



Vista Gold Australia Pty Ltd
Mt Todd Discharge
Treated Retention Pond 3 Ecotoxicological Report

February 2013

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1. Introduction

1.1 Project Background

Vista Gold Australia Pty Ltd (Vista Gold) received a Waste Discharge Licence (WDL 178-2) on 5 February 2013 from the Northern Territory Environment Protection Authority (NT EPA). The WDL outlines environmental requirements for protection of the Edith River from mine wastewater discharges. Previously, Vista Gold derived interim site specific trigger values (ISSTVs) (GHD 2012) to meet the 95% species protection trigger values downstream of the Retention Pond 1 (RP1) discharge site at SW10 (8.7 km from SW4) to meet the requirements of WDL 178-1. The discharge scenario from previous years where mine water was discharged from RP1 is no longer applicable to the site due to the need for dewatering and on-site water treatment.

The use of dilution factors derived from direct toxicity assessment (DTA) for three water bodies at the Mt Todd mine site has been selected as the most appropriate method for deriving safe concentrations of metals for environmental protection of the Edith River to meet the requirements of WDL 178-2. This method is recommended by ANZECC & ARMCANZ (2000) where chemicals are present in a complex mixture. DTA allows the determination of direct biological effects on appropriate species to be assessed and also enables metal concentrations to be established that would not cause adverse environmental effects.

DTA has been used throughout Australia to establish appropriate dilution factors for complex effluents. For example the Perth Desalination Plant (Geotechnical Services 2006, 2008) provided dilution factors to be met at the 80% species protection level within the Low Protection Area at the outfall, and the 90% species protection level at Moderate Protection Area in Cockburn Sound. All other desalination plants around Australia have used the DTA methodology to derive appropriate dilution factors and engineer the outfall configuration to meet the required dilutions (BHP Billiton 2009, Victorian Government 2008).

1.2 Objective

WDL 178-2 requires that ecotoxicological assessment be conducted for a wastewater source. This treated retention pond (RP)3 Ecotox DTA Report has been developed to address the relevant sections of the WDL 178-2 to derive a dilution factor for RP3 prior to discharging into the Edith River.

1.3 Scope of Work

This Report addresses the following aspects of the WDL 178-2:

- The methodology for calculating the 80% species protection ANZECC & ARMCANZ (2000) dilution factor for ecosystem protection applied at SW4 for mine discharges from RP3.
- Deriving Monitoring Values for the treated RP3 mine water to be met at SW4 to check that the dilution factor for the treated mine water is being met.

1.4 Limitations

This Vista Gold Australia Discharge Plan Revision 1 ("Report"):

1. *has been prepared by GHD Pty Ltd ("GHD") for Vista Gold Australia Pty Ltd (Vista Gold) and the NT EPA;*
2. *may only be used and relied on by Vista Gold and the NT EPA;*

3. *must not be copied to, used by, or relied on by any person other than Vista Gold without the prior written consent of GHD;*
4. *may only be used for the purpose of addressing WDL 178-2 requirements (and must not be used for any other purpose).*

GHD and its servants, employees and officers otherwise expressly disclaim responsibility to any person other than Vista Gold arising from or in connection with this Report.

To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by GHD and the Report are excluded unless they are expressly stated to apply in this Report.

The services undertaken by GHD in connection with preparing this Report were limited to those specifically detailed in section 1.2 of this Report.

The opinions, conclusions and any recommendations in this Report are based on assumptions made by GHD when undertaking services and preparing the Report (“Assumptions”), including (but not limited to): Current accepted practices.

GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with any of the Assumptions being incorrect.

Subject to the paragraphs in this section of the Report, the opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the time of preparation and may be relied on until 6 months, after which time, GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with those opinions, conclusions and any recommendations.

1.5 Assumptions

The assumptions upon which this report is based are:

- The treated mine water tested was representative of the RP3 water at the time of testing; and
- SW2 water used in the DTA was representative of late dry/ early wet season Edith River water.

2. Direct Toxicity Methodology

2.1 Direct Toxicity Assessment (DTA)

DTA provides an integrated measure of the toxicity of chemicals within a complex mixture, and accounts for interactions between compounds which may be additive, synergistic or ameliorative. DTA provides a better representation of natural environmental conditions than single chemical testing, and is therefore recommended by ANZECC & ARMCANZ (2000) for assessing the environmental impact from complex effluents.

The Mt Todd DTA program was designed in line with the recommendations contained in ANZECC & ARMCANZ (2000). ANZECC & ARMCANZ (2000) states that a DTA program should address the following design considerations:

- Test species selection
- Receiving water selection
- Nature of contaminant(s)
- Test methods
- Statistical considerations.

2.1.1 Selected Species

ANZECC & ARMCANZ (2000) "Minimum requirements for DTA" (section 8.3.6.8) recommend that toxicity data from between three and five species representing at least four different taxonomic groups (where five species are used) is required for effluent DTA. Further information on species used in the DTAs conducted for Mt Todd discharge to the Edith River is shown in Table 1 below.

Often, due to laboratory issues, not all tests listed in Table 1 are available at the time of testing. DTAs conducted on RP1, RP7 and RP3 Pilot Trial used a maximum of seven species to provide confidence in the species sensitivity distribution calculation.

Tests were selected adhering to the following criteria:

- a minimum of five bioassays covering at least four taxa
- preferably chronic endpoints to avoid the used of application factors
- locally occurring species or species representative of the ecosystem
- dilution water sampled from SW2
- sufficient test dilutions to obtain a statistically valid EC10 (i.e. tight 95% confidence limits)
- bioassay suite sensitive to a broad range of contaminants.

The bioassays were conducted in two laboratories because not all bioassays are available from one laboratory. The cladoceran (*Moinodaphnia macleayi*) is the most sensitive bioassay species and is only able to be conducted by the ERISS Laboratory in Darwin. All other bioassays are conducted by Ecotox Services Australasia located in Sydney as shown in Table 1.

Table 1 Species used in the Ecotoxicological Assessment of Treated RP3 Discharge

Test Organism	Test Duration	Test Endpoint	Key Reference	Laboratory
<i>Chlorella vulgaris</i> (green alga)	72 hour (chronic)	Growth inhibition	USEPA Method 1003.0 (2002)	Ecotox Services
<i>Lemna aequinoctialis</i> (duckweed)	96 hour (chronic)	Growth (frond number)	OECD Method 221 (2006)	Ecotox Services
<i>Moinodaphnia macleayi</i> (water flea)	3 brood (chronic)	Reproduction	Riethmuller <i>et al.</i> (2003)	ERISS
<i>Hydra viridissima</i> Pallas (green hydra)	96 hour (chronic)	Population growth	Riethmuller <i>et al.</i> (2003)	Ecotox Services
<i>Chironomus tepperi</i> (chironomid)	48 hour (acute)	Survival	USEPA (2002), OECD (2011)	Ecotox Services
<i>Macrobrachium bullatum</i> (shrimp)	96 hour (acute)	Survival	ESA SOP 123 (ESA 2012)	Ecotox Services
<i>Melanotaenia splendida</i> (rainbowfish)	10 day (chronic)	Embryonic development and post hatch survival	USEPA (2002)	Ecotox Services

2.1.2 Concentrations Tested

Edith River water sampled from the upstream site SW2 was used as the diluent to assess the toxicity of the treated RP3 mine water. A laboratory control was run concurrently with all tests to confirm that the natural diluent water was not confounding the bioassays (as can happen in many cases). All samples were serially diluted with the SW2 river water to achieve the required test concentrations. Concentrations differed between bioassays due to methodologies used and sensitivity of the species tested as determined by previous bioassays, as shown in Table 2.

Table 2 Concentrations of Treated RP3 used in Bioassays

Microalga % RP3	Duckweed % RP3	Cladoceran % RP3	Hydra % RP3	Chironomid % RP3	Shrimp %RP3	Fish % RP3
0	0	0	0	0	0	0
0.1	0.1	0.0078	0.06	6.3	0.3	0.03
0.2	0.2	0.0156	0.13	12.5	0.6	0.06
0.4	0.4	0.0312	0.25	25	1.3	0.13
0.8	0.8	0.0625	0.5	50	2.5	0.25
1.5	1.5	0.125	1.0	100	5.0	0.50
3	3.0	0.25	2.0	-	10.0	1.00
-	-	0.5	-	-	-	-
-	-	1.0	-	-	-	-

2.1.3 Dilution Factors

Dilution factors are derived from results of DTA using bioassays representative of the receiving ecosystem which incorporates all actions of the constituents of the effluent. These results are placed in the BurrliOZ (Campbell *et al.* 2000) statistics program for calculation of a species sensitivity distribution and the concentration of effluent is determined to protect 80% of the populations in the receiving water from a 10% decrease in growth and / or reproduction.

Concentrations of individual chemicals cannot be extrapolated from DTAs for use as trigger values. However, individual chemical concentrations can be used for monitoring purposes to ensure that the dilution factors are met at the appropriate monitoring site. If the dilution factors are not met, the investigation procedure shown in Figure 1 (GHD 2013) will be followed.

2.2 Surface Water Chemistry

Samples from SW2 (diluent) and treated RP3 water were analysed for the suite of analytes shown in Table 3.

