ATTACHMENT A

2019 AEMP SAMPLING SCHEDULE

Table A-1 2019 AEMP Sampling Schedule

Station	Ice Cover																Open Water																									
	April									May							August																				September					
	22	23	24	25	26	27	28	29	30	1	4	5	6	8	9	10	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5				
NF1	An																							Anpsb																		
NF2																An									Anpsb																	
NF3		An																																		Anpsb					
NF4		An																							Anpsb																	
NF5		An															Anpsb																									
MF1-1																An								Anpsb																	
MF1-3							An[c]																	Anpsb																	
MF1-5							An																Anpsb[a]																			
MF2-1				An																					Anpsb																	
MF2-3			An[d]																			Anpsb																				
FF2-2																An[b]						Anpsb																				
FF2-5																An						Anpsb																				
MF3-1																An																									
MF3-2									An																											Anpsb[c]					
MF3-3															An															Anpsb										
MF3-4															An[b]														Anpsb											
MF3-5															An														Anpsb											
MF3-6										An																			Anpsb											
MF3-7										An																		Anpsb												
FF1-1											Mn								Mnpsb																						
FF1-2											Mn										Mnpsb																				
FF1-3											Mn									Mnpsb																					
FF1-4											Mn[a]												Mnspb																		
FF1-5											Mn										Mnspb																				
FFB-1													Mn															Mnpsb												
FFB-2													Mn														Mnpsb[a]													
FFB-3													Mn															Mnpsb												
FFB-4												Mn[c]															Mnpsb													
FFB-5												Mn															Mnpsb													
FFA-1														Mn																									Mnpsb		
FFA-2														Mn																										Mnpsb
FFA-3														Mn																									Mnpsb	
FFA-4														Mn																									Mnpsb	
FFA-5														Mn																									Mnpsb	
LDS-1					Mn																															Mnp				
LDS-2					Mn																															Mnp				
LDS-3																Mn																				Mnp				
LDS-4																																								Mn
LDG-48														Mn																										

A = water quality surface, middle depth and bottom depth samples collected; M = mid-depth sample collected; n = nutrient sample collected; p = plankton sample collected; s = sediment sample collected; b = benthic invertebrate sample collected; QA/QC = quality assurance/quality control.

a) Field Blanks only collected for total ammonia samples.

b) Trip Blanks only collected for total ammonia samples.

c) Equipment Blanks only collected for total ammonia samples.

d) Duplicates only collected for total ammonia samples.

Note: QA/QC samples are colour coded: Grab Water (GW), Equipment Blank (EBW), Field Blank (FBW), Trip Blank (TBW), and Duplicate 1/Duplicate 2 (DUP1/DUP2).

NF = near-field; MF = mid-field; FF = far-field; LDG = Lac de Gras; LDS = Lac du Sauvage.

ATTACHMENT B

QUALITY ASSURANCE AND QUALITY CONTROL METHODS AND RESULTS

QUALITY ASSURANCE AND QUALITY CONTROL METHODS AND RESULTS

Introduction

Quality assurance and quality control (QA/QC) practices determine data integrity and are relevant to all aspects of a study, from sample collection to data analysis and reporting. Quality assurance encompasses management and technical practices designed to generate consistent, high quality data. Quality control is an aspect of quality assurance and includes the techniques used to assess data quality and the corrective actions to be taken when the data quality objectives are not met. Details of the QA/QC practices applied during the Aquatic Effects Monitoring Program (AEMP) are described in the *Quality Assurance Project Plan (QAPP) Version 3.1* (Golder 2017a). This appendix describes QA/QC practices applied during the 2019 AEMP, evaluates quality control data, and describes the implications of QC results to the interpretation of study results.

Quality Assurance

Field Staff Training and Operations

Diavik Diamond Mines (2012) Inc. (DDMI) field staff are trained to be proficient in standardized field sampling procedures, data recording, and equipment operations applicable to water quality sampling. Field work was completed according to specified instructions and standard operating procedures (SOP) as follows:

- ENVI-923-0119 AEMP SOP Combined Open Water and Ice Cover
- ENVI-915-0119 SOP SNP Sampling
- ENVI-902-0119 SOP Quality Assurance Quality Control
- ENVI-900-0119 SOP Chain of Custody
- ENVI-903-0119 SOP Dissolved Oxygen Analysis
- ENVI-904-0119 SOP pH Analysis
- ENVI-906-0119 SOP Turbidity Analysis
- ENVI-904-0119 SOP Total Suspended Solids
- ENVI-918-0119 SOP Field Meter
- ENVI-684-0317 SOP YSI ProDSS

These SOPs include guidelines for field record-keeping and sample tracking, guidance for use and calibration of sampling equipment, relevant technical procedures, and sample labelling, shipping and tracking protocols.

Laboratory Analyses

Samples were sent for analysis to Bureau Veritas Laboratories (BV Labs; formerly Maxxam Analytics), a laboratory accredited by the Canadian Association of Laboratory Accreditation (CALA). Duplicate samples for ammonia analysis were also sent to ALS Laboratories (ALS), another CALA accredited lab. Under the accreditation program, performance assessments are completed annually for laboratory procedures, analytical methods, and internal quality control.

In previous years, samples have been analyzed by BV Labs at the Burnaby, British Columbia (BC) location. However, during the ice-cover season, samples from 23 stations were analyzed at BV Labs in Burnaby and samples from the remaining 15 stations were analyzed by BV Labs at the Calgary, Alberta (AB) location, due to equipment issues at the Burnaby laboratory. All of the 2019 open-water samples were analyzed in Calgary. A lab comparison study was undertaken by BV Labs in 2019 as a result of multiple locations completing the analyses. The study is included in Annex A. Based on a review of the 2019 data, there was no indication that this change resulted in data quality issues for ammonia. The Calgary laboratory uses the same methods as the Burnaby laboratory, and has recently constructed a new clean lab. In addition, moving the analyses to the Calgary location had many benefits, including reducing risks of contamination due to subsampling and splitting of samples, improved/shorter shipping routes, which also resulted in shorter turn-around times, and reduced risk of missing hold times.

Quality assurance completed by the DDMI Environmental Sampling team encompasses all quality-related activities related to aquatic testing and analysis, and relevant technical support.

DDMI's quality assurance places an emphasis on four aspects:

- infrastructure (instruments, testing capabilities, calibrations, SOPs)
- control measures (internal/external)
- personnel (competence, ethics and integrity)
- data management

Field and Office Operations

A quality assurance system was established as an organized system of data control, analysis and filing. Relevant elements of this system are as follows:

- pre-field meetings to discuss specific work instructions with field crews
- field crew check-in with task managers every 24 to 48 hours to report work completed during that period
- designating two crew members responsible for:
  - collecting all required samples
  - downloading and storing electronic data
  - completing chain-of-custody and analytical request forms; labelling and documentation
  - processing, where required, and delivering samples to analytical laboratory in a timely manner

- cross-checking chain-of-custody forms and analysis request forms by the task manager to verify that the correct analysis packages had been requested
- review of field sheets by the task manager for completeness and accuracy
- reviewing laboratory data immediately after receipt from the analytical laboratory
- creating backup files before data analysis
- completing appropriate logic checks and verifying accuracy of calculations

Quality Control

Quality control is a specific aspect of quality assurance and includes the techniques used to assess data quality and the remedial measures to be taken when the data quality objectives are not met. The field QC program included collection of field blanks, trip blanks, equipment blanks, and duplicate samples to assess potential sample contamination, and within-station variation (i.e., sampling precision). Quality control samples were submitted to BV Labs for analysis of the full list of variables, and to ALS for analysis of ammonia.

Field blanks consisted of samples prepared in the field using laboratory-provided de-ionized water to fill a set of sample bottles, which were then submitted to the appropriate laboratory for the same analyses as the original water samples. Trip blanks consisted of sample bottles filled with high-grade de-ionized water from the laboratory. They accompanied the other samples through sample collection, handling, shipping and analysis, but remained sealed. Equipment blanks consisted of de-ionized water exposed to all aspects of sample collection and analysis, using the same procedures used in the field, including contact with all sampling devices (i.e., beta bottle) and other equipment (i.e., filters, tubing). Equipment blanks provide information regarding potential cross-contamination between samples and contamination introduced by field equipment.

The field, trip and equipment blanks were used to detect potential sample contamination during collection, shipping and analysis. Although concentrations of all variables should be below their respective detection limit (DL) in these blanks, their concentrations were considered notable if they were greater than five times the corresponding DL. This threshold is based on the Practical Quantitation Limit defined by the United States Environmental Protection Agency (US EPA 1994, 2007; BC MOE 2009), which takes into account the potential for data accuracy errors when variable concentrations approach or are below DLs.

Notable results observed in the blanks were evaluated relative to concentrations observed in the lake-water samples to determine whether sample contamination was limited to the QC sample. If, based on this comparison, sample contamination was not isolated to the QC sample, the field data were flagged and further interpretation of results was made with this limitation in mind.

Duplicate samples consisted of two samples collected from the same location at the same time, using the same sampling and sample handling procedures. They were labelled and preserved individually and submitted separately to the analytical laboratory for identical analyses. Duplicate samples are used to check within-station variation and the precision of field sampling and analytical methods. Differences between concentrations measured in duplicate water samples were calculated as the relative percent difference

(RPD) for each variable. Before calculating the RPD, concentrations below the DL were replaced with 0.5 times the DL value. The RPD was calculated using the following formula:

RPD = (|difference in concentration between duplicate samples| / mean concentration) x 100

The RPD value for a given variable was considered notable if:

- it was greater than 40%; and
- concentrations in one or both samples were greater than or equal to five times the DL.

These criteria are similar to those used by BV Labs for internal QC of laboratory duplicate samples, and take into account the potential for data accuracy error as variable concentrations approach DLs.

The number of variables which exceeded the assessment criteria was compared to the total number of variables analyzed to evaluate analytical precision. The analytical precision was rated as follows:

- high, if less than 10% of the total number of variables were notably different from one another;
- moderate, if 10% to 30% of the total number of variables were notably different from one another; and
- low, if more than 30% of the total number of variables were notably different from one another.

Quality Control Results

Detection Limits

Water quality samples were submitted to BV Labs, an accredited analytical laboratory, for analyses of variables (e.g., major ions, nutrients, metals) in water samples. BV Labs has a dedicated inductively coupled plasma-mass spectrometer (ICP-MS) specifically for ultra-low trace metal analysis. The ultra-low analytical DLs can only be obtained on water samples with very low particulate matter (i.e., turbidity less than 0.5 nephelometric turbidity unit [NTU]).

BV Labs used analyte-specific DLs to report results for water quality variables analyzed in 2019. The DLs used by BV Labs in 2019 are listed in Tables B-1 and B-2 (see also Section 2.2, Table 2-2 of the 2019 *Effluent and Water Chemistry Report* [Appendix II]). Deviations from the target DLs and a discussion of potential effects on data quality are as follows:

- The DL for total organic carbon (0.2 mg/L) was raised to 0.5 mg/L in 13 samples from the ice-cover season due to an incorrect lab test code being assigned during sample log-in at the Calgary laboratory. The error was corrected for the open-water season. Use of the elevated DL does not affect data quality, because concentrations in all 13 samples were greater than the DL.
- The DL for total dissolved solids, measured (1.0 mg/L) was raised in 16 samples (12 to 1.1 mg/L, three to 1.2 mg/L, and one to 1.3 mg/L) due to insufficient sample volume. Use of the elevated DLs does not affect data quality, because concentrations in all 16 samples were greater than the DL.
- Similar to previous years, sulphate was analyzed at a DL of 0.5 mg/L (versus a requested DL of 0.05 mg/L) due to limitations of the current analytical method. BV Labs is currently investigating ways to provide the requested DL. In 2019, samples that were less than the DL for the ICP-MS method (i.e., DL

of 0.5 mg/L) were reanalyzed using inductively coupled plasma atomic emission spectroscopy (ICP-OES) with a DL of 0.05 mg/L. Only QC blanks results were less than the DL. As a result, use of the elevated DL does not affect data quality.

- The DLs for nitrate + nitrite were elevated above the requested values (i.e., 2 µg-N/L requested and 2.2 µg-N/L reported) in 122 samples (i.e., 37 in ice-cover and 85 in open-water) due to an issue with the calculation used for the DL. BV Labs is currently investigating ways to adjust this calculation. Use of the elevated DL is not expected to affect data quality because the majority of the samples were greater than the DL and the elevated DL is close to the requested DL.
- The DL for total Kjeldahl nitrogen and total nitrogen (i.e., 20 µg-N/L) was raised to 200 µg-N/L in one sample (MF2-1T) due to insufficient sample volume and sample matrix interference, respectively.
- The DLs for total dissolved nitrogen were elevated above the requested values (i.e., 20 µg-N/L requested and 55 µg-N/L reported) in 31 samples from the ice-cover season due to an incorrect lab test code being assigned during sample log-in at the Calgary laboratory. The error was corrected for the open-water samples. Use of the elevated DL is not expected to affect data quality, because concentrations in the majority of the samples were greater than the DL with the exception of two QC samples.
- The DLs for total and dissolved sulphur were elevated above the requested values (i.e., 0.1 mg/L requested and 0.5 mg/L reported) due to limitations of the current analytical method. BV Labs is currently investigating ways to provide the requested DL. In 2019, samples that were less than the DL for the ICP-MS method (i.e., DL of 0.5 mg/L) were analyzed using inductively coupled plasma atomic emission spectroscopy (ICP-OES) with a DL of 0.1 mg/L. Only QC blanks and LDS stations were less than the DL. As a result, use of the elevated DL does not affect data quality.

Blank Samples

Of the 93 variables analyzed during the ice-cover season, six variables (i.e., dissolved calcium, nitrate, nitrate + nitrite, total dissolved nitrogen, total zinc, and dissolved copper) were measured in QC blank samples at a concentration above the data quality objective (DQO) of less than five times the DL (Table B-1). Details of the ice-cover blank sample DQO exceedances are as follows:

- Dissolved calcium, nitrate, and nitrate + nitrite exceeded the DQO in the field blank sample collected at MF3-1B.
- Total dissolved nitrogen exceeded the DQO in the equipment blank prepared at NF2B. Further details on QC issues relating to nitrogen variables are provided in the QA/QC Attachment of the *Eutrophication Indicators Report* (Appendix XIII).
- Total zinc and dissolved copper exceeded the DQO in the equipment blank at MF3-3B.

Exceedances of the DQO occurred in 1.3% of the ice-cover blank sample results and, therefore, the blank results indicated acceptable data quality. Overall, concentrations of dissolved calcium reported in the blank samples were well below those measured in the lake-water samples, whereas concentrations of nitrate, nitrate + nitrite, total dissolved nitrogen, total zinc, and dissolved copper were similar to those measured in the lake-water samples. Nitrogen variables are evaluated in the QA/QC Attachment of the *Eutrophication Indicators Report* (Appendix XIII). The potential contamination identified for copper and zinc was relatively

minor and did not interfere with the determination of Action Levels, as concentrations in the NF area were below reference conditions for Lac de Gras despite potential contamination identified in blank samples.

During the open-water season, the concentrations of two (i.e., soluble reactive phosphorus and total aluminum) of the 93 variables measured in QC blanks was greater than five times the DL (Table B-1). Details of the open-water blank sample DQO exceedances are as follows:

- Soluble reactive phosphorus exceeded the DQO in the travel blank assigned to FFA-3M.
- Total aluminum exceeded the DQO in one field blank collected at MF3-7B.

Exceedances of the DQO occurred in 0.4% of the open-water blank sample results and, therefore, the blank results indicated acceptable data quality. The concentration of soluble reactive phosphorus reported in the blank sample was above the majority of concentrations measured in the lake-water samples, whereas total aluminum was below the majority of concentrations measured in the lake-water samples. Phosphorus variables are evaluated in the QA/QC Attachment of the *Eutrophication Indicators Report* (Appendix XIII). An Action Level was triggered for total aluminum similar to previous years. The potential contamination identified for aluminum was relatively minor and did not interfere with the determination of Action Levels.

As the DQO exceedances for these parameters were infrequent, it is unlikely that the contamination found in blank samples affected the reliability of the data used in the AEMP Effluent and Water Chemistry Report.

Field Duplicate Samples

A total of 9 out of 93 water quality variables analyzed in 2019 exceeded the DQO of both the 40% RPD and five times DL criteria for field duplicate samples at least once (Table B-2). These variables included ammonia, total dissolved nitrogen, soluble reactive phosphorus, total aluminum, total zinc, dissolved aluminum, dissolved beryllium, dissolved copper, and dissolved zinc. In total, 2.5% of field duplicate data assessed in the duplicate comparison exceeded the DQO, which indicates a high level of analytical precision for the 2019 samples. These results were considered notable, because the differences in concentrations between duplicate samples for these analytes (i.e., RPD of 40% to 172%) were appreciably greater than the QC objectives used by BV Labs to identify unacceptable differences between laboratory duplicate samples (i.e., RPD of 20% to 25%). Laboratory duplicates consist of two independently analyzed portions of the same sample and would, therefore, be expected to have lower variability among paired duplicate samples than field duplicates, which consist of two separate grab samples.

Overall, duplicate sample results indicated that data were of acceptable quality. Generally, concentrations in duplicate samples with DQO exceedances were within the range of values reported at other nearby AEMP stations, indicating that the QC issues identified with these variables did not likely interfere with the evaluation of Mine-related effects.

Table B-1 Blank Sample Results, 2019

Parameter	Unit	DL	Ice-Cover					Open-Water							
			NF2B-1	MF1-1T-3	MF3-1B-2	MF3-3B-1	FF1-3M-2	NF1T-2	MF1-5T-2	MF2-3B-1	MF3-1M-3	MF3-2B-1	MF3-7B-2	FFB-2M-2	FFA-3M-3
			10-May-19	10-May-19	10-May-19	9-May-19	4-May-19	22-Aug-19	21-Aug-19	20-Aug-19	3-Sep-19	28-Aug-19	26-Aug-19	25-Aug-19	4-Sep-19
			Equipment Blank	Travel Blank	Field Blank	Equipment Blank	Field Blank	Field Blank	Field Blank	Equipment Blank	Travel Blank	Equipment Blank	Field Blank	Field Blank	Travel Blank
Conventional Parameters															
Total alkalinity as $CaCO_3$	mg/L	0.5	<0.5	<0.5	<0.5	<0.5	0.54	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5
Specific conductivity	µS/cm	1	<1	<1	<1	<1	1.1	<1	-	<1	<1	-	<1	-	<1
Total hardness as $CaCO_3$	mg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5
pH - lab	-	-	4.59	4.67	4.95	4.62	5.63	4.52	-	4.48	4.53	-	4.43	-	4.43
Total dissolved solids, calculated	mg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	-	<0.5	<0.5	-	<0.5	-	<0.5
Total dissolved solids, measured	mg/L	1	2.4	1.2	4.4	1.6	4.3	<1	-	<1	<1	-	<1	-	<1
Total suspended solids	mg/L	1	<1	<1	1.1	<1	<1	<1	-	<1	<1	-	<1	-	<1
Total organic carbon	mg/L	0.2	0.21	<0.2	<0.2	<0.2	<0.2	0.23	-	0.28	<0.2	-	0.27	-	0.3
Turbidity - lab	NTU	0.1	<0.1	<0.1	<0.1	<0.1	0.11	0.14	-	<0.1	<0.1	-	<0.1	-	<0.1
Major Ions															
Bicarbonate	mg/L	0.5	<0.5	<0.5	<0.5	<0.5	0.66	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5
Calcium (dissolved)	mg/L	0.01	0.011	<0.01	**0.055**	<0.01	<0.01	0.012	-	<0.01	<0.01	-	<0.01	-	<0.01
Carbonate	mg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5
Chloride	mg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.55	-	<0.5	<0.5	-	<0.5	-	<0.5
Fluoride	mg/L	0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.011	-	<0.01	<0.01	-	<0.01	-	<0.01
Hydroxide	mg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5
Magnesium (dissolved)	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	-	<0.005
Potassium (dissolved)	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	-	<0.01
Sodium (dissolved)	mg/L	0.01	<0.01	<0.01	0.012	0.013	<0.01	<0.01	-	0.023	<0.01	-	<0.01	-	<0.01
Sulphate	mg/L	0.5	<0.05	<0.05	<0.05	0.18	<0.05	<0.05	-	0.077	<0.05	-	<0.05	-	<0.05
Nutrients															
Ammonia[(a)]	µg-N/L	5	<5	5.2	11.1	<5	<5	<5	[(b)]	<5	<5	[(b)]	<5	[(b)]	<5
Nitrate	µg-N/L	2	<2	<2	**18**	3.7	<2	<2	-	<2	<2	-	<2	-	<2
Nitrite	µg-N/L	1	<1	<1	<1	<1	<1	<1	-	<1	<1	-	<1	-	<1
Nitrate + nitrite	µg-N/L	2	<2.2	<2.2	**18**	3.7	<2	<2	-	<2	<2	-	<2	-	<2
Total Kjeldahl nitrogen	µg-N/L	20	<20	24	23	<20	58	57	-	62	54	-	53	-	46
Total dissolved nitrogen	µg-N/L	20	**130**	<55	37	<55	28	<20	-	<20	<20	-	<20	-	<20
Total nitrogen	µg-N/L	20	<20	36	23	<20	58	57	-	53	54	-	53	-	46
Soluble reactive phosphorus	µg-P/L	1	<1	<1	<1	<1	<1	2.3	-	<1	1.6	-	<1	-	**7.3**
Total dissolved phosphorus	µg-P/L	2	<2	<2	<2	<2	<2	<2	-	2.2	<2	-	<2	-	<2
Total phosphorus	µg-P/L	2	<2	<2	<2	<2	<2	<2	-	<2	<2	-	<2	-	<2
Total Metals															
Aluminum	µg/L	0.2	0.43	0.52	0.64	0.95	0.57	<0.2	-	<0.2	<0.2	-	**1.75**	-	<0.2
Antimony	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	-	<0.02	<0.02	-	<0.02	-	<0.02
Arsenic	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	-	<0.02	<0.02	-	<0.02	-	<0.02
Barium	µg/L	0.02	0.055	<0.02	<0.02	<0.02	<0.02	<0.02	-	<0.02	<0.02	-	<0.02	-	<0.02
Beryllium	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	-	<0.01
Bismuth	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	-	<0.005
Boron	µg/L	5	<5	<5	<5	<5	<5	<5	-	<5	<5	-	<5	-	<5
Cadmium	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	-	<0.005
Calcium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	-	<0.01

Table B-1 Blank Sample Results, 2019 (continued)

Parameter	Unit	DL	Ice-Cover					Open-Water							
			NF2B-1	MF1-1T-3	MF3-1B-2	MF3-3B-1	FF1-3M-2	NF1T-2	MF1-5T-2	MF2-3B-1	MF3-1M-3	MF3-2B-1	MF3-7B-2	FFB-2M-2	FFA-3M-3
			10-May-19	10-May-19	10-May-19	9-May-19	4-May-19	22-Aug-19	21-Aug-19	20-Aug-19	3-Sep-19	28-Aug-19	26-Aug-19	25-Aug-19	4-Sep-19
			Equipment Blank	Travel Blank	Field Blank	Equipment Blank	Field Blank	Field Blank	Field Blank	Equipment Blank	Travel Blank	Equipment Blank	Field Blank	Field Blank	Travel Blank
Chromium	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05
Cobalt	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	-	<0.005
Copper	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05
Iron	µg/L	1	<1	<1	<1	<1	<1	<1	-	<1	<1	-	<1	-	<1
Lead	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	-	0.006
Lithium	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5
Magnesium	mg/L	0.005	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05
Manganese	µg/L	0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	-	<0.005
Mercury	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-	<0.002	<0.002	-	<0.002	-	<0.002
Molybdenum	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05
Nickel	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	-	<0.02	<0.02	-	<0.02	-	<0.02
Potassium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	-	<0.01
Selenium	µg/L	0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	-	<0.04	<0.04	-	<0.04	-	<0.04
Silicon	µg/L	50	51	<50	<50	63	<50	<50	-	<50	<50	-	<50	-	<50
Silver	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	-	<0.005
Sodium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	0.017	-	<0.01	-	0.02
Strontium	µg/L	0.05	0.104	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05
Sulphur	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	-	<0.1	-	<0.1
Thallium	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-	<0.002	<0.002	-	<0.002	-	<0.002
Tin	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	-	<0.01
Titanium	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5
Uranium	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-	<0.002	<0.002	-	<0.002	-	<0.002
Vanadium	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05
Zinc	µg/L	0.1	0.1	<0.1	<0.1	**0.53**	<0.1	<0.1	-	<0.1	<0.1	-	0.41	-	<0.1
Zirconium	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05
Dissolved Metals															
Aluminum	µg/L	0.2	<0.2	<0.2	0.29	<0.2	<0.2	0.62	-	<0.2	<0.2	-	<0.2	-	0.23
Antimony	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	-	<0.02	<0.02	-	<0.02	-	<0.02
Arsenic	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	-	<0.02	<0.02	-	<0.02	-	<0.02
Barium	µg/L	0.02	<0.02	<0.02	0.057	<0.02	<0.02	<0.02	-	0.033	<0.02	-	<0.02	-	<0.02
Beryllium	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	-	<0.01
Bismuth	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	-	<0.005
Boron	µg/L	5	<5	<5	<5	<5	<5	<5	-	<5	<5	-	<5	-	<5
Cadmium	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	-	<0.005
Chromium	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05
Cobalt	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	-	<0.005
Copper	µg/L	0.05	<0.05	<0.05	<0.05	**0.327**	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05
Iron	µg/L	1	<1	<1	<1	<1	<1	<1	-	<1	<1	-	<1	-	<1
Lead	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	<0.005	-	0.0052	-	<0.005
Lithium	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5
Manganese	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05
Mercury	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-	<0.002	<0.002	-	<0.002	-	<0.002
Molybdenum	µg/L	0.05	0.056	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05

Table B-1 Blank Sample Results, 2019 (continued)

Parameter	Unit	DL	Ice-Cover					Open-Water							
			NF2B-1	MF1-1T-3	MF3-1B-2	MF3-3B-1	FF1-3M-2	NF1T-2	MF1-5T-2	MF2-3B-1	MF3-1M-3	MF3-2B-1	MF3-7B-2	FFB-2M-2	FFA-3M-3
			10-May-19	10-May-19	10-May-19	9-May-19	4-May-19	22-Aug-19	21-Aug-19	20-Aug-19	3-Sep-19	28-Aug-19	26-Aug-19	25-Aug-19	4-Sep-19
			Equipment Blank	Travel Blank	Field Blank	Equipment Blank	Field Blank	Field Blank	Field Blank	Equipment Blank	Travel Blank	Equipment Blank	Field Blank	Field Blank	Travel Blank
Nickel	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.031	-	<0.02	<0.02	-	<0.02	-	<0.02
Selenium	µg/L	0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	-	<0.04	<0.04	-	<0.04	-	<0.04
Silicon	µg/L	50	54	53	<50	50	<50	<50	-	<50	<50	-	<50	-	<50
Silver	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	-	<0.005
Strontium	µg/L	0.05	<0.05	<0.05	0.057	<0.05	<0.05	<0.05	-	0.062	<0.05	-	<0.05	-	<0.05
Sulphur	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	-	<0.1	-	<0.1
Thallium	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-	<0.002	<0.002	-	<0.002	-	<0.002
Tin	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	-	<0.01
Titanium	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5
Uranium	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-	<0.002	<0.002	-	<0.002	-	<0.002
Vanadium	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05
Zinc	µg/L	0.1	<0.1	<0.1	0.13	<0.1	<0.1	<0.1	-	<0.1	<0.1	-	0.11	-	<0.1
Zirconium	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05

a) Based on the results of the ammonia investigation, the ALS ammonia dataset was used in the ice-cover season and the BV ammonia dataset was used in the open-water season (see the “Ammonia Investigation” section below).

b) Results were removed due to laboratory quality control issues identified in 2019 (see the “Ammonia Investigation” section below).

Note: **Bold** values represent an exceedance of the data quality objective for blank samples (concentration greater than 5 times the DL).

NTU = nephelometric turbidity units; µg-N/L = micrograms nitrogen per litre; µg-P/L = micrograms phosphorus per litre; µS/cm = microsiemens per centimetre; DL = detection limit; $CaCO_3$ = calcium carbonate; NF = near-field; MF = mid-field; FF = far-field.

Table B-2 Duplicate Sample Results, 2019

Parameter	Unit	MDL	NF3B		RPD	MF3-5T		RPD	FFA-5M		RPD	NF5M		RPD	MF1-1B-4		RPD	FF1-1M-4		RPD
			Sample	Duplicate		Sample	Duplicate		Sample	Duplicate		Sample	Duplicate		Sample	Duplicate		Sample	Duplicate	
			23-Apr-19	23-Apr-19		9-May-19	9-May-19		8-May-19	8-May-19		15-Aug-19	15-Aug-19		22-Aug-19	22-Aug-19		17-Aug-19	17-Aug-19	
Conventional Parameters																				
Total Alkalinity	mg/L	0.5	6.99	6.57	6.2%	5.5	7.52	31.0%	4.21	4.24	0.7%	5.23	4.6	12.8%	5.52	5.17	6.5%	5.32	5.01	6.0%
Specific Conductivity - lab	µS/cm	1	57	57	0.0%	36.5	36.1	1.1%	27.9	28.1	0.7%	36.4	35.7	1.9%	35.1	35.1	0.0%	26.3	26.3	0.0%
Total Hardness as CaCO3	mg/L	0.5	13.9	13.5	2.9%	10.3	10.2	1.0%	7.82	7.78	0.5%	9.44	9.38	0.6%	9.36	9.26	1.1%	7.5	7.45	0.7%
pH	-	-	6.71	6.73	4.6%	6.69	6.86	38.7%	6.5	6.57	16.1%	6.76	6.86	22.9%	5.89	5.82	16.1%	5.79	5.68	25.2%
Total Dissolved Solids, Calculated	mg/L	0.5	27	27	0.0%	18	19	5.4%	14	14	0.0%	17.3	17.2	0.6%	17.9	17.1	4.6%	13.4	13.1	2.3%
Total Dissolved Solids, Measured	mg/L	1	49.2	53.5	8.4%	21.2	25.2	17.2%	20.8	17.2	18.9%	23.6	24	1.7%	24.8	25.6	3.2%	17.2	16.8	2.4%
Total Suspended Solids	mg/L	1	1	<1	-	<1	<1	-	<1	<1	-	1.1	2.7	-	<1	<1	-	1.1	1.1	-
Total Organic Carbon	mg/L	0.2	2	1.9	5.1%	2.8	2.8	0.0%	1.5	1.7	12.5%	2.3	2.3	0.0%	2.3	2.5	8.3%	2.2	2.1	4.7%
Turbidity	NTU	0.1	0.22	0.15	-	<0.1	<0.1	-	<0.1	<0.1	-	0.2	0.5	-	0.22	0.17	-	0.4	0.35	-
Major Ions																				
Bicarbonate	mg/L	0.5	8.53	8.02	6.2%	6.71	9.17	31.0%	5.14	5.17	0.6%	6.38	5.61	12.8%	6.73	6.3	6.6%	6.49	6.11	6.0%
Calcium	mg/L	0.01	3.05	3.01	1.3%	1.94	1.95	0.5%	1.57	1.62	3.1%	2.1	2.52	18.2%	2.27	2.03	11.2%	1.62	1.58	2.5%
Carbonate	mg/L	0.5	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-
Chloride	mg/L	0.5	7.4	7.49	1.2%	3.1	3.1	0.0%	2.6	2.6	0.0%	3.6	3.4	5.7%	3.5	3.5	0.0%	2	1.9	-
Fluoride	mg/L	0.01	0.036	0.034	-	0.036	0.036	-	0.03	0.03	-	0.034	0.03	-	0.031	0.032	-	0.032	0.028	-
Hydroxide	mg/L	0.5	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-
Magnesium	mg/L	0.005	1.4	1.38	1.4%	1.21	1.23	1.6%	0.977	0.994	1.7%	1.04	1.09	4.7%	1.08	1.05	2.8%	0.895	0.919	2.6%
Potassium	mg/L	0.01	1.16	1.15	0.9%	1.1	1.11	0.9%	0.869	0.888	2.2%	0.974	1.03	5.6%	0.997	0.984	1.3%	0.782	0.791	1.1%
Sodium	mg/L	0.01	4.25	4.25	0.0%	2.07	2.09	1.0%	1.67	1.68	0.6%	2.2	2.14	2.8%	2.38	2.35	1.3%	1.44	1.44	0.0%
Sulphate	mg/L	0.05	4.89	5.52	12.1%	5.1	5	2.0%	3.8	3.8	0.0%	4.1	4.1	0.0%	4.2	4	4.9%	3.4	3.4	0.0%
Nutrients																				
Ammonia[(a)]	µg-N/L	5	47.3	32.3	37.7%	18.7	17.7	-	25.8	16	**46.9%**	16	12	-	8.4	11	-	22	7	-
Nitrate	µg-N/L	2	133	136	2.2%	<2	<2	-	5.3	6	-	17	13	26.7%	12	12	0.0%	<2	<2	-
Nitrite	µg-N/L	1	<1	<1	-	<1	<1	-	1.4	1.1	-	1.5	1.4	-	<1	<1	-	<1	<1	-
Nitrate + nitrite	µg-N/L	2	133	136	2.2%	<2.2	<2.2	-	6.8	7.1	-	18	14	25.0%	12	12	0.0%	<2	<2	-
Total Kjeldahl Nitrogen	µg-N/L	20	174	200	13.9%	200	200	0.0%	150	150	0.0%	250	260	3.9%	220	210	4.7%	170	200	16.2%
Total Dissolved Nitrogen	µg-N/L	20	280	288	2.8%	190	200	5.1%	130	280	**73.2%**	180	200	10.5%	300	200	**40.0%**	150	160	6.5%
Total Nitrogen	µg-N/L	20	309	339	9.3%	240	220	8.7%	190	170	11.1%	270	270	0.0%	230	220	4.4%	170	200	16.2%
Soluble Reactive Phosphorus	µg-P/L	1	1.2	2.1	-	<1	<1	-	<1	<1	-	1.3	<1	-	1.8	2	-	2.4	5.6	**80.0%**
Total Dissolved Phosphorous	µg-P/L	2	<2	<2	-	<2	<2	-	<2	<2	-	<2	<2	-	<2	<2	-	<2	<2	-
Total Phosphorous	µg-P/L	2	2.4	2.1	-	<2	<2	-	<2	<2	-	2.2	<2	-	<2	<2	-	<2	<2	-
Total Metals																				
Aluminum	µg/L	0.2	8.63	8.09	6.5%	1.91	1.85	3.2%	1.76	1.81	2.8%	2.55	4.08	**46.2%**	1.45	1.22	17.2%	1.4	2.39	**52.2%**
Antimony	µg/L	0.02	<0.02	<0.02	-	<0.02	<0.02	-	<0.02	<0.02	-	<0.02	<0.02	-	<0.02	<0.02	-	<0.02	<0.02	-
Arsenic	µg/L	0.02	0.307	0.3	2.3%	0.17	0.177	4.0%	0.05	0.052	-	0.22	0.196	11.5%	0.277	0.266	4.1%	0.214	0.195	9.3%
Barium	µg/L	0.02	5.01	4.99	0.4%	2.76	2.75	0.4%	2.13	2.14	0.5%	2.89	2.4	18.5%	2.37	2.32	2.1%	1.86	1.78	4.4%

Table B-2 Duplicate Sample Results, 2019 (continued)

Parameter	Unit	MDL	NF3B		RPD	MF3-5T		RPD	FFA-5M		RPD	NF5M		RPD	MF1-1B-4		RPD	FF1-1M-4		RPD
			Sample	Duplicate		Sample	Duplicate		Sample	Duplicate		Sample	Duplicate		Sample	Duplicate		Sample	Duplicate	
			23-Apr-19	23-Apr-19		9-May-19	9-May-19		8-May-19	8-May-19		15-Aug-19	15-Aug-19		22-Aug-19	22-Aug-19		17-Aug-19	17-Aug-19	
Beryllium	µg/L	0.01	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	<0.01	-
Bismuth	µg/L	0.005	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-
Boron	µg/L	5	<5	<5	-	<5	<5	-	<5	<5	-	15.3	<5	-	<5	<5	-	<5	<5	-
Cadmium	µg/L	0.005	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-
Calcium	µg/L	10	3130	3090	1.3%	2010	2020	0.5%	1510	1540	2.0%	2060	2040	1.0%	2020	2020	0.0%	1550	1560	0.6%
Chromium	µg/L	0.05	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	0.078	0.065	-	<0.05	<0.05	-	<0.05	<0.05	-
Cobalt	µg/L	0.005	0.014	0.014	-	0.012	0.012	-	0.013	0.012	-	0.0115	0.0123	-	0.0158	0.0116	-	0.0084	0.0084	-
Copper	µg/L	0.05	0.55	0.533	3.1%	0.645	0.642	0.5%	0.522	0.515	1.4%	0.5	0.564	12.0%	0.548	0.554	1.1%	0.515	0.573	10.7%
Iron	µg/L	1	2.2	1.9	-	<1	<1	-	<1	<1	-	2.6	2.4	-	2.6	3.5	-	2.5	2.3	-
Lead	µg/L	0.005	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-
Lithium	µg/L	0.5	2.36	2.34	-	2.47	2.43	-	1.57	1.51	-	2.19	1.09	-	<0.5	<0.5	-	0.72	<0.5	-
Magnesium	µg/L	5	3940	3620	8.5%	505	511	1.2%	678	684	0.9%	2360	2380	0.8%	2360	2600	9.7%	2420	2670	9.8%
Manganese	µg/L	0.05	1.47	1.39	5.6%	1.28	1.26	1.6%	0.982	0.959	2.4%	1.04	1.04	0.0%	1.05	1.03	1.9%	0.882	0.866	1.8%
Mercury	µg/L	0.002	<0.002	<0.002	-	<0.002	<0.002	-	<0.002	<0.002	-	<0.002	<0.002	-	<0.002	<0.002	-	0.0036	0.0031	-
Molybdenum	µg/L	0.05	1.1	1.08	1.8%	0.313	0.313	0.0%	0.232	0.236	-	0.576	0.583	1.2%	0.438	0.596	30.6%	0.12	0.112	-
Nickel	µg/L	0.02	0.758	0.764	0.8%	1.08	1.15	6.3%	0.935	0.923	1.3%	0.554	0.566	2.1%	0.623	0.622	0.2%	0.611	0.593	3.0%
Potassium	µg/L	10	1180	1150	2.6%	1120	1150	2.6%	851	858	0.8%	975	966	0.9%	959	972	1.3%	786	781	0.6%
Selenium	µg/L	0.04	<0.04	<0.04	-	<0.04	<0.04	-	<0.04	<0.04	-	<0.04	<0.04	-	<0.04	<0.04	-	<0.04	<0.04	-
Silicon	µg/L	50	279	285	2.1%	<50	<50	-	<50	<50	-	<50	<50	-	<50	<50	-	<50	<50	-
Silver	µg/L	0.005	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-
Sodium	µg/L	10	4340	4240	2.3%	2100	2140	1.9%	1630	1640	0.6%	2190	2150	1.8%	2350	2330	0.9%	1430	1430	0.0%
Strontium	µg/L	0.05	50.3	49.4	1.8%	19.3	19.6	1.5%	14.4	14.4	0.0%	23.6	24.1	2.1%	25.4	25.9	1.9%	14.7	14.7	0.0%
Sulphur	µg/L	500	1750	1640	-	1550	1590	-	1250	1240	-	1490	1340	-	1510	1470	-	820	780	-
Thallium	µg/L	0.002	<0.002	<0.002	-	0.002	0.002	-	0.002	0.002	-	<0.002	<0.002	-	<0.002	<0.002	-	<0.002	<0.002	-
Tin	µg/L	0.01	<0.01	0.015	-	0.012	0.028	-	0.029	<0.01	-	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	<0.01	-
Titanium	µg/L	0.5	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-
Uranium	µg/L	0.002	0.117	0.122	4.2%	0.05	0.052	3.9%	0.038	0.039	2.6%	0.0712	0.0703	1.3%	0.0713	0.0722	1.3%	0.0333	0.033	0.9%
Vanadium	µg/L	0.05	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-
Zinc	µg/L	0.1	0.13	0.11	-	0.36	0.28	-	0.47	0.3	-	0.44	0.17	-	0.15	0.18	-	1.21	0.6	**67.4%**
Zirconium	µg/L	0.05	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-
Dissolved Metals																				
Aluminum	µg/L	0.2	4.63	4.72	1.9%	1.53	1.61	5.1%	2.05	2.34	13.2%	5.16	6.21	18.5%	3.45	0.28	**170%**	5.5	2.52	**74.3%**
Antimony	µg/L	0.02	<0.02	<0.02	-	<0.02	<0.02	-	<0.02	<0.02	-	0.02	<0.02	-	<0.02	<0.02	-	<0.02	<0.02	-
Arsenic	µg/L	0.02	0.277	0.294	6.0%	0.12	0.125	4.1%	0.067	0.067	-	0.316	0.283	11.0%	0.278	0.281	1.1%	0.15	0.175	15.4%
Barium	µg/L	0.02	4.87	4.87	0.0%	2.63	2.65	0.8%	2.31	2.24	3.1%	2.49	2.42	2.9%	2.36	2.43	2.9%	1.97	1.78	10.1%

Table B-2 Duplicate Sample Results, 2019 (continued)

Parameter	Unit	MDL	NF3B		RPD	MF3-5T		RPD	FFA-5M		RPD	NF5M		RPD	MF1-1B-4		RPD	FF1-1M-4		RPD
			Sample	Duplicate		Sample	Duplicate		Sample	Duplicate		Sample	Duplicate		Sample	Duplicate		Sample	Duplicate	
			23-Apr-19	23-Apr-19		9-May-19	9-May-19		8-May-19	8-May-19		15-Aug-19	15-Aug-19		22-Aug-19	22-Aug-19		17-Aug-19	17-Aug-19	
Beryllium	µg/L	0.01	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	0.103	**165%**	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	<0.01	-
Bismuth	µg/L	0.005	<0.005	<0.005	-	<0.005	<0.005	-	0.009	0.007	-	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-
Boron	µg/L	5	<5	<5	-	<5	<5	-	<5	<5	-	6.6	<5	-	<5	<5	-	<5	<5	-
Cadmium	µg/L	0.005	<0.005	<0.005	-	<0.005	<0.005	-	0.006	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-
Chromium	µg/L	0.05	<0.05	0.055	-	<0.05	<0.05	-	<0.05	<0.05	-	0.063	0.067	-	<0.05	<0.05	-	<0.05	<0.05	-
Cobalt	µg/L	0.005	0.006	0.006	-	0.012	0.011	-	0.021	0.024	-	<0.005	<0.005	-	0.0089	0.0095	-	0.0143	0.0133	-
Copper	µg/L	0.05	0.508	0.491	3.4%	0.64	0.65	1.6%	0.496	5.7	**168%**	0.559	0.493	12.5%	0.462	0.55	17.4%	0.541	0.499	8.1%
Iron	µg/L	1	<1	<1	-	<1	<1	-	<1	<1	-	2.1	1.6	-	1.5	2.6	-	1.5	1.5	-
Lead	µg/L	0.005	<0.005	<0.005	-	<0.005	<0.005	-	0.008	0.009	-	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-
Lithium	µg/L	0.5	2.22	2.15	-	1.91	1.89	-	1.78	1.74	-	2.92	2.92	0.0%	4.42	3.78	15.6%	1.37	0.64	-
Manganese	µg/L	0.05	1.13	1.16	2.6%	0.297	0.251	16.8%	0.678	0.667	1.6%	1.28	0.989	25.7%	0.701	0.847	18.9%	0.978	0.903	8.0%
Mercury	µg/L	0.002	<0.002	<0.002	-	<0.002	<0.002	-	<0.002	<0.002	-	<0.002	<0.002	-	<0.002	<0.002	-	<0.002	<0.002	-
Molybdenum	µg/L	0.05	1.05	1.06	0.9%	0.361	0.311	14.9%	0.239	0.251	4.9%	0.633	0.511	21.3%	0.569	0.523	8.4%	0.189	0.157	-
Nickel	µg/L	0.02	0.708	0.752	6.0%	1.14	1.13	0.9%	0.919	0.952	3.5%	0.555	0.588	5.8%	0.601	0.604	0.5%	0.689	0.709	2.9%
Selenium	µg/L	0.04	<0.04	<0.04	-	<0.04	<0.04	-	<0.04	<0.04	-	<0.04	<0.04	-	<0.04	<0.04	-	<0.04	<0.04	-
Silicon	µg/L	50	277	253	9.1%	<50	<50	-	<50	<50	-	<50	<50	-	<50	<50	-	<50	<50	-
Silver	µg/L	0.005	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-
Strontium	µg/L	0.05	49.4	49.4	0.0%	18.2	18.2	0.0%	15	14.9	0.7%	24.4	24.2	0.8%	25.8	25.7	0.4%	13.1	13.5	3.0%
Sulphur	µg/L	500	1610	1610	-	1610	1660	-	1360	1410	-	1380	1360	-	1430	1420	-	880	940	-
Thallium	µg/L	0.002	<0.002	<0.002	-	0.002	0.002	-	0.005	0.003	-	<0.002	<0.002	-	<0.002	<0.002	-	<0.002	<0.002	-
Tin	µg/L	0.01	<0.01	<0.01	-	<0.01	0.041	-	<0.01	0.013	-	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	<0.01	-
Titanium	µg/L	0.5	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-
Uranium	µg/L	0.002	0.084	0.088	4.7%	0.048	0.046	4.3%	0.038	0.033	14.1%	0.0657	0.0609	7.6%	0.068	0.066	3.0%	0.0367	0.0304	18.8%
Vanadium	µg/L	0.05	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-
Zinc	µg/L	0.1	<0.1	<0.1	-	0.28	0.27	-	14.8	1.88	**155%**	1.33	0.1	**172%**	<0.1	0.16	-	1.48	0.66	**76.6%**
Zirconium	µg/L	0.05	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-
Calculated Quantities																				
RPD values over 20%	%	-	-	-	0.0	-	-	0.0	-	-	5.4	-	-	2.2	-	-	2.2	-	-	5.4
RPD values over 20%	#	-	-	-	0	-	-	0	-	-	5	-	-	2	-	-	2	-	-	5

a) Based on the results of the ammonia investigation, the ALS ammonia dataset was used in the ice-cover season and the BV ammonia dataset was used in the open-water season (see the “Ammonia Investigation” section below).

Note: Bold RPD values are greater than 40%, and concentrations in one or both samples that were greater than or equal to five times the DL.

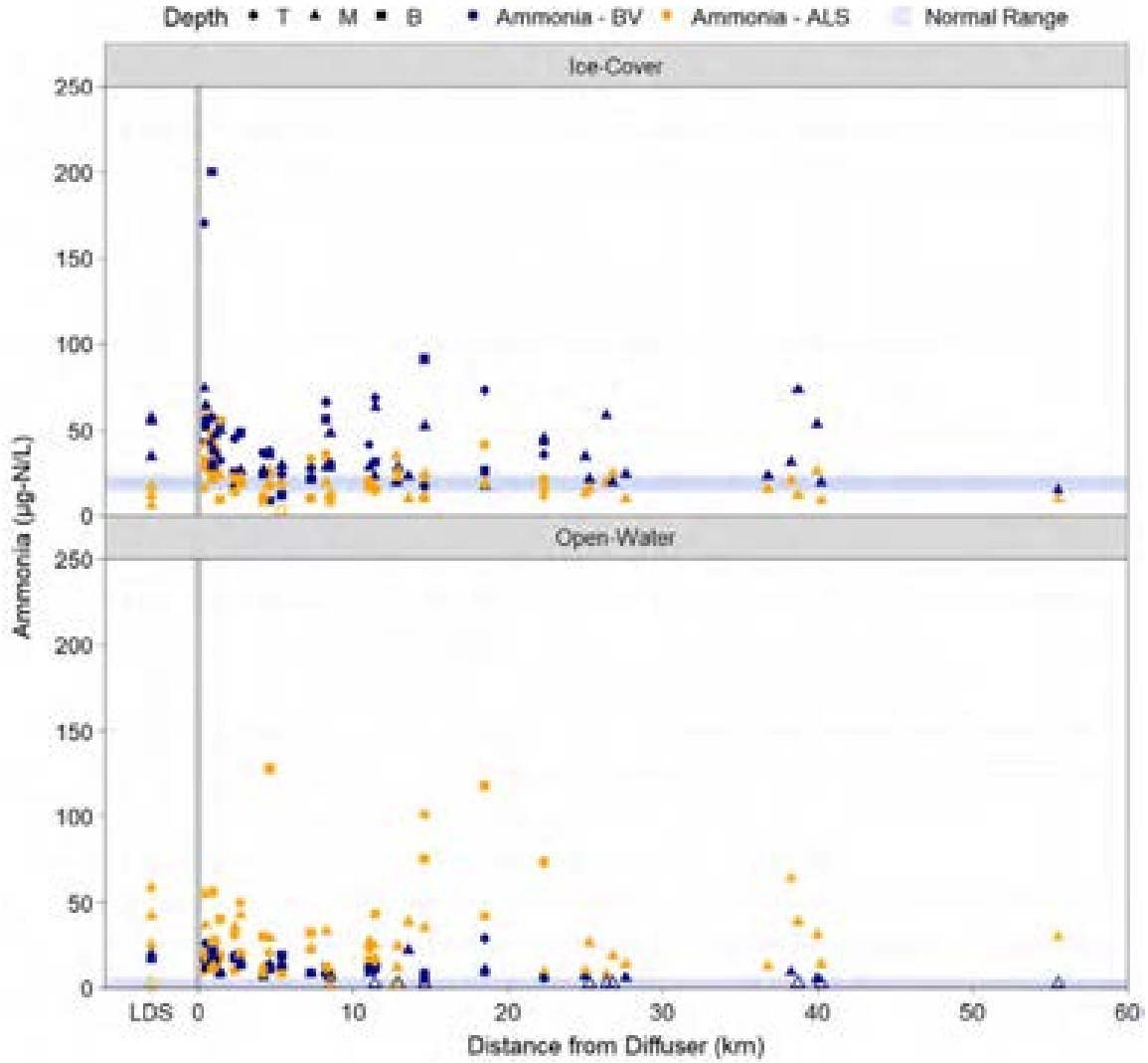
RPD = relative percent difference; - = not applicable; NTU = nephelometric turbidity unit; µg-N/L = micrograms nitrogen per litre; µg-P/L = micrograms phosphorus per litre; µS/cm = microSiemens per centimetre; DL = detection limit; NF = near-field; MF = mid-field; FF = far-field.

Ammonia Investigation

The reader is directed to Appendix 4B of the *2014 to 2016 Aquatic Effects Re-evaluation Report Version 1.1* (Golder 2019a), Appendix B of the 2017 *Effluent and Water Chemistry Report* (Golder 2018) and Appendix B of the 2018 *Effluent and Water Chemistry Report* (Golder 2019b) for a review of the history of the ammonia contamination issue for the AEMP prior to 2019. The following text provides a summary of efforts that took place in 2019 and the selection of ammonia data used for analysis in the *2019 AEMP Annual Report*.

Data quality issues with ammonia continue to be a concern in 2019, with incidental occurrences in blank samples, and relatively large variability between duplicate samples. In 2019, DDMI once again sent lake water quality samples to both BV Labs and ALS for analysis of ammonia. A comparison of the available ammonia data for Lac de Gras is shown in Figure B-1.

Figure B-1 Ammonia Concentrations in Lac de Gras Measured by Maxxam and ALS, 2019



Note: Samples from NF5T, FF1-5M, LDS-2M, and LDS-4M analyzed by BV Labs in open-water were excluded from the plot due to preservative contamination (see Table B-3 below).
T = top depth; M = middle depth; B = bottom depth; µg-N/L = micrograms nitrogen per litre; <DL = less than detection limit.

Contamination of the preservative used for the BV Labs ice-cover season ammonia samples was identified by BV Labs. The ice-cover data was found to contain erroneously elevated results and was, therefore, deemed unreliable. A letter from BV Labs describing this issue is included in Annex B (following Attachment B). BV Labs recommended that the ALS ice-cover data be reported. Since the ALS data did not appear to have a similar contamination issue, as the majority of QC samples met the DQO, this recommendation was accepted and the ice-cover season ammonia data generated by ALS were used in the data analyses, tables, and figures in the 2019 AEMP Annual Report.

Initial open-water results showed that the ammonia bottles provided by BV Labs also contained contaminated preservative. As a result, BV Labs conducted the ammonia analysis on water from the unpreserved general chemistry bottle. However, there was no alternate container for seven samples (three of which were QC samples) and the original data for contaminated samples was reported in error (Table B-3). These samples were removed from the dataset. To further investigate data quality issues identified for ammonia, BV Labs completed an inter-laboratory comparison study evaluating differences in ammonia results for the 2019 open-water samples analyzed by BV Labs and ALS. The study is included in Annex C. The key results of the study were that:

(1) The open-water BV Labs data, analyzed from the unpreserved general chemistry data, were useable.
(2) Evidence suggests the ALS open-water data were potentially subject to a variable degree of contamination from an unknown source.
(3) Open-water season ammonia data generated by BV Labs had fewer data quality issues and was recommended for reporting.

Based on these results, the recommendation to use the BV Labs data for the open-water season was accepted: BV labs open-water data was used in the data analyses, tables, and figures completed in support of the 2019 AEMP Annual Report.

Table B-3 BV Lab Ammonia Results Excluded from Analyses, Open-Water Season 2019

Sample ID	BV Sample ID	Sample Type
NF5T	WI5323	-
MF1-5T-2	WJ3219	Field Blank
MF3-2B-1	WK6304	Equipment Blank
FF1-5M	WJ4135	-
FFB-2M-2	WK2068	Field Blank
LDS-2M	WK8078	-
LDS-4M	WL7085	-

NF = near-field; MF = mid-field; FF = far-field; LDS = Lac Du Sauvage.

The DL used for ammonia (0.005 mg/L) is at the absolute limit of instrument sensitivity, and concentrations measured close to the DL are subject to large uncertainty as a result. Especially at low levels, ammonia presents issues with respect to potential contamination because it is airborne. Previous studies have shown that airborne ammonia contamination can be introduced over time into unopened containers (Golder 2019b). The 2019 open-water interlaboratory comparison study also included initiatives that BV Labs is undertaking to minimize sample contamination:

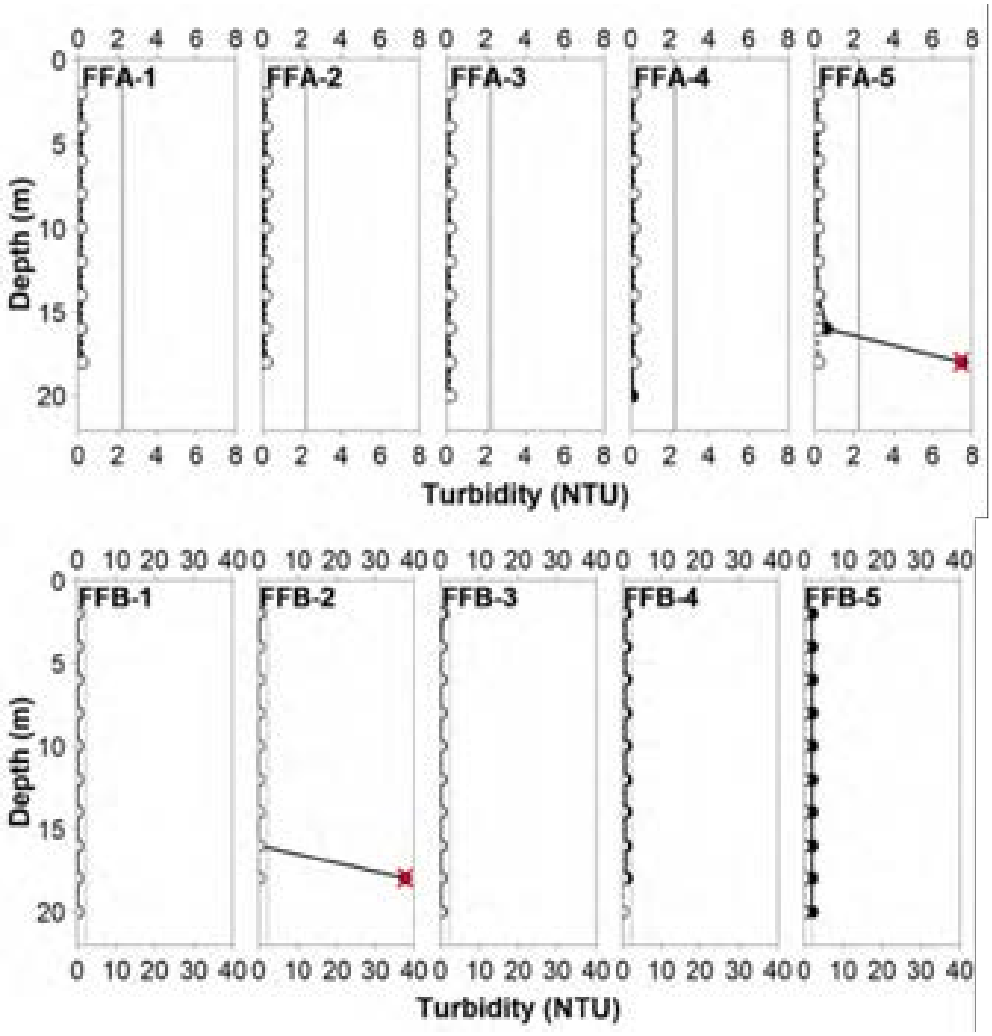
- Proofing 12 vials per lot under worst-case conditions prior to use. Previously 2 vials were proofed.
- Approaching regulators to allow sodium bisulphate as an alternate preservative instead of 50% sulphuric acid, because it is equally effective at lowering pH and, as a solid, is much less corrosive than sulphuric acid.
- Considering the use of unpreserved samples for low level ammonia, because within the typical surface water pH range (6 to 8), ammonia is greater than 99.9% to 99.0% ionized, so volatilization is not an issue.

