indicated a TSS concentration of 117 mg/L compared to the MMER Schedule 4 limit of 30 mg/L for a single grab sample. All other Schedule 4 parameters were compliant. Concurrent with the July 7th sample, a set of monthly acute lethality samples were

also taken. The results of the acute lethality were compliant with the MMER and showed no acute toxicity to either the Rainbow Trout or the Daphnia magna (i.e. LC50s in both cases were > 100% effluent). Subsequent weekly sampling results for TSS, metals concentrations and acute toxicity results have all been compliant. Sid Bruinsma and Craig Broome were both promptly notified upon our receiving the laboratory results.

Effluent from Garrow Lake ceased flowing by mid-August but surface run off from adjacent slopes maintained water flow at the designated final discharge point into August. By August 17th there was still water at the final discharge point in a pool but the flow was too low to be measured. However, we continued to collect water samples for the remainder of August, so there are water quality results presented in the attached report until August 31, 2004 but the loading calculations are zero due to the lack of flow for the last three weekly samples. The flow conditions during August as well as their implications for effluent sampling were discussed with Environmental Canada representatives in early August.

I will forward a paper copy of this report by mail. Please contact me if there are any questions related to enclosed information.

Yours truly,
Original signed by B Donald

Bruce Donald

Attachments: 3rd Quarterly Monitoring Report

cc:
Walter Kuit (Teck Cominco Limited)
Randy Baker (Azimuth Consulting Group)

POLARIS MINE – MMER MONITORING REPORT

3rd QUARTER 2004

APPENDIX A

i. Information specified by Section 8.1 of Reference Method EPS 1/Rm/13: 96 hr acute rainbow trout test

APPENDIX B

i. Information specified by Section 8.1 of Reference Method EPS 1/Rm/14: 72 hr acute *Daphnia magna* test

APPENDIX C

i. Information specified in Schedule 5 of the MMER (June 2002) for Reference Method EPAW 95-EPA West Coast: 7-day Topsmelt Survival and Growth Tests.

APPENDIX D

i. Information specified in Schedule 5 of the MMER (June 2002) for Reference Method EPS 1/Rm/27-EC: 92 hr Echinoderm (sand dollar) Fertilization Test

APPENDIX E

i. Information specified in Schedule 5 of the MMER (June 2002) for Reference Method EPA/600/4-91-003, Method 1009.0: Algae (*Champia parvula*) 7-day Sublethal Growth Tests

APPENDIX F (Mass Loadings)

i. Concentration & monthly mean concentrations of each deleterious substance of Schedule 4
ii. pH of the effluents samples as required by subsection 12(1)
iii. Description of sample collection method
iv. Total volume of effluent deposited during each month of the quarter as per section 19
v. Mass loading of the deleterious substances set out in Schedule 4 and as per section 20

APPENDIX G

i. Results of the effluent characterization as per paragraph 15(1)(a)

APPENDIX A

96-h Acute Rainbow Trout Toxicity Test

Reporting Requirements for Reference Method EPS 1/RM/13

Section 8.1.1 Effluent

i. Name & location of operation generating the effluent
   - Polaris Mine, Little Cornwallis Island, Nunavut
   - Final Discharge Point for Garrow Lake is geo referenced as 75° 22' 32" N, 97° 48' 37" W.

ii. Date & time of sampling
   - Samples for monthly acute toxicity testing were collected
   - Test 1: Wednesday July 7, 2004 – 2200h
   - Test 2: Tuesday July 27, 2004 – 2130h
   - Test 3: Tuesday August 24, 2004 – 1500h

iii. Type of sample
   - Final effluent water

iv. Brief description of sampling point
   - 20m downstream of the siphon discharge point at Garrow Lake dam

v. Sampling method
   - Water was collected from at least 15cm below the surface using a water pump with silicon tubing
   - Water was collected from the upstream direction
   - The pump was flushed with site water for at least one minute prior to sample collection
   - 2 x 20L sample bottles were filled

vi. Name of person submitting samples
   - Dennis Lu (Gartner Lee) – July 7, July 27, 2004
   - Patrick Allard (Azimuth) – August 24, 2004

Section 8.1.2 Test Facilities and Conditions

i. Test type & method
   - 96-hour Rainbow Trout LC_{50}

ii. Indications of deviations from requirements in Sections 2 to 7 of Method EPS 1/RM/13
   - No deviations from requirements
   - Salinity controls were run
   - Sample water salinity was 7ppt (Test 1); 3ppt (Test 2), and 6ppt (Test 3)

iii. Name and city of testing laboratory
   - EVS Environment Consultants, North Vancouver, BC

iv. Percent mortality of fish in stock tank(s)
   - Test 1: 0%
   - Test 2: 0.25%
   - Test 3: 0%

v. Species of test organism
   - Rainbow Trout (*Oncorhynchus mykiss*)

vi. Date and time for start of definitive test
   - Test 1: Monday July 12, 2004 – 1445h
   - Test 2: Sunday August 1, 2004 – 1030h
   - Test 3: Friday August 27, 2004 – 1100h

vii. Person(s) performing the test and verifying the results
   - Rachel DeWynter, Robert Harrison

viii. pH, temperature, dissolved oxygen, and conductivity of unadjusted, undiluted effluent
   - Test 1: pH – 8.1, T - 14.0°C, DO - 10.0mg/L, C – 11730 µS/cm
   - Test 2: pH - 7.6, T - 14.0°C, DO - 10.1mg/L, C – 4870 µS/cm
   - Test 3: pH – 7.7, T - 15.0°C, DO – 9.9mg/L, C – 7416 µS/cm

Reporting Requirements for Reference Method EPS 1/RM/13

ix. Confirmation that no adjustment of sample or solution pH occurred
- Test 1: No pH adjustment
- Test 2: No pH adjustment
- Test 3: No pH adjustment

x. Indication of aeration of test solutions before introduction of fish
- Test 1: 6.5 ± 1 mL/min/L for 30mins
- Test 2: 6.5 ± 1 mL/min/L for 30mins
- Test 3: 6.5 ± 1 mL/min/L for 30mins

xi. Concentrations and volumes tested
- Concentrations (% effluent volume / total volume) tested and total volumes used were:
- Control (0%) - 10 L (test 1&2), 12 L (test 3)
- 6.25% - 10 L (test 1&2), 12 L (test 3)
- 12.5% - 10 L (test 1&2), 12 L (test 3)
- 25% - 10 L (test 1&2), 12 L (test 3)
- 50% - 10 L (test 1&2), 12 L (test 3)
- 100% - 10 L (test 1&2), 12 L (test 3)
- Salinity Control - 10 L (test 1&2), 12 L (test 3)

xii. Measurements of dissolved oxygen, pH and temperature
- Test 1: DO: 9.3 - 10.1 mg/L, pH: 7.0 – 8.3, T: 14.0 – 16.0 °C
- Test 2: DO: 9.6 - 10.1 mg/L, pH: 6.8 - 8.3, T: 14.0 °C
- Test 3: DO: 9.1 – 10.1 mg/L, pH: 7.2 – 7.9, T: 15.0 – 16.0 °C

xiii. Number of fish added to each test vessel
- 10 fish/ vessel

xiv. Mean and range of fork length of control fish at end of test
- Test 1: 34mm (29-37)
- Test 2: 33mm (31-35)
- Test 3: 40mm (38 -44)

xv. Mean wet weight of individual control fish at end of the test
- Test 1: 0.39g (0.22-0.54)
- Test 2: 0.34g (0.29-0.42)
- Test 3: 0.45g (0.31-0.61)

xvi. Estimated loading density of fish in test solutions
- Test 1: 0.39g/L
- Test 2: 0.34g/L
- Test 3: 0.38g/L

Section 8.1.3 Results

i. Number of mortalities of fish in each test solution
- Results were the same for Test 1, Test 2, and Test 3, except where noted
- Control (0%) - 0
- 6.25% - 0
- 12.5% - 0
- 25% - 0
- 50% - 0
- 100% - 0
- Salinity Control - 0

Reporting Requirements for Reference Method EPS 1/RM/13

ii. Number of control fish showing atypical/stressed behaviour
- None in Test 1, Test 2, or Test 3

iii. Mean mortality rate in solutions of effluent and control water
- Results were the same for Test 1, Test 2, and Test 3, except where noted
- Control (0%) - 0%
- 6.25% - 0%
- 12.5% - 0%
- 25% - 0%
- 50% - 0%
- 100% - 0%
- Salinity Control - 0%

iv. Estimate of 96-h LC50 in multi-concentration tests
- Results were the same for Test 1, Test 2, and Test 3
- 96hr LC_{50} concentration > 100% effluent

v. Most recent 96-h LC50 for reference toxicity test(s)
- Reference toxicity tests for Toxicant: SDS
- Test 1: (Jun-21-04) 96-h LC_{50} = 23mg/L SDS, 95% CL = 20 - 25mg/L
- Test 2: (Jul-23-04) 96-h LC_{50} = 21mg/L SDS, 95% CL = 17 - 26mg/L
- Test 3: (Aug-27-04) 96-h LC_{50} = 38mg/L SDS, 95% CL = 33 - 44mg/L

APPENDIX B

72-h Acute *Daphnia magna* Toxicity Test

Reporting Requirements for Reference Method EPS 1/RM/14

Section 8.1.1 Effluent

i. Name & location of operation generating the effluent
   - Polaris Mine, Little Cornwallis Island, Nunavut
   - Final Discharge Point for Garrow Lake is geo referenced as 75° 22' 32" N, 97° 48' 37" W.

ii. Date & time of sampling
   - Samples for monthly acute toxicity testing were collected
   - Test 1: Wednesday July 7, 2004 – 2200h
   - Test 2: Tuesday July 27, 2004 – 2130h
   - Test 3: Tuesday August 24, 2004 – 1500h

iii. Type of sample
   - Final effluent water

iv. Brief description of sampling point
   - 20m downstream of the siphon discharge point at Garrow Lake dam

v. Sampling method
   - Water was collected from at least 15cm below the surface using a water pump with silicon tubing
   - Water was collected from the upstream direction
   - The pump was flushed with site water for at least one minute prior to sample collection
   - 2 x 20L sample bottles were filled

vi. Name of person submitting samples
   - Dennis Lu (Gartner Lee), Test 1 & 2
   - Patrick Allard (Azimuth), Test 3

Section 8.1.2 Test Facilities and Conditions

i. Test type & method
   - 48-hour *Daphnia magna* LC_{50}

ii. Indications of deviations from requirements in Sections 2 to 7 of Method EPS 1/RM/13
   - No deviations from requirements
   - Salinity controls were run
   - Sample water salinity was 7ppt (Test 1); 3ppt (Test 2), and 6ppt (Test 3)

iii. Name and city of testing laboratory
   - EVS Environment Consultants, North Vancouver, BC

iv. Species of test organism
   - *Daphnia magna*

v. Date and time for start of definitive test
   - Test 1: Sunday July 11, 2004 – 1400h
   - Test 2: Friday July 30, 2004 – 1400h
   - Test 3: Friday August 27, 2004 – 1100h

vi. Person(s) performing the test and verifying the results
   - Armando Tang, Rachel DeWynter

vii. pH, temperature, dissolved oxygen, and conductivity of unadjusted, undiluted effluent
   - Test 1: pH - 7.8 – 7.9, T - 20.0 – 22.0 °C, DO – 9.1 – 11.4mg/L, C - 11850µhos/cm
   - Test 2: pH - 7.8 – 8.0, T – 21.5 – 22.0 °C, DO - 8.8 – 12.1mg/L, C - 5020µhos/cm
   - Test 3: pH – 7.8 - 8.1, T – 22.0 – 23.0 °C, DO - 8.7 – 10.2mg/L, C - 9320µmhos/cm

viii. Confirmation that no adjustment of sample or solution pH occurred
   - Test 1: No pH adjustment
   - Test 2: No pH adjustment
   - Test 3: No pH adjustment

Reporting Requirements for Reference Method EPS 1/RM/14

ix. Indication of any adjustment of hardness of effluent sample
- Test 1: No hardness adjustment
- Test 2: No hardness adjustment
- Test 3: No hardness adjustment

x. Indication of any aeration of sample
- Test 1: Aeration for 9mins
- Test 2: Gentle Aeration for 10mins
- Test 3: 20mins

xi. Concentrations and volumes tested
- For all 3 Tests the concentrations (% effluent volume / total volume) tested and total volumes used were:
    - Control (0%) - 200 mL
    - 6.25% - 200 mL
    - 12.5% - 200 mL
    - 25% - 200 mL
    - 50% - 200 mL
    - 100% - 200 mL
    - Salinity Control - 200 mL

xii. Measurements of dissolved oxygen, pH and temperature
- Test 1: DO: 8.6 – 9.1 mg/L, pH: 7.7 – 8.2, T: 20.0 - 21.5 °C
- Test 2: DO: 8.6 - 9.1 mg/L, pH: 7.6 - 8.0, T: 20.0 - 21.5 °C
- Test 3: DO: 8.5 - 9.0 mg/L, pH: 7.6 - 8.1, T: 20.5 - 22.0 °C

xiii. Estimates of time to first brood, average number of neonates per brood, and percent mortality during the seven-day period prior to the test
- Test 1: 8 days to brood, 27.5 neonates/brood, 9.5% mortality in 7d prior to test
- Test 2: 7 days to brood, 24 neonates/brood, 6.0% mortality in 7d prior to test
- Test 3: 7 days to brood, 21 neonates/brood, 0% mortality in 7d prior to test

xiv. Number of neonates per test vessel and milliliters of solution per daphnid
- Methods for all tests and dilution series were the same:
- 10 neonates per vessel
- 200 mL of solution per daphnid

Section 8.1.3 Results

i. Number of dead and/or immobile daphnids in each test solution including controls
- Results were the same for Test 1, Test 2, and Test 3, except where noted
- Control (0%) - 0 dead / immobile
- 6.25% - 0 dead / immobile
- 12.5% - 0 dead / immobile
- 25% - 0 dead / immobile
- 50% - 0 dead / immobile
- 100% - 0 dead / immobile (test 1), 3 dead/immobile (test 2), 0 dead/immobile (test 3)
- Salinity Control - 0 dead / immobile

ii. For single-concentration test the number of daphnids dead in each of three replicate effluent solutions and in each of three replicate control solutions at end of test. Also report the mean value.
- Single concentration test was not conducted, dilution series tests were conducted

Reporting Requirements for Reference Method EPS 1/RM/14

iii. Estimate of 48-h LC50 and 95% confidence limits in multi-concentration tests, 48-h EC50 for immobilization and 95% confidence limits, indication of statistical method on which results are based.
- Test 1: 48-h LC_{50} = > 100% effluent
- Test 2: 48-h LC_{50} = > 100% effluent
- Test 3: 48-h LC_{50} = > 100% effluent

iv. Most recent 48-h LC50 for reference toxicant test(s), reference chemical(s), date test initiated, historic geometric mean LC50 and warning limits.
- Reference toxicity tests for Toxicant: Zinc
- Test 1: (July-6-04) 48-h LC_{50} = 483µg/L Zinc, 95% CL = 403-578µg/L
- Test 2: (July-27-04) 48-h LC_{50} = 683µg/L Zinc, 95% CL = 578-807µg/L
- Test 3: (Aug-24-04) 48-h LC_{50} = 536µg/L Zinc, 95% CL = 438-656µg/L

APPENDIX C

7-d Topsmelt Growth and Survival Toxicity Test

Effluent Sample

i. Name & location of operation generating the effluent
   - Polaris Mine, Little Cornwallis Island, Nunavut
   - Final Discharge Point for Garrow Lake is geo referenced as 75° 22' 32" N, 97° 48' 37" W.

ii. Date & time of sampling
   - Samples for sublethal toxicity testing were collected:
     Test 1 - Wednesday July 7, 2004 – 1100h
     Test 2 - Tuesday July 27, 2004 – 0930h
     Test 3 – Tuesday Aug 24, 2004 – 1500h

iii. Type of sample
   - Final effluent water

iv. Brief description of sampling point
   - 20m downstream of the siphon discharge point at Garrow Lake dam

v. Sampling method
   - Water was collected from at least 15cm below the surface using a water pump with silicon tubing
   - Water was collected from the upstream direction
   - The pump was flushed with site water for at least one minute prior to sample collection
   - 4 x 20L sample bottles were filled

vi. Name of person submitting samples
   - Dennis Lu (Gartner Lee) Tests 1 & 2
   - Patrick Allard (Azimuth) Test 3

Test Organisms Imported from External Supplier

i. Species of test organism
   - Topsmelt (*Atherinops affinis*)

ii. Name and city of testing laboratory
   - EVS Environment Consultants, North Vancouver, BC

iii. Source of test species
   - Aquatic Bio Systems (ABS), Fort Collins, Colorado

iv. Date test species acquired on
   - Test 1 – July 8, 2004
   - Test 2 – July 29, 2004
   - Test 3 – August 26, 2004

v. Indications of deviations from EC guidance on the importation of test organisms
   - No deviations from EC requirements

vi. Percent mortality of fish in 24-hour period preceding the test
   - Test 1 - <10% mortality
   - Test 2 - <10% mortality
   - Test 3 - <10% mortality

vii. Age at start of test
   - Test 1 - 11 days post-hatch
   - Test 2 – 10 days post-hatch
   - Test 3 – 10 days post-hatch

viii. Unusual appearance, behaviour, or treatment of larvae before their use in the test
   - None noted for any test.

ix. Confirmation that larvae are actively feeding and swimbladders are not inflated
   - All tests - Larvae actively feeding and swimbladders not inflated

x. Confirmation that temperature change was <3°C and dissolved oxygen was maintained at >6mg/L during transport

- Temperature change was <2°C and dissolved oxygen supersaturated mg/L during transport

xi. Test organism acclimation rate at the testing laboratory
- Holding water conditions upon arrival were DO=supersaturated, pH = 7.9, T = 20°C
- Organisms were acclimated slowly overnight
- Addition of EVS lab seawater at intervals of 30 – 60min to reach acceptable conditions
- Organisms were acclimated to DO = 7.4mg/L, salinity = 28ppt, T=20°C

Test Facilities and Conditions

i. Test type & method
- 7-day Topsmelt (*Atherinops affinis*) Survival and Growth Toxicity Test
- Static renewal
- Sample water was renewed daily
- Reference Method - EPA/600/R-95/136 (EPAW 95-EPA West Coast)

ii. Indications of deviations from requirements in Sections 11 of Method EPA/600/R-95/136 (EPAW 95-EPA West Coast)
- No deviations from requirements
- Salinity controls were run
- Sample water salinity for
    - Test 1 was 7ppt
    - Test 2 was 2.6 ppt
    - Test 3 was 5.2ppt

iii. Date and time for start of definitive test
- Test 1 Saturday July 10, 2004 – 1730h
- Test 2 Friday July 30, 2004 – 1500h
- Test 3 Tuesday August 27, 2004 – 1230h

iv. Test vessel description
- For all tests was a 600mL beaker

v. Person(s) performing the test and verifying the results
- Test 1: Testing by: Andy Diewald, Anja Fouche, Keven Goodearle, Ann-Marie Norris and Jenny Shao; Statistical analyses by Jenny Shao and QA/QC by Julianna Kalokai
- Test 2: Testing by: Andy Diewald, Ann-Marie Norris and Jenny Shao; Statistical analysis by Jenny Shao and Kathryn Sentance; QA/QC by Armando Tang
- Test 3: Testing by Andy Diewald, Anja Fouche and Jenny Shao; Statistics by Jenny Shao and Kathryn Sentance; QA/QC by Julianna Kalokai

vi. pH, temperature, dissolved oxygen, and conductivity of unadjusted, undiluted effluent
- Test 1: pH 8.1, T 19.5 °C, DO 9.3 mg/L, C 11660 µmhos/cm
- Test 2: pH 7.8, T 20.0 °C, DO 10.7 mg/L, C 4880 µmhos/cm
- Test 3: pH 7.6, T 20.0 °C, DO 10.1 mg/L, C 9230 µmhos/cm

vii. Confirmation that no adjustment of sample or solution pH occurred
- No pH adjustment

viii. Indication of aeration of test solutions before introduction of fish
- Pre-aeration at 6.5mL/min/L for 30mins due to supersaturation of sample with O_2 when sample was heated to 19°C

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 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

x. Type and source of control/dilution water
- For all 3 tests, control/dilution water was UV-sterilized, 0.45µm-filtered natural seawater from the Vancouver Aquarium

xi. Concentrations and volumes tested:
- Concentrations (% effluent volume / total volume) tested and total volumes used were:
- For Test 1:
    - Control (0%) - 200 mL
    - Salinity Control (0%) - 200 mL
    - 4.5% - 200mL
    - 9.1% - 200mL
    - 18.2% - 200mL
    - 36.3% - 200mL
    - 72.6% - 200mL
- For Test 2:
    - Control (0%) - 200 mL
    - Salinity Control (0%) - 200 mL
    - 4.3% - 200mL
    - 8.6% - 200mL
    - 17.3% - 200mL
    - 34.5% - 200mL
    - 69.0% - 200mL
- For Test 3:
    - Control (0%) - 200 mL
    - Salinity Control (0%) - 200 mL
    - 4.4% - 200mL
    - 9.0% - 200mL
    - 18.0% - 200mL
    - 36.0% - 200mL
    - 71.0% - 200mL

xii. Number of replicated per concentration
- For all 3 tests: 5 replicates per concentration

xiii. Number of organisms added to each test vessel
- For all 3 tests: 5 fish per vessel

xiv. Manner and rate of exchange of test solutions
- For all 3 test: Daily renewal

xv. Measurements of dissolved oxygen, pH and temperature
- Test 1: DO: 6.1 - 7.9 mg/L, pH: 7.8 - 8.3, T: 19.0 - 21.0 °C
- Test 2: DO: 6.4 - 7.7 mg/L, pH: 7.8 - 8.1, T: 20.0 – 20.5 °C
- Test 3: DO: 6.4 - 7.6 mg/L, pH: 7.8 - 8.3, T: 20.0 - 21.0 °C

Results

i. Number and % of mortalities of fish in each test solution
- Test 1: Totals from all 5 replicates are presented:
    - Control (0%) – 1/25 = 4%

- Salinity Control 1/25 = 4%
- 4.5% - 0/25 = 0%
- 9.1% - 0/25 = 0%
- 18.2% - 0/25 = 0%
- 36.3% - 1/25 = 4%
- 72.6% - 2/25 = 8%

- Test 2: Totals from all 5 replicates are presented:
  - Control (0%) – 0/25 = 0%
  - Salinity Control 0/25 = 0%
  - 4.3% - 1/25 = 4%
  - 8.6% - 1/25 = 4%
  - 17.3% - 0/25 = 0%
  - 34.5% - 0/25 = 0%
  - 69.0% - 1/25 = 4%
- Test 3: Totals from all 5 replicates are presented:
  - Control (0%) – 0/25 = 0%
  - Salinity Control 0/25 = 0%
  - 4.4% - 0/25 = 0%
  - 9.0% - 0/25 = 0%
  - 18.0% - 0/25 = 0%
  - 36.0% - 1/25 = 4%
  - 71.0% - 0/25 = 0%

ii. Average dry weight per original fish in test vessel

- Test 1: Means from all 5 replicates are presented:
  - Control (0%) – 0.93 mg
  - Salinity Control – 1.08 mg
  - 4.5% - 1.00 mg
  - 9.1% - 1.04 mg
  - 18.2% - 0.96 mg
  - 36.3% - 1.10 mg
  - 72.6% - 0.99 mg
- Test 2: Means from all 5 replicates are presented:
  - Control (0%) – 0.98 mg
  - Salinity Control – 0.99 mg
  - 4.3% - 0.91 mg
  - 8.6% - 0.87 mg
  - 17.3% - 0.78 mg
  - 34.5% - 0.90 mg
  - 69.0% - 0.77 mg
- Test 3: Means from all 5 replicates are presented:
  - Control (0%) – 0.93 mg
  - Salinity Control – 0.96 mg
  - 4.4% - 1.06 mg
  - 9.0% - 0.87 mg
  - 18.0% - 0.97 mg
  - 36.0% - 0.92 mg
  - 71.0% - 0.87 mg

iii. Estimate of 7-d LC_{50} (95% CL)

- Test 1: 7-d LC_{50} concentration > 72.6% effluent (highest concentration tested due to dilution for salinity adjustment)
- Test 2: 7-d LC_{50} concentration > 69.0% effluent (highest concentration tested due to dilution for salinity adjustment)
- Test 3: : 7-d LC_{50} concentration > 71.0% effluent (highest concentration tested due to dilution for salinity adjustment)
- Quantal statistic methods not applicable

iv. Estimate of 7-d IC_{25} (95% CL) for growth

- Test 1: 7-d IC_{25} concentration > 72.6% effluent (highest concentration tested due to dilution for salinity adjustment)
- Test 2: 7-d IC_{25} concentration > 69.0% effluent (highest concentration tested due to dilution for salinity adjustment)
- Test 3: 7-d IC_{25} concentration > 71.0% effluent (highest concentration tested due to dilution for salinity adjustment)

v. Current reference toxicity tests (95% CL) for 7-d LC_{50} for survival and 7-d IC_{50} for growth

- Test 1 :Reference toxicity tests for Toxicant: Copper
    - Test conducted on July 10, 2004, same day as effluent test
    - Reference toxicant test was conducted on the same batch of externally supplied topsmelt used in the effluent test and under the same experimental conditions as the effluent test
    - 7-d LC_{50} survival = 161mg/L Cu, 95% CL = 139-188mg/L
    - 7-d IC_{50} growth = 147mg/L Cu, 95% CL = 119-169mg/L
- Test 2 :Reference toxicity tests for Toxicant: Copper
    - Test conducted on July 30, 2004, same day as effluent test
    - Reference toxicant test was conducted on the same batch of externally supplied topsmelt used in the effluent test and under the same experimental conditions as the effluent test
    - 7-d LC_{50} survival = 130mg/L Cu, 95% CL = 115-147mg/L
    - 7-d IC_{50} growth = 124mg/L Cu, 95% CL = 87-144mg/L
- Test 3 :Reference toxicity tests for Toxicant: Copper
    - Test conducted on August 27, 2004, same day as effluent test
    - Reference toxicant test was conducted on the same batch of externally supplied topsmelt used in the effluent test and under the same experimental conditions as the effluent test
    - 7-d LC_{50} survival = 121mg/L Cu, 95% CL = 107-137mg/L
    - 7-d IC_{50} growth = 128mg/L Cu, 95% CL = 85-150mg/L

vi. Reference toxicity warning limits (+/- SD) for 7-d LC_{50} for survival and 7-d IC_{50} for growth

- Test 1: Reference toxicity tests for Toxicant: Copper
    - 7-d LC_{50} survival = 137 ± 56mg/L Cu
    - 7-d IC_{50} growth = 135 ± 51mg/L Cu
- Test 2: Reference toxicity tests for Toxicant: Copper
    - 7-d LC_{50} survival = 129 ± 48mg/L Cu,
    - 7-d IC_{50} growth = 130 ± 52mg/L Cu
- Test 3: Reference toxicity tests for Toxicant: Copper
    - 7-d LC_{50} survival = 132 ± 48mg/L Cu,
    - 7-d IC_{50} growth = 131 ± 51mg/L Cu

APPENDIX D

92-h Echinoderm Fertilization Test

Reporting Requirements for Reference Method EPS1/RM/27-EC 92 (Sperm Cell)

Effluent Sample

i. Name & location of operation generating the effluent
   - Polaris Mine, Little Cornwallis Island, Nunavut
   - Final Discharge Point for Garrow Lake is geo referenced as 75^{o} 22' 32" N, 97^{o} 48' 37" W.

ii. Date & time of sampling
   - Samples for sublethal toxicity testing were collected:
     Test 1 - Wednesday July 7, 2004 – 1100h
     Test 2 - Tuesday July 27, 2004 – 0930h
     Test 3 – Tuesday Aug 24, 2004 – 1500h

iii. Type of sample
   - Final effluent water

iv. Brief description of sampling point
   - 20m downstream of the siphon discharge point at Garrow Lake dam

v. Sampling method
   - Water was collected from at least 15cm below the surface using a water pump with silicon tubing
   - Water was collected from the upstream direction
   - The pump was flushed with site water for at least one minute prior to sample collection
   - 4 x 20L sample bottles were filled

vi. Name of person submitting samples
   - Dennis Lu (Gartner Lee) Tests 1 & 2
   - Patrick Allard (Azimuth) Test 3

Test Organisms

i. Species of test organism
   - Sandollar Echinoid (*Dendraster excentricus*)

ii. Name and city of testing laboratory
   - EVS Environment Consultants, North Vancouver, BC

iii. Source of test species
   - M-REP, Escondido, California
   - All adults providing gametes are from the same population and source
   - Gametes are spawned in-house at EVS

iv. Date test species acquired on
   - Test 1: Test was not initiated due to inability of the Sandollars to spawn.
   - Test 2: July 30, 2004
   - Test 3: August 27, 2004

v. Holding time and conditions for adults
   - Test 1: N.A.
   - Test 2: Adults received at the testing laboratory the day of the test.
   - Test 3: Adults received at the testing laboratory the day of the test.

vi. Indications of deviations from EC guidance on the importation of test organisms
   - Test 1: na
   - Test 2: No deviations from EC requirements
   - Test 3: No deviations from EC requirements

vii. Weekly percent mortality of adults being held over 7d preceding test
   - Test 1: na
   - Test 2: <2% per day over the 7 days preceding the test
   - Test 3: <2% per day over the 7 days preceding the test

viii. Age of test organisms
   - Test 1: n.a.
   - Test 2: < 4 hours after spawning

Reporting Requirements for Reference Method EPS1/RM/27-EC 92 (Sperm Cell)

- Test 3: < 4 hours after spawning

ix. Unusual appearance, behaviour, or treatment of adults or gametes before test start
- Test 1: Test was not initiated due to inability of the Sandollars to spawn
- Test 2 Organisms appear healthy
- Test 3: Organisms appear healthy

Test Facilities and Conditions

i. Test type & method
- Echinoderm (*Dendraster excentricus*) Fertilization Toxicity Test
- Static
- Reference Method – EPS/1/RM/27 with 1997 amendments

ii. Test duration
- Test 1: na
- Test 2: 10:10 min (10min sperm + 10min sperm & egg)
- Test 3: 10:10 min (10min sperm + 10min sperm & egg)

iii. Date and time for start of definitive test
- Test 1: na
- Test 2: Friday July 30, 2004 – 1620h
- Test 3: Friday August 27, 2004 – 1334h

iv. Test vessel description
- Test 1: na
- Test 2: 16 x 125mm test tubes
- Test 3: 16 x 125mm test tubes

v. Person(s) performing the test and verifying the results
- Test 1: na
- Test 2: Testing by Kathryn Sentance and Ann-Marie Norris. Statistical analyses by Jenny Shao and Kathryn Sentance. QA/QC reviewed by Julianna Kalokai.
- Test 3: Testing by Kathryn Sentance and Ann-Marie Norris. Statistical analyses by Jenny Shao and Kathryn Sentance. QA/QC reviewed by Julianna Kalokai.

vi. Indication of rate and duration of pre-aeration of test solutions before initiation of test
- Test 1: na
- Test 2: No pre-aeration noted.
- Test 3: No pre-aeration noted.

vii. Confirmation that no adjustment of sample or solution pH occurred
- Test 1: na
- Test 2: No pH adjustment
- Test 3: No pH adjustment

viii. Procedure for sample filtration
- Test 1: na
- Test 2: No sample filtration
- Test 2: No sample filtration

ix. 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

x. Procedure for salinity adjustment as per EC guidance document on salinity adjustment – July 1997

Reporting Requirements for Reference Method EPS1/RM/27-EC 92 (Sperm Cell)

- 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

xi. Type and source of control/dilution water
- Test 1: na
- Test 2: UV-sterilized, 0.45µm-filtered natural seawater from the Vancouver Aquarium
- Test 3: UV-sterilized, 0.45µm-filtered natural seawater from the Vancouver Aquarium

xii. Concentrations and volumes tested
- Test 1: na
- Test 2: Concentrations (% effluent volume / total volume) tested and total volumes used were:
    - Control (0%) - 10mL
    - Salinity Control (0%) - 10mL
    - 4.6% - 10mL
    - 9.1% - 10mL
    - 18.3% - 10mL
    - 36.6% - 10mL
    - 73.1% - 10mL
- Test 3: Concentrations (% effluent volume / total volume) tested and total volumes used were:
    - Control (0%) - 10mL
    - Salinity Control (0%) - 10mL
    - 4.7% - 10mL
    - 9.4% - 10mL
    - 18.8% - 10mL
    - 37.5% - 10mL
    - 75.1% - 10mL

xiii. Number of replicated per concentration
- Test 1: na
- Test 2: 4 replicates per treatment concentration
- Test 3: 4 replicates per treatment concentration

xiv. Number of organisms per container
- Test 1: na
- Test 2: 100 eggs per vessel
- Test 3: 100 eggs per vessel

xv. Measurements of pH and dissolved oxygen in sample water before use
- Test 1: na
- Test 2: pH 8.1, DO 8.5
- Test 3: pH 8.0, DO 8.5

xvi. Measurements of pH, temperature, dissolved oxygen, and salinity during test
- Test 1: na
- Test 2: pH – 8.0 – 8.1, T - 15.0-16.0°C, DO - 8.2-8.5mg/L, salinity - 28ppt
- Test 3: pH – 8.2 – 8.5, T - 15.0-16.0°C, DO - 8.2-8.5mg/L, salinity - 28ppt

Results

i. Number and % of fertilized eggs in each test concentration
- Test 1: na
- Test 2: (Number is equal to percent since totals were 100)
    - Control (0%): #F = 59, 62, 56, 65 #UF = 41, 38, 44, 35
    - Salinity Control: #F = 60, 57, 59, 62 #UF = 40, 43, 41, 38

Reporting Requirements for Reference Method EPS1/RM/27-EC 92 (Sperm Cell)

- 4.6%: #F = 60, 66, 56, 58 #UF = 40, 34, 44, 42
- 9.1%: #F = 46, 42, 45, 42 #UF = 54, 58, 55, 58
- 18.3%: #F = 39, 39, 37, 36 #UF = 61, 64, 63, 64
- 36.6%: #F = 31, 34, 25, 31 #UF = 69, 66, 75, 69
- 73.1%: #F = 19, 20, 21, 20 #UF = 81, 80, 79, 80

- Test 3: (Number is equal to percent since totals were 100)
  - Control (0%): #F = 77, 80, 74, 77 #UF = 23, 20, 26, 23
  - Salinity Control: #F = 76, 73, 79, 77 #UF = 24, 27, 21, 23
  - 4.7%: #F = 78, 74, 76, 72 #UF = 22, 26, 24, 28
  - 9.4%: #F = 61, 62, 62, 60 #UF = 39, 38, 38, 40
  - 18.8%: #F = 56, 58, 59, 55 #UF = 44, 42, 41, 45
  - 37.5%: #F = 49, 50, 50, 48 #UF = 51, 50, 50, 52
  - 75.1%: #F = 25, 27, 24, 27 #UF = 75, 73, 76, 73

ii. Estimate of IC_{25} (95% CL) for fertilization success

- Test 1: na
- Test 2: IC_{25} concentration = 8.7 (7.6 – 9.9)% v/v effluent
- Test 3: IC_{25} concentration = 17.5 (11.6 – 22.6)% v/v effluent

iii. Current reference toxicity tests (95% CL) for IC_{50} for fertilization

- Test 1: na
- Test 2: Reference toxicity tests for Toxicant: Sodium Dodecyl Sulfate
  - Test conducted on July 30, 2004, same day as effluent test
  - Reference test conducted under same conditions
  - IC_{50} for fertilization = 2.1mg/L SDS, 95% CL = (1.9 – 2.4)mg/L
- Test 3: Reference toxicity tests for Toxicant: Sodium Dodecyl Sulfate
  - Test conducted on August 27, 2004, same day as effluent test
  - Reference test conducted under same conditions
  - IC_{50} for fertilization = 2.3mg/L SDS, 95% CL = (2.1 – 2.4)mg/L

iv Reference toxicant warning limits (+/- 2SD) for IC_{50} for fertilization

- Test 1: na
- Test 2: 4.2 +/- 4.8 mg/L SDS
- Test 3: 3.9 +/- 4.6 mg/L SDS

APPENDIX E

7-d Sublethal *Champia* (Algae) Toxicity Test

Reporting Requirements for Reference Method EPA/600/4-91/003 Method 1009.0

Effluent Sample

i. Name & location of operation generating the effluent
   - Polaris Mine, Little Cornwallis Island, Nunavut
   - Final Discharge Point for Garrow Lake is geo referenced as 75° 22' 32" N, 97° 48' 37" W.

ii. Date & time of sampling
   - Samples for yearly sublethal toxicity testing were collected:
     Test 1 - Wednesday July 7, 2004 – 1100h
     Test 2 - Tuesday July 27, 2004 – 0930h
     Test 3 – Tuesday Aug 24, 2004 – 1500h

iii. Type of sample
   - Final effluent water

iv. Brief description of sampling point
   - 20m downstream of the siphon discharge point at Garrow Lake dam

v. Sampling method
   - Water was collected from at least 15cm below the surface using a water pump with silicon tubing
   - Water was collected from the upstream direction
   - The pump was flushed with site water for at least one minute prior to sample collection
   - 1 x 4L sample bottles were filled

vi. Name of person submitting samples
   - Dennis Lu (Gartner Lee) Tests 1 & 2
   - Patrick Allard (Azimuth) Test 3

vii. Temperature of water upon receipt at lab
   - Test 1: Test was not conducted as sample was delayed by weather and person qualified to conduct the work at the lab left for vacation. This was discussed with Sandra Blenkinsopp at the time to provide direction.
   - Test 2: 8°C
   - Test 3: 17°C

Test Organisms

i. Species of test organism
   - Algae (*Champia parvula*)

ii. Name and city of testing laboratory
   - Saskatchewan Research Council [SRC], Saskatoon, SK

iii. Source of test species
   - Test 1: na
   - Test 2 and Test 3
     - 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

Test Facilities and Conditions

i. Test type & method
   - *Champia parvula* sexual reproduction test
   - Static, non-renewal
   - 2-day exposure, followed by 5-7 day recovery period for cystocarp development
   - Reference Method - EPA/600/4-91/003, Method 1009.0

ii. Date and time for start of definitive test
   - Test 1: na

Reporting Requirements for Reference Method EPA/600/4-91/003 Method 1009.0

- Test 2: Friday July 30, 2004 – time not noted but lab notes state tests started within 72 hrs of collection
- Test 3: Friday August 27, 2004 – time not noted but lab notes state tests started within 72 hrs of collection

iii. Test vessel description
- Test 1: na
- Test 2: 270mL transparent polystyrene cups with polystyrene lids
- Test 2: 270mL transparent polystyrene cups with polystyrene lids

iv. Person(s) performing the test and verifying the results
- Test 1: na
- Tests 2 & 3 - Mary Moody

v. Indication of pre-aeration of test solutions
- Test 1: na
- Tests 2 & 3 - No pre-aeration

vi. Confirmation that no pH adjustment of sample or solution occurred
- Test 1: na
- Tests 2 & 3: - No pH adjustment

vii. Indication that EC guidance document for salinity adjustment was followed
- Test 1: na
- Test 2:
    - 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
- Test 3:
    - 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 + 230mL HSB + 10 ml test nutrient solution
    - Salinity of samples adjusted from 5ppt to 30ppt

viii. Type and source of control/dilution water
- Test 1: na
- Tests 2 & 3
    - Natural seawater collected at the Pacific Environmental Center, Environment Canada, North Vancouver, BC
    - Filtered to 0.2μm and autoclaved prior to use
    - Salinity adjusted as per EC guidance document to 30ppt with HSB from the same source

ix. Concentrations and volumes of test solutions
- Concentrations (% effluent volume / total volume) tested and total volumes used were:
- Test 1: na
- Tests 2:
    - Control (Natural Seawater) (0%) - 100mL, 4.5cm depth
    - Salinity Control Brine (0%) - 100mL, 4.5cm depth
    - 4.38% - 100mL, 4.5cm depth
    - 8.75% - 100mL, 4.5cm depth
    - 17.5% - 100mL, 4.5cm depth

Reporting Requirements for Reference Method EPA/600/4-91/003 Method 1009.0

- 35.0% - 100mL, 4.5cm depth
- 70.0% - 100mL, 4.5cm depth

- Tests 3:
  - Control (Natural Seawater) (0%) - 100mL, 4.5cm depth
  - Salinity Control Brine (0%) - 100mL, 4.5cm depth
  - 4.5% - 100mL, 4.5cm depth
  - 9.0% - 100mL, 4.5cm depth
  - 18.0% - 100mL, 4.5cm depth
  - 36.0% - 100mL, 4.5cm depth
  - 72.0% - 100mL, 4.5cm depth

x. Number of replicated per concentration
- Test 1: na
- Tests 2 & 3: 3 replicates per concentration

xi. Number of organisms per test chamber
- Test 1: na
- Tests 2 & 3: 5 female branches + 2 male branches per chamber

xii. Measurements of pH, temperature, dissolved oxygen, and salinity of sample before use
- Test 1: na
- Test 2: pH - 7.78, T – 22.0 °C, DO – 7.9mg/L, salinity - 4ppt
- Test 3: pH - 7.58, T – 23.0 °C, DO – 8.0mg/L, salinity - 5ppt

xiii. Measurements of pH, temperature, dissolved oxygen, and salinity of sample during test
- Test 1: na
- Test 2: pH – 8.20, T – 23 °C, DO – 7.9, salinity: 30ppt
- Test 3: pH – 8.33, T – 22 °C, DO – 7.9, salinity: 29ppt

