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

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

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

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

- 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.

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

- 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.

195 Pemberton Ave.
North Vancouver, BC
Canada V7P 2R4

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Fax: 604.662.8548
www.evsenvironment.com
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
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

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.
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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 / Torgo Controls [illegible]
Address: 218-2902 West Broadway, Vancouver BC, V6K 2G8
Client Contact Name: Cheryl Mackintosh / Brian Donald
Phone: 604-730-1220
Fax: 604-739-9070
Sampled By: ~~[illegible]~~ C. Mackintosh
Ship to: EVS Environment Consultants, 195 Pemberton Ave., North Vancouver, BC, V7P 2R4
Attn: Edmund Canaria
Shipping Date: Aug. 26, 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																
24/Aug/04	15:00	G-Creek-082404	E		[illegible]	5 x 20L	CC	✓	✓	✓	✓			Freshwater <24 ppt	[illegible]	[illegible]

EVS Receipt Check List

EVS Project #: 04-1108-01
EVS Workorder #: 0400382/383 RBT / 384 DM / 385 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.: 17-05-03
Project Title: Polaris Mine
Results Needed By:

Comments/Instructions:

A) Released By: C. Mackintosh Date: Aug 26/04
Company: Azimuth Time: 9:00am
Courier name: [illegible] / FedEx
Shipping containers secured by: (Tape) (Straps) Lock Other ____ (circle one)
Custody seals used? Yes No METAL STRAPS

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

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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

TABLE OF CONTENTS

LIST OF TABLES

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.

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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		new 2	old	3		new 4	old	New 5	old	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	200	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	200	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	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	JLS	JLS	JLS	[illegible]	[illegible]	JLS	JLS	[illegible]

Concentration (% v/v)	pH													
	0	1		2		3		New 4		5		6		7
Neg. Ctl	8.0	80	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	80	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	80	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	80	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	80	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	80	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	[illegible]	[illegible]	[illegible]	[illegible]	AXF	[illegible]	JLS	JLS	JLS	[illegible]	[illegible]	JLS	JLS	[illegible]

WQ Instruments Used: Temp. Cal. Hg Therm. pH II-A-030301

Comments

Test Set Up By [illegible] 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		
	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		
	B	7	1262.43	1266.70	~~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~~ 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		

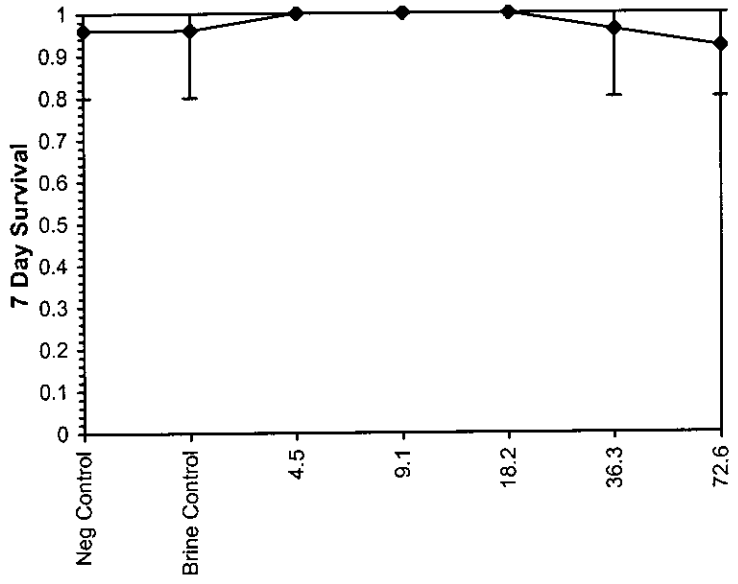
Conc-%	1	2	3	4	5
Neg Control	1.0000	1.0000	0.8000	1.0000	1.0000
Brine Control	1.0000	0.8000	1.0000	1.0000	1.0000
4.5	1.0000	1.0000	1.0000	1.0000	1.0000
9.1	1.0000	1.0000	1.0000	1.0000	1.0000
18.2	1.0000	1.0000	1.0000	1.0000	1.0000
36.3	1.0000	1.0000	0.8000	1.0000	1.0000
72.6	1.0000	1.0000	0.8000	1.0000	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				