The recommendations and conclusions outlined in this study are those of BV Labs and do not necessarily reflect DDMI's plan for the AEMP. However, the information gathered by these studies is valuable and will be used in future decision-making related to the handling of the ammonia analysis and reporting for the AEMP. DDMI will continue to work with the analytical laboratory to determine a path forward for the ammonia analysis for future monitoring. More work is planned in 2020 to help determine the path forward. Duplicate samples will again be provided to BV Labs and ALS for analysis in the ice-cover season of 2020.

Abnormal Depth Profile Data

Occasionally, measurements of turbidity taken near the lake bottom indicated that the probe had come into contact with bottom sediments. These values were not included in the graphical analysis of field measured data (Section 3.3), but are shown in Figure B-2, for reference. In total, two turbidity values (at FFA-5 and FFB-2) were removed from the depth profile plots shown in Section 3.3. All erroneous values were measured at 18 m depth, which is close to the target depth of 20 m for the AEMP stations.

Figure B-2 FFA and FFB Depth Profile Data, 2019



NTU = nephelometric turbidity unit; FF = far-field.

References

BC MOE (British Columbia Ministry of the Environment). 2009 (with updates). British Columbia Laboratory Manual. Inductively Coupled Plasma-Mass Spectrometry (PBM Method). Surrey, BC, Canada.

Golder (Golder Associates Ltd.). 2017a. Diavik Diamond Mine - Aquatic Effects Monitoring Program – Quality Assurance Project Plan (QAPP). Version 3.1. Prepared for Diavik Diamond Mines (2012) Inc., Yellowknife, NT. June 2017.

Golder. 2018. AEMP 2017 Annual Report. Submitted to Diavik Diamond Mines (2012) Inc., Yellowknife, Northwest Territories. April, 2018.

Golder. 2019a. 2014 to 2016 Aquatic Effects Re-evaluation Report. Version 1.1. Prepared for Diavik Diamond Mines (2012) Inc. (DDMI). Yellowknife, NT. June 2019.

Golder. 2019b. AEMP 2018 Annual Report. Submitted to Diavik Diamond Mines (2012) Inc., Yellowknife, Northwest Territories. March 2019.

US EPA (United States Environmental Protection Agency). 1994. Method 200.8. Revision 5.4: Determination of Trace Elements in Water and Wastes by Inductively Coupled Plasma-Mass Spectrometry. Environmental Monitoring Systems Laboratory, Office of Research and Development, Cincinnati, OH, USA.

US EPA. 2007. Method 6020A: Inductively Coupled Plasma-Mass Spectrometry. Revision 1. In Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846). 3rd Edition. Washington, DC, USA. pp 602A-1 – 6020A-30.

ATTACHMENT C

INITIAL EFFLUENT AND WATER QUALITY DATA SCREENING

INITIAL EFFLUENT AND WATER QUALITY DATA SCREENING

Introduction

Data screening is the initial phase of data handling when analyzing chemistry datasets that are subject to occasional extreme values. Extreme values are frequently incorrect, reflecting field or laboratory errors, data transcription or calculation errors, or extreme natural variability. Data screening is undertaken prior to data analysis and interpretation to verify that the data quality objectives established by the *Quality Assurance Project Plan (QAPP) Version 3.1* (Golder 2017a) and the *AEMP Design Plan Version 4.1* (Golder 2017b) have been met. The purpose of data screening is to identify unusually large or small values (referred to as anomalous data), verify or correct them if possible, and make a decision whether to retain or exclude remaining anomalous data from further analysis.

The data screening approach used in this report includes a numerical method to aid in the identification of anomalous data, followed by visual/logical assessment of the identified values. This approach removes the subjectivity of classifying values based on visual evaluation of data alone. This initial screening is primarily applicable to chemistry data, because anomalous results are less common in biological (e.g., taxonomy) data and are typically resolved through contacting the taxonomist.

Methods

Initial screening of the annual AEMP datasets was completed using a method based on Chebyshev's theorem (Mann 2010) combined with the visual examination of scatter-plots (Golder 2017b). The method is applied by first identifying data that lie outside the 4.47 SD on a scatter-plot of annual data, and then visually verifying the anomalous values based on potential spatial trends. If data were visually anomalous, the value was investigated to see if it was reported in error, or if it was consistent with associated variables (e.g., total dissolved solids and major ion concentrations) and data collected in previous years. No data were identified as anomalous based on visual evaluation alone.

In cases where the above numerical screening identified an elevated value in the NF area or at the mixing zone boundary as anomalous, the identified value was conservatively retained in the dataset used for analysis if the SD distance from the mean was less than two times the 4.5 SD criterion discussed above. Hence, only very extreme values, which were greater than approximately 9 SD from the mean, were removed from further analysis of NF area data, upon visual confirmation of screening results. Finally, in cases where the annual datasets contained a large proportion of non-detect data (i.e., censored values), only values that were greater than or equal to 5 times the detection limit (DL) were considered anomalous and were removed from the analysis if visual screening confirmed the numerical screening results.

Results

Results of the initial data screening are summarized herein for effluent, mixing zone and AEMP datasets (Tables C-1 to C-3; Figures C-1 to C-10). Results consist of a table of anomalous values removed from each dataset and scatter-plots, which allow visual review of anomalous data and provide transparency. Overall, the number of anomalous values identified by the data screening procedure was very small compared to the amount of data summarized, accounting for less than half of one percent of the total data.

SNP

Table C-1 List of Anomalous Values Removed from SNP Analyses, SNP 1645-18 and 1645-18B (Effluent)

Variable	Station	Value	Unit	Date	Standard Deviation Distance [a]
Acidity (pH 8.3)	1645-18	9	mg/L	02-Nov-2018	5.61
Total Phosphorus	1645-18	105	µg-P/L	18-Feb-2019	5.21
Total Aluminum	1645-18	2,120	µg/L	31-Jul-2019	7.24
Total Boron	1645-18	66.4	µg/L	17-Aug-2019	5.09
Total Chromium	1645-18	2.08	µg/L	06-Jul-2019	5.43
Total Iron	1645-18	473	µg/L	06-Jul-2019	7.71
Total Potassium	1645-18	184	mg/L	10-Oct-2019	7.34
Total Zinc	1645-18	6.47	µg/L	17-Jul-2019	7.19
Turbidity	1645-18B	1.8	NTU	06-Jul-2019	4.58
Total Kjeldahl Nitrogen	1645-18B	7,100	µg-N/L	01-May-2019	7.00
Total Aluminum	1645-18B	1,730	µg/L	31-Jul-2019	6.85
Total Chromium	1645-18B	1.85	µg/L	06-Jul-2019	4.83
Total Copper	1645-18B	1.39	µg/L	14-Nov-2018	4.91
Total Iron	1645-18B	467	µg/L	06-Jul-2019	7.70
Total Lead	1645-18B	0.034	µg/L	14-Nov-2018	5.03
Total Zinc	1645-18B	6.12	µg/L	17-Jul-2019	7.31

a) Number of standard deviations from the mean calculated for the 2019 monitoring period.

µg/L = micrograms per litre; µg-N/L= micrograms nitrogen per litre; µg-P/L= micrograms phosphorus per litre.

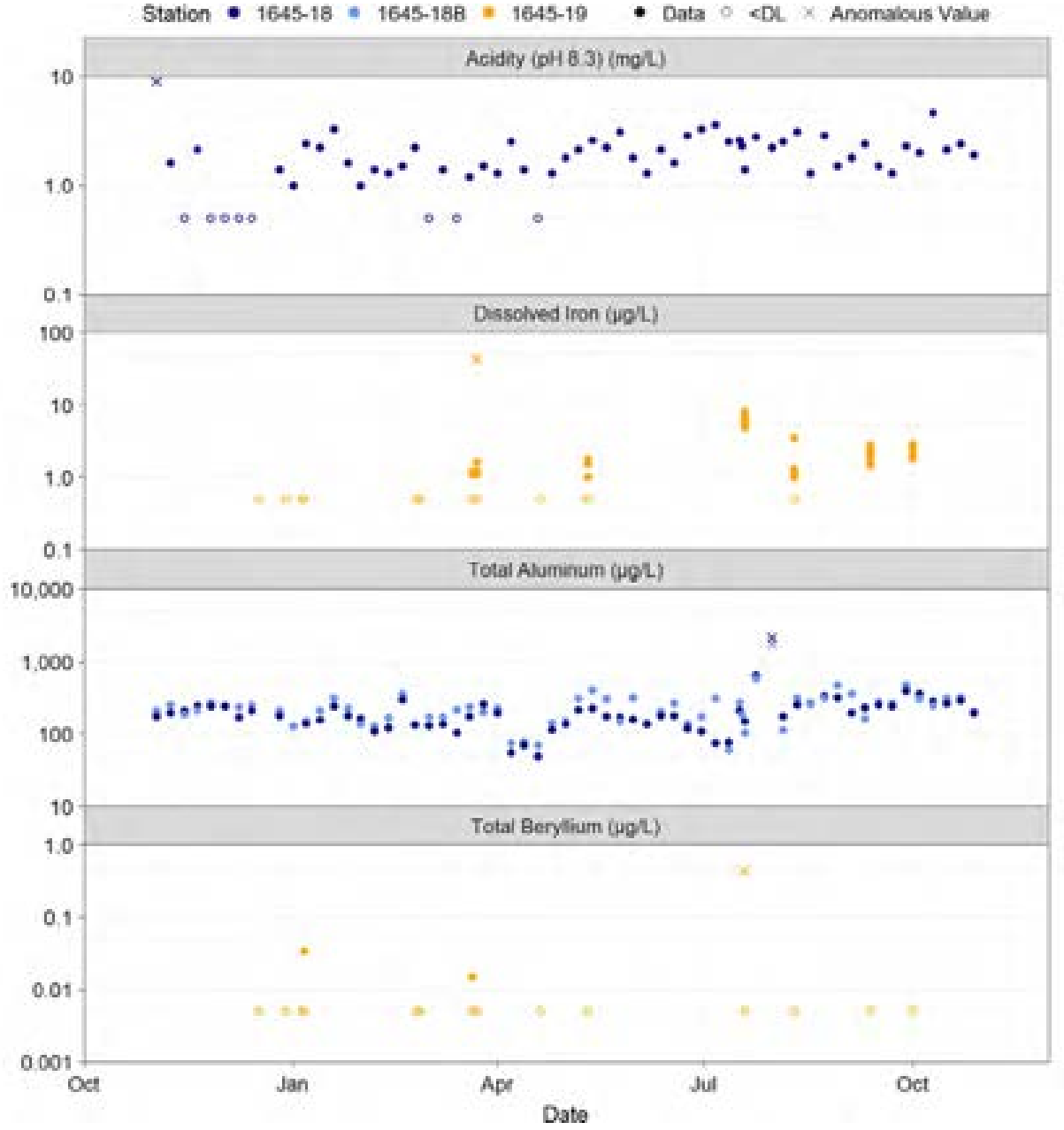
Table C-2 List of Anomalous Values Removed from SNP Analyses, SNP 1645-19A, 1645 19B and 1645-19C (Mixing Zone)

Variable	Station	Value	Unit	Date	Standard Deviation Distance [a]
Total Kjeldahl Nitrogen	1645-19	1,300	µg-N/L	19-Jul-2019	11.00
Total Beryllium	1645-19	0.44	µg/L	19-Jul-2019	11.59
Total Chromium	1645-19	2.24	µg/L	17-Dec-2018	11.32
Total Silver	1645-19	0.046	µg/L	29-Dec-2018	11.22
Dissolved Iron	1645-19	41.9	µg/L	23-Mar-2019	10.43

a) Number of standard deviations from the mean calculated for the 2019 monitoring period.

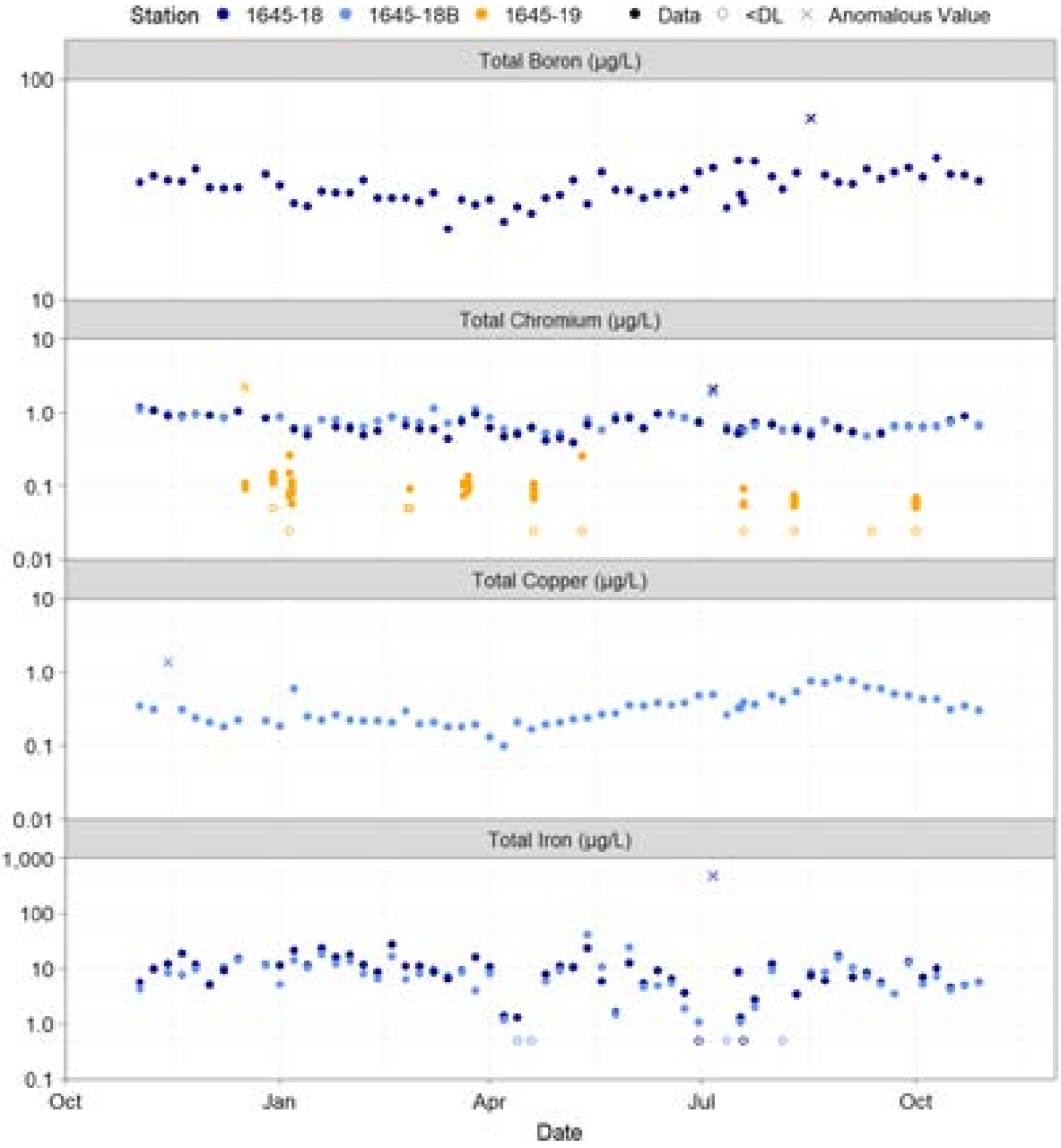
µg/L = micrograms per litre; µg-P/L= micrograms phosphorus per litre.

Figure C-1 Anomalous Data Removed from SNP Analyses Completed for Acidity (pH 8.3), Dissolved Iron, Total Aluminum, and Total Beryllium



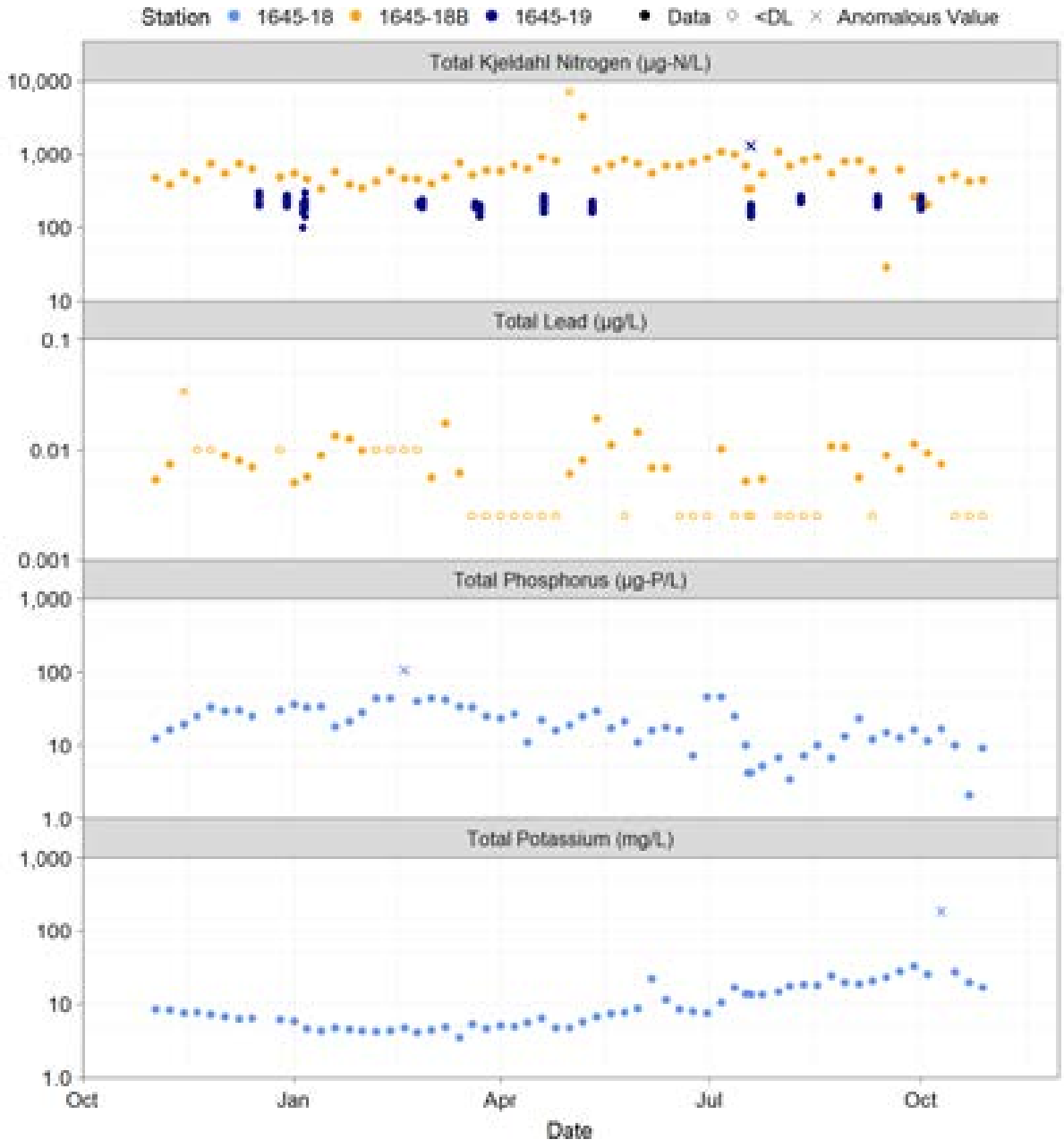
µg/L = micrograms per litre; DL= detection limit.

Figure C-2 Anomalous Data Removed from SNP Analyses Completed for Total Boron, Total Chromium, Total Copper, and Total Iron



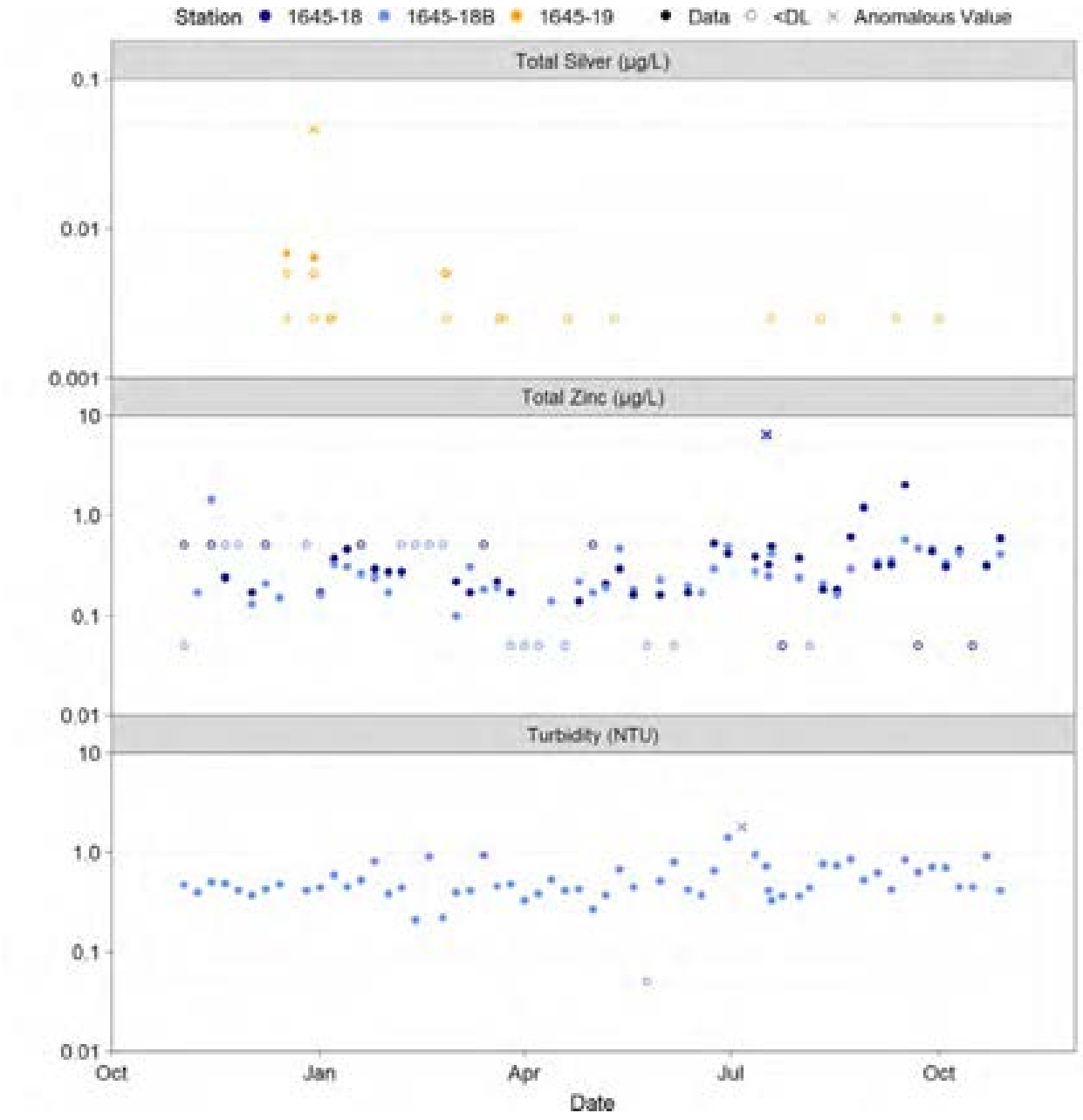
µg/L = micrograms per litre; DL= detection limit.

Figure C-3 Anomalous Data Removed from SNP Analyses Completed for Total Kjeldahl Nitrogen, Total Lead, Total Phosphorus, and Total Potassium



µg/L = micrograms per litre; µg-N/L = micrograms nitrogen per litre; µg-P/L = micrograms phosphorus per litre; DL= detection limit.

Figure C-4 Anomalous Data Removed from SNP Analyses Completed for Total Silver, Total Zinc, and Turbidity



µg/L = micrograms per litre; DL= detection limit.

AEMP

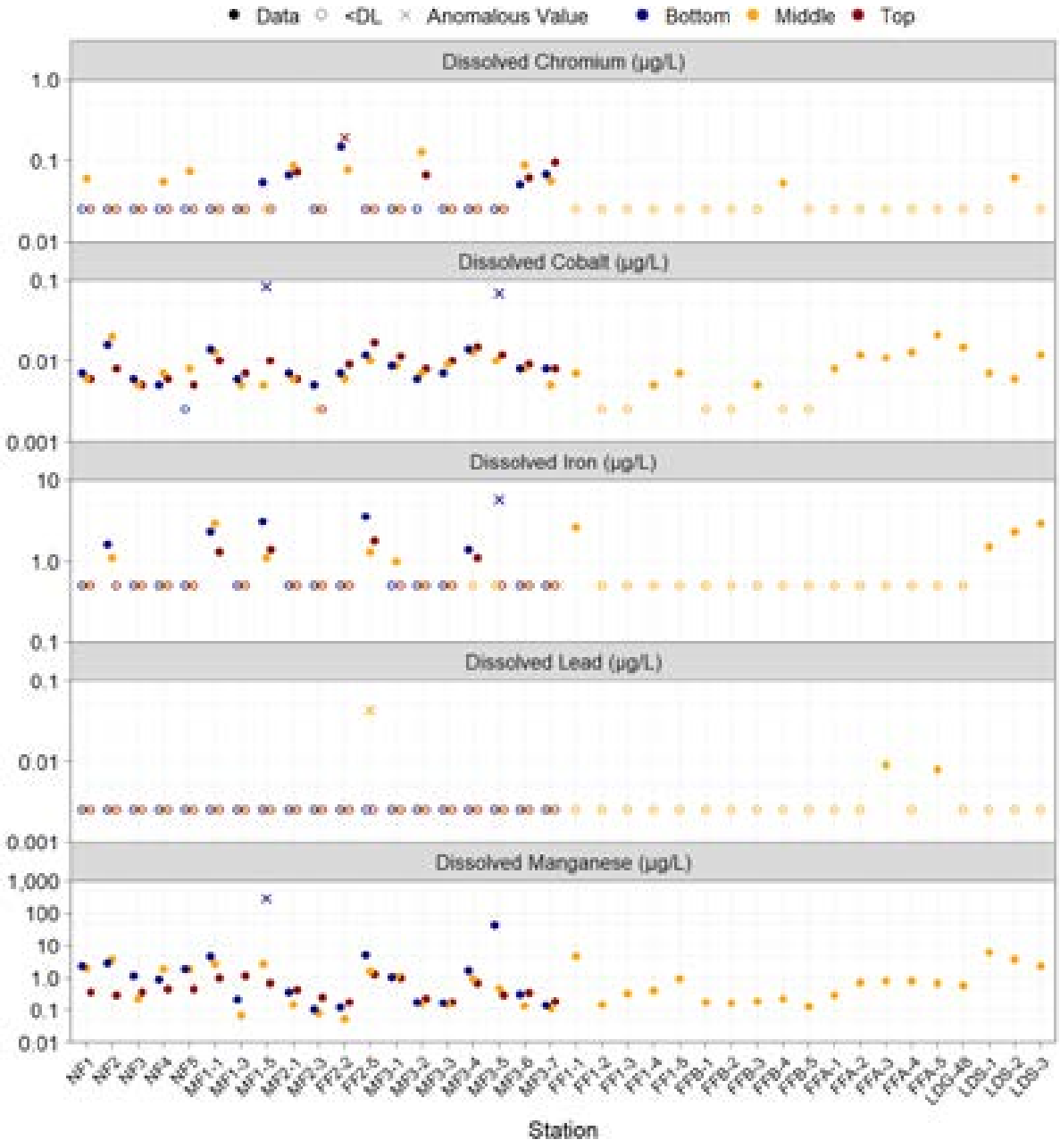
Table C-3 List of Anomalous Values Removed from AEMP Analyses

Variable	Station	Season	Value	Unit	Date	Standard Deviation Distance [(a)]
Total Arsenic	MF3-5B	IC	0.63	µg/L	09-May-2019	4.55
Total Cobalt	MF1-5B	IC	0.123	µg/L	28-Apr-2019	4.76
Total Cobalt	MF3-5B	IC	0.169	µg/L	09-May-2019	6.79
Total Iron	MF3-5B	IC	138	µg/L	09-May-2019	8.16
Total Manganese	MF1-5B	IC	298	µg/L	28-Apr-2019	7.41
Total Nickel	MF1-5B	IC	2.36	µg/L	28-Apr-2019	5.72
Total Tin	MF3-5M	IC	0.184	µg/L	09-May-2019	6.50
Total Zinc	FFA-M	IC	5.01	µg/L	08-May-2019	7.82
Soluble Reactive Phosphorus	FFB-M	IC	8.9	µg-P/L	06-May-2019	7.55
Total Dissolved Phosphorous	MF1-3T	IC	36.3	µg-P/L	28-Apr-2019	8.33
Dissolved Chromium	FF2-2T	IC	0.193	µg/L	10-May-2019	4.90
Dissolved Cobalt	MF1-5B	IC	0.083	µg/L	28-Apr-2019	6.12
Dissolved Cobalt	MF3-5B	IC	0.069	µg/L	09-May-2019	4.94
Dissolved Iron	MF3-5B	IC	5.8	µg/L	09-May-2019	5.61
Dissolved Lead	FF2-5M	IC	0.043	µg/L	10-May-2019	8.25
Dissolved Manganese	MF1-5B	IC	281	µg/L	28-Apr-2019	8.33
Dissolved Molybdenum	MF3-5M	IC	6.44	µg/L	09-May-2019	7.48
Dissolved Nickel	MF1-5B	IC	2.42	µg/L	28-Apr-2019	5.78
Dissolved Vanadium	FF2-2T	IC	0.92	µg/L	10-May-2019	4.93
Dissolved Zinc	FFA-M	IC	14.8	µg/L	08-May-2019	8.32
Total Cobalt	LDG-48M	OW	0.069	µg/L	31-Aug-2019	5.46
Total Copper	MF2-1M	OW	0.742	µg/L	23-Aug-2019	4.71
Total Tin	FF1-M	OW	0.062	µg/L	19-Aug-2019	8.43
Soluble Reactive Phosphorus	FF2-5M	OW	7.9	µg-P/L	20-Aug-2019	4.59
Dissolved Cobalt	LDG-48M	OW	0.075	µg/L	31-Aug-2019	7.30
Dissolved Iron	LDG-48M	OW	9.2	µg/L	31-Aug-2019	5.24
Dissolved Lithium	MF1-1B	OW	4.42	µg/L	22-Aug-2019	4.79

a) Number of standard deviations from the mean calculated for the 2019 monitoring period.

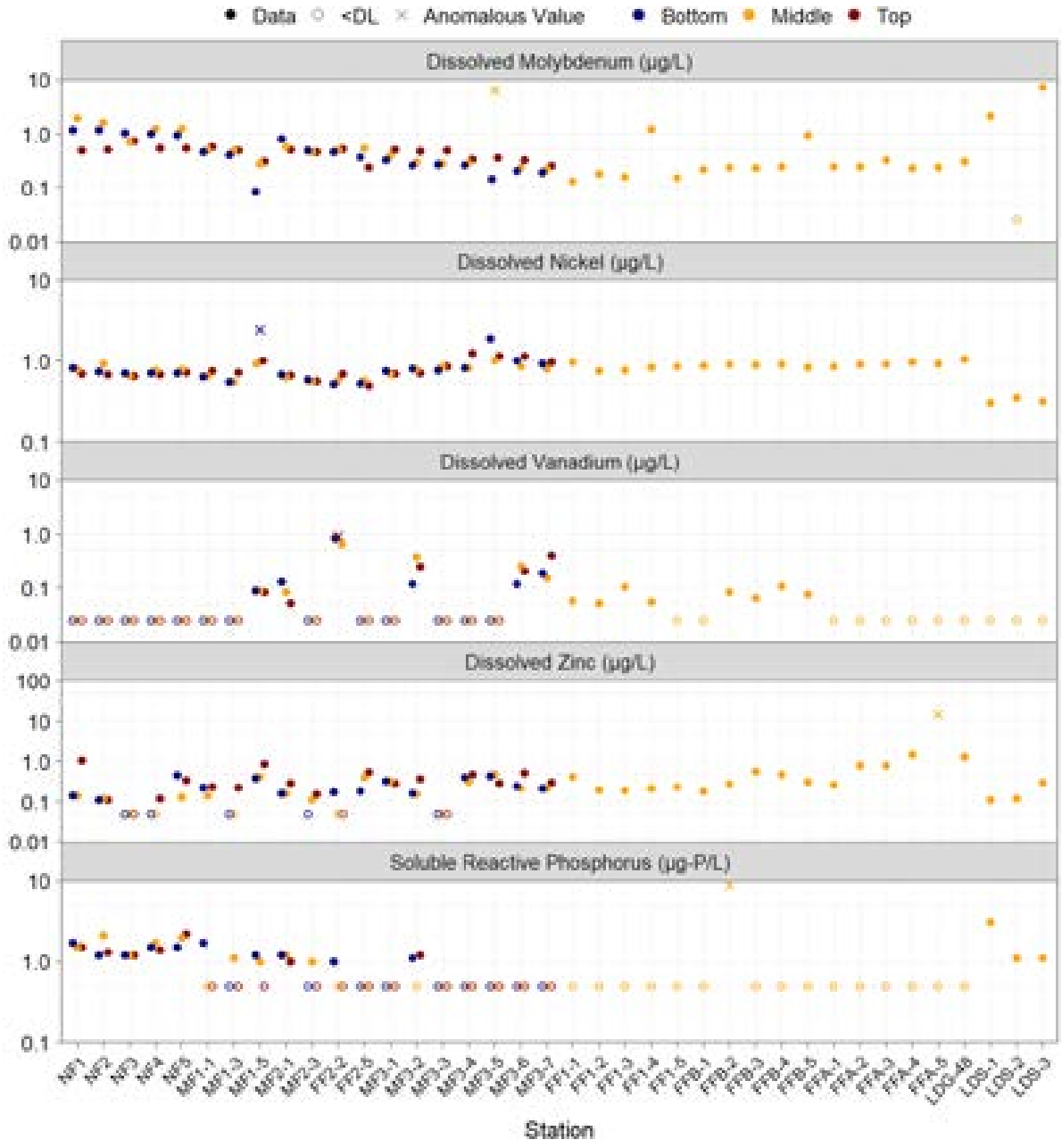
µg/L = micrograms per litre; µg-N/L = micrograms nitrogen per litre; µg-P/L = micrograms phosphorus per litre; IC = ice-cover; OW = open-water; MF = mid-field; FF = far-field; LDG = Lac De Gras.

Figure C-5 Anomalous Data Removed from AEMP Analyses Completed for Dissolved Chromium, Dissolved Cobalt, Dissolved Iron, Dissolved Lead, and Dissolved Manganese, Ice-Cover Season, 2019



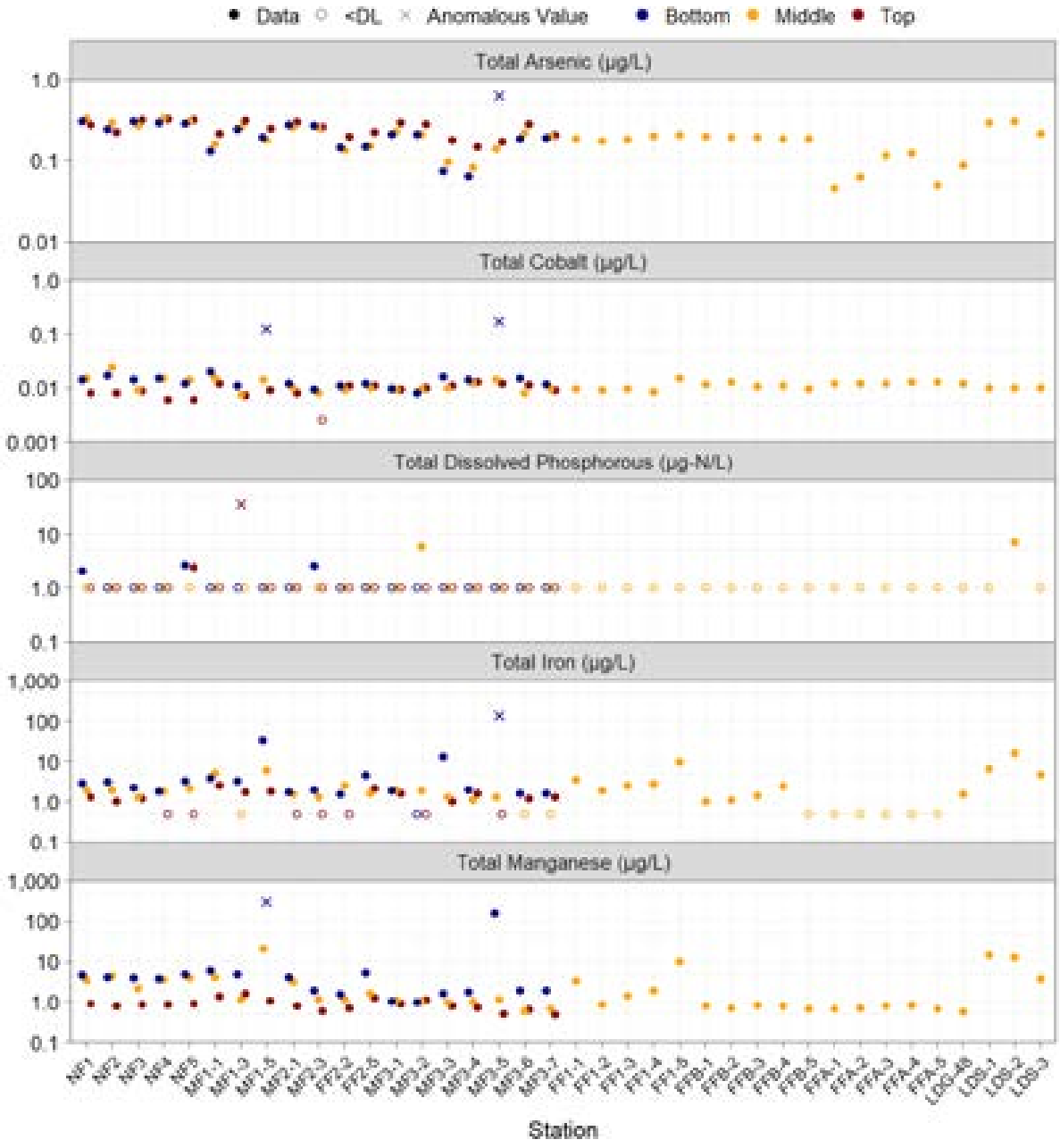
µg/L = micrograms per litre; DL= detection limit.

Figure C-6 Anomalous Data Removed from AEMP Analyses Completed for Dissolved Molybdenum, Dissolved Nickel, Dissolved Vanadium, Dissolved Zinc, and Soluble Reactive Phosphorus, Ice-Cover Season, 2019



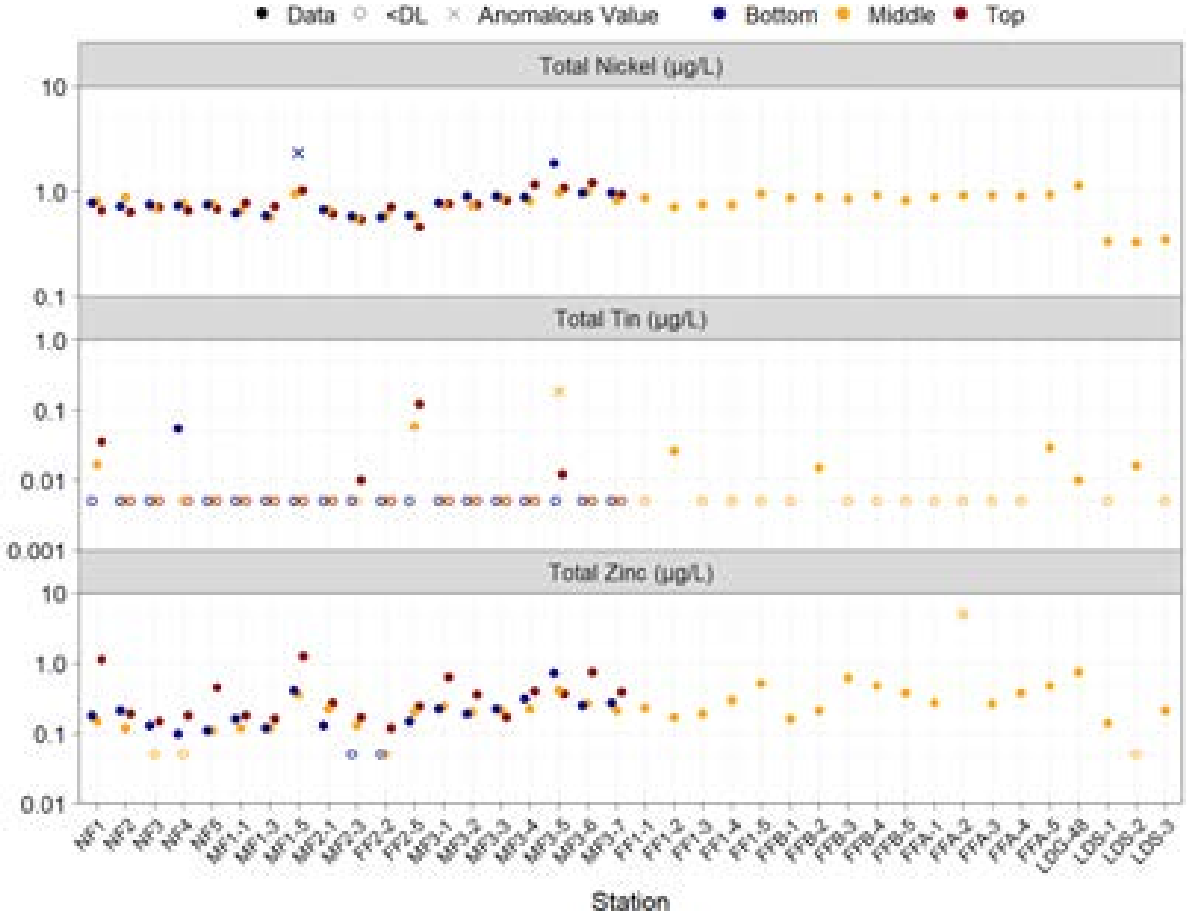
µg/L = micrograms per litre; DL= detection limit.

Figure C-7 Anomalous Data Removed from AEMP Analyses Completed for Total Arsenic, Total Cobalt, Total Dissolved Phosphorus, Total Iron, and Total Manganese, Ice-Cover Season, 2019



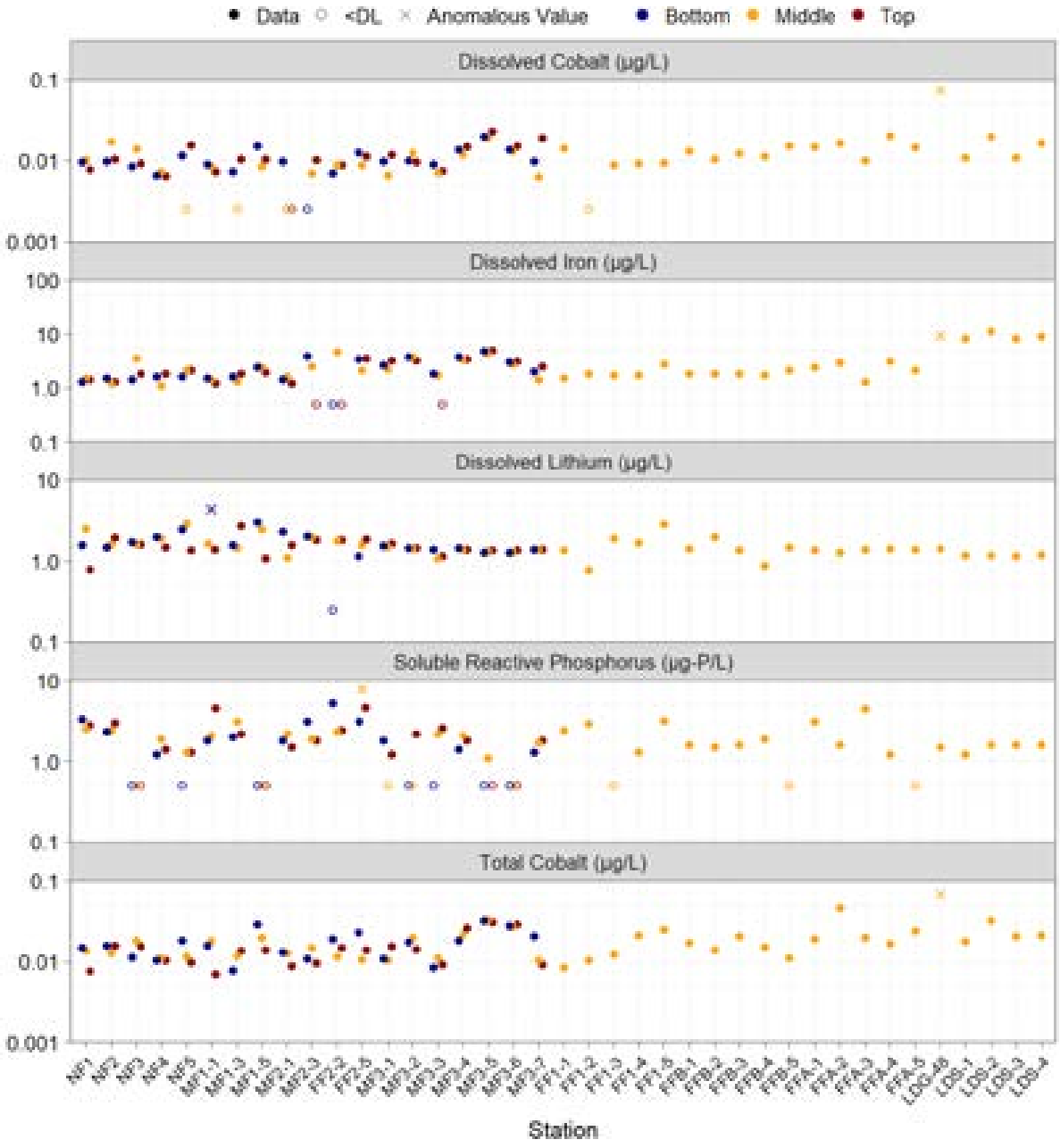
µg/L = micrograms per litre; DL= detection limit.

Figure C-8 Anomalous Data Removed from AEMP Analyses Completed for Total Nickel, Total Tin, and Total Zinc, Ice-Cover Season, 2019



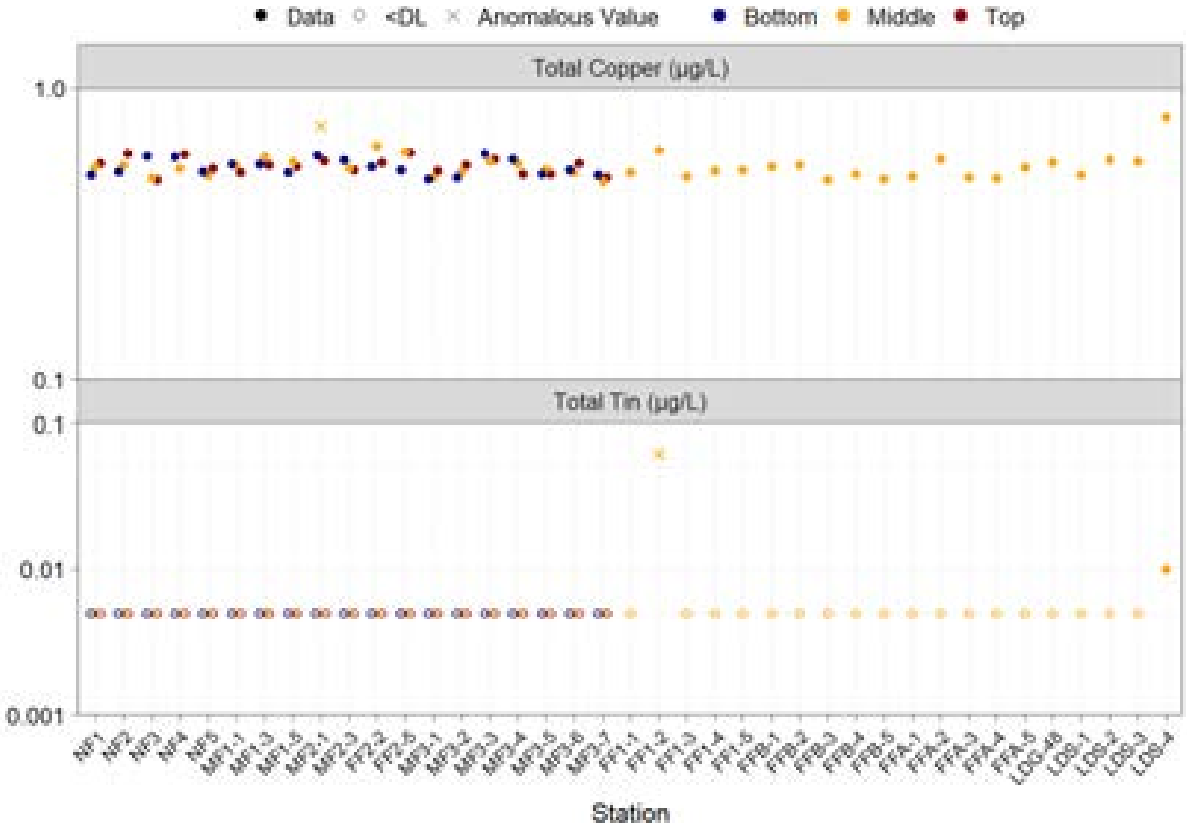
µg/L = micrograms per litre; µg-P/L = micrograms phosphorus per litre; DL= detection limit.

Figure C-9 Anomalous Data Removed from AEMP Analyses Completed for Dissolved Cobalt, Dissolved Iron, Dissolved Lithium, Soluble Reactive Phosphorus, and Total Cobalt, Open-Water Season, 2019



µg/L = micrograms per litre; µg-P/L = micrograms phosphorus per litre; DL= detection limit.

Figure C-10 Anomalous Data Removed from AEMP Analyses Completed for Total Copper and Total Tin, Open-Water Season, 2019



µg/L = micrograms per litre; µg-P/L = micrograms phosphorus per litre; DL= detection limit.

References

Golder (Golder Associates Ltd.) . 2017a. Diavik Diamond Mine - Aquatic Effects Monitoring Program – Quality Assurance Project Plan (QAPP). Version 3.1. Prepared for Diavik Diamond Mines (2012) Inc., Yellowknife, NT. June 2017.

Golder. 2017b. Diavik Diamond Mine Inc. – Aquatic Effects Monitoring Program Design Plan Version 4.1. Prepared for Diavik Diamond Mines (2012) Inc. Yellowknife, NT, Canada. June 2017.

Mann PS. 2010. Introductory Statistics. 7th Edition. John Wiley and Sons, Inc. Hoboken, NJ.

ATTACHMENT D

2019 WATER QUALITY RAW DATA – AEMP AND SNP (SNP 1645-18/18B AND SNP 1645-19)

These data are provided electronically as an Excel file.

ATTACHMENT E

2019 TOXICITY TESTING RAW DATA

These data are provided electronically as an Excel file.

Ceriodaphnia dubia Bioassay Report

Test Substance

Job and Sample ID: B8A8117 - UY0944
Test Performed By: NM9, DBA
Date sample collected: 2018/12/11
Test Initiation Date: 2018/12/12
Test End Date: 2018/12/18
Dates when subsamples used: 2018/12/12, 2018/12/13, 2018/12/14, 2018/12/15, 2018/12/16, 2018/12/17, 2018/12/18
Dissolved Oxygen prior to test (mg/L): 8.6
Temperature (°C): 25
pH prior to test (pH units): 7.2
Conductivity (µS/cm): 531

Test Results			Significant or non-significant			Method	Data Transforms	Outliers* (concentration-replicate)
Sample Test Results (% vol/vol)	7 day Survival Result	Effect	Non-Significant			Fisher Exact Test	Log X	None
	7 day Biomass Result	Effect	Non-Significant			Equal Variance t Two-Sample Test	Log X	None
Reference Toxicant Results			Endpoint	95% LCL	95% UCL	Method	Data Transforms	Outliers* (concentration-replicate)
Reference Toxicant Test Results (g/L)	7 day Survival Result	LC50	1.87	1.51	2.31	Spearman-Karber	Log X	None
	7 day Biomass Result	IC50	1.18	1.03	1.38	Regression: 4P Log-Logistic+Hormesis	Log X	None
Control Chart Data (g/L)	7 day Survival Result	LC50	1.51	0.977	2.33	Shewart	n/a	n/a
	7 day Biomass Result	IC50	1.20	0.855	1.69			

* If outliers were removed, describe in comments.

Comments

Reference toxicant analyzed 2018/12/12

Test Organisms

Species: *Ceriodaphnia dubia*
Source of test organisms: Aquatic Biosystems, Colorado
Age of organisms at test initiation: ≤ 24 hours, within 12 hours
Unusual Appearance, behaviour or treatment prior to use in test : None
Mean % mortality of brood organisms during 7-day period proceding test: 5.1
Number of neonates produced by each organism in its third or fourth brood: ≥8 neonates
Mean number of neonates per adult during first 3 broods in 7: 37
Observations of ephippia: None

All test organisms used to initiate this test were taken from a series of individual cultures, that originated from the same mass culture.
The 4th brood or subsequent broods produced during the test are not included in the final statistical analysis.

Test Facilities and Apparatus

Name address of test laboratory: Maxxam Analytics. 9331 48st NW, Edmonton, AB
Test vessels used: Fisherbrand 20 x 150 mm lime glass test tubes

Control/Dilution Water

Consists of: 16 L RODI from in-house system, to which the following are added:
4 L Perrier Brand carbonated spring water
1 mL cyanocobalamin (Vitamin B-12)
1 mL Sodium Selenate Decahydrate

Test Method

Reference method used for testing: Biological Test Method: Test of Reproduction and Survival Using the Cladoceran *Ceriodaphnia dubia* . Environment Canada, EPS 1/RM/21 Second Edition - February 2007

Did the following occur during sample preparations:

Filtered:	No
Adjusted for hardness:	No
Adjusted for pH:	No
Frequency of observations:	24 ± 1 hour
Frequency of water quality measurements:	Daily
Design and description of any specialized procedure:	N/A
Program used for statistical calculations:	Comprehensive Environmental Toxicity Information System (CETIS). Tidepool Scientific Software. Version 1.9.3.0
Reference method used for statistical calculations:	Guidance Document on Statistical Methods for Environmental Toxicity Tests. Environment Canada, EPS 1/RM/46 - March 2005.

Test Conditions and Procedures

Number of test solutions:	20
Number of test concentrations:	1 and a negative control
Concentrations tested (%):	100
Units of tested concentrations:	% vol/vol
Number of replicates:	10
Volume of test solutions:	≥ 15 mL
Depth of test solutions:	≥ 5 cm
Individuals per test vessel:	1
Was pre-aeration performed:	Yes
Procedure:	Oil-free compressed air is dispensed through airline tubing and a disposable pipette
Rate:	≤ 100 bubbles / minute
Duration:	20 minutes
Dates where pre-aeration occurred:	2018/12/12 2018/12/16 2018/12/13 2018/12/17 2018/12/14 2018/12/15
Aeration during testing:	None

Refer to comments section for any deviations.
The reference toxicity test was performed under the same experimental conditions as those used with the test sample.
Refer to comments section for any deviations regarding reference toxicity testing.

Ceriodaphnia dubia Survival and Reproduction Observations

Note: Mortalities are indicated by an "X" in the column and row of the concentration, replicate and day of occurance. If organism was not used for testing, this will be indicated by "N/A" in mortality and neonate columns for the replicate.