Results

i. Number and % mortality of female plants after recovery in each test solution
- Totals from all 3 replicates are presented:
- Test 1: na
- Test 2:
  - Control (0%): 0 (0%) mortality
  - Salinity Control (0%): 0 (0%) mortality
  - 4.38%: 0 (0%) mortality
  - 8.75%: 0 (0%) mortality
  - 17.5%: 0 (0%) mortality
  - 35.0%: 0 (0%) mortality
  - 70.0%: 0 (0%) mortality
- Test 3:
  - Control (0%): 0 (0%) mortality
  - Salinity Control (0%): 0 (0%) mortality
  - 4.5%: 0 (0%) mortality
  - 9.0%: 0 (0%) mortality
  - 18.0%: 0 (0%) mortality
  - 36.0%: 0 (0%) mortality
  - 72.0%: 0 (0%) mortality

Reporting Requirements for Reference Method EPA/600/4-91/003 Method 1009.0

ii. Mean number of cystocarps per plant in each test concentration

- Test 1: na
- Test 2:
    - Control (0%): 92.1
    - Salinity Control (0%): 92.5
    - 4.38%: 105.1
    - 8.75%: 105.1
    - 17.5%: 90.7
    - 35.0%: 61.9
    - 70.0%: 13.3
- Test 3:
    - Control (0%): 58.3
    - Salinity Control (0%): 58.6
    - 4.5%: 59.7
    - 9.0%: 59.4
    - 18.0%: 60.9
    - 36.0%: 51.3
    - 72.0%: 26.3

iii. Estimate of IC_{25} (95% CL) for cystocarp development

- Test 1: na
- Test 2: IC_{25} concentration = 26.6 (20.8 – 31.5)% effluent v/v
- Test 3: IC_{25} concentration = 45.3 (36.3 – 58.1)% effluent v/v
- Quantal statistic method was linear interpolation

iv. Current reference toxicity tests (95% CL) for IC_{50} for cystocarp development

- Reference toxicity tests for Toxicant: Sodium Dodecyl Sulfate
- Test 1: na
- Test 2: Test conducted on July 27, 2004, within 30 days of effluent test
    - Reference toxicant test was conducted under the same experimental conditions as the effluent test
    - IC_{50} cystocarp development = 1.48mg/L SDS, 95% CL = (1.38 - 1.62) mg/L
    - Reference toxicity warning limits 1.40 (+/- 2SD) for IC_{50} for cystocarp development
- Test 3: Test conducted on July 27, 2004, within 30 days of effluent test
    - Reference toxicant test was conducted under the same experimental conditions as the effluent test
    - IC_{50} cystocarp development = 1.48mg/L SDS, 95% CL = (1.38 - 1.62) mg/L
    - Reference toxicity warning limits 1.40 (+/- 2SD) for IC_{50} for cystocarp development

v. Reference toxicant warning limits (+/- 2SD) for IC_{50} for cystocarp development

- Reference toxicity tests for Toxicant: Sodium Dodecyl Sulfate
- Test 1: na
- Test 2: 1.40 (1.6-1.70) mg/L SDS
- Test 3: 1.40 (1.6-1.70) mg/L SDS

APPENDIX F

Effluent Metals Concentrations and Loadings

2004 3rd QUARTER MMER REPORT

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
05-Jul-04	7-Jul-04	0.001	0.003	0.005	0.003	0.004	0.198	117	0.020	8.1	Water pump
12-Jul-04	13-Jul-04	0.002	0.001	0.005	0.000	0.002	0.106	6	0.007	7.9	Water pump
19-Jul-04	20-Jul-04	0.002	0.000	0.005	0.001	0.001	0.044	3	0.005	7.9	Water pump
26-Jul-04	27-Jul-04	0.001	0.001	0.005	0.002	0.002	0.043	3	0.005	7.9	Water pump
02-Aug-04	3-Aug-04	0.000	0.001	0.005	0.003	0.003	0.035	3	0.006	8.0	Grab
09-Aug-04	10-Aug-04	0.001	0.001	0.006	0.001	0.007	0.048	3	0.005	8.0	Grab
16-Aug-04	17-Aug-08	0.000	0.001	0.005	0.002	0.006	0.042	5	0.010	8.0	Water pump
23-Aug-04	24-Aug-04	0.000	0.001	0.005	0.001	0.010	0.050	4	0.008	7.8	Water pump
30-Aug-04	31-Aug-04	0.000	0.001	0.005	0.003	0.013	0.078	15	0.008	7.9	Grab
06-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	0.002	0.001	0.005	0.002	0.002	0.098	32	0.009
August/04	0.001	0.001	0.005	0.002	0.005	0.072	18	0.008
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]	
05-Jul-04	7-Jul-04	0.018	0.054	0.091	0.054	0.072	3.588	2120	362,440	18,122
12-Jul-04	13-Jul-04	0.752	0.376	1.880	0.000	0.752	39.850	2256	2,631,608	375,944
19-Jul-04	20-Jul-04	0.205	0.000	0.512	0.102	0.102	4.509	307	512,395	102,479
26-Jul-04	27-Jul-04	0.028	0.028	0.141	0.056	0.056	1.213	85	141,090	28,218
02-Aug-04	3-Aug-04	0.000	0.026	0.132	0.079	0.079	0.926	79	158,700	26,450
09-Aug-04	10-Aug-04	0.026	0.026	0.155	0.026	0.181	1.243	78	129,470	25,894
16-Aug-04	17-Aug-08	0	0	0	0	0	0	0	0	0
23-Aug-04	24-Aug-04	0	0	0	0	0	0	0	0	0
30-Aug-04	31-Aug-04	0	0	0	0	0	0	0	0	0
06-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	3.55	20.33	1.65	7.62	381.00	36,952.22	28,268,381	131,191	4,066,913
August/04	0.16	0.32	1.78	0.65	1.62	13.45	973.60	1,786,654	10,469	324,533
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

APPENDIX G

Results of Effluent Characterization

RESULTS OF EFFLUENT CHARACTERIZATION

AS PER PARAGRAPH 15(1)(a)

Nine effluent samples were collected on a weekly basis during the 3rd Quarter of 2004 beginning on July 7, 2004 and ceasing on August 31, 2004. Four of the nine samples were "monthly" samples and analysed for a wider suite of elements, as per the guidance document. Monthly loadings of metals to Garrow Bay were calculated based on average weekly discharge volumes from Garrow Lake to Garrow Bay via the creek outflow.

Monthly characterization samples were attempted during early July however ice conditions at Garrow Bay made it unsafe to collect Garrow Bay water samples until July 27, 2004. During the July 27th sampling event it was still not safe to collect reference samples due to ice conditions. On August 17th and again on August 24th monthly characterization samples were obtained including Garrow Bay and the reference location.

No holding times were missed for any of the water chemistry of toxicity testing samples.

Water samples for acute and sublethal toxicity testing were collected using a pump system from about 20 m downstream of the dam on Garrow Lake, within the main flow of the creek. Acute Lethality Testing was conducted 3 times during two months (2 in July and 1 in August) during the quarter. There were no adverse effects observed for either the 96-hr Rainbow Trout toxicity tests, or the 48-hr *Daphnia magna* toxicity tests. LC_{50} values were >100% effluent for both species in all testing events.

Sublethal Toxicity Testing was attempted three times during the quarter with the first test being partially successfully completed (7-D Topsmelt successfully completed, the echinoderm fertilization toxicity test was not initiated due to the inability of the sand dollars to spawn, and the Champia parvula Sexual Reporduction test was not conducted due to laboratory problems which were out of our control), and the other two sets of sublethal toxicity tests were completed successfully. As this is considered a marine discharge, marine species were used for sublethal testing following brine adjustment of the brackish effluent (as per test protocols). Testing for fish (7-d Topsmelt growth and survival) and invertebrates (Sand dollar) was conducted at EVS Environment Consultants, Vancouver, while algae (48-h *Champia*) testing was undertaken by the Saskatchewan Research Council, Saskatoon.

There were no effects observed in the Topsmelt Survival and Growth Test at maximum concentration tested which were below 100% v/v effluent due to the salinity adjustments.

Sublethal effects were observed for the echinoid and algal tests and concentrations less than 100% effluent v/v. In the echinoid *(Dendraster excentricus)* fertilization tests (EVS Consultants) for:

- The July 27, 2004 tests, the LOAEL was 4.6% v/v effluent, the IC_{25} was 8.7% v/v, and the IC_{50} was 37.3% v/v.
- The August 24, 2004 tests, the LOAEL was 4.7 %v/v effluent, the IC_{25} was 17.5%v/v, and the IC_{50} was 50.7%v/v.

In the *Champia parvula* sexual reproduction test (Saskatchewan Research Council) for:

- The July 27, 2004 tests, the LOAEL was 35%v/v effluent, the IC_{25} (95% CL) was 26.6% v/v and the IC_{50} (95% CL) was 43.3% v/v.
- The August 24, 2004 tests, the LOAEL was 72%v/v effluent, the IC_{25} (95% CL) was 45.3% v/v and the IC_{50} (95% CL) was 66.8% v/v.

Zinc was the primary contaminant of potential concern (COPC) identified in mine effluent and is the only metal to consistently exceed BC Ambient Water Quality Guidelines (BC AWQG) in effluent. During the 9 week discharge period, effluent zinc concentration averaged 72 µg/L (range 35 – 198µg/L), which is well below the MMER effluent limit of 500µg/L. The BC AWQG is 10µg/L. On July 27, 2004 and August 24, 2004 when the sublethal samples were collected, the respective concentrations of Zn in the effluent was 43µg/L and 50 µg/L. Converting the echinoid test endpoints for the July 27, 2004 tests into Zn concentrations results in a Lowest Observed Adverse Effect Level (LOAEL) of 1.9µg/L Zinc, an IC_{25} of 3.7µg/L, and an IC_{50} of 16.0µg/L. Converting the echinoid test endpoints for the August 24, 2004 tests into Zn concentrations results in a Lowest Observed Adverse Effect Level (LOAEL) of 2.3µg/L Zinc, an IC_{25} of 8.8µg/L, and an IC_{50} of 25.4µg/L. Reference toxicity tests of zinc on *Dendraster* fertilization give mean EC_{50} concentrations of 8.5-60µg/L (Dinnel et al. 1983). The concentrations of zinc in the effluent that corresponds to the IC_{50} (i.e., 16.0 to 25.4 µg/L) are within the effects range reported in reference *Dendraster* fertilization tests. Thus the echinoid test is quite sensitive to zinc, with the LOAELs being less than the BC AWQG concentration.

Endpoints for the July 27, 2004 *Champia* test in terms of zinc concentrations were 15.1µg/L Zn (LOAEL), 11.4µg/L (IC_{25}), and 18.6µg/L (IC_{50}). Endpoints for the August 24, 2004 *Champia* test in terms of zinc concentrations were 36µg/L Zn (LOAEL), 22.6µg/L (IC_{25}), and 33.4µg/L (IC_{50}). The reference IC_{25} endpoint for zinc in the *Champia* test performed in-house at SRC was 27µg/L (95% confidence limits 16-42µg/L). This reference concentration is very similar to zinc concentrations in the mine effluent at the toxicity endpoints observed in the *Champia* test.

Given the similarity between zinc concentrations in the effluent samples and the effects concentrations of zinc in reference tests, it is likely that zinc is responsible for the sublethal effects observed in both the *Dendraster* and *Champia* tests.

Reference: Dinnel, P.A., Q.J. Stober, J.M. Link, M.W. Letourneau, W.E. Roberts, S.P. Felton, and R.E. Nakatan. 1983. Methodology and Validation of a Sperm Cell Toxicity Test for Testing Toxic Substances in Marine Waters. Final Report, FRI-UW-8306, Fisheries Research Inst., School of Fisheries, University of Washington, Seattle, WA :208. Source: EPA EcoTox database.

Bruce J. Donald
Reclamation Manager

March 15, 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 – 2004 4th Quarter Metal Mining Effluent Regulations Report

Despite having a designated discharge location for effluent identified under Section 9 of the MMER, there was no discharge from the Garrow Lake Tailings Impoundment Area during the period October 1, 2004 to December 31, 2004. While there is no data to report, I have completed the monitoring report as required by the regulations and have attached it to this letter.

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

Yours truly,

Bruce Donald

Attachments: 4th Quarter 2004 Monitoring Report

cc:
Walter Kuit (Teck Cominco Limited)
Randy Baker (Azimuth Consulting Group)

POLARIS MINE – MMER MONITORING REPORT

4th QUARTER 2004

APPENDIX A

i. Information specified by Section 8.1 of Reference Method EPS 1/Rm/13

APPENDIX B

i. Information specified by Section 8.1 of Reference Method EPS 1/Rm/14

APPENDIX C

i. Concentration & monthly mean concentrations of each deleterious substance of Schedule 4
ii. pH of the effluents samples as required by subsection 12(1)
iii. Description of sample collection method
iv. Total volume of effluent deposited during each month of the quarter as per section 19
v. Mass loading of the deleterious substances set out in Schedule 4 and as per section 20

APPENDIX D

i. Results of the effluent characterization as per paragraph 15(1)(a)

APPENDIX A

Reporting Requirements for Reference Method EPS 1/RM/13

Section 8.1.1 Effluent

i. Name & location of operation generating the effluent
   - Polaris Mine, Little Cornwallis Island, Nunavut
   - Final Discharge Point for Garrow Lake is geo referenced as 75° 22' 32" N, 96° 48' 37" W.

ii. Date & time of sampling
   - No sampling conducted as there was no effluent discharge during the quarter.

iii. Type of sample
   - No sampling conducted as there was no effluent discharge during the quarter

iv. Brief description of sampling point
   - Discharge point of siphon at Garrow Lake dam

v. Sampling method
   - No sampling conducted as there was no effluent discharge during the quarter

vi. Name of person submitting samples
   - No sampling conducted as there was no effluent discharge during the quarter

Section 8.1.2 Test Facilities and Conditions

i. Test type & method
   - No testing conducted as there was no effluent discharge during the quarter

ii. Indications of deviations from requirements in Sections 2 to 7 of Method EPS 1/RM/13
   - No deviations to report as there was no testing conducted during the quarter

iii. Name and city of testing laboratory
   - No laboratory used during the quarter

iv. Percent mortality of fish in stock tank(s)
   - None to report. There were no tests conducted during the period

v. Species of test organism
   - None to report as there were no tests conducted during the period

vi. Date and time for start of definitive test
   - None to report as there were no tests conducted during the period

vii. Person(s) performing the test and verifying the results
   - No tests performed during the quarter

viii. pH, temperature, dissolved oxygen, and conductivity of unadjusted, undiluted effluent
   - No data to report as there were no tests conducted during the period

ix. Confirmation that no adjustment of sample or solution pH occurred
   - No adjustment to report as there were no tests conducted during the period

x. Indication of aeration of test solutions before introduction of fish
   - None to report as there were no tests conducted during the period

xi. Concentrations and volumes tested
   - No data to report as there were no tests conducted during the period

xii. Measurements of dissolved oxygen, pH and temperature
   - No data to report as there were no tests conducted during the period

xiii. Number of fish added to each test vessel
   - No fish added as there were no tests conducted during the period

xiv. Mean and range of fork length of control fish at end of test
   - No data to report as there were no tests conducted during the period

xv. Mean wet weight of individual control fish at end of the test
   - No data to report as there were no tests conducted during the period

xvi. Estimated loading density of fish in test solutions
   - No data to report as there were no tests conducted during the period

Reporting Requirements for Reference Method EPS 1/RM/13 - Continued

Section 8.1.3 Results

i. Number of mortalities of fish in each test solution
   - None to report. No tests conducted during the period

ii. Number of control fish showing atypical/stressed behaviour
   - None to report. No tests conducted.

iii. Mean mortality rate in solutions of effluent and control water
   - None to report. No tests conducted

iv. Estimate of 96-h LC50 in multi-concentration tests
   - No data to report. No tests conducted

v. Most recent 96-h LC50 for reference toxicity test(s)
   - No data to report. No tests conducted

APPENDIX B

Reporting Requirements for Reference Method EPS 1/RM/14

Section 8.1.1 Effluent

i. Name & location of operation generating the effluent
   - Polaris Mine, Little Cornwallis Island, Nunavut
   - Final Discharge Point for Garrow Lake is geo referenced as 75° 22' 32" N, 96° 48' 37" W.

ii. Date & time of sampling
   - No sampling conducted as there was no effluent discharge during the quarter.

iii. Type of sample
   - No sampling conducted as there was no effluent discharge during the quarter

iv. Brief description of sampling point
   - Discharge point of siphon at Garrow Lake dam

v. Sampling method
   - No sampling conducted as there was no effluent discharge during the quarter

vi. Name of person submitting samples
   - No sampling conducted as there was no effluent discharge during the quarter

Section 8.1.2 Test Facilities and Conditions

i. Test type & method
   - No testing conducted as there was no effluent discharge during the quarter

ii. Indications of deviations from requirements in Sections 2 to 7 of Method EPS 1/RM/13
   - No deviations to report as there was no testing conducted during the quarter

iii. Name and city of testing laboratory
   - No laboratory used during the quarter

iv. Species of test organism
   - None to report as there were no tests conducted during the period

v. Date and time for start of definitive test
   - None to report as there were no tests conducted during the period

vi. Person(s) performing the test and verifying the results
   - No tests performed during the quarter

vii. pH, temperature, dissolved oxygen, and conductivity of unadjusted, undiluted effluent
   - No data to report as there were no tests conducted during the period

viii. Confirmation that no adjustment of sample or solution pH occurred
   - No adjustment to report as there were no tests conducted during the period

ix. Indication of any adjustment of hardness of effluent sample
   - No adjustment to report as there were no tests conducted during the period

x. Indication of any aeration of sample
   - No indication to report as there were no tests conducted during the period

xi. Concentrations and volumes tested
   - No data to report as there were no tests conducted during the period

xii. Measurements of dissolved oxygen, pH and temperature
   - No data to report as there were no tests conducted during the period

xiii. Estimates of time to first brood, average number of neonates per brood, and percent mortality during the seven-day period prior to the test
   - No data to report as there were no tests conducted during the period

xiv. Number of neonates per test vessel and milliliters of solution per daphnid
   - No data to report as there were no tests conducted during the period

Reporting Requirements for Reference Method EPS 1/RM/14 - Continued

Section 8.1.3 Results

i. Number of dead and/or immobile daphnids in each test solution including controls
   - No data to report. No tests conducted during the period.

ii. For single-concentration test the number of daphnids dead in each of three replicate effluent solutions and in each of three replicate control solutions at end of test. Also report the mean value.
   - No data to report. No tests conducted during the period.

iii. Estimate of 48-h LC50 and 95% confidence limits in multi-concentration tests, 48-h EC50 for immobilization and 95% confidence limits, indication of statistical method on which results are based.
   - No data to report. No tests conducted during the period

iv. Most recent 48-h LC50 for reference toxicant test(s), reference chemical(s), date test initiated, historic geometric mean LC50 and warning limits.
   - No data to report. No tests conducted during the period.

APPENDIX C

2004 4th QUARTER MMER REPORT

LOCATION - FINAL DISCHARGE POINT FROM GARROW LAKE

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
04-Oct-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
11-Oct-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
18-Oct-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
25-Oct-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
01-Nov-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
08-Nov-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
15-Nov-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
22-Nov-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
29-Nov-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
06-Dec-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
13-Dec-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
20-Dec-04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
27-Dec-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
October/04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
November/04	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]	nd[2]
December/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]	
04-Oct-04	nd[2]	0	0	0	0	0	0	0	0	0
11-Oct-04	nd[2]	0	0	0	0	0	0	0	0	0
18-Oct-04	nd[2]	0	0	0	0	0	0	0	0	0
25-Oct-04	nd[2]	0	0	0	0	0	0	0	0	0
01-Nov-04	nd[2]	0	0	0	0	0	0	0	0	0
08-Nov-04	nd[2]	0	0	0	0	0	0	0	0	0
15-Nov-04	nd[2]	0	0	0	0	0	0	0	0	0
22-Nov-04	nd[2]	0	0	0	0	0	0	0	0	0
29-Nov-04	nd[2]	0	0	0	0	0	0	0	0	0
06-Dec-04	nd[2]	0	0	0	0	0	0	0	0	0
13-Dec-04	nd[2]	0	0	0	0	0	0	0	0	0
20-Dec-04	nd[2]	0	0	0	0	0	0	0	0	0
27-Dec-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]		
October/04	0	0	0	0	0	0	0	0	0	0
November/04	0	0	0	0	0	0	0	0	0	0
December/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

APPENDIX D

RESULTS OF EFFLUENT CHARACTERIZATION

AS PER PARAGRAPH 15(1)(a)

No effluent samples were collected during the 4th Quarter of 2004 as there was no effluent discharge.
No Acute Lethality Testing conducted during the quarter as there was no effluent being discharged.

Bruce J. Donald
Reclamation Manager

September 28, 2005

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

Attention: Jenny Ferone, Regional EEM Coordinator
Peter Blackall, Regional Director of Environmental Protection

Dear Jenny Ferone and Peter Blackall;

Re: REVISED Polaris Mine 2004 Annual MMER and EEM Report

This revised report is being submitted in response to the August 9, 2005 letter from Jenny Ferone (Environment Canada) to Bruce Donald (Teck Cominco Metals Ltd.), regarding purported reporting deficiencies for the Polaris Mine 2004 Annual Report (provided in Appendix F). Azimuth staff prepared the initial 2004 Annual Report and have addressed the issues identified in the August 9th letter within this Revised 2004 Annual Report. In addition, Azimuth responded to each specific reporting issue in a letter sent to Environment Canada on behalf of Teck Cominco, dated September 14, 2005 (provided in Appendix G). Within this letter, Azimuth identified sections of the original report where some of the deficient data were presented and requested further guidance and clarification from Environment Canada on some of the reviewers' comments. Azimuth has not heard back to date, and has prepared this Revised 2004 Annual Report according to the assumptions and interpretations stated in the September 14th letter. Teck Cominco and Azimuth will ensure that all required information will be included in future reports.

Please find attached the REVISED 2004 Polaris Mine Annual Report. There was one non-compliant concentration related to Schedule 4 limits (TSS) as previously reported. There were no non-compliant results of the acute lethality tests during the year.

The following is included in our Revised 2004 Annual Report:

1. Requirements under Schedule 6
   - Identification of Site, Owner, Location, etc.
   - Non-Compliance information
   - Table 1 – Monthly Mean Concentrations, pH Range and Volume of Effluent
   - Table 2 – Results of Acute Lethality Tests and Daphnia Magna Monitoring Tests

2. Requirements under Part 1 Section 8
   - Results of studies conducted under Part 1, Section 4 (Effluent Characterization) (Table 3, Table 5)
   - Results of studies conducted under Part 1, Section 5 (Sublethal Toxicity Testing) (Table 6, Table 7, Appendix A, B, C and E) (Note that within Appendices A, B, and C, ** denotes the sections where reporting issues from the August 9th letter have been addressed)
   - Results of studies conducted under Part 1, Section 7 (Water Quality Monitoring) (Table 4, Table 5)

3. Additional Appendices
   - Appendix D – acute toxicity testing reports
   - Appendix F – Letter from Environment Canada to Teck Cominco Metals Ltd., dated August 9, 2005
   - Appendix G – Letter from Azimuth Consulting Group to Environment Canada, dated September 14, 2005.
   - Appendix H – Polaris Mine – Revised 2004 3rd Quarter Metal Mining Effluent Regulations Report (dated March 22, 2005)

As in the initial 2004 Annual Report, the revised 3rd Quarter regulatory data set is included in this submission in Appendix H. This data was revised to ensure consistency between the hardcopy and online RISS system reports.

The MMER and EEM data required to be reported in electronic format were submitted electronically through the RISS online system in March 2005, and no additional information was requested for this report format. In addition to this hardcopy report, an electronic pdf version of this report is being emailed to you (e-mailed September 28, 2005).

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.

Yours truly,

Original signed by B. Donald

Bruce Donald

Attachments: 2004 MMER Annual Report; Revised 2004 3rd Quarter Regulatory Data Tables

cc: Randy Baker (Azimuth Consulting Group)

Ken Russell (Environment Canada)

INFORMATION TO BE INCLUDED IN ANNUAL REPORT SUMMARY

The following information is to be submitted for each final discharge point.

Mine Name :	Polaris Mine
Mine Operator :	Cominco Mining Partnership and Teck Cominco Metals Lt
Address :	Bag 2000
	Kimberley, BC
	V1A 3E1
Telephone :	(250) 427-8405 Bruce Donald
E-mail :	bruce.donald@teckcominco.com
Location of Final Discharge point :	Garrow Lake Former Dam at 75o22'32"N, 96o48'37"W.
Reporting Period :	January 1, 2004 to December 31, 2004.
Date of Report :	March 21, 2005.

Non-Compliance Information

There was one non-compliant effluent discharge during 2004 (I.e., TSS of 117 mg/L, July 7, 2004), with respect to Schedule 4 limits. Upon receiving the results from the lab, this exceedance was reported to Environment Canada regulatory authorites in a letter dated August 12, 2004. The exceedance was due to the initial ice melt unplugging Garrow Lake, resulting in a flushing of sediment. There were no other non-compliant concentrations of substances during this initial flow, and TSS dropped to values of approximately 3-15 mg/L in all subsequent sampling events. Upon review of the information, Environment Canada recommended no further action in a letter date January 11, 2005 from Sidney Bruinsma. There were no non-compliant acute lethality tests during 2004, including tests performed on the July 7, 2004 sample.

TABLE 1

MONTHLY MEAN CONCENTRATIONS, pH RANGE AND VOLUME OF EFFLUENT (1)(2)

Month	As (mg/L)	Cu (mg/L)	CN (mg/L)	Pb (mg/L)	Ni (mg/L)	Zn (mg/L)	TSS (mg/L)	Ra (Bq/L)	pH range	Effluent Volume (m3)
Jan.	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)
Feb.	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)
Mar.	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)
Apr.	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)
May	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)
June	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)
July	0.0015	0.0011	0.0050	0.0014	0.0024	0.0980	32.0000	0.0090	7.90 - 8.05	4066913.00
Aug.	0.0004	0.0012	0.0051	0.0019	0.0081	0.0508	6.1000	0.0074	7.84 - 8.04	324551.00
Sept.	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)
Oct.	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)
Nov.	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)
Dec.	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)

(1) Any measurement not taken because there was no deposit from the final discharge point shall be identified by the letters "ND" - (No Deposit)

(2) Any measurement not taken because no measurement was required in accordance with the conditions set out in section 13 of the Regulations shall be identified by the letters "NMR" - (No Measurement Required).

TABLE 2

RESULTS OF ACUTE LETHALITY TESTS AND
DAPHNIA MAGNA MONITORING TESTS

Date Sample Collected	Effluent Acutely Lethal to Rainbow Trout (yes or no)	Effluent Acutely Lethal to *Daphnia magna* (yes or no)
7/7/2004	No	No
7/27/2004	No	No
8/24/2004	No	No

REVISED Table 3. Effluent Characterization Results (Part 1, Section 4)

Effluent Characterization from Final Discharge Point - Garrow Lake Former Dam / Syphons
Northing: 75°22'32"
Easting: 96°48'37"

Facility Name:		Teck Cominco Metals Limited - Polaris Mine (Little Cornwallis Island)					
FDP Name:		Garrow Lake Syphons					
Sampling Date:		7/7/2004	7/27/2004	8/17/2004	8/24/2004		
Sample Method:		Grab	Grab	Grab	Grab		
Parameter	**Units**					***Detection Limit***	**Methods[1]**
Hardness	mg/L	1400	483	973	1380	*2.7*	EPA Method 3005A, ICPOES (EPA Method 6010B)[4]
Alkalinity	mg/L	138	62.4	111	128	*1.0*	APHA Method 2320 (potentiometric titration)
Aluminum	mg/L	0.34	0.021	<0.1	<0.1	*0.1*	SPR-IDA[2], Graphite Furnace Atomic Absorption Spectrophotometry
Cadmium	mg/L	0.000588	0.00014	0.00023	0.000335	*0.0002*	SPR-IDA[2], ICPMS[3]
Iron	mg/L	0.487	0.084	0.042	0.014	*0.01*	SPR-IDA[2], Flame Atomic Absorption Spectrophotometry
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	*0.00001*	Cold Vapour Atomic Florescence Spectrophotometry
Molybdenum	mg/L	<0.005	0.0013	<0.005	<0.005	*0.005*	ICPMS[3]
Ammonia	mg/L	0.071	<0.02	0.146	0.133	*0.02*	APHA Method 4500-NH3 (selective ion electrode)
Nitrate	mg/L	0.277	0.0644	0.525	0.531	*0.01, 0.02*	APHA Method 4110 (determination of inorganic ions by ion chromatography)
Arsenic	mg/L	<0.001	<0.001	<0.0002	<0.0002	*0.001, 0.0002*	Hydride-Vapour Atomic Absorption Spectrophotometry
Copper	mg/L	0.00265	0.000518	0.00121	0.00134	*0.00005*	SPR-IDA[2], ICPMS[3]
Cyanide	mg/L	<0.005	<0.005	<0.005	<0.005	*0.005*	APHA Method 4500-CN (cynate hydrolosis using an ammonia selective electrode)
Lead	mg/L	0.00269	0.00157	0.00177	0.00119	*0.00005*	SPR-IDA[2], ICPMS[3]
Nickel	mg/L	0.00442	0.00207	0.00644	0.00967	*0.00005*	SPR-IDA[2], ICPMS[3]
Zinc	mg/L	0.198	0.0429	0.0418	0.0498	*0.0005*	SPR-IDA[2], ICPMS[3]
TSS	mg/L	117	<3	5.3	4.4	*3.0*	APHA Method 2540 (filtration through glass fibre filter)
Radium 226	Bq/L	0.02	<0.005	0.01	0.008	*0.005*	Radio Chemistry[5]
pH	pH units	8.05	7.87	7.95	7.84	*0.01*	APHA Method 4500-H (pH electrode)

Notes:

[1]Original data reports are available upon request

[2]SPR-IDA = Suspended Particulate Resin consisting of immobilized iminodiacetate on a divinyl benzene polymer is used to chelate and preconcentrate metals in seawater (preparation technique).

[3]Instrumental analysis is by ICPMS = Inductively Coupled Mass Spectrometry.

[4]This analysis is carried out using procedures adapted from "StandardMethods for the Examination of Water and Wastewater" 20th Edition 1998, published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the USEPA. The procedures may involve preliminary sample treatment by acid digestion, using either hotplate or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emissionspectrophotometry ICPOES (EPA Method 6010B).

[5]All radium isotopes in the sample solution are separated by coprecipitation with lead sulfate. The precipitate is redissolved and the radium isotopes are separated by coprecipitation with barium sulfate. The precipitate is filtered and mounted on a stainless steel disk. It is then counted on an alpha spectrometer. The radium 226 alpha energy is distinct and the peak can be clearly identified.

REVISED Table 4. Water Quality Monitoring Results (Part 1, Section 7)

Station:		Exposure Area			Reference Area			
Description:		Garrow Bay at Mouth of Garrow Creek Confluence			Garrow Bay ~1km NE of exposure station (confluence with Garrow Creek).			
Northing:		75°22'15"			75°22'40"			
Easting:		96°48'30"			96°47'12"			
Facility Name:		Teck Cominco Metals Limited - Polaris Mine (Little Cornwallis Island)			Teck Cominco Metals Limited - Polaris Mine (Little Cornwallis Island)			
FDP Name:		Garrow Lake Syphons			Garrow Lake Syphons			
Area Name:		Garrow Bay Exposure			Garrow Bay Reference			
Sampling Date:		7/27/2004	8/17/2004	8/24/2004	8/17/2004	8/24/2004		
Sample Method:		Grab	Grab	Grab	Grab	Grab		
Parameters	**Units**						***Detection Limit***	**Methods[1]**
Hardness	mg/L	482	2270	1750	2960	1560	*2.7*	EPA Method 3005A, ICPOES (EPA Method 6010B)[4]
Alkalinity	mg/L	37.5	45	38.8	46	36.1	*1.0*	APHA Method 2320 (potentiometric titration)
Aluminum	mg/L	0.033	<0.1	<0.1	<0.1	<0.1	*0.1*	SPR-IDA[2], Graphite Furnace Atomic Absorption Spectrophotometry
Cadmium	mg/L	0.00007	<0.00002	0.000028	<0.00002	<0.00002	*0.0002*	SPR-IDA[2], ICPMS[3]
Iron	mg/L	0.046	<0.01	<0.01	<0.01	<0.01	*0.01*	SPR-IDA[2], Flame Atomic Absorption Spectrophotometry
Mercury	mg/L	<0.00005	<0.00001	<0.00001	<0.00001	<0.00001	*0.00001*	Cold Vapour Atomic Florescence Spectrophotometry
Molybdenum	mg/L	0.00156	<0.005	<0.005	0.0062	<0.005	*0.005*	ICPMS[3]
Ammonia	mg/L	<0.02	<0.02	0.02	<0.02	<0.02	*0.02*	APHA Method 4500-NH3 (selective ion electrode)
Nitrate	mg/L	0.0372	<0.02	<0.02	<0.02	<0.02	*0.02*	APHA Method 4110 (determination of inorganic ions by ion chromatography)
Arsenic	mg/L	<0.001	<0.0002	0.00027	0.00044	<0.0002	*0.001, 0.0002*	Hydride-Vapour Atomic Absorption Spectrophotometry
Copper	mg/L	0.000405	0.000216	0.000209	0.000231	0.000205	*0.00005*	SPR-IDA[2], ICPMS[3]
Cyanide	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	*0.005*	APHA Method 4500-CN (cynate hydrolosis using an ammonia selective electrode)
Lead	mg/L	0.00026	<0.00005	0.000267	0.000052	<0.00005	*0.00005*	SPR-IDA[2], ICPMS[3]
Nickel	mg/L	0.000979	0.000252	0.000267	0.000217	0.000186	*0.00005*	SPR-IDA[2], ICPMS[3]
Zinc	mg/L	0.0242	0.00118	0.00092	0.0005	<0.0005	*0.0005*	SPR-IDA[2], ICPMS[3]
TSS	mg/L	3.7	3.3	8.4	9.3	7	*3.0*	APHA Method 2540 (filtration through glass fibre filter)
Radium226	Bq/L	<0.005	<0.005	0.006	<0.005	<0.005	*0.005*	Radio Chemistry[5]
pH	pH units	7.91	7.79	7.64	7.92	7.62	*0.01*	APHA Method 4500-H (pH electrode)
Water Temperature	°C	0.2	0.2	0.9	0.1	1.2	-	Field - Campbell Scientific Hydrolab Model H20, or YSI Meter Model 85
Dissolved Oxygen	mg/L	13.23	13.78	15.2	14.04	15.13	-	Field - Campbell Scientific Hydrolab Model H20, or YSI Meter Model 85

Notes

The Garrow Bay exposure area (mouth of the creek) was frozen during the July 7, 2004 sampling event.

Note that the reference area was ice free only during August 17 and August 24, 2004 sampling events.

[1]Original data reports are available upon request

[2]SPR-IDA = Suspended Particulate Resin consisting of immobilized iminodiacetate on a divinyl benzene polymer is used to chelate and preconcentrate metals in seawater (preparation technique).

[3]Instrumental analysis is by ICPMS = Inductively Coupled Mass Spectrometry.

[4]This analysis is carried out using procedures adapted from "StandardMethods for the Examination of Water and Wastewater" 20th Edition 1998, published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the USEPA. The procedures may involve preliminary sample treatment by acid digestion, using either hotplate or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emissionspectrophotometry ICPOES (EPA Method 6010B).

[5]All radium isotopes in the sample solution are separated by coprecipitation with lead sulfate. The precipitate is redissolved and the radium isotopes are separated by coprecipitation with barium sulfate. The precipitate is filtered and mounted on a stainless steel disk. It is then counted on an alpha spectrometer. The radium 226 alpha energy is distinct and the peak can be clearly identified.

Table 5. QAQC Sample Results[1] Including Field Duplicates, Field Blanks, and Transport Blanks.

Sample Type:		Field Duplicate	Original Sample		Field Duplicate	Original Sample		Field Duplicate	Original Sample	
Location:		Garrow Lake Syphons			Garrow Bay Exposure			Garrow Lake Syphons		
Description:		Final Discharge Point		RPD[2]	Mouth of Garrow Creek Confluence		RPD[2]	Final Discharge Point		RPD[2]
Sampling Date:		7/7/2004		(%)	7/27/2004		(%)	8/17/2004		(%)
Parameters	**Parameter Units**									
Hardness	mg/L	1400	1400	0.00	532	482	10.37	997	973	2.47
Alkalinity	mg/L	132	138	4.35	38.6	37.5	2.93	113	111	1.80
Aluminum	mg/L	0.26	0.34	23.53	0.031	0.033	6.06	<0.10	<0.1	n/a
Cadmium	mg/L	0.000582	0.000588	1.02	0.000062	0.00007	11.43	0.000224	0.00023	2.61
Iron	mg/L	0.441	0.487	9.45	0.035	0.046	23.91	0.039	0.042	7.14
Mercury	mg/L	<0.000010	<0.00001	n/a	<0.000050	<0.00005	n/a	<0.000010	<0.00001	n/a
Molybdenum	mg/L	<0.0050	<0.005	n/a	0.00129	0.00156	17.31	<0.0050	<0.005	n/a
Ammonia	mg/L	0.069	0.071	2.82	<0.020	<0.02	n/a	0.163	0.146	11.64
Nitrate	mg/L	0.284	0.277	2.53	0.0371	0.0372	0.27	0.54	0.525	2.86
Arsenic	mg/L	<0.0010	<0.001	n/a	<0.0010	<0.001	n/a	<0.00020	<0.0002	n/a
Copper	mg/L	0.00252	0.00265	4.91	0.000342	0.000405	15.56	0.00121	0.00121	0.00
Cyanide	mg/L	<0.0050	<0.005	n/a	<0.0050	<0.005	n/a	<0.0050	<0.005	n/a
Lead	mg/L	0.0024	0.00269	10.78	0.000205	0.00026	21.15	0.00187	0.00177	5.65
Nickel	mg/L	0.00438	0.00442	0.90	0.000772	0.000979	21.14	0.00676	0.00644	4.97
Zinc	mg/L	0.196	0.198	1.01	0.019	0.0242	21.49	0.0418	0.0418	0.00
TSS	mg/L	120	117	2.56	7	3.7	89.19	<3.0	5.3	n/a
Radium226	Bq/L	0.02	0.02	0.00	<0.0050	<0.005	n/a	<0.0050	0.01	n/a
pH	pH units	8.06	8.05	0.12	7.76	7.91	1.90	8.02	7.95	0.88

Notes

[1]QAQC samples were collected during each EEM monitoring event. At least one field duplicate and/or one blank sample was collected during each event.

[2]RPD = Relative Percent Difference = [Absolute value (DUP-ORIG)/ORIG]*100%

Cells in grey shading have RPD values >50% for co-located field duplicates

[3]Distilled water from onsite distiller.

QAQC Results

A total of 4 duplicate samples and 3 blank samples were collected during the 2004 EEM program at Polaris mine. All RPD values were less than 50%, with the exception of one measurement of TSS on July 27, 2004. This data indicate good reproducibility between co-located field duplicates (i.e., low measurement and analytical variability).

Blank samples were typically less than, or slightly higher than detection limits, revealing no background contamination issues.

Table 5. QAQC Sample Results[1] Including Field Duplicates, Field Blanks, and Transport Blanks.