Table 3 Analytes for SW2 and Treated RP3

	Analytes
In-Situ	DO, temperature, EC, pH
Metals (total and dissolved i.e. 0.45 µm)	Al, Cd, Co, Cu, Cr, Fe, Pb, Mg, Mn, Hg, Ni, Zn
Others	NO ₃ , PO ₄ , SO ₄ , bicarbonate, alkalinity, hardness, TDS, TSS, TS, Na, Cl, Ca, WAD cyanide, TOC and DOC

2.3 Sample Sites

RP3 and SW2 sampling locations are shown in Table 4. The treated RP3 water was sampled at 6 metres below the RP surface. This depth is the proposed pumping depth for discharge and provides the treated water with the highest pH and lowest metal concentrations.

Table 4 Sampling Sites

Site Name	Site Description	Easting (UTM)	Northing	Latitude (degree, decimal)	Longitude
SW2	Edith River at bridge on Edith Falls Road	0189088	8431347	-14.1718	132.12
RP3	Batman Pit	0187055	8434993	-14.1388	132.1015

3. Results

3.1 Ecotoxicology Testing of RP3 Treated Water (in-situ)

The species used were appropriate for the site and the EC10 and LC50 results were of sufficient quality to be used in the BurrliOZ (Campbell *et al.*, 2000) program for species sensitivity distribution (SSD) calculations. Not all species that were used in the ERISS (2005) toxicity testing program were available at the time of testing.

A copy of the Ecotox Report by Ecotox Services, “*Toxicity Assessment of a Treated Water Sample, January 2013*” and the ERISS Test Report are located in Appendix A. A summary of the results is provided in Table 5. The results of the site specific DTA testing performed by Ecotox Services used in this assessment do meet the laboratory NATA requirements for quality assurance/quality control (QA/QC) parameters. It must be noted however, that the majority of the reference toxicant results are in the lower 10% of the Cusum chart limits, indicating that the organisms used were more sensitive to the toxicants than is usual (Appendix A). This sensitivity means that the results from this treated RP3 DTA are very conservative.

ERISS does not hold NATA accreditation, but does perform similar QA/QC on toxicity tests, as is required for NATA accreditation.

Table 5 Summary of Treated RP3 Ecotox Results

Test	EC/IC10 and LC10 (95% confidence limits) % Treated RP3	EC/IC50 and LC50 (95% confidence limits) % Treated RP3
Microalgal 72-hour growth inhibition	0.2 (0.1-0.3)	0.3 (0.3-0.4)
Duckweed 7-day growth inhibition	0.30 (0.1-0.4)	0.6 (0.5-0.6)
Cladoceran 6-day reproduction	0.019 (0.016-0.020)	0.14 (0.01-0.20)
Hydra 96-hour growth	0.27 (0.06-0.39)	0.42 (0.35-0.49)
Chironomid 96-hour survival	7.4 (6.4-10.6)	9.5 (8.7-10.5)
Shrimp 96-hour survival	0.5 **	1.0 (0.7-1.2)
Fish 10-day post hatch survival	0.28 (0.14-0.37)	0.56 (0.43-0.71)

**No observable effect concentration (NOEC) ** 95% confidence limits not reliable*

The results show that the cladoceran is the most sensitive species to the treated RP3 water. Algae and duckweed usually show similar sensitivities to most toxicants and Gausman (2006) suggests that the two tests can be used interchangeably. Gausman (2006) also cites literature that shows that unicellular alga is more sensitive than duckweed to some metals as is shown in this suite of bioassay results.

In this case, copper, manganese and zinc are present in the treated RP3 mine water and may be causing the toxicity observed in the cladoceran, duckweed and algal bioassays. Cobalt, nickel, lead and cadmium are also present in concentrations that have potential to cause toxicity to unicellular alga, as the alga is more sensitive than duckweed to these metals.

The cladoceran is sensitive to the treated RP3 water, which may be a reflection of the toxicity of the treated RP3 water to their food source (i.e. the unicellular alga).

3.2 Acute to Chronic Ratios (ACR)

Two of the bioassays used in this study were acute bioassays where survival was the end point. The chironomid and shrimp are acute bioassays and the LC50 results need to be adjusted so that they can be incorporated into the statistics to calculate the SSD. ANZECC & ARMCANZ (2000) recommend an acute to chronic factor of 10 to go from an acute LC50 to a chronic NOEC or EC10. This acute to chronic ratio (ACR) was applied to the chironomid and shrimp LC50 data to obtain a chronic EC10.

3.3 Concentrations used to calculate the SSD

The acute bioassays required an ACR adjustment, applied to the LC50 values for the chironomid (LC50 = 9.5%) and shrimp (LC50 = 1.0%). The values used to calculate the SSD and dilution factors are shown in Table 6.

Table 6 Values used to Calculate SSD

Bioassay	EC10 % RP3
Microalgal 72-hour growth inhibition	0.2
Duckweed 96-hour growth inhibition	0.30
Cladoceran 6-day reproduction	0.02
Hydra 96-hour growth	0.27
Chironomid 48-hour survival	0.95
Shrimp 96-hour survival	0.1
Fish 96-hour imbalance	0.28

3.4 Species Protection Values

The EC10 and LC50/10 values from Table 6 were input into the BurrliOZ (Campbell *et al.*, 2000) statistics program for calculation of the 80% species protection value using the SSD. The calculated value and the dilution factor required to reach the concentration are provided in Table 7.

Table 7 Species Protection Values

Species Protection Level	Concentration of Treated RP3 (%)	Dilution Factor
80%	0.089	1,123

3.5 Dilution Factor

The 80% species protection was selected as appropriate to provide a level of protection for the Edith River from the discharge of treated RP3 water over the dewatering period. A dilution factor of 1:1,123 for the RP3 treated water (as at time of testing, 23/01/13) discharged into the Edith River will provide 80% of the species with protection from a 10% decrease in reproduction or growth (Table 7). The concentrations of chemicals at this dilution are shown in Table 8. The levels of copper and zinc have been selected as monitoring values to be met to ensure that the dilution of the treated RP3 water is at 1:1,123 to meet the requirements of WDL 178-2.

3.6 80 Percent Species Protection Monitoring Values

The chemistry of the RP3 treated water at the 1:1,123 dilution is shown in Table 8. The complete chemistry results are located in Appendix B. The concentrations of copper at 3.0 µg/L and zinc at 33.8 µg/L should be met at SW4 to ensure the correct dilution is being achieved. If this dilution is not met then action is triggered as shown in Figure 1 of the Discharge Plan (GHD 2013).

Table 8 Dilution Rates of RP3 Treated Water (in-situ) to Meet 80 percent SSD Dilution (1:1,370)

Analytes (metals 0.45 µm)	SW2 23/01/13	RP3 Treated Water 23/01/13	Conc. in RP3 treated water at 1:1,123 to be met at SW4	ANZECC 80% species protection TVs/ISSTV	ANZECC 95% species protection TVs/ISSTV
pH		-	-	6-8	6-8
DO (%)		-	-	85-120	85-120
Conductivity (µS/cm)				20-250	20-250
Mg (mg/L)	0.5	200	0.17	2.5	2.5
SO ₄ (mg/L)	<1	1,800	1.6	129	129
Al (µg/L)	110	<10	<10	150	149
Cd (µg/L)	<0.1	130	0.12	0.8	0.2
Co (µg/L)	<1	1,300	1.16	90	90
Cr (µg/L)	<1	<1	<1	40	1.0
Cu (µg/L)	<1	3,400	3.0	2.5	1.4
Fe (µg/L)	290	<10	<10	300	300
Mn (µg/L)	<5	19,000	16.9	3,600	1,700
Ni (µg/L)	<1	1,300	1.16	17	11
Pb (µg/L)	<1	65	0.06	9.4	3.4
Hg (µg/L)	<0.05	<0.05	<0.05	5.4	0.6
Zn (µg/L)	2	38,000	33.8	31	8.0

Note. Cells in green are below the ISSTVs and ANZECC & ARMICANZ (2000) default 95% trigger values

Table 9 shows the Monitoring Values for each discharge point as of 28 February 2013.

RP3 treated water will be assessed for toxicity during the 2012/2013 wet season and a revised dilution factor and Monitoring Values calculated. RP1 and RP7 mine waters will be assessed for toxicity prior to the 2013/2014 wet season.

Table 9 Monitoring Values for SW4 (February 2013)

Discharge	Chemical	Concentration (µg/L) 0.45 µm filtered
RP3 Treated Water	Cu	3.0
	Zn	33.8
RP1 Untreated Water	Cu	4.3
RP7 Untreated Water	Cu	4.2

4. Conclusions and Recommendations

4.1 Conclusions

Copper and zinc are the only metals present in the treated RP3 mine water above the 95% species protection ISSTVs at the 1:1,123 dilution factor. However the dilution factor calculated using the SSD seems to be conservative for ecosystem protection of the Edith River at SW4 because the chemistry of RP3 has improved significantly since the DTA was conducted (Table 10).

Both the zinc and copper concentrations are above the ANZECC & ARMCANZ 80% species protection trigger values. Again, the dilution factor of 1:1,123 and monitoring values for copper of 3µg/L and zinc of 33.8 µg/L are very conservative, because the mean concentrations of copper and zinc at SW4 during the 2011/2012 wet season were much higher at 20 µg/L and 102 µg/L respectively, with maximum concentrations of 77 µg/L copper and 300 µg/L zinc recorded. Monitoring conducted during the 2012 dry season showed that there were no adverse environmental impacts at SW4 or downstream of SW4 from the 2011/2012 wet season discharge from RP1.