Concentration (%/%vol)	Replicate number	Day of Testing 1 neonates	1 Mortality	2 neonates	2 Mortality	3 neonates	3 Mortality	4 neonates	4 Mortality	5 neonates	5 Mortality	6 neonates	6 Mortality	7 neonates	7 Mortality	8 neonates	8 Mortality	Cumulative Mean % Mortality	Cumulative Mean Reproduction	SD of mean reproduction
Control	1	0		0		0		8		13		18						0.0%	31.8	8.1
	2	0		0		0		6		14		0								
	3	0		0		0		5		11		16								
	4	0		0		0		8		10		0								
	5	0		0		0		7		14		20								
	6	0		0		0		7		15		14								
	7	0		0		0		5		9		12								
	8	0		0		0		8		12		15								
	9	0		0		0		10		12		18								
	10	0		0		0		5		13		13								
100%	1	0		0		0		6		13		15						0.0%	33.9	3.9
	2	0		0		0		4		15		16								
	3	0		0		0		6		11		20								
	4	0		0		0		8		19		0								
	5	0		0		0		7		14		10								
	6	0		0		0		8		13		13								
	7	0		0		0		7		12		10								
	8	0		0		0		7		12		17								
	9	0		0		0		8		15		13								
	10	0		0		0		9		10		21								

Average Values for Chemical Data of Test Concentrations

Test Concentration (% vol/vol)	Before Effluent Renewal Date	Temperature (°C)	pH	Conductivity (µS/cm)	DO (mg/L)	After Effluent Renewal Date	Temperature (°C)	pH	Conductivity (µS/cm)	DO (mg/L)
Control	2018/12/12	25	7.9	180	7.0	2018/12/13	25	7.6	190	5.4
100		26	7.3	537	8.3		25	7.5	537	6.1
Control	2018/12/13	25	7.9	180	7.0	2018/12/14	25	7.8	181	6.4
100		25	7.3	537	7.8		25	7.5	518	6.5
Control	2018/12/14	25	7.9	176	7.1	2018/12/15	25	7.7	178	6.5
100		26	7.3	537	8.5		25	7.5	519	6.5
Control	2018/12/15	25	7.8	176	7.3	2018/12/16	26	7.6	183	6.6
100		25	7.4	529	7.8		26	7.5	531	6.7
Control	2018/12/16	24	7.9	175	7.4	2018/12/17	25	7.7	179	6.5
100		24	7.4	526	8.4		25	7.5	516	6.7
Control	2018/12/17	24	8.1	173	7.4	2018/12/18	25	7.5	180	5.9
100		25	7.3	525	8.7		25	7.3	519	5.9
Control	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Control	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A

Maxxam
A Bureau Veritas Group Company

RESULTS OF *DAPHNIA MAGNA* SINGLE CONCENTRATION-100%

Success Through Science®

Client : 4388 DIAVIK DIAMOND MINES INC., YELLOWKNIFE Job Number: B8A8117

Client Project Name & Number: Quarterly Tox SNP-A Sample Number: UY0944-04

Test Result:

48 hrs Mortality % 0% Statistical Method:

Mean percent mortality: Sample 0 Control 0

Sample Name : 1645-18 Sample Matrix : Grab Water

Description: CLEAR COLOURLESS Sample Prior to Analysis:

Sample Collected: Dec 11, 2018 12:19 AM Sampling Method : N/A pH: 7.1

Sample Collected By: AH Site Collection: N/A Temperature : 18 °C

Sample Received: Dec 11, 2018 02:06 PM Volume Received: 1 L Dissolved Oxygen: 11.0 mg/L

Analysis Start : Dec 12, 2018 11:40 AM Temp.Upon Arrival: -1 °C Sample Conductance: 459 µS/cm

End : Dec 14, 2018 10:48 AM Storage: 2-6°C Hardness: 120 mg $CaCO_3$/L

Concentration	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Immobility (#)	Immobility (%)	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)
% vol/vol	Start	Start	Start	Start	24 hrs	24 hrs	24 hrs	24 hrs	48 hrs	48 hr	48 hrs	48 hrs
0	20	8.1	360	7.9	0	0	0	0	19	8.4	371	8.1
0	20	8.2	358	8.0	0	0	0	0	19	8.2	368	8.1
0	20	8.2	361	8.0	0	0	0	0	20	8.2	363	8.0
100	19	7.3	466	10.3	0	0	0	0	19	7.8	497	8.1
100	19	7.3	466	10.5	0	0	0	0	20	7.8	480	8.1
100	19	7.3	467	10.5	0	0	0	0	20	7.8	482	8.1

Concentration	Mortality (#)	Mortality (%)	Immobility (#)	Immobility (%)
% vol/vol	48 hrs	48 hrs	48 hrs	48 hrs
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
100	0	0	0	0
100	0	0	0	0
100	0	0	0	0

Comments : Many daphnia in sample concentration test vessels floating on water surface.

Culture/Control/Dilution Water: City of Edmonton dechlorinated tap water

Hardness: 180 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,0,0,100,100,100 (% vol/vol)

Organisms per Vessel :	10	Pre-aeration Time :	30 min	Rate of Pre-aeration :	25-50 mL/min/L
Total # of Organisms Used :	60	Test Temperature :	20 ± 2 °C	Test Hardness Adjusted :	No
Test Volume :	150 mL	Vessel Volume :	225 mL	Test pH Adjusted:	No
Loading Density :	15.0 mL/Daphnia	Photoperiod :	16:8 (light: dark)		

Test Organism : *Daphnia magna* Source : In House Culture

Age at Test Initiation :	<24 hrs	Average Brood Size :	24.8
Culture Photoperiod :	16:8 (light: dark)	% Mortality within 7 days :	1.6
Culture Temperature :	20 ± 2 °C	Time To First Brood :	8 Days

Culture Diet: Pseudokirchnriella and YTC at a ratio of 2 mL/L of culture daily. New cultures weekly, 63 daphnids distributed into 6 culture vessels and 3 reproductive vessels.

RESULTS OF *DAPHNIA MAGNA* SINGLE CONCENTRATION-100%

Success Through Science®

Client :	4388	DIAVIK DIAMOND MINES INC., YELLOWKNIFE	Job Number:	B8A8117
Client Project Name & Number:		Quarterly Tox SNP-A	Sample Number:	UY0944-04

Reference chemical:	Sodium Chloride	Test Date:	Dec 05, 2018
Test Endpoint 48 hrs LC50 (95% confidence interval) :	6.96 (5.70, 8.50)g/L	Statistical Method :	Binomial
Historical Mean LC50 (warning limits) :	5.80 (4.37, 7.71) g/L	Concentration : 0,1.71,2.56,3.82,5.7,8.5 g/L	

Test Method EPS 1/RM/14

Method Deviations: None

Note: The results contained in this report refer only to the testing of the sample submitted. This report may not be reproduced, except in its entirety, without the written approval of the laboratory.

Analyst : Dustin Banks, Natasha Lloyd

Chelsea Tessier

Verified By : Chelsea Tessier, Sample Logistics Supervisor Date: Dec 22, 2018 02:46 PM

Maxxam
A Bureau Veritas Group Company

RESULTS OF RAINBOW TROUT SINGLE CONCENTRATION-100%

Success Through Science®

Client : 4388 DIAVIK DIAMOND MINES INC., YELLOWKNIFE **Job Number:** B8A8117

Client Project Name & Number: Quarterly Tox SNP-A

Test Result:

96 hrs Mortality % 0% Statistical Method: Visual

Sample Name : 1645-18 **Sample Matrix :** Grab Water

Description: Clear, colourless **Sample Number:** UY0944-05

Sample Collected: Dec 11, 2018 12:19 AM **Sampling Method :** N/A **Site Collection:** N/A

Sample Collected By: AH **Volume Received:** 20 L **Temp.Upon Arrival:** -1 °C **Storage:** 2-6°C

Sample Received: Dec 11, 2018 02:06 PM **pH:** 7.3 **Dissolved Oxygen:** 11.3 mg/L

Analysis Start : Dec 12, 2018 11:17 AM **Temperature :** 12 °C **Sample Conductance:** 390 µS/cm

Concentration	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)
% vol/vol	Start	Start	Start	Start	24 hrs	24 hrs	24 hrs	24 hrs	48 hrs	48 hrs	48 hrs	48 hrs
0	15	8.0	291	9.1	0	0	0	0	0	0	0	0
100	14	7.4	411	9.2	0	0	0	0	0	0	0	0

Concentration	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)
% vol/vol	72 hrs	72 hrs	72 hrs	72 hrs	96 hrs	96 hr	96 hrs	96 hrs	96 hrs	96 hrs	96 hrs	96 hrs
0	0	0	0	0	15	7.9	301	9.2	0	0	0	0
100	0	0	0	0	15	7.7	431	9.3	0	0	0	0

Comments : The control chart result for this reference toxicant test was outside of 2SD limits. A check of all acclimation and test conditions was performed, and all requirements were met.

Culture/Control/Dilution Water City of Edmonton dechlorinated tap water

Hardness: 170 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,100 (% vol/vol)

Organisms per Vessel :	10	Test Temperature :	15 ± 1 °C	Solution Depth :	>15 cm
Total # of Organisms Used :	20	Pre-aeration Time :	120 min.	Rate of Aeration	6.5±1 mL/min/L
Test Volume :	20 L	Vessel Volume :	38L	Test pH Adjusted:	No
Loading Density :	0.4 g/L	Photoperiod :	16:8 (light: dark)		

Test Organism : Rainbow Trout *(Oncorhynchus mykiss)* Source : Spring Valley Trout Hatchery

Culture Temperature :	15 ± 2 °C	Weight (Mean) +- SD :	0.7 ± 0.1 g	Length (Mean) +- SD :	4.36 ± 0.23 cm
Culture Water Renewal :	≥ 1.0 L/min/kg fish	Weight (Range) :	0.6 – 0.9 g	Length (Range) :	4.00 – 4.80 cm
Culture Photoperiod :	16:8 (light: dark)			% Mortality within 7 days :	0.3%
Feeding rate and frequency :	daily: 1-5% biomass of trout.			Acclimation Time:	>14 days

Reference chemical: Phenol Test Date: Nov 14, 2018

Test Endpoint 96 hrs LC50 (95% confidence interval) : 12.2 (10.9, 13.8)mg/L Statistical Method : Probit

Historical Mean LC50 (warning limits) : 10.2 (8.60, 12.1) mg/L Concentration : 0,8,10,12,15,20 mg/L

Test Method EPS 1/RM/13

Method Deviations : None

Note: The results contained in this report refer only to the testing of the sample submitted. This report may not be reproduced, except in its entirety, without the written approval of the laboratory.

Analyst : Dustin Banks, Natasha Lloyd

Verified By : Natasha Lloyd, Analyst 2 Date: Dec 21, 2018 08:32 AM

Toxicity testing on samples UY0944-1645-18 and UY0945-1645-18B

Collected December 11, 2018

Final Report

February 15, 2019

Submitted to: **Maxxam Analytics**
Burnaby, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

TABLE OF CONTENTS

List of Tables

List of Appendices

SIGNATURE PAGE

Report By:
Yvonne Lam, B.Sc.
Laboratory Biologist

Reviewed By:
Armando Tang, R.P.Bio
Senior Reviewer

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

SUMMARY

Sample Information and Test Type

Sample ID	UY0944-1645-18 UY0945-1645-18B
Sample collection date	December 11, 2018
Sample receipt date	December 12, 2018
Sample receipt temperature	4.0 – 5.0°C
Test type	7-d rainbow trout (*Oncorhynchus mykiss*) embryo viability

Summary of Results

Endpoint	Mean ± SD			
	Control	UY0944-1645-18	Control	UY0945-1645-18B
Embryo viability (%)	73.3 ± 13.0	77.5 ± 12.6	72.5 ± 9.6	75.1 ± 10.5

SD = Standard Deviation

1.0 INTRODUCTION

Nautilus Environmental Company Inc. conducted 7-d rainbow trout (*Oncorhynchus mykiss*) embryo viability toxicity tests for Maxxam Analytics on two samples identified as UY0944-1645-18 and UY0945-1645-18B. The samples were collected on December 11, 2018 and delivered to the Nautilus Environmental laboratory in Burnaby, BC on December 12, 2018. The samples were each transported in four 10-L or two 20-L plastic containers and received at temperatures of 4.0 to 5.0°C. The samples were stored in the dark at 4 ± 2°C prior to testing.

This report describes the results of the toxicity tests. Copies of raw laboratory data sheets and statistical analysis are provided in Appendix A. The chain-of-custody form is provided in Appendix B.

2.0 METHODS

The method for the 7-d rainbow trout embryo viability toxicity test is summarized in Table 1, and followed procedures described by Environment Canada (1998) and modified by Canaria *et al*. (1999). Statistical analyses were performed using CETIS (Tidepool Scientific Software, 2013).

Table 1. Summary of test conditions: 7-d rainbow trout (*Oncorhynchus mykiss*) embryo viability single concentration test.

Test species	*Oncorhynchus mykiss*
Organism source	Hatchery
Organism age	<30 minutes post fertilization, <24 hour old gametes
Test type	Static-renewal
Test duration	7 days
Test vessel	2-L plastic container
Test volume	2 L
Test solution depth	17 cm
Test concentrations	100% (undiluted) sample, plus laboratory control
Test replicates	4 per treatment
Number of organisms	30 per replicate
Control/dilution water	Dechlorinated Metro Vancouver municipal tapwater
Test solution renewal	Daily (80% renewal)
Test temperature	14 ± 1°C
Feeding	None
Light intensity	Dark
Photoperiod	24 hours dark
Aeration	Continuous gentle aeration
Test measurements	Temperature, dissolved oxygen, pH and conductivity measured daily; hardness and alkalinity of undiluted sample measured at test initiation; survival checked daily
Test protocol	Environment Canada (1998), EPS 1/RM/28; Canaria *et al*. (1999)
Statistical software	CETIS Version 1.9.4
Test endpoints	Embryo viability
Test acceptability criteria for controls	Embryo viability ≥70%
Reference toxicant	Sodium dodecyl sulphate (SDS)

3.0 RESULTS

Results of the rainbow trout embryo viability toxicity tests conducted on samples UY0944-1645-18 and UY0945-1645-18B are summarized in Table 2. There were no statistically significant differences relative to the laboratory controls for either sample, with embryo viability in both samples and all test treatments ≥72% (v/v).

Table 2. Results: 7-d rainbow trout (*Oncorhynchus mykiss*) embryo viability single concentration test.

Concentration (% v/v)	Embryo Viability (%) (Mean ± SD)	
	UY0944-1645-18	UY0945-1645-18B
Laboratory Control	73.3 ± 13.0	72.5 ± 9.6
100	77.5 ± 12.6	75.1 ± 10.5

SD = Standard Deviation

The samples were not statistically significantly different relative to the Laboratory Control

4.0 QA/QC

The health history of the test organisms used in the exposure was acceptable and met the requirements of the Environment Canada protocol. The test met all control acceptability criteria and water quality parameters remained within ranges specified in the protocol throughout the test. Uncertainty associated with this test is best described by the standard deviations around the means and/or confidence limits around the point estimates.

There was a deviation from the test methodology. The eggs were exposed using a blocked design (eggs from each of the four female fish were distributed separately in each of replicates A to D) rather than pooled, as specified in the test protocol. The modification was used because the egg quality from each female varied considerably, and blocking would minimize the effects of poor quality eggs from one particular female fish.

Results of the reference toxicant test conducted during the testing program are summarized in Table 3. Results for this test fell within the acceptable range for organism performance of mean and two standard deviations, based on historical results obtained by the laboratory with this test. Thus, the sensitivity of the organisms used in this test was appropriate. The reference toxicant was performed under the same conditions as those used for the samples.

Table 3. Reference toxicant test results.

Test Species	Endpoint	Historical Mean (2 SD Range)	CV (%)	Test Date
O. mykiss	Viability (EC50): 6.6 mg/L SDS	4.2 (2.2 – 8.1) mg/L SDS	34	December 12, 2018

SD = Standard Deviation, CV = Coefficient of Variation, EC = Effective Concentration

5.0 REFERENCES

Canaria, E.C., J.R. Elphick and H.C. Bailey. 1999. A simplified procedure for conducting small-scale short-term embryo toxicity tests with salmonids. *Environ. Toxicol.* 14:301-307.

Environment Canada. 1998. Biological test method: toxicity tests using early life stages of salmonid fish (rainbow trout). Environmental Protection Series EPS 1/RM/28. Second Edition, July 1998. Environment Canada, Method Development and Application Section, Environmental Technology Centre, Ottawa, ON. 102 pp.

Tidepool Scientific Software. 2013. CETIS comprehensive environmental toxicity information system, version 1.9.4 Tidepool Scientific Software, McKinleyville, CA. 255 pp.

APPENDIX A – *Oncorhynchus mykiss* Toxicity Test Data

Rainbow Trout Early Life Stage Summary Sheet

Client: Maxxam

Start Date/Time: December 12, 2018 @ 1645h

Work Order No.: 1822o2

Test Species: *Oncorhynchus mykiss*

Sample Information:

Sample ID: UY0944-1645-18
Sample Date: December 11, 2018
Date Received: December 12, 2018
Sample Volume: 4 x 10L

Dilution Water:

Type: Dechlorinated Tap Water
Hardness (mg/L $CaCO_3$): 11
Alkalinity (mg/L $CaCO_3$): 10

Test Organism Information:

Batch No.: 12-12-18
Source: Vancouver Island Trout Hatchery, Duncan, BC
Loading Density: 1.1L 3/L

Number of male broodstock used: 4
Number of female broodstock used: 4
Sperm motility check: Verification of sperm motility using a compound microscope

SDS Reference Toxicant Results:

Reference Toxicant ID: RTE116
Stock Solution ID: 18503
Date Initiated: December 12, 2018
7-d EC50 (95% CL): 6.6 (6.4 - 6.9) mg/L SDS

Reference Toxicant Mean and Range: 4.2 (2.2 - 8.1) mg/L SDS
Reference Toxicant CV (%): 34

Test Results:

Embryo viability (7-d) Linear ± 2SD)	Sample ID		
	Control	UY0944-1645-18	
EC25 % (v/v) ~~(95% CL)~~	73.3 ± 13.0	77.5 ± 12.6	/
~~EC50 % (v/v) (95% CL)~~	—	—	/

Reviewed by: JM

Date reviewed: Feb. 4/19

7-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Maxxam
Sample ID: UT0944 - 1645 - 18
Work Order #: 182202

Start Date & Time: December 12, 2018 @ 1645h
Stop Date & Time: December 19, 2018 @ 1130h
CER #: 3
Test Species: *Oncorhynchus mykiss*

Control Concentration (% v/v)	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.0	13.5	14.0	13.5	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
DO (mg/L)	12.7	10.2	10.0	10.2	10.1	12.6	9.7	12.6	9.9	10.1	10.0	10.0	10.0	10.0
pH	6.8	7.0	7.1	6.9	7.9	7.0	6.9	7.0	7.0	7.1	7.2	7.1	7.1	6.9
Cond. (µS/cm)	32	36		35		35		35		35		35		37
Initials	MM	MM		MM		[illegible]		[illegible]		MM		MM		MM

100 Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	13.6	13.5	14.0	13.6	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
DO (mg/L)	10.3	10.1	10.0	10.2	10.1	10.3	9.8	10.2	10.1	10.0	9.9	9.9	10.0	9.9
pH	6.7	7.3	7.8	6.9	7.7	6.9	7.6	7.0	7.3	7.2	7.8	7.2	7.8	7.6
Cond. (µS/cm)	534	536		528		532		534		541		538		544
Initials	MM	MM		MM		[illegible]		[illegible]		MM		MM		MM

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: TR#3 DO meter/probe: 213 / 213 pH meter/probe: 213 / 213 Conductivity meter/probe: 213 / 213

	Control	100%		
Hardness*	11	130		
Alkalinity*	10	48		

* mg/L as CaCO3

Analysts: AMD, YYL
Reviewed by: JBL
Date reviewed: Feb. 4/19

Sample Description: clear, no colour, no odour, no particulates

Comments:

Embryo Toxicity Test
Daily Mortality

Client: Mayoan
Sample ID: UY0944-1645-18
Work Order #: ~~182002~~ 182202

Start Date & Time: December 12, 2018 @ 1645h
Stop Date & Time: December 19, 2018 @ 1130h
Test Species: *Oncorhynchus mykiss*

Concentration	Rep	Day of Test - No. of Mortalities							Total Dead Eggs	Total Undeveloped	Total No. Embryo	Total Exposed
		1	2	3	4	5	6	7				
Control	1	0	0	0	0	0	0	0	0	3	27	30
	2						0	6	6	6	18	30
	3						1	2	3	7	20	30
	4						0	3	3	4	23	30
100	1						0		0	4	26	30
	2						1	3	4	8	18	30
	3			1			0	1	2	5	23	30
	4		1	0			0	1	2	2	26	30
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
Tech Initials												

Comments:

Reviewed by:

Date reviewed: Feb. 4/19

CETIS Summary Report

Test Code/ID: 182202a / 09-1419-7120

Salmonid Embryo Survival and Development Test — **Nautilus Environmental**

Batch ID:	11-2501-8055	**Test Type:**	Development	**Analyst:**	Yvonne Lam
Start Date:	12 Dec-18 16:45	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	19 Dec-18 11:30	**Species:**	Oncorhynchus mykiss	**Brine:**	
Test Length:	6d 19h	**Taxon:**	Actinopterygii	**Source:**	Vancouver Island Trout Hat **Age:**

Sample ID:	03-8887-7508	**Code:**	UY0944-1645-18	**Project:**	
Sample Date:	11 Dec-18 00:19	**Material:**	Effluent	**Source:**	Maxxam
Receipt Date:	12 Dec-18 13:03	**CAS (PC):**		**Station:**	UY0944-1645-18
Sample Age:	40h (4 °C)	**Client:**	Maxxam		

Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
09-3823-3781	Proportion Normal	Equal Variance t Two-Sample Test	0.6618	100% passed proportion normal	1

Proportion Normal Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	4	0.7333	0.5256	0.9410	0.6000	0.9000	0.0653	0.1305	17.80%	0.00%
100		4	0.7750	0.5748	0.9752	0.6000	0.8667	0.0629	0.1258	16.24%	-5.68%

Proportion Normal Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	0.9000	0.6000	0.6667	0.7667
100		0.8667	0.6000	0.7667	0.8667

Proportion Normal Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	27/30	18/30	20/30	23/30
100		26/30	18/30	23/30	26/30

JGH Feb 4/19

CETIS Analytical Report

Salmonid Embryo Survival and Development Test — **Nautilus Environmental**

Analysis ID:	09-3823-3781	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.9.4
Analyzed:	31 Jan-19 11:07	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Batch ID:	11-2501-8055	**Test Type:**	Development	**Analyst:**	Yvonne Lam
Start Date:	12 Dec-18 16:45	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	19 Dec-18 11:30	**Species:**	Oncorhynchus mykiss	**Brine:**	
Test Length:	6d 19h	**Taxon:**	Actinopterygii	**Source:**	Vancouver Island Trout Hat Age:
Sample ID:	03-8887-7508	**Code:**	UY0944-1645-18	**Project:**	
Sample Date:	11 Dec-18 00:19	**Material:**	Effluent	**Source:**	Maxxam
Receipt Date:	12 Dec-18 13:03	**CAS (PC):**		**Station:**	UY0944-1645-18
Sample Age:	40h (4 °C)	**Client:**	Maxxam		

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	100% passed proportion normal	25.85%

Equal Variance t Two-Sample Test

Control	vs	Conc-%	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		100	-0.4385	1.943	0.210	6	CDF	0.6618	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend Test			1.0000	Non-Significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0044957	0.0044957	1	0.1923	0.6763	Non-Significant Effect
Error	0.140258	0.0233763	6			
Total	0.144753		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	1.158	47.47	0.9067	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9674	0.6451	0.8768	Normal Distribution

Proportion Normal Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	4	0.7333	0.5266	0.9410	0.7167	0.6000	0.9000	0.0653	17.80%	0.00%
100		4	0.7750	0.5748	0.9752	0.8167	0.6000	0.8667	0.0629	16.24%	-5.68%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	4	1.039	0.7872	1.291	1.011	0.8861	1.249	0.0792	15.24%	0.00%
100		4	1.087	0.8525	1.321	1.132	0.8861	1.197	0.07359	13.54%	-4.56%

Proportion Normal Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	0.9000	0.6000	0.6667	0.7667
100		0.8667	0.6000	0.7667	0.8667

Angular (Corrected) Transformed Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	1.249	0.8861	0.9553	1.067
100		1.197	0.8861	1.067	1.197

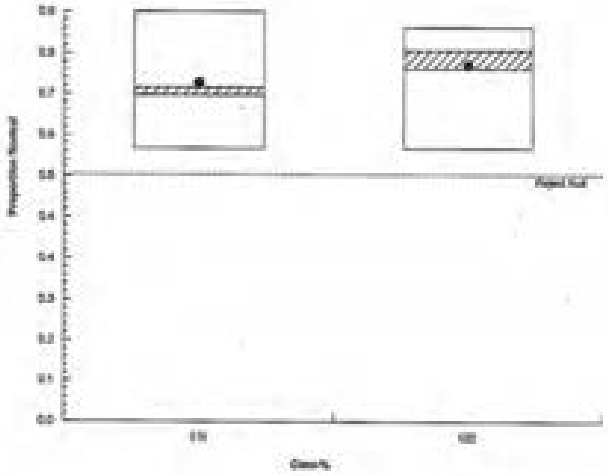
Proportion Normal Binomials

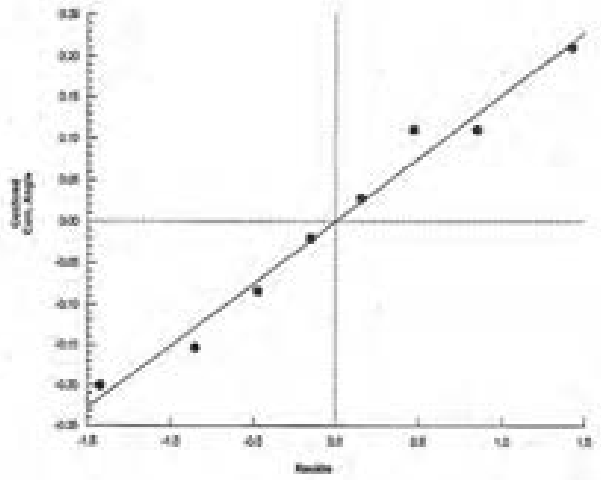
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	27/30	18/30	20/30	23/30
100		26/30	18/30	23/30	26/30

Salmonid Embryo Survival and Development Test — **Nautilus Environmental**

Analysis ID:	09-3823-3781	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.9.4
Analyzed:	31 Jan-19 11:07	**Analysis:**	Parametric-Two Sample	**Status Level:**	1

Graphics





Rainbow Trout Early Life Stage Summary Sheet

Client: Maxxam Start Date/Time: December 12, 2018 @ 1645h

Work Order No.: 1826202 Test Species: *Oncorhynchus mykiss*

Sample Information:

Sample ID: UY0945-1645-1885
Sample Date: December 11, 2018
Date Received: December 12, 2018
Sample Volume: 2 x 20L

Dilution Water:

Type: Dechlorinated Tap Water
Hardness (mg/L $CaCO_3$): 11
Alkalinity (mg/L $CaCO_3$): 10

Test Organism Information:

Batch No.: 121218
Source: Vancouver Island Trout Hatchery, Duncan, BC
Loading Density: 1-16 g/L

Number of male broodstock used: 4
Number of female broodstock used: 4
Sperm motility check: Verification of sperm motility using a compound microscope

SDS Reference Toxicant Results:

Reference Toxicant ID: RTE116
Stock Solution ID: 18503
Date Initiated: December 12, 2018
7-d EC50 (95% CL): 6.6 (6.4 - 6.9) mg/L SDS

Reference Toxicant Mean and Range: 4.2 (2.2 - 8.1) mg/L SDS
Reference Toxicant CV (%): 34

Test Results: Embryo viability (24 h) (mean ± 2SD)

	Sample ID		
	Control	UY0945-1645-1885	
EC25 % (v/v) (95% CL)	72.5 ± 9.6	75.1 ± 10.5	
EC50 % (v/v) (95% CL)	-	-	

Reviewed by: JCH Date reviewed: Feb. 4/19

7-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Maxxam
Sample ID: UY0945-1645-1813
Work Order #: 182202

Start Date & Time: December 12, 2018 @ 1645h
Stop Date & Time: December 19, 2018 @ 1130h
CER #: 3
Test Species: *Oncorhynchus mykiss*

Control Concentration (% v/v)	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	13.0	13.5	14.2	13.5	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
DO (mg/L)	10.3	10.2	10.0	10.2	10.1	10.2	9.9	10.2	10.0	10.1	10.0	10.0	10.0	9.9
pH	6.8	7.1	7.1	6.9	7.0	7.0	7.1	7.0	7.1	7.1	7.2	7.1	7.1	7.0
Cond. (µS/cm)	37	36		35		35		35		35		35		37
Initials	WM	WM		WM		A		A		WM		WM		WM

100 Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	13.5	14.0	14.0	13.5	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
DO (mg/L)	10.3	10.1	10.0	10.3	10.1	10.2	9.8	10.2	10.1	10.1	10.0	10.0	10.1	9.9
pH	6.8	7.3	7.8	6.9	7.7	7.0	7.7	7.0	7.6	7.3	7.8	7.3	7.8	7.6
Cond. (µS/cm)	523	532		529		535		537		521		537		540
Initials	WM	WM		WM		A		A		WM		WM		WM

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER3 DO meter/probe: 213 / 213 pH meter/probe: 213 / 213 Conductivity meter/probe: 213 / 213

	Control	100%		
Hardness*	11	130		
Alkalinity*	10	50		

* mg/L as CaCO3

Analysts: AWD, WM
Reviewed by: JOL
Date reviewed: Feb. 4/19

Sample Description: clear, no odour, no particulates

Comments:

Embryo Toxicity Test
Daily Mortality

Client: Maxxam
Sample ID: UY0945-1645-1EB
Work Order #: 182202

Start Date & Time: December 12, 2018 @ 1645h
Stop Date & Time: December 19, 2018 @ 1130h
Test Species: *Oncorhynchus mykiss*

Concentration	Rep	Day of Test - No. of Mortalities							Total Dead Eggs	Total Undeveloped	Total No. Embryo	Total Exposed
		1	2	3	4	5	6	7				
Control	1	0	0	0	0	0	0	0	0	8	22	30
	2						1	2	3	9	18	30
	3						0	2	2	3	25	30
	4						0	2	2	~~8~~ 6	~~20~~ 22	30
100	1						0	0	0	6	24	30
	2						1	1	2	9	19	30
	3						1	2	3	6	21	30
	4						0	0	0	4	27	31
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
Tech Initials												

Comments:

Reviewed by: JGu

Date reviewed: Feb. 4/19

CETIS Summary Report

Salmonid Embryo Survival and Development Test — Nautilus Environmental

Batch ID:	19-9100-1679	Test Type:	Development	Analyst:	Yvonne Lam
Start Date:	12 Dec-18 16:45	Protocol:	EC/EPS 1/RM/28	Diluent:	Dechlorinated Tap Water
Ending Date:	19 Dec-18 11:30	Species:	Oncorhynchus mykiss	Brine:	
Test Length:	6d 19h	Taxon:	Actinopterygii	Source:	Vancouver Island Trout Hat Age:
Sample ID:	09-8206-0820	Code:	UY0945-1645-18B	Project:	
Sample Date:	11 Dec-18 01:14	Material:	Effluent	Source:	Maxxam
Receipt Date:	12 Dec-18 13:03	CAS (PC):		Station:	UY0945-1645-18B
Sample Age:	40h (5 °C)	Client:	Maxxam		

Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
16-1432-2040	Proportion Normal	Equal Variance t Two-Sample Test	0.6455	100% passed proportion normal	1

Proportion Normal Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	4	0.7250	0.5727	0.8773	0.6000	0.8333	0.0479	0.0957	13.21%	0.00%
100		4	0.7511	0.5836	0.9186	0.6333	0.8710	0.0526	0.1053	14.01%	-3.60%

Proportion Normal Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	0.7333	0.6000	0.8333	0.7333
100		0.8000	0.6333	0.7000	0.8710

Proportion Normal Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	22/30	18/30	25/30	22/30
100		24/30	19/30	21/30	27/31

Salmonid Embryo Survival and Development Test — **Nautilus Environmental**

Analysis ID:	16-1432-2040	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.9.4
Analyzed:	31 Jan-19 11:09	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Batch ID:	19-9100-1679	**Test Type:**	Development	**Analyst:**	Yvonne Lam
Start Date:	12 Dec-18 16:45	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	19 Dec-18 11:30	**Species:**	Oncorhynchus mykiss	**Brine:**	
Test Length:	6d 19h	**Taxon:**	Actinopterygii	**Source:**	Vancouver Island Trout Hat **Age:**
Sample ID:	09-8206-0820	**Code:**	UY0945-1645-18B	**Project:**	
Sample Date:	11 Dec-18 01:14	**Material:**	Effluent	**Source:**	Maxxam
Receipt Date:	12 Dec-18 13:03	**CAS (PC):**		**Station:**	UY0945-1645-18B
Sample Age:	40h (5 °C)	**Client:**	Maxxam		

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	100% passed proportion normal	20.43%

Equal Variance t Two-Sample Test

Control	vs	Conc-%	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		100	-0.3915	1.943	0.161	6	CDF	0.6455	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend Test			1.0000	Non-Significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0020927	0.0020927	1	0.1533	0.7090	Non-Significant Effect
Error	0.0819327	0.0136554	6			
Total	0.0840254		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	1.341	47.47	0.8151	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9275	0.6451	0.4939	Normal Distribution

Proportion Normal Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	4	0.7250	0.5727	0.8773	0.7333	0.6000	0.8333	0.0479	13.21%	0.00%
100		4	0.7511	0.5836	0.9186	0.7500	0.6333	0.8710	0.0526	14.01%	-3.60%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	4	1.023	0.8513	1.195	1.028	0.8861	1.15	0.054	10.56%	0.00%
100		4	1.056	0.8565	1.255	1.049	0.9204	1.203	0.06254	11.85%	-3.16%

Proportion Normal Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	0.7333	0.6000	0.8333	0.7333
100		0.8000	0.6333	0.7000	0.8710

Angular (Corrected) Transformed Detail

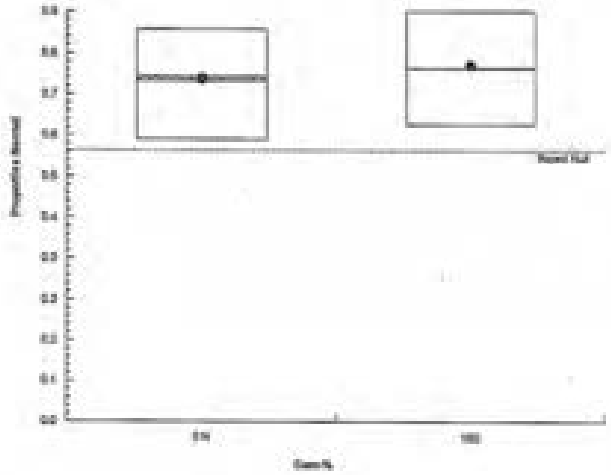
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	1.028	0.8861	1.15	1.028
100		1.107	0.9204	0.9912	1.203

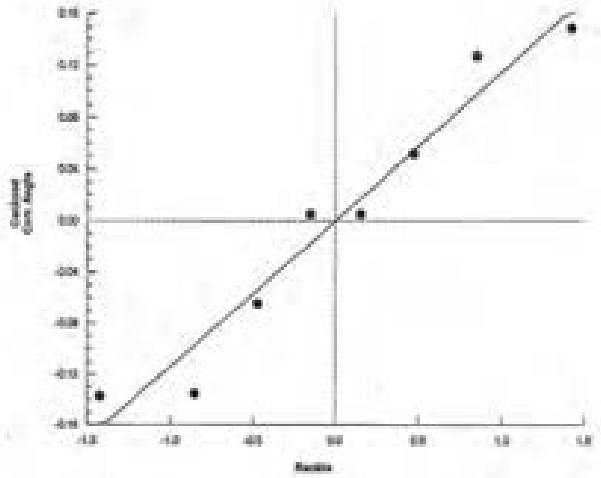
Proportion Normal Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	22/30	18/30	25/30	22/30
100		24/30	19/30	21/30	27/31

Analysis ID:	16-1432-2040	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.9.4
Analyzed:	31 Jan-19 11:09	**Analysis:**	Parametric-Two Sample	**Status Level:**	1

Graphics





APPENDIX B – Chain-of-Custody Form

Maxxam
A Bureau Veritas Group Company

Sent To: **Nautilus Environmental - Burnaby**
8664 Commerce Court
Burnaby, BC, V5A 4N7
Tel: (604) 420-8773

CHAIN OF CUSTODY RECORD FOR SUBCONTRACTED WORK

Page 01 **of** 01

COC # B8A8117-VNAU-01-01

REPORT INFORMATION

Company: Maxxam

Address: 4606 Canada Way, Burnaby, British Columbia, V5G 1K5

Contact Name: Veronica De Guzman

Email: VDeGuzman@maxxam.ca, edmenvirocs@maxxamanalytics.com

Phone:

Maxxam Project #: B8A8117

ANALYSIS REQUESTED

#	SAMPLE ID	MATRIX	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	SAMPLER INITIALS	# CONT.	Rainbow Trout 7 Day Embryo Subcontract P/F									Temp (°C)	ADDITIONAL SAMPLE INFORMATION
1	UY0944-1645-18	GRAB	2018/12/11	00:19	AH	4	X									4.0	(P: 03)
2	UY0945-1645-18B	GRAB	2018/12/11	01:14	AH	2	X									5.0	(P: 03)
3																	
4																	
5																	
6																	
7																	
8							18 12 02										
9																	
10																	

REGULATORY CRITERIA

Diavik 1645-18 Ave & Grab

SPECIAL INSTRUCTIONS

Please inform Maxxam immediately if you are not accredited for the requested test(s).
Please return a copy of this form with the report.

TURNAROUND TIME

☐ Rush Required

2019/01/17

Date Required

Please inform us if rush charges will be incurred.

COOLER ID:

	YES	NO	Temp: (°C)	1	2	3
Custody Seal Present						
Custody Seal Intact						
Cooling Media Present						

COOLER ID:

	YES	NO	Temp: (°C)	1	2	3
Custody Seal Present						
Custody Seal Intact						
Cooling Media Present						

COOLER ID:

	YES	NO	Temp: (°C)	1	2	3
Custody Seal Present						
Custody Seal Intact						
Cooling Media Present						

RELINQUISHED BY: (SIGN & PRINT)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (SIGN & PRINT)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
1. [illegible]	2018/12/12	11:30	1. Tyrone Hamilton TH	2018/12/12	13:03
2.			2.		

END OF REPORT

Ceriodaphnia dubia Bioassay Report

Test Substance

Job and Sample ID: B8A8117 - UY0945
Date sample collected: 2018/12/11
Test Initiation Date: 2018/12/12
Test End Date: 2018/12/18
Dates when subsamples used: 2018/12/12, 2018/12/13, 2018/12/14, 2018/12/15, 2018/12/16, 2018/12/17, 2018/12/18
Test Performed By: NM9, DBA

Dissolved Oxygen prior to test (mg/L): 8.3
pH prior to test (pH units): 7.2
Temperature (°C): 25
Conductivity (µS/cm): 531

Test Results			Significant or non-significant			Method	Data Transforms	Outliers* (concentration-replicate)
Sample Test Results (% vol/vol)	7 day Survival Result	Effect	Non-Significant			Fisher Exact Test	Log X	None
	7 day Biomass Result	Effect	Non-Significant			Wilcoxon Rank Sum Two-Sample Test	Log X	None
Reference Toxicant Results			Endpoint	95% LCL	95% UCL	Method	Data Transforms	Outliers* (concentration-replicate)
Reference Toxicant Test Results (g/L)	7 day Survival Result	LC50	1.87	1.51	2.31	Spearman-Karber	Log X	None
	7 day Biomass Result	IC50	1.18	1.03	1.38	Regression: 4P Log-Logistic+Hormesis	Log X	None
Control Chart Data (g/L)	7 day Survival Result	LC50	1.51	0.977	2.33	Shewart	n/a	n/a
	7 day Biomass Result	IC50	1.20	0.855	1.69			

* If outliers were removed, describe in comments.

Comments

Reference toxicant analyzed 2018/12/12

Test Organisms

Species: *Ceriodaphnia dubia*
Source of test organisms: Aquatic Biosystems, Colorado
Age of organisms at test initiation: ≤ 24 hours, within 12 hours
Unusual Appearance, behaviour or treatment prior to use in test : None
Mean % mortality of brood organisms during 7-day period proceding test: 5.1
Number of neonates produced by each organism in its third or fourth brood: ≥8 neonates
Mean number of neonates per adult during first 3 broods in 7: 37
Observations of ephippia: None

All test organisms used to initiate this test were taken from a series of individual cultures, that originated from the same mass culture.
The 4th brood or subsequent broods produced during the test are not included in the final statistical analysis.

Test Facilities and Apparatus

Name address of test laboratory: Maxxam Analytics. 9331 48st NW, Edmonton, AB
Test vessels used: Fisherbrand 20 x 150 mm lime glass test tubes

Control/Dilution Water

Consists of: 16 L RODI from in-house system, to which the following are added:
4 L Perrier Brand carbonated spring water
1 mL cyanocobalamin (Vitamin B-12)
1 mL Sodium Selenate Decahydrate

Test Method

Reference method used for testing: Biological Test Method: Test of Reproduction and Survival Using the Cladoceran *Ceriodaphnia dubia* . Environment Canada, EPS 1/RM/21 Second Edition - February 2007

Did the following occur during sample preparations:

Filtered:	No
Adjusted for hardness:	No
Adjusted for pH:	No
Frequency of observations:	24 ± 1 hour
Frequency of water quality measurements:	Daily
Design and description of any specialized procedure:	N/A
Program used for statistical calculations:	Comprehensive Environmental Toxicity Information System (CETIS). Tidepool Scientific Software. Version 1.9.3.0
Reference method used for statistical calculations:	Guidance Document on Statistical Methods for Environmental Toxicity Tests. Environment Canada, EPS 1/RM/46 - March 2005.

Test Conditions and Procedures

Number of test solutions:	20
Number of test concentrations:	1 and a negative control
Concentrations tested (%):	100
Units of tested concentrations:	% vol/vol
Number of replicates:	10
Volume of test solutions:	≥ 15 mL
Depth of test solutions:	≥ 5 cm
Individuals per test vessel:	1
Was pre-aeration performed:	Yes
Procedure:	Oil-free compressed air is dispensed through airline tubing and a disposable pipette
Rate:	≤ 100 bubbles / minute
Duration:	20 minutes
Dates where pre-aeration occurred:	2018/12/12 2018/12/16 2018/12/13 2018/12/17 2018/12/14 2018/12/15
Aeration during testing:	None

Refer to comments section for any deviations.
The reference toxicity test was performed under the same experimental conditions as those used with the test sample.
Refer to comments section for any deviations regarding reference toxicity testing.

Ceriodaphnia dubia Survival and Reproduction Observations

Note: Mortalities are indicated by an "X" in the column and row of the concentration, replicate and day of occurance. If organism was not used for testing, this will be indicated by "N/A" in mortality and neonate columns for the replicate.

Concentration (%/%vol)	Replicate number	Day of Testing 1 neonates	1 Mortality	2 neonates	2 Mortality	3 neonates	3 Mortality	4 neonates	4 Mortality	5 neonates	5 Mortality	6 neonates	6 Mortality	7 neonates	7 Mortality	8 neonates	8 Mortality	Cumulative Mean % Mortality	Cumulative Mean Reproduction	SD of mean reproduction
Control	1	0		0		0		7		11		20						0.0%	31.3	6.7
	2	0		0		0		6		10		5								
	3	0		0		0		5		12		14								
	4	0		0		0		6		13		15								
	5	0		0		0		6		15		11								
	6	0		0		0		4		14		0								
	7	0		0		0		7		10		15								
	8	0		0		0		8		14		16								
	9	0		0		0		7		10		18								
	10	0		0		0		6		12		16								
100%	1	0		0		0		5		17		16						0.0%	29.1	6.1
	2	0		0		0		6		12		12								
	3	0		0		0		4		12		15								
	4	0		0		0		5		12		12								
	5	0		0		0		7		10		0								
	6	0		0		0		7		12		12								
	7	0		0		0		9		13		0								
	8	0		0		0		5		16		6								
	9	0		0		0		7		11		12								
	10	0		0		0		7		13		16								

Average Values for Chemical Data of Test Concentrations

Test Concentration (% vol/vol)	Before Effluent Renewal Date	Temperature (°C)	pH	Conductivity (µS/cm)	DO (mg/L)	After Effluent Renewal Date	Temperature (°C)	pH	Conductivity (µS/cm)	DO (mg/L)
Control	2018/12/12	25	7.8	180	7.1	2018/12/13	25	7.7	192	6.1
100		26	7.2	536	8.1		25	7.5	531	6.1
Control	2018/12/13	25	7.9	182	7.3	2018/12/14	25	7.8	183	6.4
100		25	7.3	535	7.8		25	7.6	517	6.5
Control	2018/12/14	25	8.0	176	7.1	2018/12/15	25	7.7	178	6.6
100		26	7.4	537	8.1		25	7.4	510	6.6
Control	2018/12/15	25	7.9	176	7.3	2018/12/16	26	7.7	183	6.6
100		25	7.5	527	7.6		24	7.6	511	7.1
Control	2018/12/16	25	8.0	175	7.4	2018/12/17	25	7.7	178	6.8
100		24	7.4	525	8.1		25	7.5	514	6.8
Control	2018/12/17	24	8.0	174	7.6	2018/12/18	25	7.6	180	6.1
100		25	7.3	526	8.2		25	7.3	517	5.9
Control	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Control	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A

Maxxam
A Bureau Veritas Group Company

RESULTS OF RAINBOW TROUT SINGLE CONCENTRATION-100%

Success Through Science®

Client : 4388 DIAVIK DIAMOND MINES INC., YELLOWKNIFE Job Number: B8A8117

Client Project Name & Number: Quarterly Tox SNP-A

Test Result:

96 hrs Mortality % 0% Statistical Method: Visual

Sample Name : 1645-18B Sample Matrix : Grab Water

Description: Clear, colourless Sample Number: UY0945-05

Sample Collected: Dec 11, 2018 01:14 AM Sampling Method : N/A Site Collection: N/A

Sample Collected By: AH Volume Received: 20 L Temp.Upon Arrival: -1 °C Storage: 2-6°C

Sample Received: Dec 11, 2018 02:06 PM pH: 7.1 Dissolved Oxygen: 11.3 mg/L

Analysis Start : Dec 12, 2018 11:17 AM Temperature : 12 °C Sample Conductance: 392 µS/cm

Concentration	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)
% vol/vol	Start	Start	Start	Start	24 hrs	24 hrs	24 hrs	24 hrs	48 hrs	48 hrs	48 hrs	48 hrs
0	15	8.0	292	9.0	0	0	0	0	0	0	0	0
100	14	7.3	404	9.5	0	0	0	0	0	0	0	0

Concentration	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)
% vol/vol	72 hrs	72 hrs	72 hrs	72 hrs	96 hrs	96 hr	96 hrs	96 hrs	96 hrs	96 hrs	96 hrs	96 hrs
0	0	0	0	0	15	7.8	302	9.1	0	0	0	0
100	0	0	0	0	14	7.5	422	9.0	0	0	0	0

Comments : The control chart result for this reference toxicant test was outside of 2SD limits. A check of all acclimation and test conditions was performed, and all requirements were met.

Culture/Control/Dilution Water City of Edmonton dechlorinated tap water

Hardness: 170 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,100 (% vol/vol)

Organisms per Vessel :	10	Test Temperature :	15 ± 1 °C	Solution Depth :	>15 cm
Total # of Organisms Used :	20	Pre-aeration Time :	120 min.	Rate of Aeration	6.5±1 mL/min/L
Test Volume :	20 L	Vessel Volume :	38L	Test pH Adjusted:	No
Loading Density :	0.3 g/L	Photoperiod :	16:8 (light: dark)		

Test Organism : Rainbow Trout *(Oncorhynchus mykiss)* Source : Spring Valley Trout Hatchery

Culture Temperature :	15 ± 2 °C	Weight (Mean) +- SD :	0.6 ± 0.2 g	Length (Mean) +- SD :	4.15 ± 0.36 cm
Culture Water Renewal :	≥ 1.0 L/min/kg fish	Weight (Range) :	0.4 – 0.9 g	Length (Range) :	3.70 – 4.70 cm
Culture Photoperiod :	16:8 (light: dark)			% Mortality within 7 days :	0.3%
Feeding rate and frequency :	daily: 1-5% biomass of trout.			Acclimation Time:	>14 days

Reference chemical: Phenol Test Date: Nov 14, 2018

Test Endpoint 96 hrs LC50 (95% confidence interval) : 12.2 (10.9, 13.8)mg/L Statistical Method : Probit

Historical Mean LC50 (warning limits) : 10.2 (8.60, 12.1) mg/L Concentration : 0,8,10,12,15,20 mg/L

Test Method EPS 1/RM/13

Method Deviations : None

Note: The results contained in this report refer only to the testing of the sample submitted. This report may not be reproduced, except in its entirety, without the written approval of the laboratory.

Analyst : Dustin Banks, Natasha Lloyd

Verified By : Natasha Lloyd, Analyst 2 Date: Dec 21, 2018 08:33 AM

Maxxam
A Bureau Veritas Group Company

RESULTS OF *DAPHNIA MAGNA* SINGLE CONCENTRATION-100%

Success Through Science®

Client : 4388 DIAVIK DIAMOND MINES INC., YELLOWKNIFE Job Number: B8A8117

Client Project Name & Number: Quarterly Tox SNP-A Sample Number: UY0945-04

Test Result:

48 hrs Mortality % 0% Statistical Method:

Mean percent mortality: Sample 0 Control 0

Sample Name : 1645-18B Sample Matrix : Grab Water

Description: CLEAR COLOURLESS Sample Prior to Analysis:

Sample Collected: Dec 11, 2018 01:14 AM Sampling Method : N/A pH: 7.2

Sample Collected By: AH Site Collection: N/A Temperature : 19 °C

Sample Received: Dec 11, 2018 02:06 PM Volume Received: 1 L Dissolved Oxygen: 10.7 mg/L

Analysis Start : Dec 12, 2018 11:42 AM Temp.Upon Arrival: -1 °C Sample Conductance: 462 µS/cm

End : Dec 14, 2018 10:51 AM Storage: 2-6°C Hardness: 100 mg $CaCO_3$/L

Concentration	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Immobility (#)	Immobility (%)	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)
% vol/vol	Start	Start	Start	Start	24 hrs	24 hrs	24 hrs	24 hrs	48 hrs	48 hr	48 hrs	48 hrs
0	20	8.2	359	8.0	0	0	0	0	19	8.2	363	8.1
0	20	8.2	361	8.0	0	0	0	0	20	8.3	369	8.0
0	20	8.2	361	8.0	0	0	0	0	20	8.2	365	8.0
100	19	7.3	467	10.3	0	0	0	0	20	7.8	477	8.0
100	19	7.3	469	10.4	0	0	0	0	20	7.8	478	8.1
100	19	7.3	469	10.3	0	0	0	0	20	7.8	479	8.1

Concentration	Mortality (#)	Mortality (%)	Immobility (#)	Immobility (%)
% vol/vol	48 hrs	48 hrs	48 hrs	48 hrs
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
100	0	0	0	0
100	0	0	0	0
100	0	0	0	0

Comments : Many daphnia in sample concentration test vessels floating on water surface.

Culture/Control/Dilution Water: City of Edmonton dechlorinated tap water

Hardness: 180 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,0,0,100,100,100 (% vol/vol)

Organisms per Vessel :	10	Pre-aeration Time :	30 min	Rate of Pre-aeration :	25-50 mL/min/L
Total # of Organisms Used :	60	Test Temperature :	20 ± 2 °C	Test Hardness Adjusted :	No
Test Volume :	150 mL	Vessel Volume :	225 mL	Test pH Adjusted:	No
Loading Density :	15.0 mL/Daphnia	Photoperiod :	16:8 (light: dark)		

Test Organism : *Daphnia magna* Source : In House Culture

Age at Test Initiation :	<24 hrs	Average Brood Size :	24.8
Culture Photoperiod :	16:8 (light: dark)	% Mortality within 7 days :	1.6
Culture Temperature :	20 ± 2 °C	Time To First Brood :	8 Days

Culture Diet: Pseudokirchnriella and YTC at a ratio of 2 mL/L of culture daily. New cultures weekly, 63 daphnids distributed into 6 culture vessels and 3 reproductive vessels.

RESULTS OF *DAPHNIA MAGNA* SINGLE CONCENTRATION-100%

Success Through Science®

Client :	4388	DIAVIK DIAMOND MINES INC., YELLOWKNIFE	Job Number:	B8A8117
Client Project Name & Number:		Quarterly Tox SNP-A	Sample Number:	UY0945-04

Reference chemical:	Sodium Chloride	Test Date:	Dec 05, 2018
Test Endpoint 48 hrs LC50 (95% confidence interval) :	6.96 (5.70, 8.50)g/L	Statistical Method :	Binomial
Historical Mean LC50 (warning limits) :	5.80 (4.37, 7.71) g/L	Concentration : 0,1.71,2.56,3.82,5.7,8.5 g/L	

Test Method EPS 1/RM/14

Method Deviations: None

Note: The results contained in this report refer only to the testing of the sample submitted. This report may not be reproduced, except in its entirety, without the written approval of the laboratory.

Analyst : Dustin Banks, Natasha Lloyd

Chelsea Tessier

Verified By : Chelsea Tessier, Sample Logistics Supervisor Date: Dec 22, 2018 02:46 PM

Ceriodaphnia dubia Bioassay Report

Test Substance

Client Name and Sample ID: DDMI - 1645-18
Job and Sample ID: B921715- VK6758
Test Performed By: DBA, NM9, CSH
Date sample collected: 2019/03/26
Test Initiation Date: 2019/03/27
Test End Date: 2019/04/03
Dates when subsamples used: 2019/03/27, 2019/03/28, 2019/03/29, 2019/03/30, 2019/03/31, 2019/04/01, 2019/04/02
Dissolved Oxygen prior to test (mg/L): 9.4
pH prior to test (pH units): 7.0
Temperature (°C): 25
Conductivity (µS/cm): 507

Test Results			Significant or non-significant			Method	Data Transforms	Outliers* (concentration-replicate)
Sample Test Results (% vol/vol)	7 day Survival Result	Effect	Non-Significant			Fisher Exact Test	Untransfomed	N/A
	7 day Reproduction Result	Effect	Significant			Wilcoxon Rank Sum Two-Sample Test	Untransformed	100 - 5
Reference Toxicant Results			Endpoint	95% LCL	95% UCL	Method	Data Transforms	Outliers* (concentration-replicate)
Reference Toxicant Test Results (g/L)	7 day Survival Result	LC50	1.38	1.27	1.50	Spearman-Karber	Log- X	0.5- 10
	7 day Reproduction Result	IC50	1.29	1.13	1.36	Linear Interpolation	Log- X	N/A
Control Chart Data (g/L)	7 day Survival Result	LC50	1.55	1.02	2.36	Shewart	n/a	n/a
	7 day Reproduction Result	IC50	1.20	0.867	1.67			

* If outliers were removed, describe in comments.

Comments

Test Organisms

Species: *Ceriodaphnia dubia*
Source of test organisms: Aquatic Biosystems, Colorado
Age of organisms at test initiation: ≤ 24 hours, within 12 hours
Unusual Appearance, behaviour or treatment prior to use in test : None
Mean % mortality of brood organisms during 7-day period proceding test: 6.9
Number of neonates produced by each organism in its third or fourth brood: ≥8 neonates
Mean number of neonates per adult during first 3 broods in 7 days: 24
Observations of ephippia: None

All test organisms used to initiate this test were taken from a series of individual cultures, that originated from the same mass culture.
The 4th brood or subsequent broods produced during the test are not included in the final statistical analysis.

Test Facilities and Apparatus

Name address of test laboratory: Maxxam Analytics. 9331 48st NW, Edmonton, AB
Test vessels used: Fisherbrand 20 x 150 mm lime glass test tubes

Control/Dilution Water

Consists of: 16 L RODI from in-house system, to which the following are added:
4 L Perrier Brand carbonated spring water
1 mL cyanocobalamin (Vitamin B-12)
1 mL Sodium Selenate Decahydrate

Test Method

Reference method used for testing: Biological Test Method: Test of Reproduction and Survival Using the Cladoceran *Ceriodaphnia dubia* . Environment Canada, EPS 1/RM/21 Second Edition - February 2007

Did the following occur during sample preparations:

Filtered:	No
Adjusted for hardness:	No
Adjusted for pH:	No
Frequency of observations:	24 ± 1 hour
Frequency of water quality measurements:	Daily
Design and description of any specialized procedure:	N/A
Program used for statistical calculations:	Comprehensive Environmental Toxicity Information System (CETIS). Tidepool Scientific Software. Version 1.9.3.0
Reference method used for statistical calculations:	Guidance Document on Statistical Methods for Environmental Toxicity Tests. Environment Canada, EPS 1/RM/46 - March 2005.

Test Conditions and Procedures

Number of test solutions:	20
Number of test concentrations:	1 and a negative control
Concentrations tested (%):	100
Units of tested concentrations:	% vol/vol
Number of replicates:	10
Volume of test solutions:	≥ 15 mL
Depth of test solutions:	≥ 5 cm
Individuals per test vessel:	1
Was pre-aeration performed:	Yes
Procedure:	Oil-free compressed air is dispensed through airline tubing and a disposable pipette
Rate:	≤ 100 bubbles / minute
Duration:	20 minutes
Dates where pre-aeration occurred:	2019/03/27 2019/03/31 2019/03/28 2019/04/01 2019/03/29 2019/04/02 2019/03/30
Aeration during testing:	None

Refer to comments section for any deviations.
The reference toxicity test was performed under the same experimental conditions as those used with the test sample.
Refer to comments section for any deviations regarding reference toxicity testing.

Ceriodaphnia dubia Survival and Reproduction Observations

Note: Mortalities are indicated by an "X" in the column and row of the concentration, replicate and day of occurance. If organism was not used for testing, this will be indicated by "N/A" in mortality and neonate columns for the replicate.