Sample Type:		Field Duplicate	Original Sample		Field Blank	Transport Blank	Field Blank
Location:		Garrow Lake Syphons			n/a	n/a	n/a
Description:		Final Discharge Point		RPD[2]	Distilled Water[3]	Distilled Water[3]	Distilled Water[3]
Sampling Date:		8/24/2004		(%)	7/7/2004	7/7/2004	8/17/2004
Parameters	Parameter Units						
Hardness	mg/L	1380	1380	0.00	<0.54	<0.54	<0.54
Alkalinity	mg/L	128	128	0.00	-	-	<1.0
Aluminum	mg/L	<0.10	<0.1	n/a	<0.10	<0.10	<0.0010
Cadmium	mg/L	0.000342	0.000335	2.09	<0.000020	<0.000020	<0.00020
Iron	mg/L	0.015	0.014	7.14	<0.010	<0.010	<0.030
Mercury	mg/L	<0.000010	<0.00001	n/a	<0.000010	<0.000010	<0.000010
Molybdenum	mg/L	<0.0050	<0.005	n/a	<0.0050	<0.0050	<0.0010
Ammonia	mg/L	0.114	0.133	14.29	-	-	0.028
Nitrate	mg/L	0.529	0.531	0.38	-	-	<0.0050
Arsenic	mg/L	<0.00020	<0.0002	n/a	<0.0010	<0.0010	<0.00020
Copper	mg/L	0.00140	0.00134	4.48	0.00012	0.00012	<0.0010
Cyanide	mg/L	<0.0050	<0.005	n/a	-	-	<0.0050
Lead	mg/L	0.00116	0.00119	2.52	0.00017	0.00021	<0.0010
Nickel	mg/L	0.00971	0.00967	0.41	<0.00050	<0.00050	<0.0010
Zinc	mg/L	0.0514	0.0498	3.21	0.0012	<0.0010	<0.0050
TSS	mg/L	3.7	4.4	15.91	-	-	<3.0
Radium226	Bq/L	<0.0050	0.008	n/a	<0.0050	0.006	<0.0050
pH	pH units	7.93	7.84	1.15	-	-	5.51

Notes

[1]QAQC samples were collected during each EEM monitoring event. At least one field duplicate and/or one blank sample was collected during each event.

[2]RPD = Relative Percent Difference = [Absolute value (DUP-ORIG)/ORIG]*100%

Cells in grey shading have RPD values >50% for co-located field duplicates

[3]Distilled water from onsite distiller.

QAQC Results

A total of 4 duplicate samples and 3 blank samples were collected during the 2004 EEM program at Polaris mine. All RPD values were less than 50%, with the exception of one measurement of TSS on July 27, 2004. This data indicate good reproducibility between co-located field duplicates (i.e., low measurement and analytical variability).

Blank samples were typically less than, or slightly higher than detection limits, revealing no background contamination issues.

Table 6. Sublethal Toxicity Testing Results EC50 (Part 1, Section 5)

Facility Name	FDP Name	EC25 Test Date	Species Test	Sublethal Test Type	Sample Method	Consultant Laboratory
Teck Cominco Metals Limited - Polaris Mine (Little Cornwallis Island)	Garrow Lake Syphons	7/7/2004	Atherinops affinis	Growth	Grab	EVS Consultants, North Vancouver, BC
Teck Cominco Metals Limited - Polaris Mine (Little Cornwallis Island)	Garrow Lake Syphons	7/27/2004	Atherinops affinis	Growth	Grab	EVS Consultants, North Vancouver, BC
Teck Cominco Metals Limited - Polaris Mine (Little Cornwallis Island)	Garrow Lake Syphons	7/27/2004	Dendraster excentricus	Reproduction	Grab	EVS Consultants North Vancouver, BC
Teck Cominco Metals Limited - Polaris Mine (Little Cornwallis Island)	Garrow Lake Syphons	7/27/2004	Champia parvula	Reproduction	Grab	Saskatchewan Research Council (SRC)
Teck Cominco Metals Limited - Polaris Mine (Little Cornwallis Island)	Garrow Lake Syphons	8/24/2004	Champia parvula	Reproduction	Grab	Saskatchewan Research Council (SRC)
Teck Cominco Metals Limited - Polaris Mine (Little Cornwallis Island)	Garrow Lake Syphons	8/24/2004	Dendraster excentricus	Reproduction	Grab	EVS Consultants North Vancouver, BC
Teck Cominco Metals Limited - Polaris Mine (Little Cornwallis Island)	Garrow Lake Syphons	8/24/2004	Atherinops affinis	Growth	Grab	EVS Consultants North Vancouver, BC

Table 6. Sublethal Toxicity Testing Results EC50 (Part 1, Section 5)

EC25 Test Date	Species Test	EC25 or IC25	EC25 or IC25 Lower Confidence Limit	EC25 or IC25 Upper Confidence Limit	Notes
7/7/2004	Atherinops affinis	> 72.6	72.6	72.6	IC25 (95%CL) was > 72.6%, the highest exposure concentration due to salinity adjustment.
7/27/2004	Atherinops affinis	> 69	69	69	IC25 (95% CL) was > 69%, the highest concentration tested due to salinity adjustment.
7/27/2004	Dendraster excentricus	8.7	7.6	9.9	July 7 sandollar test not initiated because sandollars did not spawn.
7/27/2004	Champia parvula	26.6	20.8	31.5	
8/24/2004	Champia parvula	45.3	36.3	58.1	
8/24/2004	Dendraster excentricus	17.5	11.6	22.6	
8/24/2004	Atherinops affinis	> 71	71	71	IC25 (95% CL) was > 71%, the highest concentration tested due to salinity adjustment.

Table 7. Sublethal Toxicity Testing Results LC50 (Part 1, Section 5)

Facility Name	FDP Name	LC50 Test Date	Species Tested	Sublethal Test Type	Sample Method	Consultant Laboratory
Teck Cominco Metals Limited - Polaris Mine (Little Cornwallis Island)	Garrow Lake Syphons	7/7/2004	Atherinops affinis	Survival	Grab	EVS Consultants, North Vancouver, BC
Teck Cominco Metals Limited - Polaris Mine (Little Cornwallis Island)	Garrow Lake Syphons	7/27/2004	Atherinops affinis	Survival	Grab	EVS Consultants, North Vancouver, BC
Teck Cominco Metals Limited - Polaris Mine (Little Cornwallis Island)	Garrow Lake Syphons	8/24/2004	Atherinops affinis	Survival	Grab	EVS Consultants, North Vancouver, BC

Table 7. Sublethal Toxicity Testing Results LC50 (Part 1, Section 5)

LC50 Test Date	Species Tested	LC50	LC50 Lower Limit	LC50 Upper limit	Notes
7/7/2004	Atherinops affinis	> 72.6	72.6	72.6	LC50 (95% CL) was > 72.6%, the highest exposure concentration tested, due to salinity adjustment.
7/27/2004	Atherinops affinis	> 69	69	69	LC50 (95% CL) was > 69%, the highest concentration tested due to salinity adjustment.
8/24/2004	Atherinops affinis	> 71	71	71	LC50 (95% CL) was > 71%, the highest concentration tested due to salinity adjustment.

POLARIS MINE – MMER ANNUAL SUMMARY REPORT 2004

APPENDIX A

i. Information specified in Schedule 5 of the MMER (June 2002) for Reference Method EPAW 95-EPA West Coast: 7-day Topsmelt Survival and Growth Tests.

APPENDIX B

i. Information specified in Schedule 5 of the MMER (June 2002) for Reference Method EPS 1/Rm/27-EC: 92 hr Echinoderm (sand dollar) Fertilization Test

APPENDIX C

i. Information specified in Schedule 5 of the MMER (June 2002) for Reference Method EPA/600/4-91-003, Method 1009.0: Algae (*Champia parvula*) 7-day Sublethal Growth Tests

APPENDIX D

i. Acute toxicity testing laboratory reports

APPENDIX E

i. Sublethal toxicity testing laboratory reports

APPENDIX F

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

APPENDIX G

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

APPENDIX H

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

APPENDIX A

7-d Topsmelt Growth and Survival Toxicity Test

Reporting Requirements for Reference Method EPAW 95-EPA West Coast (Topsmelt)

Effluent Sample

i. Name & location of operation generating the effluent
   - Polaris Mine, Little Cornwallis Island, Nunavut
   - Final Discharge Point for Garrow Lake is geo referenced as 75° 22' 32" N, 97° 48' 37" W.

ii. Date & time of sampling
   - Samples for sublethal toxicity testing were collected:
     Test 1 - Wednesday July 7, 2004 – 1100h
     Test 2 - Tuesday July 27, 2004 – 2130h
     Test 3 – Tuesday Aug 24, 2004 – 1500h

iii. Type of sample
   - Final effluent water from final discharge point

iv. Brief description of sampling point
   - 20m downstream of the siphon discharge point at Garrow Lake dam

v. Sampling method
   - Water was collected from at least 15cm below the surface using a water pump with silicon tubing
   - Water was collected from the upstream direction
   - The pump was flushed with site water for at least one minute prior to sample collection
   - 3 x 20L sample bottles were filled

vi. Name of person submitting samples
   - Dennis Lu (Gartner Lee) Tests 1 & 2
   - Patrick Allard (Azimuth) Test 3

vii. **Labeling/coding of sample (Sample IDs)
   - Test 1 - G-Creek_sub_070704
   - Test 2 - G-Creek_Sublethal_270704
   - Test 3 – G-Creek_081704

viii. **Date & time of sample receipt
   - Samples for sublethal toxicity testing were collected:
     Test 1 - Saturday July 10, 2004 – 1425h
     Test 2 - Friday July 30, 2004 – 1200h
     Test 3 – Friday Aug 27, 2004 – 0945h

ix. **Temperature upon sample receipt at laboratory
   - Test 1 – 11.6 °C
   - Test 2 – 13.0 °C
   - Test 3 – 15.4 °C

Test Organisms Imported from External Supplier

i. Species of test organism
   - Topsmelt (*Atherinops affinis*)

ii. Name and city of testing laboratory
   - EVS Environment Consultants, North Vancouver, BC

iii. Source of test species
   - Aquatic Bio Systems (ABS), Fort Collins, Colorado

iv. Date test species acquired on
   - Test 1 – July 8, 2004
   - Test 2 – July 29, 2004
   - Test 3 – August 26, 2004

v. Indications of deviations from EC guidance on the importation of test organisms
   - No deviations from EC requirements

Reporting Requirements for Reference Method EPAW 95-EPA West Coast (Topsmelt)

vi. Percent mortality of fish in 24-hour period preceding the test
- Test 1 - <10% mortality
- Test 2 - <10% mortality
- Test 3 - <10% mortality

vii. Age at start of test
- Test 1 - 11 days post-hatch
- Test 2 – 10 days post-hatch
- Test 3 – 10 days post-hatch

viii. Unusual appearance, behaviour, or treatment of larvae before their use in the test
- None noted for any test.

ix. Confirmation that larvae are actively feeding and swimbladders are not inflated
- All tests - Larvae actively feeding and swimbladders not inflated

x. Confirmation that temperature change was <3°C and dissolved oxygen was maintained at >6mg/L during transport
- Temperature change was <2°C and dissolved oxygen supersaturated mg/L during transport

xi. Test organism acclimation rate at the testing laboratory
- Holding water conditions upon arrival were DO=supersaturated, pH = 7.9, T = 20°C
- Organisms were acclimated slowly overnight
- Addition of EVS lab seawater at intervals of 30 – 60min to reach acceptable conditions
- Organisms were acclimated to DO = 7.4mg/L, salinity = 28ppt, T=20°C

Test Facilities and Conditions

i. Test type & method
- 7-day Topsmelt (*Atherinops affinis*) Survival and Growth Toxicity Test
- Static renewal
- Sample water was renewed daily
- Reference Method - EPA/600/R-95/136 (EPAW 95-EPA West Coast)

ii. **Dates or test days during test when subsamples or multiple samples were renewed
- Samples were renewed daily for all tests (Test Day 1,2,3,4,5,6)
- Three subsamples were used on days i) 0-1; ii) 2-3; and iii) 4-5-6-7

iii. Indications of deviations from requirements in Sections 11 of Method EPA/600/R-95/136 (EPAW 95-EPA West Coast)
- No deviations from requirements
- Salinity controls were run
- Sample water salinity for
    - Test 1 was 7ppt
    - Test 2 was 2.6 ppt
    - Test 3 was 5.2ppt

iv. Date and time for start of definitive test
- Test 1 Saturday July 10, 2004 – 1730h (within 3 days)
- Test 2 Friday July 30, 2004 – 1500h (within 3 days)
- Test 3 Tuesday August 27, 2004 – 1230h (within 3 days)

v. **Date for test completion
- Test 1 July 17, 2004
- Test 2 August 6, 2004
- Test 3 September 3, 2004

vi. Test vessel description
- For all tests was a 600mL beaker

vii. Person(s) performing the test and verifying the results

Reporting Requirements for Reference Method EPAW 95-EPA West Coast (Topsmelt)

- Test 1: Testing by: Andy Diewald, Anja Fouche, Keven Goodearle, Ann-Marie Norris and Jenny Shao; Statistical analyses by Jenny Shao and QA/QC by Julianna Kalokai
- Test 2: Testing by: Andy Diewald, Ann-Marie Norris and Jenny Shao; Statistical analysis by Jenny Shao and Kathryn Sentance; QA/QC by Armando Tang
- Test 3: Testing by Andy Diewald, Anja Fouche and Jenny Shao; Statistics by Jenny Shao and Kathryn Sentance; QA/QC by Julianna Kalokai

viii. pH, temperature, dissolved oxygen, and conductivity of unadjusted, undiluted effluent

- Test 1: pH 8.1, T 19.5 °C, DO 9.3 mg/L, C 11660 µmhos/cm
- Test 2: pH 7.8, T 20.0 °C, DO 10.7 mg/L, C 4880 µmhos/cm
- Test 3: pH 7.6, T 20.0 °C, DO 10.1 mg/L, C 9230 µmhos/cm

ix. Confirmation that no adjustment of sample or solution pH occurred

- No pH adjustment

x. Indication of aeration of test solutions before introduction of fish

- Pre-aeration at 6.5mL/min/L for 30mins due to supersaturation of sample with O_2 when sample was heated to 19°C

xi. **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 filtering to at least 10 µm before placing it into the freezer and then freezing/refreezing to remove frozen layer and concentrate salts in the hypersaline brine)
    - No deviations from EC guidance document for salinity adjustment of sample
    - HSB was added to samples to salinity adjust them to 30ppt
    - For a 200mL volume the concentrations were prepared by adding:
        - Test 1: 145mL of effluent + 55mL of HSB for the highest concentration. This solution was then diluted using natural seawater for the lower test concentrations (i.e., 50% of the highest concentration + 50% of the dilution water, repeated for subsequent dilutions).
        - Test 2: 138mL of effluent + 62mL of HSB for the highest concentration. This solution was then diluted using natural seawater for the lower test concentrations (i.e., 50% of the highest concentration + 50% of the dilution water, repeated for subsequent dilutions).
        - Test 3: 142mL of effluent + 58mL of HSB for the highest concentration. This solution was then diluted using natural seawater to make the lower test concentrations (i.e., 50% of the highest concentration + 50% of the dilution water, repeated for subsequent dilutions).

xii. Type and source of control/dilution water

- For all 3 tests, control/dilution water was UV-sterilized, 0.45µm-filtered natural seawater from the Vancouver Aquarium

xiii. Concentrations and volumes tested:

- Concentrations (% effluent volume / total volume) tested and total volumes used were:
- For Test 1:
    - Control (0%) - 200 mL
    - Salinity Control (0%) - 200 mL
    - 4.5% - 200mL
    - 9.1% - 200mL
    - 18.2% - 200mL

Reporting Requirements for Reference Method EPAW 95-EPA West Coast (Topsmelt)

- 36.3% - 200mL
- 72.6% - 200mL

- For Test 2:
  - Control (0%) - 200 mL
  - Salinity Control (0%) - 200 mL
  - 4.3% - 200mL
  - 8.6% - 200mL
  - 17.3% - 200mL
  - 34.5% - 200mL
  - 69.0% - 200mL
- For Test 3:
  - Control (0%) - 200 mL
  - Salinity Control (0%) - 200 mL
  - 4.4% - 200mL
  - 9.0% - 200mL
  - 18.0% - 200mL
  - 36.0% - 200mL
  - 71.0% - 200mL

xiv. Number of replicated per concentration
- For all 3 tests: 5 replicates per concentration

xv. Number of organisms added to each test vessel
- For all 3 tests: 5 fish per vessel

xvi. Manner and rate of exchange of test solutions
- For all 3 test: Daily renewal

xvii. **Measurements of dissolved oxygen, pH and temperature, and salinity for each 24 hr period
- Test 1: See attached photocopied pages 1.1 and 1.2 of original laboratory report
- Test 2: See attached photocopied pages 2.1 and 2.2 of original laboratory report
- Test 3: See attached photocopied pages 3.1 and 3.2 of original laboratory report

Results

i. **Number and % of mortalities of fish in each test solution. Note that this data is presented in units of number of SURVIVORS and % MORTLITY. (Data is entered from original handwritten tables in lab reports)
- Test 1: Totals from all 5 replicates are presented (see attached pages 1.3-1.4 for original lab data):

Concentration		Number of Survivors - Day of Test							% Mortality on the Day of Test						
(% effluent v/v)	Replicate	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Control	A	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	B	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	C	5	5	5	5	4	4	4	0	0	0	0	20	0	0
	D	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	E	5	5	5	5	5	5	5	0	0	0	0	0	0	0
Brine Control	A	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	B	5	5	5	5	5	5	4	0	0	0	0	0	0	20
	C	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	D	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	E	5	5	5	5	5	5	5	0	0	0	0	0	0	0
4.5%	A	5	5	5	5	5	5	5	0	0	0	0	0	0	0

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Concentration		Number of Survivors - Day of Test							% Mortality on the Day of Test						
(% effluent v/v)	Replicate	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	B	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	C	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	D	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	E	5	5	5	5	5	5	5	0	0	0	0	0	0	0
9.1%	A	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	B	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	C	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	D	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	E	5	5	5	5	5	5	5	0	0	0	0	0	0	0
18.2%	A	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	B	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	C	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	D	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	E	5	5	5	5	5	5	5	0	0	0	0	0	0	0
36.3%	A	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	B	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	C	4	4	4	4	4	4	4	20	0	0	0	0	0	0
	D	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	E	5	5	5	5	5	5	5	0	0	0	0	0	0	0
72.6%	A	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	B	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	C	5	5	5	5	5	5	4	0	0	0	0	0	0	20
	D	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	E	5	5	5	5	5	5	4	0	0	0	0	0	0	20

- Test 2: Totals from all 5 replicates are presented (see attached pages 2.3-2.4 for original lab data):

Concentration		Number of Survivors - Day of Test							% Mortality - Day of Test						
(% effluent v/v)	Replicate	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Control	A	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	B	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	C	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	D	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	E	5	5	5	5	5	5	5	0	0	0	0	0	0	0
Brine Control	A	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	B	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	C	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	D	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	E	5	5	5	5	5	5	5	0	0	0	0	0	0	0
4.3%	A	5	5	5	5	5	5	4	0	0	0	0	0	0	20
	B	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	C	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	D	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	E	5	5	5	5	5	5	5	0	0	0	0	0	0	0
8.6%	A	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	B	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	C	5	5	5	5	5	5	4	0	0	0	0	0	0	20
	D	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	E	5	5	5	5	5	5	5	0	0	0	0	0	0	0

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Concentration		Number of Survivors - Day of Test							% Mortality - Day of Test						
(% effluent v/v)	Replicate	1	2	3	4	5	6	7	1	2	3	4	5	6	7
17.3%	A	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	B	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	C	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	D	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	E	5	5	5	5	5	5	5	0	0	0	0	0	0	0
34.5%	A	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	B	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	C	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	D	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	E	5	5	5	5	5	5	5	0	0	0	0	0	0	0
69.0%	A	5	5	5	5	4	4	4	0	0	0	0	20	0	0
	B	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	C	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	D	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	E	5	5	5	5	5	5	5	0	0	0	0	0	0	0

- Test 3: Totals from all 5 replicates are presented (see attached pages 3.3-3.4 for original lab data):

Concentration		Number of Survivors - Day of Test							% Mortality - Day of Test						
(% effluent v/v)	Replicate	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Control	A	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	B	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	C	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	D	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	E	5	5	5	5	5	5	5	0	0	0	0	0	0	0
Brine Control	A	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	B	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	C	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	D	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	E	5	5	5	5	5	5	5	0	0	0	0	0	0	0
4.4%	A	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	B	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	C	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	D	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	E	5	5	5	5	5	5	5	0	0	0	0	0	0	0
9.0%	A	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	B	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	C	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	D	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	E	5	5	5	5	5	5	5	0	0	0	0	0	0	0
18.0%	A	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	B	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	C	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	D	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	E	5	5	5	5	5	5	5	0	0	0	0	0	0	0
36.0%	A	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	B	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	C	5	5	5	5	5	5	4	0	0	0	0	0	0	20

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Concentration		Number of Survivors - Day of Test							% Mortality - Day of Test						
(% effluent v/v)	Replicate	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	D	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	E	5	5	5	5	5	5	5	0	0	0	0	0	0	0
71.0%	A	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	B	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	C	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	D	5	5	5	5	5	5	5	0	0	0	0	0	0	0
	E	5	5	5	5	5	5	5	0	0	0	0	0	0	0

ii. **Average dry weight (mg) per original fish in test vessel. No preservation of fish was used. Fish were dried and then weighed.

- Test 1: Mean dry weight (mg) of each replicate and overall means are presented:

Concentration	Replicate					Overall Mean	Standard Deviation
(% effluent v/v)	1	2	3	4	5		
Neg Control (0%)	1.2120	1.0040	0.7980	0.7880	0.8460	0.9296	0.1800
Salinity Control	1.1300	0.8540	1.3000	1.1120	0.9940	1.0780	0.1661
4.5%	0.9500	0.9440	0.9500	1.1360	1.0260	1.0012	0.0826
9.1%	1.0520	1.0060	0.9040	1.0820	1.1360	1.0360	0.0876
18.2%	1.1100	0.9080	0.9340	0.9140	0.9160	0.9564	0.0864
36.3%	1.0560	1.2980	0.9260	1.0120	1.2220	1.1028	0.1533
72.6%	0.9560	1.3320	0.8120	0.8060	1.0460	0.9904	0.2161

- Test 2: Mean dry weight (mg) of each replicate are presented:

Concentration	Replicate						
(% effluent v/v)	1	2	3	4	5	Overall Mean	Standard Deviation
Neg Control (0%)	1.000	1.122	0.952	0.962	0.866	0.9804	0.0931
Salinity Control	1.170	0.812	1.042	0.880	1.030	0.9868	0.1418
4.3%	0.754	1.078	1.064	0.814	0.840	0.9100	0.1503
8.6%	1.098	0.866	0.884	0.726	0.778	0.8704	0.1426
17.3%	0.710	0.794	0.944	0.596	0.872	0.7832	0.1363
34.5%	0.912	0.874	0.918	0.854	0.924	0.8964	0.0307
69.0%	0.486	0.818	0.756	0.808	1.000	0.7736	0.1854

- Test 3: Mean dry weight (mg) of each replicate are presented:

Concentration	Replicate						
(% effluent v/v)	1	2	3	4	5	Overall Mean	Standard Deviation
Neg Control (0%)	0.9680	0.9700	0.9780	0.8460	0.8940	0.9312	0.0585
Salinity Control	0.9040	0.8600	1.2680	0.9720	0.8080	0.9624	0.1811
4.4%	0.9380	1.5180	1.0220	0.8620	0.9420	1.0564	0.2642
9.0%	0.8960	0.8600	0.9480	0.7900	0.8320	0.8652	0.0604
18.0%	0.9240	0.6960	1.1280	1.0860	0.9940	0.9656	0.1704
36.0%	1.0900	0.8140	0.7880	1.0300	0.8900	0.9224	0.1328
71.0%	0.6680	0.7620	1.0920	0.9280	0.9060	0.8712	0.1631

iii. Estimate of 7-d LC_{50} (95% CL)

- Test 1: 7-d LC_{50} concentration > 72.6% effluent (highest concentration tested due to dilution for salinity adjustment)
- Test 2: 7-d LC_{50} concentration > 69.0% effluent (highest concentration tested due to dilution for salinity adjustment)
- Test 3: : 7-d LC_{50} concentration > 71.0% effluent (highest concentration tested due to dilution for salinity adjustment)
- Quantal statistic methods not applicable

iv. Estimate of 7-d IC_{25} (95% CL) for growth

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- Test 1: 7-d IC_{25} concentration > 72.6% effluent (highest concentration tested due to dilution for salinity adjustment)
- Test 2: 7-d IC_{25} concentration > 69.0% effluent (highest concentration tested due to dilution for salinity adjustment)
- Test 3: 7-d IC_{25} concentration > 71.0% effluent (highest concentration tested due to dilution for salinity adjustment)

v. Current reference toxicity tests (95% CL) for 7-d LC_{50} for survival and 7-d IC_{50} for growth

- Test 1 :Reference toxicity tests for Toxicant: Copper
  - Test conducted on July 10, 2004, same day as effluent test
  - Reference toxicant test was conducted on the same batch of externally supplied topsmelt used in the effluent test and under the same experimental conditions as the effluent test
  - 7-d LC_{50} survival = 161mg/L Cu, 95% CL = 139-188mg/L
  - 7-d IC_{50} growth = 147mg/L Cu, 95% CL = 119-169mg/L
- Test 2 :Reference toxicity tests for Toxicant: Copper
  - Test conducted on July 30, 2004, same day as effluent test
  - Reference toxicant test was conducted on the same batch of externally supplied topsmelt used in the effluent test and under the same experimental conditions as the effluent test
  - 7-d LC_{50} survival = 130mg/L Cu, 95% CL = 115-147mg/L
  - 7-d IC_{50} growth = 124mg/L Cu, 95% CL = 87-144mg/L
- Test 3 :Reference toxicity tests for Toxicant: Copper
  - Test conducted on August 27, 2004, same day as effluent test
  - Reference toxicant test was conducted on the same batch of externally supplied topsmelt used in the effluent test and under the same experimental conditions as the effluent test
  - 7-d LC_{50} survival = 121mg/L Cu, 95% CL = 107-137mg/L
  - 7-d IC_{50} growth = 128mg/L Cu, 95% CL = 85-150mg/L

vi. Reference toxicity warning limits (+/- SD) for 7-d LC_{50} for survival and 7-d IC_{50} for growth

- Test 1: Reference toxicity tests for Toxicant: Copper
  - 7-d LC_{50} survival = 137 ± 56mg/L Cu
  - 7-d IC_{50} growth = 135 ± 51mg/L Cu
- Test 2: Reference toxicity tests for Toxicant: Copper
  - 7-d LC_{50} survival = 129 ± 48mg/L Cu,
  - 7-d IC_{50} growth = 130 ± 52mg/L Cu
- Test 3: Reference toxicity tests for Toxicant: Copper
  - 7-d LC_{50} survival = 132 ± 48mg/L Cu,
  - 7-d IC_{50} growth = 131 ± 51mg/L Cu

APPENDIX B

92-h Echinoderm Fertilization Test

Reporting Requirements for Reference Method EPS1/RM/27-EC 92 (Sperm Cell)

Effluent Sample

i. Name & location of operation generating the effluent
   - Polaris Mine, Little Cornwallis Island, Nunavut
   - Final Discharge Point for Garrow Lake is geo referenced as 75° 22' 32" N, 97° 48' 37" W.

ii. Date & time of sampling
   - Samples for sublethal toxicity testing were collected:
     Test 1 - Wednesday July 7, 2004 – 1100h
     Test 2 - Tuesday July 27, 2004 – 2130h
     Test 3 – Tuesday Aug 24, 2004 – 1500h

iii. Type of sample
   - Final effluent water

iv. Brief description of sampling point
   - 20m downstream of the siphon discharge point at Garrow Lake dam

v. Sampling method
   - Water was collected from at least 15cm below the surface using a water pump with silicon tubing
   - Water was collected from the upstream direction
   - The pump was flushed with site water for at least one minute prior to sample collection
   - 4 x 20L sample bottles were filled

vi. Name of person submitting samples
   - Dennis Lu (Gartner Lee) Tests 1 & 2
   - Patrick Allard (Azimuth) Test 3

x. **Labeling/coding of sample (Sample IDs)
   - Test 1 - G-Creek_sub_070704
   - Test 2 - G-Creek_Sublethal_270704
   - Test 3 – G-Creek_081704

xi. **Date & time of sample receipt
   - Samples for sublethal toxicity testing were collected:
     Test 1 - Saturday July 10, 2004 – 1425h
     Test 2 - Friday July 30, 2004 – 1200h
     Test 3 – Friday Aug 27, 2004 – 0945h

xii. **Temperature upon sample receipt at laboratory
   - Test 1 – n/a no test
   - Test 2 – 13.0 °C
   - Test 3 – 15.4 °C

Test Organisms

i. Species of test organism
   - Sandollar Echinoid (*Dendraster excentricus*)

ii. Name and city of testing laboratory
   - EVS Environment Consultants, North Vancouver, BC

iii. Source of test species
   - M-REP, Escondido, California
   - All adults providing gametes are from the same population and source
   - Gametes are spawned in-house at EVS

iv. Date test species acquired on
   - Test 1: Test was not initiated due to inability of the Sandollars to spawn.
   - Test 2: July 30, 2004
   - Test 3: August 27, 2004

v. Holding time and conditions for adults
   - Test 1: N.A.

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- Test 2: Adults received at the testing laboratory the day of the test.
- Test 3: Adults received at the testing laboratory the day of the test.

vi. Indications of deviations from EC guidance on the importation of test organisms
- Test 1: na
- Test 2: No deviations from EC requirements
- Test 3: No deviations from EC requirements

vii. Weekly percent mortality of adults being held over 7d preceding test
- Test 1: na
- Test 2: <2% per day over the 7 days preceding the test
- Test 3: <2% per day over the 7 days preceding the test

viii. Age of test organisms
- Test 1: n.a.
- Test 2: < 4 hours after spawning
- Test 3: < 4 hours after spawning

ix. **Unusual appearance, behaviour, or treatment of adults or gametes before test start, or anything unusual about the test
- Test 1: Test was not initiated due to inability of the Sandollars to spawn
- Test 2 Organisms appear healthy, in good condition, nothing unusual about test organisms or test
- Test 3: Organisms appear healthy, in good condition, nothing unusual about test organisms or test

Test Facilities and Conditions

i. Test type & method
- Echinoderm (*Dendraster excentricus*) Fertilization Toxicity Test
- Static
- Reference Method – EPS/1/RM/27 with 1997 amendments

ii. Test duration
- Test 1: na
- Test 2: 10:10 min (10min sperm + 10min sperm & egg)
- Test 3: 10:10 min (10min sperm + 10min sperm & egg)

iii. Date and time for start of definitive test
- Test 1: na
- Test 2: Friday July 30, 2004 – 1620h
- Test 3: Friday August 27, 2004 – 1334h

iv. Test vessel description
- Test 1: na
- Test 2: 16 x 125mm test tubes
- Test 3: 16 x 125mm test tubes

v. Person(s) performing the test and verifying the results
- Test 1: na
- Test 2: Testing by Kathryn Sentance and Ann-Marie Norris. Statistical analyses by Jenny Shao and Kathryn Sentance. QA/QC reviewed by Julianna Kalokai.
- Test 3: Testing by Kathryn Sentance and Ann-Marie Norris. Statistical analyses by Jenny Shao and Kathryn Sentance. QA/QC reviewed by Julianna Kalokai.

vi. Indication of rate and duration of pre-aeration of test solutions before initiation of test
- Test 1: na
- Test 2: No pre-aeration noted.
- Test 3: No pre-aeration noted.

vii. Confirmation that no adjustment of sample or solution pH occurred
- Test 1: na

- Test 2: No pH adjustment
- Test 3: No pH adjustment

viii. Procedure for sample filtration
- Test 1: na
- Test 2: No sample filtration
- Test 2: No sample filtration

ix. **Procedure for preparation of hypersaline brine (HSB) as per EC guidance document on salinity adjustment – July 1997
- Test 1: na
- Test 2: Hypersaline brine (HSB) was prepared from natural seawater concentrated to 90ppt (by filtering to at least 10 μm before placing it into the freezer and then freezing/refreezing to remove frozen layer and concentrate salts in the hypersaline brine). HSB was added to samples to salinity adjust them to 30ppt. For a 10mL volume the concentrations were prepared by adding 7.31mL of effluent + 2.69mL of HSB for the highest concentration. This solution was diluted using natural seawater for the lower test concentrations (i.e., 50% of the highest concentration + 50% of the dilution water, repeated for subsequent dilutions). No deviations from EC guidance document (July 1997) for salinity adjustment of sample.
- Test 2: Hypersaline brine (HSB) was prepared from natural seawater concentrated to 90ppt (by filtering to at least 10 μm before placing it into the freezer and then freezing/refreezing to remove frozen layer and concentrate salts in the hypersaline brine). HSB was added to samples to salinity adjust them to 30ppt. For a 10mL volume the concentrations were prepared by adding 7.51mL of effluent + 2.49mL of HSB for the highest concentration. This solution was diluted using natural seawater for the lower test concentrations (i.e., 50% of the highest concentration + 50% of the dilution water, repeated for subsequent dilutions). No deviations from EC guidance document (July 1997) for salinity adjustment of sample.

x. 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

xi. Type and source of control/dilution water
- Test 1: na
- Test 2: UV-sterilized, 0.45μm-filtered natural seawater from the Vancouver Aquarium
- Test 3: UV-sterilized, 0.45μm-filtered natural seawater from the Vancouver Aquarium

xii. Concentrations and volumes tested
- Test 1: na
- Test 2: Concentrations (% effluent volume / total volume) tested and total volumes used were:
    - Control (0%) - 10mL
    - Salinity Control (0%) - 10mL
    - 4.6% - 10mL
    - 9.1% - 10mL
    - 18.3% - 10mL
    - 36.6% - 10mL
    - 73.1% - 10mL
- Test 3: Concentrations (% effluent volume / total volume) tested and total volumes used were:
    - Control (0%) - 10mL
    - Salinity Control (0%) - 10mL
    - 4.7% - 10mL
    - 9.4% - 10mL

Reporting Requirements for Reference Method EPS1/RM/27-EC 92 (Sperm Cell)

- 18.8% - 10mL
- 37.5% - 10mL
- 75.1% - 10mL

xiii. Number of replicated per concentration
- Test 1: na
- Test 2: 4 replicates per treatment concentration
- Test 3: 4 replicates per treatment concentration

xiv. **Number of organisms per container
- Test 1: na
- Test 2: 2000 eggs per vessel (100 counted)
- Test 3: 2000 eggs per vessel (100 counted)

xv. Measurements of pH and dissolved oxygen in sample water before use
- Test 1: na
- Test 2: pH 8.1, DO 8.5
- Test 3: pH 8.0, DO 8.5

xvi. Measurements of pH, temperature, dissolved oxygen, and salinity during test
- Test 1: na
- Test 2: pH – 8.0 – 8.1, T - 15.0-16.0°C, DO - 8.2-8.5mg/L, salinity - 28ppt
- Test 3: pH – 8.2 – 8.5, T - 15.0-16.0°C, DO - 8.2-8.5mg/L, salinity - 28ppt

Results

i. Number and % of fertilized eggs in each test concentration
- Test 1: na
- Test 2: (Number is equal to percent since totals were 100)
  - Control (0%): #F = 59, 62, 56, 65 #UF = 41, 38, 44, 35
  - Salinity Control: #F = 60, 57, 59, 62 #UF = 40, 43, 41, 38
  - 4.6%: #F = 60, 66, 56, 58 #UF = 40, 34, 44, 42
  - 9.1%: #F = 46, 42, 45, 42 #UF = 54, 58, 55, 58
  - 18.3%: #F = 39, 39, 37, 36 #UF = 61, 64, 63, 64
  - 36.6%: #F = 31, 34, 25, 31 #UF = 69, 66, 75, 69
  - 73.1%: #F = 19, 20, 21, 20 #UF = 81, 80, 79, 80
- Test 3: (Number is equal to percent since totals were 100)
  - Control (0%): #F = 77, 80, 74, 77 #UF = 23, 20, 26, 23
  - Salinity Control: #F = 76, 73, 79, 77 #UF = 24, 27, 21, 23
  - 4.7%: #F = 78, 74, 76, 72 #UF = 22, 26, 24, 28
  - 9.4%: #F = 61, 62, 62, 60 #UF = 39, 38, 38, 40
  - 18.8%: #F = 56, 58, 59, 55 #UF = 44, 42, 41, 45
  - 37.5%: #F = 49, 50, 50, 48 #UF = 51, 50, 50, 52
  - 75.1%: #F = 25, 27, 24, 27 #UF = 75, 73, 76, 73

ii. **Estimate of IC_{25} (95% CL) for fertilization success
- Test 1: na
- Test 2: IC_{25} concentration = 8.7 (7.6 – 9.9)% v/v effluent
- Test 3: IC_{25} concentration = 17.5 (11.6 – 22.6)% v/v effluent
- Quantitative statistic used to generate IC_{25} values was log-linear interpolation (200 resamples) calculated in ToxCalc v5.0.23 (Test 2) and log-logit interpolation (200 resamples) calculated in ToxCalc v5.0.23 (Test 3)

iii. Current reference toxicity tests (95% CL) for IC_{50} for fertilization
- Test 1: na
- Test 2: Reference toxicity tests for Toxicant: Sodium Dodecyl Sulfate

- Test conducted on July 30, 2004, same day as effluent test
- Reference test conducted under same conditions
- IC_{50} for fertilization = 2.1mg/L SDS, 95% CL = (1.9 – 2.4)mg/L

- Test 3: Reference toxicity tests for Toxicant: Sodium Dodecyl Sulfate
  - Test conducted on August 27, 2004, same day as effluent test
  - Reference test conducted under same conditions
  - IC_{50} for fertilization = 2.3mg/L SDS, 95% CL = (2.1 – 2.4)mg/L

iv. Reference toxicant warning limits (+/- 2SD) for IC_{50} for fertilization

- Test 1: na
- Test 2: 4.2 +/- 4.8 mg/L SDS
- Test 3: 3.9 +/- 4.6 mg/L SDS

APPENDIX C

7-d Sublethal *Champia* (Algae) Toxicity Test

Reporting Requirements for Reference Method EPA/600/4-91-003, Method 1009.0 (*Champia*)

Effluent Sample

i. Name & location of operation generating the effluent
   - Polaris Mine, Little Cornwallis Island, Nunavut
   - Final Discharge Point for Garrow Lake is geo referenced as 75° 22' 32" N, 97° 48' 37" W.

ii. Date & time of sampling
   - Samples for yearly sublethal toxicity testing were collected:
     Test 1 - Wednesday July 7, 2004 – 1100h
     Test 2 - Tuesday July 27, 2004 – 2130h
     Test 3 – Tuesday Aug 24, 2004 – 1500h

iii. Type of sample
   - Final effluent water

iv. Brief description of sampling point
   - 20m downstream of the siphon discharge point at Garrow Lake dam

v. Sampling method
   - Water was collected from at least 15cm below the surface using a water pump with silicon tubing
   - Water was collected from the upstream direction
   - The pump was flushed with site water for at least one minute prior to sample collection
   - 1 x 4L sample bottles were filled

vi. Name of person submitting samples
   - Dennis Lu (Gartner Lee) Tests 1 & 2
   - Patrick Allard (Azimuth) Test 3

vii. Temperature of water upon receipt at lab
   - Test 1: Test was not conducted as sample was delayed by weather and person qualified to conduct the work at the lab left for vacation. This was discussed with Sandra Blenkinsopp at the time to provide direction.
   - Test 2: 8°C
   - Test 3: 17°C

xiii. **Labeling/coding of sample (Sample IDs)
   - Test 1 - G-Creek_sub_070704
   - Test 2 - G-Creek_Sublethal_270704
   - Test 3 – G-Creek_081704

xiv. **Date & time of sample receipt
   - Samples for sublethal toxicity testing were collected:
     Test 1 – n/a test not conducted
     Test 2 - Friday July 30, 2004 – 0900h
     Test 3 – Friday Aug 27, 2004 – 0900h

Test Organisms

i. Species of test organism
   - Algae (*Champia parvula*)

ii. Name and city of testing laboratory
   - Saskatchewan Research Council [SRC], Saskatoon, SK

iii. Source of test species and health of organisms
   - Test 1: na
   - Test 2 and Test 3
     - Sexually mature male and female branches
     - Obtained from USEPA, Hatfield Marine Science Center, Newport Oregon, 1995
     - Appear in excellent health, healthy red color
     - Females have trichogynes, males have sori with spermatia

Reporting Requirements for Reference Method EPA/600/4-91-003, Method 1009.0 (*Champia*)

iv. **Any unusual appearance, behaviour, or treatment of test organisms, before their use in test
- Test 1: na
- Test 2 and Test 3
    - Nothing unusual about the appearance, behaviour, or treatment of test organisms, before their use in test; everything is normal
    - Nothing unusual about the tests

Test Facilities and Conditions

i. Test type & method
- *Champia parvula* sexual reproduction test
- Static, non-renewal
- 2-day exposure, followed by 5-7 day recovery period for cystocarp development
- Reference Method - EPA/600/4-91/003, Method 1009.0

ii. Date and time for start of definitive test
- Test 1: na
- Test 2: Friday July 30, 2004 – time not noted but lab notes state tests started within 72 hrs of collection
- Test 3: Friday August 27, 2004 – time not noted but lab notes state tests started within 72 hrs of collection

xviii. **Date for test completion
- Test 1 – n/a
- Test 2 – August 6, 2004
- Test 3 – September 3, 2004

iii. Test vessel description
- Test 1: na
- Test 2: 270mL transparent polystyrene cups with polystyrene lids
- Test 2: 270mL transparent polystyrene cups with polystyrene lids

iv. Person(s) performing the test and verifying the results
- Test 1: na
- Tests 2 & 3 - Mary Moody

v. Indication of pre-aeration of test solutions
- Test 1: na
- Tests 2 & 3 - No pre-aeration

vi. Confirmation that no pH adjustment of sample or solution occurred
- Test 1: na
- Tests 2 & 3: - No pH adjustment

vii. **Indication that EC guidance document for salinity adjustment was followed
- Test 1: na
- Test 2:
    - No deviations from EC guidance document on preparation of hypersaline brine (May 2001)
    - HSB prepared from natural seawater at 90ppt (by filtering to at least 10 μm before placing it into the freezer and then freezing/refreezing to remove frozen layer and concentrate salts in the hypersaline brine)
    - 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
- Test 3:

Reporting Requirements for Reference Method EPA/600/4-91-003, Method 1009.0 (*Champia*)

- No deviations from EC guidance document on preparation of hypersaline brine (May 2001)
- HSB prepared from natural seawater at 90ppt (by filtering to at least 10 μm before placing it into the freezer and then freezing/refreezing to remove frozen layer and concentrate salts in the hypersaline brine)
- No deviations from EC guidance document for salinity adjustment of sample
- Salinity adjustment: 600mL effluent + 230mL HSB + 10 ml test nutrient solution
- Salinity of samples adjusted from 5ppt to 30ppt

viii. Type and source of control/dilution water

- Test 1: na
- Tests 2 & 3
  - Natural seawater collected at the Pacific Environmental Center, Environment Canada, North Vancouver, BC
  - Filtered to 0.2μm and autoclaved prior to use
  - Salinity adjusted as per EC guidance document to 30ppt with HSB from the same source

ix. **Type and quantity of any chemicals added to the control dilution water

- Test 1: na
- Test 2: Test nutrients as described in Test Method USEPA/600/4-91/003, Method 1009.0 were added at concentration of 10mL/L, analytical grade, 8.5mL added
- Test 3: Test nutrients as described in Test Method USEPA/600/4-91/003, Method 1009.0 were added at concentration of 10mL/L, analytical grade, 10mL added

x. Concentrations and volumes of test solutions

- Concentrations (% effluent volume / total volume) tested and total volumes used were:
  - Test 1: na
  - Tests 2:
    - Control (Natural Seawater) (0%) - 100mL, 4.5cm depth
    - Salinity Control Brine (0%) - 100mL, 4.5cm depth
    - 4.38% - 100mL, 4.5cm depth
    - 8.75% - 100mL, 4.5cm depth
    - 17.5% - 100mL, 4.5cm depth
    - 35.0% - 100mL, 4.5cm depth
    - 70.0% - 100mL, 4.5cm depth
  - Tests 3:
    - Control (Natural Seawater) (0%) - 100mL, 4.5cm depth
    - Salinity Control Brine (0%) - 100mL, 4.5cm depth
    - 4.5% - 100mL, 4.5cm depth
    - 9.0% - 100mL, 4.5cm depth
    - 18.0% - 100mL, 4.5cm depth
    - 36.0% - 100mL, 4.5cm depth
    - 72.0% - 100mL, 4.5cm depth

xi. Number of replicated per concentration

- Test 1: na
- Tests 2 & 3: 3 replicates per concentration

xii. Number of organisms per test chamber

- Test 1: na
- Tests 2 & 3: 5 female branches + 2 male branches per chamber

xiii. Measurements of pH, temperature, dissolved oxygen, and salinity of sample before use

Reporting Requirements for Reference Method EPA/600/4-91-003, Method 1009.0 (*Champia*)

- Test 1: na
- Test 2: pH - 7.78, T – 22.0 °C, DO – 7.9mg/L, salinity - 4ppt
- Test 3: pH - 7.58, T – 23.0 °C, DO – 8.0mg/L, salinity - 5ppt

xiv. **Measurements of pH, temperature, dissolved oxygen, and salinity of test solution and controls at 0hr, 48hr, and the beginning and end of recovery period

- Test 1: na
- Test 2:

Concentration (% v/v)	Temperature (°C)				Dissolved Oxygen (mg/L)				pH (pH units)				Salinity (ppt)			
	Exposure		Recovery		Exposure		Recovery		Exposure		Recovery		Exposure		Recovery	
	0	48	0	end	0	48	0	end	0	48	0	end	0	48	0	end
Control-NSW[1]	22	23	22	23	7.9	7.9	8.0	7.9	8.20	8.35	8.33	8.22	30	30	30	30
Control-brine	22	23	22	23	7.9	7.9	8.0	7.9	7.93	8.20	8.34	8.21	30	30	30	30
A 70	22	23	22	23	7.9	7.9	8.0	7.9	7.80	8.40	8.34	8.26	30	30	30	30
C 17.5	22	23	22	23	7.9	7.9	8.0	7.9	8.15	8.31	8.34	8.36	30	30	30	30
E 4.38	22	23	22	23	7.9	7.9	8.0	7.9	8.19	8.36	8.34	8.21	30	30	30	30

[1]NSW = natural seawater

- Test 3:

Concentration (% v/v)	Temperature (°C)				Dissolved Oxygen (mg/L)				pH (pH units)				Salinity (ppt)			
	Exposure		Recovery		Exposure		Recovery		Exposure		Recovery		Exposure		Recovery	
	0	48	0	end	0	48	0	end	0	48	0	end	0	48	0	end
Control-NSW[1]	23	23	23	23	7.9	7.9	8.0	7.9	8.34	8.61	8.22	8.37	30	30	30	30
Control-brine	23	23	23	23	7.9	7.9	8.0	7.9	7.92	8.52	8.22	8.42	30	30	30	30
A 70	23	23	23	23	8.0	7.9	8.0	7.9	7.83	8.52	8.22	8.44	30	30	30	30
C 17.5	23	23	23	23	7.9	7.9	8.0	7.9	8.21	8.29	8.21	8.41	30	30	30	30
E 4.38	23	23	23	23	7.9	7.9	8.0	7.9	8.32	8.42	8.22	8.39	30	30	30	30

[1]NSW = natural seawater

Results

i. Number and % mortality of female plants after recovery in each test solution

- Totals from all 3 replicates are presented:
- Test 1: na
- Test 2:
  - Control (0%): 0 (0%) mortality
  - Salinity Control (0%): 0 (0%) mortality
  - 4.38%: 0 (0%) mortality
  - 8.75%: 0 (0%) mortality
  - 17.5%: 0 (0%) mortality
  - 35.0%: 0 (0%) mortality
  - 70.0%: 0 (0%) mortality
- Test 3:
  - Control (0%): 0 (0%) mortality
  - Salinity Control (0%): 0 (0%) mortality
  - 4.5%: 0 (0%) mortality
  - 9.0%: 0 (0%) mortality
  - 18.0%: 0 (0%) mortality
  - 36.0%: 0 (0%) mortality
  - 72.0%: 0 (0%) mortality

ii. **Mean number of cystocarps per plant in each replicate of each test concentration

- Test 1: na
- Test 2: (Replicates are A, B, and C)
  - Control (0%): A) 89.6, B) 89.8, C) 96.8
  - Salinity Control (0%): A) 86.2, B) 93.4, C) 98.0

- 4.38%: A) 114.8, B) 101.0, C) 99.6
- 8.75%: A) 108.4, B) 105.8, C) 101.0
- 17.5%: A) 81.6, B) 90.2, C) 100.2
- 35.0%: A) 54.4, B) 64.2, C) 67.0
- 70.0%: A) 9.6, B) 9.0, C) 21.4

- Test 3: (Replicates are A, B, and C)
  - Control (0%): A) 55.2, B) 62.0, C) 57.6
  - Salinity Control (0%): A) 50.8, B) 70.4, C) 55.6
  - 4.5%: A) 61.4, B) 50.8, C) 67.0
  - 9.0%: A) 63.0, B) 56.0, C) 61.0
  - 18.0%: A) 68.6, B) 53.2, C) 61.0
  - 36.0%: A) 53.8, B) 48.6, C) 51.6
  - 72.0%: A) 31.2, B) 36.4, C) 11.2

iii. **Estimate of IC_{25} (95% CL) for cystocarp development

- Test 1: na
- Test 2: IC_{25} concentration = 26.6 (20.8 – 31.5)% effluent v/v
- Test 3: IC_{25} concentration = 45.3 (36.3 – 58.1)% effluent v/v
  - Quantal statistic method was linear interpolation (200 resamples) determined using ToxCalc v5.0.23

iv. Current reference toxicity tests (95% CL) for IC_{50} for cystocarp development

- Reference toxicity tests for Toxicant: Sodium Dodecyl Sulfate
- Test 1: na
- Test 2: Test conducted on July 27, 2004, within 30 days of effluent test
  - Reference toxicant test was conducted under the same experimental conditions as the effluent test
  - IC_{50} cystocarp development = 1.48mg/L SDS, 95% CL = (1.38 - 1.62) mg/L
  - Reference toxicity warning limits 1.40 (+/- 2SD) for IC_{50} for cystocarp development
- Test 3: Test conducted on July 27, 2004, within 30 days of effluent test
  - Reference toxicant test was conducted under the same experimental conditions as the effluent test
  - IC_{50} cystocarp development = 1.48mg/L SDS, 95% CL = (1.38 - 1.62) mg/L
  - Reference toxicity warning limits 1.40 (+/- 2SD) for IC_{50} for cystocarp development

v. Reference toxicant warning limits (+/- 2SD) for IC_{50} for cystocarp development

- Reference toxicity tests for Toxicant: Sodium Dodecyl Sulfate
- Test 1: na
- Test 2: 1.40 (1.6-1.70) mg/L SDS
- Test 3: 1.40 (1.6-1.70) mg/L SDS

Note that Pages 1.1-1.4, 2.1-2.4, 3.1-3.4 are included in the hardcopy paper report only. This data can also be found in Appendix E. Note that the champia test lab reports are only included in the hardcopy paper report, not in this pdf.

APPENDIX D

Acute Toxicity Testing Laboratory Reports

EVS environment consultants

July 21, 2004

Our File: 09-0302-54.00
Work Order: 0400304/307

Cheryl Mackintosh
Azimuth Consulting Group
218 – 2902 West Broadway
Vancouver, BC V6K 2G8

Dear Ms. Mackintosh:

RE: Acute Toxicity Test Results for a sample collected July 7, 2004

We are pleased to provide you with the results of the toxicity tests performed on the sample identified as G-Creek acute 070704 (received July 10, 2004). The sample was tested with the 96-h rainbow trout LC50 test and the 48-h *Daphnia magna* LC50 test. Testing was performed according to the Environment Canada protocols for conducting acute toxicity tests using rainbow trout (EPS 1/RM/13, Second Edition, 2000) and *D. magna* (EPS 1/RM/14, Second Edition, 2000). An independent EVS QA/QC review confirmed that all acceptability criteria specified by the protocols were met. The results of these tests are summarized from the appended data and are presented in Table 1.

Table 1. Toxicity Test Results.

Sample ID	Sample Date (Time h)	96-h Rainbow Trout LC50 (95% CL) (% v/v)	48-h *Daphnia magna* LC50 (95% CL) (% v/v)
G-Creek acute 070704	7-July-04 (2200h)	>100	>100

Should you have any questions or comments regarding this report, please do not hesitate to contact the undersigned at 604-986-4331.

Sincerely,

Robert Harrison, B.Sc. Hons.
Assistant Bioassay Test Supervisor– Fish Team
rharrison@evsenvironment.com

Verified By:

QA/QC Committee:
Armando Tang, B.Sc.
Cathy McPherson, B.Sc.
Julianna Kalocai, M.Sc.
John Wilcockson, M.Sc.

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info@evsenvironment.com

EVS ENVIRONMENT CONSULTANTS
RAINBOW TROUT ACUTE TOXICITY TEST DATA SUMMARY

Client: (Polaris) Azimuth
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400304
EVS Analysts: RGH, AWD
Test Type: 96h LC50
Test Initiation Date: July 12/04 @ 1445

SAMPLE
Identification: G-Creek acute 070704
Amount Received: 2 x 20L
Date Collected: July 7 /04
Date Received: July 10 /04
Other:

DILUTION/CONTROL WATER (initial water quality)
Fresh Water (dechlorinated): ✓
Temperature (°C): 15.0
pH: 7.4
Dissolved Oxygen (mg/L): 10.1
Conductivity (µS/cm): 37
Hardness (mg/L as $CaCO_3$): 12
Alkalinity (mg/L as $CaCO_3$): 12
Other:

TEST SPECIES INFORMATION
Source: Fraser Valley
Collection Date/Batch: 052604
Control Fish Size (mean, SD and range measured at end of test)
Date Measured: July 16 /04
Fork Length (mm): 34±2 (29-37)
Wet Weight (g): 0.39±0.09 (0.22-0.54)
Reference Toxicant: SDS
Current Reference Toxicant Result
Reference Toxicant Test Date: June 21 /04
Duration of Acclimation (days): 26
96-h LC50 (and 95% CL): 23 (20 and 25) mg/L SDS
Reference Toxicant Warning Limits (mean ± 2SD) and CV
29±12 mg/L SDS CV: 21%

TEST CONDITIONS
Dissolved Oxygen Range (mg/L): 9.3 - 10.1
Temperature Range (°C): 14.0 - 15.0
pH Range: 7.0 - 8.3
Conductivity Range (µS/cm): 37 - 11843
Aeration Provided? (give rate): 6.5±1 mL/min/L
Photoperiod (L:D h): 16:8
No. Organisms/Volume: 10/10L
Loading Density (g/L): 0.39
Acclimation Before Testing (days): 47
Mortality In Previous Week of Acclimation (%): 0
Other:

TEST RESULTS The 96h LC50 is estimated at > 100% (v/v)

Data Verified By: Amanda Terry
Date Verified: August 5, 2004

EVS ENVIRONMENT CONSULTANTS
RAINBOW TROUT ACUTE TOXICITY TEST DATA

WHOLE SAMPLE WATER QUALITY

	Initial	pH Adjustment[1]	After 30-min Pre-aeration
Temp. (°C)	14		14
pH	8.1		8.1
DO (mg/L)	10.0		10.1
Cond. (µS/cm)	11730		11730

1. Document pH adjustment procedure (if used) under "Comments".

Total Pre-Aeration Time 30 min

Client Azimuth (Polaris)
EVS Project No. 09-0302-54
EVS Work Order No. 0400304
Trout Batch No. and 7-d Acclimation Mortality 052604/0%
No. Fish/Volume 10/10L
Sample ID CT-Creek acute 070704
Date/Time Collected July 7/04
Test Initiation Date/Time July 12/04 @ 1445

Concentration % (v/v)	Number of Survivors (1 to 96 hours)							Dissolved Oxygen (mg/L)					Temperature (°C)					pH					Conductivity (µS/cm)	
	1	2	4	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	96
Control				10	10	10	10	10.1	9.5	9.8	9.8	10.0	15.0	15.0	15.0	15	15	7.4	7.3	7.0	7.2	7.1	37	43
6.25				10	10	10	10	10.1	9.5	9.6	9.7	9.8	15.0	15.0	15.0	15	15	7.6	7.3	7.1	7.1	7.2	1520	1543
12.5				10	10	10	10	10.1	9.6	9.3	9.7	9.9	14.5	15.0	15.0	15	15	7.8	7.5	7.3	7.4	7.4	2270	2300
25				10	10	10	10	10.1	9.7	9.8	9.6	9.9	14.5	15.0	15.0	15	15	7.9	7.6	7.5	7.6	7.7	3660	3700
50				10	10	10	10	10.1	9.6	9.7	9.7	9.9	14.5	15.0	15.0	15	15	8.0	7.8	7.7	7.8	7.9	6070	6120
100				10	10	10	10	10.1	9.8	9.8	9.7	9.9	14.0	15.0	15.0	15	15	8.1	8.3	8.2	7.9	8.1	11730	11843
Technician Initials				RLH	RLH	~	~	RLH	RLH	RLH	~	~	RLH	RLH	RLH	~	~	RLH	RLH	RLH	~	~	RLH	~

WQ Instruments Used: Temperature Calibrated Hg Thermometer pH II-A-030302 DO II-A-3 Conductivity II-A-030306
Sample Description cloudy white/grey
Comments

Test Set Up By RLH Data Verified By Amanda Teng Date Verified July 30, 2004

EVS ENVIRONMENT CONSULTANTS
48-h *Daphnia magna* TOXICITY TEST DATA SUMMARY

Client: Azimuth (Polaris)
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400307
EVS Analysts: AKN JRY
Test Type: 48hr - LC50
Test Initiation Date: July 11, 2004

SAMPLE INFORMATION

Identification: G-Creek. 070704
Amount Received: 1 x 2L subsampled from 2x20L @ EVS
Date Collected: July 7, 2004
Date Received: 10 July 2004
Temperature (°C): 22.0 → 20.0
pH: 7.9 → 7.8
pH adjustment details: None.
Dissolved Oxygen (mg/L): 11.4 → 9.1
Pre-aeration rate and duration: @aerated 8min
Conductivity (µmhos/cm): 11850
Hardness (mg/L as $CaCO_3$): 1440
Alkalinity (mg/L as $CaCO_3$): —
Ammonia (mg/L N): —
Chlorine (mg/L Cl): —

DILUTION/CONTROL WATER (initial water quality)

Water Type: Moderately Hard H_2O (July 7B)
Temperature (°C): 20.0
pH: 8.0
Dissolved Oxygen (mg/L): 9.1
Conductivity (µS/cm): 357
Hardness (mg/L as $CaCO_3$): 98
Alkalinity (mg/L as $CaCO_3$): 66
Other: —

TEST SPECIES INFORMATION

Broodstock Culture ID (in-house culture): June 15A+B
Age (on Day 0): <24h
Days to First Brood: 8
Avg. Young/Brood (after 1st brood): 27.5
% Mortality in 7 d Before Test: ~~11.8%~~ 9.5%
Reference Toxicant: Zinc
Current Reference Toxicant Result
Reference Toxicant Test Date: July 6, 2004
48-h LC50 and 95% CL: 483 (403 - 578) mg/L Zn
Reference Toxicant Warning Limits (mean ± 2SD) and CV
462 ± 315 mg/L Zn % CV = 34

TEST CONDITIONS

Temperature Range (°C): 20.0 - 21.5
pH Range: REM 7.7-8 - 8.2
Dissolved Oxygen Range (mg/L): 8.6 - 9.1
Conductivity Range (µS/cm): 357 - 11850
Photoperiod (L:D h): 16:8
No. Organisms/Volume: 10/200mL
Other: —

TEST RESULTS The 48h LC50 for G-Creek 070704 is > 100% (v/v).

Data Verified By: Amanda Teng
Date Verified: August 5, 2004

EVS ENVIRONMENT CONSULTANTS
48-h *Daphnia magna* ACUTE TOXICITY TEST DATA

Client: Azimuth – Polaris
Sample ID: G-Creek. 070704
EVS Project No.: 09-0302-54
Date Collected: July 7, 2004
EVS Work Order No.: 0400307
Test Initiation Date/Time: July 11th/04 @ 1400
Daphnid Broodstock Batch: June 15A
No. Organisms/Volume: 10/200mL.

Concentration % (v/v)	Number of Survivors (1 to 48 h)					Dissolved Oxygen (mg/L)			Temperature (°C)			pH			Conductivity (µmhos/cm)	
	1	2	4	24	48	0	24	48	0	24	48	0	24	48	0	48
CONTROL				10	10	9.1	8.8	8.6	20.0	21.0	21.5	8.0	7.7	7.7	357	~~357~~ 358
6.25				10	10	9.1	8.8	8.7	20.0	21.0	21.0	8.0	7.8	7.8	1231	1206
12.5				10	10	9.1	8.8	8.8	20.0	21.0	21.0	8.0	7.9	7.9	2020	2000
25				10	10	9.1	8.8	8.8	20.0	21.0	21.0	7.9	7.9	8.0	3630	3600
50				10	10	9.1	8.8	8.8	20.0	21.0	21.0	7.9	8.0	8.1	6370	6270
100				10	7	9.1	8.8	8.8	20.0	21.0	21.0	7.8	8.0	8.2	11850	11640
Technician Initials				AKN	AKN	AW	AKN	AKN	AKN	AKN	AKN	AKN	AKN	AKN	AKN	AKN

Sample Description: Clear colourless
WQ Instruments Used: Temp. Calibrated Hg Thermometer pH II-A-020502 DO II-A-011201 Cond. II-A-990501
Comments:

Test Set Up By: AKN Data Verified By: Armando Tang Date Verified: August 5, 2004

AZIMUTH (POLARIS)

CHAIN-OF-CUSTODY/TEST REQUEST FORM

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: Teck Cominco
Client Contact: Bruce Donald
Ship to:

Address: Bag 2000
Kimberley, BC
V1A 3E9
Phone: 250 427-8405
Fax: 250 427.8451
Sampled by: Dennis Lu
Attn:
Shipping Date:

1 Collection Date (DD/MMM/YYYY)	1 Time (24-h clock)	Sample Identification	2 Type of Each Sample	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)	3 Sample Container Type by Code	Test(s) Requested: 96hr LC50 Rainbow Trout	Test(s) Requested: Topsmelt / Echinoderm	Test(s) Requested: D. magna 48h LC50	Test(s) Requested	Test(s) Requested	4 Sample Notes (e.g. preserved, saltwater, freshwater, may contain sewage)
~~07/Jul/2004~~	~~22:00~~	~~G-Creek_070704~~											
07/Jul/2004	22:00	G-Creek_acute_070704	E		G	2x70L		X		X			
07/Jul/2004	22:00	G-Creek_sub_070704	E		G	3x70L			X				

PO/Reference No.:
Project Title:
Results Needed By:

Comments/Instructions:

1) Released by:	Date:	2) Released by:	Date:
Company:	Time:	Company:	Time:
Courier name:		Courier name:	
1) Received: JGK	Date: 10 JUL 04	2) Received by:	Date:
Company: EVS	Time: 1425	Company:	Time:

Shaded area to be completed by EVS Laboratory upon sample receipt.

EVS Project No. 04-0302-54
EVS Work Order (WO) No. 0400302/303/304/307
EOH TOSM. RBT DAPH.
Condition Upon Receipt GOOD
Receipt Sample Temp. (C) 11.6°

1 For composite effluent or water samples, the sample collection date/time is the **end** of the compositing period.
2 Receiving Water (RW); Effluent (E); Elutriate (ELU); Sediment (SED); Chemical (CHEM); Stormwater (SW); Other (Please Specify)
3 Collapsible Carboy (CC); Glass Jar (GJ); Jerry Can (JC); Plastic HDPE (P); Other (Please Specify)
4 Please note any conditions the lab should be aware of for safety and storage concerns

Distribution of copies: White, yellow - accompany the shipment
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Please see instructions for completion on back of form.

Revision Date: March 6, 2004

EVS environment consultants

August 9, 2004

Our File: 09-0302-54.00
Work Order: 0400342,348

Cheryl Mackintosh
Azimuth Consulting Group
218 – 2902 West Broadway
Vancouver, BC V6K 2G8

Dear Ms. Mackintosh:

RE: Acute Toxicity Test Results for a sample collected July 27, 2004

We are pleased to provide you with the results of the toxicity tests performed on the sample identified as G-Creek acute 270704 (received July 27, 2004). The sample was tested with the 96-h rainbow trout LC50 test and the 48-h *Daphnia magna* LC50 test. Testing was performed according to the Environment Canada protocols for conducting acute toxicity tests using rainbow trout (EPS 1/RM/13, Second Edition, 2000) and *D. magna* (EPS 1/RM/14, Second Edition, 2000). An independent EVS QA/QC review confirmed that all acceptability criteria specified by the protocols were met. The results of these tests are summarized from the appended data and are presented in Table 1.

Table 1. Toxicity Test Results.

Sample ID	Sample Date (Time h)	96-h Rainbow Trout LC50 (95% CL) (% v/v)	48-h *Daphnia magna* LC50 (95% CL) (% v/v)
G-Creek acute 270704	27-July-04 (2130h)	>100	>100

Should you have any questions or comments regarding this report, please do not hesitate to contact the undersigned at 604-986-4331.

Sincerely,

Rachel DeWynter, B.Sc.
Algal Bioassay Supervisor
rdewynter@evsenvironment.com

Verified By:

QA/QC Committee:
Armando Tang, B.Sc.
Cathy McPherson, B.Sc.
Julianna Kalocai, M.Sc.
John Wilcockson, M.Sc.

195 Pemberton Ave.
North Vancouver, BC
Canada V7P 2R4

Tel: 604.986.4331
Fax: 604.662.8548
www.evsenvironment.com
info@evsenvironment.com

EVS ENVIRONMENT CONSULTANTS
48-h *Daphnia magna* TOXICITY TEST DATA SUMMARY

Client: Azimuth - (Polaris)
EVS Project No.: 09-0302-54.01
EVS Work Order No.: 0400348
EVS Analysts: JRY, AWD
Test Type: 48h LC50
Test Initiation Date: July 30, 2004

SAMPLE INFORMATION

Identification: G-Creek 270704
Amount Received: 3 x 20L
Date Collected: July 27, 2004
Date Received: July 30, 2004
Temperature (°C): 22.0 @ 21.5
pH: 7.8 @ 8.0
Dissolved Oxygen (mg/L): 12.1 @ 8.8
Conductivity (µmhos/cm): 5020
Hardness (mg/L as $CaCO_3$): 590
Alkalinity (mg/L as $CaCO_3$): —
Ammonia (mg/L N): —
Chlorine (mg/L Cl): —

pH adjustment details: none
① Pre-aeration rate and duration: 10 minutes gentle aeration

DILUTION/CONTROL WATER (initial water quality)

Water Type: Moderately Hard Water (July 29)
Temperature (°C): 20.0
pH: 7.8
Dissolved Oxygen (mg/L): 9.1
Conductivity (µS/cm): 363
Hardness (mg/L as $CaCO_3$): 96
Alkalinity (mg/L as $CaCO_3$): 56
Other: —

TEST SPECIES INFORMATION

Broodstock Culture ID (in-house culture): July 2B
Age (on Day 0): <24hrs.
Days to First Brood: 7
Avg. Young/Brood (after 1st brood): 24
% Mortality in 7 d Before Test: 6%
Reference Toxicant: ZnC
Current Reference Toxicant Result
Reference Toxicant Test Date: 27-Jul-04
48-h LC50 and 95% CL: 683 (578-807) mg/L Zn
Reference Toxicant Warning Limits (mean ± 2SD) and CV
463 ± 315 mg/L Zn %CV=34

TEST CONDITIONS

Temperature Range (°C): 20.0 - 21.5
pH Range: 7.7 - 8.0
Dissolved Oxygen Range (mg/L): 8.6 - 9.1
Conductivity Range (µS/cm): 363 - 5020
Photoperiod (L:D h): 16:8
No. Organisms/Volume: 10/200ml
Other: —

TEST RESULTS The 48h LC50 of G-Creek 270704 is >100% (v/v)

Data Verified By: [signature]
Date Verified: Sept. 10/04

EVS ENVIRONMENT CONSULTANTS
48-h *Daphnia magna* ACUTE TOXICITY TEST DATA

Client: Azimuth (Polaris)
EVS Project No.: 04-0302-5401
EVS Work Order No.: 0400348
Daphnid Broodstock Batch: July 2B

Sample ID: G-Creek 270704
Date Collected: July 27, 2004
Test Initiation Date/Time: July 30, 2004 @ 14:00
No. Organisms/Volume: 10/200ml

Concentration % (v/v)	Number of Survivors (1 to 48 h)					Dissolved Oxygen (mg/L)			Temperature (°C)			pH			Conductivity (µmhos/cm)	
	1	2	4	24	48	0	24	48	0	24	48	0	24	48	0	48
Control				10	10	9.1	8.9	8.7	20.0	21.0	21.0	7.8	8.1	7.9	363	374
6.25				10	10	9.0	8.9	8.6	20.5	21.0	21.0	7.8	8.1	7.8	688	680
12.5				10	10	8.9	8.8	8.7	21.0	21.0	21.0	7.9	7.7	7.7	990	984
25				10	10	8.9	8.8	8.7	21.0	21.0	21.0	7.9	7.7	7.7	1592	1586
50				10	10	8.9	8.6	8.7	21.0	21.0	21.0	7.9	7.6	7.8	2750	2690
100				10	10	8.8	8.7	8.6	21.5	21.0	21.0	8.0	7.7	7.7	5020	4940
Technician Initials				~	~	JM	~	~	JM	~	~	JM	~	~	JM	~

Sample Description: Clear, colourless
WQ Instruments Used: Temp. Calibrated Hg Thermometer pH II-A-020502 DO II-A-011201 Cond. II-A-990901
Comments:

Test Set Up By: JRY Data Verified By: [illegible] Date Verified: Sept 8/04

EVS ENVIRONMENT CONSULTANTS
RAINBOW TROUT ACUTE TOXICITY TEST DATA SUMMARY

Client: Azimuth
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400340 342 RSD
EVS Analysts: AWD
Test Type: 96h LC50
Test Initiation Date: Aug 1/04

SAMPLE
Identification: G-Creek acute 270704
Amount Received: 3x20L
Date Collected: July 27/04
Date Received: July 30/04
Other:

DILUTION/CONTROL WATER (initial water quality)
Fresh Water (dechlorinated): ✓
Temperature (°C): 14
pH: 6.8
Dissolved Oxygen (mg/L): 10.1
Conductivity (µS/cm): 30
Hardness (mg/L as $CaCO_3$): 16
Alkalinity (mg/L as $CaCO_3$): 10
Other:

TEST SPECIES INFORMATION
Source: Fraser Valley
Collection Date/Batch: 070504
Control Fish Size (mean, SD and range measured at end of test)
Date Measured: Aug 5/04
Fork Length (mm): 33 ± 2 (31-35)
Wet Weight (g): 0.34 ± 0.04 (0.29-0.42)
Reference Toxicant: SDS
Current Reference Toxicant Result
Reference Toxicant Test Date: July 23/04
Duration of Acclimation (days): 18
96-h LC50 (and 95% CL): 21 (17 and 26)
Reference Toxicant Warning Limits (mean ± 2SD) and CV
29 ± 12 mg/L SDS CV = 21%

TEST CONDITIONS
Dissolved Oxygen Range (mg/L): 9.6 - 10.1
Temperature Range (°C): 14
pH Range: 6.8 - 8.3
Conductivity Range (µS/cm): 30 - ~~4860~~ RSD 4870
Aeration Provided? (give rate): 6.5 ± 1 mL/min/L
Photoperiod (L:D h): 16:8
No. Organisms/Volume: 10/10L
Loading Density (g/L): 0.34
Acclimation Before Testing (days): 27
Mortality In Previous Week of Acclimation (%): 0.25
Other:

TEST RESULTS The 96-h LC50 was estimated to be >100% (v/v)

Data Verified By: [signature]
Date Verified: Sept. 10/04

EVS ENVIRONMENT CONSULTANTS
RAINBOW TROUT ACUTE TOXICITY TEST DATA

WHOLE SAMPLE WATER QUALITY

	Initial	pH Adjustment[1]	After 30-min Pre-aeration
Temp. (°C)	14		14
pH	7.6		7.7
DO (mg/L)	10.1		10.1
Cond. (µS/cm)	4810		4870

1. Document pH adjustment procedure (if used) under "Comments".

Total Pre-Aeration Time 30 min

Client Polaris Azimuth
EVS Project No. 09-0302-54
EVS Work Order No. 0400~~346~~342
Trout Batch No. and 7-d Acclimation Mortality 070504/0.25%
No. Fish/Volume 10/10L
Sample ID G-Creek
Date/Time Collected July 27/04 @ ~~2230~~ 2130
Test Initiation Date/Time Aug 1-04 @ 1030

Concentration % (v/v)	Number of Survivors (1 to 96 hours)							Dissolved Oxygen (mg/L)					Temperature (°C)					pH					Conductivity (µS/cm)	
	1	2	4	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	96
Control			10	10	10	10	10	10.1	9.8	9.6	9.7	9.9	14	14	14	14	14	68	71	74	72	73	38	41
6.25			10	10	10	10	10	10.1	9.8	9.6	9.7	9.7	14	14	14	14	14	71	74	75	74	72	~~260~~ 300	540
12.5			10	10	10	10	10	10.1	9.6	9.6	9.7	9.8	14	14	14	14	14	74	78	77	75	72	900	940
25			10	10	10	10	10	10.1	9.7	9.7	9.6	9.6	14	14	14	14	14	75	79	80	76	74	1670	1760
50			10	10	10	10	10	10.1	9.7	9.8	9.7	9.7	14	14	14	14	14	76	80	79	78	79	~~4840~~ 2020	2110
100			10	10	10	10	10	10.1	9.7	9.7	9.7	9.7	14	14	14	14	14	77	81	82	83	81	4870	4860
Technician Initials			~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~

WQ Instruments Used: Temperature Calibrated Hg Thermometer pH II-A-030302 DO II-A-3 Conductivity II-A-030306
Sample Description Clear
Comments

Test Set Up By ~
Data Verified By [illegible]
Date Verified Sept. 10/04

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: Teck Cominco (Polaris) Client Contact Name: Cheryl. MacKintosh Ship to:

Address: ~~Azimuth Consulting Group~~ Phone: 604 730 9220
218-2902 West Broadway Fax: 604 739 8511
Vancouver B.C. Sampled By: Karlette Tinsley Attn: Shipping Date:

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]	Tests Requested: 7D TOXMELT	RBT LC50 96H	48H ECHINODERM	48H DAPHNIA			Notes? (e.g. preserved, saltwater, freshwater, may contain sewage) [3]
For composite sample record date & time starting and ending														
27/07/04	9:30PM	G-Creek_Sublethal_270704	E			2x20L	HDPE	✓		✓				POLARIS PROJ
		G-Creek-Acute_270704	E			3x20L	HDPE		✓		✓			POLARIS PROJ

PO/Reference No.:
Project Title:
Results Needed By:

Comments/Instructions:

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

B) Received by: AWD Date: 30 JUL 04
Company: EVS Time: 12:00
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) HDPE Plastic
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

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EVS environment consultants

A member of the Golder group of companies

Golder Associates

Golder Associates Ltd.

195 Pemberton Avenue
North Vancouver, British Columbia
Canada V7P 2R4
Telephone 604-986-4331
Fax 604-662-8548

Our File: 09-0302-54.00
Work Order: 0400382,383

September 2, 2004

Cheryl Mackintosh
Azimuth Consulting Group
218 – 2902 West Broadway
Vancouver, BC V6K 2G8

Dear Ms. Mackintosh:

RE: Acute Toxicity Test Results for a sample collected August 24, 2004

We are pleased to provide you with the results of the toxicity tests performed on the sample identified as G-Creek acute 081704 (received August 24, 2004). The sample was tested with the 96-h rainbow trout LC50 test and the 48-h *Daphnia magna* LC50 test. Testing was performed according to the Environment Canada protocols for conducting acute toxicity tests using rainbow trout (EPS 1/RM/13, Second Edition, 2000) and *D. magna* (EPS 1/RM/14, Second Edition, 2000). An independent EVS QA/QC review confirmed that all acceptability criteria specified by the protocols were met. The results of these tests are summarized from the appended data and are presented in Table 1.

Table 1. Toxicity Test Results.

Sample ID	Sample Date (Time h)	96-h Rainbow Trout LC50 (95% CL) (% v/v)	48-h *Daphnia magna* LC50 (95% CL) (% v/v)
G-Creek acute 081704	24-Aug-04 (1500h)	>100	>100

Should you have any questions or comments regarding this report, please do not hesitate to contact the undersigned at 604-986-4331.

Sincerely,

Robert Harrison, B.Sc. Hons.
Assistant Bioassay Test Supervisor– Fish Team
rharrison@evsenvironment.com

Verified By:

QA/QC Committee:
Armando Tang, B.Sc.
Cathy McPherson, B.Sc.
Julianna Kalocai, M.Sc.
John Wilcockson, M.Sc.

EVS ENVIRONMENT CONSULTANTS
48-h *Daphnia magna* TOXICITY TEST DATA SUMMARY

Client: Azimuth (Polaris)
EVS Project No.: 09-1108-01.01
EVS Work Order No.: 0400383
EVS Analysts: JRY, ~~BLR~~ AWP
Test Type: 48hr LC50
Test Initiation Date: August 27, 2004

SAMPLE INFORMATION

Identification: G-Creek 081704
Amount Received: 1x2L subsampled @ EVS from 1x20L
Date Collected: August 24, 2004
Date Received: August 27, 2004
Temperature (°C): 23.0 ① 22.0
pH: 7.8 ① 8.1
Dissolved Oxygen (mg/L): 10.2 ① 8.7
Conductivity (µmhos/cm): 9320
Hardness (mg/L as $CaCO_3$): 1220
Alkalinity (mg/L as $CaCO_3$): —
Ammonia (mg/L N): —
Chlorine (mg/L Cl): —

pH adjustment details: none
Pre-aeration rate and duration: 20 minutes

DILUTION/CONTROL WATER (initial water quality)

Water Type: Moderately Hard water (Aug 23)
Temperature (°C): 20.5
pH: 8.0
Dissolved Oxygen (mg/L): 9.0
Conductivity (µS/cm): 319
Hardness (mg/L as $CaCO_3$): 84 80
Alkalinity (mg/L as $CaCO_3$): 50
Other: —

TEST SPECIES INFORMATION

Broodstock Culture ID (in-house culture): Aug 6A
Age (on Day 0): <24hrs
Days to First Brood: 7
Avg. Young/Brood (after 1st brood): 21
% Mortality in 7 d Before Test: 0
Reference Toxicant: Zinc
Current Reference Toxicant Result
Reference Toxicant Test Date: August 24, 2004
48-h LC50 and 95% CL: 536 (438 - 656) µS/cm Zn
Reference Toxicant Warning Limits (mean ± 2SD) and CV
481 ± 322 µS/cm Zn ; CV = 33

TEST CONDITIONS

Temperature Range (°C): 20.5 - 22.0
pH Range: 7.6 - 8.1
Dissolved Oxygen Range (mg/L): 8.5 - 9.0
Conductivity Range (µS/cm): 303 - 9320
Photoperiod (L:D h): 16:8
No. Organisms/Volume: 10/200ml
Other: —

TEST RESULTS The 48hr LC50 of G-Creek 081704 is >100 % (v/v).