Table 10 RP3 Chemistry (Top 15 metres)

Analyte Dissolved µg/L	20 Oct 12	23 Nov 12	20 Dec 12	17 Jan 13	14 Feb 13
Aluminium	57,000	31,000	1,700	270	<10
Chromium	2	2	1	<1	<1
Copper	10,000	11,000	9,900	5,400	140
Lead	210	190	160	86	<1
Cadmium	140	140	140	130	45
Zinc	36,000	34,000	38,000	39,000	8,400

Treatment of RP3 is on-going and the water quality is constantly improving with elevated pH and reduced metal concentrations (Table 10). The dilution factor of 1: 1,123 calculated in this report will be applied until the results of the next DTA become available. Due to the improvement of the RP3 water quality since the DTA, the dilution factor calculated in this report is very conservative.

It must be noted that the SW2 Edith River water sampled at the end of the dry season used as the dilution water for the DTA was not representative of wet season river water, when TOC and DOC are elevated. Therefore, the DTA conducted on this sample would have been a worst case scenario as increased DOC has the ability to reduce the toxicity of metals in the mine water.

4.2 Recommendations

To meet the 80% species protection level required by WDL 178-2, based on ecotoxicological testing, it is recommended that a dilution factor of 1:1,123 be applied to the discharge of RP3 treated mine water, with the following Monitoring Values applied at SW4:

- Cu 3.0 µg/L
- Zn 33.8 µg/L

These monitoring values will apply until a further round of ecotoxicological testing is conducted to derive a new dilution factor and Monitoring Values.

5. References

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Appendices

Appendix A – Ecotox Reports



Cladoceran Reproduction Test Report (1317D)

Client: Vista Gold Pty Ltd.
Project: Ecotoxicological assessment of Mt Todd Gold Mine discharge waters
Test Performed: BTT-D, 3 brood reproduction test using *Moinodaphnia macleayi*

Samples Collected:	15 th January 2013	
Samples Received:	16 th January 2012	Test Initiated: 17 th January 2013
ERISS Sample ID.	Sample Name	Sample Description
Reference water	Edith River (SW2)	Edith River upstream reference site
Toxicant	Treated RP3 water (RP3)	Lime treated water from Retention Pond 3
Comments: Waters received 16 th January 2012 and refrigerated at 4 °C. Waters were filtered (3 µm pore size) on the 17 th January		

Sample Physico-Chemistry and Preparation:			
Sample	Physico-chemistry		
	pH	EC ^a	DO ^b
QA Magela Creek water control	5.7	17	84.2
Edith River – reference water	6.4	17	80.8
Mt Todd treated RP3 water	6.5	2770	79.1

^a EC = Electrical Conductivity (µS cm⁻¹) unless other units provided; ^b DO = Dissolved Oxygen (% saturation)

Test Method: Cladoceran neonates (<6 h old) were exposed to a Magela Creek water QA control, a Reference/control water (Edith River, SW2) and 8 concentrations of Mt Todd Mine treated RP3 water, diluted with the reference water, for a period of 144 h. All waters were filtered (3 µm pore size) prior to testing.

The test was completed when >80% of control cladocera had released their third brood offspring. Observations of the appearance and number of neonates produced by each cladoceran were recorded at 24 h intervals, after which the cladocera were transferred to fresh test solution containing food. The detailed test protocol is presented in Riethmuller et al. (2003).

Linear interpolation analysis was used to determine point estimates of Inhibitory Concentrations (ICs) that reduced neonate production by 10% and 50% (i.e. IC₁₀ and IC₅₀) relative to the reference site control responses (CETIS v1.8.1.2).

Comments: A larger concentration range was achieved by reducing treatment replication from 10 to 5 per treatment. Control replication was not modified (i.e. 10 replicates). This allows greater characterisation of the concentration-response of the cladoceran.

Results*		
Sample	Mean neonate production ± SEM	% of Reference
QA Magela Creek water control	29.8 ± 0.6	98
SW2 - Reference water	30.3 ± 1.4	100
0.0078% Treated RP3 water	30.0 ± 0.9	99
0.0156% Treated RP3 water	32.6 ± 1.3	107
0.0313% Treated RP3 water	17.6 ± 0.4	58
0.0625% Treated RP3 water	16.2 ± 2.2	53
0.125% Treated RP3 water	16.8 ± 1.5	55
0.25% Treated RP3 water	10.4 ± 1.4	34
0.5% Treated RP3 water	0.4 ± 0.4	1.3
1.0% Treated RP3 water	0 ± 0	0
Toxicity Estimates		
IC10 (95% Confidence limits)	IC50 (95% Confidence limits)	
0.019 (0.016 – 0.020) % RP3 water	0.14 (0.01 – 0.20) % RP3 water	
<p>Comments: A full concentration-response relationship was established for the treated RP3 water (Figure 1). Individuals exposed to 0.078 and 0.0156% treated RP3 water had neonate counts of > 30 neonates adult⁻¹. Individuals exposed to 0.0313, 0.0625, 0.125 and 0.25% treated RP3 water produced 42, 47, 45 and 66% less neonates compared to the SW2 reference control, respectively. Exposure to 0.5% treated RP3 water resulted in 80% mortality with 2 neonates produced. 100% mortality of test organisms following exposure to 1% treated RP3 water, resulting in no reproduction.</p> <p>Toxicity of treated RP3 water lies between the toxicity responses of RP1 and RP7, where IC10's were 0.1 and 0.008%, respectively. This was consistent with the different metal concentrations found in the three water types. The toxicity of this water was higher than treated RP3 water that was tested in August 2011 (IC10=1.3%), which may be due to the extended storage time (6 weeks) of that sample.</p> <p>* See Attachment A for test raw data and statistical analysis report.</p>		

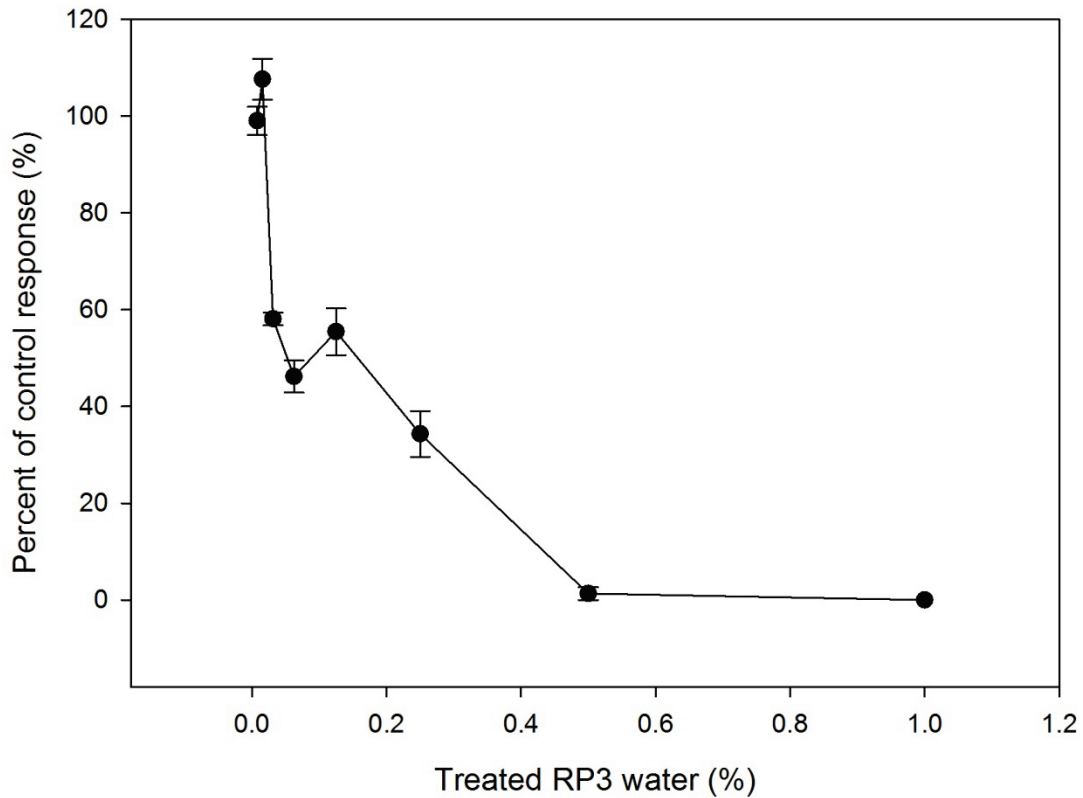


Figure 1 Effect of Mt Todd Retention Pond 3 water to *Moinodaphnia macleayi*. Results are represented as mean±standard error of neonate production (5 replicates) compared to control response (10 replicates). Mean control response = 30.3 neonates

Quality Control *	Criterion	NMCW	SW2	Criterion Met?
Mean # neonates in control	>30	29.8	30.3	Yes
% co-efficient of variation of control	<20	7	15	Yes
pH (Magela Creek water control)	<1 unit variation	<1	<1	Yes
DO concentration (throughout test)	>70% saturation	86.4%	86.4%	Yes
EC	<10% or < 3 $\mu\text{S cm}^{-1}$ variation	1 $\mu\text{S cm}^{-1}$	2 $\mu\text{S cm}^{-1}$	Yes
Reference toxicant EC50 ($\mu\text{g U L}^{-1}$)	± 2 SD of running mean ie. 76±132	171		No
<p>Comments: NMCW control produced less than the acceptability criterion of >30 neonates whereas SW2 reference water reached the criterion. Hence, this test was valid. The most recent reference toxicity test indicated reduced sensitivity of <i>M. macleayi</i> to uranium. This is currently under investigation.</p> <p>* See Attachment B for detailed test QC physico-chemical data.</p>				