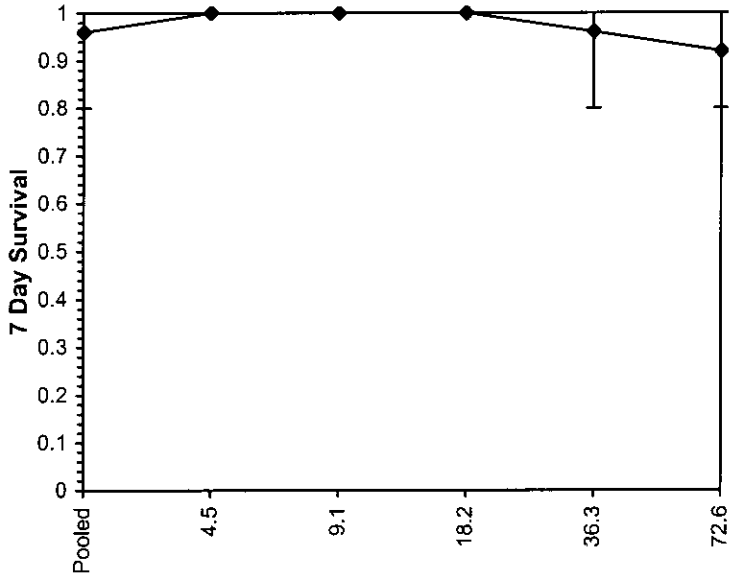
Conc-%	1	2	3	4	5
Neg Control	1.0000	1.0000	0.8000	1.0000	1.0000
Brine Control	1.0000	0.8000	1.0000	1.0000	1.0000
4.5	1.0000	1.0000	1.0000	1.0000	1.0000
9.1	1.0000	1.0000	1.0000	1.0000	1.0000
18.2	1.0000	1.0000	1.0000	1.0000	1.0000
36.3	1.0000	1.0000	0.8000	1.0000	1.0000
72.6	1.0000	1.0000	0.8000	1.0000	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

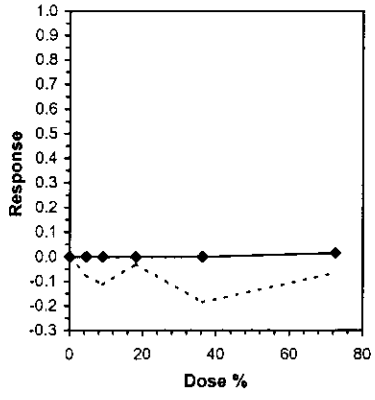
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
Neg Control	0.9296	0.1800	0.9296	0.7880	1.2120	19.366	5				1.0052	1.0000
Brine Control	1.0780	0.1661	1.0780	0.8540	1.3000	15.410	5					
4.5	1.0012	0.0826	1.0012	0.9440	1.1360	8.252	5	-0.786	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		

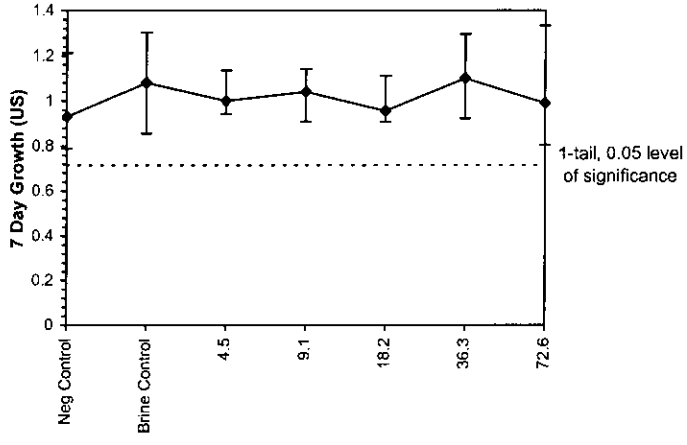
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	72.6	>72.6		1.37741	0.21507	0.23136	0.01877	0.02076	0.49467	5, 24

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

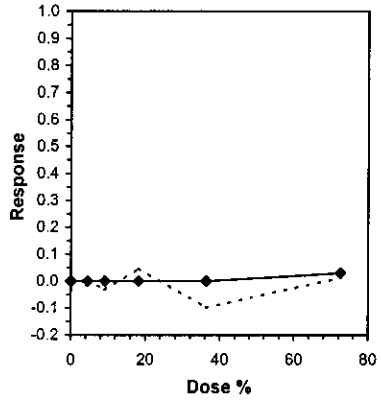
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	SD	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
Pooled	1.0038	0.1811	1.0038	0.7880	1.3000	18.038	10				1.0200	1.0000
4.5	1.0012	0.0826	1.0012	0.9440	1.1360	8.252	5	0.031	2.462	0.2040	1.0200	1.0000
9.1	1.0360	0.0876	1.0360	0.9040	1.1360	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		