Data Verified By: [signature]
Date Verified: Nov. 16/04

EVS ENVIRONMENT CONSULTANTS
48-h *Daphnia magna* ACUTE TOXICITY TEST DATA

Client Azimuth (Polaris)
EVS Project No. 04-1108-01.01
EVS Work Order No. 0400383
Daphnid Broodstock Batch Aug 6A

Sample ID G-Creek 081704
Date Collected August 24, 2004
Test Initiation Date/Time August 27/04 @ 11:00
No. Organisms/Volume 10/200ml

Concentration % (v/v)	Number of Survivors (1 to 48 h)					Dissolved Oxygen (mg/L)			Temperature (°C)			pH			Conductivity (µmhos/cm)	
	1	2	4	24	48	0	24	48	0	24	48	0	24	48	0	48
Control				10	10	9.0	8.8	8.7	20.5	21.0	21.5	8.0	7.6	7.7	319	303
6.25				10	10	9.0	8.7	8.7	20.5	21.5	21.5	8.0	7.6	7.7	919	924
12.5				10	10	9.0	8.7	8.6	20.5	21.5	21.5	8.0	7.7	7.8	1514	1551
25				10	10	9.0	8.7	8.6	20.5	21.5	21.5	8.0	7.6	7.8	2720	2810
50				10	10	8.9	8.6	8.5	21.0	21.5	21.5	8.0	7.7	7.8	4960	4920
100				10	10	8.7	8.7	8.5	22.0	21.5	21.5	8.1	7.7	7.8	9320	9120
Technician Initials				~	~	JM	~	~	JM	~	~	JM	~	~	JM	~

Sample Description Clear, colourless
WQ Instruments Used: Temp. Calibrated Hg Thermometer pH II-A-030501 DO II-A-011201 Cond. II-A-990501
Comments

Test Set Up By JRY Data Verified By [signature] Date Verified Nov. 16/04

EVS ENVIRONMENT CONSULTANTS
RAINBOW TROUT ACUTE TOXICITY TEST DATA SUMMARY

Client: Azimuth (Polaris)
EVS Project No.: 09-0302-54
EVS Work Order No.: 0900382
EVS Analysts: AMD, RETH
Test Type: 96-h LC50
Test Initiation Date: August 27/04 @ 1145

SAMPLE
Identification: G-Creek
Amount Received: 5 x 20L
Date Collected: Aug 24/04
Date Received: Aug 27/04
Other: —

DILUTION/CONTROL WATER (initial water quality)
Fresh Water (dechlorinated): ✓
Temperature (°C): 15
pH: 7.4
Dissolved Oxygen (mg/L): 10.1
Conductivity (µS/cm): 46
Hardness (mg/L as $CaCO_3$): 16
Alkalinity (mg/L as $CaCO_3$): 10
Other: —

TEST SPECIES INFORMATION
Source: Sun Valley
Collection Date/Batch: 072804
Control Fish Size (mean, SD and range measured at end of test)
Date Measured: Aug 31/04
Fork Length (mm): 0.40 ± 0.02 (0.38–0.44)
Wet Weight (g): 0.45 ± 0.10 (0.31–0.61)
Reference Toxicant: SDS
Current Reference Toxicant Result
Reference Toxicant Test Date: Aug 27/04
Duration of Acclimation (days): 30
96-h LC50 (and 95% CL): 38 (33 and 44) mg/L SDS
Reference Toxicant Warning Limits (mean ± 2SD) and CV
29 ± 13 mg/L SDS CV: 22%

TEST CONDITIONS
Dissolved Oxygen Range (mg/L): 9.1 – 10.1
Temperature Range (°C): 15 each
pH Range: 7.2 – 7.89
Conductivity Range (µS/cm): 46 – 7533
Aeration Provided? (give rate): 6.5 ± 1 mL/min
Photoperiod (L:D h): 16:8
No. Organisms/Volume: 10/12L
Loading Density (g/L): 0.38
Acclimation Before Testing (days): 30
Mortality In Previous Week of Acclimation (%): 0
Other: —

TEST RESULTS The 96-h LC50 was estimated to be >100% (v/v)

Data Verified By: Qualified
Date Verified: Nov 16/04

EVS ENVIRONMENT CONSULTANTS
RAINBOW TROUT ACUTE TOXICITY TEST DATA

WHOLE SAMPLE WATER QUALITY

	Initial	pH Adjustment[1]	After 30-min Pre-aeration
Temp. (°C)	15		15
pH	7.7		7.7
DO (mg/L)	9.9		10.1
Cond. (µS/cm)	7416		7416

1. Document pH adjustment procedure (if used) under "Comments".

Total Pre-Aeration Time 30 minutes

Client Azimuth (Polaris)
EVS Project No. 09-0302-S4
EVS Work Order No. 0400382
Trout Batch No. and 7-d Acclimation Mortality 072804 / 0%
No. Fish/Volume 10/12L
Sample ID G-Creek
Date/Time Collected August 24/04 @ 1500
Test Initiation Date/Time August 27/04 @ 1145

Concentration % (V/V)	Number of Survivors (1 to 96 hours)							Dissolved Oxygen (mg/L)					Temperature (°C)					pH					Conductivity (µS/cm)	
	1	2	4	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	96
Control				10	10	10	10	10.1	9.9	9.8	10.0	9.8	15	15	15	15	15	7.4	7.4	7.5	7.2	7.4	46	58
6.25				10	10	10	10	10.1	9.7	9.8	10.0	9.9	15	15	15	15	15	7.5	7.5	7.9	7.4	7.9	556	601
12.5				10	10	10	10	10.1	9.9	9.8	9.3	9.6	15	15	16	15	15	7.6	7.5	7.8	7.5	7.6	1030	1054
25				10	10	10	10	10.1	9.8	9.9	9.1	9.5	15	15	16	15	15	7.6	7.7	7.8	7.6	7.6	1825	1881
50				10	10	10	10	10.1	9.8	9.9	9.5	9.3	15	15	16	15	15	7.7	7.8	7.7	7.6	7.7	3950	3983
100				10	10	10	10	10.1	9.8	9.9	9.6	9.5	15	15	16	15	15	7.7	7.8	7.9	7.8	7.8	7416	7533
Technician Initials				RLH	~	RLH	RLH	RLH	~	~	RLH	RLH	RLH	~	~	RLH	RLH	RLH	~	~	RLH	RLH	RLH	RLH

WQ Instruments Used: Temperature Calibrated Hg Thermo pH II-A-020601 DO II-A-3 Conductivity II-A-030306
Sample Description test is clear with slight meter cloudy
Comments

Test Set Up By RLH Data Verified By [signature] Date Verified Nov. 16/04

CHAIN-OF-CUSTODY/TEST REQUEST FORM

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

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

Client Name: Azimuth Consulting Group
Address: Total Consulted, 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: ~~Brandy Beelaw~~ C. Mackintosh

Ship to: EVS Environment Consultants, 195 Pemberton Ave. North Vancouver, BC, V7P 2R4
Attn: Edmund Canaria
Shipping Date: Aug. 28, 2004

Collection Date (dd/mmm/yy)	Time (24-h clock)	Sample Identification	1 Type of Each Sample	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)	2 Sample Container Type by Code	Test(s) Requested: Rainbow trout 96-hr LC50	Daphnia magna 48-hr LC50	7-day Topsmelt	Echinoderm 48h fertilization			3 Notes? (e.g. preserved, saltwater, freshwater, may contain sewage)	Receipt Sample Temp. (°C)	4 Condition/Integrity
For composite sample record date & time starting and ending																
28/Aug/04	15:00	G-Creek 082704	E		G	5x20L	CC	✓	✓	✓	✓			Freshwater ~20 ppt		

EVS Receipt Check List

EVS Project #: 09-1108-01
EVS Workorder #: 0400382/383/384/385 RET/DM/TSM/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.: 11-03-03
Project Title: Polaris Mine
Results Needed By:

Comments/Instructions:

A) Released By: C. Mackintosh Date: Aug. 28/04
Company: Azimuth Time: 9:00am
Courier name: [illegible]
Shipping containers secured by: (Tape) (Straps) Lock Other ____ (circle one)
Custody seals used? Yes No METAL STRAPS

B) Received by: AXF Date: 29 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: White, yellow, pink - accompany the shipment
Orange - retained by consignor (e.g., shipper)
Yellow - retained by consignee (e.g., receiver)
Pink - for use as needed
White - returned to consignor by consignee

APPENDIX E

Sublethal Toxicity Testing Laboratory Reports

Azimuth Consulting Group

ENVIRONMENTAL EFFECTS MONITORING PROGRAM

July 10, 2004

PREPARED FOR:

Azimuth Consulting Group
Vancouver, BC

PREPARED BY:

EVS environment consultants
North Vancouver, BC

AZIMUTH CONSULTING GROUP

POLARIS MINE ENVIRONMENTAL EFFECTS MONITORING PROGRAM

July 10, 2004

LABORATORY REPORT

Prepared for

Azimuth Consulting Group
218-2902 W. Broadway
Vancouver, BC
V6K 2G8

Prepared by

EVS Environment Consultants
195 Pemberton Avenue
North Vancouver, BC
Canada V7P 2R4

EVS Project No.

09-0302-54

September 2004

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ACKNOWLEDGEMENTS

Toxicity testing was conducted by Andy Diewald, Anja Fouche, Keven Goodearle, Ann-Marie Norris and Jenny Shao. Statistical analyses were perfomed by Jenny Shao The report was written by Kathryn Sentance and reviewed by Edmund Canaria. Quality Assurance/Quality Control (QA/QC) review was conducted by Julianna Kalokai.

1. INTRODUCTION

EVS Environment Consultants conducted sublethal Metal Mining Effluent Regulations (MMER) toxicity testing for Azimuth Consulting Group as part of the Environmental Effects Monitoring (EEM) program for Polaris Mine.

A sample, identified as G Creek, was collected from the Polaris Mine Site on July 07, 2004 in 20-L collapsible polyethylene containers. It was received at the EVS laboratory on July 10, 2004 and was stored in the dark at 4°C prior to test initiation. The sample was evaluated for toxicity using the 7-d topsmelt (*Atherinops affinis*) survival and growth toxicity test. The 7-d topsmelt toxicity testing was initiated on the day of initial sample receipt.

This report describes the methods and results of the 7-d topsmelt (*Atherinops affinis*) toxicity test. The raw data and statistical analyses are provided in Appendix A and the chain-of-custody form is provided in Appendix B.

The sample was also intended for toxicity evaluation using the echinoderm (*Dendraster excentricus*) fertilization toxicity test as part of the EEM program requirements. The test was not initiated successfully due to inability of the sand dollars to spawn.

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) 1100-4 (EVS, 2002) 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 STATISTICAL ANALYSIS

Statistical analyses for all tests were conducted using the computer software program TOXCALC (version 5.0.23; Tidepool Scientific Software, 1994). The Power Standards were calculated as outlined by the Washington Department of Ecology (WDOE, 2001).

2.3 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	11d
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 0.45µm-filtered natural sea water from Vancouver Aquarium, BC
Dilutions	4.5, 9.1, 18.2, 36.3, 72.6% (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

3. RESULTS

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

The highest concentration tested was 72.6% due to salinity adjustment. The test results are summarized in Table 2 and the raw statistical analyses are provided in Appendix A.

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 ($p \leq 0.05$). The mean survival in both the negative and brine controls was 96%.

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.

An attempt was made to initiate the echinoderm (*Dendraster excentricus*) fertilization toxicity test as part of the sample evaluation requirements. The sand dollars purchased from Westwind Sealab Supplies, did not spawn, and consequently, the test was not initiated. The inability of the sand dollars to spawn may have resulted from various reasons such as handling of organisms during transport, seasonal conditions, holding and culturing conditions and poor quality of organisms.

Table 2. 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	96.0 ± 8.9	0.93 ± 0.18
Brine Control	96.0 ± 8.9	1.08 ± 0.17
Pooled Controls	96.0 ± 8.4	1.00 ± 0.18
4.5	100 ± 0.0	1.00 ± 0.08
9.1	100 ± 0.0	1.04 ± 0.09
18.2	100 ± 0.0	0.96 ± 0.09
36.3	96.0 ± 8.9	1.10 ± 0.15
72.6	92.0 ± 11.0	0.99 ± 0.22
TEST ENDPOINT	**SURVIVAL (% v/v)**	**GROWTH (% v/v)**
NOEC	72.6	72.6
LOEC	>72.6	>72.6
LC50	>72.6	na
IC50	na	>72.6
IC25	na	>72.6

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

4. REFERENCES

EVS (EVS Environment Consultants). 2002. Topsmelt (*Atherinops affinis*) 7-d larval survival and growth test. EVS SOP 1100-4. In: EVS Consultants Laboratory Standard Operating Procedures (SOP) Manual. Volume II: Water Toxicity Tests. EVS Environment Consultants, North Vancouver, BC.

US EPA (U.S. Environmental Protection Agency). 2002. Short-term methods for estimating the chronic toxicity of effluents and receiving waters to marine and estuarine organisms. 3rd edition. US Environmental Protection Agency, Office of Water (4303T). US Environmental Protection Agency, Washington, DC. EPA/821/R-02/014. 464 pp.

US EPA. 1995. Short term methods for estimating the chronic toxicity of effluents and receiving waters to marine and estuarine organisms. 2nd edition. US Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Office of Research and Development, Washington, DC. EPA/600/R-95/136. 563 pp.

Tidepool Scientific Software. 1994. TOXCALC: Comprehensive Toxicity Data Analysis and Database Software, Version 5.0.23. Tidepool Scientific Software, McKinleyville, CA. 80 pp.

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 Mine)
EVS Project No. 09-0302-54
EVS Work Order No. 0400303

EVS Analysts KMG. AKN AWD. AXF, JXS
Test Initiation Date 10-Jul-04

Sample	Initial Sample	Refresh Samples	
	Day 0	Day 2	Day 4
Identification	G-CREEK -070704	-	-
Amount Received		-	-
Date Collected		-	-
Date Received	10-Jul-04	-	-
Temperature (°C)	19.5 ① → 19.0	-	-
pH	8.1 ① → 8.0	-	-
DO (mg/L)	9.3 ① → 7.9	-	-
Conductivity (µmhos/cm)	11600	-	-
Salinity (ppt)	7 ① → 29	-	-
Ammonia (mg/L N)	-	-	-
Chlorine (mg/L Cl)	-	-	-
Other	-	-	-

DILUTION/CONTROL WATER (initial water quality)
Water Type UV Sterilized, Filtered Sea H2O
Temperature (°C) 20.0
pH 8.0
Dissolved Oxygen (mg/L) 7.6
Salinity 28

TEST SPECIES INFORMATION
Source Aquatic Bio Systems (ABS)
Date Received 08-Jul-04
Age (on Day 0) 11d
Reference Toxicant Cu
Current Reference Toxicant Result (incl. 95% CL)
Reference Toxicant Test Date 10-Jul-04
7-d survival LC50 ~~143~~ 161 ~~148-203~~ 203 mg/L Cu (139-188)
7-d growth IC50 147 mg/L Cu (119-169)
Reference Toxicant Warning Limits (mean ± 2SD) and CV
7-d survival LC50 134 mg/L Cu ± ~~28.5~~ 56, CV = 21%
7-d growth IC50 135 mg/L Cu ± ~~24~~ 51, CV = 19%

① Sal. adj. to 30 ± 2 ppt.

TEST CONDITIONS
Temperature Range (°C) 19.0 - 21.0
pH Range 7.8 - 8.3
Dissolved Oxygen Range (mg/L) 6.1 - 7.9
Salinity (ppt) 28 - 31
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)	72.6	> 72.6	> 72.6		
Growth		72.6	> 72.6		> 72.6	> 72.6

Other -

Data Verified By Galyn A
Date Verified August 18/04

EVS ENVIRONMENT CONSULTANTS

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

Client: Azimuth (Polaris Mine)
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400303

Sample ID: G-Creek - 070704
Test Initiation Date/Time: 10-Jul-04 / 1730h
Source/Date Received: ABS / 08-Jul-04

Concentration (% v/v)	Temperature (°C)													
	0	1		2 new	2 old	3		4 new	4 old	5 new	5 old	6 new	6 old	7
Neg. Ctl	20.0	20.0	19.5	20.0	20.5	20.0	21.0	20.0	21.0	20.0	20.5	20.0	21.0	20.5
Brine Ctl	20.0	20.0	19.5	20.0	20.5	20.0	21.0	20.0	21.0	20.0	20.5	20.0	21.0	20.5
4.5	20.0	20.0	19.5	20.0	20.5	20.0	21.0	20.0	21.0	20.0	20.5	20.0	21.0	20.5
9.1	20.0	20.0	19.5	20.0	20.5	20.0	21.0	20.0	21.0	20.0	20.5	20.0	21.0	20.5
18.2	20.0	20.0	19.5	20.0	20.5	20.0	21.0	20.0	21.0	20.0	20.5	20.0	21.0	20.5
36.3	19.5	20.0	19.5	20.0	20.5	20.0	21.0	20.0	21.0	20.0	20.5	20.0	21.0	20.5
72.6	19.0	20.0	19.5	20.0	20.5	20.5	21.0	20.0	21.0	20.0	20.5	20.0	21.0	20.5
Tech. Initials	vmb	A	A	A	A	A	JKS	JKS	JKS	A	A	JKS	JKS	A

Concentration (% v/v)	pH													
	0	1		2		3		New 4		5		6		7
Neg. Ctl	8.0	8.0	7.9	7.9	7.8	7.9	7.8	8.0	7.8	8.0	7.9	8.0	7.9	7.9
Brine Ctl	8.1	8.0	7.9	7.9	7.8	7.9	7.8	8.0	7.8	8.0	7.9	8.0	7.9	7.9
4.5	8.0	8.0	7.9	7.9	7.8	7.9	7.8	8.0	7.9	~~7.6~~ 8.1	7.9	8.0	7.9	7.9
9.1	8.0	8.0	7.9	7.9	7.8	7.9	7.8	8.0	7.9	8.1	8.0	8.0	8.0	7.9
18.2	8.0	8.0	7.9	7.9	7.8	7.9	7.9	8.1	8.0	8.2	8.1	8.1	8.0	7.9
36.3	8.0	8.0	7.9	7.9	7.9	7.9	7.9	8.1	8.0	8.3	8.1	8.1	8.1	8.0
72.6	8.0	8.0	7.9	8.0	7.9	8.1	8.0	8.2	8.1	8.3	8.2	8.2	8.1	8.1
Tech. Initials	vmb	A	A	A	AXF	A	JKS	JKS	JKS	A	A	JKS	JKS	A

WQ Instruments Used: Temp. Cal. Hg Therm. pH II-A-030301

Comments ______________________

Test Set Up By: vmb   Data Verified By: [signature]   Date Verified: August 17/04

EVS ENVIRONMENT CONSULTANTS

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

Client: Azimuth (Polaris Mine) | Sample ID: G-Creek - 070704

EVS Project No.: 04-0302.54 | Test Initiation Date/Time: 10-Jul-04 / 1730h

EVS Work Order No.: 0406303 | Source/Date Received: ABS / 08-Jul-04

Concentration (% v/v)	Salinity (ppt)							
	0	1	2	3	4	5	6	7
Neg. Ctl	28	30	28	28	28	28	28	29
Brine Ctl	29	30	30	29	29	30	30	30
4.5	28	30	28	28	28	28	28	29
9.1	28	31	28	28	28	28	28	29
18.2	28	30	28	28	28	28	28	29
36.3	28	31	28	28	28	28	28	29
72.6	29	30	28	28	28	28	28	29
Tech. Initials	KMB	AL	~	~	JLJ	~	JLJ	~

Concentration (% v/v)	Dissolved Oxygen (mg/L)													
	0	1		2		3		NEW 4		5		6		7
Neg. Ctl	7.6	7.6	7.4	7.5	6.1	7.4	6.2	7.6	6.6	7.5	6.9	7.6	6.6	6.7
Brine Ctl	7.6	7.6	7.5	7.5	6.2	7.5	6.2	7.5	6.6	7.5	6.8	7.5	6.6	6.6
4.5	7.4	7.6	7.3	7.4	6.1	7.4	6.2	7.6	6.4	7.4	6.8	7.6	6.7	6.8
9.1	7.4	7.6	7.3	7.4	6.1	7.4	6.2	7.6	6.5	7.4	6.8	7.6	6.6	6.7
18.2	7.6	7.4	7.3	7.5	6.3	7.4	6.2	7.6	6.6	7.4	6.7	7.6	6.6	6.7
36.3	7.6	7.6	7.4	7.5	6.3	7.5	6.2	7.6	6.6	7.4	6.8	7.6	6.5	6.7
72.6	7.9	7.6	7.2	7.6	6.4	7.6	6.2	7.6	6.5	7.4	6.8	7.6	6.6	6.7
Tech. Initials	KMB	~	~	AKF	AXF	~	JLJ	JLJ	JLJ	~	~	JLJ	JLJ	~

WQ Instruments Used: Salinity II-A-030306 DO II-A-3 / II-A-011202

Comments

Test Set Up By: KMB Data Verified By: [signature] Date Verified: August 17/04

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

Client: Azimuth (Polaris Mine)
EVS Project No.: 09-0302-54
EVS Work Order No.: 04C0303

Sample ID: ~~EE~~ G-Creek-070704
Test Species/Batch: A. affinis / 6-29-04
Test Initiation Date/Time: 10-Jul-04 / 1730h
No. of Organisms/Volume: 5 / 200 mL

Concentration (% v/v)	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
Neg Ctl	A	T1	5	5	5	5	5	5	5	
	B	T2	5	5	5	5	5	5	5	
	C	T3	5	5	5	5	4	4	4	
	D	T4	5	5	5	5	5	5	5	
	E	T5	5	5	5	5	5	5	5	
Reinf Ctl.	A	T6	5	5	5	5	5	5	5	
	B	T7	5	5	5	5	5	5	~~4~~ 4	
	C	T8	5	5	5	5	5	5	5	
	D	T9	5	5	5	5	5	5	5	
	E	T10	5	5	5	5	5	5	5	
4.5	A	T11	5	5	5	5	5	5	5	
	B	T12	5	5	5	5	5	5	5	
	C	T13	5	5	5	5	5	5	5	
	D	T14	5	5	5	5	5	5	5	
	E	T15	5	5	5	5	5	5	5	
9.1	A	T16	5	5	5	5	5	5	5	
	B	T17	5	5	5	5	5	5	5	
	C	T18	5	5	5	5	5	5	5	
	D	T19	5	5	5	5	5	5	5	
	E	T20	5	5	5	5	5	5	5	
Technician Initials		JW	AH	AH	JW	JW	JW	JW	JW	

Sample Description: LIGHT GREY TRANSPARENT, NO ODOUR.
Data Verified By: [signature]
Date Verified: August 17/04

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

Client: Azimuth (Polaris Mine)
EVS Project No.: 04-0302-54
EVS Work Order No.: 0400303

Sample ID: G. CREEK - 070704
Test Species/Batch: A. AFFINIS / 6.09.04
Test Initiation Date/Time: 6-JUL-04 / 1730h
No. of Organisms/Volume: 5 / 200mL

Concentration (% v/v)	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
18.2	A	T21	5	5	5	5	5	5	5	
	B	T22	5	5	5	5	5	5	5	
	C	T23	5	5	5	5	5	5	5	
	D	T24	5	5	5	5	5	5	5	
	E	T25	5	5	5	5	5	5	5	
36.3	A	T26	5	5	5	5	5	5	5	
	B	T27	5	5	5	5	5	5	5	
	C	T28	4	4	4	4	4	4	4	
	D	T29	5	5	5	5	5	5	5	
	E	T30	5	5	5	5	5	5	5	
72.6	A	T31	5	5	5	5	5	5	5	
	B	T32	5	5	5	5	5	5	5	
	C	T33	5	5	5	5	5	5	4	
	D	T34	5	5	5	5	5	5	5	
	E	T35	5	5	5	5	5	5	4	
	A									
	B									
	C									
	D									
	E									
Technician Initials		Tay								

Sample Description: LIGHT GREY, TRANSPARENT, NO ODOUR.
Data Verified By: Quality
Date Verified: August 17/04

EVS ENVIRONMENT CONSULTANTS
LARVAL FISH TOXICITY TESTS – DRY WEIGHT DATA

Client: Azimuth (Polaris Mines)
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400303
Balance Type/Serial Number: Sartorius BP211D

Test Type: 7-d Survival and Growth
Test Species: Atherinops affinis (Topsmelt)
Start Date (Day 0): July 10-04
Sample ID: G Creek-070704

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.
Ctl	A	1	1265.92	1271.98	5	5		[illegible]
	B	2	1267.67	1272.69	5	5		↓
	C	3	1264.20	1269.67	4	4		↓
	D	4	1265.68	1268.14	5	5		↓
	E	5	1265.14	1269.37	5	5		↓
Brine Ctl	A	6	1275.52	1281.17	5	5		[illegible]
	B	7	1262.43	1266.40	~~5~~ 4	4		↓
	C	8	1261.98	1268.48	5	5		↓
	D	9	1264.82	1270.38	5	5	confirmed: 1270.27 mg	↓
	E	10	~~1?62.05~~ 1262.05	1267.02	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: [signature]

Date Verified: August 17/04

EVS ENVIRONMENT CONSULTANTS
LARVAL FISH TOXICITY TESTS – DRY WEIGHT DATA

Client: Azimuth (Polaris Mines)
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400303
Balance Type/Serial Number: Sartorius BP2111

Test Type: 7 d Survival and Growth
Test Species: Atherinops affinis (Topsmelt)
Start Date (Day 0): July 10-04
Sample ID: G L Creek - 070704

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.
4.5	A	T 11	1266.53	1271.28	5	5		JJS
	B	12	1271.92	1276.64	5	5		
	C	13	1270.40	1275.21	5	5		
	D	14	1276.78	1282.46	5	5		
	E	15	1248.70	1253.83	5	5		
9.1	A	T 16	1273.13	1278.39	5	5		JJS
	B	17	1259.26	1264.29	5	5		
	C	18	1270.13	1274.65	5	5		
	D	19	1258.37	1263.78	5	5		
	E	20	1256.17	1261.85	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: Gal Jick

Date Verified: August 17/04

EVS ENVIRONMENT CONSULTANTS
LARVAL FISH TOXICITY TESTS – DRY WEIGHT DATA

Client: Azimuth (Polaris Mines)
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400303
Balance Type/Serial Number: Sartorius BP2111

Test Type: 7 d Survival and Growth
Test Species: Atherinops affinis (Topsmelt)
Start Date (Day 0): July 10-04
Sample ID: G-L Creek - 070704

Sample ID % (S/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.
18.2	A	21	1257.35	1262.90	5	5		JCS
	B	22	1273.94	1278.48	5	5	confirmed: 1278.26 ✓	
	C	23	1277.53	1282.20	5	5		
	D	24	1274.93	1279.50	5	5		
	E	25	1268.36	1272.94	5	5		
36.3	A	26	1269.83	1275.11	5	5	confirmed 1274.99 mg ✓	JCS
	B	27	1269.98	1276.47	5	5		
	C	28	1276.05	1280.68	4	4		
	D	29	1249.27	1254.33	5	5		
	E	30	1265.89	1271.96	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: Gaigh

Date Verified: August 17/04

EVS ENVIRONMENT CONSULTANTS
LARVAL FISH TOXICITY TESTS – DRY WEIGHT DATA

Client: Azimuth (Polaris Mines)
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400303
Balance Type/Serial Number: Sartorius BP211D

Test Type: 7 d Survival and Growth
Test Species: Atherinops affinis (Topsmelt)
Start Date (Day 0): July 10-04
Sample ID: 6 Creek - 070704

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.
72.6 (5/5)	A	T 31	1251.66	1256.44	5	5	confirmed: 1256.42 mg ✓	JG
↓	B	32	1263.20	1269.86	5	5		↓
	C	33	1278.57	1282.63	4	4		
	D	34	1281.29	1285.32	5	5		
	E	√ 35	1253.46	1258.69	4	4		↓
	A	T 6						
	B	7						
	C	8						
	D	9						
	E	√ 10						

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: Galyk

Date Verified: August 17/04

Test: LF-Larval Fish Growth and Survival Test | Test ID: 0400303
Species: AA-Atherinops affinis | Protocol: EPAW 95-EPA West Coast
Sample ID: G-Creek-070704 | Sample Type: EFF2-Industrial
Start Date: 7/10/2004 End Date: 7/17/2004 | 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	Neg Control	5							5	5	1271.98	1265.92
	2	2	Neg Control	5							5	5	1272.69	1267.67
	3	3	Neg Control	5							4	4	1269.67	1265.68
	4	4	Neg Control	5							5	5	1268.14	1264.2
	5	5	Neg Control	5							5	5	1269.37	1265.14
	6	1	Brine Control	5							5	5	1281.17	1275.52
	7	2	Brine Control	5							4	4	1266.7	1262.43
	8	3	Brine Control	5							5	5	1268.48	1261.98
	9	4	Brine Control	5							5	5	1270.38	1264.82
	10	5	Brine Control	5							5	5	1267.02	1262.05
	11	1	4.500	5							5	5	1271.28	1266.53
	12	2	4.500	5							5	5	1276.64	1271.92
	13	3	4.500	5							5	5	1275.21	1270.46
	14	4	4.500	5							5	5	1282.46	1276.78
	15	5	4.500	5							5	5	1253.83	1248.7
	16	1	9.100	5							5	5	1278.39	1273.13
	17	2	9.100	5							5	5	1264.29	1259.26
	18	3	9.100	5							5	5	1274.65	1270.13
	19	4	9.100	5							5	5	1263.78	1258.37
	20	5	9.100	5							5	5	1261.85	1256.17
	21	1	18.200	5							5	5	1262.9	1257.35
	22	2	18.200	5							5	5	1278.48	1273.94
	23	3	18.200	5							5	5	1282.2	1277.53
	24	4	18.200	5							5	5	1279.5	1274.93
	25	5	18.200	5							5	5	1272.94	1268.36
	26	1	36.300	5							5	5	1275.11	1269.83
	27	2	36.300	5							5	5	1276.47	1269.98
	28	3	36.300	5							4	4	1280.68	1276.05
	29	4	36.300	5							5	5	1254.33	1249.27
	30	5	36.300	5							5	5	1271.98	1265.87
	31	1	72.600	5							5	5	1256.44	1251.66
	32	2	72.600	5							5	5	1269.86	1263.2
	33	3	72.600	5							4	4	1282.63	1278.57
	34	4	72.600	5							5	5	1285.32	1281.29
	35	5	72.600	5							4	4	1258.69	1253.46

Comments: Azimuth(Polaris Mine)09-0302-54; 0400303

Reviewed by: August 18/04

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	7/10/2004	Test ID: 400303	Sample ID: G-Creek-070704
End Date:	7/17/2004	Lab ID: BCEVS-EVS Environment Cc	Sample Type: EFF2-Industrial
Sample Date:		Protocol: EPAW 95-EPA West Coast	Test Species: AA-Atherinops affinis
Comments:	Azimuth(Polaris Mine)09-0302-54; 0400303		

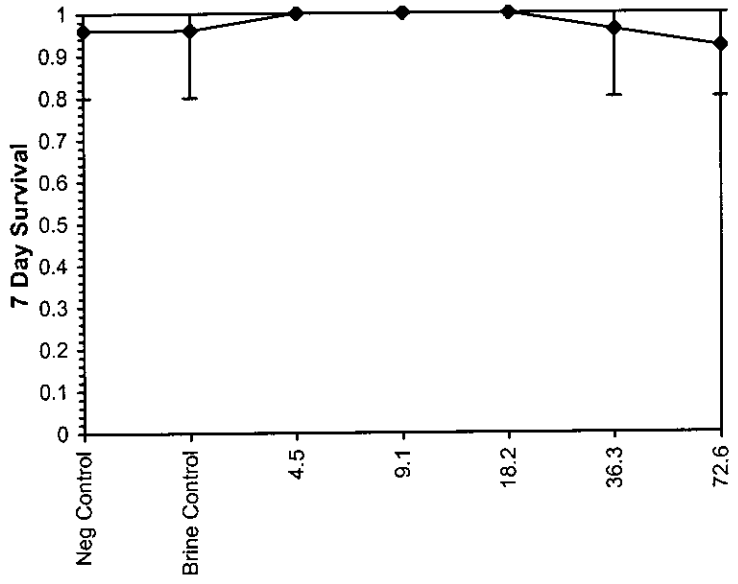
Conc-%	1	2	3	4	5
Neg Control	1.0000	1.0000	0.8000	1.0000	1.0000
Brine Control	1.0000	0.8000	1.0000	1.0000	1.0000
4.5	1.0000	1.0000	1.0000	1.0000	1.0000
9.1	1.0000	1.0000	1.0000	1.0000	1.0000
18.2	1.0000	1.0000	1.0000	1.0000	1.0000
36.3	1.0000	1.0000	0.8000	1.0000	1.0000
72.6	1.0000	1.0000	0.8000	1.0000	0.8000

			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical
Neg Control	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5		
Brine Control	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5		
4.5	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	30.00	16.00
9.1	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	30.00	16.00
18.2	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	30.00	16.00
36.3	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	27.50	16.00
72.6	0.9200	0.1095	1.2500	1.1071	1.3453	10.434	5	25.00	16.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.76012	0.9	-1.4778	1.97749
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	72.6	>72.6		1.37741

Dose-Response Plot



Statistical comparisons were aginst the Neg Control only

Reviewed by: August 18/04

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	7/10/2004	Test ID:	400303	Sample ID:	G-Creek-070704
End Date:	7/17/2004	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	EFF2-Industrial
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Azimuth(Polaris Mine)09-0302-54; 0400303				

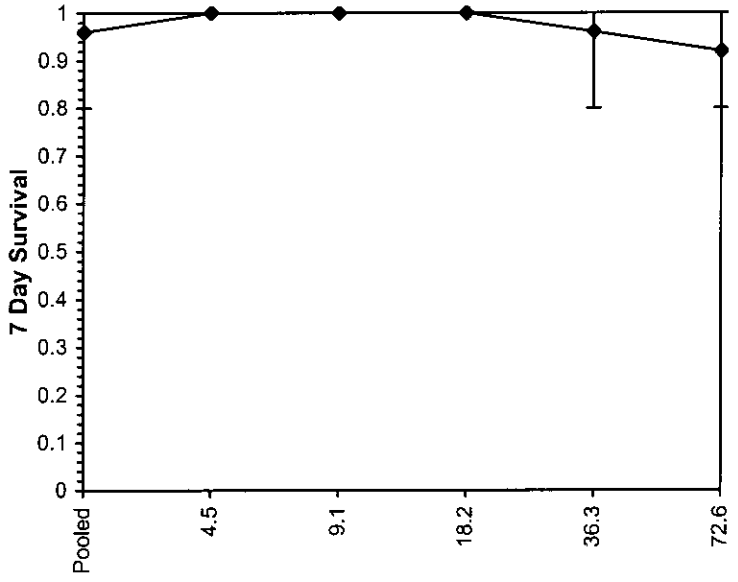
Conc-%	1	2	3	4	5
Neg Control	1.0000	1.0000	0.8000	1.0000	1.0000
Brine Control	1.0000	0.8000	1.0000	1.0000	1.0000
4.5	1.0000	1.0000	1.0000	1.0000	1.0000
9.1	1.0000	1.0000	1.0000	1.0000	1.0000
18.2	1.0000	1.0000	1.0000	1.0000	1.0000
36.3	1.0000	1.0000	0.8000	1.0000	1.0000
72.6	1.0000	1.0000	0.8000	1.0000	0.8000

			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical
Pooled	0.9600	0.0843	1.2977	1.1071	1.3453	7.738	10		
4.5	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	45.00	21.00
9.1	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	45.00	21.00
18.2	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	45.00	21.00
36.3	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	40.00	21.00
72.6	0.9200	0.1095	1.2500	1.1071	1.3453	10.434	5	35.00	21.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.74527	0.91	-1.5211	1.67424
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	72.6	>72.6		1.37741

Dose-Response Plot



Statistical comparisons were against the Pooled Controls

Reviewed by: August 18/04

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

Start Date:	7/10/2004	Test ID:	400303	Sample ID:	G-Creek-070704
End Date:	7/17/2004	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	EFF2-Industrial
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Azimuth(Polaris Mine)09-0302-54; 0400303				

Conc-%	1	2	3	4	5
Neg Control	1.2120	1.0040	0.7980	0.7880	0.8460
Brine Control	1.1300	0.8540	1.3000	1.1120	0.9940
4.5	0.9500	0.9440	0.9500	1.1360	1.0260
9.1	1.0520	1.0060	0.9040	1.0820	1.1360
18.2	1.1100	0.9080	0.9340	0.9140	0.9160
36.3	1.0560	1.2980	0.9260	1.0120	1.2220
72.6	0.9560	1.3320	0.8120	0.8060	1.0460

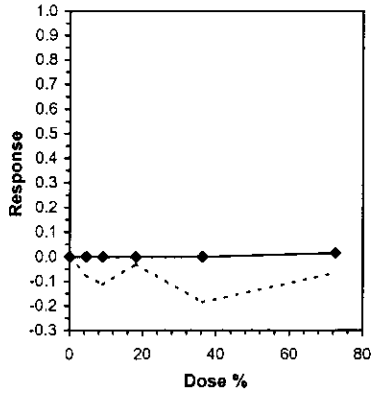
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
Neg Control	0.9296	0.1800	0.9296	0.7880	1.2120	19.366	5				1.0052	1.0000
Brine Control	1.0780	0.1661	1.0780	0.8540	1.3000	15.410	5					
4.5	1.0012	0.0826	1.0012	0.9440	1.1360	8.252	5	-0.786	2.360	0.2151	1.0052	1.0000
9.1	1.0360	0.0876	1.0360	0.9040	1.1360	8.456	5	-1.168	2.360	0.2151	1.0052	1.0000
18.2	0.9564	0.0864	0.9564	0.9080	1.1100	9.035	5	-0.294	2.360	0.2151	1.0052	1.0000
36.3	1.1028	0.1533	1.1028	0.9260	1.2980	13.901	5	-1.901	2.360	0.2151	1.0052	1.0000
72.6	0.9904	0.2161	0.9904	0.8060	1.3320	21.819	5	-0.667	2.360	0.2151	0.9904	0.9853

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.93465	0.9	0.85573	0.53805
Bartlett's Test indicates equal variances (p = 0.27)	6.38263	15.0863		
The control means are not significantly different (p = 0.21)	1.35465	2.30601		

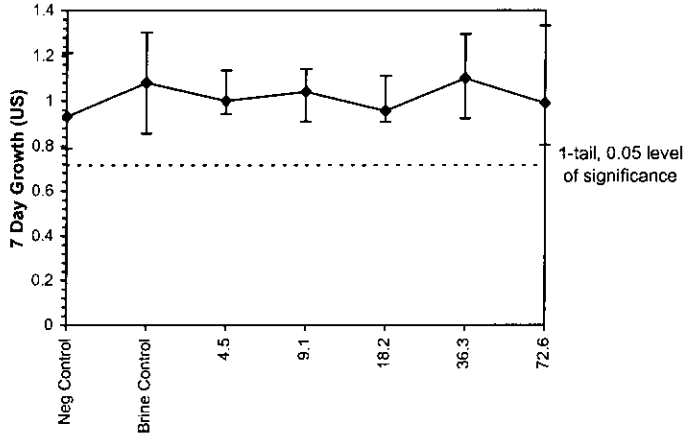
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	72.6	>72.6		1.37741	0.21507	0.23136	0.01877	0.02076	0.49467	5, 24

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)	Skew
IC05	>72.6			
IC10	>72.6			
IC15	>72.6			
IC20	>72.6			
IC25	>72.6			
IC40	>72.6			
IC50	>72.6		%(v/v)	



Dose-Response Plot



Statistical comparisons were against the Neg Control only

Reviewed by: August 18/04

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

Start Date:	7/10/2004	Test ID:	400303	Sample ID:	G-Creek-070704
End Date:	7/17/2004	Lab ID:	BCEVS-EVS Environment C	Sample Type:	EFF2-Industrial
Sample Date:		Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Azimuth(Polaris Mine)09-0302-54; 0400303				

Conc-%	1	2	3	4	5
Neg Control	1.2120	1.0040	0.7980	0.7880	0.8460
Brine Control	1.1300	0.8540	1.3000	1.1120	0.9940
4.5	0.9500	0.9440	0.9500	1.1360	1.0260
9.1	1.0520	1.0060	0.9040	1.0820	1.1360
18.2	1.1100	0.9080	0.9340	0.9140	0.9160
36.3	1.0560	1.2980	0.9260	1.0120	1.2220
72.6	0.9560	1.3320	0.8120	0.8060	1.0460

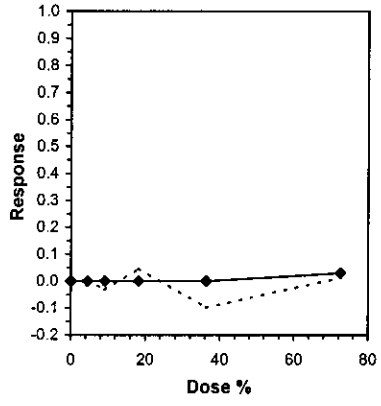
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
Pooled	1.0038	0.1811	1.0038	0.7880	1.3000	18.038	10				1.0200	1.0000
4.5	1.0012	0.0826	1.0012	0.9440	1.1360	8.252	5	0.031	2.462	0.2040	1.0200	1.0000
9.1	1.0360	0.0876	1.0360	0.9040	1.1360	8.456	5	-0.389	2.462	0.2040	1.0200	1.0000
18.2	0.9564	0.0864	0.9564	0.9080	1.1100	9.035	5	0.572	2.462	0.2040	1.0200	1.0000
36.3	1.1028	0.1533	1.1028	0.9260	1.2980	13.901	5	-1.195	2.462	0.2040	1.0200	1.0000
72.6	0.9904	0.2161	0.9904	0.8060	1.3320	21.819	5	0.162	2.462	0.2040	0.9904	0.9709

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.95473	0.91	0.53946	-0.0716
Bartlett's Test indicates equal variances (p = 0.23)	6.8891	15.0863		
The control means are not significantly different (p = 0.21)	1.35465	2.30601		

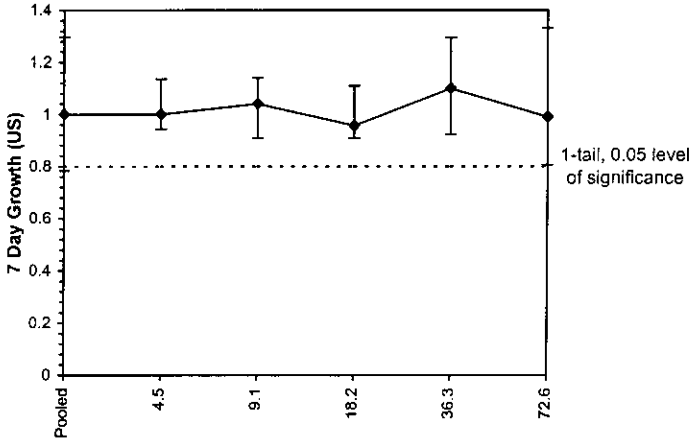
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	72.6	>72.6		1.37741	0.20401	0.20324	0.01261	0.02289	0.73615	5, 29

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)	Skew
IC05	>72.6			
IC10	>72.6			
IC15	>72.6			
IC20	>72.6			
IC25	>72.6			
IC40	>72.6			
IC50	>72.6		%(v/v)	



Dose-Response Plot



Statistical comparisons were against the Pooled controls

Reviewed by: August 18/04

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

Client: Azimuth (Polaris Mine)
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400303