References:

Riethmuller N, Camilleri C, Franklin N, Hogan AC, King A, Koch A, Markich SJ, Turley C & van Dam R 2003. *Ecotoxicological testing protocols for Australian tropical freshwater ecosystems*. Supervising Scientist Report 173, Supervising Scientist, Darwin NT.
<http://www.environment.gov.au/ssd/publications/ssr/pubs/ssr173-print-quality.pdf>

Test carried out by:	Kim Cheng and Claire Costello
Test supervised by:	Rick van Dam and Andrew Harford
Test report prepared by:	Kim Cheng Professional Officer (ph: 08 8920 1361)
Test report authorised by:	Andrew Harford A/g Program Leader (ph: 08 8920 1175)
Date:	12/02/13

Attachment A – Test raw data and statistical analysis report

CETIS Analytical Report

Report Date: 24 Jan-13 09:30 (p 1 of 2)
 Test Code: 1317D | 09-3585-5883

Cladoceran Reproduction Test			eriss ecotoxicology lab		
Analysis ID: 18-4815-7504	Endpoint: Total neonates	CETIS Version: CETISv1.8.7			
Analyzed: 24 Jan-13 9:30	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes			
Batch ID: 19-4868-4197	Test Type: Cladoceran reproduction	Analyst: Kim Cheng			
Start Date: 17 Jan-13	Protocol: Clad (chronic) eriss tropical freshwater	Diluent: Upstream of Discharge			
Ending Date: 23 Jan-13	Species: Moinodaphnia macleayi	Brine: Not Applicable			
Duration: 6d 0h	Source: In-House Culture	Age:			
Sample ID: 06-4638-2752	Code: 1317D	Client: Vista Gold			
Sample Date: 15 Jan-13	Material: RP7	Project: Mt Todd			
Receive Date: 16 Jan-13	Source: RP3				
Sample Age: 48h	Station:				

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1477154	200	Yes	Two-Point Interpolation

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value	3.499	3.128	0.0092	Outlier Detected

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	0.01742	0.001629	0.01779	5740	5621	61380
IC10	0.01922	0.01634	0.01996	5202	5010	6121
IC15	0.02103	0.01853	0.02213	4756	4518	5397
IC20	0.02284	0.0207	0.02431	4379	4113	4830
IC25	0.02465	0.0227	0.02649	4058	3774	4406
IC40	0.0301	0.02836	0.123	3323	812.8	3526
IC50	0.1449	0.006486	0.1959	690	510.4	15420

Total neonates Summary

C-%	Control Type	Count	Calculated Variate						
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Upstream Contro	10	30.3	20	37	1.453	4.596	15.2%	0.0%
0.0078		5	30	27	32	0.8944	2	6.67%	0.99%
0.015625		5	32.6	28	35	1.288	2.881	8.84%	-7.50%
0.03125		5	17.6	17	19	0.4	0.8944	5.08%	41.9%
0.0625		5	16.2	11	24	2.177	4.868	30.1%	46.5%
0.125		5	16.8	13	22	1.463	3.271	19.5%	44.6%
0.25		5	10.4	7	15	1.435	3.209	30.9%	65.7%
0.5		5	0.4	0	2	0.4	0.8944	224.0%	98.7%
1		5	0	0	0	0	0		100.0%

Total neonates Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Upstream Control	33	26	33	30	30	32	30	32	37	20
0.0078		29	27	32	31	31					
0.015625		28	35	32	33	35					
0.03125		19	17	18	17	17					
0.0625		17	15	24	11	14					
0.125		16	17	16	13	22					
0.25		7	8	10	12	15					
0.5		0	2	0	0	0					
1		0	0	0	0	0					

000-428-181-4

CETIS™ v1.8.7.4

Analyst: _____ QA: _____

CETIS Analytical Report

Report Date: 24 Jan-13 09:30 (p 2 of 2)
Test Code: 1317D | 09-3585-5883

Cladoceran Reproduction Test

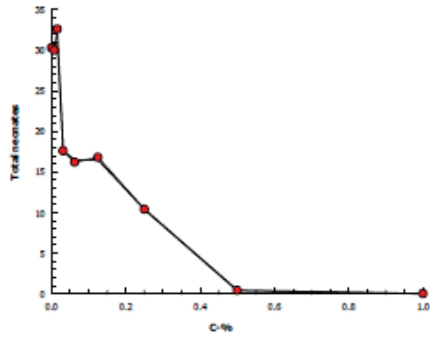
eriss ecotoxicology lab

Analysis ID: 18-4815-7504
Analyzed: 24 Jan-13 9:30

Endpoint: Total neonates
Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



000-428-181-4

CETIS™ v1.8.7.4

Analyst:

QA:

Attachment B - Physico-chemical measurements of the test solutions for test 1317D

Treatment (%)	MCW		SW2		0.01		0.02		0.03		0.06		0.13		0.25		0.5		1.0	
Parameter	0 h	24 h	0 h	24 h	0 h	24 h	0 h	24 h	0 h	24 h	0 h	24 h	0 h	24 h	0 h	24 h	0 h	24 h	0 h	24 h
Day 0 pH	5.8	6.3	6.5	6.6	6.5	6.6	6.5	6.8	6.6	6.7	6.5	6.8	6.5	6.7	6.5	6.7	6.5	6.7	6.5	6.7
EC ($\mu\text{S cm}^{-1}$)	21	21	21	20	20	22	21	22	21	22	24	24	24	27	32	33	44	44	66	67
DO (%)	102	90	98	89	103	88	101	90	104	89	100	91	99	91	101	90	101	91	98	88
Temp ($^{\circ}\text{C}$)	23.1	23.5	23.3	23.7	22.6	23.6	22.6	22.7	22.5	22.8	22.6	22.7	22.6	22.4	22.5	22.4	22.2	22.2	22.2	22.3
Day 1 pH	6.0	6.4	6.5	6.8	6.6	6.7	6.6	6.8	6.6	6.8	6.6	6.8	6.6	6.8	6.5	6.8	6.6	6.8	6.6	N.M
EC ($\mu\text{S cm}^{-1}$)	21	21	20	20	20	21	21	23	22	22	23	24	26	26	32	35	44	44	66	N.M
DO (%)	97	91	105	89	106	90	103	87	102	91	103	92	105	90	103	90	102	90	99	N.M
Temp ($^{\circ}\text{C}$)	23.0	22.5	22.6	22.3	22.1	22.1	22.8	22.2	21.8	22.0	21.4	22.1	21.2	22.0	21.3	22.0	21.1	21.8	20.9	N.M
Day 2 pH	5.9	6.5	6.5	6.8	6.5	6.8	6.5	6.8	6.5	6.8	6.5	6.8	6.5	6.8	6.5	6.8	6.5	6.7	N.M	N.M
EC ($\mu\text{S cm}^{-1}$)	20	21	19	20	19	20	20	22	21	22	22	23	24	26	31	33	44	44	N.M	N.M
DO (%)	106	89	111	89	116	93	116	91	111	90	114	94	115	90	113	92	114	91	N.M	N.M
Temp ($^{\circ}\text{C}$)	23.3	21.1	23.3	21.1	23.8	21.4	23.7	21.6	23.3	21.4	23.3	22.1	23.1	20.9	23.0	22.1	22.8	21.3	N.M	N.M
Day 3 pH	6.1	6.8	6.8	6.7	6.7	6.8	6.7	6.9	6.7	6.8	6.7	6.8	6.7	6.8	6.7	6.8	6.7	6.7	N.M	N.M
EC ($\mu\text{S cm}^{-1}$)	21	21	20	19	20	20	20	20	20	21.0		23	25	26	31	33	44	42	N.M	N.M
DO (%)	101	86	102	86	107	86	109	85	107	90	107	88	110	86	102	85	106	90	N.M	N.M
Temp ($^{\circ}\text{C}$)	23.1	21.9	22.3	22.2	22.9	22.0	23.2	22.0	23.4	21.9	23.0	21.8	22.1	21.6	21.7	21.6	21.4	21.1	N.M	N.M
Day 4 pH	5.9	6.5	6.7	6.7	6.7	6.9	6.6	6.8	6.6	6.8	6.6	6.8	6.6	6.8	6.8	6.8	6.7	6.8	N.M	N.M
EC ($\mu\text{S cm}^{-1}$)	20	21	19	20	18	21	18	22	21	23	22	24	26	26	32	32	44	44	N.M	N.M
DO (%)	103	90	113	89	111	90	112	90	112	92	107	93	101	91	104	92	104	93	N.M	N.M
Temp ($^{\circ}\text{C}$)	23.3	24.5	22.4	23.2	23.7	22.8	23.4	23.6	23.9	24.3	23.7	24.7	22.9	24.5	22.0	24.2	21.7	24.2	N.M	N.M
Day 5 pH	6.0	6.4	6.6	6.7	6.8	6.9	6.8	6.9	6.8	6.9	6.8	6.9	6.7	6.9	6.7	6.8	6.7	6.8	N.M	N.M
EC ($\mu\text{S cm}^{-1}$)	24	21	21	19	21	21	20	21	22	22	23	24	25	26	31	32	44	44	N.M	N.M
DO (%)	103	88	99	90	102	88	106	89	101	91	106	90	108	92	106	92	104	90	N.M	N.M
Temp ($^{\circ}\text{C}$)	23.5	22.7	23.4	23.0	22.0	23.7	21.5	22.6	21.6	22.4	21.5	24.5	21.4	24.1	21.4	23.9	21.0	22.7	N.M	N.M