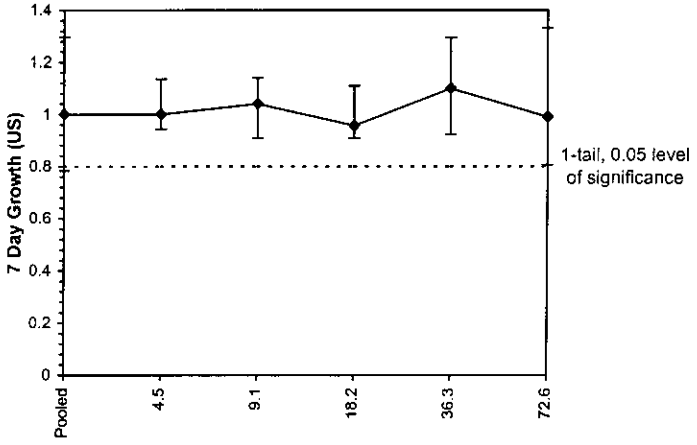
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	72.6	>72.6		1.37741	0.20401	0.20324	0.01261	0.02289	0.73615	5, 29

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	New 3	old	New 4	old	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	~	JKS	~	~	JKS	JKS	~	~	JJS	JJS	~

Concentration (µg/L Cu)	pH													
	0	1		New 2	old	New 3	old	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	AK	A	~	AXF/~	~	~	JKS	JKS	~	~	JJS	JJS	~

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

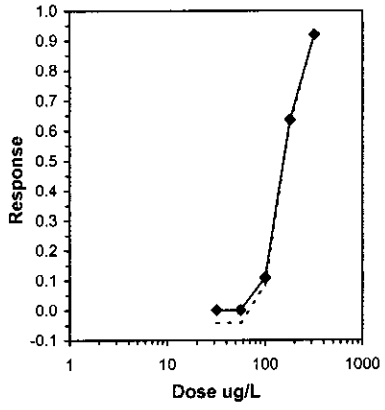
			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-ug/L	Mean	SD	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
D-Control	0.9600	0.0894	1.2977	1.1071	1.3453	8.207	5			1	25
32	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	30.00	16.00	0	25
56	1.0000	0.0000	1.3453	1.3453	1.3453	0.000	5	30.00	16.00	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				

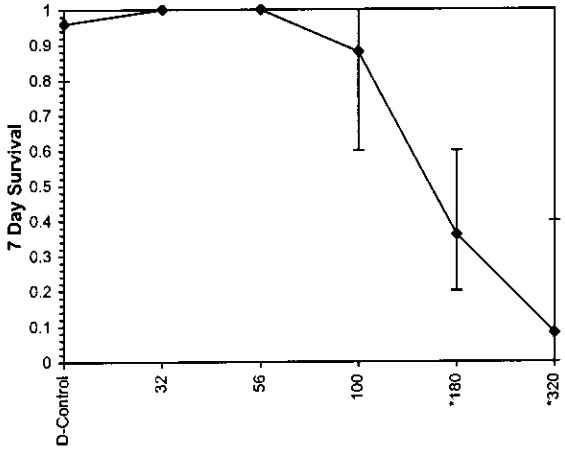
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	100	180	134.164	

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

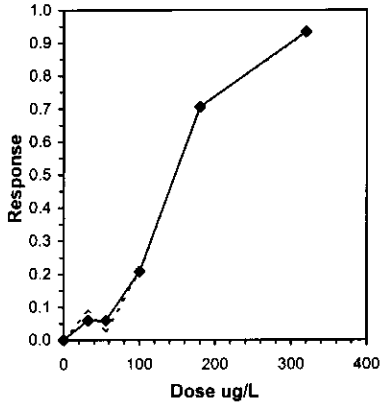
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97039	0.9	0.15928	-0.3767
Bartlett's Test indicates equal variances (p = 0.21)	7.13123	15.0863		

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

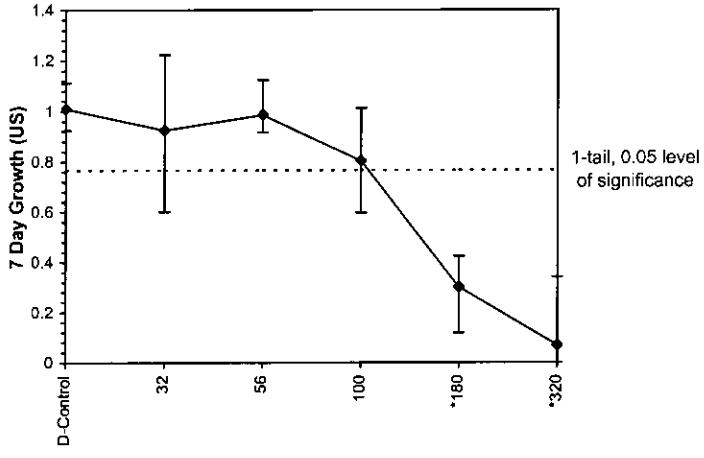
Linear Interpolation (200 Resamples)

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