Concentration (%/%vol)	Replicate number	Day of Testing																Cumulative Mean % Mortality	Cumulative Mean Reproduction	SD of mean reproduction
		1		2		3		4		5		6		7		8				
		neonates	Mortality	neonates	Mortality	neonates	Mortality	neonates	Mortality	neonates	Mortality	neonates	Mortality	neonates	Mortality	neonates	Mortality			
Control	1	0		0		0		7		10		0		17						
	2	0		0		0		4		10		0		14						
	3	0		0		0		5		12		19								
	4	0		0		0		7		11		0		17						
	5	0		0		0		3		13		0		16						
	6	0		0		0		8		12		3						10.0%	31	4.5
	7	0		0		0		7		9		0		9	x					
	8	0		0		0		6		9		15								
	9	0		0		0		7		10		19								
	10	0		0		0		4		12		15								
100%	1	0		0		0		5		10		0		11						
	2	0		0		0		5		9		0		9						
	3	0		0		0		5		12		8								
	4	0		0		0		5		10		0		11						
	5	0		0		0		5		2	X									
	6	0		0		0		5		11		0		11				20.0%	24.1	6.2
	7	0		0		0		5		9		0		13						
	8	0		0		0		6		10		0		9						
	9	0		0		0		5		8		13			X					
	10	0		0		0		7		13		9								

Average Values for Chemical Data of Test Concentrations

Test Concentration (% vol/vol)	Before Effluent Renewal					After Effluent Renewal				
	Date	Temperature (°C)	pH	Conductivity (µS/cm)	DO (mg/L)	Date	Temperature (°C)	pH	Conductivity (µS/cm)	DO (mg/L)
Control	2019/03/27	26	7.7	179	7.3	2019/03/28	26	7.7	191	6.5
100		26	7.0	513	8.7		26	7.5	516	6.8
Control	2019/03/28	25	7.9	174	7.4	2019/03/29	25	7.6	176	6.2
100		25	7.2	505	8.8		25	7.3	487	6.4
Control	2019/03/29	25	7.9	174	7.2	2019/03/30	25	7.6	178	6.3
100		25	7.2	496	8.8		25	7.5	496	6.4
Control	2019/03/30	25	7.8	176	7.0	2019/03/31	26	7.8	184	7.2
100		25	7.2	502	8.1		26	7.5	500	7.4
Control	2019/03/31	24	8.1	171	7.8	2019/04/01	26	7.8	179	6.6
100		25	7.3	499	8.8		26	7.6	503	6.8
Control	2019/04/01	25	7.9	131	7.3	2019/04/02	25	7.4	140	6.6
100		25	7.3	500	9.1		25	7.2	495	6.7
Control	2019/04/02	26	7.7	130	7.4	2019/04/03	25	7.1	132	6.7
100		26	7.1	515	8.4		25	7.1	502	6.6
Control	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A

Maxxam
A Bureau Veritas Group Company

RESULTS OF *DAPHNIA MAGNA* SINGLE CONCENTRATION-100%

Success Through Science®

Client : 4388 DIAVIK DIAMOND MINES INC., YELLOWKNIFE Job Number: B921715

Client Project Name & Number: Quarterly Tox SNP-A Sample Number: VK6758-01

Test Result:

48 hrs Mortality % 0 Statistical Method:

Mean percent mortality: Sample 0 Control 0

Sample Name : 1645-18 Sample Matrix : Grab Water

Description: Clear and colourless Sample Prior to Analysis:

Sample Collected: Mar 26, 2019 04:19 AM Sampling Method : N/A pH: 7.0

Sample Collected By: AH Site Collection: N/A Temperature : 18 °C

Sample Received: Mar 26, 2019 02:42 PM Volume Received: 1 L Dissolved Oxygen: 11.1 mg/L

Analysis Start : Mar 27, 2019 03:16 PM Temp.Upon Arrival: -2 °C Sample Conductance: 439 µS/cm

End : Mar 29, 2019 03:22 PM Storage: 2-6°C Hardness: 120 mg $CaCO_3$/L

Concentration	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Immobility (#)	Immobility (%)	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)
% vol/vol	Start	Start	Start	Start	24 hrs	24 hrs	24 hrs	24 hrs	48 hrs	48 hr	48 hrs	48 hrs
0	20	8.2	391	8.4	0	0	0	0	20	8.0	393	8.3
0	20	8.0	391	8.4	0	0	0	0	20	8.0	395	8.4
0	20	8.0	390	8.4	0	0	0	0	20	8.0	395	8.4
100	20	7.2	451	10.8	0	0	0	0	20	7.6	457	8.5
100	20	7.1	452	10.9	0	0	0	0	20	7.6	457	8.5
100	20	7.0	452	10.7	0	0	0	0	20	7.6	455	8.5

Concentration	Mortality (#)	Mortality (%)	Immobility (#)	Immobility (%)
% vol/vol	48 hrs	48 hrs	48 hrs	48 hrs
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
100	0	0	0	0
100	0	0	0	0
100	0	0	0	0

Comments : None

Culture/Control/Dilution Water: City of Edmonton dechlorinated tap water

Hardness: 180 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,0,0,100,100,100 (% vol/vol)

Organisms per Vessel :	10	Pre-aeration Time :	30 min	Rate of Pre-aeration :	25-50 mL/min/L
Total # of Organisms Used :	60	Test Temperature :	20 ± 2 °C	Test Hardness Adjusted :	No
Test Volume :	150 mL	Vessel Volume :	225 mL	Test pH Adjusted:	No
Loading Density :	15.0 mL/Daphnia	Photoperiod :	16:8 (light: dark)		

Test Organism : *Daphnia magna* Source : In House Culture

Age at Test Initiation :	<24 hrs	Average Brood Size :	26.2
Culture Photoperiod :	16:8 (light: dark)	% Mortality within 7 days :	1.6
Culture Temperature :	20 ± 2 °C	Time To First Brood :	8 Days

Culture Diet: Pseudokirchnriella and YTC at a ratio of 2 mL/L of culture daily. New cultures weekly, 63 daphnids distributed into 6 culture vessels and 3 reproductive vessels.

RESULTS OF *DAPHNIA MAGNA* SINGLE CONCENTRATION-100%

Success Through Science®

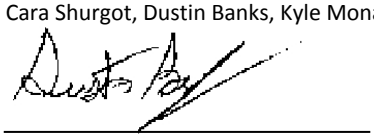
Client :	4388	DIAVIK DIAMOND MINES INC., YELLOWKNIFE	Job Number:	B921715
Client Project Name & Number:		Quarterly Tox SNP-A	Sample Number:	VK6758-01

Reference chemical:	Sodium Chloride	Test Date:	Mar 27, 2019
Test Endpoint 48 hrs LC50 (95% confidence interval) :	6.17 (5.50, 6.93)g/L	Statistical Method :	Untrimmed Spearman-Kärber
Historical Mean LC50 (warning limits) :	6.10 (4.57, 8.14) g/L	Concentration :	0,1.71,2.56,3.82,5.7,8.5 g/L

Test Method	EPS 1/RM/14
Method Deviations:	None

Note: The results contained in this report refer only to the testing of the sample submitted. This report may not be reproduced, except in its entirety, without the written approval of the laboratory.

Analyst : Cara Shurgot, Dustin Banks, Kyle Monaghan



Verified By : Dustin Banks, Analyst 2 Date: Apr 02, 2019 04:09 PM

Maxxam
A Bureau Veritas Group Company

RESULTS OF RAINBOW TROUT SINGLE CONCENTRATION-100%

Success Through Science®

Client : 4388 DIAVIK DIAMOND MINES INC., YELLOWKNIFE Job Number: B921715

Client Project Name & Number: Quarterly Tox SNP-A

Test Result:

96 hrs Mortality % 0 Statistical Method: Visual

Sample Name : 1645-18 Sample Matrix : Grab Water

Description: Clear and colourless. Sample Number: VK6758-03

Sample Collected: Mar 26, 2019 04:19 AM Sampling Method : N/A Site Collection: N/A

Sample Collected By: AH Volume Received: 20L Temp.Upon Arrival: -2 °C Storage: 2-6°C

Sample Received: Mar 26, 2019 02:42 PM pH: 7.1 Dissolved Oxygen: 10.7 mg/L

Analysis Start : Mar 27, 2019 01:20 PM Temperature : 13 °C Sample Conductance: 383 µS/cm

Concentration	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)
% vol/vol	Start	Start	Start	Start	24 hrs	24 hrs	24 hrs	24 hrs	48 hrs	48 hrs	48 hrs	48 hrs
0	15	7.7	347	9.0	0	0	0	0	0	0	0	0
100	14	7.2	388	9.3	0	0	0	0	0	0	0	0

Concentration	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)
% vol/vol	72 hrs	72 hrs	72 hrs	72 hrs	96 hrs	96 hr	96 hrs	96 hrs	96 hrs	96 hrs	96 hrs	96 hrs
0	0	0	0	0	15	7.9	351	9.2	1	10.0	0	0
100	0	0	0	0	15	7.6	413	9.1	0	0	0	0

Comments : None

Culture/Control/Dilution Water City of Edmonton dechlorinated tap water

Hardness: 190 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,100 (% vol/vol)

Organisms per Vessel :	10	Test Temperature :	15 ± 1 °C	Solution Depth :	>15 cm
Total # of Organisms Used :	20	Pre-aeration Time :	120 min.	Rate of Aeration	6.5±1 mL/min/L
Test Volume :	20 L	Vessel Volume :	38L	Test pH Adjusted:	No
Loading Density :	0.3 g/L	Photoperiod :	16:8 (light: dark)		

Test Organism : Rainbow Trout *(Oncorhynchus mykiss)* Source : Spring Valley Trout Hatchery

Culture Temperature :	15 ± 2 °C	Weight (Mean) +- SD :	0.5 ± 0.2 g	Length (Mean) +- SD :	3.96 ± 0.38 cm
Culture Water Renewal :	≥ 1.0 L/min/kg fish	Weight (Range) :	0.4 – 0.8 g	Length (Range) :	3.40 – 4.40 cm
Culture Photoperiod :	16:8 (light: dark)			% Mortality within 7 days :	0.2%
Feeding rate and frequency :	daily: 1-5% biomass of trout.			Acclimation Time:	>14 days

Reference chemical: Phenol Test Date: Mar 07, 2019

Test Endpoint 96 hrs LC50 (95% confidence interval) : 9.50 (8.64, 10.3)mg/L Statistical Method : Probit

Historical Mean LC50 (warning limits) : 10.3 (8.65, 12.3) mg/L Concentration : 0,8,10,12,15,20 mg/L

Test Method EPS 1/RM/13

Method Deviations : None

Note: The results contained in this report refer only to the testing of the sample submitted. This report may not be reproduced, except in its entirety, without the written approval of the laboratory.

Analyst : Cara Shurgot, Dustin Banks, Kyle Monaghan

Verified By : Natasha Lloyd, Analyst 2 Date: Apr 09, 2019 09:57 AM

Toxicity testing on samples VK6758-1645-18 and VK6759-1645-18B

Collected March 26, 2019

Final Report

April 24, 2019

Submitted to: **Maxxam Analytics**
Burnaby, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

TABLE OF CONTENTS

List of Tables

List of Appendices

SIGNATURE PAGE

Report By:
Yvonne Lam, B.Sc.
Laboratory Biologist

Reviewed By:
Armando Tang, R.P.Bio
Senior Reviewer

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

SUMMARY

Sample Information and Test Type

Sample ID	VK6758-1645-18 VK6759-1645-18B
Sample collection date	March 26, 2019
Sample receipt date	March 27, 2019
Sample receipt temperature	2.7°C and 3.4°C
Test type	7-d rainbow trout (*Oncorhynchus mykiss*) embryo viability

Summary of Results

Endpoint	Mean ± SD			
	Control	VK6758-1645-18	Control	VK6759-1645-18B
Embryo viability (%)	86.7 ± 23.1	86.7 ± 20.3	82.8 ± 27.0	81.1 ± 32.7

SD = Standard Deviation

1.0 INTRODUCTION

Nautilus Environmental Company Inc. conducted 7-d rainbow trout (*Oncorhynchus mykiss*) embryo viability toxicity tests for Maxxam Analytics on two samples identified as VK6758-1645-18 and VK6759-1645-18B. The samples were collected on March 26, 2019 and delivered to the Nautilus Environmental laboratory in Burnaby, BC on March 27, 2019. The samples were each transported in four 10-L plastic containers and received at temperatures of 2.7 and 3.4°C. The samples were stored in the dark at 4 ± 2°C prior to testing.

This report describes the results of the toxicity tests. Copies of raw laboratory data sheets and statistical analysis are provided in Appendix A. The chain-of-custody form is provided in Appendix B.

2.0 METHODS

The method for the 7-d rainbow trout embryo viability toxicity test is summarized in Table 1, and followed procedures described by Environment Canada (1998) and modified by Canaria *et al*. (1999). Statistical analyses were performed using CETIS (Tidepool Scientific Software, 2013).

Table 1. Summary of test conditions: 7-d rainbow trout (*Oncorhynchus mykiss*) embryo viability single concentration test.

Test species	*Oncorhynchus mykiss*
Organism source	Hatchery
Organism age	<30 minutes post fertilization, <24 hour old gametes
Test type	Static-renewal
Test duration	7 days
Test vessel	2-L plastic container
Test volume	2 L
Test solution depth	17 cm
Test concentrations	100% (undiluted) sample, plus laboratory control
Test replicates	4 per treatment
Number of organisms	30 per replicate
Control/dilution water	Dechlorinated Metro Vancouver municipal tapwater
Test solution renewal	Daily (80% renewal)
Test temperature	14 ± 1°C
Feeding	None
Light intensity	Dark
Photoperiod	24 hours dark
Aeration	Continuous gentle aeration
Test measurements	Temperature, dissolved oxygen, pH and conductivity measured daily; hardness and alkalinity of undiluted sample measured at test initiation; survival checked daily
Test protocol	Environment Canada (1998), EPS 1/RM/28; Canaria *et al*. (1999)
Statistical software	CETIS Version 1.9.4
Test endpoints	Embryo viability
Test acceptability criteria for controls	Embryo viability ≥70%
Reference toxicant	Sodium dodecyl sulphate (SDS)

3.0 RESULTS

Results of the rainbow trout embryo viability toxicity tests conducted on samples VK6758-1645-18 and VK6759-1645-18B are summarized in Table 2. There were no statistically significant differences relative to the laboratory controls for either sample, with embryo viability in both samples and all test treatments ≥81% (v/v).

Table 2. Results: 7-d rainbow trout (*Oncorhynchus mykiss*) embryo viability single concentration test.

Concentration (% v/v)	Embryo Viability (%) (Mean ± SD)	
	VK6758-1645-18	VK6759-1645-18B
Laboratory Control	86.7 ± 23.1	82.8 ± 27.0
100	86.7 ± 20.3	81.1 ± 32.7

SD = Standard Deviation

The samples were not statistically significantly different relative to their respective Laboratory Control

4.0 QA/QC

The health history of the test organisms used in the exposure was acceptable and met the requirements of the Environment Canada protocol. The test met all control acceptability criteria and water quality parameters remained within ranges specified in the protocol throughout the test. Uncertainty associated with this test is best described by the standard deviations around the means and/or confidence limits around the point estimates.

There were deviations from the test methodology. The eggs were exposed using a blocked design (eggs from each of the four female fish were distributed separately in each of replicates A to D) rather than pooled, as specified in the test method. The modification was used because the egg quality from each female varied considerably, and blocking would minimize the effects of poor quality eggs from one particular female fish. While the method specifies that a minimum of four female egg sources must be used, at test termination one egg source (Replicate A) produced results that were inconsistent with the other three. Thus, this replicate was removed from the final statistical analyses. The deviations did not seem to affect the results of the test and control criterion was met at the end of the exposure.

Results of the reference toxicant test conducted during the testing program are summarized in Table 3. Results for this test fell within the acceptable range for organism performance of mean and two standard deviations, based on historical results obtained by the laboratory with this test. Thus, the sensitivity of the organisms used in this test was appropriate. The reference toxicant was performed under the same conditions as those used for the samples.

Table 3. Reference toxicant test results.

Test Species	Endpoint	Historical Mean (2 SD Range)	CV (%)	Test Date
O. mykiss	Viability (EC50): 2.2 mg/L SDS	4.1 (2.2 – 7.7) mg/L SDS	32	March 27, 2019

SD = Standard Deviation, CV = Coefficient of Variation, EC = Effective Concentration

5.0 REFERENCES

Canaria, E.C., J.R. Elphick and H.C. Bailey. 1999. A simplified procedure for conducting small-scale short-term embryo toxicity tests with salmonids. *Environ. Toxicol.* 14:301-307.

Environment Canada. 1998. Biological test method: toxicity tests using early life stages of salmonid fish (rainbow trout). Environmental Protection Series EPS 1/RM/28. Second Edition, July 1998. Environment Canada, Method Development and Application Section, Environmental Technology Centre, Ottawa, ON. 102 pp.

Tidepool Scientific Software. 2013. CETIS comprehensive environmental toxicity information system, version 1.9.4 Tidepool Scientific Software, McKinleyville, CA. 255 pp.

APPENDIX A – *Oncorhynchus mykiss* Toxicity Test Data

Rainbow Trout Early Life Stage Summary Sheet

Client: Maxxam

Start Date/Time: March 27, 2019 @ 1745h

Work Order No.: 190577

Test Species: *Oncorhynchus mykiss*

Sample Information:

Sample ID: VK6758-1645-18
Sample Date: March 26, 2019
Date Received: March 27, 2019
Sample Volume: 4 x 10L

Dilution Water:

Type: Dechlorinated Tap Water
Hardness (mg/L $CaCO_3$): 12
Alkalinity (mg/L $CaCO_3$): 11

Test Organism Information:

Batch No.: 032719
Source: Trout Lodge, Sumner, WA
Loading Density: 1.14 g/L

Number of male broodstock used: 3
Number of female broodstock used: 3
Sperm motility check: Verification of sperm motility using a compound microscope

SDS Reference Toxicant Results:

Reference Toxicant ID: RTE118
Stock Solution ID: 18303
Date Initiated: March 27, 2019
7-d EC50 (95% CL): 2.2 (2.1-2.4) mg/L SDS

Reference Toxicant Mean and Range: 4.1 (2.2-7.7) mg/L SDS
Reference Toxicant CV (%): 52

Test Results: Embryo viability (v/v) (mean ± 2SD)

	Sample ID		
	Control	VK6758-1645-18	
EC25 % (v/v) (95% CL)	86.7 ± 23.1	86.7 ± 20.3	
EC50 % (v/v) (95% CL)	—	—	

Reviewed by: [signature]

Date reviewed: April 18, 2019

7-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Hydrogen
Sample ID: VK6759 - 1645-18
Work Order #: 190517

Start Date & Time: March 27, 2019 @ 1745h
Stop Date & Time: April 3, 2019 @ 1515h
CER #: 3
Test Species: *Oncorhynchus mykiss*

Control Concentration (% v/v)	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	13.5	14.0	13.5	14.0	13.5	13.0	13.5	14.0	13.5	14.0	13.5	14.0	13.5	13.5
DO (mg/L)	10.2	10.3	10.2	10.0	9.8	10.5	10.2	10.2	10.3	10.0	10.0	10.2	10.3	10.1
pH	6.9	7.1	7.1	6.8	6.5	7.1	7.2	6.9	7.1	6.6	6.4	6.8	6.9	7.0
Cond. (µS/cm)	32	32		32		34		34		34		34		34
Initials	YML	YML		CS/YML		SD		YML		YML		YML		YML

100 Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.0	14.0	13.5	13.5	13.5	13.5	13.5	14.0	13.5	14.0	13.5	14.0	13.5	13.5
DO (mg/L)	10.2	10.2	10.2	10.0	9.9	10.2	10.2	10.1	10.3	10.2	10.0	9.9	10.2	10.2
pH	7.1	7.3	7.5	7.2	7.3	7.4	7.6	7.3	7.5	7.3	7.4	7.3	7.5	7.6
Cond. (µS/cm)	500	501		502		502		505		504		502		509
Initials	YML	YML		CS/YML		SD		YML		YML		YML		YML

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: EE#3 DO meter/probe: 213 / 213 pH meter/probe: 213 / 213 Conductivity meter/probe: 213 / 213

	Control	100%		
Hardness*	12	114		
Alkalinity*	11	38		

* mg/L as CaCO3

Analysts: SD, CS, YML
Reviewed by:
Date reviewed: April 18, 2019

Sample Description: clear, no colour, no odour, no particulates

Comments:

Embryo Toxicity Test
Daily Mortality

Client: MSXXGN
Sample ID: VK6758-1645-18
Work Order #: 190577

Start Date & Time: March 27, 2019 @ 1745h
Stop Date & Time: April 3, 2019 @ 1515h
Test Species: *Oncorhynchus mykiss*

Concentration (% v/v)	Rep	Day of Test - No. of Mortalities							Total Dead Eggs	Total Undeveloped	Total No. Embryo	Total Exposed
		1	2	3	4	5	6	7				
Control	1	0	0	0	0	0	0	0	0	29	0	29
	2	↓	↓	↓	↓	↓	↓	↓	0	0	30	30
	3	↓	↓	↓	↓	↓	↓	↓	0	0	30	30
	4	↓	↓	↓	↓	↓	↓	↓	0	12	18	30
100	1	↓	↓	↓	↓	↓	↓	2	2	28	0	30
	2	↓	↓	↓	↓	↓	↓	0	0	1	29	30
	3	↓	↓	↓	↓	↓	↓	0	0	0	30	30
	4	↓	↓	↓	↓	↓	↓	0	0	11	19	30
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
Tech Initials				JP								

Comments:

Reviewed by:

Date reviewed: April 15, 2019

CETIS Summary Report

Report Date: 09 Apr-19 13:44 (p 1 of 1)
Test Code/ID: 190577a / 11-2177-9031

Salmonid Embryo Survival and Development Test — **Nautilus Environmental**

Batch ID:	12-5813-6512	Test Type:	Development	Analyst:	Yvonne Lam		
Start Date:	27 Mar-19 17:45	Protocol:	EC/EPS 1/RM/28	Diluent:	Dechlorinated Tap Water		
Ending Date:	03 Apr-19 15:15	Species:	Oncorhynchus mykiss	Brine:			
Test Length:	6d 21h	Taxon:	Actinopterygii	Source:	Trout Lodge Fish Farm	Age:	
Sample ID:	19-9428-3318	Code:	76DE5936	Project:			
Sample Date:	26 Mar-19 04:19	Material:	Effluent	Source:	Maxxam		
Receipt Date:	27 Mar-19 13:30	CAS (PC):		Station:	VK6758-1645-18		
Sample Age:	37h (2.7 °C)	Client:	Maxxam				

Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
15-6649-1090	Proportion Normal	Equal Variance t Two-Sample Test	0.4725	100% passed proportion normal	1

Proportion Normal Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	3	0.8667	0.2930	1.0000	0.6000	1.0000	0.1333	0.2309	26.65%	0.00%
100		3	0.8667	0.3630	1.0000	0.6333	1.0000	0.1171	0.2028	23.40%	0.00%

Proportion Normal Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	N	1.0000	1.0000	0.6000
100		0.9667	1.0000	0.6333

Proportion Normal Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	N	30/30	30/30	18/30
100		29/30	30/30	19/30

Only 3 replicates used in statistical analysis (Rep A excluded due to possible poor egg quality)

CETIS Analytical Report

Salmonid Embryo Survival and Development Test — **Nautilus Environmental**

Analysis ID:	15-6649-1090	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.9.4
Analyzed:	09 Apr-19 13:44	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Batch ID:	12-5813-6512	**Test Type:**	Development	**Analyst:**	Yvonne Lam
Start Date:	27 Mar-19 17:45	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	03 Apr-19 15:15	**Species:**	Oncorhynchus mykiss	**Brine:**	
Test Length:	6d 21h	**Taxon:**	Actinopterygii	**Source:**	Trout Lodge Fish Farm **Age:**
Sample ID:	19-9428-3318	**Code:**	76DE5936	**Project:**	
Sample Date:	26 Mar-19 04:19	**Material:**	Effluent	**Source:**	Maxxam
Receipt Date:	27 Mar-19 13:30	**CAS (PC):**		**Station:**	VK6758-1645-18
Sample Age:	37h (2.7 °C)	**Client:**	Maxxam		

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	100% passed proportion normal	49.67%

Equal Variance t Two-Sample Test

Control	vs	Conc-%	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		100	0.07345	2.132	0.560	4	CDF	0.4725	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0005588	0.0005588	1	0.005395	0.9450	Non-Significant Effect
Error	0.414316	0.103579	4			
Total	0.414875		5			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	1.306	199	0.8672	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.735	0.43	0.0141	Normal Distribution

Proportion Normal Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	3	0.8667	0.2930	1.0000	1.0000	0.6000	1.0000	0.1333	26.65%	0.00%
100		3	0.8667	0.3630	1.0000	0.9667	0.8333	1.0000	0.1171	23.40%	0.00%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	3	1.282	0.4307	2.133	1.479	0.8861	1.479	0.1978	26.73%	0.00%
100		3	1.262	0.5178	2.007	1.387	0.9204	1.479	0.173	23.74%	1.51%

Proportion Normal Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	N	1.0000	1.0000	0.6000
100		0.9667	1.0000	0.8333

Angular (Corrected) Transformed Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	N	1.479	1.479	0.8861
100		1.387	1.479	0.9204

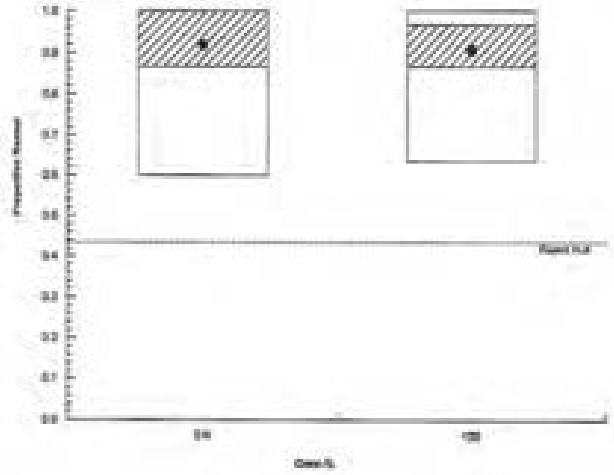
Proportion Normal Binomials

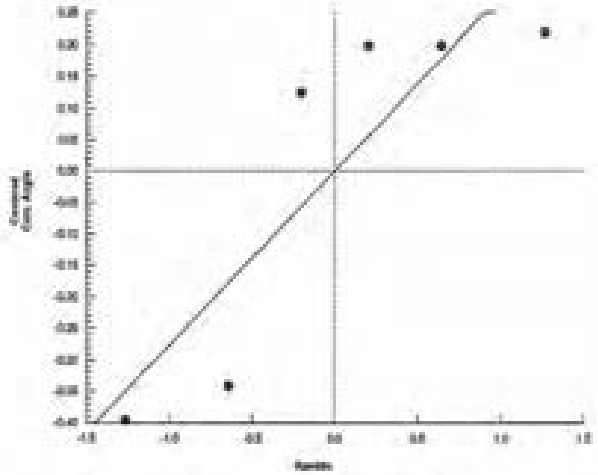
Conc-%	Code	Rep 1	Rep 2	Rep 3
0	N	30/30	30/30	18/30
100		29/30	30/30	19/30

Salmonid Embryo Survival and Development Test — Nautilus Environmental

Analysis ID:	15-6649-1090	Endpoint:	Proportion Normal	CETIS Version:	CETISv1.9.4
Analyzed:	09 Apr-19 13:44	Analysis:	Parametric-Two Sample	Status Level:	1

Graphics





Rainbow Trout Early Life Stage Summary Sheet

Client: MAXCAM

Start Date/Time: March 27, 2019 @ 1745h

Work Order No.: 190577

Test Species: *Oncorhynchus mykiss*

Sample Information:

Sample ID: VK6759-1645-188
Sample Date: March 26, 2019
Date Received: March 27, 2019
Sample Volume: 4 x 10L

Dilution Water:

Type: Dechlorinated Tap Water
Hardness (mg/L $CaCO_3$): 12
Alkalinity (mg/L $CaCO_3$): 11

Test Organism Information:

Batch No.: 032719
Source: Trout Lodge, Sumner, WA
Loading Density: 1.14 g/L

Number of male broodstock used: 3
Number of female broodstock used: 3
Sperm motility check: Verification of sperm motility using a compound microscope

SDS Reference Toxicant Results:

Reference Toxicant ID: RTE118
Stock Solution ID: 18303
Date Initiated: March 27, 2019
7-d EC50 (95% CL): 2.2 (2.1 - 2.4) mg/L SDS

Reference Toxicant Mean and Range: 4.1 (2.2 - 7.7) mg/L SDS
Reference Toxicant CV (%): 32

Test Results: Embryo viability (%) (mean ± 2SD)

	Sample ID		
	Control	VK6759-1645-188	
EC25 % (v/v) (95% CL)	82.8 ± 27.0	81.1 ± 32.7	
EC50 % (v/v) (95% CL)	—	—	—

Reviewed by: [signature]

Date reviewed: April 18, 2019

7-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Mosaic
Sample ID: VK675899-1645-188
Work Order #: 190577

Start Date & Time: March 27, 2019 @ 1745h
Stop Date & Time: April 3, 2019 @ 1515h
CER #: 3
Test Species: *Oncorhynchus mykiss*

Control Concentration (% v/v)	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	13.5	14.0	13.5	14.0	13.5	13.0	13.5	14.0	13.5	14.0	13.5	14.0	13.5	13.5
DO (mg/L)	10.2	10.1	10.2	10.0	9.8	12.5	12.3	10.2	12.3	10.0	9.9	10.2	10.3	10.2
pH	6.9	7.1	7.1	6.0	6.5	7.1	7.2	6.9	7.1	6.6	6.5	6.8	6.9	7.0
Cond. (µS/cm)	32	32		32		34		34		34		34		35
Initials	MM	MM		CS/MM		JD		MM		MM		MM		MM

100 Concentration	Days													
	0	1		2		3		4		5		6		7
	Init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.0	14.0	13.5	13.5	13.5	13.5	13.5	14.0	13.5	14.0	13.5	14.0	13.5	13.5
DO (mg/L)	10.3	10.1	10.2	9.9	10.0	12.3	12.3	10.2	10.2	10.1	10.0	10.0	10.2	10.2
pH	7.1	7.2	7.5	7.2	7.3	7.4	7.6	7.5	7.5	7.3	7.3	7.3	7.5	7.6
Cond. (µS/cm)	502	505		506		509		506		508		506		513
Initials	MM	MM		CS/MM		JD		MM		MM		MM		MM

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER#3 DO meter/probe: #3 / #3 pH meter/probe: #3 / #3 Conductivity meter/probe: #3 / #3

	Control	100%		
Hardness*	12	136		
Alkalinity*	11	40		

* mg/L as CaCO3

Analysts: JD, CS, MM

Reviewed by:

Date reviewed: April 18, 2019

Sample Description: clear, no color, no odour, no particulates

Comments:

Embryo Toxicity Test
Daily Mortality

Client: Maxxam
Sample ID: VK6759 - 1645-1BB
Work Order #: 190577

Start Date & Time: March 27, 2018 @ 1745h
Stop Date & Time: April 3, 2019 @ 1515h
Test Species: *Oncorhynchus mykiss*

Concentration (% v/v)	Rep	Day of Test - No. of Mortalities							Total Dead Eggs	Total Undeveloped	Total No. Embryo	Total Exposed
		1	2	3	4	5	6	7				
control	1	0	0	0	0	0	0	↓	1	29	0	30
	2	↓	↓	↓	↓	↓	↓	0	1	0	30	31
	3	↓	↓	↓	↓	↓	0	↓	0	0	30	30
	4	↓	↓	↓	↓	↓	↓	↓	0	15	16	31
100	1	↓	↓	↓	↓	↓	↓	↓	0	30	0	30
	2	↓	↓	↓	↓	↓	↓	↓	0	0	30	30
	3	↓	↓	↓	↓	↓	↓	↓	0	0	30	30
	4	↓	↓	↓	↓	↓	↓	1	1	16	13	30
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
Tech Initials		ww	SD ww	SD	ww	ww	ww	ww	tim	ww	ww	ww

Comments:

Reviewed by:

Date reviewed: April 18, 2019

CETIS Summary Report

Salmonid Embryo Survival and Development Test — **Nautilus Environmental**

Batch ID:	06-6452-2148	**Test Type:**	Development	**Analyst:**	Yvonne Lam		
Start Date:	27 Mar-19 17:45	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water		
Ending Date:	03 Apr-19 15:15	**Species:**	Oncorhynchus mykiss	**Brine:**			
Test Length:	6d 21h	**Taxon:**	Actinopterygii	**Source:**	Trout Lodge Fish Farm	**Age:**	

Sample ID:	02-2850-9630	**Code:**	D9EC7BE	**Project:**	
Sample Date:	26 Mar-19 04:15	**Material:**	Effluent	**Source:**	Maxxam
Receipt Date:	27 Mar-19 13:30	**CAS (PC):**		**Station:**	VK6759-1654-18B
Sample Age:	38h (3.4 °C)	**Client:**	Maxxam		

Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
16-9121-8660	Proportion Normal	Fisher Exact Test	0.4721	100% passed proportion normal	1

Proportion Normal Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	3	0.8280	0.1559	1.0000	0.5161	1.0000	0.1562	0.2705	32.67%	0.00%
100		3	0.8111	0.0000	1.0000	0.4333	1.0000	0.1889	0.3272	40.34%	2.03%

Proportion Normal Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	N	0.9677	1.0000	0.5161
100		1.0000	1.0000	0.4333

Proportion Normal Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	N	30/31	30/30	16/31
100		30/30	30/30	13/30

Only 3 replicates used in statistical analyses
(Rep A excluded due to possible poor egg quality)

April 18/19

CETIS Analytical Report

Test Code/ID: 190577b / 03-5139-8410

Salmonid Embryo Survival and Development Test — **Nautilus Environmental**

Analysis ID:	16-9121-8660	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.9.4
Analyzed:	09 Apr-19 13:46	**Analysis:**	Single 2x2 Contingency Table	**Status Level:**	1
Batch ID:	06-6452-2148	**Test Type:**	Development	**Analyst:**	Yvonne Lam
Start Date:	27 Mar-19 17:45	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	03 Apr-19 15:15	**Species:**	Oncorhynchus mykiss	**Brine:**	
Test Length:	6d 21h	**Taxon:**	Actinopterygii	**Source:**	Trout Lodge Fish Farm **Age:**
Sample ID:	02-2850-9630	**Code:**	D9EC7BE	**Project:**	
Sample Date:	26 Mar-19 04:15	**Material:**	Effluent	**Source:**	Maxxam
Receipt Date:	27 Mar-19 13:30	**CAS (PC):**		**Station:**	VK6759-1654-16B
Sample Age:	38h (3.4 °C)	**Client:**	Maxxam		

Data Transform	Alt Hyp	Comparison Result
Untransformed	C > T	100% passed proportion normal

Fisher Exact Test

Control	vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Negative Control		100	0.4721	Exact	0.4721	Non-Significant Effect

Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	N	76	16	92	0.8261	0.1739	-1.85%
100		73	17	90	0.8111	0.1889	0.0%

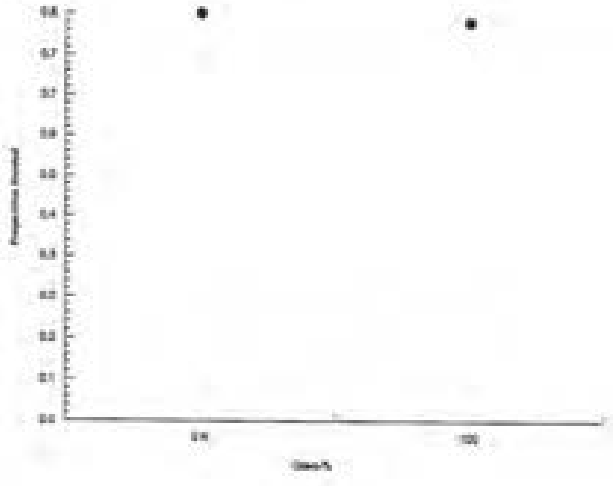
Proportion Normal Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	N	0.9677	1.0000	0.5161
100		1.0000	1.0000	0.4333

Proportion Normal Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	N	30/31	30/30	16/31
100		30/30	30/30	13/30

Graphics



April 18/19

APPENDIX B – Chain-of-Custody Form

Maxxam
A Bureau Veritas Group Company

Sent To: Nautilus Environmental - Burnaby
8664 Commerce Court
Burnaby, BC, V5A 4N7
Tel: (604) 420-8773

CHAIN OF CUSTODY RECORD FOR SUBCONTRACTED WORK

COC # B921715-VNAU-01-01

REPORT INFORMATION	
Company:	Maxxam
Address:	9331 - 48th Street, Edmonton, Alberta, T6B 2R4
Contact Name:	Geraldlyn Gouthro
Email:	GGouthro@maxxam.ca, edmenvirocs@maxxamanalytics.com
Phone:	(403) 735-2230
Maxxam Project #:	B921715

#	SAMPLE ID	MATRIX	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	SAMPLER INITIALS	# CONT.	ANALYSIS REQUESTED: Rainbow Trout 7 Day Embryo Subcontract B/F										ADDITIONAL SAMPLE INFORMATION
1	VR6758-1645-18	W	2019/03/26	04:19	AH	4	X								27°C		(P: 04)
2	VR6759-1645-18B	W	2019/03/26	04:15	AH	4	X								34°C		(P: 04)
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

REGULATORY CRITERIA	SPECIAL INSTRUCTIONS
Diavik 1645-18 Ave & Grab	Please inform Maxxam immediately if you are not accredited for the requested test(s). **Please return a copy of this form with the report.**

TURNAROUND TIME

☐ Rush Required

2019/05/01

Date Required

Please inform us if rush charges will be incurred.

COOLER ID:	YES	NO	Temp: (°C)	1	2	3
Custody Seal Present						
Custody Seal Intact						
Cooling Media Present						

SEE BOTTOM

COOLER ID:	YES	NO	Temp: (°C)	1	2	3
Custody Seal Present						
Custody Seal Intact						
Cooling Media Present						

COOLER ID:	YES	NO	Temp: (°C)	1	2	3
Custody Seal Present						
Custody Seal Intact						
Cooling Media Present						

RELINQUISHED BY: (SIGN & PRINT)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (SIGN & PRINT)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
1. David Tidman	2019/03/26	16:49	1. BRITTANY BURLONE	2019/03/27	09:55
2. PEDRO TACK	2019/03/27	11:20	2.		

Rec'd Mar 27/19 @ 13:30h
4 x 1L per sample

END OF REPORT

Ceriodaphnia dubia Bioassay Report

Test Substance

Client Name and Sample ID: DDMI - 1645-18B
Job and Sample ID: B921715- VK6759 Test Performed By: DBA, NM9, CSH
Date sample collected: 2019/03/26
Test Initiation Date: 2019/03/27
Test End Date: 2019/04/03
Dates when subsamples used: 2019/03/27 2019/03/31
2019/03/28 2019/04/01
2019/03/29 2019/04/02
2019/03/30
Dissolved Oxygen prior to test (mg/L): 9.4 Temperature (°C): 25
pH prior to test (pH units): 6.7 Conductivity (µS/cm): 513

Test Results			Significant or non-significant			Method	Data Transforms	Outliers* (concentration-replicate)
Sample Test Results (% vol/vol)	7 day Survival Result	Effect	Non-Significant			Fisher Exact Test	Untransformed	N/A
	7 day Reproduction Result	Effect	Non-Significant			Wilcoxon Rank Sum Two-Sample Test	Untransformed	0 - 7
Reference Toxicant Results			Endpoint	95% LCL	95% UCL	Method	Data Transforms	Outliers* (concentration-replicate)
Reference Toxicant Test Results (g/L)	7 day Survival Result	LC50	1.38	1.27	1.50	Spearman-Karber	Log- X	0.5- 10
	7 day Reproduction Result	IC50	1.29	1.13	1.36	Linear Interpolation	Log- X	N/A
Control Chart Data (g/L)	7 day Survival Result	LC50	1.55	1.02	2.36	Shewart	n/a	n/a
	7 day Reproduction Result	IC50	1.20	0.867	1.67			

* If outliers were removed, describe in comments.

Comments

Test Organisms

Species: *Ceriodaphnia dubia*
Source of test organisms: Aquatic Biosystems, Colorado
Age of organisms at test initiation: ≤ 24 hours, within 12 hours
Unusual Appearance, behaviour or treatment prior to use in test : None
Mean % mortality of brood organisms during 7-day period proceding test: 6.9
Number of neonates produced by each organism in its third or fourth brood: ≥8 neonates
Mean number of neonates per adult during first 3 broods in 7 days: 24
Observations of ephippia: None

All test organisms used to initiate this test were taken from a series of individual cultures, that originated from the same mass culture.
The 4th brood or subsequent broods produced during the test are not included in the final statistical analysis.

Test Facilities and Apparatus

Name address of test laboratory: Maxxam Analytics. 9331 48st NW, Edmonton, AB
Test vessels used: Fisherbrand 20 x 150 mm lime glass test tubes

Control/Dilution Water

Consists of: 16 L RODI from in-house system, to which the following are added:
4 L Perrier Brand carbonated spring water
1 mL cyanocobalamin (Vitamin B-12)
1 mL Sodium Selenate Decahydrate

Test Method

Reference method used for testing: Biological Test Method: Test of Reproduction and Survival Using the Cladoceran *Ceriodaphnia dubia* . Environment Canada, EPS 1/RM/21 Second Edition - February 2007

Did the following occur during sample preparations:

Filtered:	No
Adjusted for hardness:	No
Adjusted for pH:	No
Frequency of observations:	24 ± 1 hour
Frequency of water quality measurements:	Daily
Design and description of any specialized procedure:	N/A
Program used for statistical calculations:	Comprehensive Environmental Toxicity Information System (CETIS). Tidepool Scientific Software. Version 1.9.3.0
Reference method used for statistical calculations:	Guidance Document on Statistical Methods for Environmental Toxicity Tests. Environment Canada, EPS 1/RM/46 - March

Test Conditions and Procedures

Number of test solutions:	20
Number of test concentrations:	1 and a negative control
Concentrations tested (%):	100
Units of tested concentrations:	% vol/vol
Number of replicates:	10
Volume of test solutions:	≥ 15 mL
Depth of test solutions:	≥ 5 cm
Individuals per test vessel:	1
Was pre-aeration performed:	Yes
Procedure:	Oil-free
Rate:	≤ 100 bubbles / minute
Duration:	20 minutes
Dates where pre-aeration occurred:	2019/03/27 2019/03/31 2019/03/28 2019/04/01 2019/03/29 2019/04/02 2019/03/30
Aeration during testing:	None

Refer to comments section for any deviations.
The reference toxicity test was performed under the same experimental conditions as those used with the test sample.
Refer to comments section for any deviations regarding reference toxicity testing.

Ceriodaphnia dubia Survival and Reproduction Observations

Note: Mortalities are indicated by an "X" in the column and row of the concentration, replicate and day of occurance. If organism was not used for testing, this will be indicated by "N/A" in mortality and neonate columns for the replicate.

Concentration (%/%vol)	Replicate number	Day of Testing																Cumulative Mean % Mortality	Cumulative Mean Reproduction	SD of mean reproduction
		1		2		3		4		5		6		7		8				
		neonates	Mortality	neonates	Mortality	neonates	Mortality	neonates	Mortality	neonates	Mortality	neonates	Mortality	neonates	Mortality	neonates	Mortality			
Control	1	0		0		0		5		8		0		15				10.0%	27	6.0
	2	0		0		0		5		10		13								
	3	0		0		0		0		10		18								
	4	0		0		0		4		11		0		16						
	5	0		0		0		5		10		0		15						
	6	0		0		0		7		10		16								
	7	0		0		0		4		11		0	X							
	8	0		0		0		7		10		0		16						
	9	0		0		0		5		9		12								
	10	0		0		3		0		8		7								
100%	1	0		0		0		6		9		0		11				0.0%	27.2	2.0
	2	0		0		0		4		9		0		11						
	3	0		0		0		5		13		8								
	4	0		0		0		6		8		0		13						
	5	0		0		0		6		11		0		13						
	6	0		0		0		7		10		0		14						
	7	0		0		0		5		10		0		13						
	8	0		0		0		6		7		0		14						
	9	0		0		0		0		14		12								
	10	0		0		0		6		10		11								

Average Values for Chemical Data of Test Concentrations

Test Concentration (% vol/vol)	Before Effluent Renewal					After Effluent Renewal				
	Date	Temperature (°C)	pH	Conductivity (µS/cm)	DO (mg/L)	Date	Temperature (°C)	pH	Conductivity (µS/cm)	DO (mg/L)
Control	2019/03/27	26	7.8	180	7.5	2019/03/28	25	7.7	189	6.7
100		26	7.0	518	8.8		25	7.4	515	6.9
Control	2019/03/28	25	7.9	175	7.5	2019/03/29	24	7.5	173	6.4
100		25	7.0	509	9.1		24	7.3	480	6.6
Control	2019/03/29	25	7.9	173	7.3	2019/03/30	25	7.7	178	6.4
100		25	7.0	501	8.9		24	7.3	493	6.6
Control	2019/03/30	25	7.9	176	7.1	2019/03/31	26	7.8	180	7.3
100		25	7.0	507	8.6		26	7.5	502	7.4
Control	2019/03/31	24	8.1	172	7.7	2019/04/01	26	7.8	178	6.7
100		25	7.1	503	9.2		26	7.5	507	6.7
Control	2019/04/01	25	8.0	127	7.4	2019/04/02	25	7.4	136	6.8
100		25	7.1	502	8.7		24	7.3	453	7.4
Control	2019/04/02	26	7.7	130	7.6	2019/04/03	25	7.4	133	6.6
100		26	7.0	517	8.7		25	7.2	501	6.5
Control	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A

Maxxam
A Bureau Veritas Group Company

RESULTS OF *DAPHNIA MAGNA* SINGLE CONCENTRATION-100%

Success Through Science®

Client : 4388 DIAVIK DIAMOND MINES INC., YELLOWKNIFE Job Number: B921715

Client Project Name & Number: Quarterly Tox SNP-A Sample Number: VK6759-01

Test Result:

48 hrs Mortality % 0 Statistical Method:

Mean percent mortality: Sample 0 Control 0

Sample Name : 1645-18B Sample Matrix : Grab Water

Description: Clear and colourless. Sample Prior to Analysis:

Sample Collected: Mar 26, 2019 04:15 AM Sampling Method : N/A pH: 6.9

Sample Collected By: AH Site Collection: N/A Temperature : 19 °C

Sample Received: Mar 26, 2019 02:42 PM Volume Received: 1 L Dissolved Oxygen: 10.9 mg/L

Analysis Start : Mar 27, 2019 03:19 PM Temp.Upon Arrival: -2 °C Sample Conductance: 442 µS/cm

End : Mar 29, 2019 03:29 PM Storage: 2-6°C Hardness: 120 mg $CaCO_3$/L

Concentration	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Immobility (#)	Immobility (%)	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)
% vol/vol	Start	Start	Start	Start	24 hrs	24 hrs	24 hrs	24 hrs	48 hrs	48 hr	48 hrs	48 hrs
0	20	8.0	389	8.5	0	0	0	0	20	8.0	395	8.4
0	20	7.9	391	8.4	0	0	0	0	20	8.0	398	8.3
0	20	8.1	391	8.4	0	0	0	0	20	8.0	392	8.4
100	20	7.0	456	10.7	0	0	0	0	20	7.6	463	8.5
100	20	7.0	456	10.8	0	0	0	0	20	7.6	460	8.5
100	20	6.9	455	10.7	0	0	0	0	20	7.5	466	8.4

Concentration	Mortality (#)	Mortality (%)	Immobility (#)	Immobility (%)
% vol/vol	48 hrs	48 hrs	48 hrs	48 hrs
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
100	0	0	0	0
100	0	0	0	0
100	0	0	0	0

Comments : None

Culture/Control/Dilution Water: City of Edmonton dechlorinated tap water

Hardness: 180 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,0,0,100,100,100 (% vol/vol)

Organisms per Vessel :	10	Pre-aeration Time :	30 min	Rate of Pre-aeration :	25-50 mL/min/L
Total # of Organisms Used :	60	Test Temperature :	20 ± 2 °C	Test Hardness Adjusted :	No
Test Volume :	150 mL	Vessel Volume :	225 mL	Test pH Adjusted:	No
Loading Density :	15.0 mL/Daphnia	Photoperiod :	16:8 (light: dark)		

Test Organism : *Daphnia magna* Source : In House Culture

Age at Test Initiation :	<24 hrs	Average Brood Size :	19.9
Culture Photoperiod :	16:8 (light: dark)	% Mortality within 7 days :	3.2
Culture Temperature :	20 ± 2 °C	Time To First Brood :	8 Days

Culture Diet: Pseudokirchnriella and YTC at a ratio of 2 mL/L of culture daily. New cultures weekly, 63 daphnids distributed into 6 culture vessels and 3 reproductive vessels.

RESULTS OF *DAPHNIA MAGNA* SINGLE CONCENTRATION-100%

Success Through Science®

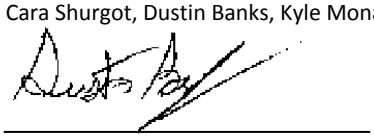
Client :	4388	DIAVIK DIAMOND MINES INC., YELLOWKNIFE	Job Number:	B921715
Client Project Name & Number:		Quarterly Tox SNP-A	Sample Number:	VK6759-01

Reference chemical:	Sodium Chloride	Test Date:	Mar 27, 2019
Test Endpoint 48 hrs LC50 (95% confidence interval) :	6.17 (5.50, 6.93)g/L	Statistical Method :	Untrimmed Spearman-Kärber
Historical Mean LC50 (warning limits) :	6.10 (4.57, 8.14) g/L	Concentration :	0,1.71,2.56,3.82,5.7,8.5 g/L

Test Method	EPS 1/RM/14
Method Deviations:	None

Note: The results contained in this report refer only to the testing of the sample submitted. This report may not be reproduced, except in its entirety, without the written approval of the laboratory.

Analyst : Cara Shurgot, Dustin Banks, Kyle Monaghan



Verified By : Dustin Banks, Analyst 2 Date: Apr 02, 2019 04:11 PM

Maxxam
A Bureau Veritas Group Company

RESULTS OF RAINBOW TROUT SINGLE CONCENTRATION-100%

Success Through Science®

Client : 4388 DIAVIK DIAMOND MINES INC., YELLOWKNIFE Job Number: B921715

Client Project Name & Number: Quarterly Tox SNP-A

Test Result:

96 hrs Mortality % 0 Statistical Method: Visual

Sample Name : 1645-18B Sample Matrix : Grab Water

Description: Clear and colourless Sample Number: VK6759-03

Sample Collected: Mar 26, 2019 04:15 AM Sampling Method : N/A Site Collection: N/A

Sample Collected By: AH Volume Received: 20 L Temp.Upon Arrival: -2 °C Storage: 2-6°C

Sample Received: Mar 26, 2019 02:42 PM pH: 6.8 Dissolved Oxygen: 11.6 mg/L

Analysis Start : Mar 27, 2019 01:20 PM Temperature : 13 °C Sample Conductance: 387 µS/cm

Concentration	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)
% vol/vol	Start	Start	Start	Start	24 hrs	24 hrs	24 hrs	24 hrs	48 hrs	48 hrs	48 hrs	48 hrs
0	15	7.8	347	9.0	0	0	0	0	0	0	0	0
100	14	6.9	374	10.6	0	0	0	0	0	0	0	0

Concentration	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)
% vol/vol	72 hrs	72 hrs	72 hrs	72 hrs	96 hrs	96 hr	96 hrs	96 hrs	96 hrs	96 hrs	96 hrs	96 hrs
0	0	0	0	0	15	8.0	352	9.0	0	0	0	0
100	0	0	0	0	15	7.5	416	8.8	0	0	0	0

Comments : None

Culture/Control/Dilution Water City of Edmonton dechlorinated tap water

Hardness: 190 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,100 (% vol/vol)

Organisms per Vessel :	10	Test Temperature :	15 ± 1 °C	Solution Depth :	>15 cm
Total # of Organisms Used :	20	Pre-aeration Time :	120 min.	Rate of Aeration	6.5±1 mL/min/L
Test Volume :	20 L	Vessel Volume :	38L	Test pH Adjusted:	No
Loading Density :	0.2 g/L	Photoperiod :	16:8 (light: dark)		

Test Organism : Rainbow Trout *(Oncorhynchus mykiss)* Source : Spring Valley Trout Hatchery

Culture Temperature :	15 ± 2 °C	Weight (Mean) +- SD :	0.4 ± 0.1 g	Length (Mean) +- SD :	3.73 ± 0.13 cm
Culture Water Renewal :	≥ 1.0 L/min/kg fish	Weight (Range) :	0.4 – 0.5 g	Length (Range) :	3.40 – 3.90 cm
Culture Photoperiod :	16:8 (light: dark)			% Mortality within 7 days :	0.2%
Feeding rate and frequency :	daily: 1-5% biomass of trout.			Acclimation Time:	>14 days

Reference chemical: Phenol Test Date: Mar 07, 2019

Test Endpoint 96 hrs LC50 (95% confidence interval) : 9.50 (8.64, 10.3)mg/L Statistical Method : Probit

Historical Mean LC50 (warning limits) : 10.3 (8.65, 12.3) mg/L Concentration : 0,8,10,12,15,20 mg/L

Test Method EPS 1/RM/13

Method Deviations : None

Note: The results contained in this report refer only to the testing of the sample submitted. This report may not be reproduced, except in its entirety, without the written approval of the laboratory.

Analyst : Cara Shurgot, Dustin Banks, Kyle Monaghan

Verified By : Natasha Lloyd, Analyst 2 Date: Apr 09, 2019 10:00 AM

Toxicity Testing on VM7449-1645-18 and VM7450-1645-18B

(collected April 8, 2019)

Final Report

May 8, 2019

Submitted to: **Maxxam Analytics**
Burnaby, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

TABLE OF CONTENTS

List of Tables

List of Appendices

SIGNATURE PAGE

Report By:
Jeslin Wijaya, B.Sc.
Laboratory Biologist

Reviewed By:
Edmund Canaria, R.P.Bio
Senior Reviewer

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

SUMMARY

Sample Information and Test Type

Sample ID	VM7449-1645-18 and VM7450-1645-18B
Sample collection date	April 8, 2019
Sample receipt date	April 11, 2019
Sample receipt temperature	4.8 – 4.9°C
Test types	72-h *Pseudokirchneriella subcapitata* growth inhibition

Summary of Results

% (v/v)	Cell Yield (Mean ± SD)	
	VM7449-1645-18	VM7450-1645-18B
Laboratory Control	38.6 ± 3.1	38.2 ± 2.7
95.2	90.0 ± 5.1*	86.8 ± 5.4*

SD = Standard Deviation

* = indicates cell yield that was significantly greater than the laboratory control

1.0 INTRODUCTION

Nautilus Environmental Company Inc. conducted a 72-h *Pseudokirchneriella subcapitata* growth inhibition toxicity test for Maxxam Analytics on samples identified as VM7449-1645-18 and VM7450-1645-18B. The samples were collected on April 8, 2019 and delivered to the Nautilus Environmental laboratory in Burnaby, BC on April 11, 2019. Samples were transported in two 1-L plastic containers each and were received at temperatures of 4.9 and 4.8°C. The sample was stored in the dark at 4 ± 2°C prior to testing.

This report describes the results of the toxicity tests. Copies of raw laboratory data sheets and statistical analyses are provided in Appendix A. The chain-of-custody form is provided in Appendix B.

2.0 METHODS

Methods for the toxicity tests are summarized in Table 1. Testing was conducted according to procedures described by Environment Canada (2007). Statistical analyses were performed using CETIS (Tidepool Scientific Software, 2013).

Table 1. Summary of test conditions: 72-h *Pseudokirchneriella subcapitata* growth inhibition test.

Test species	*Pseudokirchneriella subcapitata*, strain CPCC #37
Organism source	In-house axenic culture, obtained from Canadian Phycological Culture Center, and originally isolated from Nivelta River, Norway.
Organism age	3-to 7-day old culture in logarithmic growth phase
Test type	Static
Test duration	72 hours
Test vessel	Microplate
Test volume	220 µL
Test concentrations	Full strength sample diluted to 95.2% (v/v) with nutrients, plus laboratory control
Test replicates	4 per treatment; 8 for laboratory control
Number of organisms	10,000 cells/mL
Control/dilution water	Deionized water supplemented with nutrients
Test solution renewal	None
Test temperature	24 ± 2°C
Feeding	None
Light intensity	3600 to 4400 lux
Photoperiod	24 hours light
Aeration	None
Test measurements	Test area temperature measured daily; temperature and pH measured at test initiation; pH of two control wells measured at test termination
Test protocol	Environment Canada (2007), EPS 1/RM/25
Statistical software	CETIS Version 1.9.4
Test endpoint	Algal cell growth inhibition
Test acceptability criteria for controls	>16-fold increase in number of algal cells; CV ≤ 20%; no trend when analyzed using Mann-Kendall test
Reference toxicant	Zinc (added as $ZnSO_4$)

3.0 RESULTS

The results of the toxicity test on samples VM7449-1645-18 and VM7450-1645-18B are summarized in Table 2. Significant stimulatory effects on cell yield were observed in both samples. Percent stimulation was 133% for sample VM7449-1645-18 and 126.8% for sample VM7450-1645-18B.

Table 2. Results: 72-h *Pseudokirchneriella subcapitata* growth inhibition test.

Concentration (% v/v)	Mean ± SD			
	VM7449-1645-18		VM7450-1645-18B	
	Cell Yield (x 10^4 cells/mL)	Stimulation (%)	Cell Yield (x 10^4 cells/mL)	Stimulation (%)
Laboratory Control	38.6 ± 3.1	--	38.2 ± 2.7	--
95.2	90.0 ± 5.1*	133.0	86.8 ± 5.4*	126.8

SD = Standard Deviation
* = indicates cell yield that was significantly greater than the laboratory control

4.0 QA/QC

The health history of the test organisms used in the exposure was acceptable and met the requirements of the Environment Canada protocol. The test met all control acceptability criteria and water quality parameters remained within ranges specified in the protocol throughout the tests. There were no deviations from the test methodology. Uncertainty associated with the test is best described by the standard deviation around the mean and/or the confidence intervals around the point estimates.

Results of the reference toxicant test conducted during the testing program are summarized in Table 3. Results for this test fell within the range for organism performance of the mean and two standard deviations, based on historical results obtained by the laboratory with this test. Thus, the sensitivity of the organisms used in the test was appropriate. The reference toxicant test was performed under the same conditions as those used for the sample.

Table 3. Reference toxicant results.

Test Species	Endpoint	Historical Mean (2 SD Range)	CV (%)	Test Date
P. subcapitata	Growth (IC50): 32.5 µg/L Zn	31.0 (25.0 – 38.5)	11	March 29, 2019

SD = Standard Deviation, CV = Coefficient of Variation, IC = Inhibition Concentration

5.0 REFERENCES

Environment Canada. 2007. Biological test method: growth inhibition test using the freshwater alga. Environmental Protection Series, Report EPS 1/RM/25. Second Edition, March 2007. Environment Canada, Method Development and Application Section, Environmental Science and Technology Centre, Science and Technology Branch, Ottawa, ON. 53 pp.