N.M- not measured due to 100% mortality in treatment

Attachment C - Metal and major ion analyses of QA/QC waters

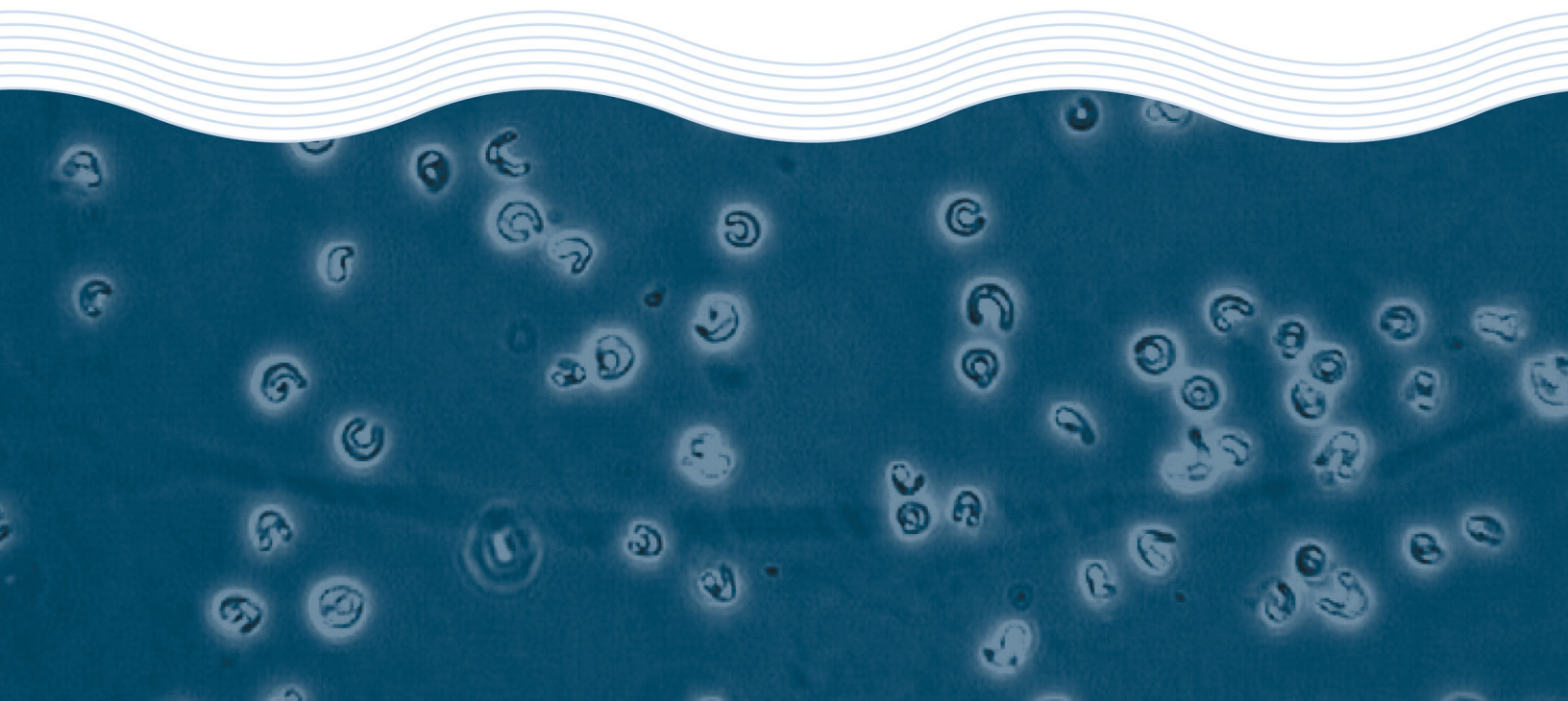
Elements	Units	Sample ID	
		1317D Pr BIK	1317D BIK
Aluminium-Total	µg L ⁻¹	0.26	0.32
Cadmium-Total	µg L ⁻¹	<0.02	<0.02
Cobalt-Total	µg L ⁻¹	<0.01	<0.01
Chromium-Total	µg L ⁻¹	<0.1	<0.1
Copper-Total	µg L ⁻¹	<0.01	0.025
Iron-Total	µg L ⁻¹	<1	<1
Manganese-Total	µg L ⁻¹	<0.01	<0.01
Nickel-Total	µg L ⁻¹	0.047	0.047
Lead-Total	µg L ⁻¹	0.082	<0.01
Selenium-Total	µg L ⁻¹	<0.2	<0.2
Uranium-Total	µg L ⁻¹	0.45	0.11
Zinc-Total	µg L ⁻¹	<0.1	<0.1
Calcium - Total	mg L ⁻¹	<0.1	<0.1
Magnesium - Total	mg L ⁻¹	<0.1	<0.1
Sodium - Total	mg L ⁻¹	<0.1	<0.1
Sulphate, SO ₄	mg L ⁻¹	<0.5	<0.5

Toxicity Assessment of a Treated Water Sample

Vista Gold Australia Pty Ltd

Test Report

January 2013



Toxicity Assessment of a Treated Water Sample

Vista Gold Australia Pty Ltd

Test Report

January 2013

Toxicity Test Report: TR0989/1

(page 1 of 2)

Client:	Vista Gold Pty Ltd PO Box 1616 Katherine NT 0851	ESA Job #:	PR0989
Attention:	Andrew Sawicki	Date Sampled:	Not supplied
Client Ref:	Not supplied	Date Received:	16 January 2013
		Sampled By:	Client
		ESA Quote #:	PL0989_q01

Lab ID No.:	Sample Name:	Sample Description:
5822	SW2	Aqueous sample, pH 7.0, conductivity 23.2µS/cm, total ammonia <2.0mg/L*. Sample received at room temperature in apparent good condition.
5823	RP3	Aqueous sample, pH 6.4, conductivity 2590µS/cm, total ammonia <2.0mg/L*. Sample received at room temperature in apparent good condition.

*Ammonia analysis is not covered by Ecotox Services Australasia's scope of accreditation

Test Performed:	48-hr acute (survival) toxicity test using the freshwater chironomid <i>Chironomus tepperi</i>
Test Protocol:	ESA SOP 121 (ESA 2012), based on OECD (2011) USEPA (2002) and Bailey <i>et al.</i> (2000)
Test Temperature:	The test was performed at 25±1°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	The sample was serially diluted with Sample 5822 'SW2' to achieve the test concentrations. A DMW and diluent control (SW2) were tested concurrently with the sample.
Source of Test Organisms:	ESA Laboratory culture
Age of Test Organisms:	8-14 days
Test Initiated:	29 January 2013 at 1430h

Sample 5823: RP3 Concentration (%)	% Survival (Mean ± SD)	Vacant	Vacant
DMW Control	95.0 ± 10.0		
Diluent Control	90.0 ± 11.6		
6.3	100 ± 0.0		
12.5	10.0 ± 11.6 *		
25	0.0 ± 0.0		
50	0.0 ± 0.0		
100	0.0 ± 0.0		
48-hr IC10 = 7.4 (6.4-10.6)% 48-hr EC50 = 9.5 (8.7-10.5)% NOEC = 6.3% LOEC = 12.5%			

*Significantly lower percent survival compared with the Diluent Control (Steel's Many-One Rank Test, 1-tailed, P=0.05)

Toxicity Test Report: TR0989/1

(page 2 of 2)

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean % survival	≥85.0%	95.0%	Yes
Reference Toxicant within cusum chart limits	16.5-3474.6 µg Cu/L	268.9µg Cu/L	Yes

* Cusum chart limits are not available due to limited testing with *C. tepperi*



Test Report Authorised by:

Dr Rick Krassoi, Director on 22 February 2013

NATA Accredited Laboratory Number: 14709

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Citations:

Bailey, H.C., Krassoi, R., Elphick, J.R., Mulhall, A., Hunt, P., Tedmanson, L. and Lovell, A. (2000) Application of *Ceriodaphnia cf. dubia* for whole effluent toxicity tests in the Hawkesbury-Nepean watershed, New South Wales, Australia: method development and validation. *Environmental Toxicology and Chemistry* 19:88-93.

ESA (2012) *SOP 121 – Acute toxicity test using Chironomus tepperi*. Issue No. 1. Ecotox Services Australasia, Sydney, New South Wales.

OECD (2011) OECD Guideline for the Testing of Chemicals. Test Guideline 235: *Chironomus sp.*, Acute Immobilisation Test.

USEPA (2002) *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms*. 4th Ed. United States Environmental Protection Agency, Office of Water, Washington DC.

Toxicity Test Report: TR0989/2

(page 1 of 2)

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Client:	Vista Gold Pty Ltd PO Box 1616 Katherine NT 0851	ESA Job #:	PR0989
Attention:	Andrew Sawicki	Date Sampled:	Not supplied
Client Ref:	Not supplied	Date Received:	16 January 2013
		Sampled By:	Client
		ESA Quote #:	PL0989_q01

Lab ID No.:	Sample Name:	Sample Description:
5822	SW2	Aqueous sample, pH 7.0, conductivity 23.2µS/cm, total ammonia <2.0mg/L*. Sample received at room temperature in apparent good condition.
5823	RP3	Aqueous sample, pH 6.4, conductivity 2590µS/cm, total ammonia <2.0mg/L*. Sample received at room temperature in apparent good condition.