EVS Analysts: KMG, AKN, AWD, AVF, JXS
Test Initiation Date: 10-Jun-04

Sample	Initial Sample	Refresh Samples	
	Day 0	Day 2	Day 4
Identification	Cu Reftox (04-Cu-001)	–	–
Amount ~~Received~~ Refreshed	1 x 1L	–	–
Date ~~Collected~~ Prepared	15-MAR-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: UV Sterilized, Filtered Sea H2O
Temperature (°C): 20.0
pH: 8.0
Dissolved Oxygen (mg/L): 7.6
Salinity: 28

TEST SPECIES INFORMATION

Source: Aquatic BioSystems (ABS)
Date Received: 08-Jun-04
Age (on Day 0): 11d
Reference Toxicant: Cu
Current Reference Toxicant Result (incl. 95% CL)
Reference Toxicant Test Date: 15-Jul-04
7-d survival LC50: 161 mg/L Cu (139-188)
7-d growth IC50: 147 mg/L Cu (119-169)
Reference Toxicant Warning Limits (mean ± 2SD) and CV
7-d survival LC50: 137 mg/L Cu ± 23.50 CV = 21%
7-d growth IC50: 135 mg/L Cu ± 26.51 CV = 19%

TEST CONDITIONS

Temperature Range (°C): 19.5 - 20.5
pH Range: 7.8 - 8.0
Dissolved Oxygen Range (mg/L): 6.4 - 7.6
Salinity (ppt): 23-33
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 Cu	100	180	161 (139-188)		
Growth		100	180		147 (119-169)	101 (63-133)

Other: –

Data Verified By: Qualified
Date Verified: August 17/04

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

Client: Azimuth (Polaris Mine)
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400303

Sample ID: Cu Reftox
Test Initiation Date/Time: 10-Jul-04 / 1715h
Source/Date Received: ABS / 08-Jul-04

Concentration (µg/L Cu)	Temperature (°C)														
	0	1		New 2	old 2	New 3	old 3	New 4	old 4	5		6		7
CTL	20.0	20.0	20.0	20.0	20.0	20.0	20.5	20.0	20.0	20.0	20.5	20.0	20.0	20.0
32	20.0	20.0	19.5	20.0	20.0	20.0	20.5	20.0	20.0	20.0	20.5	20.0	20.0	20.0
56	20.0	20.0	19.5	20.0	20.0	20.0	20.5	20.0	20.0	20.0	20.5	20.0	20.0	20.0
100	20.0	20.0	19.5	20.0	20.0	20.0	20.5	20.0	20.0	20.0	20.5	20.0	20.0	20.0
180	20.0	20.0	19.5	20.0	20.0	20.0	20.5	20.0	20.0	20.0	20.5	20.0	20.0	20.0
320	20.0	20.0	19.5	20.0	20.0	20.0	20.5	20.0	20.0	20.0	20.5	20.0	20.0	20.0
Tech. Initials	VMB	AKN	A	A	JWS	A	A	JWS	JWS	A	A	JWS	JWS	A

Concentration (µg/L Cu)	pH														
	0	1		New 2	old 2	New 3	old 3	New 4		5		6		7
CTL	8.0	8.0	7.9	7.9	7.8	7.9	7.8	7.9	7.9	8.0	7.9	8.0	7.9	7.9
32	8.0	8.0	7.9	7.9	7.8	7.9	7.8	7.9	7.9	8.0	7.9	8.0	7.9	7.9
56	8.0	8.0	7.8	7.9	7.8	7.9	7.9	7.9	7.9	8.0	7.9	8.0	7.9	7.9
100	8.0	8.0	7.8	7.9	7.8	7.9	7.9	7.9	7.9	8.0	7.9	8.0	7.9	7.9
180	8.0	8.0	7.8	7.9	7.8	7.9	7.9	7.9	7.9	8.0	7.9	8.0	7.9	7.9
320	8.0	8.0	7.8	7.9	7.8	7.9	7.9	7.9	7.9	8.0	8.0	8.0	7.9	7.9
Tech. Initials	VMB	AKN	A	A	AXF/A	A	A	JWS	JWS	A	A	JWS	JWS	A

WQ Instruments Used: Temp. Cal. Hg Therm. pH I-A-0303C1

Comments

Test Set Up By: VMB   Data Verified By: [signature]   Date Verified: August 17/04

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

Client: Azimuth (Polaris Mine) | Sample ID: Cu Reftox
EVS Project No.: 09-0302-54 | Test Initiation Date/Time: 10-Jul-04 / 1715h
EVS Work Order No.: 0400303 | Source/Date Received: ABS / 08-Jul-04

Concentration (µg/L Cu)	Salinity (ppt)							
	0	1	2	3	4	5	6	7
CTL	28	30	28	28	28	28	28	29
32	28	30	28	28	28	28	28	29
56	28	30	28	28	28	28	28	29
100	28	30	28	28	28	29	28	29
180	28	30	28	28	28	28	28	29
320	28	30	28	28	28	28	28	29
Tech. Initials	KMC	AW	AM	AM	JC	AM	JC	AM

Concentration (µg/L Cu)	Dissolved Oxygen (mg/L)													
	0	1		2		3		New 4		5		6		7
CTL	7.6	7.6	7.5	7.5	6.4 AXE	7.4	6.4	7.6	6.6	7.5	7.0	7.6	6.6	7.0
32	7.6	7.6	7.5	7.5	6.4	7.4	6.6	7.6	6.6	7.5	7.0	7.6	6.8	6.9
56	7.6	7.6	7.4	7.5	6.7	7.4	6.5	7.6	6.4	7.5	7.0	7.6	6.6	6.9
100	7.6	7.6	7.4	7.5	6.6	7.4	6.6	7.6	6.6	7.5	7.0	7.6	6.7	6.9
180	7.6	7.6	7.4	7.5	6.8	7.4	6.4	7.6	6.6	7.5	7.0	7.6	6.7	6.7
320	7.6	7.6	7.0	7.5	6.9	7.4	6.7	7.6	6.6	7.5	6.9	7.6	6.7	6.6
Tech. Initials	KMC	AW	AM	AM	AXE/AM	AM	JAS	JC	JC	AM	AM	JC	JC	AM

WQ Instruments Used: Salinity II-A-030306 DO II-A-3 / II-A-011202

Comments

Test Set Up By: KMC Data Verified By: [signature] Date Verified: August 17/04

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

Client: Azimuth (Polaris Nine)
EVS Project No.: 09-0302-54
EVS Work Order No.: 04CC303

Sample ID: Cu Reftox
Test Species/Batch: A. affinis / 6.29.04
Test Initiation Date/Time: 10-Jul-04 / 1715h
No. of Organisms/Volume: 5 / 200mL

Concentration (mg/L Cu)	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
CTL	A	T36	5	5	5	5	5	5	5	
	B	T37	5	5	5	5	5	5	5	
	C	T38	5	5	5	5	5	5	5	
	D	T39	5	5	5	5	5	5	5	
	E	T40	5	5	5	5	5	4	4	
32	A	T41	5	5	5	5	5	5	5	
	B	T42	5	5	5	5	5	5	5	
	C	T43	5	5	5	5	5	5	5	
	D	T44	5	5	5	5	5	5	5	
	E	T45	5	5	5	5	5	5	5	
56	A	T46	5	5	5	5	5	5	5	
	B	T47	5	5	5	5	5	5	5	
	C	T48	5	5	5	5	5	5	5	
	D	T49	5	5	5	5	5	5	5	
	E	T50	5	5	5	5	5	5	5	
100	A	T51	5	5	5	4	4	~~3~~	~~3~~	
	B	T52	5	5	5	5	5	5	5	
	C	T53	5	5	5	5	5	5	5	
	D	T54	5	5	4	4	4	4	~~4~~	
	E	T55	5	5	5	5	5	5	5	
Technician Initials		TW	AW	AW		TW	TW	TW		

Sample Description: CLEAR, COLORLESS, ODORLESS.
Data Verified By: Qualified
Date Verified: August 17/04

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

Client: Azimuth (Polaris Mine)
EVS Project No.: C9-0302-54
EVS Work Order No.: 04CC303

Sample ID: Cu Reflex
Test Species/Batch: A. affinis / 6.29.04
Test Initiation Date/Time: 10-Jul-04 / 1715h
No. of Organisms/Volume: 5 / 200mL

Concentration (µg/L Cu)	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
180	A	T56	5	5	4	4	3	3	3	
	B	T57	5	3	1	1	1	1	1	
	C	T58	5	4	2	2	2	2	2	
	D	T59	5	3	2	1	1	1	1	
	E	T60	4	3	3	2	2	2	2	
320	A	T61	1	0	—	—	—	—	—	
	B	T62	3	3	3	2	2	2	2	
	C	T63	2	2	1	0	—	—	—	
	D	T64	1	1	0	—	—	—	—	
	E	T65	3	3	1	0	—	—	—	
	A									
	B									
	C									
	D									
	E									
	A									
	B									
	C									
	D									
	E									
Technician Initials		JZS	AHW	AHW	N	JZS	JZS	JZS	N	

Sample Description: CLEAR, COLOURLESS, ODOURLESS.
Data Verified By: Qualified
Date Verified: August 17/04

EVS ENVIRONMENT CONSULTANTS
LARVAL FISH TOXICITY TESTS – DRY WEIGHT DATA

Client: Azimuth (Polaris Mines)
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400303
Balance Type/Serial Number: Sartorius BP2111

Test Type: 7 d Survival and Growth
Test Species: Arctinops affinis (Topsmelt)
Start Date (Day 0): July 10-04
Sample ID: Cu Reftox

Sample ID 49/L Cu	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.
320	A	T61	1255.61	—	0	0		TM
	B	62	1256.09	1257.79	2	2		
	C	63	1268.85	—	0	0		
	D	64	1252.87	—	0	0		
	E	65	1270.02	—	0	0		
180	A	T56	1252.98	1255.06	3	3		TM
	B	57	1247.43	1248.02	1	1		
	C	58	1270.37	1272.49	2	2	confirmed 1272.50 mg ✓	
	D	59	1280.94	1281.59	1	1		
	E	60	1280.02	1282.095	2	2		

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: Qualified

Date Verified: August 17/04

EVS ENVIRONMENT CONSULTANTS
LARVAL FISH TOXICITY TESTS – DRY WEIGHT DATA

Client: Azimuth (Polaris Mines)
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400303
Balance Type/Serial Number: Sartorius BP2111)

Test Type: 7 d Survival and Growth
Test Species: Atherinops affinis (Topsmelt)
Start Date (Day 0): July 10-04
Sample ID: Cu Reftox

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.
49/L Cu								
100	A	T51	1272.54	1275.53	3	3		JZS
	B	52	1242.48	1247.54	5	5		
	C	53	1265.30	1269.62	5	5		
	D	54	1240.38	1243.48	4	4		
	E	55	1264.67	1269.25	5	5		
56	A	T46	1286.39	1291.02	5	5	confirm 1291.095 mg ✓	JZS
	B	47	1271.46	1276.05	5	5		
	C	48	1238.91	1243.78	5	5		
	D	49	1262.66	1267.58	5	5		
	E	50	1256.18	1261.80	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: Qualified

Date Verified: August 17/04

EVS ENVIRONMENT CONSULTANTS
LARVAL FISH TOXICITY TESTS – DRY WEIGHT DATA

Client: Azimuth (Polaris Mines)
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400303
Balance Type/Serial Number: Sartorius BP2111)

Test Type: 7-d Survival and Growth
Test Species: Atherinops affinis (Topsmelt)
Start Date (Day 0): July 10-04
Sample ID: Cu Reftox

Sample ID 49/L Cu	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.
32	A	T41	1280.70	1283.69 71	5	5		JCS
	B	42	1256.85	1261.03	5	5		
	C	43	1272.55	1276.95	5	5		
	D	44	1278.22	1284.04	5	5		
	E	45	1273.94	1280.06	5	5		
Ctl	A	T36	1272.84	1277.49	5	5		JCS
	B	37	1275.33	1280.65	5	5	confirmed: 1280.57 mg ✓	
	C	38	1269.27	1274.85	5	5		
	D	39	1236.88	1241.99	5	5		
	E	40	1264.45	1269.15	4	4		

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: Rachel

Date Verified: August 17/04

Test: LF-Larval Fish Growth and Survival Test
Species: AA-Atherinops affinis
Sample ID: REF-Ref Toxicant
Start Date: 7/10/2004 End Date: 7/17/2004

Test ID: RTAACu36
Protocol: EPAW 95-EPA West Coast
Sample Type: CU-Copper
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	1277.49	1272.84
	2	2	D-Control	5							5	5	1280.65	1275.33
	3	3	D-Control	5							5	5	1274.85	1269.27
	4	4	D-Control	5							5	5	1241.99	1236.88
	5	5	D-Control	5							4	4	1269.15	1264.45
	6	1	32.000	5							5	5	1283.71	1280.7
	7	2	32.000	5							5	5	1261.03	1256.85
	8	3	32.000	5							5	5	1276.95	1272.95
	9	4	32.000	5							5	5	1284.04	1278.22
	10	5	32.000	5							5	5	1280.06	1273.94
	11	1	56.000	5							5	5	1291.02	1286.39
	12	2	56.000	5							5	5	1276.05	1271.46
	13	3	56.000	5							5	5	1243.78	1238.91
	14	4	56.000	5							5	5	1267.58	1262.66
	15	5	56.000	5							5	5	1261.8	1256.18
	16	1	100.000	5							3	3	1275.53	1272.54
	17	2	100.000	5							5	5	1247.54	1242.48
	18	3	100.000	5							5	5	1269.68	1265.3
	19	4	100.000	5							4	4	1243.48	1240.38
	20	5	100.000	5							5	5	1269.25	1264.67
	21	1	180.000	5							3	3	1255.06	1252.98
	22	2	180.000	5							1	1	1248.02	1247.43
	23	3	180.000	5							2	2	1272.49	1270.37
	24	4	180.000	5							1	1	1281.59	1280.94
	25	5	180.000	5							2	2	1282.05	1280.02
	26	1	320.000	5							0	0	0	1255.61
	27	2	320.000	5							2	2	1257.79	1256.09
	28	3	320.000	5							0	0	0	1268.85
	29	4	320.000	5							0	0	0	1252.87
	30	5	320.000	5							0	0	0	1270.02

Comments: 09-0302-54, 0400303

Reviewed by: August 17/04

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	7/10/2004	Test ID:	RTAACu36	Sample ID:	REF-Ref Toxicant
End Date:	7/17/2004	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, 0400303				

Conc-ug/L	1	2	3	4	5
D-Control	1.0000	1.0000	1.0000	1.0000	0.8000
32	1.0000	1.0000	1.0000	1.0000	1.0000
56	1.0000	1.0000	1.0000	1.0000	1.0000
100	0.6000	1.0000	1.0000	0.8000	1.0000
180	0.6000	0.2000	0.4000	0.2000	0.4000
320	0.0000	0.4000	0.0000	0.0000	0.0000

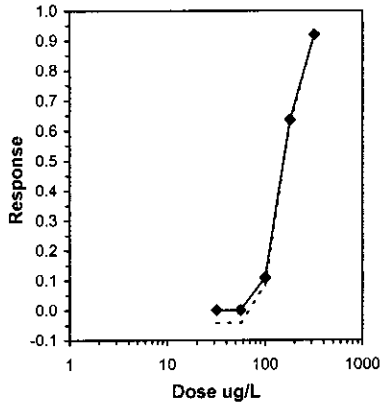
			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-ug/L	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
D-Control	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5			1	25
32	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	30.00	16.00	0	25
56	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	30.00	16.00	0	25
100	0.8800	0.1789	1.2058	0.8861	1.3453	17.113	5	24.50	16.00	3	25
*180	0.3600	0.1673	0.6366	0.4636	0.8861	27.958	5	15.00	16.00	16	25
*320	0.0800	0.1789	0.3174	0.2255	0.6847	64.711	5	15.00	16.00	23	25

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.93876	0.9	0.31435	1.7423
Equality of variance cannot be confirmed				

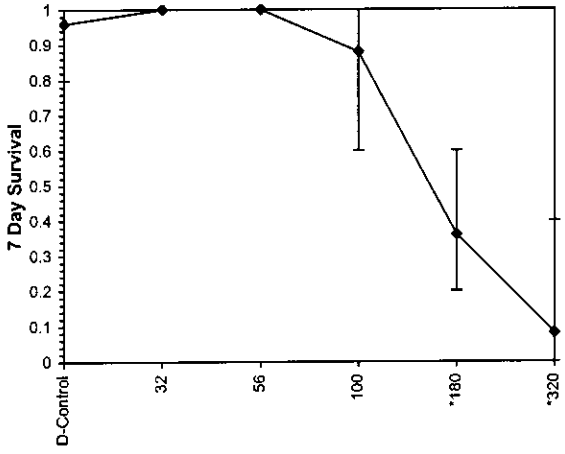
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	100	180	134.164	

Trimmed Spearman-Karber

Trim Level	EC50	95% CL		
0.0%				
5.0%				
10.0%	161.11	138.26	187.73	
20.0%	158.05	132.14	189.04	
Auto-8.1%	161.46	138.66	188.00	ug/L Cu



Dose-Response Plot



Reviewed by Qalijk August 17/04

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

Start Date:	7/10/2004	Test ID:	RTAACu36	Sample ID:	REF-Ref Toxicant
End Date:	7/17/2004	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, 0400303				

Conc-ug/L	1	2	3	4	5
D-Control	0.9300	1.0640	1.1160	1.0220	0.9400
32	0.6020	0.8360	0.8000	1.1640	1.2240
56	0.9260	0.9180	0.9740	0.9840	1.1240
100	0.5980	1.0120	0.8760	0.6200	0.9160
180	0.4160	0.1180	0.4240	0.1300	0.4060
320	0.0000	0.3400	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	1.0144	0.0798	1.0144	0.9300	1.1160	7.871	5				1.0144	1.0000
32	0.9252	0.2619	0.9252	0.6020	1.2240	28.309	5	0.851	2.360	0.2474	0.9552	0.9416
56	0.9852	0.0828	0.9852	0.9180	1.1240	8.403	5	0.279	2.360	0.2474	0.9552	0.9416
100	0.8044	0.1853	0.8044	0.5980	1.0120	23.031	5	2.004	2.360	0.2474	0.8044	0.7930
*180	0.2988	0.1598	0.2988	0.1180	0.4240	53.465	5	6.827	2.360	0.2474	0.2988	0.2946
*320	0.0680	0.1521	0.0680	0.0000	0.3400	223.607	5	9.029	2.360	0.2474	0.0680	0.0670

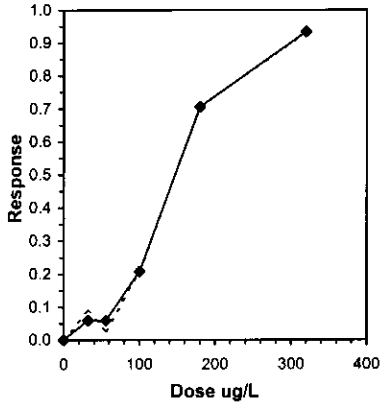
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97039	0.9	0.15928	-0.3767
Bartlett's Test indicates equal variances (p = 0.21)	7.13123	15.0863		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	100	180	134.164		0.24736	0.24385	0.80038	0.02746	1.9E-09	5, 24

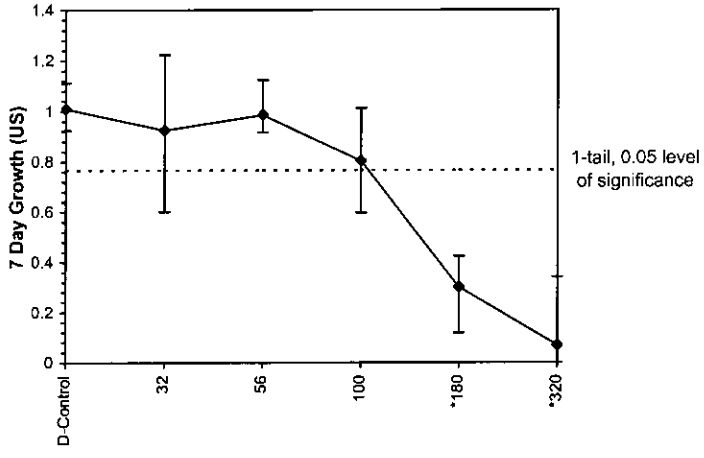
Linear Interpolation (200 Resamples)

Point	ug/L	SD	95% CL(Exp)		Skew
IC05*	27.42	22.74	0.00	93.30	0.4541
IC10	68.32	24.38	0.00	122.43	-0.2058
IC15	83.12	21.17	0.00	125.48	-0.8306
IC20	97.92	15.93	48.64	127.61	-0.9650
IC25	106.90	12.35	63.02	133.27	-0.3411
IC40	130.97	9.49	95.73	153.51	-0.4555
IC50	147.03	8.36	119.23	169.15	-0.1133

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



ToxCalc v5.0.23

Reviewed by: August 17/04

APPENDIX B

Chain-of-Custody Form

AZIMUTH (POLARIS)

CHAIN-OF-CUSTODY/TEST REQUEST FORM

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: Teck Cominco
Client Contact: Bruce Donald
Ship to:

Address: Bag 2000
Kimberley, BC
V1A 3E1
Phone: 250 427-8405
Fax: 250 427-8451
Sampled by: Dennis Lu
Attn:
Shipping Date:

1 Collection Date (DD/MMM/YYYY)	1 Time (24-h clock)	Sample Identification	2 Type of Each Sample	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)	3 Sample Container Type by Code	Test(s) Requested: 96h LC50 Rainbow Trout	Test(s) Requested: Topsmelt / Echinoderm	Test(s) Requested: D. magna 48h LC50	Test(s) Requested	Test(s) Requested	4 Sample Notes (e.g. preserved, saltwater, freshwater, may contain sewage)
~~07/Jul/2004~~	~~22:00~~	~~G-Creek_070704~~											
07/Jul/2004	22:00	G-Creek_comte_070704	E		G	2x20L		X		X			
07/Jul/2004	22:00	G-Creek_sub_070704	E		G	3x20L			X				

PO/Reference No.:
Project Title:
Results Needed By:

Comments/Instructions:

1) Released by:	Date:	2) Released by:	Date:
Company:	Time:	Company:	Time:
Courier name:		Courier name:	
1) Received: JGK	Date: 10 Jul 04	2) Received by:	Date:
Company: EVS	Time: 1425	Company:	Time:

Shaded area to be completed by EVS Laboratory upon sample receipt.

EVS Project No. 04-0302-54
EVS Work Order (WO) No. 0400302/303/304/307
EOH TOBM. RBT DAPH.
Condition Upon Receipt GOOD
Receipt Sample Temp. (C) 11.6°

1 For composite effluent or water samples, the sample collection date/time is the **end** of the compositing period.
2 Receiving Water (RW); Effluent (E); Elutriate (ELU); Sediment (SED); Chemical (CHEM); Stormwater (SW); Other (Please Specify)
3 Collapsible Carboy (CC); Glass Jar (GJ); Jerry Can (JC); Plastic HDPE (P); Other (Please Specify)
4 Please note any conditions the lab should be aware of for safety and storage concerns

Distribution of copies: White, yellow - accompany the shipment
Pink - kept by consignor (e.g., shipper)
Yellow - kept by consignee (e.g., receiver)
White - returned to consignor by consignee

Please see instructions for completion on back of form.

Revision Date: March 6, 2004

September 2004

LABORATORY REPORT

Azimuth Consulting Group

POLARIS MINE

ENVIRONMENTAL EFFECTS MONITORING PROGRAM

July 30, 2004

PREPARED FOR:

Azimuth Consulting Group
Vancouver, BC

PREPARED BY:

EVS environment consultants
A Member of the Golder Group of Companies
North Vancouver, BC

AZIMUTH CONSULTING GROUP

POLARIS MINE ENVIRONMENTAL EFFECTS MONITORING PROGRAM

July 30, 2004

LABORATORY REPORT

Prepared for

Azimuth Consulting Group
218-2902 W. Broadway
Vancouver, BC
V6K 2G8

Prepared by

EVS Environment Consultants - A Member of the Golder Group of Companies
195 Pemberton Avenue
North Vancouver, BC
Canada V7P 2R4

EVS Project No.

09-0302-54

September 2004

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ACKNOWLEDGEMENTS

The *A. affinis* toxicity test was conducted by Andy Diewald, Ann-Marie Norris and Jenny Shao. Kathryn Sentance and Armando Tang performed the *D. excentricus* fertilization toxicity test. Statistical analyses were performed by Jenny Shao and Kathryn Sentance. The report was written by Kathryn Sentance and reviewed by Edmund Canaria. Quality Assurance/Quality Control (QA/QC) review on the *D. excentricus* test was conducted by Julianna Kalokai and Armando Tang reviewed the *A. affinis* toxicity test.

1. INTRODUCTION

EVS Environment Consultants conducted sublethal Metal Mining Effluent Regulations (MMER) toxicity testing for Azimuth Consulting Group as part of the Environmental Effects Monitoring (EEM) program for Polaris Mine.

A sample, identified as G Creek, was collected from the Polaris Mine Site on July 27, 2004 in 20-L collapsible polyethylene containers. It was received at the EVS laboratory on July 30, 2004 and was stored in the dark at 4°C prior to test initiation. The sample was evaluated for toxicity using the 7-d topsmelt (*Atherinops affinis*) survival and growth toxicity test and the echinoderm (*Dendraster excentricus*) fertilization toxicity test. Toxicity testing was initiated on the day of initial sample receipt.

This report describes the methods and results of the 7-d topsmelt (*Atherinops affinis*) toxicity test and the echinoderm (*Dendraster excentricus*) fertilization toxicity test. The raw data and statistical analyses are provided in Appendix A and B respectively, and the chain-of-custody form is provided in Appendix C.

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) 1100-4 (EVS, 2002) 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	10d
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	4.3, 8.6, 17.3, 34.5, 69.0% (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	4.6, 9.1, 18.3, 36.6, 73.1% (v/v)
Renewal of dilutions	None
Aeration	None during testing
Water quality parameters and frequency	Temperature, pH, dissolved oxygen, and conductivity daily; hardness and alkalinity at test initiation
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 69.0% due to salinity adjustment. The mean survival in both the negative and brine controls was 100%. The negative and brine controls were not significantly different for the growth and survival endpoints (p =1.00 and p =0.93, respectively).

The *A. affinis* survival and growth toxicity test showed no adverse effects on survival in all tested concentrations relative to the pooled controls ($p \leq 0.05$). Adverse effects for growth were observed in the 17.3 and 69.0% (v/v) concentrations. For the survival and growth endpoints the NOEC was 69.0 and 8.6, and the LOEC was >69.0 and 17.3% (v/v), respectively. The LC50 for survival was >69.0% (v/v). The IC50 and IC25 for growth were both >69.0% (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 73.1% due to salinity adjustment. Mean fertilization in the pooled controls was 59.9%. The negative and brine controls were not significantly different (p =0.72).

The *D. excentricus* fertilization toxicity test exhibited adverse effects on egg fertilization in all except the lowest (4.6%(v/v)) test concentrations relative to the pooled controls ($p \leq 0.05$). The NOEC was 4.6 and LOEC was 9.1 %(v/v). The IC50 and IC25 (95% confidence limits) values were 37.3 (24.4 – 46.0) and 8.7 (7.6 – 9.9) %(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	0.98 ± 0.09
Brine Control	100.0 ± 0.0	0.99 ± 0.14
Pooled Controls	100.0 ± 0.0	0.98 ± 0.11
4.3	96.0 ± 8.9	0.91 ± 0.15
8.6	96.0 ± 8.9	0.87 ± 0.14
17.3	100.0 ± 0.0	0.78 ± 0.14*
34.5	100.0 ± 0.0	0.90 ± 0.03
69.0	96.0 ± 8.9	0.77 ± 0.19*
TEST ENDPOINT	**SURVIVAL (% v/v)**	**GROWTH (% v/v)**
NOEC	69.0	8.6
LOEC	>69.0	17.3
LC50	>69.0	na
IC50	na	>69.0
IC25	na	>69.0

*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	60.0 ± 4.1
Brine Control	60.0 ± 2.1
Pooled Control	60.0 ± 3.0
4.6	60.0 ± 4.3
9.1	43.8 ± 2.1*
18.3	37.0 ± 1.4*
36.6	30.2 ± 3.8*
73.1	20.0 ± 0.8*
TEST ENDPOINT	**PROPORTION FERTILIZED %(v/v)**
NOEC	4.6
LOEC	9.1
IC50 (95% CL)	37.3 (24.4 – 46.0)
IC25 (95% CL)	8.7 (7.6 – 9.9)

*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.

EVS (EVS Environment Consultants). 2002. Topsmelt (*Atherinops affinis*) 7-d larval survival and growth test. EVS SOP 1100-4. In: EVS Consultants Laboratory Standard Operating Procedures (SOP) Manual. Volume II: Water Toxicity Tests. EVS Environment Consultants, North Vancouver, BC.

US EPA (U.S. Environmental Protection Agency). 2002. Short-term methods for estimating the chronic toxicity of effluents and receiving waters to marine and estuarine organisms. 3rd edition. US Environmental Protection Agency, Office of Water (4303T). US Environmental Protection Agency, Washington, DC. EPA/821/R-02/014. 464 pp.

US EPA. 1995. Short term methods for estimating the chronic toxicity of effluents and receiving waters to marine and estuarine organisms. 2nd edition. US Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Office of Research and Development, Washington, DC. EPA/600/R-95/136. 563 pp.

Tidepool Scientific Software. 1994. TOXCALC: Comprehensive Toxicity Data Analysis and Database Software, Version 5.0.23. Tidepool Scientific Software, McKinleyville, CA. 80 pp.

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. JES. AKN
EVS Project No. 09-0302-54
EVS Work Order No. 0400339 | Test Initiation Date July 30, 2004

Sample	Initial Sample	Refresh Samples	
	Day 0	Day 2	Day 4
Identification	G-Creek - sublethal - 27704		
Amount Received	20 L		
Date Collected	July 27, 2004		
Date Received	July 30, 2004		
Temperature (°C)	20.0 D→ 20.0		
pH	7.8 D→ 8.3		
DO (mg/L)	10.7 D→ 7.4		
Conductivity (µmhos/cm)	4880		
Salinity (ppt)	2.6 D→ 28		
Ammonia (mg/L N)	—		
Chlorine (mg/L Cl)	—		
Other	0 Brine adjusted to 30±2 ppt with 40 ppt HSB		

DILUTION/CONTROL WATER (initial water quality)
Water Type Filtered, UV sterilized seaH2O
Temperature (°C) 20.0
pH 8.1
Dissolved Oxygen (mg/L) 7.4
Salinity 28 ppt

TEST SPECIES INFORMATION
Source Aquatic Biosystems (ABS)
Date Received July 29, 2004
Age (on Day 0) 10-d
Reference Toxicant Cu
Current Reference Toxicant Result (incl. 95% CL)
Reference Toxicant Test Date July 30, 2004
7-d survival LC50 130 (115-147) mg/L Cu
7-d growth IC50 124 (87-144) mg/L Cu
Reference Toxicant Warning Limits (mean ± 2SD) and CV
7-d survival LC50 129 ± 48 mg/L Cu. CV=19%
7-d growth IC50 130 ± 52 mg/L Cu. CV=20%

TEST CONDITIONS
Temperature Range (°C) 20.0-20.5
pH Range 7.8-8.1
Dissolved Oxygen Range (mg/L) 6.4-7.7
Salinity (ppt) 28
Photoperiod (L:D h) 16:8
Aeration Provided? NA
Other —

TEST RESULTS

Endpoint	Conc. Units	NOEC	LOEC	LC50 (95% CL)	IC50 (95% CL)	IC25 (95% CL)
Survival	% (v/v)	69	>69	>69		
Growth		8.6 ~~34.5~~	17.3 ~~69~~		>69	>69

Other

Data Verified By [signature] | Date Verified Sept. 16/04

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

Client: Azimuth (Polaris) | Sample ID: G-Creek - Acute - 270704
EVS Project No.: 09-0302-54 | Test Initiation Date/Time: July 30/1500 h
EVS Work Order No.: 0400339 | Source/Date Received: ABS / July 29/04

Concentration (%) v/v	Temperature (°C)													
	0	1 old	1 new	2		3		4		5		6		7
Neg. CTL	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5
B-CTL	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5
4.3	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5
8.6	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5
17.3	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5
34.5	20.0	20.5	20.0	20.5	20.0	20.6	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5
69	20.0	20.5	20.0	20.5	20.0	20.6	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5
Tech. Initials	JES													

Concentration (%) v/v	pH													
	0	1		2		3		4		5		6		7
Neg. CTL	8.1	8.1	7.9	7.9	8.0	8.0	7.9	8.0	7.8	8.0	7.8	7.9	8.0	7.9
B-CTL	8.1	8.1	7.9	7.9	8.0	7.9	7.9	8.0	7.8	8.0	7.8	7.9	8.0	7.9
4.3	8.2	8.0	8.1	8.1	8.1	7.9	8.1	7.9	8.1	7.9	8.1	8.0	8.1	8.0
8.6	8.2	8.1	8.2	8.2	8.1	8.1	8.2	8.1	8.1	8.0	8.2	8.1	8.1	8.1
17.3	8.2	8.1	8.2	8.2	8.2	8.1	8.2	8.2	8.2	8.1	8.2	8.2	8.2	8.1
34.5	8.2	8.1	8.3	8.3	8.2	8.2	8.2	8.2	8.3	8.2	8.2	8.2	8.3	8.2
69	8.3	8.2	8.4	8.4	8.4	8.3	8.3	8.3	8.4	8.3	8.7	8.4	8.3	8.2
Tech. Initials	JES													

WQ Instruments Used: Temp. Calibrated Hg thermometer pH II-A-51

Comments

Test Set Up By: AWD. JES. AKN | Data Verified By: [signature] | Date Verified: Sept. 13/04

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

Client Azimuth (Polaris) Sample ID G - Creek - Acute - 270704

EVS Project No. 09-0302-54 Test Initiation Date/Time July 30 / 15:00 h

EVS Work Order No. 0400339 Source/Date Received ABS / July 29/04

Concentration % (v/v)	Salinity (ppt)							
	0	1	2	3	4	5	6	7
Neg-CTL	28	28	28	28	28	28	28	28
B-CTL	28	28	28	28	28	28	28	28
4.3	28	28	28	28	28	28	28	28
8.6	28	28	28	28	28	28	28	28
17.3	28	28	28	28	28	28	28	28
34.5	28	28	28	28	28	28	28	28
69	28	28	28	28	28	28	28	28
Tech. Initials	JES	~	~	~	~	~	~	~

Concentration % (v/v)	Dissolved Oxygen (mg/L)													
	0	1		new 2 old		3		4		5		6		7
Neg. CTL	7.4	6.6	7.4	7.5	6.8	7.4	7.0	7.5	7.0	7.6	6.8	6.7	7.6	6.8
B-CTL	7.4	6.8	7.4	7.5	6.7	7.4	6.9	7.5	6.9	7.6	6.7	6.6	7.6	6.9
4.3	7.4	6.7	7.4	7.5	6.8	7.4	6.8	7.5	6.8	7.6	6.7	6.6	7.6	6.9
8.6	7.4	6.8	7.0	7.5	6.9	7.4	6.8	7.5	6.8	7.6	6.7	6.5	7.7	6.8
17.3	7.4	6.9	7.4	7.5	6.8	7.4	6.6	7.5	6.5	7.6	6.8	6.6	7.7	6.7
34.5	7.4	6.7	7.4	7.5	6.7	7.4	6.7	7.5	6.4	7.6	6.8	6.7	7.7	6.7
69	7.4	6.7	7.4	7.4	6.7	7.4	6.7	7.5	6.4	7.6	6.8	6.7	7.7	6.7
Tech. Initials	JES	~	~	~	~	~	~	~	~	~	~	~	~	~

WQ Instruments Used: Salinity II-A-030304 DO II-A-011202

Comments

Test Set Up By AWD, JES, AKN Data Verified By Qualified Date Verified Sept 13/04

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.: 0400339

Start Date (Day 0): July 30/04
Sample ID: G-Creek - Acute - 270704
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.
Neg. CTL	A	A1	1239.31	1244.31	5	5		JS 13/Aug
	B	A2	1249.28	1254.89	5	5		
	C	A3	1245.80	1250.56	5	5		
	D	A4	1249.65	1254.46	5	5		
	E	A5	1272.31	1276.64	5	5		
Brine CTL	A	A6	1247.06	1252.91	5	5		
	B	A7	1253.79	1257.85	5	5	confirmed 1257.82 ✓	
	C	A8	1281.77	1286.98	5	5		
	D	A9	1251.58	1255.98	5	5		
	E	A10	1259.93	1265.08	5	5		
4.3	A	A11	1257.42	1261.19	4	4		
	B	A12	1236.86	~~1241~~ 1242.25	5	5	confirmed 1242.19 ✓	
	C	A13	1239.81	1245.13	5	5		
	D	A14	1242.85	1246.92	5	5		
	E	A15	1235.71	1239.91	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: [signature]
Date Verified: Sept. 13/04

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. 0400339

Start Date (Day 0) July 30, 2004
Sample ID G-Creek - Acute - 270704
Balance Type/Serial Number Sartorius BP 211D

Sample ID % %N	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.
8.6	A	A16	1227.02	1232.51	5	5		
	B	A17	1239.24	1243.57	5	5		
	C	A18	1229.02	1233.44	4	4		
	D	A19	1233.84	1237.47	5	5		
	E	A20	1228.86	1232.75	5	5	confirmed 1232.80 ✓	
17.3	A	A21	1231.20	1234.75	5	5		
	B	A22	1233.22	1237.19	5	5		
	C	A23	1222.38	1227.10	5	5		
	D	A24	1222.20	1225.18	5	5		
	E	A25	1226.00	1230.36	5	5		
34.5	A	A26	1225.11	1229.67	5	5		
	B	A27	1233.99	1238.36	5	5		
	C	A28	1237.10	1241.69	5	5	confirmed 1241.64 ✓	
	D	A29	1222.42	1226.65	5	5		
	E	A30	1233.63	1238.25	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 Ralph K

Date Verified Sept. 13/04

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.: 0400339

Start Date (Day 0): July 30/04
Sample ID: G-Creek - Acute - 270704
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.
69	A	A31	1239.64	1242.07	4	4		~~JJ~~
	B	A32	1237.11	1241.20	5	5		
	C	A33	1231.11	1234.89	5	5		
	D	A34	1239.84	1243.88	5	5		
	E	A35	1233.50	1238.50	5	5	confirmed 1238.46 ✓	

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: Sept. 13/04

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

Client: Azimuth (Polaris Mine)
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400339

Sample ID: G-Creek - Grab - 270704
Test Species/Batch: A. affinis
Test Initiation Date/Time: July 30 / 15:00 2004
No. of Organisms/Volume: 5 / 200 ml

Concentration % v/v	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
Neg. CTL	A		5	5	5	5	5	5	5	
	B		5	5	5	5	5	5	5	
	C		5	5	5	5	5	5	5	
	D		5	5	5	5	5	5	5	
	E		5	5	5	5	5	5	5	
B-CTL	A		5	5	5	5	5	5	5	
	B		5	5	5	5	5	5	5	
	C		5	5	5	5	5	5	5	
	D		5	5	5	5	5	5	5	
	E		5	5	5	5	5	5	5	
4.3	A		5	5	5	5	5	5	4	
	B		5	5	5	5	5	5	5	
	C		5	5	5	5	5	5	5	
	D		5	5	5	5	5	5	5	
	E		5	5	5	5	5	5	5	
8.6	A		5	5	5	5	5	5	5	
	B		5	5	5	5	5	5	5	
	C		5	5	5	5	5	5	4	
	D		5	5	5	5	5	5	5	
	E		5	5	5	5	5	5	5	
Technician Initials										

Sample Description: clear, colorless
Data Verified By: [signature]
Date Verified: Sept. 15/04

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

Client: Azimuth (Polaris Mine)
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400339

Sample ID: G-Creek - Acute - 270704
Test Species/Batch: A. affinis / July 29, 04
Test Initiation Date/Time: July 30 / 15:00
No. of Organisms/Volume: 5/200ml

Concentration %	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
17.3	A		5	5	5	5	5	5	5	
	B		5	5	5	5	5	5	5	
	C		5	5	5	5	5	5	5	
	D		5	5	5	5	5	5	5	
	E		5	5	5	5	5	5	5	
34.5	A		5	5	5	5	5	5	5	
	B		5	5	5	5	5	5	5	
	C		5	5	5	5	5	5	5	
	D		5	5	5	5	5	5	5	
	E		5	5	5	5	5	5	5	
69	A		5	5	5	5	4	4	4	
	B		5	5	5	5	5	5	5	
	C		5	5	5	5	5	5	5	
	D		5	5	5	5	5	5	5	
	E		5	5	5	5	5	5	5	
	A									
	B									
	C									
	D									
	E									
Technician Initials										

Sample Description: clear colorless
Data Verified By: Qualified
Date Verified: Sept 15/04