Tidepool Scientific Software. 2013. CETIS comprehensive environmental toxicity information system, version 1.9.4.11 Tidepool Scientific Software, McKinleyville, CA. 275 pp.

APPENDIX A – *Pseudokirchneriella subcapitata* Toxicity Test Data

Pseudokirchneriella subcapitata Summary Sheet

Client: MDXXAM
Work Order No.: 1906S2

Start Date: April 11/19
Set up by: MD

Sample Information:

Sample ID: VM344R-1645-13
Sample Date: April 8/19
Date Received: April 11/19
Sample Volume: 2x1L

Test Organism Information:

Culture Date: April 5/19
Age of culture (Day 0): 6d

Zinc Reference Toxicant Results:

Reference Toxicant ID: SC181
Stock Solution ID: 19Zn02
Date Initiated: March 29/19

72-h IC50 (95% CL): 32.5 (26.4-37.2) ug/L Zn

72-h IC50 Reference Toxicant Mean and Range: 31.0 (25.2-38.5) ug/L Zn CV (%): 11

Test Results:

	Cell Yield (Mean± SD)
Negative Control	38.6 ± 3.1
96.2 (7.4)	90.0 ± 5.1 *
	±
	±
	±
	±
	±
	±
	±

* indicates that cell yield is significantly higher than the lab control.

Reviewed by: JGH
Date reviewed: May 7/19

72-h Algal Growth Inhibition Toxicity Test
Water Quality Measurements

Client: Maxxam | Setup by: MG

Sample ID: VW7449-1615-18 | Test Date/Time: April 11/19 1200h

Work Order No.: 190687 | CER #: 4

Test Species: *Pseudokirchneriella subcapitata*

Culture Date: April 5/19 | Age of Culture: 6d | Culture Health: Good

Culture Count: 1 345 2 365 | Average: 355 | Culture Cell Density (c1): 355 x 10⁴ cells/mL

v1 = 220,000 cells/ml x 100 ml / 355x10⁴ cells/ml = 6.20mL
(c1)

Time Zero Counts: 1 24 2 23 | Average: 23.5

No. of Cells/mL: 23.5 x 10⁴ | Initial Density: # cells/mL x 220 µL x 10 µL = 10682 cells/mL

Concentration %(v/v)	Water Quality		Incubator Temperature (°C)				Microplates rotated 2X per day?			
	pH	Temp (°C)								
	0 h	0 h	0 h	24 h	48 h	72 h	0 h	24 h	48 h	72 h
Control	7.3	24.0	25	25	24.0	24.0	✓	✓	✓	✓
93.2	7.6	24.0	↓	↓	↓	↓	✓	✓	✓	✓
Initials	MG	MG	MG	MG	A	A	MG	MG	A	A

Initial control pH: Well 1: 7.3 Well 2: 7.3

Final control pH: Well 1: 7.1 Well 2: 7.1

Light intensity (lux): 4100 Date measured: April 11/19

Thermometer: 4 Light meter: 1 pH meter/probe: 1/1

Sample Description: dark, colourless, cloudy, wet particulates

Comments:

Reviewed: JR Date reviewed: May 7/19

Pseudokirchneriella subcapitata Toxicity Test Data Sheet
72-h Algal Cell Counts

Client: Maxxam Start Date/Time: Apr 11/12 1200h
Work Order #: 191682 Termination Date: Apr 14/12 1200h
Sample ID: VM3449-166-18 Test set up by: MC
%(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control	A	38					MC
	B	41					
	C	37					
	D	44					
	E	39					
	F	36					
	G	44					
	H	38					
95.7	A	93					
	B	84					
	C	91					
	D	96					
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						

Comments:

Reviewed by: JGL Date Reviewed: May 7/12

Pseudokirchneriella subcapitata Algal Counts

Client:	Maxxam	Start Date/Time:	11-Apr-19 @ 1200h
WO#:	190682	Termination Date/Time	14-Apr-19 @ 1200h
Sample ID:	VM7449-1645-18		
		Initial Cell Density:	10682 cell/mL

235000
0.22
0.01
10681.82

Concentration %(v/v)	Rep	Count 1 (x 10^4)	Count 2 (x 10^4)	Count 3 (x 10^4)	Count 4 (x 10^4)	Mean (x 10^4)	Cell Yield (x 10^4) cell/mL		
Control	A	38				38	36.9	mean	38.6
	B	41				41	39.9	SD	3.067689
	C	37				37	35.9	CV	7.956281
	D	44				44	42.9		
	E	39				39	37.9		
	F	36				36	34.9		
	G	44				44	42.9		
	H	38				38	36.9		
95.2	A	93				93	91.9		
	B	84				84	82.9		
	C	91				91	89.9		
	D	96				96	94.9		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		

Reviewed by: JBh

Date reviewed: May 7/19

CETIS Summary Report

Test Code/ID: 190682a / 15-1978-1798

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Batch ID:	11-3520-3888	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	11 Apr-19 12:00	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	14 Apr-19 12:00	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Test Length:	72h	**Taxon:**	Chlorophyta	**Source:**	In-House Culture **Age:** 6d

Sample ID:	08-2891-8816	**Code:**	31684C20	**Project:**	
Sample Date:	08 Apr-19 15:09	**Material:**	Water Sample	**Source:**	Maxxam
Receipt Date:	11 Apr-19 07:45	**CAS (PC):**		**Station:**	VM7449-1645-18
Sample Age:	69h (4.9 °C)	**Client:**	Maxxam		

Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
03-4059-8565	Cell Yield	Equal Variance t Two-Sample Test	<1.0E-37	95.2% failed cell yield	1

Cell Yield Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	8	38.62	36.06	41.19	35	43	1.085	3.068	7.94%	0.00%
95.2		4	90	81.89	98.11	83	95	2.55	5.099	5.67%	-133.01%

Cell Yield Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	N	37	40	36	43	38	35	43	37
95.2		92	83	90	95				

Analyst: MT QA: May 7/19

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	03-4059-8565	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.9.4
Analyzed:	07 May-19 14:37	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Batch ID:	11-3520-3886	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	11 Apr-19 12:00	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	14 Apr-19 12:00	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Test Length:	72h	**Taxon:**	Chlorophyta	**Source:**	In-House Culture **Age:** 9d
Sample ID:	08-2891-8816	**Code:**	31684C20	**Project:**	
Sample Date:	08 Apr-19 15:09	**Material:**	Water Sample	**Source:**	Maxxam
Receipt Date:	11 Apr-19 07:45	**CAS (PC):**		**Station:**	VM7449-1645-18
Sample Age:	69h (4.9 °C)	**Client:**	Maxxam		

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C < T	95.2% failed cell yield	10.90%

Equal Variance t Two-Sample Test

Control	vs	Control II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		95.2*	22.12	1.812	4.21	10	CDF	<1.0E-37	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend Test			0.9061	Non-Significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	7038.38	7038.38	1	489.2	<1.0E-37	Significant Effect
Error	143.875	14.3875	10			
Total	7182.25		11			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	2.763	10.88	0.2422	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9586	0.8025	0.7633	Normal Distribution

Cell Yield Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	8	38.62	36.06	41.19	37.5	35	43	1.085	7.94%	0.00%
95.2		4	90	81.89	98.11	91	83	95	2.55	5.67%	-133.01%

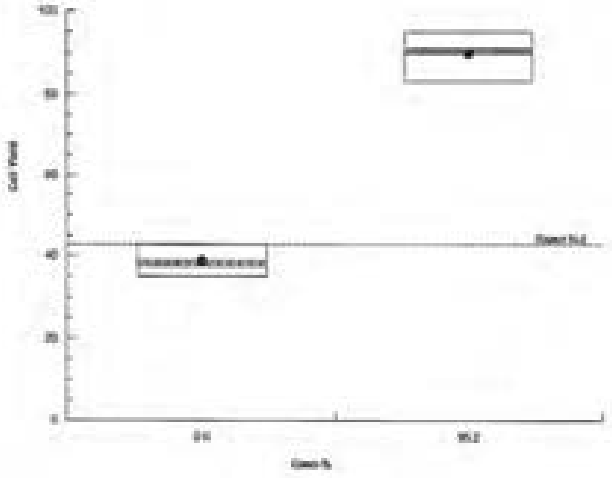
Cell Yield Detail

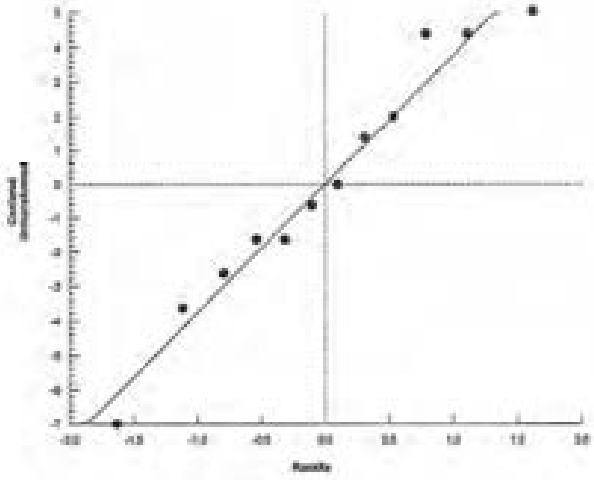
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	N	37	40	38	43	38	35	43	37
95.2		92	83	90	95				

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	03-4059-8565	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.9.4
Analyzed:	07 May-19 14:37	**Analysis:**	Parametric-Two Sample	**Status Level:**	1

Graphics





Pseudokirchneriella subcapitata Summary Sheet

Client: MCXCAM
Work Order No.: 190627

Start Date: April 11/19
Set up by: MC

Sample Information:

Sample ID: VM3450-1645-188
Sample Date: April 8/19
Date Received: April 11/19
Sample Volume: 2xL

Test Organism Information:

Culture Date: April 5/19
Age of culture (Day 0): 6d

Zinc Reference Toxicant Results:

Reference Toxicant ID: SC181
Stock Solution ID: 190307
Date Initiated: March 29/19

72-h IC50 (95% CL): 33.5 (26.4 - 37.2) ug/L Zn

72-h IC50 Reference Toxicant Mean and Range: 31.2 (25.0 - 38.5) ug/L Zn CV (%): 11

Test Results:

Negative Control	Cell Yield (Mean± SD)
95.2% (v/v)	38.2 ± 2.7
	86.8 ± 5.4 *
	±
	±
	±
	±
	±
	±
	±

* indicates that cell yield is significantly greater than the lab control

Reviewed by: JGL

Date reviewed: May 7/19

72-h Algal Growth Inhibition Toxicity Test
Water Quality Measurements

Client: Maxxam — Setup by: MG

Sample ID: VM7437-1645-1BR — Test Date/Time: April 11/19 @ 1200h

Work Order No.: 190687 — CER #: 4

Test Species: *Pseudokirchneriella subcapitata*

Culture Date: April 5/19 — Age of Culture: 6d — Culture Health: Good

Culture Count: 1 345 2 345 — Average: ____ — Culture Cell Density (c1): 355 x 10⁴ cells/mL

v1 = 220,000 cells/mL (c1) x 100 mL / 355 x 10⁴ cells/mL = 6.20 mL

Time Zero Counts: 1 24 2 23 — Average: 23.5

No. of Cells/mL: 23.5 x 10⁴ — Initial Density: # cells/mL ÷ 220 µL x 10 µL = 10682 cells/mL

Concentration %(v/v)	Water Quality pH 0 h	Water Quality Temp (°C) 0 h	Incubator Temperature (°C) 0 h	24 h	48 h	72 h	Microplates rotated 2X per day? 0 h	24 h	48 h	72 h
Control	7.3	24.0	25.0	25.2	26.0	26.2	✓	✓	✓	✓
95.2	7.6	24.0	2	2	1	1	✓	✓	✓	✓
Initials	MG	MG	MG	MG	[illegible]	[illegible]	MG	MG	[illegible]	[illegible]

Initial control pH: Well 1: 7.3 — Well 2: 7.3

Final control pH: Well 1: 7.1 — Well 2: 7.1

Light intensity (lux): 4040 — Date measured: April 11/19

Thermometer: 4 — Light meter: 1 — pH meter/probe: 1 / 1

Sample Description: clear, colourless, odourless, no particulates

Comments: ____

Reviewed: JBL — Date reviewed: May 7/19

Pseudokirchneriella subcapitata Toxicity Test Data Sheet
72-h Algal Cell Counts

Client: McKenzie Start Date/Time: April 11/19 @ 12:00h

Work Order #: 190682 Termination Date: April 14/19 @ 12:00h

Sample ID: WP45-1645 - 186 Test set up by: MG

%(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control	A	40					MG
	B	36					
	C	41					
	D	40					
	E	41					
	F	38					
	G	43					
	H	36					
95.2	A	88					
	B	86					
	C	95					
	D	87					
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						

Comments:

Reviewed by: JGL Date Reviewed: May 7/19

Pseudokirchneriella subcapitata Algal Counts

Client: Maxxam
WO#: 190682
Sample ID: VM7450-1645-18B

Start Date/Time: 11-Apr-19 @ 1200h
Termination Date/Time: 14-Apr-19 @ 1200h

Initial Cell Density: 10682 cell/mL

235000
0.22
0.01

Concentration %(v/v)	Rep	Count 1 (x 10^4)	Count 2 (x 10^4)	Count 3 (x 10^4)	Count 4 (x 10^4)	Mean (x 10^4)	Cell Yield (x 10^4) cell/mL		10681.82
Control	A	40				40	38.9	mean	38.2
	B	35				35	33.9	SD	2.712405
	C	41				41	39.9	CV	7.103919
	D	40				40	38.9		
	E	41				41	39.9		
	F	38				38	36.9		
	G	43				43	41.9		
	H	36				36	34.9		
95.2	A	88				88	86.9		
	B	86				86	84.9		
	C	95				95	93.9		
	D	82				82	80.9		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		

Reviewed by: ____________

Date reviewed: May 7/19

CETIS Summary Report

Test Code/ID: 190682b / 06-2042-6889

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Batch ID:	04-7047-9893	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	11 Apr-19 12:00	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	14 Apr-19 12:00	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Test Length:	72h	**Taxon:**	Chlorophyta	**Source:**	In-House Culture **Age:** 6d
Sample ID:	09-3303-2160	**Code:**	379CF0E0	**Project:**	
Sample Date:	08 Apr-19 15:11	**Material:**	Water Sample	**Source:**	Maxxam
Receipt Date:	11 Apr-19 07:45	**CAS (PC):**		**Station:**	VM7450-1645-18B
Sample Age:	69h (4.8 °C)	**Client:**	Maxxam		

Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
14-0268-3040	Cell Yield	Equal Variance t Two-Sample Test	<1.0E-37	95.2% failed cell yield	1

Cell Yield Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	8	38.25	35.98	40.52	34	42	0.959	2.712	7.09%	0.00%
95.2		4	86.75	78.1	95.4	81	94	2.72	5.439	6.27%	-126.80%

Cell Yield Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	N	39	34	40	39	40	37	42	35
95.2		87	85	94	81				

Analyst: MT QA: May 7/19

EC Alga Growth Inhibition Test — Nautilus Environmental

Analysis ID:	14-0268-3040	Endpoint:	Cell Yield	CETIS Version:	CETISv1.9.4
Analyzed:	07 May-19 14:40	Analysis:	Parametric-Two Sample	Status Level:	1
Batch ID:	04-7047-6893	Test Type:	Cell Growth	Analyst:	Mimi Tran
Start Date:	11 Apr-19 12:00	Protocol:	EC/EPS 1/RM/25	Diluent:	Deionized Water + nutrients
Ending Date:	14 Apr-19 12:00	Species:	Pseudokirchneriella subcapitata	Brine:	
Test Length:	72h	Taxon:	Chlorophyta	Source:	In-House Culture Age: 6d
Sample ID:	09-3303-2160	Code:	379CF0E0	Project:	
Sample Date:	08 Apr-19 15:11	Material:	Water Sample	Source:	Maxxam
Receipt Date:	11 Apr-19 07:45	CAS (PC):		Station:	VM7450-1645-18B
Sample Age:	69h (4.8 °C)	Client:	Maxxam		

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C < T	95.2% failed cell yield	10.87%

Equal Variance t Two-Sample Test

Control	vs	Control II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		95.2*	21.15	1.812	4.157	10	CDF	<1.0E-37	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend Test			1.0000	Non-Significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	6272.67	6272.67	1	447.2	<1.0E-37	Significant Effect
Error	140.25	14.025	10			
Total	6412.92		11			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	4.021	10.88	0.1180	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.977	0.8025	0.9690	Normal Distribution

Cell Yield Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	8	38.25	35.98	40.52	39	34	42	0.959	7.09%	0.00%
95.2		4	86.75	78.1	95.4	86	81	94	2.72	6.27%	-126.80%

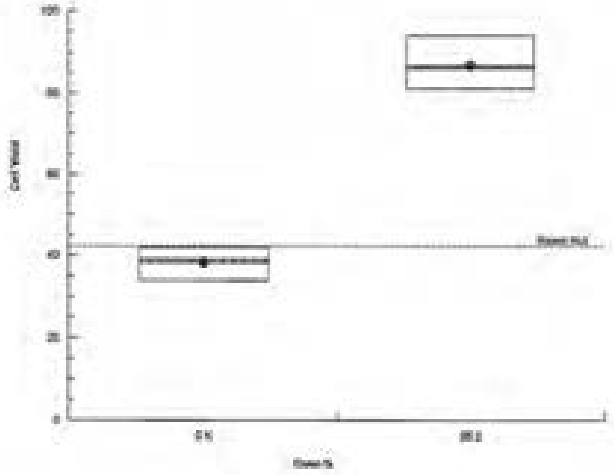
Cell Yield Detail

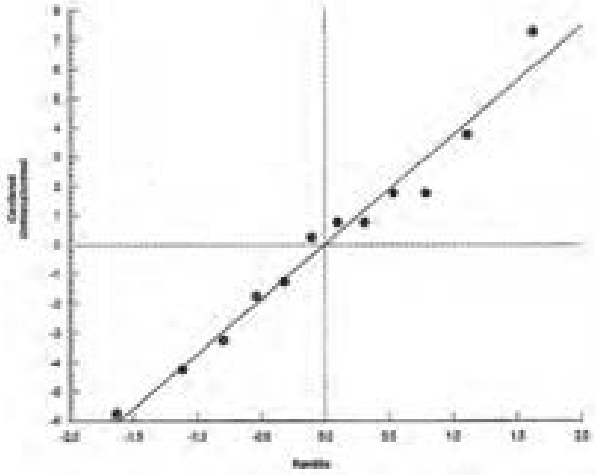
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	N	39	34	40	39	40	37	42	35
95.2		87	85	94	81				

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	14-0268-3040	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.9.4
Analyzed:	07 May-19 14:40	**Analysis:**	Parametric-Two Sample	**Status Level:**	1

Graphics





Analyst: MC QA: May 7/19

APPENDIX B – Chain-of-Custody Form

Maxxam
A Bureau Veritas Group Company

Sent To: Nautilus Environmental - Burnaby
8664 Commerce Court
Burnaby, BC, V5A 4N7
Tel: (604) 420-8773

CHAIN OF CUSTODY RECORD FOR SUBCONTRACTED WORK

COC # B926150-VNAU-01-01

REPORT INFORMATION	
Company:	Maxxam
Address:	4606 Canada Way, Burnaby, British Columbia, V5G 1K5
Contact Name:	Geraldlyn Gouthro
Email:	GGouthro@maxxam.ca, customerservicebc@maxxamanalytics.com
Phone:	(403) 735-2230
Maxxam Project #:	B926190

#	SAMPLE ID	MATRIX	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	SAMPLER INITIALS	# CONT.	PHC Alkane (100% only)	Temp °C	ADDITIONAL SAMPLE INFORMATION
1	VM7449-1645-1B (1)	W	2019/04/08	15:09	SS2	2x	X	9.9	(P: 01)
2	VM7450-1645-1BB (1)	W	2019/04/08	15:11	SS2	2x	X	9.8	(P: 01)
3									
4									(1) sample description: clear, colourless, odourless, no particulates.
5									
6									
7									
8									
9									
10									

REGULATORY CRITERIA	SPECIAL INSTRUCTIONS	TURNAROUND TIME
Diavik 1645-1B Ave & Grab	Please inform Maxxam immediately if you are not accredited for the requested test(s). **Please return a copy of this form with the report.**	☐ Rush Required 2019/05/08 Date Required *Please inform us if rush charges will be incurred*

COOLER ID:	YES	NO	Temp: (°C)	1	2	3
Custody Seal Present						
Custody Seal Intact						
Cooling Media Present						

COOLER ID:	YES	NO	Temp: (°C)	1	2	3
Custody Seal Present						
Custody Seal Intact						
Cooling Media Present						

COOLER ID:	YES	NO	Temp: (°C)	1	2	3
Custody Seal Present		/				
Custody Seal Intact		/				
Cooling Media Present	/		2.9			

RELINQUISHED BY: (SIGN & PRINT)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (SIGN & PRINT)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
1. [signature] Billie PUNI	2019/04/11	1500	1. VNL - Nautilus	2019/04/11	0745
2.			2.		

2 x 1 L per sample

END OF REPORT

RESULTS OF *DAPHNIA MAGNA* SINGLE CONCENTRATION-100%

Client : 4388 DIAVIK DIAMOND MINES INC., YELLOWKNIFE Job Number: B950328

Client Project Name & Number: Quarterly Tox SNP-A Sample Number: VY7818-01

Test Result:

48 hrs Mortality % 0 Statistical Method:

Mean percent mortality: Sample 0 Control 0

Sample Name : 1645-18 Sample Matrix : Water

Description: Clear, Colourless Sample Prior to Analysis:

Sample Collected: Jun 25, 2019 12:18 AM Sampling Method : N/A pH: 6.9

Sample Collected By: AH Site Collection: N/A Temperature : 20 °C

Sample Received: Jun 25, 2019 01:41 PM Volume Received: 1 L Dissolved Oxygen: 9.9 mg/L

Analysis Start : Jun 27, 2019 01:35 PM Temp.Upon Arrival: 7 °C Sample Conductance: 443 µS/cm

End : Jun 29, 2019 02:19 PM Storage: 2-6°C Hardness: 100 mg $CaCO_3$/L

Concentration	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Immobility (#)	Immobility (%)	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)
% vol/vol	Start	Start	Start	Start	24 hrs	24 hrs	24 hrs	24 hrs	48 hrs	48 hr	48 hrs	48 hrs
0	21	8.1	355	8.2	0	0	0	0	20	8.2	336	8.2
0	21	8.1	358	8.2	0	0	0	0	20	8.2	339	8.2
0	21	8.0	358	8.2	0	0	0	0	20	8.2	342	8.2
100	20	7.2	452	10.0	0	0	0	0	20	7.6	428	8.2
100	20	7.0	451	9.4	0	0	0	0	19	7.5	430	8.3
100	20	6.9	452	10.0	0	0	0	0	20	7.6	428	8.2

Concentration	Mortality (#)	Mortality (%)	Immobility (#)	Immobility (%)
% vol/vol	48 hrs	48 hrs	48 hrs	48 hrs
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
100	0	0	0	0
100	0	0	0	0
100	0	0	0	0

Comments : None

Culture/Control/Dilution Water: City of Edmonton dechlorinated tap water

Hardness: 160 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,0,0,100,100,100 (% vol/vol)

Organisms per Vessel :	10	Pre-aeration Time :	30 min	Rate of Pre-aeration :	25-50 mL/min/L
Total # of Organisms Used :	60	Test Temperature :	20 ± 2 °C	Test Hardness Adjusted :	No
Test Volume :	150 mL	Vessel Volume :	225 mL	Test pH Adjusted:	No
Loading Density :	15.0 mL/Daphnia	Photoperiod :	16:8 (light: dark)		

Test Organism : *Daphnia magna* Source : In House Culture

Age at Test Initiation :	<24 hrs	Average Brood Size :	28.1
Culture Photoperiod :	16:8 (light: dark)	% Mortality within 7 days :	4.8
Culture Temperature :	20 ± 2 °C	Time To First Brood :	8 Days

Culture Diet: Pseudokirchnriella and YTC at a ratio of 2 mL/L of culture daily. New cultures weekly, 63 daphnids distributed into 6 culture vessels and 3 reproductive vessels.

RESULTS OF *DAPHNIA MAGNA* SINGLE CONCENTRATION-100%

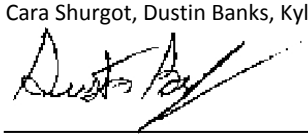
Client :	4388	DIAVIK DIAMOND MINES INC., YELLOWKNIFE	Job Number:	B950328
Client Project Name & Number:		Quarterly Tox SNP-A	Sample Number:	VY7818-01

Reference chemical:	Sodium Chloride	Test Date:	Jun 25, 2019
Test Endpoint 48 hrs LC50 (95% confidence interval) :	5.26 (4.69, 5.91)g/L	Statistical Method :	Untrimmed Spearman-Kärber
Historical Mean LC50 (warning limits) :	5.99 (4.39, 8.18) g/L	Concentration :	0,1.71,2.56,3.82,5.7,8.5 g/L

Test Method	EPS 1/RM/14
Method Deviations:	None

Note: The results contained in this report refer only to the testing of the sample submitted. This report may not be reproduced, except in its entirety, without the written approval of the laboratory.

Analyst : Cara Shurgot, Dustin Banks, Kyle Monaghan



Verified By : Dustin Banks, Team Lead, Bioassay Date: Jul 03, 2019 04:27 PM

RESULTS OF RAINBOW TROUT SINGLE CONCENTRATION-100%

Client : 4388 DIAVIK DIAMOND MINES INC., YELLOWKNIFE Job Number: B950328

Client Project Name & Number: Quarterly Tox SNP-A

Test Result:

96 hrs Mortality % 0 Statistical Method: Visual

Sample Name : 1645-18 Sample Matrix : Water

Description: CLEAR, COLOURLESS Sample Number: VY7818-02

Sample Collected: Jun 25, 2019 12:18 AM Sampling Method : N/A Site Collection: N/A

Sample Collected By: AH Volume Received: 20 L Temp.Upon Arrival: 7 °C Storage: 2-6°C

Sample Received: Jun 25, 2019 01:41 PM pH: 6.9 Dissolved Oxygen: 10.3 mg/L

Analysis Start : Jun 27, 2019 10:56 AM Temperature : 14 °C Sample Conductance: 388 µS/cm

Concentration	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)
% vol/vol	Start	Start	Start	Start	24 hrs	24 hrs	24 hrs	24 hrs	48 hrs	48 hrs	48 hrs	48 hrs
0	15	7.9	367	9.1	0	0	0	0	0	0	0	0
100	14	7.1	392	9.8	0	0	0	0	0	0	0	0

Concentration	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)
% vol/vol	72 hrs	72 hrs	72 hrs	72 hrs	96 hrs	96 hr	96 hrs	96 hrs	96 hrs	96 hrs	96 hrs	96 hrs
0	0	0	0	0	15	7.7	379	8.6	0	0	0	0
100	0	0	0	0	15	7.4	413	8.8	0	0	0	0

Comments : None

Culture/Control/Dilution Water City of Edmonton dechlorinated tap water

Hardness: 180 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,100 (% vol/vol)

Organisms per Vessel :	10	Test Temperature :	15 ± 1 °C	Solution Depth :	>15 cm
Total # of Organisms Used :	20	Pre-aeration Time :	120 min.	Rate of Aeration	6.5±1 mL/min/L
Test Volume :	20 L	Vessel Volume :	38L	Test pH Adjusted:	No
Loading Density :	0.2 g/L	Photoperiod :	16:8 (light: dark)		

Test Organism : Rainbow Trout *(Oncorhynchus mykiss)* Source : Spring Valley Trout Hatchery

Culture Temperature :	15 ± 2 °C	Weight (Mean) +- SD :	0.4 ± 0.1 g	Length (Mean) +- SD :	3.75 ± 0.26 cm
Culture Water Renewal :	≥ 1.0 L/min/kg fish	Weight (Range) :	0.3 – 0.5 g	Length (Range) :	3.40 – 4.20 cm
Culture Photoperiod :	16:8 (light: dark)			% Mortality within 7 days :	0%
Feeding rate and frequency :	daily: 1-5% biomass of trout.			Acclimation Time:	>14 days

Reference chemical: Phenol Test Date: Jun 20, 2019

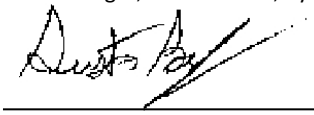
Test Endpoint 96 hrs LC50 (95% confidence interval) : 10.0 (9.12, 10.9)mg/L Statistical Method : Probit

Historical Mean LC50 (warning limits) : 10.5 (8.73, 12.6) mg/L Concentration : 0,8,10,12,15,20 mg/L

Test Method EPS 1/RM/13

Method Deviations : None

Analyst : Cara Shurgot, Dustin Banks, Kyle Monaghan



Verified By : Dustin Banks, Team Lead, Bioassay Date: Jul 15, 2019 01:33 PM

Toxicity testing on samples VY7818-1645-18 and VY7819-1645-18B

Collected June 25, 2019

Final Report

August 2, 2019

Submitted to: **Bureau Veritas Laboratories**
Burnaby, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

TABLE OF CONTENTS

List of Tables

List of Appendices

SIGNATURE PAGE

Report By:
Yvonne Lam, B.Sc.
Laboratory Biologist

Reviewed By:
Armando Tang, R.P.Bio
Senior Reviewer

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

SUMMARY

Sample Information and Test Type

Sample ID	VY7818-1645-18 VY7819-1645-18B
Sample collection date	June 25, 2019
Sample receipt date	June 27, 2019
Sample receipt temperature	3.6°C and 2.7°C
Test type	72-h *Pseudokirchneriella subcapitata* growth inhibition *Ceriodaphnia dubia* survival and reproduction 7-d rainbow trout (*Oncorhynchus mykiss*) embryo viability

Summary of Results

Endpoint	Mean ± SD			
	Control	VY7818-1645-18	Control	VY7819-1645-18B
P. subcapitata				
Cell Yield (x10^4 cells/mL)	39.8 ± 3.5	118.2 ± 4.6*	39.6 ± 3.8	107.2 ± 7.7*
Ceriodaphnia dubia				
Survival (%)	100	100	90	100
Reproduction (mean ± SD)	17.5 ± 2.8	20.1 ± 4.6	19.4 ± 5.7	18.5 ± 4.7
Oncorhynchus mykiss				
Embryo viability (%)	74.4 ± 9.8	67.5 ± 5.0	70.7 ± 9.0	80.7 ± 4.2

SD = Standard Deviation

* = Indicates cell yield was significantly greater than the control

1.0 INTRODUCTION

Nautilus Environmental Company Inc. conducted sub-lethal toxicity tests for Bureau Veritas Laboratories on two samples identified as VY7818-1645-18 and VY7819-1645-18B. The samples were collected on June 25, 2019 and delivered to the Nautilus Environmental laboratory in Burnaby, BC on June 27, 2019. The samples were each transported in nine 1-L and four 10-L plastic containers and received at temperatures of 3.6 and 2.7°C. The samples were stored in the dark at 4 ± 2°C prior to testing. The following toxicity tests were performed on the samples:

- 72-h *Pseudokirchneriella subcapitata* growth inhibition
- *Ceriodaphnia dubia* survival and reproduction
- 7-d rainbow trout (*Oncorhynchus mykiss*) embryo viability

Testing for *C. dubia* and *O. mykiss* was initiated on June 27, 2019, and *P. subcapitata* testing was initiated on June 28, 2019. This report describes the results of these toxicity tests. Copies of raw laboratory data sheets and statistical analyses for each test species are provided in Appendices A to C. The chain-of-custody form is provided in Appendix D.

2.0 METHODS

The samples were tested at 100% single-concentration only, and the methods are summarized in Tables 1 to 3. Testing for *C. dubia* and *P. subcapitata* was conducted according to procedures described by Environment Canada (2007a and 2007b). The *O. mykiss* test followed procedures described by Environment Canada (1998) and modified by Canaria *et al.* (1999). Statistical analyses were performed using CETIS (Tidepool Scientific Software, 2013).

Table 1. Summary of test conditions: *Pseudokirchneriella subcapitata* growth inhibition single concentration test.

Test species	*Pseudokirchneriella subcapitata*, strain CPCC# 37
Organism source	In-house axenic culture, obtained from Canadian Phycological Culture Center, and originally isolated from Nivelta River, Norway.
Organism age	3-to 7-day old culture in logarithmic growth phase
Test type	Static
Test duration	72 hours
Test vessel	Microplate
Test volume	220 µL
Test concentrations	Full strength sample diluted to 95.2% (v/v) with nutrients, plus laboratory control
Test replicates	4 per treatment; 8 for laboratory control
Number of organisms	10,000 cells/mL
Control/dilution water	Deionized water supplemented with nutrients
Test solution renewal	None
Test temperature	24 ± 2°C
Feeding	None
Light intensity	3600 to 4400 lux
Photoperiod	24 hours light
Aeration	None
Test measurements	Test area temperature measured daily; temperature and pH measured at test initiation; pH of two control wells measured at test termination
Test protocol	Environment Canada (2007a), EPS 1/RM/25
Statistical software	CETIS Version 1.9.4
Test endpoints	Algal cell growth inhibition
Test acceptability criteria for controls	>16-fold increase in number of algal cells; CV ≤ 20%; no trend when analyzed using Mann-Kendall test
Reference toxicant	Zinc (added as $ZnSO_4$)

Table 2. Summary of test conditions: *Ceriodaphnia dubia* survival and reproduction single concentration test.

Test species	*Ceriodaphnia dubia*
Organism source	In-house culture
Organism age	<24 hour old neonates, produced within a 12 hour window
Test type	Static-renewal
Test duration	7 ± 1 day
Test vessel	20-mL glass test tube
Test volume	15 mL
Test solution depth	10 cm
Test concentrations	100% (undiluted) sample, plus laboratory control
Test replicates	10 per treatment
Number of organisms	1 per replicate
Control/dilution water	20% Perrier water and 80% deionized water + 5 µg/L Se and 2 µg/L vitamin B12
Test solution renewal	Daily (100% renewal)
Test temperature	25 ± 1°C
Feeding	Daily with *Pseudokirchneriella subcapitata* and TCC[1] (3:1 ratio)
Light intensity	100 to 600 lux at water surface
Photoperiod	16 hours light / 8 hours dark
Aeration	None
Test measurements	Temperature, dissolved oxygen, pH and conductivity measured daily; hardness and alkalinity of undiluted sample measured at test initiation; survival and reproduction checked daily
Test protocol	Environment Canada (2007b), EPS 1/RM/21
Statistical software	CETIS Version 1.9.4
Test endpoints	Survival and reproduction
Test acceptability criteria for controls	≥80% survival; ≥15 young per surviving control producing three broods; ≥60% of controls producing three or more broods; no ephippia present
Reference toxicant	Sodium chloride (NaCl)

[1] TCC = Trout chow and Cerophyl

Table 3. Summary of test conditions: 7-d rainbow trout (*Oncorhynchus mykiss*) embryo viability single concentration test.

Test species	*Oncorhynchus mykiss*
Organism source	Hatchery
Organism age	<30 minutes post fertilization, <24 hour old gametes
Test type	Static-renewal
Test duration	7 days
Test vessel	2-L plastic container
Test volume	2 L
Test solution depth	17 cm
Test concentrations	100% (undiluted) sample, plus laboratory control
Test replicates	4 per treatment
Number of organisms	30 per replicate
Control/dilution water	Dechlorinated Metro Vancouver municipal tapwater
Test solution renewal	Daily (80% renewal)
Test temperature	14 ± 1°C
Feeding	None
Light intensity	Dark
Photoperiod	24 hours dark
Aeration	Continuous gentle aeration
Test measurements	Temperature, dissolved oxygen, pH and conductivity measured daily; hardness and alkalinity of undiluted sample measured at test initiation; survival checked daily
Test protocol	Environment Canada (1998), EPS 1/RM/28; Canaria *et al*. (1999)
Statistical software	CETIS Version 1.9.4
Test endpoints	Embryo viability
Test acceptability criteria for controls	Embryo viability ≥70%
Reference toxicant	Sodium dodecyl sulphate (SDS)

3.0 RESULTS

Results of the single-concentration toxicity tests on samples VY7818-1645-18 and VY7819-1645-18B are summarized in Tables 4 to 6.

No adverse effects were observed on *P. subcapitata* cell yield (Table 4) for either sample; however, enhanced algal growth was observed in both samples and the percent stimulation were 198% and 171%. For *C. dubia* (Table 5), there were no significant differences observed in either survival or reproduction. There were also no statistically significant differences in either sample for *O. mykiss* (Table 6) relative to their respective laboratory controls, with embryo viability in both samples ≥67% (v/v).

Table 4. Results: *Pseudokirchneriella subcapitata* growth inhibition single concentration test.

Concentration (% v/v)	Sample ID			
	VY7818-1645-18		VY7819-1645-18B	
	Cell Yield (x 10^4 cells/mL) (Mean ± SD)	Stimulation (%)	Cell Yield (x 10^4 cells/mL) (Mean ± SD)	Stimulation (%)
Laboratory Control	39.8 ± 3.5	--	39.6 ± 3.8	--
100	118.2 ± 4.6*	197.5	107.2 ± 7.7*	170.7

SD = Standard Deviation

* = Indicates cell yield was significantly greater than the laboratory control

Table 5. Results: *Ceriodaphnia dubia* survival and reproduction single concentration test.

Concentration (% v/v)	Sample ID			
	VY7818-1645-18		VY7819-1645-18B	
	Survival (%)	Reproduction (Mean ± SD)	Survival (%)	Reproduction (Mean ± SD)
Laboratory Control	100	17.5 ± 2.8	90	19.4 ± 5.7
100	100	20.1 ± 4.6	100	18.5 ± 4.7

SD = Standard Deviation
The samples were not statistically significantly different relative to their respective Laboratory Control

Table 6. Results: 7-d rainbow trout (*Oncorhynchus mykiss*) embryo viability single concentration test.

Concentration (% v/v)	Sample ID	
	VY7818-1645-18	VY7819-1645-18B
	Embryo viability (%) (Mean ± SD)	Embryo viability (%) (Mean ± SD)
Laboratory Control	74.4 ± 9.8	70.7 ± 9.0
100	67.5 ± 5.0	80.7 ± 4.2

SD = Standard Deviation
The samples were not statistically significantly different relative to their respective Laboratory Control

4.0 QA/QC

The health history of the test organisms used in the exposures were acceptable and met the requirements of the Environment Canada protocols. The tests met all control acceptability criteria and water quality parameters remained within ranges specified in the protocols throughout the tests. Uncertainty associated with these tests is best described by the standard deviations around the means and/or confidence limits around the point estimates.

There was a deviation from the test methodology in the *O. mykiss* embryo viability test. The eggs were exposed using a blocked design (eggs from each of the four female fish were distributed separately in each of replicates A to D) rather than pooled, as specified in the test method. The modification was used because the egg quality from each female varied considerably, and blocking would minimize the effects of poor quality eggs from one particular female fish. The deviation did not seem to affect the results of the test and control criterion was met at the end of the exposure.

Results of the reference toxicant tests conducted during the testing program are summarized in Table 7. Results for these tests fell within the acceptable range for organism performance of mean and two standard deviations, based on historical results obtained by the laboratory with these tests. Thus, the sensitivities of the organisms used in the tests were appropriate. The reference toxicants were performed under the same conditions as those used for the samples.

Table 7. Reference toxicant test results.

Test Species	Endpoint	Historical Mean (2 SD Range)	CV (%)	Test Date
P. subcapitata	Growth (IC50): 29.6 µg/L Zn	31.0 (25.2 – 38.3) µg/L Zn	10	June 28, 2019
C. dubia	Survival (LC50): 2.1 g/L NaCl	2.0 (1.8 – 2.2) g/L NaCl	5	June 19, 2019
	Reproduction (IC50): 1.9 g/L NaCl	1.5 (1.0 – 2.3) g/L NaCl	20	
O. mykiss	Viability (EC50): 4.1 mg/L SDS	3.8 (2.3 – 6.0) mg/L SDS	24	June 27, 2019

SD = Standard Deviation, CV = Coefficient of Variation, LC = Lethal Concentration, IC = Inhibition Concentration, EC = Effective Concentration

5.0 REFERENCES

Canaria, E.C., J.R. Elphick and H.C. Bailey. 1999. A simplified procedure for conducting small-scale short-term embryo toxicity tests with salmonids. *Environ. Toxicol.* 14:301-307.

Environment Canada. 1998. Biological test method: toxicity tests using early life stages of salmonid fish (rainbow trout). Environmental Protection Series EPS 1/RM/28. Second Edition, July 1998. Environment Canada, Method Development and Application Section, Environmental Technology Centre, Ottawa, ON. 102 pp.

Environment Canada. 2007a. Biological test method: growth inhibition test using the freshwater alga. Environmental Protection Series, Report EPS 1/RM/25, Second Edition, March 2007. Environment Canada, Method Development and Application Section, Environmental Science and Technology Centre, Science and Technology Branch, Ottawa, ON. 53 pp.

Environment Canada. 2007b. Biological test method: test of reproduction and survival using the cladoceran *Ceriodaphnia dubia*. Environmental Protection Series, Report EPS 1/RM/21, Second Edition, February 2007. Environment Canada, Method Development and Application Section, Environmental Science and Technology Centre, Science and Technology Branch, Ottawa, ON. 74 pp.

Tidepool Scientific Software. 2013. CETIS comprehensive environmental toxicity information system, version 1.9.4 Tidepool Scientific Software, McKinleyville, CA. 255 pp.

APPENDIX A – *Pseudokirchneriella subcapitata* Toxicity Test Data

Pseudokirchneriella subcapitata Summary Sheet

Client: Bureau Veritas Laboratories Start Date: June 23/19
Work Order No.: 191291 Set up by: MG

Sample Information:

Sample ID: VY7818 - 1645-18
Sample Date: June 25/19
Date Received: June 27/19
Sample Volume: 2x1L

Test Organism Information:

Culture Date: June 21/19
Age of culture (Day 0): 7d

Zinc Reference Toxicant Results:

Reference Toxicant ID: Se184
Stock Solution ID: 190ct2
Date Initiated: June 28/19

72-h IC50 (95% CL): 29.6 (26.0 - 33.6) ug/L Zn

72-h IC50 Reference Toxicant Mean and Range: 31.0 (29.2 - 38.3) ug/L Zn CV (%): 15

Test Results:

	Cell Yield (Mean± SD)
Negative Control	39.8 ± 3.5
VY7818-1645-18 (95.2%)	118.7 ± 4.6 *
	±
	±
	±
	±
	±
	±
	±

* indicates that cell yield is significantly greater than the lab control

Reviewed by: L. Tong Date reviewed: July 30/19

72-h Algal Growth Inhibition Toxicity Test
Water Quality Measurements

Client: Bureau Veritas Laboratories | Setup by: MG

Sample ID: V47818-1645-18 | Test Date/Time: June 28/19 @ 1130h

Work Order No.: 191291 | CER #: 4

Test Species: *Pseudokirchneriella subcapitata*

Culture Date: June 21/19 | Age of Culture: 7d | Culture Health: Good

Culture Count: 1 460 2 490 | Average: 475 | Culture Cell Density (c1): 475 x10⁴ cells/mL

v1 = 220,000 cells/mL (c1) x 100 mL / 475 x10⁴ cells/mL = 4.63mL

Time Zero Counts: 1 21 2 24 | Average: 22.5

No. of Cells/mL: 22.5x10⁴ | Initial Density: # cells/mL ÷ 220 µL x 10 µL = 10227 cells/mL

Concentration %(v/v)	Water Quality		Incubator Temperature (°C)				Microplates rotated 2X per day?			
	pH	Temp (°C)								
	0 h	0 h	0 h	24 h	48 h	72 h	0 h	24 h	48 h	72 h
Control	7.3	23.0	25.0	24.0	24.0	25.0	✓	✓	✓	✓
95.7	7.6	23.0	↓	↓	↓	↓	✓	✓	✓	✓
Initials	MG	MG	MG	AR	AR	MG	MG	AR	AR	MG

Initial control pH: Well 1: 7.3 Well 2: 7.3

Final control pH: Well 1: 7.2 Well 2: 7.2

Light intensity (lux): 4140 Date measured: June 28/19

Thermometer: 4 Light meter: 1 pH meter/probe: 1 / 1

Sample Description: clear, colourless, odourless, no particulates.

Comments:

Reviewed: L. Tang Date reviewed: July 30, 2019

Pseudokirchneriella subcapitata Toxicity Test Data Sheet
72-h Algal Cell Counts

Client: Bureau Veritas Lab Start Date/Time: June 28/19 @ 1130h

Work Order #: 191291 Termination Date: July 1/19 @ 1130h

Sample ID: VU7818-1645-18 Test set up by: ML

%(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control	A	37					ML
	B	43					
	C	46					
	D	44					
	E	41					
	F	39					
	G	36					
	H	40					
95.2.	A	121					
	B	115					
	C	129					
	D	116					
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						

Comments:

Reviewed by: L-Tong Date Reviewed: July 30, 2019

Pseudokirchneriella subcapitata Algal Counts

Client: Bureau Veritas Laboratories
WO#: 191291
Sample ID: VY7818-1645-18

Start Date/Time: 28-Jun-19 @ 1130h
Termination Date/Time 1-Jul-19 @ 1130h

Initial Cell Density: 10227 cell/mL

225000
0.22
0.01

Concentration %(v/v)	Rep	Count 1 (x 10^4)	Count 2 (x 10^4)	Count 3 (x 10^4)	Count 4 (x 10^4)	Mean (x 10^4)	Cell Yield (x 10^4) cell/mL		10227.27
Control	A	37				37	36.0	mean	39.7
	B	43				43	42.0	SD	3.453776
	C	46				46	45.0	CV	8.693716
	D	44				44	43.0		
	E	41				41	40.0		
	F	39				39	38.0		
	G	36				36	35.0		
	H	40				40	39.0		
95.2	A	121				121	120.0		
	B	115				115	114.0		
	C	125				125	124.0		
	D	116				116	115.0		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		

Reviewed by: A. Tong

Date reviewed: July 30, 2019

CETIS Summary Report

EC Alga Growth Inhibition Test — Nautilus Environmental

Batch ID:	08-0180-7424	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	28 Jun-19 11:30	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	01 Jul-19 11:30	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Test Length:	72h	**Taxon:**	Chlorophyta	**Source:**	In-House Culture **Age:** 7d
Sample ID:	15-0705-8829	**Code:**	59D3E48D	**Project:**	
Sample Date:	25 Jun-19 00:18	**Material:**	Water Sample	**Source:**	Bureau Veritas Laboratories
Receipt Date:	27 Jun-19 12:05	**CAS (PC):**		**Station:**	VY7818-1645-18
Sample Age:	83h (3.6 °C)	**Client:**	Bureau Veritas Laboratories		

Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
06-6935-3753	Cell Yield	Equal Variance t Two-Sample Test	<1.0E-37	95.2% failed cell yield	1

Cell Yield Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	8	39.75	36.86	42.64	35	45	1.221	3.454	8.69%	0.00%
95.2		4	118.2	110.9	125.6	114	124	2.323	4.646	3.93%	-197.48%

Cell Yield Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	N	36	42	45	43	40	38	35	39
95.2		120	114	124	115				

Analyst: MT QA: KET July 30/19

CETIS Analytical Report

EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID:	06-6935-3753	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.9.4
Analyzed:	03 Jul-19 17:17	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Batch ID:	08-0180-7424	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	28 Jun-19 11:30	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	01 Jul-19 11:30	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Test Length:	72h	**Taxon:**	Chlorophyta	**Source:**	In-House Culture **Age:** 7d
Sample ID:	15-0705-8829	**Code:**	59D3E48D	**Project:**	
Sample Date:	25 Jun-19 00:18	**Material:**	Water Sample	**Source:**	Bureau Veritas Laboratories
Receipt Date:	27 Jun-19 12:05	**CAS (PC):**		**Station:**	VY7818-1645-18
Sample Age:	83h (3.6 °C)	**Client:**	Bureau Veritas Laboratories		

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C < T	95.2% failed cell yield	10.75%

Equal Variance t Two-Sample Test

Control	vs	Control II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		95.2*	33.29	1.812	4.273	10	CDF	<1.0E-37	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend Test			0.3987	Non-Significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	16432.7	16432.7	1	1108	<1.0E-37	Significant Effect
Error	148.25	14.825	10			
Total	16580.9		11			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	1.809	10.88	0.4663	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9355	0.2025	0.4459	Normal Distribution

Cell Yield Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	8	39.75	36.86	42.64	39.5	35	45	1.221	8.69%	0.00%
95.2		4	118.2	110.9	125.6	117.5	114	124	2.323	3.93%	-197.48%

Cell Yield Detail

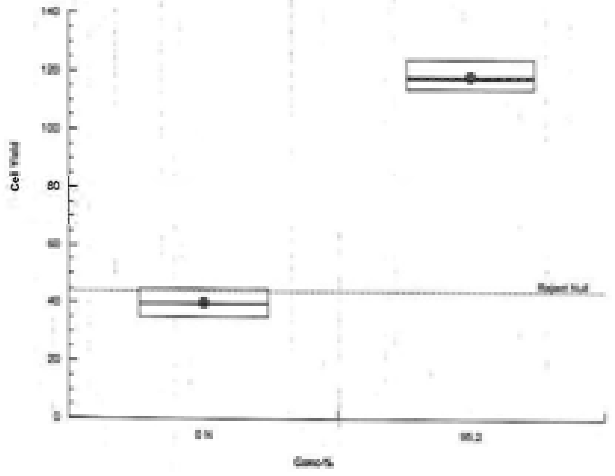
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	N	36	42	45	43	40	38	35	39
95.2		120	114	124	115				

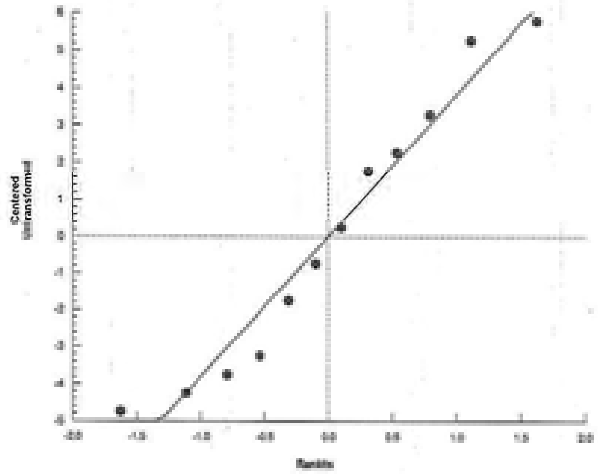
Analyst: MD QA: July 30/19

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	06-6935-3753	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.9.4
Analyzed:	03 Jul-19 17:17	**Analysis:**	Parametric-Two Sample	**Status Level:**	1

Graphics





Pseudokirchneriella subcapitata Summary Sheet

Client: Bureau Veritas Laboratories
Work Order No.: 19129 1

Start Date: June 28/19
Set up by: MG

Sample Information:

Sample ID: VU7818-1645-18B
Sample Date: June 25/19
Date Received: June 27/19
Sample Volume: 2 x 1L

Test Organism Information:

Culture Date: June 21/19
Age of culture (Day 0): 7d

Zinc Reference Toxicant Results:

Reference Toxicant ID: Sc184
Stock Solution ID: 19Jun03
Date Initiated: June 28/19

72-h IC50 (95% CL): 29.6 (26.0-33.6) ug/L Zn

72-h IC50 Reference Toxicant Mean and Range: 31.0 (25.2-38.3) ug/L Zn CV (%): 10

Test Results:

	Cell Yield (Mean± SD)
Negative Control	39.6 ± 3.8
VU7818-1645-18B (95.2%)	109.2 ± 7.7 *
	±
	±
	±
	±
	±
	±
	±

* indicates that cell yield is significantly higher than the lab control

Reviewed by: A. Tong

Date reviewed: July 30/19

72-h Algal Growth Inhibition Toxicity Test
Water Quality Measurements

Client: Burrard Ventos Laboratories Setup by: MG

Sample ID: VV7819-1645-18B Test Date/Time: June 28/19 @ 1140h

Work Order No.: 19129| CER #: 4

Test Species: *Pseudokirchneriella subcapitata*

Culture Date: June 21/19 Age of Culture: 7d Culture Health: Good

Culture Count: 1 460 2 490 Average: 475 Culture Cell Density (c1): 475 x10⁴ cells/mL

v1 = (220,000 cells/ml x 100 ml) / 475 x10⁴ cells/ml = 4.63mL
(c1)

Time Zero Counts: 1 21 2 24 Average: 22.5

No. of Cells/mL: 22.5 x10⁴ Initial Density: # cells/mL ÷ 220 µL x 10 µL = 10227 cells/mL

Concentration %(v/v)	Water Quality pH 0 h	Water Quality Temp (°C) 0 h	Incubator Temperature (°C) 0 h	24 h	48 h	72 h	Microplates rotated 2X per day? 0 h	24 h	48 h	72 h
Control	7.3	23.0	25.0	25.0	25.0	25.0	✓	✓	✓	✓
95.2.	7.6 MG	23.0	↓	↓	↓	↓	✓	✓	✓	✓
	7.5									
Initials	MG	MG	MG	~	~	MG	MG	~	~	MG

Initial control pH: Well 1: 7.3 Well 2: 7.3

Final control pH: Well 1: 7.0 Well 2: 7.0

Light intensity (lux): 4080 Date measured: June 28/19

Thermometer: 4 Light meter: 1 pH meter/probe: 1,1

Sample Description: clear, colourless, odourless, no particulates.

Comments:

Reviewed: A. Tang Date reviewed: July 30, 2019

Pseudokirchneriella subcapitata Toxicity Test Data Sheet
72-h Algal Cell Counts

Client: Bureau Veritas Lab Start Date/Time: June 28/19 @ 1140h
Work Order #: 191291 Termination Date: July 1/19 @ 1140h
Sample ID: VY7819-1645-18B Test set up by: MG
%(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control	A	4844					MG
	B	39					
	C	43					
	D	37					
	E	47					
	F	34					
	G	41					
	H	36					
95.7	A	97					
	B	112					
	C	114					
	D	110					↓
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						

Comments:

Reviewed by: A. Tang Date Reviewed: July 30, 2019

Pseudokirchneriella subcapitata Algal Counts

Client:	Bureau Veritas Laboratories	Start Date/Time:	28-Jun-19 @ 1140h
WO#:	191291	Termination Date/Time	1-Jul-19 @ 1140h
Sample ID:	VY7819-1645-18B		
		Initial Cell Density:	10227 cell/mL

225000
0.22
0.01

Concentration %(v/v)	Rep	Count 1 (x 10^4)	Count 2 (x 10^4)	Count 3 (x 10^4)	Count 4 (x 10^4)	Mean (x 10^4)	Cell Yield (x 10^4) cell/mL		10227.27
Control	A	44				44	43.0	mean	39.6
	B	39				39	38.0	SD	3.814914
	C	43				43	42.0	CV	9.633069
	D	37				37	36.0		
	E	47				47	46.0		
	F	38				38	37.0		
	G	41				41	40.0		
	H	36				36	35.0		
95.2	A	97				97	96.0		
	B	112				112	111.0		
	C	114				114	113.0		
	D	110				110	109.0		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		

Reviewed by: ____________

Date reviewed: July 30, 2019

CETIS Summary Report

EC Alga Growth Inhibition Test — Nautilus Environmental

Batch ID:	16-1445-2520	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran		
Start Date:	28 Jun-19 11:40	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients		
Ending Date:	01 Jul-19 11:40	**Species:**	Pseudokirchneriella subcapitata	**Brine:**			
Test Length:	72h	**Taxon:**	Chlorophyta	**Source:**	In-House Culture	**Age:**	7d

Sample ID:	21-1420-7830	**Code:**	7E044056	**Project:**	
Sample Date:	25 Jun-19 00:10	**Material:**	Water Sample	**Source:**	Bureau Veritas Laboratories
Receipt Date:	27 Jun-19 12:05	**CAS (PC):**		**Station:**	VY7819-1645-18B
Sample Age:	83h (2.7 °C)	**Client:**	Bureau Veritas Laboratories		

Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
04-1578-7606	Cell Yield	Equal Variance t Two-Sample Test	<1.0E-37	95.2% failed cell yield	1

Cell Yield Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	8	39.62	36.44	42.81	35	46	1.349	3.815	9.63%	0.00%
95.2		4	107.2	95.04	119.5	96	113	3.838	7.676	7.16%	-170.66%

Cell Yield Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	N	43	38	42	36	46	37	40	35
95.2		96	111	113	109				

Analyst: MT QA: July 30/19

CETIS Analytical Report

EC Alga Growth Inhibition Test — Nautilus Environmental

Analysis ID:	04-1578-7606	Endpoint:	Cell Yield	CETIS Version:	CETISv1.9.4
Analyzed:	03 Jul-19 7:01	Analysis:	Parametric-Two Sample	Status Level:	1
Batch ID:	16-1445-2520	Test Type:	Cell Growth	Analyst:	Mimi Tran
Start Date:	28 Jun-19 11:40	Protocol:	EC/EPS 1/RM/25	Diluent:	Deionized Water + nutrients
Ending Date:	01 Jul-19 11:40	Species:	Pseudokirchneriella subcapitata	Brine:	
Test Length:	72h	Taxon:	Chlorophyta	Source:	In-House Culture Age: 7d
Sample ID:	21-1420-7830	Code:	7E044056	Project:	
Sample Date:	25 Jun-19 00:10	Material:	Water Sample	Source:	Bureau Veritas Laboratories
Receipt Date:	27 Jun-19 12:05	CAS (PC):		Station:	VY7819-1645-18B
Sample Age:	83h (2.7 °C)	Client:	Bureau Veritas Laboratories		

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C < T	95.2% failed cell yield	14.79%

Equal Variance t Two-Sample Test

Control	vs	Control II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		95.2*	20.92	1.812	5.859	10	CDF	<1.0E-37	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend Test			0.2751	Non-Significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	12195	12195	1	437.7	<1.0E-37	Significant Effect
Error	278.625	27.8625	10			
Total	12473.7		11			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	4.048	10.88	0.1163	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9411	0.8025	0.5129	Normal Distribution

Cell Yield Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	8	39.62	36.44	42.81	39	35	46	1.349	9.63%	0.00%
95.2		4	107.2	95.04	119.5	110	96	113	3.838	7.16%	-170.66%

Cell Yield Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	N	43	38	42	36	46	37	40	35
95.2		96	111	113	109				

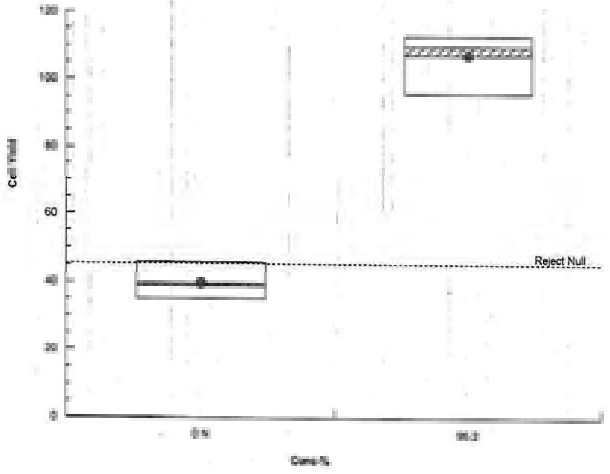
Analyst: MC QA: July 30/19

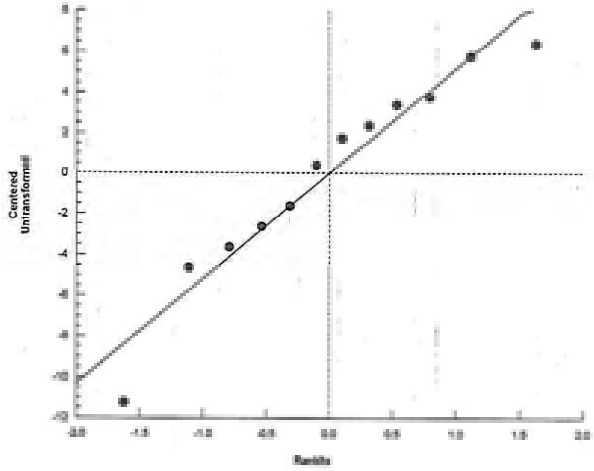
EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID:	04-1578-7606	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.9.4
Analyzed:	03 Jul-19 17:21	**Analysis:**	Parametric-Two Sample	**Status Level:**	1

Graphics





Analyst: MLT QA: July 30/19

APPENDIX B – *Ceriodaphnia dubia* Toxicity Test Data

Ceriodaphnia dubia Summary Sheet

Client: Envirosystems
Work Order No.: 191292

Start Date/Time: June 27/19 1300h
Set up by: SSK/JB

Sample Information:

Sample ID: (as received)
Sample Date: June 25/19
Date Received: June 27/19
Sample Volume: 7 x 1L

Test Validity Criteria:

1) Mean survival of first generation controls is ≥80 %
2) At least 60% of controls have produced three broods within 8 days
3) An average of ≥15 live young produced per surviving female in the control solutions during the first three broods.
4) Invalid if ephippia observed in any control solution at any time.