*Ammonia analysis is not covered by Ecotox Services Australasia's scope of accreditation

Test Performed:	96-hr Growth inhibition of the freshwater aquatic duckweed <i>Lemna aequinoctialis</i>
Test Protocol:	ESA SOP 112 (ESA 2011), based on OECD method 221 (2006)
Test Temperature:	The test was performed at 29±2°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	The highest concentration was prepared by diluting Sample 5823 'RP3' with Sample 5822 'SW2', then serially diluting to achieve the test concentrations. A DMW and diluent control (SW2) were tested concurrently with the sample.
Source of Test Organisms:	ESA Laboratory culture
Test Initiated:	17 January 2013 at 1230h

Sample 5823: RP3	Concentration (%)	Specific Growth Rate (Mean ± SD)	Vacant	Vacant
CAAC Control		0.24 ± 0.02		
Diluent Control		0.26 ± 0.03		
	0.1	0.26 ± 0.03		
	0.2	0.25 ± 0.02		
	0.4	0.22 ± 0.01*		
	0.8	0.00 ± 0.00		
	1.5	0.00 ± 0.00		
	3.0	0.00 ± 0.00		
96-hr IC10 = 0.3 (0.1-0.4)% 96-hr IC50 = 0.6 (0.5-0.6)% NOEC = 0.2% LOEC = 0.4%				

*Significantly lower specific growth rate compared with the Diluent Control (Dunnett's Test, 1-tailed, P=0.05)

Toxicity Test Report: TR0989/2

(page 2 of 2)

QA/QC Parameter	Criterion	This Test	Criterion met?
Control frond doubling time	<3.0 days	2.9 days	Yes
Reference Toxicant within cusum chart limits	7.8-62.4mg MgSO ₄ /L	13.7mg MgSO ₄ /L	Yes



Test Report Authorised by:

Dr Rick Krassoi, Director on 22 February 2013

Results are based on the samples in the condition as received by ESA.

NATA Accredited Laboratory Number: 14709

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Citations:

ESA (2011) *SOP 112 – Duckweed Growth Inhibition Test*. Issue No. 3. Ecotox Services Australasia, Sydney NSW

OECD (2006) *Lemna sp.* Growth Inhibition Test. Method 221. OECD Guideline for the Testing of Chemicals. Organisation for Economic Cooperation and Development, Paris

Toxicity Test Report: TR0989/3

(page 1 of 2)

Client:	Vista Gold Pty Ltd PO Box 1616 Katherine NT 0851 Andrew Sawicki	ESA Job #:	PR0989
Attention:	Not supplied	Date Sampled:	Not supplied
		Date Received:	16 January 2013
		Sampled By:	Client
		ESA Quote #:	PL0989_q01

Lab ID No.:	Sample Name:	Sample Description:
5822	SW2	Aqueous sample, pH 7.0, conductivity 23.2µS/cm, total ammonia <2.0mg/L*. Sample received at room temperature in apparent good condition.
5823	RP3	Aqueous sample, pH 6.4, conductivity 2590µS/cm, total ammonia <2.0mg/L*. Sample received at room temperature in apparent good condition.

*Ammonia analysis is not covered by Ecotox Services Australasia's scope of accreditation

Test Performed:	96-hr acute survival test using the freshwater shrimp <i>Macrobrachium bullatum</i>
Test Protocol:	ESA SOP 123 (ESA 2012), based on USEPA (1996)
Test Temperature:	The test was performed at 25±1°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	The highest concentration was prepared by diluting Sample 5823 'RP3' with Sample 5822 'SW2', then serially diluting to achieve the test concentrations. A DMW and diluent control were tested concurrently with the sample.
Source of Test Organisms:	Hatchery reared, NT
Test Initiated:	25 January 2013 at 1600h

Sample 5823: RP3		Vacant	Vacant
Concentration (%)	% Un-affected (Mean ± SD)		
DMW Control	90.0 ± 11.6		
Diluent Control	95.0 ± 10.0		
0.3	95.0 ± 10.0		
0.6	70.0 ± 25.8		
1.3	40.0 ± 36.5		
2.5	0.0 ± 0.0		
5.0	0.0 ± 0.0		
10.0	0.0 ± 0.0		
96-hr EC10 = 0.5%**			
96-hr EC50 = 1.0 (0.7-1.2)%			
NOEC = 0.6%			
LOEC = 1.3%			

*Significantly lower percentage of un-affected shrimp compared with the Diluent Control (Dunnett's Test, 1-tailed, P=0.05)

**95% confidence limits not reliable

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean % un-affected	≥90.0%	90.0%	Yes
Reference Toxicant within cusum chart limits	30.1-287.8µg Cu/L	54.8 µg Cu/L	Yes

Toxicity Test Report: TR0989/3

(page 2 of 2)

Test Report Authorised by:



Dr Rick Krassoi, Director on 22 February 2013

Results are based on the samples in the condition as received by ESA

NATA Accredited Laboratory Number: 14709

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Citations:

ESA (2012) SOP 123 –*Acute Toxicity Test Using Freshwater Shrimp*. Issue No 1. Ecotox Services Australasia, Sydney, NSW

USEPA (1996) Ecological Effects Test Guidelines: OPPTS 850.1035 Mysid Acute Toxicity Test. Public Draft. United States Environmental Protection Agency, Washington DC, USA.

Toxicity Test Report: TR0989/4

(page 1 of 2)

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Client:	Vista Gold Pty Ltd PO Box 1616 Katherine NT 0851	ESA Job #:	PR0989
Attention:	Andrew Sawicki	Date Sampled:	Not supplied
Client Ref:	Not supplied	Date Received:	16 January 2013
		Sampled By:	Client
		ESA Quote #:	PL0989_q01

Lab ID No.:	Sample Name:	Sample Description:
5822	SW2	Aqueous sample, pH 7.0, conductivity 23.2µS/cm, total ammonia <2.0mg/L*. Sample received at room temperature in apparent good condition.
5823	RP3	Aqueous sample, pH 6.4, conductivity 2590µS/cm, total ammonia <2.0mg/L*. Sample received at room temperature in apparent good condition.

*Ammonia analysis is not covered by Ecotox Services Australasia's scope of accreditation

Test Performed:	72-hr microalgal growth inhibition test using the green alga <i>Chlorella vulgaris</i>
Test Protocol:	ESA SOP 103 (ESA 2011), based on USEPA (2002)
Test Temperature:	The test was performed at 25±1°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	The highest concentration was prepared by diluting Sample 5823 'RP3' with Sample 5822 'SW2', then serially diluting to achieve the test concentrations. Sample 5822 'SW2' was filtered to 0.45µm prior to use. A DMW and diluent control (SW2) were tested concurrently with the sample.
Source of Test Organisms:	ESA Laboratory culture, originally sourced from CSIRO Microalgal Supply Service, TAS
Test Initiated:	18 January 2013 at 1640h

Sample 5823: RP3 Concentration (%)	Cell Yield x10 ⁴ cells/mL (Mean ± SD)	Vacant	Vacant
USEPA Control	305.0 ± 58.0		
Diluent Control	325.3 ± 20.3		
0.1	325.5 ± 31.1		
0.2	272.5 ± 47.0		
0.4	92.0 ± 19.3 *		
0.8	0.4 ± 0.8 *		
1.5	0.0 ± 0.0		
3.0	0.0 ± 0.0		
72-hr IC10 = 0.2 (0.1-0.3)% 72-hr IC50 = 0.3 (0.3-0.4)% NOEC = 0.2% LOEC = 0.4%			

*Significantly lower cell yield compared with the Diluent Control (Steel's Many-One Rank Test, 1-tailed, P=0.05)

Toxicity Test Report: TR0989/4

(page 2 of 2)

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean cell density	$\geq 16.0 \times 10^4$ cells/mL	305.0×10^4 cells/mL	Yes
Control coefficient of variation	<20%	19.0%	Yes
Reference Toxicant within cusum chart limits	N/A*	2.0g KCl/L	N/A

*Cusum chart not available due to limited testing with this species



Test Report Authorised by:

Dr Rick Krassoi, Director on 22 February 2013

Results are based on the samples in the condition as received by ESA.

This document shall not be reproduced except in full.

Citations:

ESA (2011) *ESA SOP 103 – Green Alga, Selenastrum capricornutum, Growth Test*. Issue No 9. Ecotox Services Australasia, Sydney, NSW.

USEPA (2002) *Short-term methods for estimating the chronic toxicity of effluents and receiving waters to freshwater organisms*. Fourth Edition. EPA-821-R-02-013. United States Environmental Protection Agency, Office of Research and Development, Washington DC, USA,

Toxicity Test Report: TR0989/5

(page 1 of 2)

This document is issued in accordance with NATA's accreditation requirements

Client:	Vista Gold Pty Ltd PO Box 1616 Katherine NT 0851	ESA Job #:	PR0989
Attention:	Andrew Sawicki	Date Sampled:	Not supplied
Client Ref:	Not supplied	Date Received:	16 January 2013
		Sampled By:	Client
		ESA Quote #:	PL0989_q01

Lab ID No.:	Sample Name:	Sample Description:
5822	SW2	Aqueous sample, pH 7.0, conductivity 23.2µS/cm, total ammonia <2.0mg/L*. Sample received at room temperature in apparent good condition.
5823	RP3	Aqueous sample, pH 6.4, conductivity 2590µS/cm, total ammonia <2.0mg/L*. Sample received at room temperature in apparent good condition.