Test: LF-Larval Fish Growth and Survival Test | Test ID: 0400339
Species: AA-Atherinops affinis | Protocol: EPAW 95-EPA West Coast
Sample ID: G-Creek-sublethal-270704 | Sample Type: EFF2-Industrial
Start Date: 7/30/2004 End Date: 8/6/2004 | 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	Neg Control	5							5	5	1244.31	1239.31
	2	2	Neg Control	5							5	5	1254.89	1249.28
	3	3	Neg Control	5							5	5	1250.56	1245.8
	4	4	Neg Control	5							5	5	1254.46	1249.65
	5	5	Neg Control	5							5	5	1276.64	1272.31
	6	1	Brine Control	5							5	5	1252.91	1247.06
	7	2	Brine Control	5							5	5	1257.85	1253.79
	8	3	Brine Control	5							5	5	1286.98	1281.77
	9	4	Brine Control	5							5	5	1255.98	1251.58
	10	5	Brine Control	5							5	5	1265.08	1259.93
	11	1	4.300	5							4	4	1261.19	1257.42
	12	2	4.300	5							5	5	1242.25	1236.86
	13	3	4.300	5							5	5	1245.13	1239.81
	14	4	4.300	5							5	5	1246.92	1242.85
	15	5	4.300	5							5	5	1239.91	1235.71
	16	1	8.600	5							5	5	1232.51	1227.02
	17	2	8.600	5							5	5	1243.57	1239.24
	18	3	8.600	5							4	4	1233.44	1229.02
	19	4	8.600	5							5	5	1237.47	1233.84
	20	5	8.600	5							5	5	1232.75	1228.86
	21	1	17.300	5							5	5	1234.75	1231.2
	22	2	17.300	5							5	5	1237.19	1233.22
	23	3	17.300	5							5	5	1227.1	1222.38
	24	4	17.300	5							5	5	1225.18	1222.2
	25	5	17.300	5							5	5	1230.36	1226
	26	1	34.500	5							5	5	1229.67	1225.11
	27	2	34.500	5							5	5	1238.36	1233.99
	28	3	34.500	5							5	5	1241.69	1237.1
	29	4	34.500	5							5	5	1226.65	1222.38
	30	5	34.500	5							5	5	1238.25	1233.63
	31	1	69.000	5							4	4	1242.07	1239.64
	32	2	69.000	5							5	5	1241.2	1237.11
	33	3	69.000	5							5	5	1234.89	1231.11
	34	4	69.000	5							5	5	1243.88	1239.84
	35	5	69.000	5							5	5	1238.5	1233.5

Comments: Azimuth(Polaris Mine)09-0302-54

Reviewed by: 8/17/04

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	7/30/2004	Test ID:	400339	Sample ID:	G-Creek-sublethal-270704
End Date:	8/6/2004	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	EFF2-Industrial
Sample Date:	7/27/2004	Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Azimuth(Polaris Mine)09-0302-54				

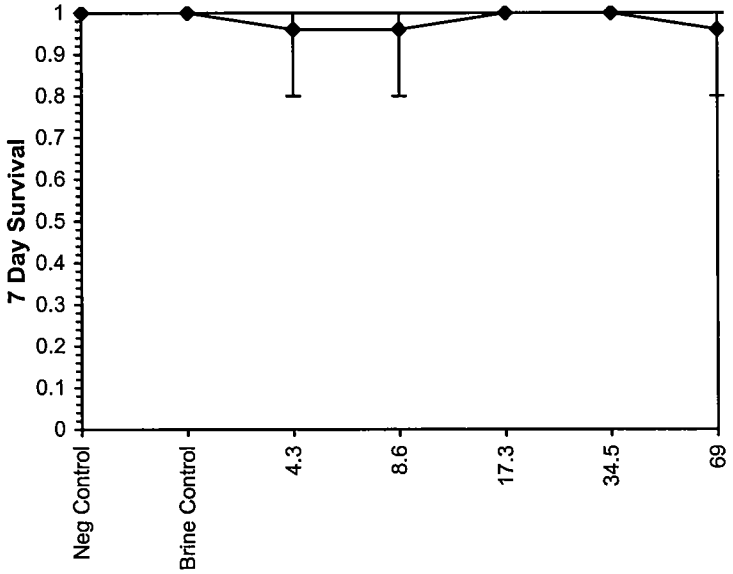
Conc-%	1	2	3	4	5
Neg Control	1.0000	1.0000	1.0000	1.0000	1.0000
Brine Control	1.0000	1.0000	1.0000	1.0000	1.0000
4.3	0.8000	1.0000	1.0000	1.0000	1.0000
8.6	1.0000	1.0000	0.8000	1.0000	1.0000
17.3	1.0000	1.0000	1.0000	1.0000	1.0000
34.5	1.0000	1.0000	1.0000	1.0000	1.0000
69	0.8000	1.0000	1.0000	1.0000	1.0000

			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical
Neg 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		
4.3	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	25.00	16.00
8.6	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	25.00	16.00
17.3	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	27.50	16.00
34.5	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	27.50	16.00
69	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	25.00	16.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.59678	0.9	-2.2346	4.3922
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	69	>69		1.44928

Dose-Response Plot



Statistical comparisons were against the D-Control only

Reviewed by: Ralph Scott · 15/04

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	7/30/2004	Test ID:	400339	Sample ID:	G-Creek-sublethal-270704
End Date:	8/6/2004	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	EFF2-Industrial
Sample Date:	7/27/2004	Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Azimuth(Polaris Mine)09-0302-54				

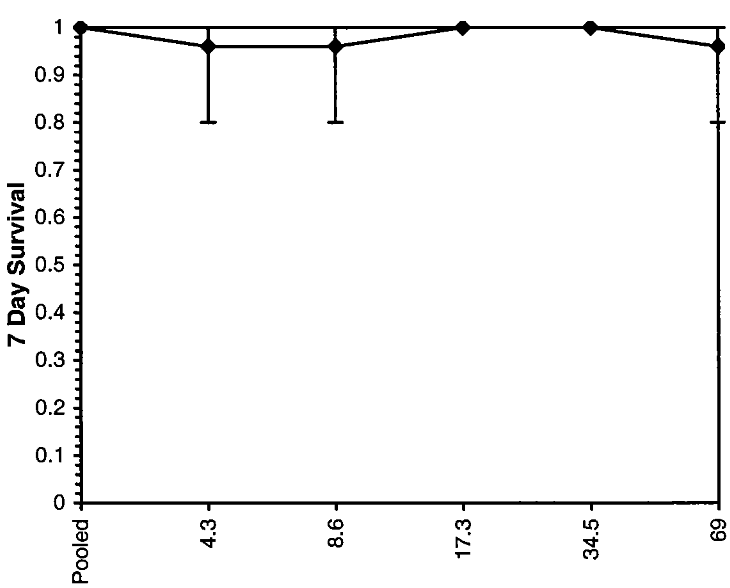
Conc-%	1	2	3	4	5
Neg Control	1.0000	1.0000	1.0000	1.0000	1.0000
Brine Control	1.0000	1.0000	1.0000	1.0000	1.0000
4.3	0.8000	1.0000	1.0000	1.0000	1.0000
8.6	1.0000	1.0000	0.8000	1.0000	1.0000
17.3	1.0000	1.0000	1.0000	1.0000	1.0000
34.5	1.0000	1.0000	1.0000	1.0000	1.0000
69	0.8000	1.0000	1.0000	1.0000	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		
4.3	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	35.00	21.00
8.6	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	35.00	21.00
17.3	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	40.00	21.00
34.5	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	40.00	21.00
69	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	35.00	21.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.58129	0.91	-2.3952	5.50568
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	69	>69		1.44928

Dose-Response Plot



Statistical comparisons were against the Pooled control.

ToxCalc v5.0.23

Reviewed by: [signature] Sept. 16/04

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

Start Date:	7/30/2004	Test ID:	400339	Sample ID:	G-Creek-sublethal-270704
End Date:	8/6/2004	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	EFF2-Industrial
Sample Date:	7/27/2004	Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Azimuth(Polaris Mine)09-0302-54				

Conc-%	1	2	3	4	5
Neg Control	1.0000	1.1220	0.9520	0.9620	0.8660
Brine Control	1.1700	0.8120	1.0420	0.8800	1.0300
4.3	0.7540	1.0780	1.0640	0.8140	0.8400
8.6	1.0980	0.8660	0.8840	0.7260	0.7780
17.3	0.7100	0.7940	0.9440	0.5960	0.8720
34.5	0.9120	0.8740	0.9180	0.8540	0.9240
69	0.4860	0.8180	0.7560	0.8080	1.0000

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
Neg Control	0.9804	0.0931	0.9804	0.8660	1.1220	9.496	5				0.9804	1.0000
Brine Control	0.9868	0.1418	0.9868	0.8120	1.1700	14.370	5					
4.3	0.9100	0.1503	0.9100	0.7540	1.0780	16.519	5	0.840	2.360	0.1979	0.9100	0.9282
8.6	0.8704	0.1426	0.8704	0.7260	1.0980	16.389	5	1.312	2.360	0.1979	0.8704	0.8878
17.3	0.7832	0.1363	0.7832	0.5960	0.9440	17.397	5	2.352	2.360	0.1979	0.8398	0.8566
34.5	0.8964	0.0307	0.8964	0.8540	0.9240	3.425	5	1.002	2.360	0.1979	0.8398	0.8566
*69	0.7736	0.1854	0.7736	0.4860	1.0000	23.961	5	2.466	2.360	0.1979	0.7736	0.7891

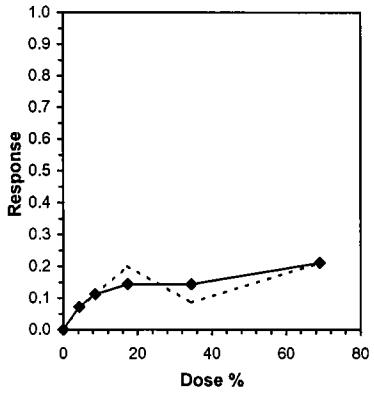
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97283	0.9	-0.0321	0.12793
Bartlett's Test indicates equal variances (p = 0.10)	9.1539	15.0863		
The control means are not significantly different (p = 0.93)	0.08436	2.30601		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	34.5	69	48.7904	2.89855	0.1979	0.20186	0.03131	0.01758	0.15497	5, 24

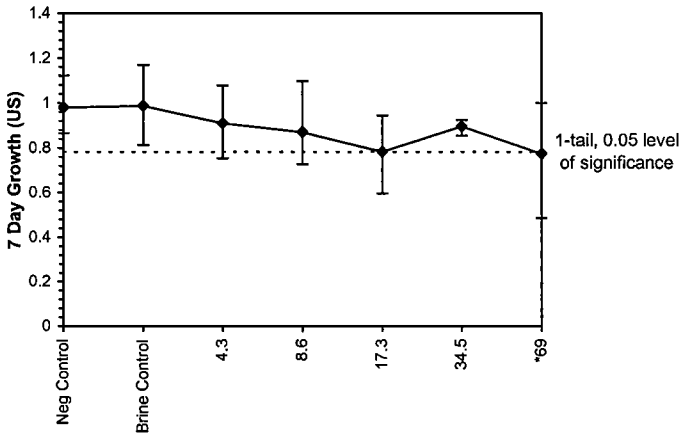
Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05*	2.994	3.701	0.790	14.903	3.3103
IC10	7.301				
IC15	37.867				
IC20	63.413				
IC25	>69				
IC40	>69				
IC50	>69				

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



Statistical comparisons were against the D-Control only

Reviewed by Sept. 15-'04

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

Start Date:	7/30/2004	Test ID:	400339	Sample ID:	G-Creek-sublethal-270704
End Date:	8/6/2004	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	EFF2-Industrial
Sample Date:	7/27/2004	Protocol:	EPAW 95-EPA West Coast	Test Species:	AA-Atherinops affinis
Comments:	Azimuth(Polaris Mine)09-0302-54				

Conc-%	1	2	3	4	5
Neg Control	1.0000	1.1220	0.9520	0.9620	0.8660
Brine Control	1.1700	0.8120	1.0420	0.8800	1.0300
4.3	0.7540	1.0780	1.0640	0.8140	0.8400
8.6	1.0980	0.8660	0.8840	0.7260	0.7780
17.3	0.7100	0.7940	0.9440	0.5960	0.8720
34.5	0.9120	0.8740	0.9180	0.8540	0.9240
69	0.4860	0.8180	0.7560	0.8080	1.0000

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
Pooled	0.9836	0.1131	0.9836	0.8120	1.1700	11.503	10				0.9836	1.0000
4.3	0.9100	0.1503	0.9100	0.7540	1.0780	16.519	5	1.021	2.462	0.1775	0.9100	0.9252
8.6	0.8704	0.1426	0.8704	0.7260	1.0980	16.389	5	1.570	2.462	0.1775	0.8704	0.8849
*17.3	0.7832	0.1363	0.7832	0.5960	0.9440	17.397	5	2.780	2.462	0.1775	0.8398	0.8538
34.5	0.8964	0.0307	0.8964	0.8540	0.9240	3.425	5	1.209	2.462	0.1775	0.8398	0.8538
*69	0.7736	0.1854	0.7736	0.4860	1.0000	23.961	5	2.913	2.462	0.1775	0.7736	0.7865

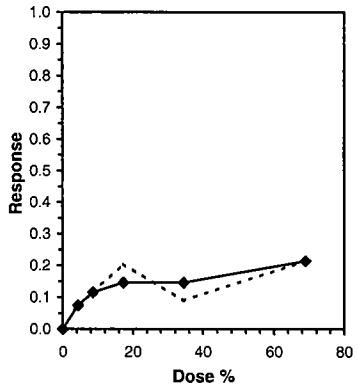
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97705	0.91	-0.0216	-0.1535
Bartlett's Test indicates equal variances (p = 0.11)	8.86442	15.0863		
The control means are not significantly different (p = 0.93)	0.08436	2.30601		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	8.6	17.3	12.1975	11.6279	0.1775	0.18046	0.04318	0.01733	0.05389	5, 29

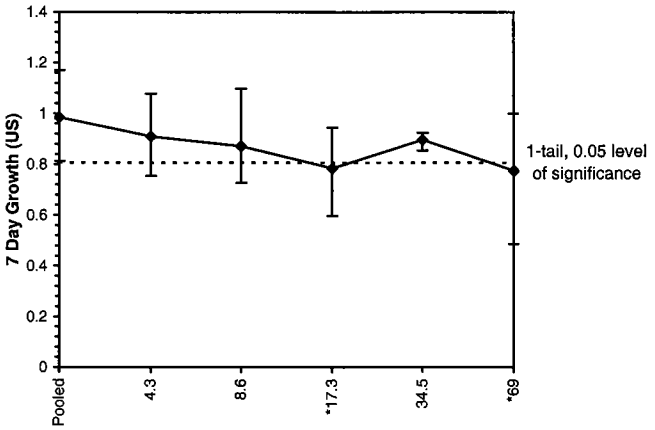
Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05*	2.873	2.982	0.771	15.235	1.2072
IC10	6.989				
IC15	36.449				
IC20	62.079				
IC25	>69				
IC40	>69				
IC50	>69				

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



Statistic comparisons were against the pooled control.

Reviewed by:

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.: 0400339
EVS Analysts: JKS, AWD
Test Initiation Date: July 30, 2004

Sample	Initial Sample	Refresh Samples	
	Day 0	Day 2	Day 4
Identification	04-Cu-001		
Amount ~~Received~~	1 L		
Date ~~Collected~~ prepared	March-15, 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: UV sterilized, filtered SW
Temperature (°C): 20.0
pH: 8.1
Dissolved Oxygen (mg/L): 7.4
Salinity: 28 ppt

TEST CONDITIONS

Temperature Range (°C): 20.0 - 20.5
pH Range: 7.8 - 8.1
Dissolved Oxygen Range (mg/L): 6.4 - 7.6
Salinity (ppt): 28
Photoperiod (L:D h): 16:8
Aeration Provided?: NA
Other: —

TEST SPECIES INFORMATION

Source: Aquatic Biosystems (ABS)
Date Received: July 29, 2004
Age (on Day 0): 10-d
Reference Toxicant: Cu
Current Reference Toxicant Result (incl. 95% CL)
Reference Toxicant Test Date: July 30, 04
7-d survival LC50: 130 (115-147) mg/L Cu
7-d growth IC50: ~~119 (89-138)~~ 124 (83-144) mg/L Cu
Reference Toxicant Warning Limits (mean ± 2SD) and CV
7-d survival LC50: 129 ± 48 mg/L Cu. CV = 19%
7-d growth IC50: 130 ± 52 mg/L Cu. CV = 20%

TEST RESULTS

Endpoint	Conc. Units	NOEC	LOEC	LC50 (95% CL)	IC50 (95% CL)	IC25 (95% CL)
Survival	mg/L Cu	100	180	130 (115-147)		
Growth		56	100		124 (87-144) ~~119 (89-138)~~	85 (~~12~~ 3.6-127) ~~82 (0.4-124)~~

Other ______

Data Verified By: [signature]
Date Verified: Sept. 13/04

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

Client: Azimuth (Polaris) | Sample ID: Cu reftox

EVS Project No.: 09-0302-54 | Test Initiation Date/Time: July 30/04 / 1430 h

EVS Work Order No.: 0400339 | Source/Date Received: ABS / July 29, 2004

Concentration Cu mg/L	Temperature (°C)													
	0	old 1	new	2		3		4		5		6		7
Neg. CTL.	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5
32	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5
56	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5
100	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5
180	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5	20.0	20.5
320	20.0	20.5	20.0	20.5	20.0									
Tech. Initials	JW	~	~	~	~	~	~	~	~	~	~	~	~	~

Concentration Cu mg/L	pH													
	0	1		2		3		4		5		6		7
Neg. CTL	8.1	8.0	7.9	7.9	8.0	7.9	8.0	7.8	8.0	7.8	8.0	8.0	7.9	7.8
32	8.1	8.0	7.9	7.9	8.0	7.9	8.1	7.8	8.0	7.8	8.1	8.0	7.9	7.8
56	8.1	7.9	7.9	7.9	8.0	7.9	8.1	7.8	8.0	7.8	8.1	8.0	7.9	7.9
100	8.1	7.9	7.9	7.9	8.0	7.9	8.1	7.8	7.9	7.8	8.0	8.0	7.8	7.9
180	8.1	7.9	7.9	7.9	8.0	7.9	8.1	7.8	7.9	7.8	8.1	8.0	7.9	7.9
320	8.1	7.9	7.9	7.9	8.0									
Tech. Initials	JW	~	~	~	~	~	~	~	~	~	~	~	~	~

WQ Instruments Used: Temp. Calibrated Hg thermometer pH II-A-51

Comments

Test Set Up By: JW/AS Data Verified By: [signature] Date Verified: Sept. 10/04

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

Client: Azimuth | Sample ID: Cu · reftox
EVS Project No.: 09-0302-54 | Test Initiation Date/Time: July 30, 2004 / 1430 h
EVS Work Order No.: 0400339 | Source/Date Received: ABS / July 29, 04

Concentration Cu mg/L	Salinity (ppt)							
	0	1	2	3	4	5	6	7
Neg. CTL	28	28	28	28	28	28	28	28
32	28	28	28	28	28	28	28	28
56	28	28	28	28	28	28	28	28
100	28	28	28	28	28	28	28	28
180	28	28	28	28	28	28	28	28
320	28	28	28	—	—			
Tech. Initials	JKS	~	~	~	~	~	~	

Concentration Cu mg/L	Dissolved Oxygen (mg/L)													
	0	1		2 new old		3		4		5		6		7
Neg. CTL	7.4	7.0	7.4	7.5	6.7	7.0	7.4	7.0	7.5	6.8	7.6	6.4	7.~~6~~	6.7
32	7.4	6.9	7.4	7.5	6.7	6.8	7.4	6.9	7.5	6.9	7.6	6.6	7.6	6.8
56	7.4	6.9	7.4	7.5	6.8	6.8	7.4	6.7	7.5	7.0	7.6	6.7	7.6	6.7
100	7.4	6.8	7.4	7.5	6.8	6.7	7.4	6.5	7.5	6.9	7.6	6.4	7.6	6.8
180	7.4	6.8	7.4	7.5	6.7	6.7	7.4	6.4	7.5	6.8	7.6	6.6	7.6	6.8
320	7.4	6.8	7.4	7.5	6.7	~~6.8~~	~~7.4~~	—						
Tech. Initials	JKS	~	~	~	~	~	~	~	~	~	~	~	~	~

WQ Instruments Used: Salinity II-A030304 DO II-A-011202

Comments

Test Set Up By: JKS/AWD | Data Verified By: [signature] | Date Verified: Sept. 10/04

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

Client: Azimuth (Polaris Mine)
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400339

Sample ID: Cu (Reflox)
Test Species/Batch: A. affinis / July 29, 2004
Test Initiation Date/Time: July 30, 2004 / 1430 h
No. of Organisms/Volume: 5/200ml

Cu mg/L Concentration	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
Neg. CTL	A	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	
32	A	41	5	5	5	5	5	5	5	
	B	42	5	5	5	5	5	5	5	
	C	43	5	5	5	4	4	4	4	
	D	44	5	5	5	5	5	5	M/5	
	E	45	5	5	5	5	5	5	5	
56	A	46	5	5	5	5	5	5	5	
	B	47	5	5	5	5	5	4	4	
	C	49	5	5	5	5	5	5	5	
	D	50	5	5	5	5	5	5	5	
	E	51	5	5	5	5	5	5	5	
100	A	52	4	3	3	3	3	3	3	
	B	53	4	4	4	4	4	4	4	
	C	54	5	5	5	5	5	5	5	
	D	55	5	5	5	5	5	5	5	
	E	56	5	5	5	4	4	4	4	
Technician Initials										

Sample Description: clear, colorless
Data Verified By: [signature]
Date Verified: Sept. 13/04

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

Client Azimuth (Polaris Mine)
EVS Project No. 09-0302-54
EVS Work Order No. 0400339

Sample ID Cu reflux
Test Species/Batch A. affinis / July 29, 2004
Test Initiation Date/Time July 30, 04/1430 h
No. of Organisms/Volume 5/200ml

Cu µg/L Concentration	Rep.	Pan No.	Number of Survivors – Day of Test 1	2	3	4	5	6	7	Comments
180	A	~~A5~~	2	1	0	—	—	—	—	
	B	—	2	2	1	1	0	—	—	
	C	A58	4	4	2	2	2	2	2	
	D	A59	2	1	1	1	1	1	1	
	E	—	2	2	2	1	0	—	—	
320	A	—	1	0	—	—	—	—	—	
	B	—	0	—	—	—	—	—	—	
	C	—	0	—	—	—	—	—	—	
	D	—	0	—	—	—	—	—	—	
	E	—	0	—	—	—	—	—	—	
	A									
	B									
	C									
	D									
	E									
	A									
	B									
	C									
	D									
	E									
Technician Initials										

Sample Description
Data Verified By Ralph Ch Date Verified Sept 13/04

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.: 0400339

Start Date (Day 0): July 30, 2004
Sample ID: Cu-reftox
Balance Type/Serial Number: Sartorius BP211D

Sample ID Cu mg/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.
Neg. CTL	A	A36	1225.46	1231.37	5	5		JAS/
	B	A37	1223.00	1227.74	5	5		
	C	A38	1227.28	1232.01	5	5		
	D	A39	1225.60	1232.35 ✓	5	5		
	E	A40	1231.~~5~~361	1238.39	5	5	confirmed 1238.42 ✓	
32	A	A41	1223.15	1228.32	5	5		
	B	A42	1232.24	1238.17	5 ✓	5		
	C	A43	1228.~~29~~15	1232.39	4	4		
	D	A44	1228.67	1233.67	5	5		
	E	A45	1223.92	1228.14	5	5	Confirmed 1228.16 ✓	
56	A	A46	1224.29	1229.51	5	5		
	B	A47	1219.34	1223.14	4	4		
	~~C~~	~~A48~~	~~1223.19~~	~~12~~				
	~~D~~ C	~~A49~~ A49	1224.29	1229.03	5	5		
	~~E~~ D	~~A50~~ A50	1228.49	1234.94	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: [signature]
Date Verified: Sept. 13/04

Concentration	Pan #	pan wt	Final pan wt	# Survival	# Weighed
56 mg/L E	A51	1228.55	1233.48	5	5

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

Client: Azimuth
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400339
Start Date (Day 0): July 30-04
Sample ID: Cu Effluent
Balance Type/Serial Number: Sartorius BP 211D

Sample ID Cu µg/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	A	A52	1229.80	1231.98	3	3		JAS µ
	B	A53	1230.92	1234.72	4	4		
	C	A54	1226.04	1230.33	5	5		
	D	A55	1228.91	1234.05	5	5	confirmed 1234.07 ✓	
	E	A56	1226.61	1231.21	4	4		
180	C	~~A58~~ ~~A63~~	~~1230.23~~ 1214.44	1215.67	2	2		
	D	~~A59~~ ~~A64~~	~~1225.91~~ 1229.90	1230.26	1	1		✓

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: Sept - 13/04

Test: LF-Larval Fish Growth and Survival Test
Species: AA-Atherinops affinis
Sample ID: REF-Ref Toxicant
Start Date: 7/30/2004 End Date: 8/6/2004

Test ID: RTAACu37
Protocol: EPAW 95-EPA West Coast
Sample Type: CU-Copper
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	1231.37	1225.46
	2	2	D-Control	5							5	5	1227.74	1223
	3	3	D-Control	5							5	5	1232.01	1227.28
	4	4	D-Control	5							5	5	1232.35	1225.6
	5	5	D-Control	5							5	5	1238.39	1231.61
	6	1	32.000	5							5	5	1228.32	1223.15
	7	2	32.000	5							5	5	1238.17	1232.24
	8	3	32.000	5							4	4	1232.39	1228.15
	9	4	32.000	5							5	5	1233.67	1228.67
	10	5	32.000	5							5	5	1228.14	1223.92
	11	1	56.000	5							5	5	1229.51	1224.29
	12	2	56.000	5							4	4	1223.14	1219.34
	13	3	56.000	5							5	5	1229.03	1224.29
	14	4	56.000	5							5	5	1234.94	1228.49
	15	5	56.000	5							5	5	1233.48	1228.55
	16	1	100.000	5							3	3	1231.98	1229.8
	17	2	100.000	5							4	4	1234.72	1230.92
	18	3	100.000	5							5	5	1230.33	1226.04
	19	4	100.000	5							5	5	1234.05	1228.91
	20	5	100.000	5							4	4	1231.21	1226.61
	21	1	180.000	5							0	0	0	0
	22	2	180.000	5							0	0	0	0
	23	3	180.000	5							2	2	1215.67	1214.44
	24	4	180.000	5							1	1	1230.26	1229.9
	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, 0400339

ToxCalc 5.0

Reviewed by:

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	7/30/2004	Test ID:	RTAACu37	Sample ID:	REF-Ref Toxicant
End Date:	8/6/2004	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, 0400339				

Conc-ug/L	1	2	3	4	5
D-Control	1.0000	1.0000	1.0000	1.0000	1.0000
32	1.0000	1.0000	0.8000	1.0000	1.0000
56	1.0000	0.8000	1.0000	1.0000	1.0000
100	0.6000	0.8000	1.0000	1.0000	0.8000
180	0.0000	0.0000	0.4000	0.2000	0.0000
320	0.0000	0.0000	0.0000	0.0000	0.0000

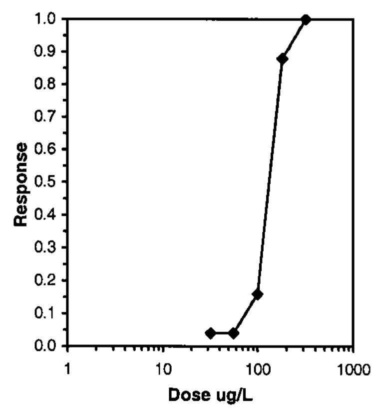
			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-ug/L	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
D-Control	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5			0	25
32	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	25.00	17.00	1	25
56	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	25.00	17.00	1	25
100	0.8400	0.1673	1.1582	0.8861	1.3453	16.679	5	20.00	17.00	4	25
*180	0.1200	0.1789	0.3650	0.2255	0.6847	56.537	5	15.00	17.00	22	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 normal distribution (p > 0.01)	0.94287	0.888	0.10595	0.6692
Equality of variance cannot be confirmed				

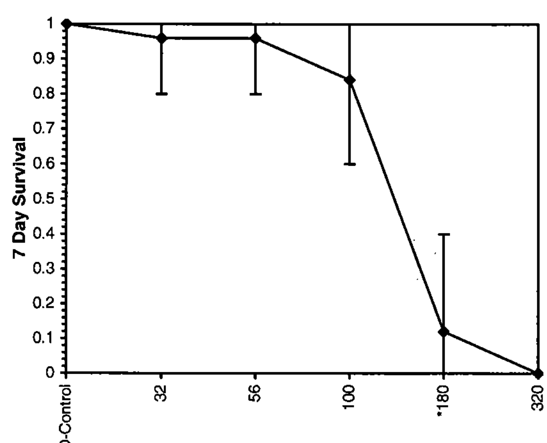
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	100	180	134.164	

Trimmed Spearman-Karber

Trim Level	EC50	95% CL		
0.0%				
5.0%	129.88	114.75	146.99	
10.0%	130.93	116.99	146.54	
20.0%	131.99	121.77	143.08	
Auto-4.0%	129.69	114.60	146.77	ug/L Cu



Dose-Response Plot



Reviewed by: [signature] Sept. 13/04

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

Start Date:	7/30/2004	Test ID:	RTAACu37	Sample ID:	REF-Ref Toxicant
End Date:	8/6/2004	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, 0400339				

Conc-ug/L	1	2	3	4	5
D-Control	1.1820	0.9480	0.9460	1.3500	1.3560
32	1.0340	1.1860	0.8480	1.0000	0.8440
56	1.0440	0.7600	0.9480	1.2900	0.9860
100	0.4360	0.7600	0.8580	1.0280	0.9200
180	0.0000	0.0000	0.2460	0.0720	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	1.1564	0.2035	1.1564	0.9460	1.3560	17.599	5				1.1564	1.0000
32	0.9824	0.1429	0.9824	0.8440	1.1860	14.543	5	1.534	2.300	0.2608	0.9940	0.8596
56	1.0056	0.1913	1.0056	0.7600	1.2900	19.023	5	1.330	2.300	0.2608	0.9940	0.8596
*100	0.8004	0.2257	0.8004	0.4360	1.0280	28.204	5	3.139	2.300	0.2608	0.8004	0.6921
*180	0.0636	0.1066	0.0636	0.0000	0.2460	167.649	5	9.636	2.300	0.2608	0.0636	0.0550
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)	0.97311	0.888	-0.2174	-0.3474
Bartlett's Test indicates equal variances (p = 0.67)	2.36564	13.2767		

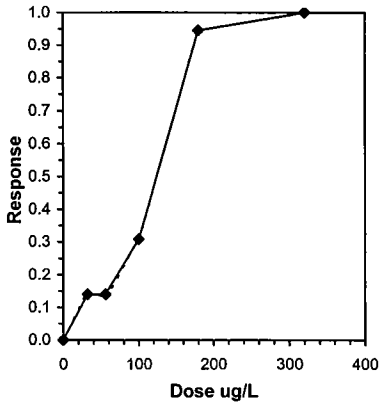
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	56	100	74.8331		0.26083	0.22555	0.93104	0.03215	4.6E-08	4, 20

Linear Interpolation (200 Resamples)

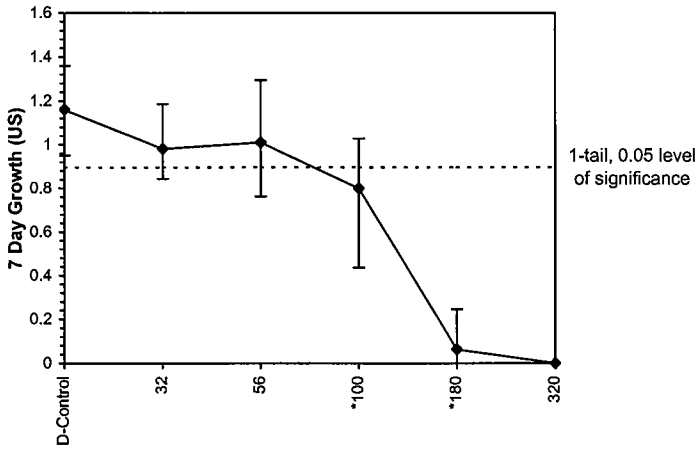
Point	ug/L	SD	95% CL(Exp)		Skew
IC05*	11.39	19.61	3.51	97.01	1.6113
IC10*	22.79	23.89	7.01	129.04	1.0634
IC15	58.51	26.81	0.00	126.48	0.4512
IC20	71.65	25.04	0.99	127.04	-0.1836
IC25	84.80	21.56	3.62	127.36	-0.5667
IC40	111.57	11.06	71.01	135.64	-0.6491
IC50	124.13	9.44	86.97	143.83	-0.7596

ug/L Cu

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



Reviewed by Gail H 4
Sent. 13/04

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
EVS Work Order No.: 0400340

EVS Analysts: KES ART
Test Initiation Date: 30 July 2004

SAMPLE

Identification: G-Creek Sublethal-270704
Amount Received: 5 x 20L
Date Collected: 27 July 2004
Date Received: 30 July 2004
Temperature (°C): 16.0 ① → 15.0
pH: 7.7 ① → 8.1
Dissolved Oxygen (mg/L): 9.6 ① → 8.5
Conductivity (µmhos/cm): 4940
Salinity (ppt): 2.6 ① → 28
Ammonia (mg/L N): –
Chlorine (mg/L Cl): –
Other: –

① Brine adjustment

TEST SPECIES

Organism: Dendraster excentricus
Source: Westwind Sealab Supplies
Date Received: 30 July 2004
Reference Toxicant: SDS
Current Reference Toxicant Result
Reference Toxicant Test Date: 30 July 2004
IC50 (and 95% CL): ~~2.2~~ 2.1 (1.9-2.4) mg/L SDS
Reference Toxicant Warning Limits (mean ± 2SD) and CV
4.2 ± 4.8 mg/L SDS, CV% = 57

DILUTION/CONTROL WATER (initial water quality)

Water Type: UV Steralized, 0.45µm filtered SW
Temperature (°C): 16.0
pH: 8.0
Dissolved Oxygen (mg/L): 8.2
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: 1600:1
Test Duration: 10:10
Other: –

TEST RESULTS

IC 50: 37.3 (24.4 – 46.0) % v/v
IC 25: 8.7 (7.6 – 9.9) % v/v
NOEC: 4.6 % v/v
LOEC: 9.1 % v/v

Data Verified By: [signature]
Date Verified: Sept. 10/04

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST INITIAL WATER QUALITY

Client ~~09-0302-54~~ #kf AZIMUTH CONSULTING GROUP
Test Initiation Date/Time 30 JULY 2004
EVS Project No. 09-0302-54
Test Species Dendraster excentricus
EVS Work Order No. 0400340
Source/Date Received #kf 30 JULY 2004 / Westwind Seatlab Supplies
Logbook #13 Pages 50 – 53
Test Duration 10:10

Sample ID	Conc/Rep %. v/v	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
CONTROL		16.0	8.0	28	8.2	
BRINE CONTROL		15.0	8.1	28	8.4	
G. CREEK #kf	4.6	15.5	8.0	28	8.2	
↓	9.1	15.5	8.0	28	8.3	
	18.3	15.0	8.0	28	8.3	
	36.6	15.0	8.1	28	8.4	
	73.1	15.0	8.1	28	8.5	
Tech. Init.	#kf	#kf	#kf	#kf	#kf	

WQ Instruments Used: Temp. Calibrated Hg Thermometer pH II-A-51 Salinity II-A-030303 DO II-A-011202
Data Verified By Qualified Date Verified Sept. 8, 2004

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

Client: AZIMUTH CONSULTING GROUP
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400340
Logbook: Echinoid #13 Pages: 50-53

Test Initiation Date/Time: 30 JULY 2004 @ 16:20
Test Species: Dendraster excentricus
Source/Date Received: Westwind Sealab Supplies/30 July 2004
Test Duration: 10:10
Sperm:Egg Ratio: 1600:1

Sample ID % (v/v)	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
CONTROL	A	59	41		KEF
	B	62	38		
	C	56	44		
	D	65	35		
4.6	A	60	40		KEF
	B	66	34		
	C	56	44		
	D	58	42		
9.1	A	46	54		KEF
	B	42	58		
	C	45	55		
	D	42	58		
18.3	A	39	61		KEF
	B	36	64		
	C	37	63		
	D	36	64		
36.6	A	31	69		KEF
	B	34	66		
	C	25	75		
	D	31	69		
73.1	A	19	81		KEF
	B	20	80		
	C	21	79		
	D	20	80		

Data Verified By: [signature]
Date Verified: Sept. 8/04

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

Client: AZIMUTH CONSULTING GROUP
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400340
Logbook: Echinoid #13 Pages: 50-53

Test Initiation Date/Time: 30 JULY 2004 @ 16:20
Test Species: Dendraster excentricus
Source/Date Received: Westwind Sealab Supplies / 30 July 2004
Test Duration: 10:10
Sperm:Egg Ratio: 1600:1

Sample ID	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
BRINE CONTROL	A	60	40		KG
	B	57	43		↓
	C	59	41		↓
	D	62	38		↓
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				

Data Verified By: [signature]
Date Verified: Sept. 8/04

Test: SC-Sperm Cell Fertilization test						Test ID: 0400340	
Species: DE-Dendraster excentricus						Protocol: EPS1/RM/27-EC 92 (Sperm Cell)	
Sample ID: G CREEK 270704E						Sample Type: EFF2-Industrial	
Start Date: 7/30/2004 16:20 (10:16)				End Date: 7/30/2004		Lab ID: BCEVS-EVS Environment Consultants	
Pos	ID	Rep	Group	Total Counted	Number Fertilized	Number Unfertilized	Notes
	1	1	D-Control	100	59	41	
	2	2	D-Control	100	62	38	
	3	3	D-Control	101	56	44	
	4	4	D-Control	100	65	35	
	5	1	B-Control	100	60	40	
	6	2	B-Control	100	57	43	
	7	3	B-Control	100	59	41	
	8	4	B-Control	100	62	38	
	9	1	4.6	100	60	40	
	10	2	4.6	100	66	34	
	11	3	4.6	100	56	44	
	12	4	4.6	100	58	42	
	13	1	9.1	100	46	54	
	14	2	9.1	100	42	58	
	15	3	9.1	100	45	55	
	16	4	9.1	100	42	58	
	17	1	18.3	100	39	61	
	18	2	18.3	100	36	64	
	19	3	18.3	100	37	63	
	20	4	18.3	100	36	64	
	21	1	36.6	100	31	69	
	22	2	36.6	100	34	66	
	23	3	36.6	100	25	75	
	24	4	36.6	100	31	69	
	25	1	73.1	100	19	81	
	26	2	73.1	100	20	80	
	27	3	73.1	100	21	79	
	28	4	73.1	100	20	80	

Comments: Azimuth Consulting Group (Polaris), 09-0302-54 (0400340)

Reviewed by: Qual 8/10/04

Sperm Cell Fertilization test-Proportion Fertilized

Start Date:	7/30/2004 10:10	Test ID:	400340	Sample ID:	G CREEK 270704E
End Date:	7/30/2004	Lab ID:	BCEVS-EVS Environment C	Sample Type:	EFF2-Industrial
Sample Date:	7/27/2004	Protocol:	EPS1/RM/27-EC 92 (Sperm	Test Species:	DE-Dendraster excentricus

Comments: Azimuth Consulting Group (Polaris), 09-0302-54 (0400340)

Conc-%	1	2	3	4
D-Control	0.5900	0.6200	0.5545	0.6500
B-Control	0.6000	0.5700	0.5900	0.6200
4.6	0.6000	0.6600	0.5600	0.5800
9.1	0.4600	0.4200	0.4500	0.4200
18.3	0.3900	0.3600	0.3700	0.3600
36.6	0.3100	0.3400	0.2500	0.3100
73.1	0.1900	0.2000	0.2100	0.2000

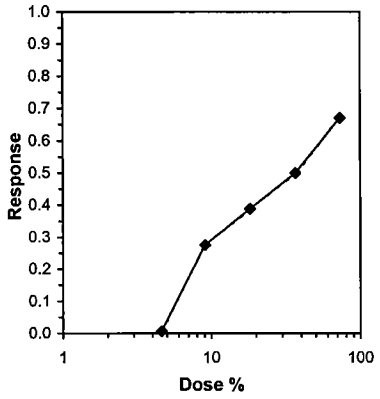
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.6036	0.0409	0.6036	0.5545	0.6500	6.778	4				0.6035	1.0000
B-Control	0.5950	0.0208	0.5950	0.5700	0.6200	3.499	4					
4.6	0.6000	0.0432	0.6000	0.5600	0.6600	7.201	4	0.166	2.410	0.0523	0.6000	0.9942
*9.1	0.4375	0.0206	0.4375	0.4200	0.4600	4.712	4	7.650	2.410	0.0523	0.4375	0.7249
*18.3	0.3700	0.0141	0.3700	0.3600	0.3900	3.822	4	10.759	2.410	0.0523	0.3700	0.6131
*36.6	0.3025	0.0377	0.3025	0.2500	0.3400	12.479	4	13.868	2.410	0.0523	0.3025	0.5013
*73.1	0.2000	0.0082	0.2000	0.1900	0.2100	4.082	4	18.589	2.410	0.0523	0.2000	0.3314