WQ Ranges:

T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4 ; pH = 6.0 to 8.5

Test Organism Information:

Broodstock No.: 000619(1-20)
Age of young (Day 0): <24-h (within 12-h)
Avg No. young in first 3 broods of previous 7 d: 22
Mortality (%) in previous 7 d: 0
Individual female # used ≥8 young on test day: 1-6, 8-12, 14, 16-19

NaCl Reference Toxicant Results:

Reference Toxicant ID: 0d224
Stock Solution ID: 16NaCl (100g/L NaCl)
Date Initiated: June 19/19

7-d LC50 (95% CL): 2.1 (1.5 - 3.0) g/L NaCl
7-d IC50 (95% CL): 1.9 (1.7 - 2.0) g/L NaCl

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.8-2.2) g/L NaCl CV (%): 5
7-d IC50 Reference Toxicant Mean and Historical Range: 1.5 (1.0 - 2.3) g/L NaCl CV (%): 20

Test Results:

	Survival (%)	Reproduction (Mean ± SD)
Negative Control	100	17.5 ± 2.8
VW818-1645-18	100	20.1 ± 4.6
Negative Control	90	19.4 ± 5.7
VW819-1645-18B	100	18.5 ± 4.7
		±
		±
		±
		±
		±

Reviewed by: JOU
Date reviewed: July 18/19

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Bureau Veritas
Sample ID: VM789-1645-15B
Work Order #: 191242
(%v/v)

Start Date & Time: Jun 27/19 @ 1500h
Stop Date & Time: July 3/19 @ 1400h
CER #: 4
Test Species: Ceriodaphnia dubia

Concentration: CONTROL	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.5	25.0		
DO (mg/L)	8.0	7.8	8.2	7.4	8.2	7.4	8.2	7.8	8.1	6.5	8.2	6.9		
pH	8.2	8.3	8.3	7.8	8.2	7.8	8.2	7.8	8.1	7.8	8.4	7.8		
Cond. (µS/cm)	215	214		215		216		216		217		225		
Initials	SSK	JB						JN		MD		JB		

100 % Concentration: ~~+56~~ 15	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	25.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.5	25.0		
DO (mg/L)	8.2	7.2	8.1	7.3	8.0	7.3	8.1	7.0	7.9	6.7	8.3	6.9		
pH	7.2	7.4	7.5	7.4	7.3	7.4	7.3	7.4	7.3	7.2	7.1	7.5		
Cond. (µS/cm)	500	501		492		495		492		496		486		
Initials	SSK	JB						JN		MD		JB		

Concentration: 12.5	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration: 100	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: 4 DO meter/probe: 1 / 1 pH meter/probe: 1 / 1 Conductivity meter/probe: 1 / 1

	Control	100%		
Hardness*	102 ~~100~~	154		
Alkalinity*	96	32		

* mg/L as CaCO3

Analysts: KL, JB, MWD
~~SSK~~
Reviewed by: JGH
Date reviewed: July 17/19

Sample Description: Ceriodaphnia dubia, no problems

Comments: Broodboard Used: BB061719 (1-6, 8-12, 14, 16-18)

Chronic Freshwater Toxicity Test
C. dubia Reproduction Data

Client: Bureau Veritas
Sample ID: V47894-1645-18B
Work Order: [illegible]

Start Date & Time: Jan 27/19 @ 1000h
Stop Date & Time: July 31/19 @ 1400h
Set up by: ~~YL~~/SSK/JB

°C(M/V)

SSK

Concentration: control

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	S
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
3	✓	3	4	3	5	3	3	3	3	3	A
4	7	7	✓	7	7	4	7	✓	✓	2	JW
5	✓	✓	9	✓	✓	X	✓	6	6	10	MC
6	10	11	11	11	10	1	12	12	11	12	MC
7											
8											
Total	17	21	22	21	22	4X	22	21	20	24	MC

Concentration: ~~SSK-56~~ 100

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
3	3	2	3	✓	✓	3	3	✓	3	2	A
4	✓	6	✓	4	✓	✓	8	5	6	7	JW
5	6	9	8	9	7	7	7	✓	✓	8	MC
6	11	15	13	14	12	8	13	15	9	11	MC
7											
8											
Total	20	14	24	27	19	18	18	20	18	17	MC

Concentration: 3.12

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Concentration: 6.25

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Concentration: 12.5

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Concentration: 25

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Concentration: 50

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Concentration: 100

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Concentration:

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Notes: X = mortality.

Comments: 1. Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

2. Ephippia present in Controls (Y) (N) ?

Reviewed by: JGr

Date reviewed: July 17/19

CETIS Summary Report

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Batch ID:	18-6640-7080	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Kania Lywe		
Start Date:	27 Jun-19 13:00	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**			
Ending Date:	03 Jul-19 14:00	**Species:**	Ceriodaphnia dubia	**Brine:**			
Test Length:	6d 1h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture	**Age:**	<24

Sample ID:	08-3720-8412	**Code:**	31E6C95C	**Project:**			
Sample Date:	25 Jun-19 00:10	**Material:**	Water Sample	**Source:**	Bureau Veritas Laboratories		
Receipt Date:	27 Jun-19 12:05	**CAS (PC):**		**Station:**	VY7819-1645-18B		
Sample Age:	61h (2.7 °C)	**Client:**	Bureau Veritas Laboratories				

Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
15-7117-9767	6d Survival Rate	Fisher Exact Test	1.0000	100% passed 6d survival rate	1
14-5656-3824	Reproduction	Equal Variance t Two-Sample Test	0.3525	100% passed reproduction	1

6d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	10	0.9000	0.6738	1.0000	0.0000	1.0000	0.1000	0.3162	35.14%	0.00%
100		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-11.11%

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	10	19.4	15.32	23.48	4	24	1.802	5.7	29.38%	0.00%
100		10	18.5	15.12	21.88	10	27	1.493	4.72	25.51%	4.64%

6d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	N	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	N	17	21	22	21	22	4	22	21	20	24
100		20	14	24	27	19	18	18	10	18	17

6d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	N	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

CETIS Analytical Report

Test Code/ID: 191292b / 06-2576-8471

Ceriodaphnia 7-d Survival and Reproduction Test — Nautilus Environmental

Analysis ID:	15-7117-9767	Endpoint:	6d Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	17 Jul-19 18:38	Analysis:	Single 2x2 Contingency Table	Status Level:	1
Batch ID:	18-6640-7080	Test Type:	Reproduction-Survival (7d)	Analyst:	Kania Lywe
Start Date:	27 Jun-19 13:00	Protocol:	EC/EPS 1/RM/21	Diluent:	
Ending Date:	03 Jul-19 14:00	Species:	Ceriodaphnia dubia	Brine:	
Test Length:	6d 1h	Taxon:	Branchiopoda	Source:	In-House Culture Age: <24
Sample ID:	08-3720-8412	Code:	31E6C95C	Project:	
Sample Date:	25 Jun-19 00:10	Material:	Water Sample	Source:	Bureau Veritas Laboratories
Receipt Date:	27 Jun-19 12:05	CAS (PC):		Station:	VY7819-1645-16B
Sample Age:	61h (2.7 °C)	Client:	Bureau Veritas Laboratories		

Data Transform	Alt Hyp	Comparison Result
Untransformed	C > T	100% passed 6d survival rate

Fisher Exact Test

Control	vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Negative Control		100	1.0000	Exact	1.0000	Non-Significant Effect

Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	N	9	1	10	0.9	0.1	10.0%
100		10	0	10	1	0	0.0%

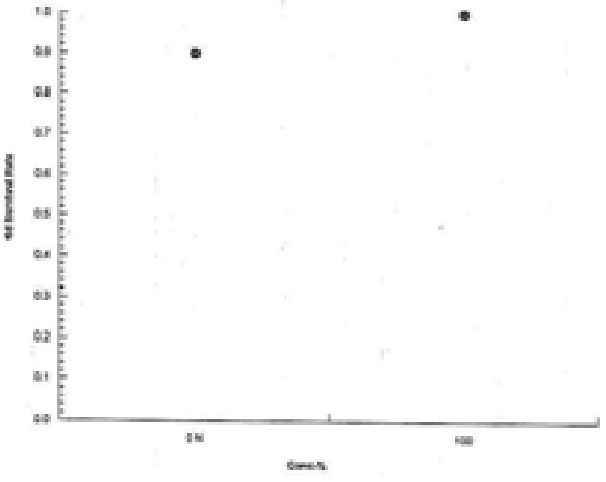
6d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	N	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

6d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	N	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Graphics



CETIS Analytical Report

Report Date: 11 Jul-19 17:26 (p 1 of 1)
Test Code/ID: 191292b / 06-2576-8471

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID:	14-5656-3824	Endpoint:	Reproduction	CETIS Version:	CETISv1.9.4
Analyzed:	11 Jul-19 17:26	Analysis:	Parametric-Two Sample	Status Level:	1
Batch ID:	18-6640-7080	Test Type:	Reproduction-Survival (7d)	Analyst:	Kania Lywe
Start Date:	27 Jun-19 13:00	Protocol:	EC/EPS 1/RM/21	Diluent:	
Ending Date:	03 Jul-19 14:00	Species:	Ceriodaphnia dubia	Brine:	
Test Length:	6d 1h	Taxon:	Branchiopoda	Source:	In-House Culture Age: <24
Sample ID:	08-3720-8412	Code:	31E6C95C	Project:	
Sample Date:	25 Jun-19 00:10	Material:	Water Sample	Source:	Bureau Veritas Laboratories
Receipt Date:	27 Jun-19 12:05	CAS (PC):		Station:	VY7819-1645-16B
Sample Age:	61h (2.7 °C)	Client:	Bureau Veritas Laboratories		

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	100% passed reproduction	20.92%

Equal Variance t Two-Sample Test

Control	vs	Conc-%	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		100	0.3846	1.734	4.058	18	CDF	0.3525	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	4.05	4.05	1	0.1479	0.7051	Non-Significant Effect
Error	492.9	27.3833	18			
Total	496.95		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	1.458	6.541	0.5831	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.8705	0.866	0.0120	Normal Distribution

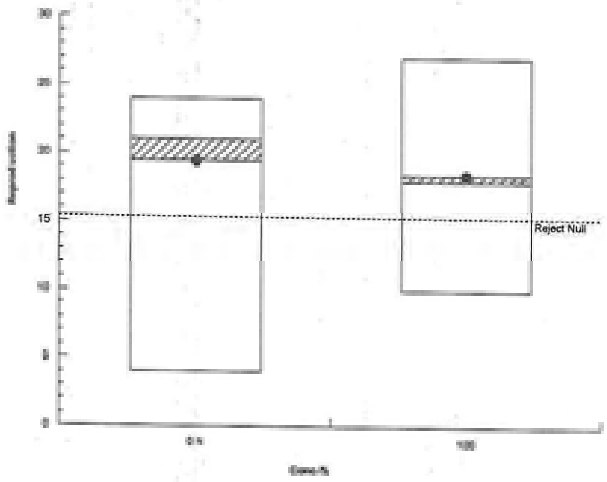
Reproduction Summary

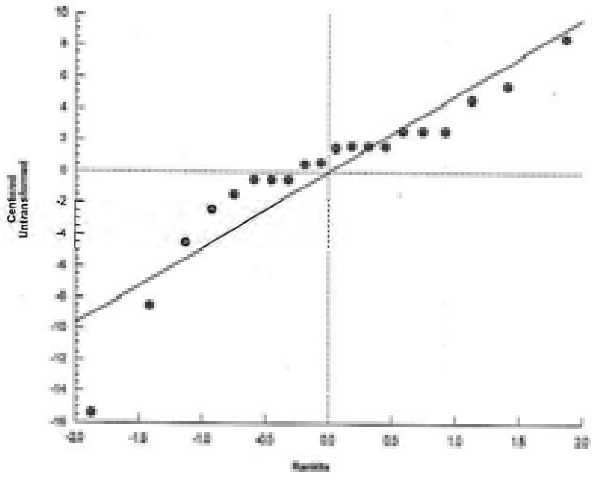
Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	10	19.4	15.32	23.48	21	4	24	1.802	29.38%	0.00%
100		10	18.5	15.12	21.88	18	10	27	1.493	25.51%	4.64%

Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	N	17	21	22	21	22	4	22	21	20	24
100		20	14	24	27	19	18	18	10	18	17

Graphics





Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Bureau Veritas
Sample ID: W781 8-1645-18
Work Order #: 191292

Start Date & Time: Jun 07/19 @ Noon
Stop Date & Time: July 3/19 @ 1400h
CER #: 4
Test Species: Ceriodaphnia dubia

(%v/v)

Concentration CONTROL	Day 0 init.	Day 1 old	Day 1 new	Day 2 old	Day 2 new	Day 3 old	Day 3 new	Day 4 old	Day 4 new	Day 5 old	Day 5 new	Day 6 old	Day 6 new	Day 7 final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.5	25.0		
DO (mg/L)	8.0	6.8	8.2	7.4	8.2	7.4	8.2	7.0	8.1	6.5	8.2	6.9		
pH	8.2	8.0	8.3	7.8	8.2	7.9	8.2	7.8	8.1	7.3	8.4	7.8		
Cond. (µS/cm)	215	215		215		216		215		217		215		
Initials	SSK	JB		[illegible]		[illegible]		JW		MLT		JB		

Concentration 100% (~~156~~ JB)	Day 0 init.	Day 1 old	Day 1 new	Day 2 old	Day 2 new	Day 3 old	Day 3 new	Day 4 old	Day 4 new	Day 5 old	Day 5 new	Day 6 old	Day 6 new	Day 7 final
Temperature (°C)	25.0	25.0	24.0	25.0	24.0	25.0	24.0	24.5	24.0	25.0	24.0	25.0		
DO (mg/L)	8.2	7.2	8.1	7.8	8.0	7.4	8.0	6.9	8.0	6.7	8.3	6.0		
pH	7.2	7.4	7.6	7.3	7.2	7.4	7.3	7.5	7.2	7.3	7.2	7.4		
Cond. (µS/cm)	500	500		490		491		491		497		497		
Initials	SSK	JB		[illegible]		[illegible]		JW		MLT		JB		

Concentration 18.5	Day 0 init.	Day 1 old	Day 1 new	Day 2 old	Day 2 new	Day 3 old	Day 3 new	Day 4 old	Day 4 new	Day 5 old	Day 5 new	Day 6 old	Day 6 new	Day 7 final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration 100	Day 0 init.	Day 1 old	Day 1 new	Day 2 old	Day 2 new	Day 3 old	Day 3 new	Day 4 old	Day 4 new	Day 5 old	Day 5 new	Day 6 old	Day 6 new	Day 7 final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: 4 DO meter/probe: 1 / 1 pH meter/probe: 1 / 1 Conductivity meter/probe: 1 / 1

	Control	100%		
Hardness*	~~100~~ 102	158		
Alkalinity*	96	54		

* mg/L as CaCO3

Analysts: ~~KL~~, JB, AWD, SSK, JW, MLT
Reviewed by: [illegible]
Date reviewed: July 17/19

Sample Description: clear, colourless, odourless, no particulates.

Comments: Broodboard Used: BBD61719 (1-6, 8-12, 14, 16-18)

Chronic Freshwater Toxicity Test
C. dubia Reproduction Data

Client: Bureau Veritas
Sample ID: VM788-1645-1B
Work Order: 191292

Start Date & Time: Jun 27/19 @ 1300h
Stop Date & Time: July 3/19 @ 1400h
Set up by: KL/SSK/JB

%(v/v)

Concentration: Control

Days	A	B	C	D	E	F	G	H	I	J	Init
1	/	/	/	/	/	/	/	/	/	/	S
2	/	/	/	/	/	/ 3XM	/	/	/	/	0
3	3	3	✓	2	3	[illegible]	3	4	3	3	/
4	7	6	2	5	✓	6	✓	✓	[illegible]	✓	JW
5	✓	✓	7	✓	6	✓	6	4	✓	✓	MG
6	9	8	10	9	10	11	9	13	10	10	MG
7											
8								21			
Total	19	17	19	16	19	20	18	14	13	13	MG

Concentration: ~~1.56~~ 100%

Days	A	B	C	D	E	F	G	H	I	J	Init
1	/	/	/	/	/	/	/	/	/	/	
2	/	/	/	/	/	/	/	/	/	/	0
3	/	/	4	/	3	3	3	3	3	3	/
4	5	4	5	4	8	✓	5	5	✓	6	JW
5	8	8	9	9	✓	5	✓	7	6	✓	MG
6	16	14	13	12	12	9	8	12	8	10	MG
7											
8											
Total	29	26	18	21	23	17	16	15	17	19	MG

Concentration: 3.12

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

SSK

Concentration: 6.25

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Concentration: 12.5

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Concentration: 25

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Concentration: 50

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Concentration: 100

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Concentration:

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Notes: X = mortality.

Comments:
1. Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.
2. Ephippia present in Controls (Y) (N) ?

Reviewed by: JGh

Date reviewed: July 17/19

CETIS Summary Report

Test Code/ID: 191292a / 02-8345-8739

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Batch ID:	15-1560-5987	Test Type:	Reproduction-Survival (7d)	Analyst:	Kania Lywe
Start Date:	27 Jun-19 13:00	Protocol:	EC/EPS 1/RM/21	Diluent:	
Ending Date:	03 Jul-19 14:00	Species:	Ceriodaphnia dubia	Brine:	
Test Length:	6d 1h	Taxon:	Branchiopoda	Source:	In-House Culture Age: <24
Sample ID:	09-8732-8648	Code:	3AD97088	Project:	
Sample Date:	25 Jun-19 00:18	Material:	Water Sample	Source:	Bureau Veritas Laboratories
Receipt Date:	27 Jun-19 12:05	CAS (PC):		Station:	VY7818-1645-18
Sample Age:	61h (3.6 °C)	Client:	Bureau Veritas Laboratories		

Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	$
02-7458-4694	6d Survival Rate	Fisher Exact Test	1.0000	100% passed 6d survival rate	1
08-0577-6558	Reproduction	Equal Variance t Two-Sample Test	0.9285	100% passed reproduction	1

6d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	10	17.5	15.53	19.47	13	21	0.8724	2.759	15.76%	0.00%
100		10	20.1	18.81	23.39	15	29	1.456	4.606	22.91%	-14.86%

6d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	N	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	N	19	17	19	16	19	20	18	21	13	13
100		29	26	18	21	23	17	16	15	17	19

6d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	N	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Analyst: KL QA: July 17/19

CETIS Analytical Report

Test Code/ID: 191292a / 02-8345-8739

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID:	02-7458-4694	Endpoint:	6d Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	11 Jul-19 17:22	Analysis:	Single 2x2 Contingency Table	Status Level:	1
Batch ID:	15-1560-5987	Test Type:	Reproduction-Survival (7d)	Analyst:	Kania Lywe
Start Date:	27 Jun-19 13:00	Protocol:	EC/EPS 1/RM/21	Diluent:	
Ending Date:	03 Jul-19 14:00	Species:	Ceriodaphnia dubia	Brine:	
Test Length:	6d 1h	Taxon:	Branchiopoda	Source:	In-House Culture Age: <24
Sample ID:	09-8732-8648	Code:	3AD97088	Project:	
Sample Date:	25 Jun-19 00:18	Material:	Water Sample	Source:	Bureau Veritas Laboratories
Receipt Date:	27 Jun-19 12:05	CAS (PC):		Station:	VY7818-1645-18
Sample Age:	61h (3.6 °C)	Client:	Bureau Veritas Laboratories		

Data Transform	Alt Hyp	Comparison Result
Untransformed	C > T	100% passed 6d survival rate

Fisher Exact Test

Control	vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Negative Control		100	1.0000	Exact	1.0000	Non-Significant Effect

Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	N	10	0	10	1	0	0.0%
100		10	0	10	1	0	0.0%

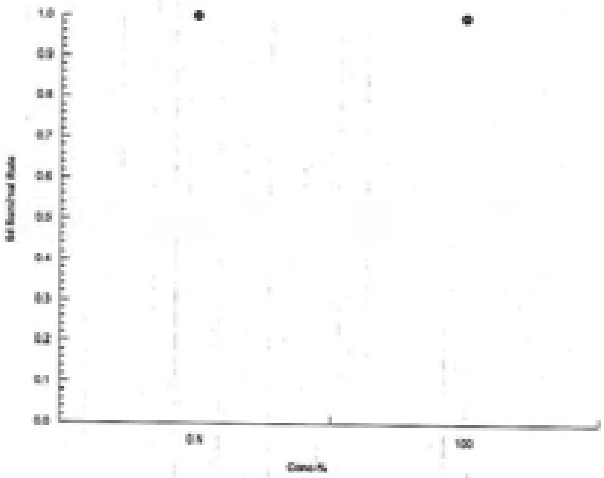
6d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	N	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

6d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	N	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Graphics



CETIS Analytical Report

Report Date: 11 Jul-19 17:22 (p 1 of 1)
Test Code/ID: 191292a / 02-8345-8739

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID:	08-0577-6558	Endpoint:	Reproduction	CETIS Version:	CETISv1.9.4
Analyzed:	11 Jul-19 17:22	Analysis:	Parametric-Two Sample	Status Level:	1
Batch ID:	15-1560-5987	Test Type:	Reproduction-Survival (7d)	Analyst:	Kania Lywe
Start Date:	27 Jun-19 13:00	Protocol:	EC/EPS 1/RM/21	Diluent:	
Ending Date:	03 Jul-19 14:00	Species:	Ceriodaphnia dubia	Brine:	
Test Length:	6d 1h	Taxon:	Branchiopoda	Source:	In-House Culture Age: <24
Sample ID:	09-8732-8648	Code:	3AD97088	Project:	
Sample Date:	25 Jun-19 00:18	Material:	Water Sample	Source:	Bureau Veritas Laboratories
Receipt Date:	27 Jun-19 12:05	CAS (PC):		Station:	VY7818-1645-18
Sample Age:	61h (3.6 °C)	Client:	Bureau Veritas Laboratories		

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	100% passed reproduction	16.82%

Equal Variance t Two-Sample Test

Control	vs	Conc-%	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		100	-1.531	1.734	2.944	18	CDF	0.9285	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	33.8	33.8	1	2.345	0.1430	Non-Significant Effect
Error	259.4	14.4111	18			
Total	293.2		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	2.787	6.541	0.1428	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9519	0.866	0.3961	Normal Distribution

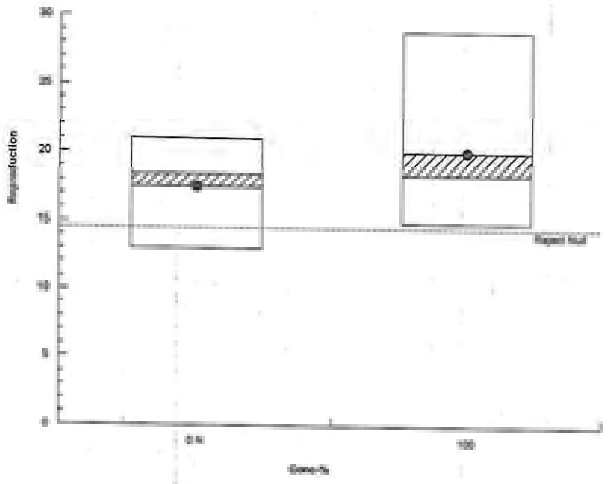
Reproduction Summary

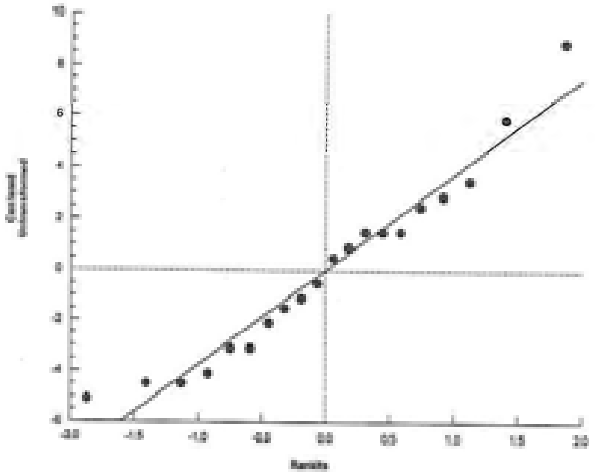
Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	10	17.5	15.53	19.47	18.5	13	21	0.8724	15.76%	0.00%
100		10	20.1	16.81	23.39	18.5	15	29	1.456	22.91%	-14.86%

Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	N	19	17	19	16	19	20	18	21	13	13
100		29	26	18	21	23	17	16	15	17	19

Graphics





APPENDIX C – *Oncorhynchus mykiss* Toxicity Test Data

Rainbow Trout Early Life Stage Summary Sheet

Client: Bureau Veritas Start Date/Time: June 27, 2019 @ 1245h

Work Order No.: 191293 Test Species: *Oncorhynchus mykiss*

Sample Information:

Sample ID: VV7818-1645-18
Sample Date: June 25, 2019
Date Received: June 27, 2019
Sample Volume: 4x10L

Dilution Water:

Type: Dechlorinated Tap Water
Hardness (mg/L $CaCO_3$): 6
Alkalinity (mg/L $CaCO_3$): 8

Test Organism Information:

Batch No.: 062619
Source: Trout Lodge, Sumner, WA
Loading Density: c.66 g/L

Number of male broodstock used: 3
Number of female broodstock used: 4
Sperm motility check: Verification of sperm motility using a compound microscope

SDS Reference Toxicant Results:

Reference Toxicant ID: RTE40(TL)
Stock Solution ID: 19501
Date Initiated: June 27 2019
7-d EC50 (95% CL): 4.1 (3.9-4.4) mg/L SDS

Reference Toxicant Mean and Range: 3.8 (2.3-6.0) mg/L SDS
Reference Toxicant CV (%): 29

Test Results: Embryo viability (Day 4) (mean ± 2SD)

	Sample ID		
	Control	VV7818-1645-18	
EC25 % (v/v) (95% CL)	74.4 ± 9.8	67.5 ± 5.0	/
EC50 % (v/v) (95% CL)	—	—	/

Reviewed by: JH Date reviewed: July 16/19

7-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Burau Veritas
Sample ID: VY7818-1645-18
Work Order #: 191293

Start Date & Time: June 27, 2019 @ 1245h
Stop Date & Time: July 4, 2019 @ 1115h
CER #: 3
Test Species: *Oncorhynchus mykiss*

Control (% v/v) Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.2	14.0	13.5	14.0	13.5	14.2	13.6	14.0	13.5	14.0	13.5	14.0	13.5	14.0
DO (mg/L)	10.2	10.2	10.3	10.2	9.9	10.1	10.1	10.0	10.2	10.1	10.2	10.2	10.1	10.1
pH	6.9	7.0	6.9	6.9	7.1	6.9	6.9	6.9	6.8	7.0	7.0	7.1	7.1	7.1
Cond. (µS/cm)	33	28		28		28		28		28		28		29
Initials		MW						MW		MW		MW		MW

100 Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	13.3	14.0	13.5	14.0	13.5	14.0	13.5	14.0	13.5	14.0	13.5	14.0	13.5	14.0
DO (mg/L)	10.3	10.1	10.2	10.1	9.8	10.0	10.1	9.9	10.1	9.8	10.1	10.0	10.1	10.2
pH	6.9	7.2	7.4	7.0	7.0	7.0	7.5	6.9	7.5	6.8	7.3	6.8	7.3	7.4
Cond. (µS/cm)	480	480		483		487		487		495		486		489
Initials		MW		MW				MW		MW		MW		MW

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: 1584 DO meter/probe: 3 / 3 pH meter/probe: 3 / 3 Conductivity meter/probe: 3 / 3

	Control	100%		
Hardness*	6	158		
Alkalinity*	8	34		

* mg/L as CaCO3

Analysts: AWD, MW
Reviewed by: JBL
Date reviewed: July 16/19

Sample Description: clear, no colour, no odour, no particulates

Comments:

Embryo Toxicity Test
Daily Mortality

Client: Bureau Veritas
Sample ID: VY7318-1645-18
Work Order #: 191293

Start Date & Time: June 27, 2019 @1245h
Stop Date & Time: July 4, 2019 @ 1115h
Test Species: *Oncorhynchus mykiss*

Concentration (% v/v)	Rep	Day of Test - No. of Mortalities							Total Dead Eggs	Total Undeveloped	Total No. Embryo	Total Exposed
		1	2	3	4	5	6	7				
Control	1	0	0	0	0	1	5	2	8	1	22	31
	2					0	2	1	3	4	23	30
	3					2	2	0	4	7	19	30
	4				↓	0	1	3	4	0	26	30
100	1				1	5	1	3	10	2	18	30
	2				0	1	0	0	1	8	21	~~29~~ 30
	3				2	1	1	0	4	5	21	30
	4	↓	↓	↓	0	0	2	2	4	5	21	30
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
Tech Initials		UM	UM	A	UM	UM	UM	UM	UM	UM	UM	UM

Comments:

Reviewed by: JH

Date reviewed: July 16/19

Salmonid Embryo Survival and Development Test — Nautilus Environmental

Batch ID:	02-1260-0826	Test Type:	Development	Analyst:	Yvonne Lam		
Start Date:	27 Jun-19 12:45	Protocol:	EC/EPS 1/RM/28	Diluent:	Dechlorinated Tap Water		
Ending Date:	04 Jul-19 11:15	Species:	Oncorhynchus mykiss	Brine:			
Test Length:	6d 22h	Taxon:	Actinopterygii	Source:	Trout Lodge Fish Farm	Age:	
Sample ID:	09-8732-8648	Code:	3AD97088	Project:			
Sample Date:	25 Jun-19 00:18	Material:	Water Sample	Source:	Bureau Veritas Laboratories		
Receipt Date:	27 Jun-19 12:05	CAS (PC):		Station:	VY7818-1645-18		
Sample Age:	60h (3.6 °C)	Client:	Bureau Veritas Laboratories				

Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
21-1488-3114	Proportion Normal	Equal Variance t Two-Sample Test	0.1250	100% passed proportion normal	1

Proportion Normal Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	4	0.7441	0.5877	0.9005	0.6333	0.8667	0.0492	0.0983	13.21%	0.00%
100		4	0.6750	0.5954	0.7546	0.6000	0.7000	0.0250	0.0500	7.41%	9.28%

Proportion Normal Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	0.7097	0.7667	0.6333	0.8667
100		0.6000	0.7000	0.7000	0.7000

Proportion Normal Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	22/31	23/30	19/30	26/30
100		18/30	21/30	21/30	21/30

Analyst: VM QA: July 16/19

Salmonid Embryo Survival and Development Test — Nautilus Environmental

Analysis ID:	21-1488-3114	Endpoint:	Proportion Normal	CETIS Version:	CETISv1.9.4
Analyzed:	12 Jul-19 17:37	Analysis:	Parametric-Two Sample	Status Level:	1
Batch ID:	02-1260-0826	Test Type:	Development	Analyst:	Yvonne Lam
Start Date:	27 Jun-19 12:45	Protocol:	EC/EPS 1/RM/28	Diluent:	Dechlorinated Tap Water
Ending Date:	04 Jul-19 11:15	Species:	Oncorhynchus mykiss	Brine:	
Test Length:	6d 22h	Taxon:	Actinopterygii	Source:	Trout Lodge Fish Farm Age:
Sample ID:	09-8732-8648	Code:	3AD97088	Project:	
Sample Date:	25 Jun-19 00:18	Material:	Water Sample	Source:	Bureau Veritas Laboratories
Receipt Date:	27 Jun-19 12:05	CAS (PC):		Station:	VY7818-1645-18
Sample Age:	60h (3.6 °C)	Client:	Bureau Veritas Laboratories		

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	100% passed proportion normal	14.68%

Equal Variance t Two-Sample Test

Control	vs	Conc-%	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		100	1.273	1.943	0.125	6	CDF	0.1250	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	1.795	2.127	0.3341	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0133052	0.0133052	1	1.621	0.2501	Non-Significant Effect
Error	0.0492508	0.0082085	6			
Total	0.0625559		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	4.947	47.47	0.2219	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9245	0.6451	0.4678	Normal Distribution

Proportion Normal Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	4	0.7441	0.5877	0.9005	0.7382	0.6333	0.8667	0.0492	13.21%	0.00%
100		4	0.6750	0.5954	0.7546	0.7000	0.6000	0.7000	0.0250	7.41%	9.28%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	4	1.046	0.8605	1.232	1.034	0.9204	1.197	0.05843	11.17%	0.00%
100		4	0.9649	0.8813	1.048	0.9912	0.8861	0.9912	0.02627	5.45%	7.79%

Proportion Normal Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	0.7097	0.7667	0.6333	0.8667
100		0.6000	0.7000	0.7000	0.7000

Angular (Corrected) Transformed Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	1.002	1.067	0.9204	1.197
100		0.8861	0.9912	0.9912	0.9912

Proportion Normal Binomials

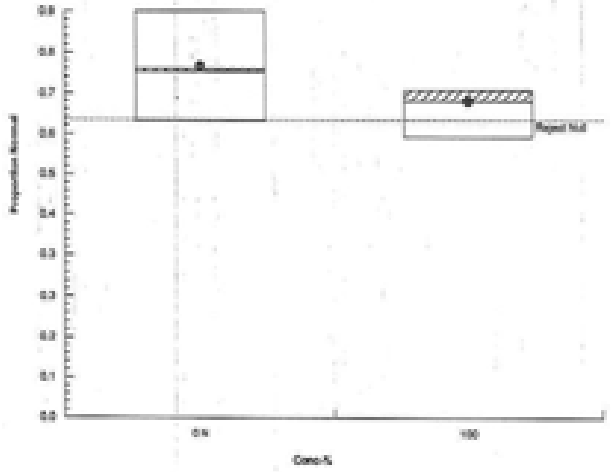
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	22/31	23/30	19/30	26/30
100		18/30	21/30	21/30	21/30

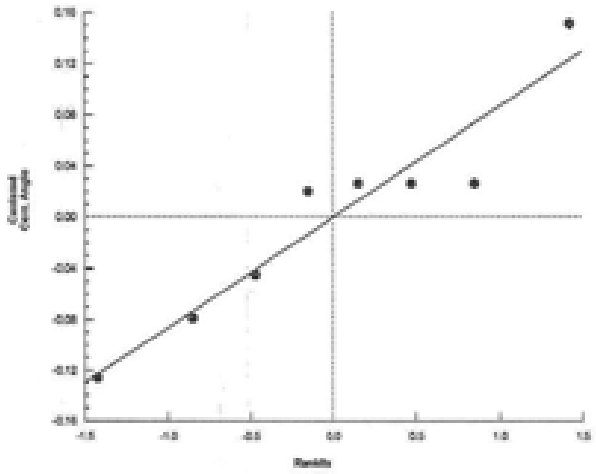
Analyst: YL QA: JCL July 16/19

Salmonid Embryo Survival and Development Test — Nautilus Environmental

Analysis ID:	21-1488-3114	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.9.4
Analyzed:	12 Jul-19 17:37	**Analysis:**	Parametric-Two Sample	**Status Level:**	1

Graphics





Analyst: [signature] QA: [signature] July 16/19

Rainbow Trout Early Life Stage Summary Sheet

Client: Bureau Veritas Start Date/Time: June 27, 2019 @ 1245h

Work Order No.: 191293 Test Species: *Oncorhynchus mykiss*

Sample Information:

Sample ID: VY7819-1645-1BB
Sample Date: June 25, 2019
Date Received: June 27, 2019
Sample Volume: 4 x 10L

Dilution Water:

Type: Dechlorinated Tap Water
Hardness (mg/L $CaCO_3$): 6
Alkalinity (mg/L $CaCO_3$): 8

Test Organism Information:

Batch No.: 062619
Source: Trout Lodge, Sumas, WA
Loading Density: 0.66 g/L

Number of male broodstock used: 3
Number of female broodstock used: 4
Sperm motility check: Verification of sperm motility using a compound microscope

SDS Reference Toxicant Results:

Reference Toxicant ID: RTE40(TL)
Stock Solution ID: 19501
Date Initiated: June 27, 2018
7-d EC50 (95% CL): 4.1 (3.9 - 4.4) mg/L SDS

Reference Toxicant Mean and Range: 3.8 (2.3 - 6.0) mg/L SDS
Reference Toxicant CV (%): 24

Test Results: Embryo viability (%-v/v) (mean ± 2SD)

	Sample ID		
	Control	VY7819-1645-1BB	
EC25 % (v/v) (95% CL)	74.7 ± 9.0	89.7 ± 4.2	/
~~EC50 %~~ (v/v) (95% CL)	-	-	/

TK

Reviewed by: JBe Date reviewed: July 16/19

7-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Bureau Veritas
Sample ID: VY7819-1645-18B
Work Order #: 191293

Start Date & Time: June 27, 2019 @ 1245h
Stop Date & Time: July 4, 2019 @ 1115h
CER #: 3
Test Species: *Oncorhynchus mykiss*

Control Concentration (% v/v)	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.0	14.0	13.5	14.0	13.5	14.0	13.5	14.0	13.5	14.0	13.5	14.0	13.5	14.0
DO (mg/L)	10.3	10.2	10.3	10.2	9.9	10.1	10.0	10.0	10.1	12.1	12.0	10.2	10.1	10.2
pH	6.9	7.0	6.9	6.9	7.1	6.9	6.8	6.9	6.8	7.0	7.1	7.1	7.0	7.1
Cond. (µS/cm)	33	28		28		28		28		28		28		30
Initials	[illegible]	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]

100 Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	13.5	14.0	13.5	14.0	13.5	14.0	13.5	14.0	13.5	14.0	13.5	14.0	13.5	14.0
DO (mg/L)	10.3	10.1	10.2	10.1	9.9	10.0	10.1	10.0	10.1	9.9	10.1	9.9	10.1	10.2
pH	6.9	7.1	7.4	7.0	7.0	7.0	7.5	6.9	7.5	6.8	7.3	6.9	7.3	7.4
Cond. (µS/cm)	483	486		486		491		490		488		488		4890
Initials	[illegible]	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: [illegible] DO meter/probe: 3 / 3 pH meter/probe: 3 / 3 Conductivity meter/probe: 3 / 3

	Control	100%		
Hardness*	6	154		
Alkalinity*	154	32		

* mg/L as $CaCO_3$

Analysts: AWD, MC
Reviewed by: [illegible]
Date reviewed: July 16/19

Sample Description: clear, no colour, no odours, no particulates

Comments:

Embryo Toxicity Test
Daily Mortality

Client: Bureau Veritas
Sample ID: VY7819-1645-18B
Work Order #: 191293

Start Date & Time: June 27, 2019 @ 1245h
Stop Date & Time: July 4, 2019 @ 1115h
Test Species: *Oncorhynchus mykiss*

Concentration (% v/v)	Rep	Day of Test - No. of Mortalities 1	2	3	4	5	6	7	Total Dead Eggs	Total Undeveloped	Total No. Embryo	Total Exposed
Control	1	0	0	0	0	3	4	3	10	2	18	30
	2					1	0	0	1	5	243	~~30~~ 29
	3					1	0	0	1	9	20	30
	4					0	2	3	5	2	23	3~~1~~0
100	1					1	2	1	4	2	24	30
	2					3	0	0	3	3	23	29
	3					1	0	0	1	6	23	30
	4					1	0	2	3	1	26	30
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
Tech Initials												

Comments:

Reviewed by: JCh

Date reviewed: July 16/19

Version 1.0 Issued June 26, 2006

CETIS Summary Report

Salmonid Embryo Survival and Development Test — **Nautilus Environmental**

Batch ID:	07-2052-4791	**Test Type:**	Development	**Analyst:**	Yvonne Lam		
Start Date:	27 Jun-19 12:45	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water		
Ending Date:	04 Jul-19 11:15	**Species:**	Oncorhynchus mykiss	**Brine:**			
Test Length:	6d 22h	**Taxon:**	Actinopterygii	**Source:**	Trout Lodge Fish Farm	**Age:**	
Sample ID:	08-3720-8412	**Code:**	31E6C95C	**Project:**			
Sample Date:	25 Jun-19 00:10	**Material:**	Water Sample	**Source:**	Bureau Veritas Laboratories		
Receipt Date:	27 Jun-19 12:05	**CAS (PC):**		**Station:**	VY7819-1645-18B		
Sample Age:	61h (2.7 °C)	**Client:**	Bureau Veritas Laboratories				

Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
10-5310-7670	Proportion Normal	Equal Variance t Two-Sample Test	0.9564	100% passed proportion normal	1

Proportion Normal Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	4	0.7066	0.5641	0.8491	0.6000	0.7931	0.0448	0.0895	12.67%	0.00%
100		4	0.8066	0.7389	0.8743	0.7667	0.8667	0.0213	0.0425	5.27%	-14.15%

Proportion Normal Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	0.6000	0.7931	0.6667	0.7667
100		0.8000	0.7931	0.7667	0.8667

Proportion Normal Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	18/30	23/29	20/30	23/30
100		24/30	23/29	23/30	26/30

Analyst: ____ QA: July 16/19

Salmonid Embryo Survival and Development Test — Nautilus Environmental

Analysis ID:	10-5310-7670	Endpoint:	Proportion Normal	CETIS Version:	CETISv1.9.4
Analyzed:	12 Jul-19 17:37	Analysis:	Parametric-Two Sample	Status Level:	1
Batch ID:	07-2052-4791	Test Type:	Development	Analyst:	Yvonne Lam
Start Date:	27 Jun-19 12:45	Protocol:	EC/EPS 1/RM/28	Diluent:	Dechlorinated Tap Water
Ending Date:	04 Jul-19 11:15	Species:	Oncorhynchus mykiss	Brine:	
Test Length:	6d 22h	Taxon:	Actinopterygii	Source:	Trout Lodge Fish Farm Age:
Sample ID:	08-3720-8412	Code:	31E6C95C	Project:	
Sample Date:	25 Jun-19 00:10	Material:	Water Sample	Source:	Bureau Veritas Laboratories
Receipt Date:	27 Jun-19 12:05	CAS (PC):		Station:	VY7819-1645-18B
Sample Age:	61h (2.7 °C)	Client:	Bureau Veritas Laboratories		

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	100% passed proportion normal	14.32%

Equal Variance t Two-Sample Test

Control	vs	Conc-%	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		100	-2.043	1.943	0.110	6	CDF	0.9564	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	1.559	2.127	0.7540	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0267683	0.0267683	1	4.172	0.0871	Non-Significant Effect
Error	0.0384968	0.0064161	6			
Total	0.0652651		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	3.109	47.47	0.3765	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9356	0.6451	0.5688	Normal Distribution

Proportion Normal Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	4	0.7666	0.5641	0.8491	0.7167	0.6000	0.7931	0.0448	12.67%	0.00%
100		4	0.8666	0.7389	0.8743	0.7966	0.7667	0.8667	0.0213	5.27%	-14.15%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	4	1.002	0.8449	1.158	1.011	0.8861	1.099	0.04927	9.84%	0.00%
100		4	1.117	1.028	1.206	1.103	1.067	1.197	0.02794	5.00%	-11.55%

Proportion Normal Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	0.6000	0.7931	0.8667	0.7667
100		0.8000	0.7931	0.7667	0.8667

Angular (Corrected) Transformed Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	0.8861	1.099	0.9553	1.067
100		1.107	1.099	1.067	1.197

Proportion Normal Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	18/30	23/29	20/30	23/30
100		24/30	23/29	23/30	26/30

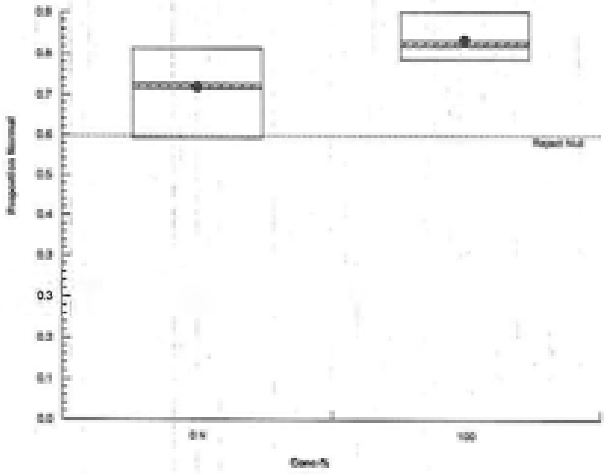
Analyst: YVL QA: JGL July 16/19

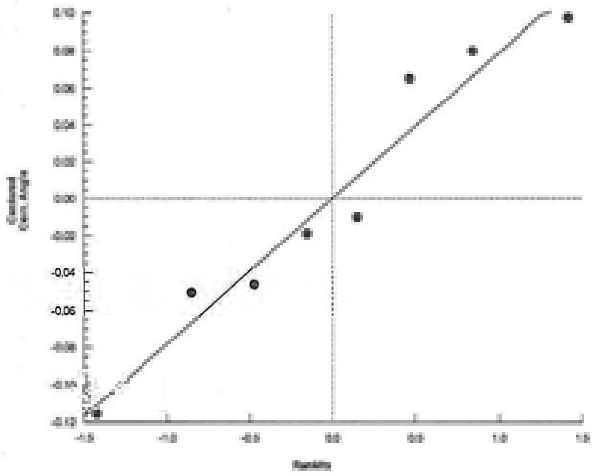
Salmonid Embryo Survival and Development Test

Nautilus Environmental

Analysis ID:	10-5310-7670	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.9.4
Analyzed:	12 Jul-19 17:37	**Analysis:**	Parametric-Two Sample	**Status Level:**	1

Graphics





Analyst: _____ QA: _____ 7/16/19

APPENDIX D – Chain-of-Custody Form

Sent To: **Nautilus Environmental**
8664 Commerce Court
Burnaby, BC, V5A 4N7
Tel: (604) 420-8773

CHAIN OF CUSTODY RECORD FOR SUBCONTRACTED WORK

COC # B950328-ENAU-01-01

REPORT INFORMATION	
Company:	Bureau Veritas Laboratories
Address:	9331 - 48th Street, Edmonton, Alberta, T6B 2R4
Contact Name:	Geraldlyn Gouthro
Email:	GGouthro@bvlabs.com, customerservice@bvlabs.com
Phone:	(403) 735-2230
BV Labs Project #:	B950328

#	SAMPLE ID	MATRIX	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	SAMPLER INITIALS	# CONT.	ANALYSIS REQUESTED: PEI Algae (100 %) 2 wk	Ceriodaphnia (100%) Screen Test SubC 7 wk	Rainbow Trout 7 Day Embryo Subcontract (100 %) 4 wk							Temp °C	ADDITIONAL SAMPLE INFORMATION
1	VY7818-1645-1B ①	GRAB	2019/06/25	00:18	AH	13	X	X	X							3.6	(P: 03, 12, 13)
2	VY7819-1645-1BB ①	GRAB	2019/06/25	00:10	AH	13	X	X	X							2.7	(P: 03, 12, 13)
3																	
4																	
5																	
6																	
7																	
8							19 12 91	19 12 92	19 12 93								
9																	
10																	

REGULATORY CRITERIA

SPECIAL INSTRUCTIONS

Please inform BV Labs immediately if you are not accredited for the requested test(s).
Please return a copy of this form with the report.
① Sample desc - clear, no colour, no odour, no particulates

TURNAROUND TIME

☐ Rush Required

2019/07/30

Date Required

Please inform us if rush charges will be incurred.

COOLER ID:	YES	NO	Temp: (°C)			
Custody Seal Present						
Custody Seal Intact						
Cooling Media Present						

COOLER ID:	YES	NO	Temp: (°C)			
Custody Seal Present						
Custody Seal Intact						
Cooling Media Present						

COOLER ID:	YES	NO	Temp: (°C)			
Custody Seal Present						
Custody Seal Intact						
Cooling Media Present						

RELINQUISHED BY: (SIGN & PRINT)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (SIGN & PRINT)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
1. David Tidman	2019/06/25	17:36	1. Tyana Hamilton	June 27/19	12:05
2.			2.		

END OF REPORT

RESULTS OF *DAPHNIA MAGNA* SINGLE CONCENTRATION-100%

Client : 4388 DIAVIK DIAMOND MINES INC., YELLOWKNIFE Job Number: B950328

Client Project Name & Number: Quarterly Tox SNP-A Sample Number: VY7819-01

Test Result:

48 hrs Mortality % 0 Statistical Method:

Mean percent mortality: Sample 0 Control 0

Sample Name : 1645-18B Sample Matrix : Water

Description: Clear, colourless Sample Prior to Analysis:

Sample Collected: Jun 25, 2019 12:10 AM Sampling Method : N/A pH: 6.9

Sample Collected By: AH Site Collection: N/A Temperature : 20 °C

Sample Received: Jun 25, 2019 01:41 PM Volume Received: 1 L Dissolved Oxygen: 9.9 mg/L

Analysis Start : Jun 27, 2019 01:38 PM Temp.Upon Arrival: 7 °C Sample Conductance: 434 µS/cm

End : Jun 29, 2019 02:21 PM Storage: 2-6°C Hardness: 100 mg $CaCO_3$/L

Concentration	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Immobility (#)	Immobility (%)	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)
% vol/vol	Start	Start	Start	Start	24 hrs	24 hrs	24 hrs	24 hrs	48 hrs	48 hr	48 hrs	48 hrs
0	21	8.1	358	8.1	0	0	0	0	20	8.1	339	8.2
0	21	8.1	358	8.1	0	0	0	0	20	8.1	341	8.3
0	21	8.0	358	8.1	0	0	0	0	20	8.1	340	8.3
100	20	7.0	454	9.9	0	0	0	0	20	7.6	428	8.2
100	20	6.9	454	9.9	0	0	0	0	20	7.6	429	8.3
100	20	6.9	454	9.9	0	0	0	0	20	7.6	429	8.3

Concentration	Mortality (#)	Mortality (%)	Immobility (#)	Immobility (%)
% vol/vol	48 hrs	48 hrs	48 hrs	48 hrs
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
100	0	0	0	0
100	0	0	0	0
100	0	0	0	0

Comments : None

Culture/Control/Dilution Water: City of Edmonton dechlorinated tap water

Hardness: 160 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,0,0,100,100,100 (% vol/vol)

Organisms per Vessel :	10	Pre-aeration Time :	30 min	Rate of Pre-aeration :	25-50 mL/min/L
Total # of Organisms Used :	60	Test Temperature :	20 ± 2 °C	Test Hardness Adjusted :	No
Test Volume :	150 mL	Vessel Volume :	225 mL	Test pH Adjusted:	No
Loading Density :	15.0 mL/Daphnia	Photoperiod :	16:8 (light: dark)		

Test Organism : *Daphnia magna* Source : In House Culture

Age at Test Initiation :	<24 hrs	Average Brood Size :	21.6
Culture Photoperiod :	16:8 (light: dark)	% Mortality within 7 days :	6.3
Culture Temperature :	20 ± 2 °C	Time To First Brood :	8 Days

Culture Diet: Pseudokirchnriella and YTC at a ratio of 2 mL/L of culture daily. New cultures weekly, 63 daphnids distributed into 6 culture vessels and 3 reproductive vessels.

RESULTS OF *DAPHNIA MAGNA* SINGLE CONCENTRATION-100%

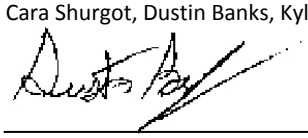
Client :	4388	DIAVIK DIAMOND MINES INC., YELLOWKNIFE	Job Number:	B950328
Client Project Name & Number:		Quarterly Tox SNP-A	Sample Number:	VY7819-01

Reference chemical:	Sodium Chloride	Test Date:	Jun 25, 2019
Test Endpoint 48 hrs LC50 (95% confidence interval) :	5.26 (4.69, 5.91)g/L	Statistical Method :	Untrimmed Spearman-Kärber
Historical Mean LC50 (warning limits) :	5.99 (4.39, 8.18) g/L	Concentration :	0,1.71,2.56,3.82,5.7,8.5 g/L

Test Method	EPS 1/RM/14
Method Deviations:	None

Note: The results contained in this report refer only to the testing of the sample submitted. This report may not be reproduced, except in its entirety, without the written approval of the laboratory.