*Ammonia analysis is not covered by Ecotox Services Australasia's scope of accreditation

Test Performed:	96-hr fish imbalance toxicity test using the eastern rainbowfish <i>Melanotaenia splendida splendida</i>
Test Protocol:	ESA SOP 117 (ESA 2011), based on USEPA (2002)
Test Temperature:	The test was performed at 25±1°C.
Deviations from Protocol:	Three replicates were tested for the control treatment rather than four
Comments on Solution Preparation:	The highest concentration was prepared by diluting sample 5823 'RP3' with sample 5822 'SW2'. This concentration was then serially diluted with Sample 5822 'SW2' to achieve the test concentrations. A DMW control and a diluent control (SW2) were tested concurrently with the sample.
Source of Test Organisms:	In-house cultures
Test Initiated:	31 January 2013 at 1530h

Sample 5823: RP3	Concentration (%)	% Un-affected (Mean ± SD)		
DMW Control		100 ± 0.0		
Diluent Control		80.0 ± 20.0		
	0.06	85.0 ± 10.0		
	0.13	50.0 ± 11.6		
	0.25	25.0 ± 25.2 *		
	0.50	0.0 ± 0.0		
	1.00	0.0 ± 0.0		
96-hr IC10 = 0.08%**				
96-hr EC50 = 0.17 (0.13-0.20)%				
NOEC = 0.13%				
LOEC = 0.25%				


*Significantly lower percentage of un-affected larval fish compared with the DMW Control (Bonferroni t Test, 1-tailed, P=0.05)

**95% confidence limits not reliable

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean % un-affected	≥80.0%	100%	Yes
Reference Toxicant within cusum chart limits	4.8-74.1µg Cu/L	12.7µg Cu/L	Yes

Toxicity Test Report: TR0989/5

(page 2 of 2)

Test Report Authorised by:  Dr Rick Krassoi, Director on 22 February 2013

Results are based on the samples in the condition as received by ESA.

NATA Accredited Laboratory Number: 14709

This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025. NATA is a signatory to the APLAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration and inspection reports. This document shall not be reproduced except in full.

Citations:

ESA (2011) SOP 117 –*Freshwater and Marine Fish Imbalance Test*. Issue No 7. Ecotox Services Australasia, Sydney, NSW

USEPA (2002) Methods for measuring the acute toxicity of effluents and receiving waters to freshwater and marine organisms. Fifth edition EPA-821-R-02-012. United States Environmental Protection Agency, Office of Research and Development, Washington FC, USA

Toxicity Test Report: TR0989/6

(page 1 of 2)

This document is issued in accordance with NATA's accreditation requirements

Client:	Vista Gold Pty Ltd PO Box 1616 Katherine NT 0851	ESA Job #:	PR0989
Attention:	Andrew Sawicki	Date Sampled:	Not supplied
Client Ref:	Not supplied	Date Received:	16 January 2013
		Sampled By:	Client
		ESA Quote #:	PL0989 q01

Lab ID No.:	Sample Name:	Sample Description:
5822	SW2	Aqueous sample, pH 7.0, conductivity 23.2µS/cm, total ammonia <2.0mg/L*. Sample received at room temperature in apparent good condition.
5823	RP3	Aqueous sample, pH 6.4, conductivity 2590µS/cm, total ammonia <2.0mg/L*. Sample received at room temperature in apparent good condition.

*Ammonia analysis is not covered by Ecotox Services Australasia's scope of accreditation

Test Performed:	96-hr acute toxicity test using the freshwater hydra <i>hydra viridissima</i>
Test Protocol:	ESA SOP 125 (2012), based on Riethmuller et al. (2003)
Test Temperature:	The test was performed at 27±1°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	The highest concentration was prepared by diluting sample 5823 'RP3' with sample 5822 'SW2'. This concentration was then serially diluted with Sample 5822 'SW2' to achieve the test concentrations. A laboratory water control and a diluent control (SW2) were tested concurrently with the sample.
Source of Test Organisms:	ESA Laboratory culture
Test Initiated:	4 February 2013 at 1330h


Sample 5823: RP3 Concentration (%)	Population Growth Rate (Mean ± SD)	Vacant
Laboratory Water Control	0.30 ± 0.03	
Diluent Control	0.30 ± 0.03	
0.06	0.30 ± 0.03	
0.13	0.30 ± 0.03	
0.25	0.29 ± 0.03	
0.50	0.07 ± 0.07 *	
1.00	0.0 ± 0.0	
2.00	0.0 ± 0.0	
96-hr IC10 = 0.27 (0.06-0.30)%		
96-hr IC50 = 0.42 (0.35-0.49)%		
NOEC = 0.25%		
LOEC = 0.5%		

*Significantly lower population growth rate compared with the Diluent Control (Dunnett's Test, 1-tailed, P=0.05)

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean population growth rate	≥0.25	0.30	Yes
Reference Toxicant within cusum chart limits	1.3-15.9 µg Cu/L	2.8µg Cu/L	Yes

Toxicity Test Report: TR0989/6

(page 2 of 2)

Test Report Authorised by: 

Dr Rick Krasso, Director on 22 February 2013

Results are based on the samples in the condition as received by ESA.

NATA Accredited Laboratory Number: 14709

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Citations:

ESA (2012) SOP 125 –*Hydra Population Growth Test*. Issue No 1. Ecotox Services Australasia, Sydney, NSW

Riethmuller N, Camilleri C, Franklin N, Hogan A, King A, Koch A, Markich SJ, Turley C and van Dam R (2003). Green Hydra Population Growth Test. In: *Ecotoxicological testing protocols for Australian tropical freshwater ecosystems*. Supervising Scientist Report 173, Supervising Scientist, Darwin NT.

Toxicity Test Report: TR0989/7

(page 1 of 2)

Client:	Vista Gold Pty Ltd PO Box 1616 Katherine NT 0851	ESA Job #:	PR0989
Attention:	Andrew Sawicki	Date Sampled:	Not supplied
Client Ref:	Not supplied	Date Received:	16 January 2013
		Sampled By:	Client
		ESA Quote #:	PL0989_q01

Lab ID No.:	Sample Name:	Sample Description:
5822	SW2	Aqueous sample, pH 7.0, conductivity 23.2µS/cm, total ammonia <2.0mg/L*. Sample received at room temperature in apparent good condition.
5823	RP3	Aqueous sample, pH 6.4, conductivity 2590µS/cm, total ammonia <2.0mg/L*. Sample received at room temperature in apparent good condition.

*Ammonia analysis is not covered by Ecotox Services Australasia's scope of accreditation

Test Performed:	Rainbowfish embryo hatching test using <i>Melanotaenia splendida splendida</i>
Test Protocol:	ESA SOP 126 (2012), based on USEPA (2002), but adapted for use with native rainbowfish
Test Temperature:	The test was performed at 25±1°C.
Deviations from Protocol:	Test solutions were renewed every 48 hours instead of 24 hours
Comments on Solution Preparation:	The highest concentration was prepared by diluting sample 5823 'RP3' with sample 5822 'SW2'. This concentration was then serially diluted with Sample 5822 'SW2' to achieve the test concentrations. A DMW control and a diluent control (SW2) were tested concurrently with the sample.
Source of Test Organisms:	ESA Laboratory culture
Test Initiated:	6 February 2013 at 1515 h

Sample 5823: RP3 Concentration (%)	% Un-Affected (Mean ± SD)	Vacant
DMW Control	100 ± 0.0	
Diluent Control	90.0 ± 11.6	
0.03	100 ± 0.0	
0.06	100 ± 0.0	
0.13	100 ± 0.0	
0.25	90.0 ± 20.0	
0.50	55.0 ± 19.2	
1.00	15.0 ± 10.0 *	
10 day EC10 = 0.28 (0.14-0.37)%		
10 day EC50 = 0.56 (0.43-0.71)%		
NOEC = 0.5%		
LOEC = 1.0%		

*Significantly lower percentage of un-affected fish compared with the diluent control (Steel's Many-One Rank Test, 1-tailed, P=0.05)

Toxicity Test Report: TR0989/7

(page 2 of 2)

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean % survival	≥80.0%	100%	Yes
Reference Toxicant within cusum chart limit	20.7-401.3µg Cu/L	78.9µg Cu/L	Yes

Test Report Authorised by:



Dr Rick Krassoi, Director on 22 February 2013

Results are based on the samples in the condition as received by ESA.

NATA Accredited Laboratory Number: 14709

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Citations:

ESA (2012) *SOP 126- Rainbowfish Embryo Hatching Test*. Issue N°2. Ecotox Services Australasia, Sydney NSW

USEPA (2002) *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*. 4th Ed. United States Environmental Protection Agency, Office of Water, Washington DC.