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97262	0.884	0.10504	0.3504
Bartlett's Test indicates equal variances (p = 0.12)	8.83506	15.0863		
The control means are not significantly different (p = 0.72)	0.37528	2.44691		

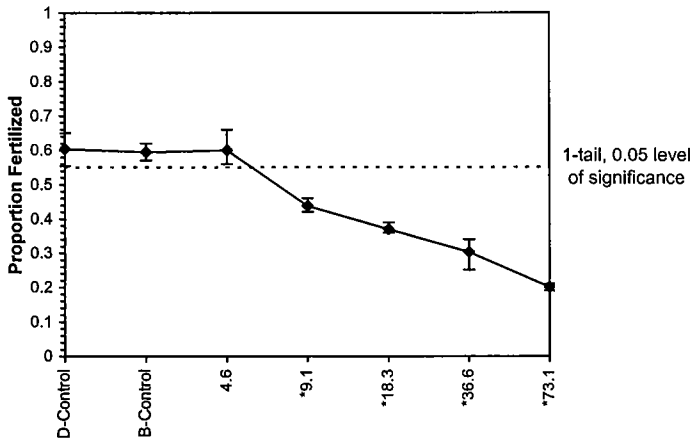
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	4.6	9.1	6.46993	21.7391	0.05233	0.08669	0.1049	0.00094	6.9E-13	5, 18

Log-Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05	5.169	1.017	0.000	5.397	-2.0092
IC10	5.883	0.366	4.155	6.252	-1.2685
IC15	6.680	0.367	5.002	7.221	-0.7933
IC20	7.569	0.396	5.813	8.353	-0.2936
IC25	8.561	0.492	6.881	9.883	0.8154
IC40	19.868	2.019	13.185	25.832	0.4117
IC50	36.788	4.538	22.468	46.940	-0.2718



Dose-Response Plot



Statistical comparisons were against the D-control

Sperm Cell Fertilization test-Proportion Fertilized

Start Date:	7/30/2004 10:10	Test ID:	400340	Sample ID:	G CREEK 270704E
End Date:	7/30/2004	Lab ID:	BCEVS-EVS Environment Cc	Sample Type:	EFF2-Industrial
Sample Date:	7/27/2004	Protocol:	EPS1/RM/27-EC 92 (Sperm (	Test Species:	DE-Dendraster excentricus
Comments:	Azimuth Consulting Group (Polaris), 09-0302-54 (0400340)				

Conc-%	1	2	3	4
D-Control	0.5900	0.6200	0.5545	0.6500
B-Control	0.6000	0.5700	0.5900	0.6200
4.6	0.6000	0.6600	0.5600	0.5800
9.1	0.4600	0.4200	0.4500	0.4200
18.3	0.3900	0.3600	0.3700	0.3600
36.6	0.3100	0.3400	0.2500	0.3100
73.1	0.1900	0.2000	0.2100	0.2000

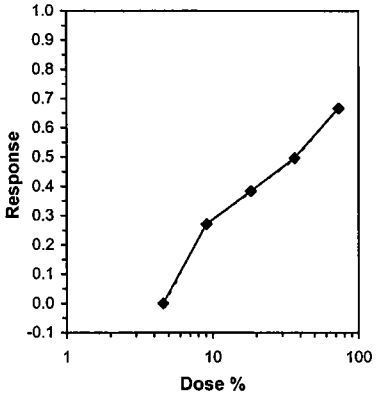
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
Pooled	0.5993	0.0304	0.5993	0.5545	0.6500	5.073	8				0.5996	1.0000
4.6	0.6000	0.0432	0.6000	0.5600	0.6600	7.201	4	-0.039	2.508	0.0444	0.5996	1.0000
*9.1	0.4375	0.0206	0.4375	0.4200	0.4600	4.712	4	9.132	2.508	0.0444	0.4375	0.7296
*18.3	0.3700	0.0141	0.3700	0.3600	0.3900	3.822	4	12.941	2.508	0.0444	0.3700	0.6171
*36.6	0.3025	0.0377	0.3025	0.2500	0.3400	12.479	4	16.750	2.508	0.0444	0.3025	0.5045
*73.1	0.2000	0.0082	0.2000	0.1900	0.2100	4.082	4	22.535	2.508	0.0444	0.2000	0.3335

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97514	0.896	0.207	0.38283
Bartlett's Test indicates equal variances (p = 0.14)	8.25726	15.0863		
The control means are not significantly different (p = 0.72)	0.37528	2.44691		

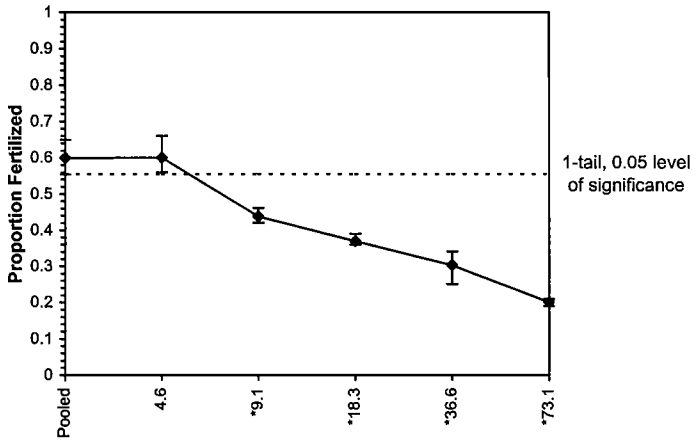
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	4.6	9.1	6.46993	21.7391	0.04445	0.07416	0.12612	0.00084	3.0E-16	5, 22

Log-Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew	
IC05	5.245	0.437	3.010	5.322	-4.5891	
IC10	5.965	0.211	4.856	6.144	-1.3490	
IC15	6.768	0.218	5.712	7.144	-0.5439	
IC20	7.663	0.265	6.670	8.281	0.2881	
IC25	8.661	0.385	7.566	9.896	1.1053	
IC40	20.352	1.691	14.803	25.784	0.6254	
IC50	37.275	3.916	24.371	46.032	-0.2591	%v/v



Dose-Response Plot



Statistical comparisons were against the pooled controls

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST DATA SUMMARY

Client: Azimuth Consulting Group
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400340

EVS Analysts: KES, ART
Test Initiation Date: 30 July 2004

SAMPLE

Identification: SDS RefTox Stock Sol^n #04-5-005
Amount ~~Received~~ Prep'd: 1 x 1L
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: Westcoast Sealab Supplies
Date Received: 30 July 2004
Reference Toxicant: SDS
Current Reference Toxicant Result
Reference Toxicant Test Date: 30 July 2004
IC50 (and 95% CL): 2.1 (1.9-2.4) mg/L SDS
Reference Toxicant Warning Limits (mean ± 2SD) and CV
4.2 ± 4.8 mg/L SDS, CV% = 57

DILUTION/CONTROL WATER (initial water quality)

Water Type: UV Steralized, 0.45µm filtered SW
Temperature (°C): 16.0
pH: 8.0
Dissolved Oxygen (mg/L): 8.2
Salinity (ppt): 28
Other: —

TEST CONDITIONS

Temperature Range (°C): 16.0
pH Range: 8.0
Dissolved Oxygen Range (mg/L): 8.2
Salinity Range (ppt): 28
Sperm:Egg Ratio: 1600:1
Test Duration: 10:10
Other: —

TEST RESULTS

IC 50: ~~1~~ 2.1 (1.9-2.4) mg/L SDS
IC 25: ~~1~~ 1.3 (0.9-1.5) mg/L SDS
NOEC: <1 mg/L SDS
LOEC: 1 mg/L SDS

Data Verified By: [signature]
Date Verified: Sept-10/04

EVS ENVIRONMENT CONSULTANTS
ECHINOID FERTILIZATION TOXICITY TEST INITIAL WATER QUALITY

Client: AZIMUTH CONSULTING GROUP
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400340
Logbook: ECHINOID #13 Pages: 50-53

Test Initiation Date/Time: 30 JULY 2004 @16:20
Test Species: Dendraster excentricus
Source/Date Received: 30 JULY
Test Duration: 10:10

Sample ID	Conc/Rep mg/L	Temperature (°C)	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Comments
SDS	CONTROL	16.0	8.0	28	8.2	
	1.0	16.0	8.0	28	~~8.4~~ 8.2	
	1.8	16.0	8.0	28	8.2	
	3.2	16.0	8.0	28	8.2	
	5.6	16.0	8.0	28	8.2	
↓	10.0	16.0	8.0	28	8.2	
Tech. Init.	KEJ	KEJ	KEJ	KEJ	KEJ	

WQ Instruments Used: Temp. Calibrated Hg thermometer pH II-A-51 Salinity II-A-03-03 DO II-A-011202

Data Verified By: [signature] Date Verified: Sept 8/04

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

Client: AZIMUTH CONSULTING GROUP
EVS Project No.: 09 0302-54
EVS Work Order No.: 0400340
Logbook: ECHINOID #13 Pages: 50 – 53

Test Initiation Date/Time: 30 JULY 2004 @ 16:20
Test Species: Dendraster excentricus
Test Duration: 10:10
Sperm:Egg Ratio: ~~1:1600~~ kef 1600:1

Concentration SDS mg/L	Replicate	No. Fertilized Eggs	No. Unfertilized Eggs	Comments	Tech. Initials
Reference Toxicant					
1.0	A	47	53		kef
	B	55	45		↓
	C	50	50		↓
	D	48	52		↓
1.8	A	33	67		kef
	B	36	64		↓
	C	39	61		↓
	D	35	65		↓
3.2	A	14	86		kef
	B	11	89		↓
	C	~~kef 15~~ 15	85		↓
	D	18	82		↓
5.6	A	5	~~kef 95~~ 95		kef
	B	8	92		↓
	C	7	93		↓
	D	5	~~482~~ 95		↓
10.0	A	2	98		kef
	B	3	97		↓
	C	2	98		↓
	D	2	98		↓
Control Seawater					
	A	59	41		kef
	B	62	38		↓
	C	56	44		↓
	D	65	35		↓

Data Verified By: [signature]
Date Verified: Sept. 10/04

Test: SC-Sperm Cell Fertilization test						Test ID: rtscsds8	
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: 7/30/2003 10:10			End Date: 7/30/2003			Lab ID: BCEVS-EVS Environment Consultants	
Pos	ID	Rep	Group	Total Counted	Number Fertilized	Number Unfertilized	Notes
	1	1	D-Control	100	59	41	
	2	2	D-Control	100	62	38	
	3	3	D-Control	100	56	44	
	4	4	D-Control	100	65	35	
	5	1	1.0	100	47	53	
	6	2	1.0	100	55	45	
	7	3	1.0	100	50	50	
	8	4	1.0	100	48	52	
	9	1	1.8	100	33	67	
	10	2	1.8	100	36	64	
	11	3	1.8	100	39	61	
	12	4	1.8	100	35	65	
	13	1	3.2	100	14	86	
	14	2	3.2	100	11	89	
	15	3	3.2	100	15	85	
	16	4	3.2	100	18	82	
	17	1	5.6	100	5	95	
	18	2	5.6	100	8	92	
	19	3	5.6	100	7	93	
	20	4	5.6	100	5	95	
	21	1	10.0	100	2	98	
	22	2	10.0	100	3	97	
	23	3	10.0	100	2	98	
	24	4	10.0	100	2	98	

Comments: Azimuth Consulting Group 09-0302-54 (0400340)

Reviewed by: Qal

Sperm Cell Fertilization test-Proportion Fertilized

Start Date:	7/30/2003 10:10	Test ID:	rtscsds8	Sample ID:	REF-Ref Toxicant
End Date:	7/30/2003	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 (0400340)				

Conc-mg/L	1	2	3	4
D-Control	0.5900	0.6200	0.5600	0.6500
1	0.4700	0.5500	0.5000	0.4800
1.8	0.3300	0.3600	0.3900	0.3500
3.2	0.1400	0.1100	0.1300	0.1800
5.6	0.0500	0.0800	0.0700	0.0500
10	0.0200	0.0300	0.0200	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	0.6050	0.0387	0.6050	0.5600	0.6500	6.402	4				0.6050	1.0000
*1	0.5000	0.0356	0.5000	0.4700	0.5500	7.118	4	5.417	2.410	0.0467	0.5000	0.8264
*1.8	0.3575	0.0250	0.3575	0.3300	0.3900	6.993	4	12.769	2.410	0.0467	0.3575	0.5909
*3.2	0.1400	0.0294	0.1400	0.1100	0.1800	21.028	4	23.990	2.410	0.0467	0.1400	0.2314
*5.6	0.0625	0.0150	0.0625	0.0500	0.0800	24.000	4	27.989	2.410	0.0467	0.0625	0.1033
*10	0.0225	0.0050	0.0225	0.0200	0.0300	22.222	4	30.052	2.410	0.0467	0.0225	0.0372

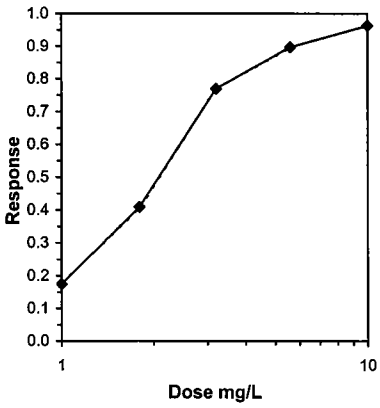
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.95924	0.884	0.47024	-0.048
Bartlett's Test indicates equal variances (p = 0.10)	9.12722	15.0863		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	<1	1			0.04671	0.07721	0.23459	0.00075	7.9E-17	5, 18

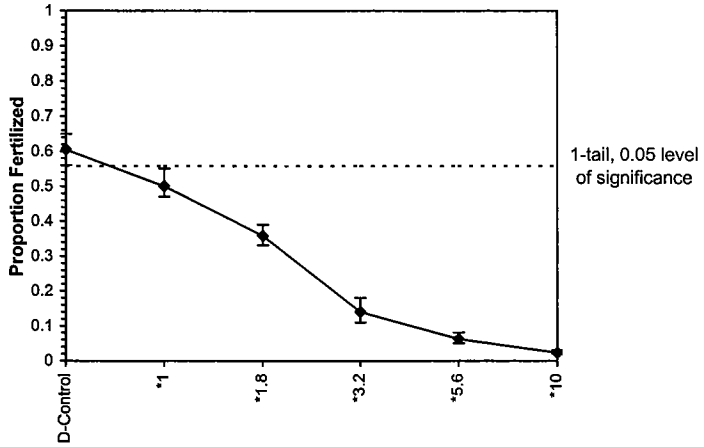
Log-Linear Interpolation (200 Resamples)

Point	mg/L	SD	95% CL(Exp)		Skew	
IC05*	0.2210	0.0598	0.1215	0.4427	1.9998	
IC10*	0.4909	0.1376	0.2541	1.0631	1.4199	
IC15*	0.8204	0.1664	0.3977	1.2636	0.1322	
IC20	1.0770	0.1112	0.6393	1.3408	-0.5478	
IC25	1.2308	0.0881	0.9462	1.4744	0.0167	
IC40	1.7639	0.0892	1.4812	2.0222	0.0823	
IC50	2.1023	0.0768	1.8738	2.3581	0.1963	mg/L SDS

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



Reviewed by: Sent. 15/06

APPENDIX C

Chain-of-Custody Form

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

EVS Environment Consultants
North Vancouver, BC
Canada V7P 2R4
Tel: 604-986-4331
Fax: 604-662-8548
www.evsenvironment.com

Client Name: Teck Cominco (Polaris) Client Contact Name: Cheryl. MacKintosh Ship to: _____

Address: Azimuth Consulting Group Phone: 604 730 1220

218-2902 West Broadway Fax: 604 739 8511

Vancouver B.C. Sampled By: Karlette Tunaley Attn: _____ Shipping Date: _____

Topsail

Collection Date (dd/mmm/yy)	Time (24-h clock)	Sample Identification	1 Type of Each Sample	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)	2 Sample Container Type by Code	Test(s) Requested						3 Notes? (e.g. preserved, saltwater, freshwater, may contain sewage)
For composite sample record date & time starting and ending								Fed Topsail						
27/07/04	9:30AM	G-Creek_Sublethal_270704	E			2x20L	HDPE							POLARIS Proj
		G-Creek_Acute_270704	E			3x20L	HDPE							POLARIS Proj

-54

PO/Reference No.:

Project Title:

Results Needed By:

Comments/Instructions:

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

B) Received by: Ann Date: July 30-04
Company: EVS Time: 1200
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) HDPE Plastic
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:
White, yellow, pink - accompany the shipment
Orange - retained by consignor (e.g., shipper)
Yellow - retained by consignee (e.g., receiver)
Pink - for use as needed
White - returned to consignor by consignee

Photocopy of original because 3 coolers.

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

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

Client Name: Teck Cominco (Polaris) Client Contact Name: Cheryl. MacKintosh Ship to: _____

Address: ~~Azimuth Consulting Group~~ Phone: 604 730 9220

218-2902 West Broadway Fax: 604 739 8511

Vancouver B.C. Sampled By: Karlette Tinsley Attn: _____

Shipping Date: _____ Kathyrn

Collection Date (dd/mmm/yy)	Time (24-h clock)	Sample Identification	1 Type of Each Sample	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)	2 Sample Container Type by Code	Test(s) Requested						3 Notes? (e.g. preserved, saltwater, freshwater, may contain sewage)
For composite sample record date & time starting and ending														
27/07/04	9:30PM	G-Creek_Sublethal_270704	E			2x20L	HDPE							POLARIS PROJ
		G-Creek_Acute_270704	E			3x20L	HDPE							POLARIS PROJ

Photo copy of original because 3 coolers

PO/Reference No.:

Project Title:

Results Needed By:

Comments/Instructions:

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

B) Received by: AWD Date: 30 JULY 2004
Company: EVS Time: 12:00
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) HDPE Plastic
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

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White, yellow, pink - accompany the shipment
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Yellow - retained by consignee (e.g., receiver)
Pink - for use as needed
White - returned to consignor by consignee

October 2004

LABORATORY REPORT

Azimuth Consulting Group

POLARIS MINE

ENVIRONMENTAL EFFECTS MONITORING PROGRAM

August 24, 2004

PREPARED FOR:

Azimuth Consulting Group
Vancouver, BC

PREPARED BY:

EVS environment consultants
A Member of the Golder Group of Companies
North Vancouver, BC

AZIMUTH CONSULTING GROUP

POLARIS MINE ENVIRONMENTAL EFFECTS MONITORING PROGRAM

August 24, 2004

LABORATORY REPORT

Prepared for

Azimuth Consulting Group
218-2902 W. Broadway
Vancouver, BC
V6K 2G8

Prepared by

EVS Environment Consultants - A Member of the Golder Group of Companies
195 Pemberton Avenue
North Vancouver, BC
Canada V7P 2R4

EVS Project No.

09-0302-54

October 2004

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ACKNOWLEDGEMENTS

The *A. affinis* toxicity test was conducted by Andy Diewald, Anja Fouche and Jenny Shao. Kathryn Sentance and Ann-Marie Norris performed the *D. excentricus* fertilization toxicity test. Statistical analyses were performed by Jenny Shao and Kathryn Sentance. The report was written by Kathryn Sentance and reviewed by Edmund Canaria. Quality Assurance/Quality Control (QA/QC) review was conducted by Julianna Kalokai.

1. INTRODUCTION

EVS Environment Consultants conducted sublethal Metal Mining Effluent Regulations (MMER) toxicity testing for Azimuth Consulting Group as part of the Environmental Effects Monitoring (EEM) program for Polaris Mine.

A sample, identified as G Creek-082404, was collected from the Polaris Mine Site on August 24, 2004 in 20-L collapsible polyethylene containers. It was received at the EVS laboratory on August 27, 2004 and was stored in the dark at 4°C prior to test initiation. The sample was evaluated for toxicity using the 7-d topsmelt (*Atherinops affinis*) survival and growth toxicity test and the echinoderm (*Dendraster excentricus*) fertilization toxicity test. Toxicity testing was initiated on the day of initial sample receipt.

This report describes the methods and results of the 7-d topsmelt (*Atherinops affinis*) toxicity test and the echinoderm (*Dendraster excentricus*) fertilization toxicity test. The raw data and statistical analyses are provided in Appendix A and B respectively, and the chain-of-custody form is provided in Appendix C.

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 (Pelagus) | 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 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 SPECIES INFORMATION

Source: ABS (Aquatic Bio Systems)

Date Received: ~~26~~ Aug 25 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) µg/L

7-d growth IC50: 128 (85-152) (41-153) µg/L

Reference Toxicant Warning Limits (mean ± 2SD) and CV

7-d survival LC50: 132 ± 48 µg/L CV: 18%

7-d growth IC50: 138 ± 51 µg/L CV: 20%

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.: 04-0302-54 | 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)
EVS Project No.: 09-0302-54
EVS Work Order No.: 0400384

Sample ID: G-Creek 082404
Test Species/Batch: A. affinis / Aug 17-04
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	
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: 6-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	0								
Technician Initials		JCS	M	—	JCS	C	~	JCS	JCS	

Sample Description: clear, colorless
Data Verified By: Qalpha
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	1224.42	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	pre wt: 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 % (y/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.
~~72~~ 71	A	A 61	1236.40	1239.74	5	5		~~JJ~~
	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		

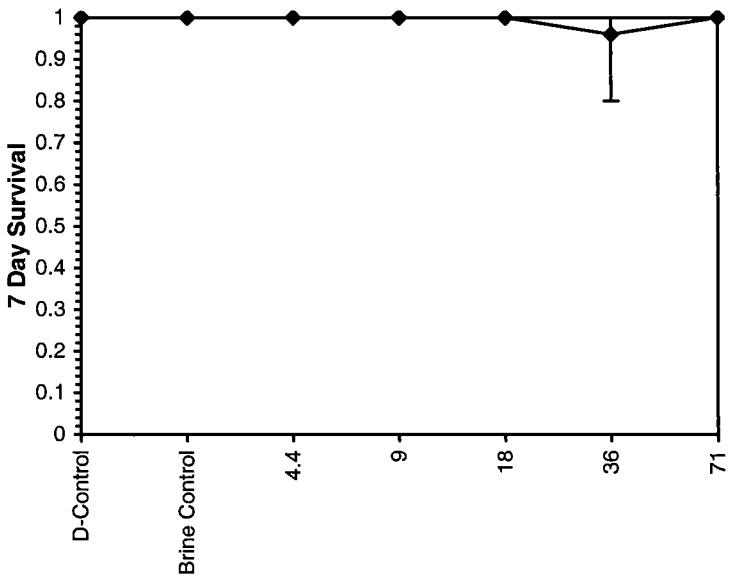
Conc-%	1	2	3	4	5
D-Control	1.0000	1.0000	1.0000	1.0000	1.0000
Brine Control	1.0000	1.0000	1.0000	1.0000	1.0000
4.4	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
18	1.0000	1.0000	1.0000	1.0000	1.0000
36	1.0000	1.0000	0.8000	1.0000	1.0000
71	1.0000	1.0000	1.0000	1.0000	1.0000

			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

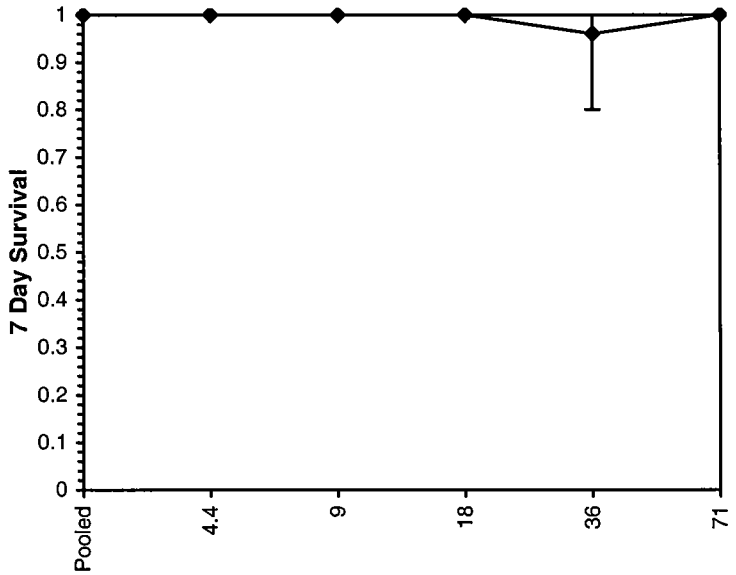
Conc-%	1	2	3	4	5
D-Control	1.0000	1.0000	1.0000	1.0000	1.0000
Brine Control	1.0000	1.0000	1.0000	1.0000	1.0000
4.4	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
18	1.0000	1.0000	1.0000	1.0000	1.0000
36	1.0000	1.0000	0.8000	1.0000	1.0000
71	1.0000	1.0000	1.0000	1.0000	1.0000

			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

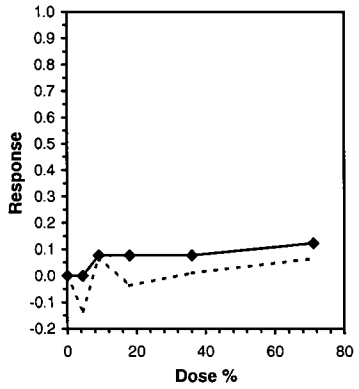
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.94863	0.9	0.95961	2.51611
Bartlett's Test indicates equal variances (p = 0.05)	11.0427	15.0863		
The control means are not significantly different (p = 0.72)	0.36654	2.30601		

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

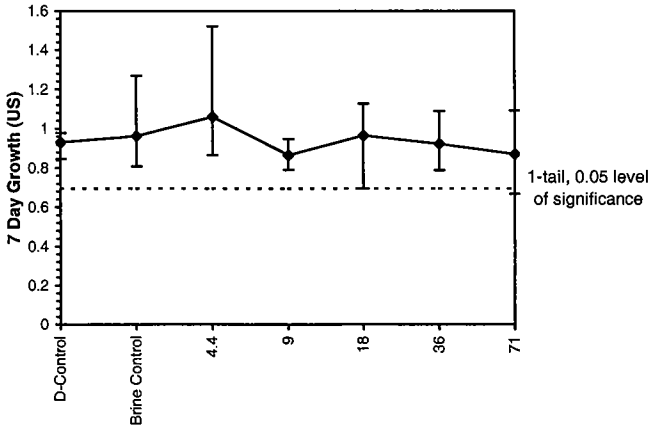
Linear Interpolation (200 Resamples)

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

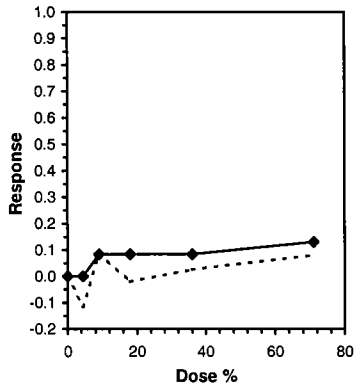
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.94174	0.91	1.04686	2.00659
Bartlett's Test indicates equal variances (p = 0.18)	7.64107	15.0863		
The control means are not significantly different (p = 0.72)	0.36654	2.30601		

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

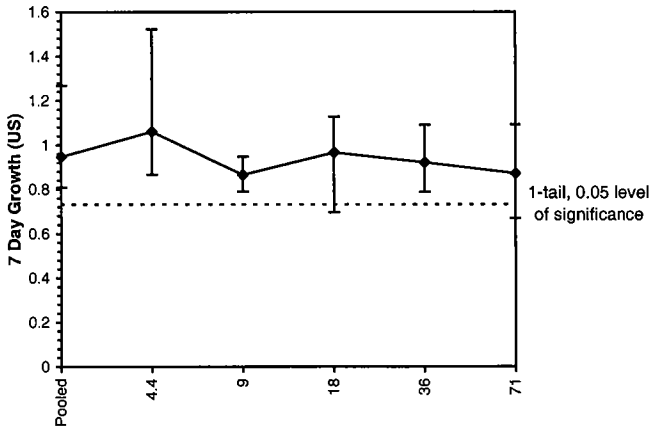
Linear Interpolation (200 Resamples)

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.

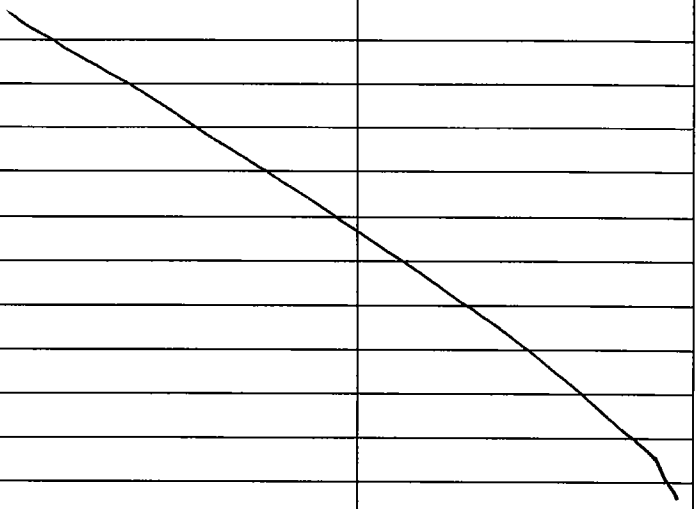
Reviewed by Oct 20/04

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	µg/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 ug/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	^	^	^	JLS	^	^	JLS	JLS

Concentration ug/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	~	~	~	~	~	JLS	~	~	~	^	^	JLS	JLS	JLS

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

Comments

Test Set Up By: AWD | Data Verified By: [signature] | 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)
Sample ID: Cu reftox
EVS Project No.: 09-0302-54
Test Species/Batch: A. affinis / Aug 24-04
EVS Work Order No.: 0400384
Test Initiation Date/Time: Aug 25, 2004 @ 1245
No. of Organisms/Volume: 5/200mL

Concentration ug/L	Rep.	Pan No.	Number of Survivors – Day of Test							Comments
			1	2	3	4	5	6	7	
	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	~~1~~	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: Galfish
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 791L	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	A 1	1236.92	1240.48	5	5		AW/SJ
	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	1236.85	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: Galfish
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 27, 2004
Sample ID: Cu Ref/tox
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

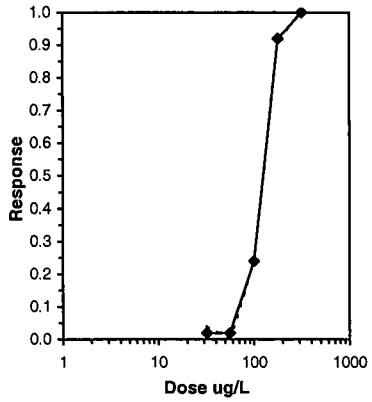
			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-ug/L	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
D-Control	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5			0	25
32	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5	25.00	17.00	1	25
56	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	27.50	17.00	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				

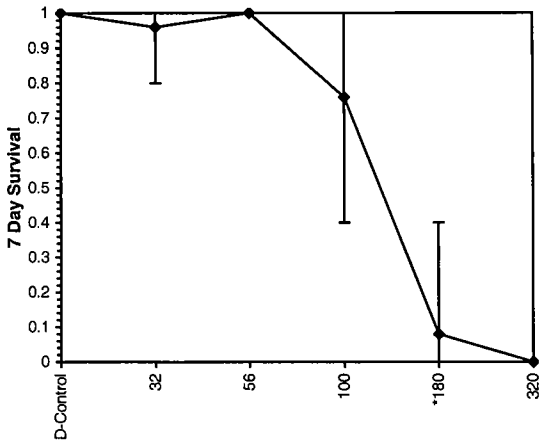
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	100	180	134.164	

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

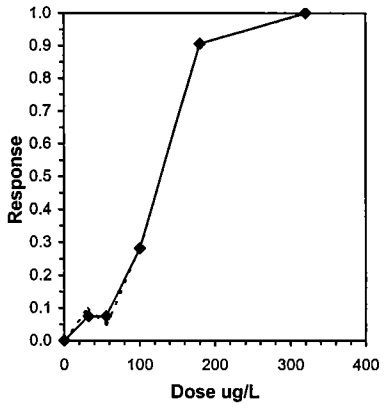
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-ug/L	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.9064	0.1208	0.9064	0.7120	1.0360	13.330	5				0.9064	1.0000
32	0.8148	0.1529	0.8148	0.5800	0.9520	18.764	5	0.859	2.300	0.2451	0.8388	0.9254
56	0.8628	0.1413	0.8628	0.7160	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

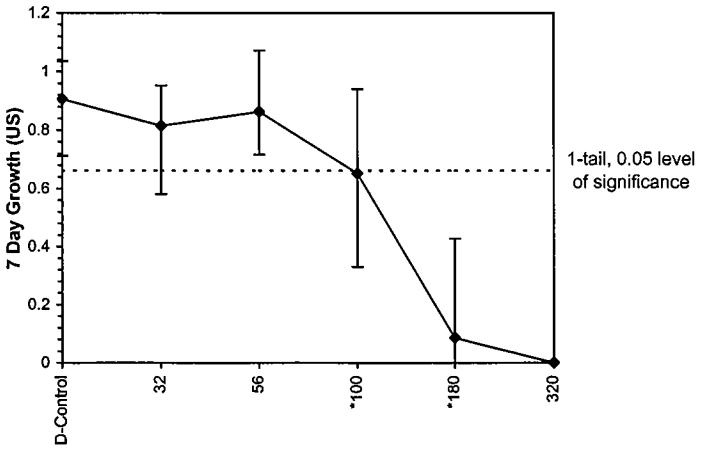
Linear Interpolation (200 Resamples)

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-030305 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 (GCREEK 082404) % J/N	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Comments	Tech. Initials
4.7	A	~~78~~	22		dkf
	B	~~74~~	26		↓
	C	76	24		↓
	D	72	28		↓
9.4	A	61	39		dkf
	B	62	38		↓
	C	62	38		↓
	D	60	40		↓
18.8	A	56	44		dkf
	B	58	42		↓
	C	~~41~~ 59	41		↓
	D	55	45		↓
37.5	A	49	51		dkf
	B	50	50		↓
	C	50	50		↓
	D	48	52		↓
75.1	A	25	75		↓
	B	27	73		dkf
	C	24	76		↓
	D	27	73		↓
CONTROL SEA WATER	A	~~77~~	~~77~~ 23		dkf
	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

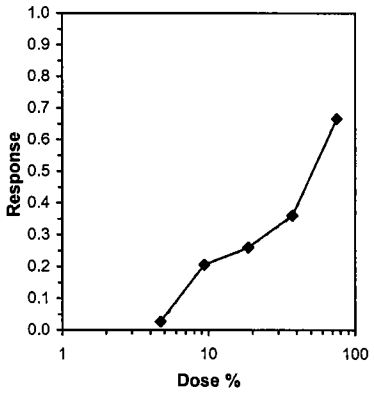
			Transform: Untransformed						1-Tailed		Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.7700	0.0245	0.7700	0.7400	0.8000	3.181	4				0.7700	1.0000
B-Control	0.7625	0.0250	0.7625	0.7300	0.7900	3.279	4					
4.7	0.7500	0.0258	0.7500	0.7200	0.7800	3.443	4	1.546	2.410	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		

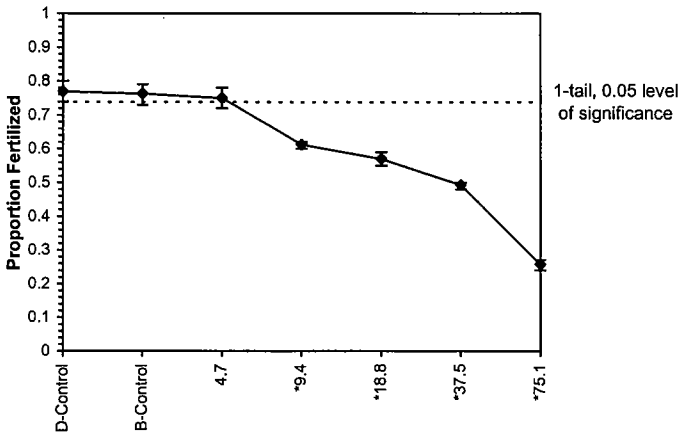
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	4.7	9.4	6.6468	21.2766	0.03118	0.04049	0.14215	0.00033	5.1E-18	5, 18

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

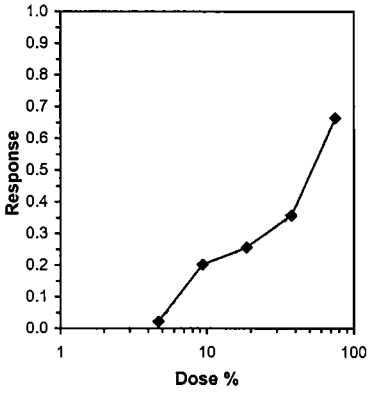
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
Pooled	0.7663	0.0233	0.7663	0.7300	0.8000	3.036	8				0.7663	1.0000
4.7	0.7500	0.0258	0.7500	0.7200	0.7800	3.443	4	1.390	2.508	0.0293	0.7500	0.9788
*9.4	0.6125	0.0096	0.6125	0.6000	0.6200	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		

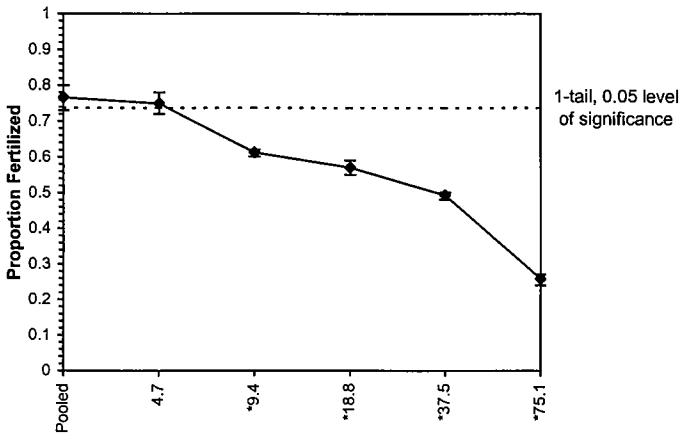
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	4.7	9.4	6.6468	21.2766	0.02931	0.03826	0.16613	0.00036	1.9E-21	5, 22

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

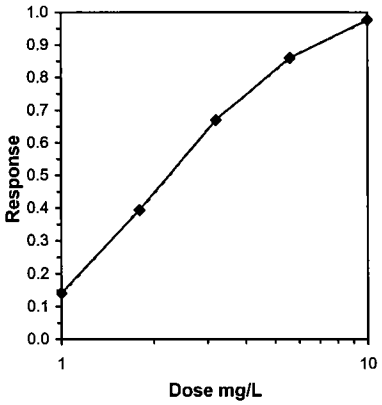
			Transform: Untransformed						1-Tailed		Isotonic	
Conc-mg/L	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.7700	0.0245	0.7700	0.7400	0.8000	3.181	4					
*1	0.6975	0.0171	0.6975	0.6800	0.7200	2.448	4	5.813	2.410	0.0301		
*1.8	0.4675	0.0171	0.4675	0.4500	0.4900	3.653	4	24.254	2.410	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

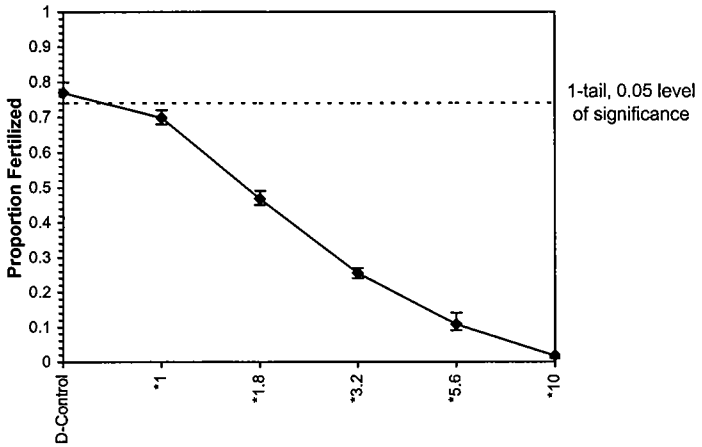
Log-Linear Interpolation (200 Resamples)

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. ~~18~~ 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																
~~18~~ 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 #: 09-1108-01
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. ~~18~~/04
Company: Azimuth Time: 9:00am
Courier name: First air / FedEx
Shipping containers secured by: (Tape) (Straps) Lock Other (circle one)
Custody seals used? Yes No METAL STRIPS

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:
White, yellow, pink - accompany the shipment
Orange - retained by consignor (e.g., shipper)
Yellow - retained by consignee (e.g., receiver)
Pink - for use as needed
White - returned to consignor by consignee

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.
218-2902 Broadway West
Vancouver, BC, V6K 2G8
P: 604-730-1220
F: 604-739-8511
e-mail: cmackintosh@azimuthgroup.ca

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