Analyst : Cara Shurgot, Dustin Banks, Kyle Monaghan



Verified By : Dustin Banks, Team Lead, Bioassay Date: Jul 03, 2019 04:28 PM

RESULTS OF RAINBOW TROUT SINGLE CONCENTRATION-100%

Client : 4388 DIAVIK DIAMOND MINES INC., YELLOWKNIFE Job Number: B950328

Client Project Name & Number: Quarterly Tox SNP-A

Test Result:

96 hrs Mortality % 0 Statistical Method: Visual

Sample Name : 1645-18B Sample Matrix : Water

Description: CLEAR, COLOURLESS Sample Number: VY7819-02

Sample Collected: Jun 25, 2019 12:10 AM Sampling Method : N/A Site Collection: N/A

Sample Collected By: AH Volume Received: 20 L Temp.Upon Arrival: 7 °C Storage: 2-6°C

Sample Received: Jun 25, 2019 01:41 PM pH: 6.8 Dissolved Oxygen: 10.1 mg/L

Analysis Start : Jun 27, 2019 10:56 AM Temperature : 14 °C Sample Conductance: 389 µS/cm

Concentration	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)
% vol/vol	Start	Start	Start	Start	24 hrs	24 hrs	24 hrs	24 hrs	48 hrs	48 hrs	48 hrs	48 hrs
0	15	7.9	366	9.0	0	0	0	0	0	0	0	0
100	14	7.0	392	9.5	0	0	0	0	0	0	0	0

Concentration	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)
% vol/vol	72 hrs	72 hrs	72 hrs	72 hrs	96 hrs	96 hr	96 hrs	96 hrs	96 hrs	96 hrs	96 hrs	96 hrs
0	0	0	0	0	15	7.8	376	8.8	0	0	0	0
100	0	0	0	0	15	7.3	412	8.7	0	0	0	0

Comments : None

Culture/Control/Dilution Water City of Edmonton dechlorinated tap water

Hardness: 180 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,100 (% vol/vol)

Organisms per Vessel :	10	Test Temperature :	15 ± 1 °C	Solution Depth :	>15 cm
Total # of Organisms Used :	20	Pre-aeration Time :	120 min.	Rate of Aeration	6.5±1 mL/min/L
Test Volume :	20 L	Vessel Volume :	38L	Test pH Adjusted:	No
Loading Density :	0.2 g/L	Photoperiod :	16:8 (light: dark)		

Test Organism : Rainbow Trout *(Oncorhynchus mykiss)* Source : Spring Valley Trout Hatchery

Culture Temperature :	15 ± 2 °C	Weight (Mean) +- SD :	0.5 ± 0.1 g	Length (Mean) +- SD :	3.83 ± 0.19 cm
Culture Water Renewal :	≥ 1.0 L/min/kg fish	Weight (Range) :	0.4 – 0.6 g	Length (Range) :	3.50 – 4.20 cm
Culture Photoperiod :	16:8 (light: dark)			% Mortality within 7 days :	0%
Feeding rate and frequency :	daily: 1-5% biomass of trout.			Acclimation Time:	>14 days

Reference chemical: Phenol Test Date: Jun 20, 2019

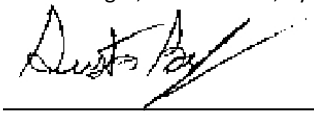
Test Endpoint 96 hrs LC50 (95% confidence interval) : 10.0 (9.12, 10.9)mg/L Statistical Method : Probit

Historical Mean LC50 (warning limits) : 10.5 (8.73, 12.6) mg/L Concentration : 0,8,10,12,15,20 mg/L

Test Method EPS 1/RM/13

Method Deviations : None

Analyst : Cara Shurgot, Dustin Banks, Kyle Monaghan



Verified By : Dustin Banks, Team Lead, Bioassay Date: Jul 15, 2019 01:35 PM

RESULTS OF *DAPHNIA MAGNA* SINGLE CONCENTRATION-100%

Client : 4388 DIAVIK DIAMOND MINES INC., YELLOWKNIFE Job Number: B979875

Client Project Name & Number: Monthly (13,18,18B) SNP-A Sample Number: WN6547-01

Test Result:

48 hrs Mortality % 0 Statistical Method:

Mean percent mortality: Sample 0 Control 0

Sample Name : 1645-18 Sample Matrix : Grab Water

Description: Clear, colourless Sample Prior to Analysis:

Sample Collected: Sep 16, 2019 03:54 PM Sampling Method : N/A pH: 7.2

Sample Collected By: AH Site Collection: N/A Temperature : 19 °C

Sample Received: Sep 20, 2019 04:18 PM Volume Received: 1 L Dissolved Oxygen: 9.7 mg/L

Analysis Start : Sep 20, 2019 12:07 PM Temp.Upon Arrival: 13 °C Sample Conductance: 604 µS/cm

End : Sep 22, 2019 01:01 PM Storage: 2-6°C Hardness: 140 mg $CaCO_3$/L

Concentration	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Immobility (#)	Immobility (%)	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)
% vol/vol	Start	Start	Start	Start	24 hrs	24 hrs	24 hrs	24 hrs	48 hrs	48 hr	48 hrs	48 hrs
0	21	8.1	341	8.1	0	0	0	0	20	8.1	330	8.4
0	21	8.2	346	7.9	0	0	0	0	20	8.1	341	8.3
0	21	8.2	346	7.9	0	0	0	0	20	8.1	339	8.3
100	20	7.3	617	9.4	0	0	0	0	20	7.7	614	8.3
100	20	7.2	620	9.4	0	0	0	0	20	7.6	620	8.3
100	20	7.2	619	9.3	0	0	0	0	20	7.7	620	8.3

Concentration	Mortality (#)	Mortality (%)	Immobility (#)	Immobility (%)
% vol/vol	48 hrs	48 hrs	48 hrs	48 hrs
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
100	0	0	0	0
100	0	0	0	0
100	0	0	0	0

Comments : None

Culture/Control/Dilution Water: City of Edmonton dechlorinated tap water

Hardness: 180 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,0,0,100,100,100 (% vol/vol)

Organisms per Vessel :	10	Pre-aeration Time :	30 min	Rate of Pre-aeration :	25-50 mL/min/L
Total # of Organisms Used :	60	Test Temperature :	20 ± 2 °C	Test Hardness Adjusted :	No
Test Volume :	150 mL	Vessel Volume :	225 mL	Test pH Adjusted:	No
Loading Density :	15.0 mL/Daphnia	Photoperiod :	16:8 (light: dark)		

Test Organism : *Daphnia magna* Source : In House Culture

Age at Test Initiation :	<24 hrs	Average Brood Size :	31.7
Culture Photoperiod :	16:8 (light: dark)	% Mortality within 7 days :	0
Culture Temperature :	20 ± 2 °C	Time To First Brood :	10 Days

Culture Diet: Pseudokirchnriella and YTC at a ratio of 2 mL/L of culture daily. New cultures weekly, 63 daphnids distributed into 6 culture vessels and 3 reproductive vessels.

RESULTS OF *DAPHNIA MAGNA* SINGLE CONCENTRATION-100%

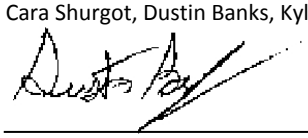
Client :	4388	DIAVIK DIAMOND MINES INC., YELLOWKNIFE	Job Number:	B979875
Client Project Name & Number:		Monthly (13,18,18B) SNP-A	Sample Number:	WN6547-01

Reference chemical:	Sodium Chloride	Test Date:	Sep 07, 2019
Test Endpoint 48 hrs LC50 (95% confidence interval) :	6.69 (6.20, 7.21)g/L	Statistical Method :	Untrimmed Spearman-Kärber
Historical Mean LC50 (warning limits) :	6.01 (4.52, 8.00) g/L	Concentration :	0,1.71,2.56,3.82,5.7,8.5 g/L

Test Method	EPS 1/RM/14
Method Deviations:	None

Note: The results contained in this report refer only to the testing of the sample submitted. This report may not be reproduced, except in its entirety, without the written approval of the laboratory.

Analyst : Cara Shurgot, Dustin Banks, Kyle Monaghan



Verified By : Dustin Banks, Team Lead, Bioassay Date: Sep 26, 2019 02:43 PM

RESULTS OF RAINBOW TROUT SINGLE CONCENTRATION-100%

Client : 4388 DIAVIK DIAMOND MINES INC., YELLOWKNIFE Job Number: B979875

Client Project Name & Number: Monthly (13,18,18B) SNP-A

Test Result:

96 hrs Mortality % 0 Statistical Method: Visual

Sample Name : 1645-18 Sample Matrix : Grab Water

Description: CLEAR, COLOURLESS Sample Number: WN6547-11

Sample Collected: Sep 16, 2019 03:54 PM Sampling Method : N/A Site Collection: N/A

Sample Collected By: AH Volume Received: 20 L Temp.Upon Arrival: 13 °C Storage: 2-6°C

Sample Received: Sep 20, 2019 04:18 PM pH: 7.0 Dissolved Oxygen: 9.4 mg/L

Analysis Start : Sep 21, 2019 12:16 PM Temperature : 14 °C Sample Conductance: 526 µS/cm

Concentration	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)
% vol/vol	Start	Start	Start	Start	24 hrs	24 hrs	24 hrs	24 hrs	48 hrs	48 hrs	48 hrs	48 hrs
0	14	8.0	287	8.9	0	0	0	0	0	0	0	0
100	14	7.1	534	9.4	0	0	0	0	0	0	0	0

Concentration	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)
% vol/vol	72 hrs	72 hrs	72 hrs	72 hrs	96 hrs	96 hr	96 hrs	96 hrs	96 hrs	96 hrs	96 hrs	96 hrs
0	0	0	0	0	14	7.8	291	8.9	0	0	0	0
100	0	0	0	0	14	7.4	547	9.0	0	0	0	0

Comments : None

Culture/Control/Dilution Water City of Edmonton dechlorinated tap water

Hardness: 180 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,100 (% vol/vol)

Organisms per Vessel :	10	Test Temperature :	15 ± 1 °C	Solution Depth :	>15 cm
Total # of Organisms Used :	20	Pre-aeration Time :	30 min.	Rate of Aeration	6.5±1 mL/min/L
Test Volume :	20 L	Vessel Volume :	38L	Test pH Adjusted:	No
Loading Density :	0.2 g/L	Photoperiod :	16:8 (light: dark)		

Test Organism : Rainbow Trout *(Oncorhynchus mykiss)* Source : Spring Valley Trout Hatchery

Culture Temperature :	15 ± 2 °C	Weight (Mean) +- SD :	0.4 ± 0.2 g	Length (Mean) +- SD :	3.72 ± 0.46 cm
Culture Water Renewal :	≥ 1.0 L/min/kg fish	Weight (Range) :	0.2 – 0.8 g	Length (Range) :	3.00 – 4.50 cm
Culture Photoperiod :	16:8 (light: dark)			% Mortality within 7 days :	0%
Feeding rate and frequency :	daily: 1-5% biomass of trout.			Acclimation Time:	>14 days

Reference chemical: Phenol Test Date: Sep 18, 2019

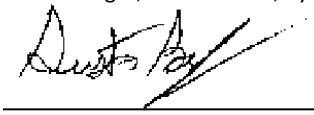
Test Endpoint 96 hrs LC50 (95% confidence interval) : 9.99 (9.10, 10.8)mg/L Statistical Method : Probit

Historical Mean LC50 (warning limits) : 9.95 (7.10, 13.9) mg/L Concentration : 0,8,10,12,15,20 mg/L

Test Method EPS 1/RM/13

Method Deviations : None

Analyst : Cara Shurgot, Dustin Banks, Kyle Monaghan



Verified By : Dustin Banks, Team Lead, Bioassay Date: Oct 02, 2019 03:04 PM

www.bvlabs.com

BUREAU VERITAS LABORATORIES
4606 Canada Way
Burnaby, BC V5G 1K5

Office 604 734 7276
Toll Free 800 665 8566
Fax 604 731 2386

CERIODAPHNIA DUBIA SURVIVAL AND REPRODUCTION TESTS ON: 1645-18 AND 1645-18B

SAMPLING DATE: SEPTEMBER 17, 2019

Prepared for:

Diavik Diamond Mines Inc.
PO. Box 2498
300-5201 – 50th Ave.
Yellowknife, NT
Canada X1A 2P8

Prepared by:

Ecotoxicology Group
Bureau Veritas Laboratories

Job No.: B978381
October 2019

Results for the *Ceriodaphnia dubia* Partial Life-Cycle Toxicity Test
Collected 2019 September 17

Job B978381

Sample: 1645-18

Test		Significant Effect
Ceriodaphnia dubia:	Survival	No
	Reproduction	No

Sample: 1645-18B

Test		Significant Effect
Ceriodaphnia dubia:	Survival	No
	Reproduction	No

Ceriodaphnia dubia Test Data Summary

Client Name/Location	Diavik Diamond Mines Inc. / Yellowknife, NT
Testing Lab/Location	Bureau Veritas Laboratories / Burnaby, BC
Collection Approach	2 samples each collected as 4 separate containers
Test Type	Static-renewal
Effluent Sample	
Sample name	1645-18 and 1645-18B
Information on labelling/coding	See Chain of Custody form
Sample collection date (y/m/d)	2019/Sep/17
Date (y/m/d)/time of sample receipt at lab	2019/Sep/17 @ 16:15
Test Organisms	
Species	*Ceriodaphnia dubia*
Source	In-house culture started from organisms obtained from Aquatic Research Organisms, Hampton, NH.
Age at start of test	<24 hours old; within 12 hours of each other
Unusual appearance, behaviour or treatment of test organisms, before use in test	None
Mean percent mortality of brood in 7d preceding test	The mean percent mortality was 1.45. See "*Ceriodaphnia* Culture Health - Mortality Records" sheet
Mean number of surviving young produced per adult in culture during 7d preceding test	The mean number of surviving young was 30.5. See "*Ceriodaphnia* Culture Health – Mortality and Mean Neonates"
Number of young produced in the 3rd or subsequent brood	See "*Ceriodaphnia dubia* - Clearing Records"
Ephippia in the culture	No Ephippia present

Test Conditions & Facilities	
Test method	BBY2 SOP-00001 *Ceriodaphnia dubia* Chronic Survival and Reproduction Test EPS 1/RM/21, 2nd Ed., February 2007
Dates or days when subsamples used	See “Initial Measurements and Observations” sheet
Date test started (y/m/d)	2019/Sep/19
Date (y/m/d) of test completion	2019/Sep/25
Test vessels	20 mL glass culture tubes
Persons performing test	G. Matharu, T. Wollelo, N. Shergill
Rate of preaeration	Minimal and controlled (100 bubbles/min)
Duration of preaeration	See “Initial Measurements and Observations” sheet
Rate/duration of aeration during test	No aeration
Procedure for pH adjustment	No pH adjustment of samples
Procedure for filtration	1645-18: Sample was not filtered 1645-18B: Sample was filtered through a 60µm nytex mesh to remove native organisms on day 5 of test
Source of control/dilution water & quantity of chemicals added	Lab Control - Type I deionized water hardened to 92 mg/L $CaCO_3$ with 20% Perrier water, Vitamin B_{12} & Selenium
Number and concentration of test solutions	100% and lab control
Volume and depth of solution in test vessels	15 mL & 9 cm
Number of replicates per conc.	10
Number of organisms per test vessel	1
DO & pH of sample just before its use	See “Initial Measurements and Observations”
Temperature, DO, & pH of test solutions and controls	See daily water quality on “Observation and Measurements”
Test solution renewal intervals	See “Initial Measurements and Observations”
Test observations and/or deviations from test method and standard practices	There was nothing unusual about the tests, no deviations from test method, and no problems with the tests.
Outliers?	1645-18: Yes, replicate 1 of the control was determined to be an outlier for reproduction; however, it was not removed from the statistical analysis. 1645-18B: Yes, replicate 6 and 9 of the control were both determined to be outliers for reproduction; however, they were not removed from the statistical analysis.

QA	
Did the test pass the test validity criteria of: •Mean mortality of the control adults is ≤20% •Average of ≥15 neonates/surviving adult in the controls •3 broods produced by ≥60% of control organisms by the end of the 8th day.	Did Lab controls meet validity criteria? 1645-18: Yes 1645-18B: Yes •Mean mortality in Lab controls: 1645-18: 0% 1645-18B: 10% •Average live young produced/surviving adult: 1645-18: 21.3 1645-18B: 22.3 •Percent of Lab control organisms producing 3 broods: 1645-18: 80% 1645-18B: 80%
Reference toxicant test LC50 (95% CL) (mg NaCl/L) for survival	1579 (1424, 1751)
Reference toxicant test historic mean & 2SD range (mg NaCl/L) for survival	1826 2SD (1514, 2202)
Reference toxicant test IC50 (95% CL) (mg NaCl/L) for reproduction	1305 (1220, 1408)
Reference toxicant test historic mean & 2SD range (mg NaCl/L) for reproduction	1454 2SD (1110, 1904)
Invalid Reference toxicant test?	No
Date of reference toxicant test (y/m/d) and duration	2019/Sep/05 6 days
Conditions of reference toxicant test	Same as test conditions

CETIS Analytical Report

Test Code: CD-4388-0119 | 05-2335-1518

Ceriodaphnia 7-d Survival and Reproduction Test — **Bureau Veritas Laboratories**

Analysis ID:	08-1863-5527	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	08 Oct-19 15:02	**Analysis:**	Single 2x2 Contingency Table	**Official Results:**	Yes
Batch ID:	08-1395-2930	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	T. Wollelo
Start Date:	19 Sep-19 13:23	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	Dilute Perrier Water
Ending Date:	25 Sep-19 10:35	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Duration:	5d 21h	**Source:**	Aquatic Research Organisms, NH	**Age:**	
Sample ID:	03-4570-7959	**Code:**	B978381	**Client:**	Diavik Diamond Mines Inc
Sample Date:	17 Sep-19	**Material:**	Mining Discharge/Runoff	**Project:**	General Misc. Bioassays
Receipt Date:	17 Sep-19 16:15	**Source:**	Diavik		
Sample Age:	61h	**Station:**	1645-18		

Data Transform	Alt Hyp	Comparison Result
Untransformed	C > T	100% passed 6d survival rate

Fisher Exact Test

Control	vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Negative Control		100	1.0000	Exact	1.0000	Non-Significant Effect

Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	N	10	0	10	1	0	0.0%
100		10	0	10	1	0	0.0%

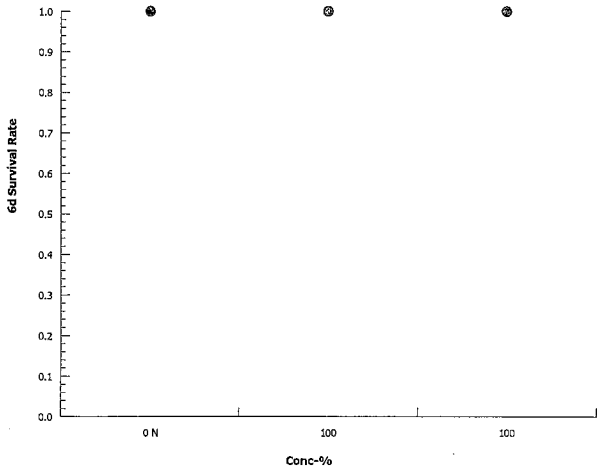
6d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	N	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

6d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	N	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Graphics



2019 Oct08 2019 Oct10

Analyst: MM QA: KF

CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Bureau Veritas Laboratories**

Analysis ID:	17-0740-8917	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	08 Oct-19 15:03	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes
Batch ID:	08-1395-2930	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	T. Wollelo
Start Date:	19 Sep-19 13:23	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	Dilute Perrier Water
Ending Date:	25 Sep-19 10:35	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Duration:	5d 21h	**Source:**	Aquatic Research Organisms, NH	**Age:**	
Sample ID:	03-4570-7959	**Code:**	B978381	**Client:**	Diavik Diamond Mines Inc
Sample Date:	17 Sep-19	**Material:**	Mining Discharge/Runoff	**Project:**	General Misc. Bioassays
Receipt Date:	17 Sep-19 16:15	**Source:**	Diavik		
Sample Age:	61h	**Station:**	1645-18		

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	100% passed reproduction	18.78%

Wilcoxon Rank Sum Two-Sample Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		100	145.5	n/a	2	18	Exact	0.9996	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	3.246	2.708	0.0018	Outlier Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	304.2	304.2	1	11.43	0.0033	Significant Effect
Error	479	26.6111	18			
Total	783.2		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	4.047	6.541	0.0492	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.8346	0.866	0.0030	Non-Normal Distribution

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	10	21.3	16.63	25.97	22	5	28	2.066	30.67%	0.00%
100		10	29.1	26.78	31.42	28	26	35	1.027	11.16%	-36.62%

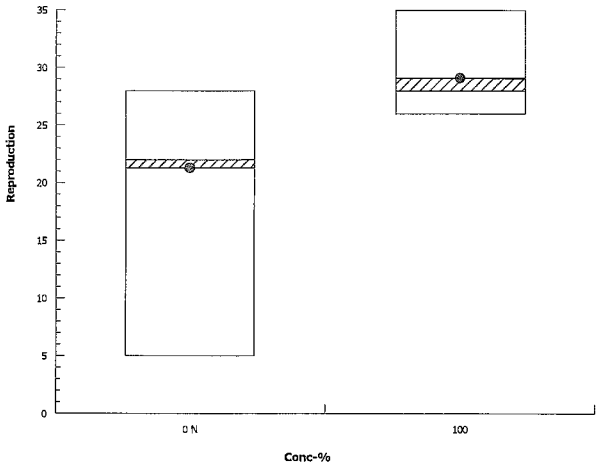
Reproduction Detail

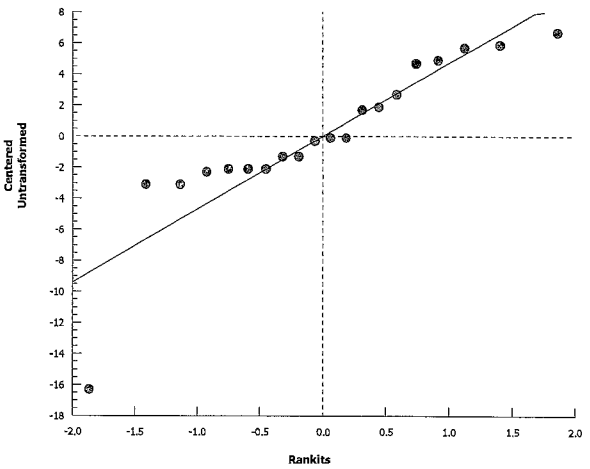
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	N	5	20	19	27	23	24	28	20	21	26
100		26	26	27	31	29	27	35	27	34	29

2019 Oct 08 2019 OCT 10

Analysis ID:	17-0740-8917	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	08 Oct-19 15:03	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes

Graphics





2019 Oct 08

2019 OCT 10

Analyst: mo QA: KT

ECOTOXICOLOGY

Ceriodaphnia dubia Survival and Reproduction Test - Initial Measurements and Observations

MaxXam
BBY2FCD-00149/10
Tab - Observations

Client # & Name: 8, Diavik Diamond Mines — Job/Sample: B978381/WM9244

Sample ID: 1645-18 — Date & Time Sampled: 2019 Sep 17 @00:00

Date & Time Started: 2019 Sep 19 @ 13:23 — Date & Time Received: 2019 Sep 17 @16:15

Date & Time Ended: 2019 Sep 25 @ 10:35 — Organism Lot #: ABO 2019 Sep09

Before Use Measurements After Temperature Adjustment — Deviations - See BLNC ☐ — Worksheet Created: ☐

Day	Date	Initial DO (mg/L)	Initial Temp (°C)	Initial pH	Aeration* (min)	Post Aeration DO (mg/L)	Post Aeration Temp (°C)	Analyst
0	2019Sep19	10.9	25.3	7.4	20	8.6	24.9	CS
1	Sep20	8.6	25.7	N/A	20	8.3	25.2	CS
2	Sep21	5.6	25.8	N/A	n/a	n/a	n/a	CS
3	Sept22	8.8	26.0	N/A	20	8.5	25.4	NS
4	Sept23	9.7	25.8	N/A	20	8.4	25.2	NS
5	Sept24	10.1	26.0	N/A	20	8.8	24.5	NS
6				N/A	mm 2019 Oct 09			
7				N/A				

* Rate of aeration must be ≤ 100 bubbles/minute — Instrument ID's: DBY2-6408

Sample Description: Clear & Colourless — Initials: CS

Sample Hardness: 168 — Initials: CS

Observations during the Test (e.g. aeration duration, behaviour of test organisms, bag effluent taken from etc.)

Day		Analyst Initials
0	Date: 2019Sep19 (Bottle) / Carboy #: 1 — Pre - Aerated From: 11:50 - 12:10 Feeding volume (µL) PKS: 150 YCT: 50 — Test Seeded @: 13:23	CS, TW
1	Date: Sep20 2019 (Bottle) / Carboy #: 1 — Pre - Aerated From: 11:53 - 12:13 Feeding volume (µL) PKS: 150 YCT: 50 — Test Water Change @: 12:40	CS
2	Date: Sep 21 2019 (Bottle) / Carboy #: 1 — Pre - Aerated From: n/a Feeding volume (µL) PKS: 150 YCT: 50 — Test Water Change @: 12:34	CS
3	Date: 2019Sept22 (Bottle) / Carboy #: 2 — Pre - Aerated From: 1010 - 1030 Feeding volume (µL) PKS: 150 YCT: 50 — Test Water Change @: 1141	NS
4	Date: 2019Sept23 (Bottle) / Carboy #: 3 — Pre - Aerated From: 0920 - 0940 Feeding volume (µL) PKS: 150 YCT: 50 — Test Water Change @: 11:44	NS
5	Date: 2019Sept24 (Bottle) / Carboy #: 4 — Pre - Aerated From: 1130 - 1150 Feeding volume (µL) PKS: 150 YCT: 50 — Test Water Change @: 1349	NS
6	Date: 2019 Sep 25 Test ended @ 10:35	TW
7	Date: N/A TW 2019 Sep 27	
8	Date:	

ECOTOXICOLOGY

Ceriodaphnia dubia Survival and Reproduction Test - Observations and Measurements

Maxxam
BBY2FCD-00149/10
Tab - Test Concentrations

Job/Sample # B978381/WM9244

Analyst(s): G Mathews, T. Wullelo NSnergill

Concentration: Control

Control Water Batch: Date(s): 2019 Sep 09

Hardness(es): 92

Day	Reproduction (# Live neonates)										Conductivity (µS/cm)	Temperature (°C)		DO (mg/L)		pH		Analyst		Daily WQ Reviewed by:
	1	2	3	4	5	6	7	8	9	10	Initial	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
1	0	0	0	0	0	0	0	0	0	0	181	25.3	25.3	8.3	7.8	8.3	8.2	CS	CS	CS CS
2	0	0	0	0	0	0	0	0	0	0	181	25.2	25.1	8.3	8.1	8.3	8.3	CS	CS	CS CS
3	0	0	0	0	0	0	0	0	0	0	184	25.1	25.5	8.2	7.9	8.3	8.3	CS	NS	CS NS
4	0	1	2	3	2	2	3	2	3	5	189	25.0	24.9	8.3	8.0	8.4	8.3	NS	NS	NS NS
5	0	5	6	7	8	7	9	3	6	7	180	25.0	25.1	8.2	8.0	8.3	8.2	NS	NS	NS NS
6	5	14	11	17	13	15	16	15	12	14	181	25.2	25.7	8.4	7.5 S (4)	8.4	8.2	NS	TW	NS TW
7												mo	2019	Oct	09					
8																				
Total	5	20	19	27	23	24	~~27~~ 28 (B)	20	~~20~~ 21 (B)	26								SY	mo	

X = dead adult; S = small adult; (#) immobilised neonates
M = missing/lost adult; P = pale adult; * dead neonates present

(B) Corrected calculation error - mo 2019 Oct 08

(A) WETW 2019 Sep 25

Ceriodaphnia dubia Survival and Reproduction Test - Observations and Measurements

Concentration (%v/v): 100

Job/Sample #: B978381/WM9244

Day	Reproduction (# Live neonates)										Conductivity (µS/cm)	Temperature (°C)		DO (mg/L)		pH		Analyst		Daily WQ Reviewed by:
	1	2	3	4	5	6	7	8	9	10	Initial	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
1	0	0	0	0	0	0	0	0	0	0	757	24.8	25.5	8.6	7.8	7.7	7.8	CS	CS	CS S
2	0	0	0	0	0	0	0	0	0	0	759	25.2	25.2	8.2	8.0	7.7	7.9	CS	CS	CS C
3	0	0	0	0	0	0	0	0	0	0	762	25.4	25.7	5.6	7.9	7.7	8.0	CS	NS	CS NS
4	4	3	6	4	5	3	5	5	3	4	762	24.7	25.1	8.3	7.9	7.8	7.8	NS	NS	NS NS
5	7	7	5	9	8	7	11	11	11	8	754	25.2	25.2	8.4	7.8	7.9	7.9	NS	NS	NS NS
6	15	16	16	18	16	17	19	11	20	17	754	24.9	25.4	8.5	7.5	7.7	7.8	NS	TW	NS TW
7												mo 20/a Oct 09								
8																				
Total	26	26	27	31	29	27	35	27	34	29								SG	two	

X = dead adult
M = missing/lost adult
S = small adult
P = pale adult
(#) immobilised neonates
* dead neonates present

CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Bureau Veritas Laboratories**

Analysis ID:	00-4316-0955	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	08 Oct-19 15:38	**Analysis:**	Single 2x2 Contingency Table	**Official Results:**	Yes
Batch ID:	15-3532-2097	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	T. Wollelo
Start Date:	19 Sep-19 13:18	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	Dilute Perrier Water
Ending Date:	25 Sep-19 10:40	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Duration:	5d 21h	**Source:**	Aquatic Research Organisms, NH	**Age:**	
Sample ID:	19-7152-2137	**Code:**	B978381	**Client:**	Diavik Diamond Mines Inc
Sample Date:	17 Sep-19	**Material:**	Mining Discharge/Runoff	**Project:**	General Misc. Bioassays
Receipt Date:	17 Sep-19 16:15	**Source:**	Diavik		
Sample Age:	61h	**Station:**	1645-18B		

Data Transform	Alt Hyp	Comparison Result
Untransformed	C > T	100% passed 6d survival rate

Fisher Exact Test

Control	vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Negative Control		100	1.0000	Exact	1.0000	Non-Significant Effect

Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	N	9	1	10	0.9	0.1	0.0%
100		10	0	10	1	0	-11.11%

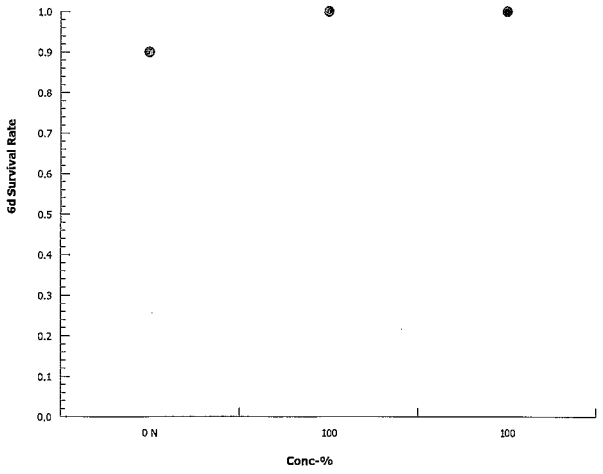
6d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	N	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

6d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	N	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Graphics



2019 Oct08 2019 Oct10

CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Bureau Veritas Laboratories**

Analysis ID:	19-6997-7886	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	08 Oct-19 15:39	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes
Batch ID:	15-3532-2097	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	T. Wollelo
Start Date:	19 Sep-19 13:18	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	Dilute Perrier Water
Ending Date:	25 Sep-19 10:40	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Duration:	5d 21h	**Source:**	Aquatic Research Organisms, NH	**Age:**	
Sample ID:	19-7152-2137	**Code:**	B978381	**Client:**	Diavik Diamond Mines Inc
Sample Date:	17 Sep-19	**Material:**	Mining Discharge/Runoff	**Project:**	General Misc. Bioassays
Receipt Date:	17 Sep-19 16:15	**Source:**	Diavik		
Sample Age:	61h	**Station:**	1645-18B		

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	100% passed reproduction	23.64%

Wilcoxon Rank Sum Two-Sample Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		100	108	n/a	5	18	Exact	0.5959	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	3.047	2.708	0.0074	Outlier Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	48.05	48.05	1	1.183	0.2910	Non-Significant Effect
Error	730.9	40.6056	18			
Total	778.95		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	27.11	6.541	3.6E-05	Unequal Variances
Distribution	Shapiro-Wilk W Normality Test	0.7968	0.866	7.7E-04	Non-Normal Distribution

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	10	20.9	14.57	27.23	23.5	2	29	2.799	42.34%	0.00%
100		10	24	22.78	25.22	24	21	27	0.5375	7.08%	-14.83%

Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	N	21	23	29	26	22	8	27	27	2	24
100		25	26	23	21	24	27	24	24	23	23

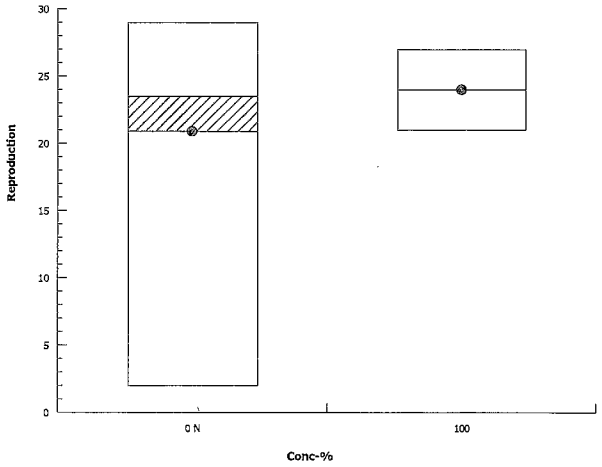
2019 Oct08 2019 OCT10

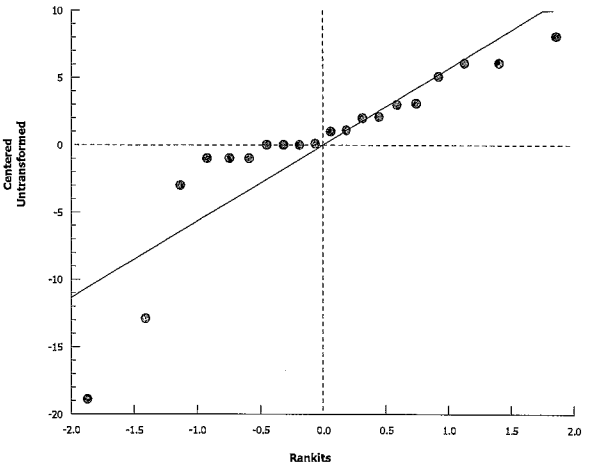
Analyst: MO QA: KT

Ceriodaphnia 7-d Survival and Reproduction Test — **Bureau Veritas Laboratories**

Analysis ID:	19-6997-7886	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	08 Oct-19 15:39	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes

Graphics





2019 Oct08 2019 0010

Analyst: MM QA: KT

ECOTOXICOLOGY

Ceriodaphnia dubia Survival and Reproduction Test - Initial Measurements and Observations

MaxXam
BBY2FCD-00149/10
Tab - Observations

Client # & Name: 8, Diavik Diamond Mines — Job/Sample: B978381/WM9245

Sample ID: 1645-18B — Date & Time Sampled: 2019 Sep 17 @00:00

Date & Time Started: 2019 Sep 19 @ 13:18 — Date & Time Received: 2019 Sep 17 @16:15

Date & Time Ended: 2019 Sep 25 @ 10:40 — Organism Lot #: ARO 25 Sep 19

Before Use Measurements After Temperature Adjustment — Deviations - See BLNC ☐ — Worksheet Created: ☐

Day	Date	Initial DO (mg/L)	Initial Temp (°C)	Initial pH	Aeration* (min)	Post Aeration DO (mg/L)	Post Aeration Temp (°C)	Analyst
0	2019Sep19	10.8	26.0	7.4	20	8.7	25.7	CS
1	Sep20	8.7	25.6	N/A	20	8.4	25.1	CS
2	Sep21	5.4	25.7	N/A	n/a	n/a	n/a	CS
3	Sept22	8.9	26.0	N/A	20 (1)	8.3 (1)	25.3	NS
4	Sept23	10.0	25.8	N/A	20	8.8	25.2	NS
5	Sept24	9.8	25.9	N/A	20	8.9	24.6	NS
6				N/A				
7				N/A				

(1) NS 2019 Sept 22

* Rate of aeration must be ≤ 100 bubbles/minute — Instrument ID's: BBY2-0408

Sample Description: Clear and colourless — Initials: CS

Sample Hardness: 156 — Initials: CS

Observations during the Test (e.g. aeration duration, behaviour of test organisms, bag effluent taken from etc.)

Day		Analyst Initials
0	Date: 2019Sep19 (Bottle) / Carboy #: 1 — Pre - Aerated From: 11:50-12:10 Feeding volume (µL) PKS: 150 YCT: 50 — Test Seeded @: 13:18	TW
1	Date: Sep20 2019 (Bottle) / Carboy #: 1 — Pre - Aerated From: 11:54-12:14 Feeding volume (µL) PKS: 150 YCT: 50 — Test Water Change @: 12:51	CS
2	Date: Sep21,2019 (Bottle) / Carboy #: 1 — Pre - Aerated From: n/a Feeding volume (µL) PKS: 150 YCT: 50 — Test Water Change @: 12:43	CS
3	Date: 2019 Sept 22 (Bottle) / Carboy #: 2 — Pre - Aerated From: 1010-1030 Feeding volume (µL) PKS: 150 YCT: 50 — Test Water Change @: 1144	NS
4	Date: 2019 Sept 23 (Bottle) / Carboy #: 2 — Pre - Aerated From: 0920-0940 Feeding volume (µL) PKS: 150 YCT: 50 — Test Water Change @: 11:50	NS
5	Date: 2019Sept24 (Bottle) / Carboy #: 3 — Pre - Aerated From: 1130-1150 Feeding volume (µL) PKS: 150 YCT: 50 — Test Water Change @: 1355 Removed native organisms using 60µm mesh.	NS
6	Date: 2019Sep25 Test ended at 10:40	TW
7	Date:	N/A
8	Date:	TW 2019Sep27

ECOTOXICOLOGY

Ceriodaphnia dubia Survival and Reproduction Test - Observations and Measurements

Maxxam
BBY2FCD-00149/10
Tab - Test Concentrations

Job/Sample # B978381/WM9245

Analyst(s): G Mathews, T. Wollelo NShergill

Concentration: Control

Control Water Batch: Date(s): 2019Sep09

Hardness(es): 92

Day	Reproduction (# Live neonates)										Conductivity (µS/cm)	Temperature (°C)		DO (mg/L)		pH		Analyst		Daily WQ Reviewed by:
	1	2	3	4	5	6	7	8	9	10	Initial	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
1	0	0	0	0	0	0	0	0	0	0	181	25.1	25.4	8.3	7.8	8.3	8.2	CS	CS	CS
2	0	0	0	0	0	0	0	0	0	0	181	25.2	25.2	8.3	8.0	8.3	8.3	CS	CS	CS
3	0	0	0	0	0	0	0	0	0	0	184	25.0	25.6	8.2	7.9	8.3	8.3	CS	NS	CS NS
4	5	3	3	3	2	4	4	5	2	4	185	24.7	25.0	8.3	7.9	8.4	8.2	NS	NS	NS NS
5	6	6	8	6	6	4X	8	7	0sp	6	180	25.2	25.2	8.3	7.8	8.4	8.3	NS	NS	NS NS
6 (A)	~~18~~ 8	~~8~~ 14	18	17	14	|	15	15	0	14	183	24.8	25.8	~~8.6~~ 8.4 (#)	7.5	8.4	8.2	NS	TW	NS TW
7						|					n/a	nv	2019Oct09						
8						|													
Total	21	23	29	26	22	8X	27	27	2	24						S		84	no	

(A) we NS 2019 Sept 24

X = dead adult
M = missing/lost adult
S = small adult
P = pale adult
(#) immobilised neonates
* dead neonates present

Concentration (%v/v): 100

Job/Sample #: B978381/WM9245

Day	Reproduction (# Live neonates)										Conductivity (µS/cm)	Temperature (°C)		DO (mg/L)		pH		Analyst		Daily WQ Reviewed by:
	1	2	3	4	5	6	7	8	9	10	Initial	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
1	0	0	0	0	0	0	0	0	0	0	749	25.5	25.7	8.7	7.7	7.7	7.8	CS	CS	CS
2	0	0	0	0	0	0	0	0	0	0	750	25.1	25.3	8.4	8.0	~~7.7~~ 7.7 (A)	7.9	CS	CS	CS
3	(D) ~~10~~	0	0	0	0	0	0	0	0	0	756	25.3	25.6	5.5	7.8	7.7	8.0	CS	NS	NS CS
4	4	4	6	3	2	2	4	3	4	0	742	25.2	25.0	8.3	7.9	7.8	7.9	NS	NS	NS NS
5	8	8	4	4	7	8	7	7	6	7	746	25.2	25.2	8.8	7.8	7.6	7.8	NS	NS	NS NS
6	13	14	13	14	15	17	13	14	13	16	745	24.8	25.7	8.5	7.6	7.8	~~8.1~~ 7.8 (C)	NS	TW	NS TW
7												n/a	mo	2019	Oct	09				
8					(E)															
Total	25	26	23	21	~~25~~ 24	27	24	24	23	23								SY	mo	

X = dead adult; M = missing/lost adult; S = small adult; P = pale adult

(#) immobilised neonates; * dead neonates present

(B) Native organisms present – NS 2019 Sept 22

(E) (C) WES 2019 Sep 16

WES 2019 Oct 15

(C) WETW 2019 Sep 25

(D) LE WE NS 2019 Oct 15

(A) – WE CS 2019 Sep 20

Culture Date: ARO2019 Sep 09

% MORTALITY

Day	Date	Started	Deaths	Removed or Lost	Total Number	% Daily Mortality	% Mortality in Previous 7 Days
0	09-Sep	80	0	0	80	0.00%	
1	10-Sep		0	10	70	0.00%	
2	11-Sep		0	0	70	0.00%	
3	12-Sep		1	0	69	1.43%	
4	13-Sep		0	0	69	0.00%	
5	14-Sep		0	1	68	0.00%	
6	15-Sep		1	0	67	1.47%	
7	16-Sep		0	0	67	0.00%	
8	17-Sep		0	0	67	0.00%	2.86%
9	18-Sep		0	0	67	0.00%	2.90%
10	19-Sep		0	0	67	0.00%	1.45%
11					67	0.00%	1.47%
12					67	0.00%	1.49%
13					67	0.00%	0.00%
14					67	0.00%	0.00%
15					67	0.00%	0.00%

MEAN NEONATES

Day	1	2	3	4	5	6	7	Total
Date	10-Sep	11-Sep	12-Sep	13-Sep	14-Sep	15-Sep	16-Sep	
Replicate 1	0	0	0	7	8	0	16	31
Replicate 2	0	0	0	5	9	13	0	27
Replicate 3	0	0	0	6	8	0	16	30
Replicate 4	0	0	0	6	12	0	17	35
Replicate 5	0	0	0	5	10	13	0	28
Replicate 6	0	0	0	8	9	14	0	31
Replicate 7	0	0	0	5	10	0	18	33
Replicate 8	0	0	0	6	8	0	18	32
Replicate 9	0	0	0	4	8	14	0	26
Replicate 10	0	0	0	5	11	16	0	32
Mean								**30.5**

Proofed: KT 20190910

Health Criteria

An average of at least 15 young per adult must be produced in the first 3 broods (Environment Canada).

An average of at least 20 young per adult must be produced in the first 3 broods (US EPA).

Comments: * Fourth or subsequent brood not counted.

ECOTOXICOLOGY

CERIODAPHNIA DUBIA - CLEARING RECORDS

MaxXam

BBY2FCD-00242/5

Clearing Records for Young Produced by Each Brood Organism Used in a Test
for parent culture AB170413CD

Check once (√) if 2-7 neonates present (1 neonate ≠ a brood)
Check twice (√√) if ≥8 neonates
Check thrice (√√√) if ≥16 neonates

Test Day: Record actual number of neonates present

YCT Batch: 2019 Aug13; 2019Sep10 PKS Batch: 2019 Aug27 Water Batch: 2019Sep03

Culture Date: AR0 2019 Sep09 Analyst(s): TW, CD, MO

Date	Sep10	Sep11	Sep12	Sep13	Sep14	Sep15	Sep16	Sep17	Sep18
Time	08:14	10:14	11:28	07:42	7:41	08:26	07:00	07:29	08:32
Tracking/Clear	clear	clear	Clear	Clear	Clear	Clear	clear	clear	Clear
YCT (µL)	50	50	50	50	50	80	50	50	80
PKS (µL)	150	150	150	150	150	150	150	150	150
Cup #	Brood size								
1	0	0	0	7	8	0	16 A	17	21
2	0	0	0	5	9	13	0	16	19
3	0	0	0	6	8	0	16 A	23	20
4	0	0	0	6	12	0	14 A	17	19
5	0	0	0	5	10	13	0	19	18
6	0	0	XRejected	10 8	9	14	0 ~~15~~ A(2)	21	16
7	0	0	0	5	10	0	18 A	23	20
8	0	0	0	6	8	0	(2)(2) 18	21	21
9	0	0	0	4	8	14	0	23	19
10	0	0	0	5	11	16	0	22	19
11	0	0	0	√	√√	0	A √√	√√	W
12	0	0	0	√	√√	0	A √√	√√	W
13	0	0	0	√	√√	0	A √√	√√	W
14	0	0	0	√	√√	0	A √√	√√	W
15	0	0	0	√	√√	W	0	√√	W
16	0	0	0	√	√√	W	0	√√	W
17	0	0	0	√	√√	W	0	√√	W
18	0	0	0	√	√√	0	√	√√	W
19	0	0	0	√	√√	W	0	√√	W
20	0	0	0	√	√√	W	0	√√	W
21	0	0	0	√	√√	0	√√	√√	W
22	0	0	0	√	√√	0	√√	√√	W
23	0	0	0	√	√√	0	√√	√√	W
24	0	0	0	√	√√	0	√√ A	√√	W
25	0	0	0	√	√√	0	√√	√√	W
26	0	0	0	√	√√	0	√√	√√	W
27	0	0	0	√					(2)
28	0	0	0	√	√√	0x			
29	0	0	0	√	√√	0	√√ A	√√	W
30	0	b	0	√	√√	W	0	√√	W
31	0	0	0	√	√√	0	√√	√√	W
32	0	0	0	√	√√	W	√√	√√	W
33	0	0	0	√	√√	0	√√ √	√√	W
34	0	0	0	√	√√	0	√√ √	√√	W
35	0	0	0	√	√√	0	√√	√√	W
# Missing/Lost	0	0	0	0	1	0	0	0	0
# Dead	0	0	0 (1)(B)	0	0	1	0	0	0
Analyst	TW	TW	NS	TW	CD	MO	TW	TW	MO
Time	08:25	10:39	1135	07:55	7:53	08:33	07:11	07:41	08:40

*** See next page for Environment Canada and US EPA requirements.***

On test day, select appropriate neonates (i.e.>8 neonates in a brood) and indicate in the brood size box which test they will be used for by placing a letter according to this legend:

A - AR0 only Sep16	D -
B -	E -
C -	F -

(B) Went 2019 Sept 12

(1) Accidently spilled - CD 2019 Sep 14

Clearing Records for Young Produced by Each Brood Organism Used in a Test
for parent culture AB170413CD

Culture Date: AR02019 Sep 09 Analyst(s): TW, CS mo

Cup #	Brood size								
Date	Sep10	Sep11	Sep12	Sep13	Sep14	Sep15	Sep16	Sep17	Sep18
Time	08:16	10:39	1135	07:55	7:55	08:33	07:12	07:21	08:40
36	0	0	0	0 L	L L	W	0	LLL	WW
37	0	0	0	0 L	L L	W	0	LLL	WW
38	0	0	0	0 L	L L	0	LLL	LLL	WW
39	0	0	0	0 L	L L	W	0	LLL	WW
40	0	0	0	0 L	L L	W	0	LLL	WW
41	0	0	0	L	L L	W	0	LLL	WW
42	0	0	0	L	L L	W	0	LLL	WW
43	0	0	0	L	L L	W	0	LLL	WW
44	0	0	0	L	L L	W	0	LLL	WW
45	0	0	0	L	L L	W	0	LLL	WW
46	0	0	0	L	L L	W	0	LLL	WW
47	0	0	0	L	L L	W	0	LLL	WW
48	0	0	0	L	L L	W	0	LLL	WW
49	0	0	0	L	L L	W	0	LLL	WW
50	0	0	0	L	L L	W	0	LLL	WW
51	0	0	0	L	L L	0	LLL	LLL	WW
52	0	0	0	L	L L	W	0	LLL	WW
53	0	0	0	L	L L	0	0 LLL	LLL	WW
54	0	0	0	L	L L	W (A)	~~LLL~~ 0	LLL	WW
55	0	0	0	L	L L	W (A)	0	LLL	WW
56	0	0	0	L	L L	W	0	LLL	WW
57	0	0	0	L	L L	W	0	LLL	WW
58	0	0	0	L	L L	W	0	LLL	WW
59	0	0	0	L	L L	0	LLL	LLL	WW
60	0	0	0	L	L L	W	0	LLL	WW
61	0	0	0	L	L L	W	0	LLL	WW
62	0	0	0	L	L L	W	0	LLL	WW
63	0	0	0	L	L L	0	LLL	LLL	WW
64	0	0	0	L	L L	W	0	LLL	WW
65	0	0	0	L	L L	W	0	LL	WW
66	0	0	0	L	L L	W	0	LLL	WW
67	0	0	0	L	L L	W	0	LLL	WW
68	0	0	0	L	L L	W	0	LLL	WW
69	0	0	0	L	L L	W	0	LLL	WW
70	0	0	0 Used as replacement						
# Missing/Lost	0	0	0	0	0	0	0	0	0
# Dead	0	0	0	0	0	0	0	0	0
Analyst	~~DTW~~	TW	NS	TW	CS	mo	TW	TW	mo
Time	08:35	10:46	1142	09:04	8:05	08:40	07:20	07:50	08:45

Environment Canada: At least 8 young must be produced by each brood organism in their third or subsequent broods, and in the brood to be used in a test. Neonates used in tests must be < 24 hours old and within 12 hours of each other.
US EPA : Neonates used in tests must be < 24 hours old and within 8 hours of each other. Neonates used in tests must be taken from adults that have had at least 8 or more young in the brood to be used in a test, and in their third or subsequent broods.

(A) WETW 2019 Sep16

Example:

Cup #	Brood size				
Date	2008Jan22	2008Jan23	2008Jan23	2008Jan24	A - Rx #1
Time	10:10am	8:25am	8:15pm	8:00am	B - Client # 123
1	√	√	√√	12 A	
2	√	√	√√	14 B	

Clearing Records for Young Produced by Each Brood Organism Used in a Test for parent culture AB170413CD

Check once (√) if 2-7 neonates present (1 neonate ≠ a brood)
Check twice (√√) if ≥8 neonates
Check thrice (√√√) if ≥16 neonates
Test Day: Record actual number of neonates present

YCT Batch: 2018Aug27, PKS Batch: 2018SepID Water Batch: 2018Sep15

Culture Date: AR02619Sep09 Analyst(s): AS, TW

Date	Sep18	Sep18	Sep19						
Time	17:00	2116	07:14						
Tracking/Clear	Track	Track	Clear						
YCT (µL)	n/a	n/a	50						
PKS (µL)	n/a	n/a	150						
Cup #	Brood size								
1	0	0	21 A						
2	0	0	25 A						
3	0	0	22 A						
4	0	0	5 A						
5	0	0	19 A						
6	0	0	22 A						
7	0	0	3 A						
8	0	0	18 A						
9	0	0	22 A						
10	0	0	20 A						
11	0	0	√√B						
12	0	0	√√B						
13	0	0	√√B						
14	0	0	0						
15	0	0	√√B						
16	0	0	√√B						
17	0	0	√√B						
18	0	0	√√B						
19	0	0	√√B						
20	0	0	√√B						
21	0	0	√√B						
22	0	0	0						
23	0	0	√√C						
24	0	0	0						
25	0	0	0						
26	0	0	0						
27	—	—	—						
28	—	—	—						
29	0	0	√√C						
30	0	0	√√C						
31	0	0	√√C						
32	0	0	√√C						
33	0	0	√√C						
34	0	0	√√C						
35	0	0	√√C						
# Missing/Lost	0	0	0						
# Dead	0	0	0						
Analyst	AS	Dme	TW						
Time	17:03	2117	07:26						

*** See next page for Environment Canada and US EPA requirements.***

On test day, select appropriate neonates (i.e.>8 neonates in a brood) and indicate in the brood size box which test they will be used for by placing a letter according to this legend:

A - MZP	D - 1645
B - BAB	E - 16:45B
C - BAG	F -

Clearing Records for Young Produced by Each Brood Organism Used in a Test
for parent culture AB170413CD

Culture Date: ARO 2019 Sep 09 Analyst(s): RJ, TW

Cup #	Brood size								
Date	Sep 18	Sep18	Sep19						
Time	17:03	2118	07:26						
36	0	0	VVC						
37	0	0	VVC						
38	0	0	VV						
39	0	0	VV						
40	0	0	VV						
41	0	0	VVD						
42	0	0	VVD						
43	0	0	VVD						
44	0	0	VVD						
45	0	0	VVD						
46	0	0	VVD						
47	0	0	VVD						
48	0	0	VVD						
49	0	0	VVD						
50	0	0	VVD						
51	0	0	VVE						
52	0	0	VVE						
53	0	0	VVE						
54	0	0	VVE						
55	0	0	VVE						
56	0	0	VVE						
57	0	0	VVE						
58	0	0	VVE						
59	0	0	VVE						
60	0	0	VVE						
61	0	0	VV						
62	0	0	VV						
63	0	0	VV						
64	0	0	VV						
65	0	0	VV						
66	0	0	VV						
67	0	0	VV						
68	0	0	VV						
69	0	0	VV						
70	0								
# Missing/Lost	0	0	0						
# Dead	0	0	0						
Analyst	RJ	AM	TW						
Time	17:05	2119	07:34						

Environment Canada: At least 8 young must be produced by each brood organism in their third or subsequent broods, and in the brood to be used in a test.
Neonates used in tests must be < 24 hours old and within 12 hours of each other.

US EPA : Neonates used in tests must be < 24 hours old and within 8 hours of each other.
Neonates used in tests must be taken from adults that have had at least 8 or more young in the brood to be used in a test, and in their third or subsequent broods.

Example:

Cup #	Brood size				
Date	2008Jan22	2008Jan23	2008Jan23	2008Jan24	A - Rx #1
Time	10:10am	8:25am	8:15pm	8:00am	B - Client # 123
1	√	√	√√	12 A	
2	√	√	√√	14 B	

Toxicity Testing on samples WM9244-1645-18 and WM9245-1645-18B

(collected September 17, 2019)

Final Report

October 21, 2019

Submitted to: **Bureau Veritas Laboratories**
Burnaby, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

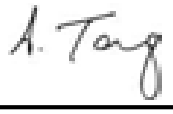
TABLE OF CONTENTS

List of Tables

List of Appendices

SIGNATURE PAGE

Report By:
Mimi Tran, Dipl. T.
Laboratory Biologist



Reviewed By:
Armando Tang, R.P.Bio
Senior Reviewer

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

SUMMARY

Sample Information and Test Type

Sample ID	WM9244-1645-18 and WM9245-1645-18B
Sample collection date	September 17, 2019
Sample receipt date	September 19, 2019
Sample receipt temperature	2.3 to 2.9°C
Test types	72-h *Pseudokirchneriella subcapitata* growth inhibition

Summary of Results

Endpoint	Mean ± SD		
	Control	WM9244-1645-18	WM9245-1645-18B
Cell Yield (x10^4 cells/mL)	30.2 ± 2.0	89.2 ± 7.6*	--
	34.0 ± 2.4	--	96.5 ± 10.8*

SD = Standard Deviation

* = Indicates cell yield was significantly greater than the control

1.0 INTRODUCTION

Nautilus Environmental Company Inc. conducted a 72-h *Pseudokirchneriella subcapitata* growth inhibition toxicity test for Bureau Veritas Laboratories on samples identified as WM9244-1645-18 and WM9245-1645-18B. The samples were collected on September 17, 2019 and delivered to the Nautilus Environmental laboratory in Burnaby, BC on September 19, 2019. The samples were collected in 1-L plastic containers and were received at temperatures of 2.3 and 2.9°C. The samples were stored in the dark at 4 ± 2°C prior to testing.

This report describes the results of the toxicity test. Copies of raw laboratory data sheets and statistical analyses are provided in Appendix A. The chain-of-custody form is provided in Appendix B.

2.0 METHODS

Methods for the toxicity tests are summarized in Table 1. Testing was conducted according to procedures described by Environment Canada (2007). Statistical analyses were performed using CETIS (Tidepool Scientific Software, 2013).

Table 1. Summary of test conditions: *Pseudokirchneriella subcapitata* growth inhibition single concentration test.

Test species	*Pseudokirchneriella subcapitata*, strain CPCC# 37
Organism source	In-house axenic culture, obtained from Canadian Phycological Culture Center, and originally isolated from Nivelta River, Norway.
Organism age	3-to 7-day old culture in logarithmic growth phase
Test type	Static
Test duration	72 hours
Test vessel	Microplate
Test volume	220 µL
Test concentrations	Full strength sample diluted to 95.2% (v/v) with nutrients, plus laboratory control
Test replicates	4 per treatment; 8 for laboratory control
Number of organisms	10,000 cells/mL
Control/dilution water	Deionized water supplemented with nutrients
Test solution renewal	None
Test temperature	24 ± 2°C
Feeding	None
Light intensity	3600 to 4400 lux
Photoperiod	24 hours light
Aeration	None
Test measurements	Test area temperature measured daily; temperature and pH measured at test initiation; pH of two control wells measured at test termination
Test protocol	Environment Canada (2007), EPS 1/RM/25
Statistical software	CETIS Version 1.9.4
Test endpoints	Algal cell growth inhibition
Test acceptability criteria for controls	>16-fold increase in number of algal cells; CV ≤ 20%; no trend when analyzed using Mann-Kendall test
Reference toxicant	Zinc (added as $ZnSO_4$)

3.0 RESULTS

The results of the toxicity tests on samples WM9244-1645-18 and WM9245-1645-18B are summarized in Table 2. Cell yield was significantly greater than the laboratory control; percent stimulation was 195.0% for WM9244-1645-18 and 183.8% for WM9245-1645-18B.

Table 2. Results: *Pseudokirchneriella subcapitata* growth inhibition single concentration test.

Sample ID	Cell Yield (x 10^4 cells/mL) (Mean ± SD)	Stimulation (%)
Laboratory Control	30.2 ± 2.0	--
WM9244-1645-18	89.2 ± 7.6*	195.0
Laboratory Control	34.0 ± 2.4	--
WM9245-1645-18B	96.5 ± 10.8*	183.8

SD = Standard Deviation
* = Indicates cell yield was significantly greater than the laboratory control

4.0 QA/QC

The health history of the test organisms used in the exposure was acceptable and met the requirements of the Environment Canada protocol. The tests met all control acceptability criteria and water quality parameters remained within ranges specified in the protocol throughout the tests. There were no deviations from the test methodology. Uncertainty associated with the tests are best described by the standard deviation around the mean and/or the confidence intervals around the point estimates.

Result of the reference toxicant test conducted during the testing program is summarized in Table 3. Results for this test fell within the range for organism performance of the mean and two standard deviations, based on historical results obtained by the laboratory with this test. Thus, the sensitivity of the organisms used in the test was appropriate. The reference toxicant test was performed under the same conditions as those used for the sample.

Table 3. Reference toxicant results.

Test Species	Endpoint	Historical Mean (2 SD Range)	CV (%)	Test Date
P. subcapitata	Growth (IC50): 31.8 µg/L Zn	31.1 (25.1 – 38.6)	11	September 20, 2019

SD = Standard Deviation, CV = Coefficient of Variation, IC = Inhibition Concentration

5.0 REFERENCES

Environment Canada. 2007. Biological test method: growth inhibition test using the freshwater alga. Environmental Protection Series, Report EPS 1/RM/25. Second Edition, March 2007. Environment Canada, Method Development and Application Section, Environmental Science and Technology Centre, Science and Technology Branch, Ottawa, ON. 53 pp.

Tidepool Scientific Software. 2013. CETIS comprehensive environmental toxicity information system, version 1.9.4.11 Tidepool Scientific Software, McKinleyville, CA. 275 pp.

APPENDIX A – *Pseudokirchneriella subcapitata* Toxicity Test Data

Pseudokirchneriella subcapitata Summary Sheet

Client: Burrard Vexitas Lab
Work Order No.: 191825

Start Date: Sept 19/19
Set up by: MG

Sample Information:

Sample ID: WM 9244-1645-18
Sample Date: Sept 17/19
Date Received: Sept 19/19
Sample Volume: 1x1L

Test Organism Information:

Culture Date: Sept 13/19
Age of culture (Day 0): 6d

Zinc Reference Toxicant Results:

Reference Toxicant ID: SC189
Stock Solution ID: 193003
Date Initiated: Sept 20/19

72-h IC50 (95% CL): 31.8 (21.4-34.6) ug/L Zn

72-h IC50 Reference Toxicant Mean and Range: 31.1 (25.1-38.6) ug/L Zn CV (%): 11

Test Results:

	Cell Yield (Mean± SD)
Negative Control	30.2 ± 2.0
WM 9244-1645-18 (95.2% v/v)	89.2 ± 7.6*
	±
	±
	±
	±
	±
	±
	±

* indicates that cell yield is significantly greater than the lab control

Reviewed by: JGL

Date reviewed: Oct. 17/19

72-h Algal Growth Inhibition Toxicity Test
Water Quality Measurements

Client: Bureau Veritas Labs — Setup by: MG

Sample ID: WM92~~91~~94-1645-18 — Test Date/Time: Sept 19/19 @ 1500h

Work Order No.: 191856 — CER #: 4

Test Species: *Pseudokirchneriella subcapitata*

Culture Date: Sept 13/19 — Age of Culture: 6d — Culture Health: Good

Culture Count: 1 220 2 240 — Average: 230 — Culture Cell Density (c1): 230 x10⁴ cells/mL

v1 = (220,000 cells/ml x 100 ml) / (c1) 230 x10⁴ cells/ml = 9.56mL

Time Zero Counts: 1 20 2 21 — Average: 20.5

No. of Cells/mL: 20.5 x10⁴ — Initial Density: # cells/mL ÷ 220 µL x 10 µL = 9318 cells/mL

Concentration %(v/v)	Water Quality pH 0 h	Water Quality Temp (°C) 0 h	Incubator Temperature (°C) 0 h	24 h	48 h	72 h	Microplates rotated 2X per day? 0 h	24 h	48 h	72 h
Control	7.2	22.2	25.0	25.2	25.0	25.0	✓	✓	✓	✓
93.7	7.6	22.0	↓	↓	↓	↓	✓	✓	✓	✓
Initials	MG	MG	MG	MG	[illegible]	[illegible]	MG	MG	[illegible]	[illegible]

Initial control pH: Well 1: 7.2 — Well 2: 7.2

Final control pH: Well 1: 7.1 — Well 2: 7.1

Light intensity (lux): 8900 — Date measured: Sept 19/19

Thermometer: 4 — Light meter: 1 — pH meter/probe: 1 / 1

Sample Description: clear, colourless, odourless, some particulates

Comments:

Reviewed: JBM — Date reviewed: Oct. 11/19

Pseudokirchneriella subcapitata Toxicity Test Data Sheet
72-h Algal Cell Counts

Client: Bureau Veritas Labs Start Date/Time: Sept 19/19 @ 1500h

Work Order #: ~~WW9244-1645-181835~~ Termination Date: Sept 22/19 @ 1500h

Sample ID: WW9244-1645-18 Test set up by: MD

%(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control	A	32					MD
	B	20					
	C	33					
	D	31					
	E	29					
	F	30					
	G	35					
	H	30					
95.7	A	96					
	B	97					
	C	80					
	D	89					
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						

Comments:

Reviewed by: Date Reviewed: Oct. 11/19

Pseudokirchneriella subcapitata Algal Counts

Client:	Bureau Veritas Labs	Start Date/Time:	19-Sep-19 @ 1500h
WO#:	191835	Termination Date/Time	22-Sep-19 @ 1500h
Sample ID:	WM9244-1645-18		
		Initial Cell Density:	9318 cell/mL

205000
0.22
0.01

Concentration %(v/v)	Rep	Count 1 (x 10^4)	Count 2 (x 10^4)	Count 3 (x 10^4)	Count 4 (x 10^4)	Mean (x 10^4)	Cell Yield (x 10^4) cell/mL		9318.182
Control	A	32				32	31.1	mean	30.3
	B	30				30	29.1	SD	1.982062
	C	33				33	32.1	CV	6.537537
	D	31				31	30.1		
	E	29				29	28.1		
	F	30				30	29.1		
	G	35				35	34.1		
	H	30				30	29.1		
95.2	A	95				95	94.1		
	B	97				97	96.1		
	C	80				80	79.1		
	D	89				89	88.1		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		

Reviewed by: JGu

Date reviewed: Oct. 11/19

CETIS Summary Report

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Batch ID:	15-8744-8356	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran		
Start Date:	19 Sep-19 15:00	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients		
Ending Date:	22 Sep-19 15:00	**Species:**	Pseudokirchneriella subcapitata	**Brine:**			
Test Length:	72h	**Taxon:**	Chlorophyta	**Source:**	In-House Culture	**Age:**	6d
Sample ID:	10-5123-2224	**Code:**	3EA887E0	**Project:**			
Sample Date:	17 Sep-19	**Material:**	Water Sample	**Source:**	Bureau Veritas Laboratories		
Receipt Date:	19 Sep-19	**CAS (PC):**		**Station:**	WM9244-1645-18		
Sample Age:	63h (2.9 °C)	**Client:**	Bureau Veritas Laboratories				

Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
11-9560-1267	Cell Yield	Unequal Variance t Two-Sample Test	3.1E-04	95.2% failed cell yield	1

Cell Yield Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	8	30.25	28.59	31.91	28	34	0.7008	1.982	6.55%	0.00%
95.2		4	89.25	77.11	101.4	79	96	3.816	7.632	8.55%	-195.04%

Cell Yield Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	N	31	29	32	30	28	29	34	29
95.2		94	96	79	88				

Analyst: MN QA: JGH Oct. 7/19

EC Alga Growth Inhibition Test — Nautilus Environmental

Analysis ID:	11-9560-1267	Endpoint:	Cell Yield	CETIS Version:	CETISv1.9.4
Analyzed:	01 Oct-19 13:38	Analysis:	Parametric-Two Sample	Status Level:	1
Batch ID:	15-8744-8356	Test Type:	Cell Growth	Analyst:	Mimi Tran
Start Date:	19 Sep-19 15:00	Protocol:	EC/EPS 1/RM/25	Diluent:	Deionized Water + nutrients
Ending Date:	22 Sep-19 15:00	Species:	Pseudokirchneriella subcapitata	Brine:	
Test Length:	72h	Taxon:	Chlorophyta	Source:	In-House Culture Age: 6d
Sample ID:	10-5123-2224	Code:	3EA887E0	Project:	
Sample Date:	17 Sep-19	Material:	Water Sample	Source:	Bureau Veritas Laboratories
Receipt Date:	19 Sep-19	CAS (PC):		Station:	WM9244-1645-18
Sample Age:	63h (2.9 °C)	Client:	Bureau Veritas Laboratories		

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C < T	95.2% failed cell yield	30.16%

Unequal Variance t Two-Sample Test

Control	vs	Control II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		95.2*	15.21	2.353	9.131	3	CDF	3.1E-04	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend Test			0.5634	Non-Significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	9282.67	9282.67	1	459	<1.0E-37	Significant Effect
Error	202.25	20.225	10			
Total	9484.92		11			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	14.83	10.88	0.0041	Unequal Variances
Distribution	Shapiro-Wilk W Normality Test	0.901	0.8025	0.1632	Normal Distribution

Cell Yield Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	8	30.25	28.59	31.91	29.5	28	34	0.7008	6.55%	0.00%
95.2		4	89.25	77.11	101.4	91	79	96	3.816	8.55%	-195.04%

Cell Yield Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	N	31	29	32	30	28	29	34	29
95.2		94	96	79	88				

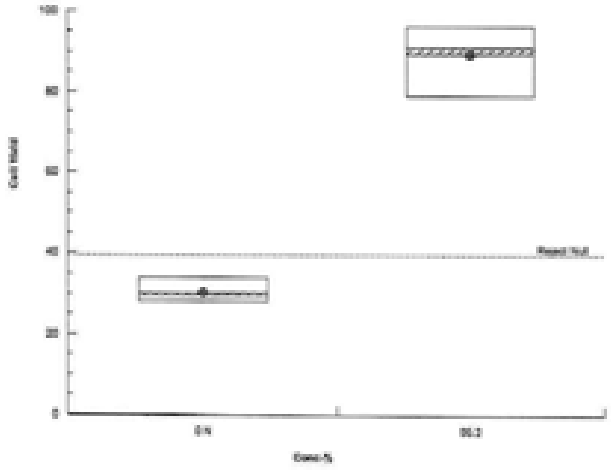
Analyst: MT QA: Oct.17/19

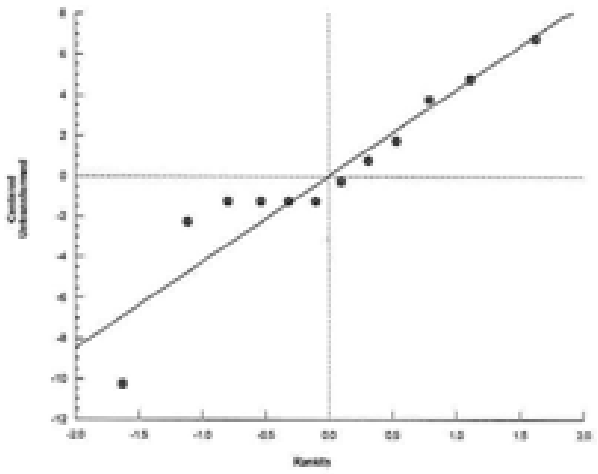
JGa

EC Alga Growth Inhibition Test — Nautilus Environmental

Analysis ID:	11-9560-1257	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.9.4
Analyzed:	01 Oct-19 13:38	**Analysis:**	Parametric-Two Sample	**Status Level:**	1

Graphics





Analyst: MD QA: JBL Oct-17-19

Pseudokirchneriella subcapitata Summary Sheet

Client: Bureau Veritas Labs
Work Order No.: 191835

Start Date: Sept 19/19
Set up by: MD

Sample Information:

Sample ID: NM9245-1645-18B
Sample Date: Sept 17/19
Date Received: Sept 19/19
Sample Volume: 1X1L

Test Organism Information:

Culture Date: Sept 13/19
Age of culture (Day 0): 6d

Zinc Reference Toxicant Results:

Reference Toxicant ID: SC189
Stock Solution ID: 19Zn03
Date Initiated: Sept 20/19

72-h IC50 (95% CL): 31.8 (21.4 - 34.6) ug/L Zn

72-h IC50 Reference Toxicant Mean and Range: 31.1 (25.1-38.6) ug/L Zn CV (%): 11

Test Results:

	Cell Yield (Mean± SD)
Negative Control	34.0 ~~34.8~~ ± ~~1.8~~ 2.4
NM9245-1645-18B (95.2-1.6)	96.5 ± 10.8 *
	±
	±
	±
	±
	±
	±
	±

* indicates that cell yield was significantly greater than the lab control

Reviewed by: JGh
Date reviewed: Oct. 17/19

72-h Algal Growth Inhibition Toxicity Test
Water Quality Measurements

Client: Bureau Veritas Labs | Setup by: MG

Sample ID: WW9245-1645-18B | Test Date/Time: Sept 19/19 @ 1500h

Work Order No.: 191835 | CER #: 4

Test Species: *Pseudokirchneriella subcapitata*

Culture Date: Sept 13/19 | Age of Culture: 6d | Culture Health: Good

Culture Count: 1 220 2 240 | Average: 230 | Culture Cell Density (c1): 230 x10⁴ cells/mL

v1 = 220,000 cells/ml x 10 ml / (c1) 230 x10⁴ cells/ml = 9.56mL

Time Zero Counts: 1 20 2 21 | Average: 20.5

No. of Cells/mL: 20.5 x10⁴ | Initial Density: # cells/mL ÷ 220 µL x 10 µL = 9318 cells/mL

Concentration %(v/v)	Water Quality pH 0 h	Water Quality Temp (°C) 0 h	Incubator Temperature (°C) 0 h	24 h	48 h	72 h	Microplates rotated 2X per day? 0 h	24 h	48 h	72 h
Control	7.8	22.0	25.0	25.0	25.0	25.0	✓	✓	✓	✓
95.7	7.6	22.0	↓	↓	↓	↓	✓	✓	✓	✓
Initials	MG	MG	MG	MG	↑	↑	MG	MG	↑	↑

Initial control pH: Well 1: 7.2 Well 2: 7.2

Final control pH: Well 1: 7.1 Well 2: 7.1

Light intensity (lux): 4090 Date measured: Sept 19/19

Thermometer: 4 Light meter: 1 pH meter/probe: 1 / 1

Sample Description: clear, colourless, odourless, no apparent particulates

Comments:

Reviewed: JGL Date reviewed: Oct. 11/19

Pseudokirchneriella subcapitata Toxicity Test Data Sheet
72-h Algal Cell Counts

Client: Bureau Veritas Lab Start Date/Time: Sept 19/19 @ 1550h

Work Order #: 191835 ~~198~~ 49 Termination Date: Sept 22/19 @ 1500h

Sample ID: WL 9245-1645-186 Test set up by: MD

%(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control	A	37					MD
	B	38					
	C	35					
	D	36					
	E	32					
	F	36					
	G	35					
	H	31					
95.0	A	107					
	B	85					
	C	106					
	D	92					↓
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						

Comments:

Reviewed by: JDH Date Reviewed: Oct-11/19

Pseudokirchneriella subcapitata Algal Counts

Client: Bureau Veritas Labs
WO#: 191835
Sample ID: WM9245-1645-18B

Start Date/Time: 19-Sep-19 @ 1500h
Termination Date/Time 22-Sep-19 @ 1500h

Initial Cell Density: 9318 cell/mL

205000
0.22
0.01
9318.182

Concentration %(v/v)	Rep	Count 1 (x 10^4)	Count 2 (x 10^4)	Count 3 (x 10^4)	Count 4 (x 10^4)	Mean (x 10^4)	Cell Yield (x 10^4) cell/mL		
Control	A	37				37	36.1	mean	34.1
	B	38				38	37.1	SD	2.390457
	C	35				35	34.1	CV	7.016686
	D	36				36	35.1		
	E	32				32	31.1		
	F	36				36	35.1		
	G	35				35	34.1		
	H	31				31	30.1		
95.2	A	107				107	106.1		
	B	85				85	84.1		
	C	106				106	105.1		
	D	92				92	91.1		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		

Reviewed by: ______________________

Date reviewed: Oct. 17/19

CETIS Summary Report

Report Date: 16 Oct-19 16:59 (p 1 of 1)
Test Code/ID: 191835b / 19-4494-7760

EC Alga Growth Inhibition Test — Nautilus Environmental

Batch ID:	20-1271-0259	Test Type:	Cell Growth	Analyst:	Mimi Tran		
Start Date:	19 Sep-19 15:00	Protocol:	EC/EPS 1/RM/25	Diluent:	Deionized Water + nutrients		
Ending Date:	22 Sep-19 15:00	Species:	Pseudokirchneriella subcapitata	Brine:			
Test Length:	72h	Taxon:	Chlorophyta	Source:	In-House Culture	Age:	6d
Sample ID:	11-4615-1826	Code:	4450E392	Project:			
Sample Date:	17 Sep-19	Material:	Water Sample	Source:	Bureau Veritas Laboratories		
Receipt Date:	19 Sep-19	CAS (PC):		Station:	WM9245-1645-18B		
Sample Age:	63h (2.3 °C)	Client:	Bureau Veritas Laboratories				

Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
17-5366-0575	Cell Yield	Unequal Variance t Two-Sample Test	7.1E-04	95.2% failed cell yield	1

Cell Yield Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	8	34	32	36	30	37	0.8452	2.39	7.03%	0.00%
95.2		4	96.5	79.34	113.7	84	106	5.393	10.79	11.18%	-183.82%

Cell Yield Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	N	36	37	34	35	31	35	34	30
95.2		106	84	105	91				

EC Alga Growth Inhibition Test — Nautilus Environmental

Analysis ID:	17-5366-0575	Endpoint:	Cell Yield	CETIS Version:	CETISv1.9.4
Analyzed:	11 Oct-19 18:02	Analysis:	Parametric-Two Sample	Status Level:	1
Batch ID:	20-1271-0259	Test Type:	Cell Growth	Analyst:	Mimi Tran
Start Date:	19 Sep-19 15:00	Protocol:	EC/EPS 1/RM/25	Diluent:	Deionized Water + nutrients
Ending Date:	22 Sep-19 15:00	Species:	Pseudokirchneriella subcapitata	Brine:	
Test Length:	72h	Taxon:	Chlorophyta	Source:	In-House Culture Age: 6d
Sample ID:	11-4615-1828	Code:	4450E392	Project:	
Sample Date:	17 Sep-19	Material:	Water Sample	Source:	Bureau Veritas Laboratories
Receipt Date:	19 Sep-19	CAS (PC):		Station:	WM9245-1645-18B
Sample Age:	63h (2.3 °C)	Client:	Bureau Veritas Laboratories		

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C < T	95.2% failed cell yield	37.78%

Unequal Variance t Two-Sample Test

Control vs	Control II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control	95.2*	11.45	2.353	12.85	3	CDF	7.1E-04	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	2.102	2.412	0.2284	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	10416.7	10416.7	1	267.8	<1.0E-37	Significant Effect
Error	389	38.9	10			
Total	10805.7		11			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	20.36	10.88	0.0016	Unequal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9534	0.8025	0.6877	Normal Distribution

Cell Yield Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	8	34	32	36	34.5	30	37	0.8452	7.03%	0.00%
95.2		4	96.5	79.34	113.7	98	84	106	5.393	11.18%	-183.82%

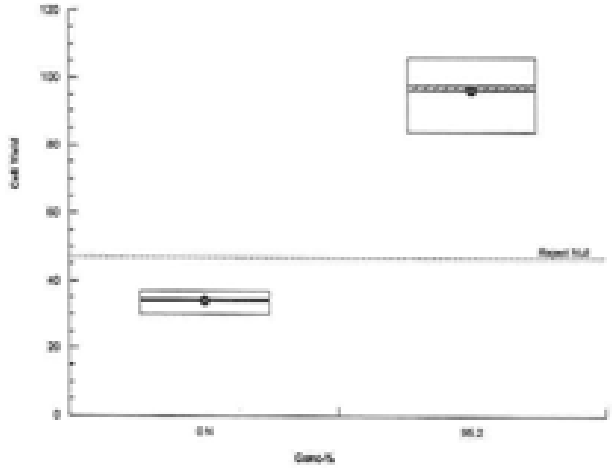
Cell Yield Detail

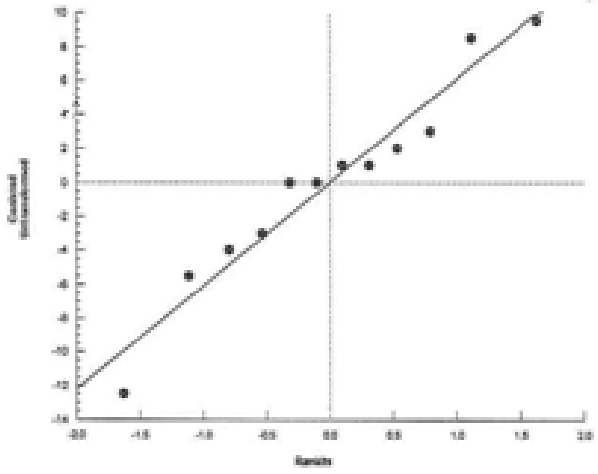
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	N	36	37	34	35	31	35	34	30
95.2		106	84	105	91				

EC Alga Growth Inhibition Test **Nautilus Environmental**

Analysis ID:	17-5366-0575	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.9.4
Analyzed:	11 Oct-19 18:02	**Analysis:**	Parametric-Two Sample	**Status Level:**	1

Graphics





Analyst: MCT QA: Oct-17/19

APPENDIX B – Chain-of-Custody Form

Sent To: **Nautilus Environmental**
8664 Commerce Court
Burnaby, BC, V5A 4N7
Tel: (604) 420-8773

CHAIN OF CUSTODY RECORD FOR SUBCONTRACTED WORK

Page 01 of 01

COC # B978381-ENAU-01-01

REPORT INFORMATION	
Company:	Bureau Veritas Laboratories
Address:	9331 - 48th Street, Edmonton, Alberta, T6B 2R4
Contact Name:	Geraldlyn Gouthro
Email:	geraldlyn.gouthro@bvlabs.com, customerservice@bvlabs.com
Phone:	(780) 577-7173
BV Labs Project #:	B978381

							ANALYSIS REQUESTED										
#	SAMPLE ID	MATRIX	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	SAMPLER INITIALS	# CONT.	PKS Algae									Temp °C	ADDITIONAL SAMPLE INFORMATION
1	WM9244-1645-18 ①	W	2019/09/17	00:00	AH	1	X									2.9	(P: 02) 1x1L
2	WM9245-1645-18B ①	W	2019/09/17	00:00	AH	1	X									2.3	(P: 02) 1x1L
3																	
4																	① sample description: clear,
5																	colourless, odourless, some
6																	particulates
7																	
8							19/1895										
9																	
10																	

REGULATORY CRITERIA	SPECIAL INSTRUCTIONS	TURNAROUND TIME
Diavik 1645-18 Ave & Grab	Please inform BV Labs immediately if you are not accredited for the requested test(s). **Please return a copy of this form with the report.**	☐ Rush Required **2019/10/15** Date Required *Please inform us if rush charges will be incurred.*

COOLER ID:	YES	NO	Temp: (°C)	1	2	3
Custody Seal Present						
Custody Seal Intact						
Cooling Media Present						

COOLER ID:	YES	NO	Temp: (°C)	1	2	3
Custody Seal Present						
Custody Seal Intact						
Cooling Media Present						

COOLER ID:	YES	NO	Temp: (°C)	1	2	3
Custody Seal Present						
Custody Seal Intact						
Cooling Media Present						

RELINQUISHED BY: (SIGN & PRINT)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (SIGN & PRINT)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
1. Gina Antonucci Gina Antonucci	2019/09/18	16:28	1. Tyrone Nomathon	Sept 19/2019	9:20
2.			2.		

END OF REPORT

RESULTS OF *DAPHNIA MAGNA* SINGLE CONCENTRATION-100%

Client : 4388 DIAVIK DIAMOND MINES INC., YELLOWKNIFE Job Number: B979875

Client Project Name & Number: Monthly (13,18,18B) SNP-A Sample Number: WN6548-01

Test Result:

48 hrs Mortality % 0 Statistical Method:

Mean percent mortality: Sample 0 Control 0

Sample Name : 1645-18B Sample Matrix : Grab Water

Description: Clear, Colourless Sample Prior to Analysis:

Sample Collected: Sep 16, 2019 04:14 PM Sampling Method : N/A pH: 7.1

Sample Collected By: AH Site Collection: N/A Temperature : 19 °C

Sample Received: Sep 20, 2019 04:18 PM Volume Received: 1 L Dissolved Oxygen: 10.2 mg/L

Analysis Start : Sep 20, 2019 12:09 PM Temp.Upon Arrival: 13 °C Sample Conductance: 608 µS/cm

End : Sep 22, 2019 01:02 PM Storage: 2-6°C Hardness: 140 mg $CaCO_3$/L

Concentration	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Immobility (#)	Immobility (%)	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)
% vol/vol	Start	Start	Start	Start	24 hrs	24 hrs	24 hrs	24 hrs	48 hrs	48 hr	48 hrs	48 hrs
0	21	8.2	342	7.9	0	0	0	0	19	8.1	343	8.4
0	21	8.2	344	7.7	0	0	0	0	20	8.1	340	8.4
0	21	8.2	344	7.7	0	0	0	0	20	8.1	339	8.4
100	20	7.2	618	9.6	0	0	0	0	20	7.7	615	8.4
100	20	7.2	618	9.6	0	0	0	0	20	7.6	616	8.4
100	20	7.1	622	9.5	0	0	0	0	20	7.6	625	8.3

Concentration	Mortality (#)	Mortality (%)	Immobility (#)	Immobility (%)
% vol/vol	48 hrs	48 hrs	48 hrs	48 hrs
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
100	0	0	0	0
100	0	0	0	0
100	0	0	0	0

Comments : None

Culture/Control/Dilution Water: City of Edmonton dechlorinated tap water

Hardness: 180 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,0,0,100,100,100 (% vol/vol)

Organisms per Vessel :	10	Pre-aeration Time :	30 min	Rate of Pre-aeration :	25-50 mL/min/L
Total # of Organisms Used :	60	Test Temperature :	20 ± 2 °C	Test Hardness Adjusted :	No
Test Volume :	150 mL	Vessel Volume :	225 mL	Test pH Adjusted:	No
Loading Density :	15.0 mL/Daphnia	Photoperiod :	16:8 (light: dark)		

Test Organism : *Daphnia magna* Source : In House Culture

Age at Test Initiation :	<24 hrs	Average Brood Size :	31.7
Culture Photoperiod :	16:8 (light: dark)	% Mortality within 7 days :	0
Culture Temperature :	20 ± 2 °C	Time To First Brood :	10 Days

Culture Diet: Pseudokirchnriella and YTC at a ratio of 2 mL/L of culture daily. New cultures weekly, 63 daphnids distributed into 6 culture vessels and 3 reproductive vessels.

RESULTS OF *DAPHNIA MAGNA* SINGLE CONCENTRATION-100%

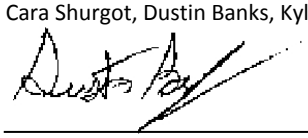
Client :	4388	DIAVIK DIAMOND MINES INC., YELLOWKNIFE	Job Number:	B979875
Client Project Name & Number:		Monthly (13,18,18B) SNP-A	Sample Number:	WN6548-01

Reference chemical:	Sodium Chloride	Test Date:	Sep 07, 2019
Test Endpoint 48 hrs LC50 (95% confidence interval) :	6.69 (6.20, 7.21)g/L	Statistical Method :	Untrimmed Spearman-Kärber
Historical Mean LC50 (warning limits) :	6.01 (4.52, 8.00) g/L	Concentration :	0,1.71,2.56,3.82,5.7,8.5 g/L

Test Method	EPS 1/RM/14
Method Deviations:	None

Note: The results contained in this report refer only to the testing of the sample submitted. This report may not be reproduced, except in its entirety, without the written approval of the laboratory.

Analyst : Cara Shurgot, Dustin Banks, Kyle Monaghan



Verified By : Dustin Banks, Team Lead, Bioassay Date: Sep 26, 2019 02:44 PM

RESULTS OF RAINBOW TROUT SINGLE CONCENTRATION-100%

Client : 4388 DIAVIK DIAMOND MINES INC., YELLOWKNIFE Job Number: B979875

Client Project Name & Number: Monthly (13,18,18B) SNP-A

Test Result:

96 hrs Mortality % 0 Statistical Method: Visual

Sample Name : 1645-18B Sample Matrix : Grab Water

Description: CLEAR, COLOURLESS Sample Number: WN6548-11

Sample Collected: Sep 16, 2019 04:14 PM Sampling Method : N/A Site Collection: N/A

Sample Collected By: AH Volume Received: 20 L Temp.Upon Arrival: 13 °C Storage: 2-6°C

Sample Received: Sep 20, 2019 04:18 PM pH: 6.9 Dissolved Oxygen: 9.4 mg/L

Analysis Start : Sep 21, 2019 12:16 PM Temperature : 14 °C Sample Conductance: 517 µS/cm

Concentration	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)
% vol/vol	Start	Start	Start	Start	24 hrs	24 hrs	24 hrs	24 hrs	48 hrs	48 hrs	48 hrs	48 hrs
0	14	7.9	288	8.9	0	0	0	0	0	0	0	0
100	14	7.0	526	9.3	0	0	0	0	0	0	0	0

Concentration	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)
% vol/vol	72 hrs	72 hrs	72 hrs	72 hrs	96 hrs	96 hr	96 hrs	96 hrs	96 hrs	96 hrs	96 hrs	96 hrs
0	0	0	0	0	14	7.8	290	9.1	0	0	0	0
100	0	0	0	0	14	7.3	546	8.9	0	0	0	0

Comments : None

Culture/Control/Dilution Water City of Edmonton dechlorinated tap water

Hardness: 180 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,100 (% vol/vol)

Organisms per Vessel :	10	Test Temperature :	15 ± 1 °C	Solution Depth :	>15 cm
Total # of Organisms Used :	20	Pre-aeration Time :	30 min.	Rate of Aeration	6.5±1 mL/min/L
Test Volume :	20 L	Vessel Volume :	38L	Test pH Adjusted:	No
Loading Density :	0.2 g/L	Photoperiod :	16:8 (light: dark)		

Test Organism : Rainbow Trout *(Oncorhynchus mykiss)* Source : Spring Valley Trout Hatchery

Culture Temperature :	15 ± 2 °C	Weight (Mean) +- SD :	0.3 ± 0.1 g	Length (Mean) +- SD :	3.37 ± 0.24 cm
Culture Water Renewal :	≥ 1.0 L/min/kg fish	Weight (Range) :	0.2 – 0.5 g	Length (Range) :	3.00 – 3.90 cm
Culture Photoperiod :	16:8 (light: dark)			% Mortality within 7 days :	0%
Feeding rate and frequency :	daily: 1-5% biomass of trout.			Acclimation Time:	>14 days

Reference chemical: Phenol Test Date: Sep 18, 2019

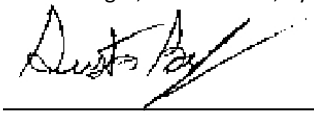
Test Endpoint 96 hrs LC50 (95% confidence interval) : 9.99 (9.10, 10.8)mg/L Statistical Method : Probit

Historical Mean LC50 (warning limits) : 9.95 (7.10, 13.9) mg/L Concentration : 0,8,10,12,15,20 mg/L

Test Method EPS 1/RM/13

Method Deviations : None

Analyst : Cara Shurgot, Dustin Banks, Kyle Monaghan



Verified By : Dustin Banks, Team Lead, Bioassay Date: Oct 02, 2019 03:05 PM

Toxicity testing on samples WT4468-1645-18 and WT4469-1645-18B

Collected October 22, 2019

Final Report

November 28, 2019

Submitted to: **Bureau Veritas Laboratories**
Burnaby, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

TABLE OF CONTENTS

List of Tables

List of Appendices

SIGNATURE PAGE

Report By:
Yvonne Lam, B.Sc.
Laboratory Biologist

Reviewed By:
Armando Tang, R.P.Bio
Senior Reviewer

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

SUMMARY

Sample Information and Test Type

Sample ID	WT4468-1645-18 WT4469-1645-18B
Sample collection date	October 22, 2019
Sample receipt date	October 23, 2019
Sample receipt temperature	3.9°C and 2.0°C
Test type	7-d rainbow trout (*Oncorhynchus mykiss*) embryo viability

Summary of Results

Endpoint	Mean ± SD			
	Control	WT4468-1645-18	Control	WT4469-1645-18B
Embryo viability (%)	84.3 ± 1.9	79.1 ± 21.8	82.8 ± 12.9	82.5 ± 15.2

SD = Standard Deviation

1.0 INTRODUCTION

Nautilus Environmental Company Inc. conducted 7-d rainbow trout (*Oncorhynchus mykiss*) embryo viability toxicity tests for Bureau Veritas Laboratories on two samples identified as WT4468-1645-18 and WT4469-1645-18B. The samples were collected on October 22, 2019 and delivered to the Nautilus Environmental laboratory in Burnaby, BC on October 23, 2019. The samples were each transported in four 10-L plastic containers and received at temperatures of 3.9 and 2.0°C. The samples were stored in the dark at 4 ± 2°C prior to testing.

This report describes the results of the toxicity tests. Copies of raw laboratory data sheets and statistical analysis are provided in Appendix A. The chain-of-custody form is provided in Appendix B.

2.0 METHODS

The method for the 7-d rainbow trout embryo viability toxicity test is summarized in Table 1, and followed procedures described by Environment Canada (1998) and modified by Canaria *et al.* (1999). Statistical analyses were performed using CETIS (Tidepool Scientific Software, 2013).

Table 1. Summary of test conditions: 7-d rainbow trout (*Oncorhynchus mykiss*) embryo viability single concentration test.

Test species	*Oncorhynchus mykiss*
Organism source	Hatchery
Organism age	<30 minutes post fertilization, <24 hour old gametes
Test type	Static-renewal
Test duration	7 days
Test vessel	2-L plastic container
Test volume	2 L
Test solution depth	17 cm
Test concentrations	100% (undiluted) sample, plus laboratory control
Test replicates	4 per treatment
Number of organisms	30 per replicate
Control/dilution water	Dechlorinated Metro Vancouver municipal tapwater
Test solution renewal	Daily (80% renewal)
Test temperature	14 ± 1°C
Feeding	None
Light intensity	Dark
Photoperiod	24 hours dark
Aeration	Continuous gentle aeration
Test measurements	Temperature, dissolved oxygen, pH and conductivity measured daily; hardness and alkalinity of undiluted sample measured at test initiation; survival checked daily
Test protocol	Environment Canada (1998), EPS 1/RM/28; Canaria *et al*. (1999)
Statistical software	CETIS Version 1.9.4
Test endpoints	Embryo viability
Test acceptability criteria for controls	Embryo viability ≥70%
Reference toxicant	Sodium dodecyl sulphate (SDS)

3.0 RESULTS

Results of the rainbow trout embryo viability toxicity tests conducted on samples WT4468-1645-18 and WT4469-1645-18B are summarized in Table 2. There was no statistically significant difference relative to their respective laboratory control for either sample, with embryo viability in both samples and all test treatments ≥79% (v/v).

Table 2. Results: 7-d rainbow trout (*Oncorhynchus mykiss*) embryo viability single concentration test.

Concentration (% v/v)	Embryo Viability (%) (Mean ± SD)	
	WT4468-1645-18	**WT4469-1645-18B**
Laboratory Control	84.3 ± 1.9	82.8 ± 12.9
100	79.1 ± 21.8	82.5 ± 15.2

SD = Standard Deviation

The samples were not statistically significantly different relative to their respective Laboratory Control

4.0 QA/QC

The health history of the test organisms used in the exposure was acceptable and met the requirements of the Environment Canada protocol. The test met all control acceptability criteria and water quality parameters remained within ranges specified in the protocol throughout the test. Uncertainty associated with this test is best described by the standard deviations around the means and/or confidence limits around the point estimates.

There were deviations from the test methodology. The eggs were exposed using a blocked design (eggs from each of the four female fish were distributed separately in each of replicates A to D) rather than pooled, as specified in the test method. The modification was used because the egg quality from each female varied considerably, and blocking would minimize the effects of poor quality eggs from one particular female fish. This deviation did not seem to affect the results of the tests and control criterion was met at the end of the exposure.

Results of the reference toxicant test conducted during the testing program are summarized in Table 3. Results for this test fell within the acceptable range for organism performance of mean and two standard deviations, based on historical results obtained by the laboratory with this test. Thus, the sensitivity of the organisms used in this test was appropriate. The reference toxicant was performed under the same conditions as those used for the samples.

Table 3. Reference toxicant test results.

Test Species	Endpoint	Historical Mean (2 SD Range)	CV (%)	Test Date
O. mykiss	Viability (EC50): 4.5 mg/L SDS	4.2 (2.1 – 8.4) mg/L SDS	36	October 23, 2019

SD = Standard Deviation, CV = Coefficient of Variation, EC = Effective Concentration

5.0 REFERENCES

Canaria, E.C., J.R. Elphick and H.C. Bailey. 1999. A simplified procedure for conducting small-scale short-term embryo toxicity tests with salmonids. *Environ. Toxicol.* 14:301-307.

Environment Canada. 1998. Biological test method: toxicity tests using early life stages of salmonid fish (rainbow trout). Environmental Protection Series EPS 1/RM/28. Second Edition, July 1998. Environment Canada, Method Development and Application Section, Environmental Technology Centre, Ottawa, ON. 102 pp.

Tidepool Scientific Software. 2013. CETIS comprehensive environmental toxicity information system, version 1.9.4 Tidepool Scientific Software, McKinleyville, CA. 255 pp.

APPENDIX A – *Oncorhynchus mykiss* Toxicity Test Data

Rainbow Trout Early Life Stage Summary Sheet

Client: Bureau Veritas

Start Date/Time: October 23, 2019 @ 1550h

Work Order No.: 192142

Test Species: *Oncorhynchus mykiss*

Sample Information:

Sample ID: WT4468-1645-18
Sample Date: October 22, 2019
Date Received: October 23, 2019
Sample Volume: 4 x 10L

Dilution Water:

Type: Dechlorinated Tap Water
Hardness (mg/L $CaCO_3$): 8
Alkalinity (mg/L $CaCO_3$): 0

Test Organism Information:

Batch No.: 102319
Source: Lyndon FTSH Hatcheries, New Dundee, ON
Loading Density: 0.96 g/L

Number of male broodstock used: 6
Number of female broodstock used: 4
Sperm motility check: Verification of sperm motility using a compound microscope

SDS Reference Toxicant Results:

Reference Toxicant ID: RTE125
Stock Solution ID: 19501
Date Initiated: October 23, 2019
7-d EC50 (95% CL): 4.5 (4.2-4.8) mg/L SDS

Reference Toxicant Mean and Range: 4.2 (2.1-8.4) mg/L SDS
Reference Toxicant CV (%): 36

Test Results: Embryo viability (%) (mean ± 2SD)

	Sample ID		
	Control	WT4468-1645-18	
EC25 % (v/v) (95% CL)	84.3 ± 1.9	79.1 ± 21.9	
~~EC50~~ % (v/v) (95% CL)	–	–	

Reviewed by: [signature]

Date reviewed: Nov 21, 2019

7-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Bureau Veritas
Sample ID: WT4468-1645-18
Work Order #: 192142

Start Date & Time: October 23, 2019 @ 1550h
Stop Date & Time: October 30, 2019 @ 0950h
CER #: 10
Test Species: *Oncorhynchus mykiss*

CONT Concentration (% v/v)	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.5	14.0	14.0	14.0	14.0
DO (mg/L)	10.2	10.1	9.8	10.1	10.0	10.1	9.8	10.0	9.8	9.8	9.7	9.9	9.8	10.0
pH	7.1	6.8	7.1	6.9	7.1	6.9	6.9	6.9	7.0	6.8	7.0	6.9	6.9	6.8
Cond. (µS/cm)	30	30		29		33		33		28		30		31
Initials	HW									HW		HW		HW

100 Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
DO (mg/L)	9.9	10.1	9.8	10.0	10.0	10.0	9.8	10.0	9.8	9.7	10.0	9.8	9.9	10.0
pH	7.4	7.3	7.4	7.3	7.4	7.2	7.3	7.2	7.4	7.4	7.6	7.3	7.6	7.5
Cond. (µS/cm)	719	731		740		741		743		725		727		731
Initials	HW									HW		HW		HW

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: (2418) DO meter/probe: 213 / 213 pH meter/probe: 213 / 213 Conductivity meter/probe: 213 / 213

	Control	100%		
Hardness*	8	150		
Alkalinity*	8	38		

* mg/L as CaCO3

Analysts: AWD, HW
Reviewed by: [signature]
Date reviewed: Nov. 20, 2019

Sample Description: clear, no colour, no odour, no particulates

Comments:

Embryo Toxicity Test
Daily Mortality

Client: Bureau Veritas
Sample ID: WT4468-1645-18
Work Order #: 192142

Start Date & Time: October 23, 2019 @ 1550h
Stop Date & Time: October 30, 2019 @ 0950h
Test Species: *Oncorhynchus mykiss*

Concentration (% v/v)	Rep	Day of Test - No. of Mortalities							Total Dead Eggs	Total Undeveloped	Total No. Embryo	Total Exposed
		1	2	3	4	5	6	7				
control	1	0	0	0	0	0	1	0	1	3	27	31
	2	1					2		3	2	25	30
	3	0				↓	0		0	5	25	30
	4					2	3		5	0	25	30
100	1					1	0	↓	1	1	28	30
	2					1	0	1	2	2	26	30
	3					0	1	1	2	14	14	30
	4	↓	↓	↓		1	2	0	3	0	26	29
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
Tech Initials												

Comments:

Reviewed by:

Date reviewed: Nov. 21, 2019

CETIS Summary Report

Salmonid Embryo Survival and Development Test — **Nautilus Environmental**

Batch ID:	15-4943-2006	**Test Type:**	Development	**Analyst:**	Yvonne Lam		
Start Date:	23 Oct-19 15:50	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water		
Ending Date:	30 Oct-19 09:50	**Species:**	Oncorhynchus mykiss	**Brine:**			
Test Length:	6d 18h	**Taxon:**	Actinopterygii	**Source:**	Lyndon Fish Hatcheries	**Age:**	
Sample ID:	10-2289-6264	**Code:**	WT4468-1645-18	**Project:**			
Sample Date:	22 Oct-19 05:02	**Material:**	Effluent	**Source:**	Bureau Veritas Laboratories		
Receipt Date:	23 Oct-19 09:43	**CAS (PC):**		**Station:**	WT4468-1645-18		
Sample Age:	35h (3.9 °C)	**Client:**	Bureau Veritas Laboratories				

SIngle Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
14-1544-5687	Proportion Normal	Fisher Exact Test	0.1854	100% passed proportion normal	1

Proportion Normal Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	4	0.8427	0.8128	0.8727	0.8333	0.8710	0.0094	0.0188	2.23%	0.00%
100		4	0.7908	0.4442	1.0000	0.4667	0.9333	0.1089	0.2178	27.54%	6.16%

Proportion Normal Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	0.8710	0.8333	0.8333	0.8333
100		0.9333	0.8667	0.4667	0.8966

Proportion Normal Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	27/31	25/30	25/30	25/30
100		28/30	26/30	14/30	26/29

Analyst: YWL QA: NH 21/19

CETIS Analytical Report

Salmonid Embryo Survival and Development Test — **Nautilus Environmental**

Analysis ID:	14-1544-5687	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.9.4
Analyzed:	18 Nov-19 18:49	**Analysis:**	Single 2x2 Contingency Table	**Status Level:**	1
Batch ID:	15-4943-2006	**Test Type:**	Development	**Analyst:**	Yvonne Lam
Start Date:	23 Oct-19 15:50	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	30 Oct-19 09:50	**Species:**	Oncorhynchus mykiss	**Brine:**	
Test Length:	6d 18h	**Taxon:**	Actinopterygii	**Source:**	Lyndon Fish Hatcheries **Age:**
Sample ID:	10-2289-6264	**Code:**	WT4468-1645-18	**Project:**	
Sample Date:	22 Oct-19 05:02	**Material:**	Effluent	**Source:**	Bureau Veritas Laboratories
Receipt Date:	23 Oct-19 09:43	**CAS (PC):**		**Station:**	WT4468-1645-18
Sample Age:	45h (3.9 °C)	**Client:**	Bureau Veritas Laboratories		

Data Transform	Alt Hyp	Comparison Result
Untransformed	C > T	100% passed proportion normal

Fisher Exact Test

Control	vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Negative Control		100	0.1854	Exact	0.1854	Non-Significant Effect

Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	N	102	19	121	0.843	0.157	-6.72%
100		94	25	119	0.7899	0.2101	0.0%

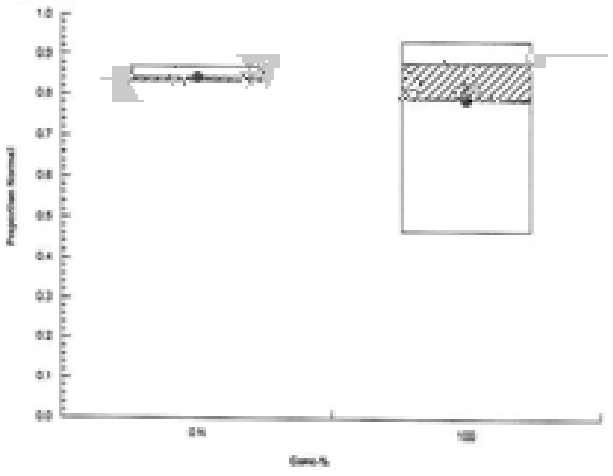
Proportion Normal Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	0.8710	0.8333	0.8333	0.8333
100		0.9333	0.8667	0.4667	0.8966

Proportion Normal Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	27/31	25/30	25/30	25/30
100		28/30	26/30	14/30	26/29

Graphics



Analyst: YWL QA: Nov 21/19

Rainbow Trout Early Life Stage Summary Sheet

Client: Bureau Veritas Start Date/Time: October 23, 2019

Work Order No.: 192142 Test Species: *Oncorhynchus mykiss*

Sample Information:

Sample ID: WT4469-1645-19B
Sample Date: October 22, 2019
Date Received: October 23, 2019
Sample Volume: 4 x 10L

Dilution Water:

Type: Dechlorinated Tap Water
Hardness (mg/L $CaCO_3$): 3
Alkalinity (mg/L $CaCO_3$): 8

Test Organism Information:

Batch No.: 102319
Source: Linden Fish Hatchery, New Dundee, ON
Loading Density: 0.96 g/L

Number of male broodstock used: 6
Number of female broodstock used: 4
Sperm motility check: Verification of sperm motility using a compound microscope

SDS Reference Toxicant Results:

Reference Toxicant ID: RTE125
Stock Solution ID: 19501
Date Initiated: October 23, 2019
7-d EC50 (95% CL): 4.5 (4.2-4.8) mg/L SDS

Reference Toxicant Mean and Range: 4.2 (2.1-8.4) mg/L SDS
Reference Toxicant CV (%): 36

Test Results: Embryo viability (7 dph) (mean ± 2SD)

	Sample ID		
	control	WT4469-1645-19B	
EC25 % (v/v) (95% CL)	82.8 ± 12.9	82.5 ± 15.2	/
~~EC50 % (v/v) (95% CL)~~ NC	/	/	/

Reviewed by: [signature] Date reviewed: Nov 21, 2019

7-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Bureau Veritas
Sample ID: WT4469-1645-1815
Work Order #: 192142

Start Date & Time: October 23, 2019 @ 1550h
Stop Date & Time: October 30, 2019 @ 0950h
CER #: 10
Test Species: *Oncorhynchus mykiss*

CONT Concentration (% v/v)	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.0	14.2	14.2	14.2	14.2	14.2	14.0	14.0	14.2	14.5	14.0	14.0	14.0	14.0
DO (mg/L)	10.2	10.1	9.9	10.1	10.2	10.1	10.0	10.0	9.9	9.8	9.8	9.9	10.1	10.0
pH	7.1	6.8	7.1	6.9	7.1	6.8	6.9	6.9	6.9	6.8	6.9	6.9	6.8	6.8
Cond. (µS/cm)	30	30		30		30		31		29		30		31
Initials	MM	A		A		A		A		MM		MM		MM

100 Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	13.5	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
DO (mg/L)	10.1	10.0	9.9	10.0	9.9	10.0	9.9	10.0	9.8	9.5	9.9	9.8	10.1	10.0
pH	7.4	7.4	7.5	7.4	7.4	7.2	7.4	7.1	7.2	7.3	7.6	7.5	7.6	7.6
Cond. (µS/cm)	716	736		741		745		743		724		725		732
Initials	MM	A		A		A		A		MM		MM		MM

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CEBH0 DO meter/probe: 213 / 213 pH meter/probe: 45 / 213 Conductivity meter/probe: 313 / 343

	Control	100%		
Hardness*	9	142		
Alkalinity*	8	38		

* mg/L as CaCO3

Analysts: AWD, MM
Reviewed by:
Date reviewed: Nov 21, 2019

Sample Description: clear, no colour, no odour, no particulates

Comments:

Embryo Toxicity Test
Daily Mortality

Client: Bureau Veritas
Sample ID: WT4469-1642-1BB
Work Order #: 192142

Start Date & Time: October 23, 2019 @ 1550h
Stop Date & Time: October 30, 2019 @ 0950h
Test Species: *Oncorhynchus mykiss*

Concentration (% v/v)	Rep	Day of Test - No. of Mortalities							Total Dead Eggs	Total Undeveloped	Total No. Embryo	Total Exposed
		1	2	3	4	5	6	7				
Control	1	0	0	0	0	0	0	1	1	4	25	30
	2	↓	↓	↓	↓	↓	1	1	2	1	27	30
	3	↓	↓	↓	↓	↓	1	1	2	9	20	31
	4	↓	↓	↓	↓	↓	1	0	1	1	28	30
100	1	↓	↓	↓	↓	↓	0	↓	0	3	27	30
	2	↓	↓	↓	↓	↓	0	↓	0	0	30	30
	3	↓	↓	↓	↓	↓	0	↓	0	10	20	30
	4	↓	↓	↓	↓	↓	2	↓	4	4	22	30
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
Tech Initials												

Comments:

Reviewed by:

Date reviewed: Nov-21, 2019

Version 1.0 Issued June 26, 2006

Nautilus Environmental Company Inc.

CETIS Summary Report

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Batch ID:	06-1126-3867	**Test Type:**	Development	**Analyst:**	Yvonne Lam		
Start Date:	23 Oct-19 15:50	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water		
Ending Date:	30 Oct-19 09:50	**Species:**	Oncorhynchus mykiss	**Brine:**			
Test Length:	6d 18h	**Taxon:**	Actinopterygii	**Source:**	Lyndon Fish Hatcheries	**Age:**	
Sample ID:	10-7588-4037	**Code:**	WT4469-1645-18	**Project:**			
Sample Date:	22 Oct-19 05:00	**Material:**	Effluent	**Source:**	Bureau Veritas Laboratories		
Receipt Date:	23 Oct-19 09:43	**CAS (PC):**		**Station:**	WT4469-1645-18B		
Sample Age:	35h (2 °C)	**Client:**	Bureau Veritas Laboratories				

Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
02-3915-6312	Proportion Normal	Equal Variance t Two-Sample Test	0.5465	100% passed proportion normal	1

Proportion Normal Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	4	0.8280	0.5231	1.0000	0.6452	0.9333	0.0644	0.1288	15.55%	0.00%
100		4	0.8250	0.5824	1.0000	0.6667	1.0000	0.0762	0.1524	18.48%	0.36%

Proportion Normal Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	0.8333	0.9000	0.6452	0.9333
100		0.9000	1.0000	0.6667	0.7333

Proportion Normal Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	25/30	27/30	20/31	28/30
100		27/30	30/30	20/30	22/30

Analyst: WW QA: NN·21/19

Salmonid Embryo-Alevin Survival and Development Test — Nautilus Environmental

Analysis ID:	02-3915-6312	Endpoint:	Proportion Normal	CETIS Version:	CETISv1.9.4
Analyzed:	18 Nov-19 18:51	Analysis:	Parametric-Two Sample	Status Level:	1
Batch ID:	06-1126-3867	Test Type:	Development	Analyst:	Yvonne Lam
Start Date:	23 Oct-19 15:50	Protocol:	EC/EPS 1/RM/28	Diluent:	Dechlorinated Tap Water
Ending Date:	30 Oct-19 09:50	Species:	Oncorhynchus mykiss	Brine:	
Test Length:	6d 18h	Taxon:	Actinopterygii	Source:	Lyndon Fish Hatcheries Age:
Sample ID:	10-7588-4037	Code:	WT4469-1645-18	Project:	
Sample Date:	22 Oct-19 05:00	Material:	Effluent	Source:	Bureau Veritas Laboratories
Receipt Date:	23 Oct-19 09:43	CAS (PC):		Station:	WT4469-1645-18B
Sample Age:	35h (2 °C)	Client:	Bureau Veritas Laboratories		

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	100% passed proportion normal	28.26%

Equal Variance t Two-Sample Test

Control	vs	Conc-%	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		100	-0.1217	1.943	0.281	6	CDF	0.5465	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0006173	0.0006173	1	0.01482	0.9071	Non-Significant Effect
Error	0.250009	0.0416681	6			
Total	0.250626		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	2.046	47.47	0.5716	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9375	0.6451	0.5867	Normal Distribution

Proportion Normal Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	4	0.8280	0.6231	1.0000	0.8667	0.6452	0.9333	0.0644	15.55%	0.00%
100		4	0.8250	0.5824	1.0000	0.8167	0.6667	1.0000	0.0762	18.48%	0.36%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	4	1.16	0.8972	1.424	1.2	0.9327	1.31	0.08271	14.26%	0.00%
100		4	1.178	0.8015	1.554	1.139	0.9553	1.479	0.1183	20.08%	-1.51%

Proportion Normal Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	0.8333	0.9000	0.6452	0.9333
100		0.9000	1.0000	0.6667	0.7333

Angular (Corrected) Transformed Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	1.15	1.249	0.9327	1.31
100		1.249	1.479	0.9553	1.028

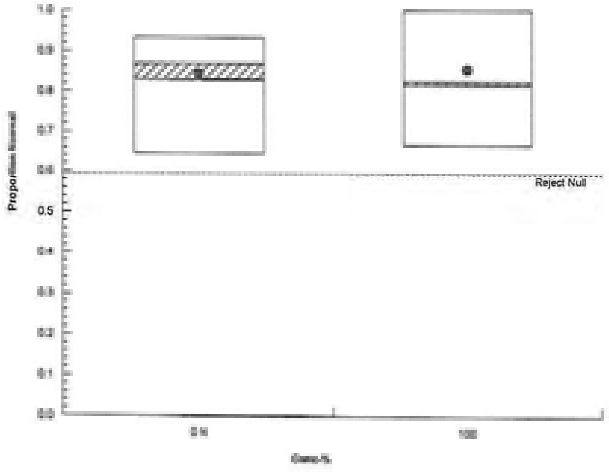
Proportion Normal Binomials

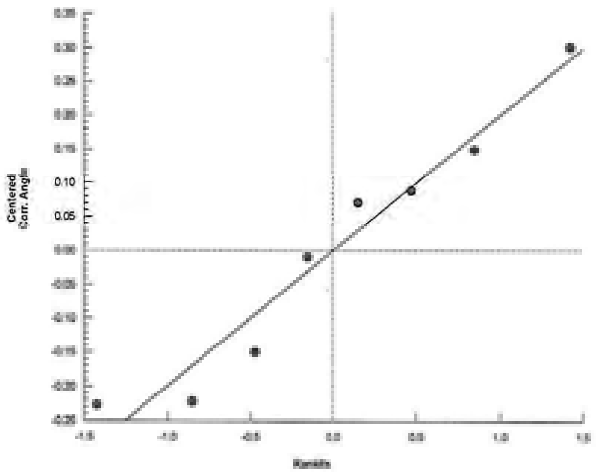
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	25/30	27/30	20/31	28/30
100		27/30	30/30	20/30	22/30

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID:	02-3915-6312	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.9.4
Analyzed:	18 Nov-19 18:51	**Analysis:**	Parametric-Two Sample	**Status Level:**	1

Graphics





APPENDIX B – Chain-of-Custody Form

Sent To: Nautilus Environmental
8664 Commerce Court
Burnaby, BC, V5A 4N7
Tel: (604) 420-8773

CHAIN OF CUSTODY RECORD FOR SUBCONTRACTED WORK

COC # B990653-ENAU-01-01

REPORT INFORMATION	
Company:	Bureau Veritas Laboratories
Address:	9331 - 48th Street, Edmonton, Alberta, T6B 2R4
Contact Name:	Geraldlyn Gouthro
Email:	geraldlyn.gouthro@bvlabs.com, customerservice@bvlabs.com
Phone:	(780) 577-7173
BV Labs Project #:	B990653

#	SAMPLE ID	MATRIX	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	SAMPLER INITIALS	# CONT.	ANALYSIS REQUESTED: Rainbow Trout 7 Day Embryo Subcontract P/F										ADDITIONAL SAMPLE INFORMATION
1	WT4468-1645-18	W	2019/10/22	05:02	SS2	4	X									3.9	(P: 01)
2	WT4469-1645-18B	W	2019/10/22	05:00	SS2	4	X									2.0	(P: 01)
3																	
4																	
5																	
6																	
7																	
8							19 2142										
9																	
10																	

REGULATORY CRITERIA

Diavik 1645-18 Ave & Grab

Missing 1x10L For 18
...arrived Oct. 23/19 @ 1430h

SPECIAL INSTRUCTIONS

Please inform BV Labs immediately if you are not accredited for the requested test(s).
Please return a copy of this form with the report.

TURNAROUND TIME

☐ Rush Required

2019/11/26

Date Required

Please inform us if rush charges will be incurred.

COOLER ID:	YES	NO	Temp: (°C)			
Custody Seal Present						
Custody Seal Intact						
Cooling Media Present						

COOLER ID:	YES	NO	Temp: (°C)			
Custody Seal Present						
Custody Seal Intact						
Cooling Media Present						

COOLER ID:	YES	NO	Temp: (°C)			
Custody Seal Present						
Custody Seal Intact						
Cooling Media Present						

RELINQUISHED BY: (SIGN & PRINT)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (SIGN & PRINT)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
1. David Tidman	2019/10/22	15:29	1. Tyrone Nimmo	Oct. 23/19	9:43
2.			2.		

END OF REPORT