Chain-of-Custody Documentation

Sample Receipt Notification

Attention : Andrew Sawicki

Client : Vista Gold Pty Ltd
PO Box 1616
Katherine NT 0851

Email : asawicki@vistagoldaustralia.com.au
Telephone :
Facsimile :

Date : 16/01/2013

Re : Receipt of Sample

Pages : 2

ESA Project : PR0989

For Review

Additional Documentation Required - Please Respond

Sample Delivery Details

Completed Chain of Custody accompanied samples:	NO - Documentation Required
Samples received in apparent good condition and correctly bottled:	YES
Security seals on sample bottles and esky intact:	YES

Date samples received : 16/01/2013
Time samples received : 10:00
No. of samples received : 1
Sample matrix : aqueous
Sample temperature : room temperature

Comments : Includes 2 x 30L SW2 (ESA ID# 5822) and 1 x 30L RP3 (ESA ID# 5823)

Contact Details

Customer Services Officer : Tina Micevska
Telephone : 61 2 9420 9481
Facsimile : 61 2 9420 9484
Email : tmicevska@ecotox.com.au

Please contact customer services officer for all queries or issues regarding samples

Note that the chain-of-custody provides definitive information on the tests to be performed

Ecotox Services Australia

ABN 45 094 714 904
Unit 27, 2 Chaplin Drive
Lane Cove NSW 2066 Australia

Phone : 61 2 9420 9481
Fax : 61 2 9420 9484
Email : info@ecotox.com.au

**Statistical Printouts for the Acute
Test with *Chironomus tepperi***

Chironomid Acute Toxicity Test-48hr Survival

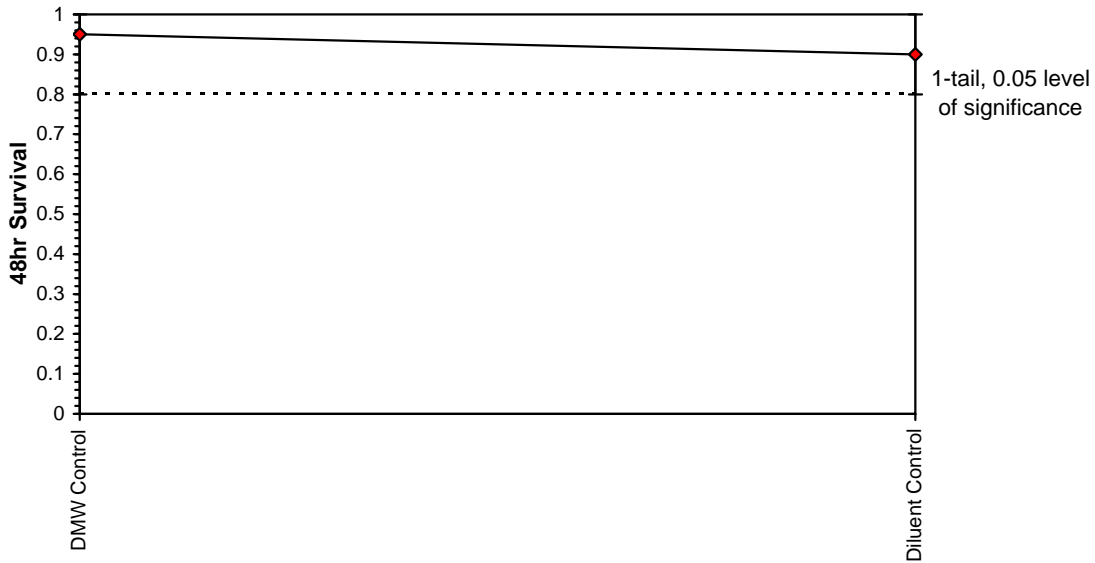
Start Date:	29/01/2013 14:30	Test ID:	PR0989/02	Sample ID:	SW2
End Date:	31/01/2013 13:00	Lab ID:	5823	Sample Type:	Diluent Control
Sample Date:		Protocol:	ESA 121	Test Species:	CT-Chironomus tepperi
Comments:					

Conc-	1	2	3	4
DMW Control	0.8000	1.0000	1.0000	1.0000
Diluent Control	0.8000	0.8000	1.0000	1.0000

Conc-	Mean	N-Mean	Transform: Arcsin Square Root				N	t-Stat	1-Tailed	
			Mean	Min	Max	CV%			Critical	MSD
DMW Control	0.9500	1.0000	1.2857	1.1071	1.3453	9.261	4	0.655	1.943	0.1767
Diluent Control	0.9000	0.9474	1.2262	1.1071	1.3453	11.212	4			

Auxiliary Tests	Statistic	Critical	Skew	Kurt		
Shapiro-Wilk's Test indicates normal distribution ($p > 0.05$)	0.827836	0.818	-0.57143	-1.72857		
F-Test indicates equal variances ($p = 0.82$)	1.333333	47.46723				
Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences Treatments vs DMW Control	0.119415	0.129669	0.007088	0.01654	0.536963	1, 6

Dose-Response Plot



Chironomid Acute Toxicity Test-48hr Survival

Start Date: 29/01/2013 14:30 Test ID: PR0989/02 Sample ID: SW2
End Date: 31/01/2013 13:00 Lab ID: 5823 Sample Type: Diluent Control
Sample Date: Protocol: ESA 121 Test Species: CT-Chironomus tepperi
Comments:

Auxiliary Data Summary

Conc-	Parameter	Mean	Min	Max	SD	CV%	N
DMW Control	% Survival	95.00	80.00	100.00	10.00	3.33	4
Diluent Control		90.00	80.00	100.00	11.55	3.78	4
DMW Control	pH	8.10	8.10	8.10	0.00	0.00	1
Diluent Control		7.50	7.50	7.50	0.00	0.00	1
DMW Control	Cond uS/cm	297.00	297.00	297.00	0.00	0.00	1
Diluent Control		69.40	69.40	69.40	0.00	0.00	1
DMW Control	DO %	97.70	97.70	97.70	0.00	0.00	1
Diluent Control		93.10	93.10	93.10	0.00	0.00	1

Chironomid Acute Toxicity Test-48hr Survival

Start Date:	29/01/2013 14:30	Test ID:	PR0989/03	Sample ID:	RP3
End Date:	31/01/2013 13:00	Lab ID:	5823	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 121	Test Species:	CT-Chironomus tepperi

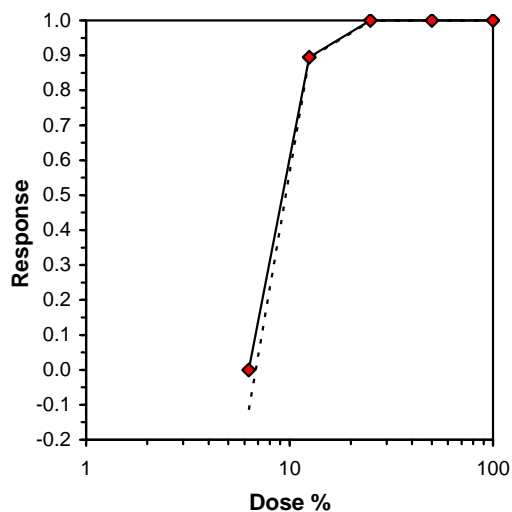
Conc-%	1	2	3	4
DMW Control	0.8000	1.0000	1.0000	1.0000
Diluent Control	0.8000	0.8000	1.0000	1.0000
6.3	1.0000	1.0000	1.0000	1.0000
12.5	0.2000	0.0000	0.2000	0.0000
25	0.0000	0.0000	0.0000	0.0000
50	0.0000	0.0000	0.0000	0.0000
100	0.0000	0.0000	0.0000	0.0000

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root				Rank Sum	1-Tailed Critical	Number Resp	Total Number
			Mean	Min	Max	CV%				
DMW Control	0.9500	1.0556	1.2857	1.1071	1.3453	9.261	4			
Diluent Control	0.9000	1.0000	1.2262	1.1071	1.3453	11.212	4	*	2	
6.3	1.0000	1.1111	1.3453	1.3453	1.3453	0.000	4	22.00	0	
*12.5	0.1000	0.1111	0.3446	0.2255	0.4636	39.900	4	10.00	18	
25	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4		20	
50	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4		20	
100	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4		20	

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.810646	0.859	3.39E-16	-1.65
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 0.54)	0.654654	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	6.3	12.5	8.87412	15.87302
Treatments vs Diluent Control				

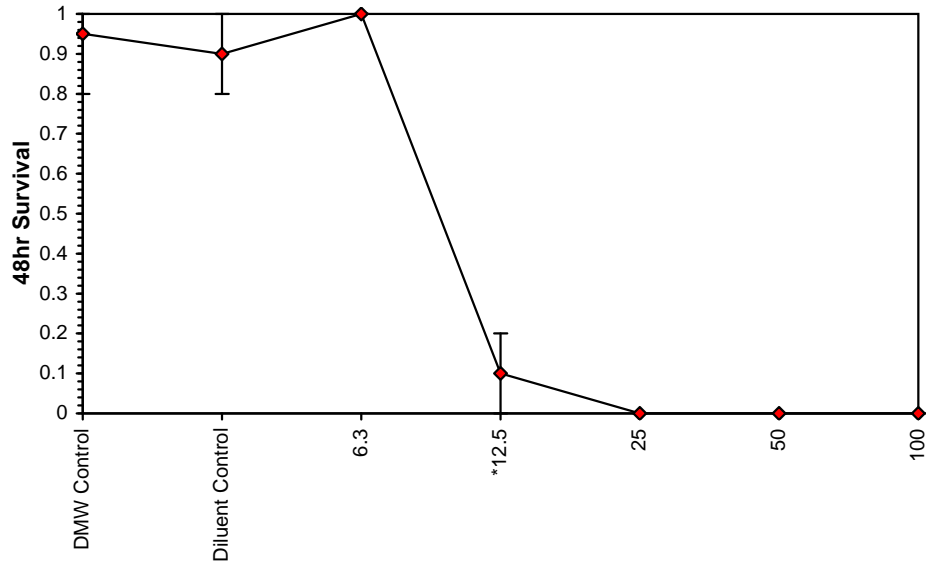
Trimmed Spearman-Kärber			
Trim Level	EC50	95% CL	
0.0%	9.5418	8.6807	10.4884
5.0%	9.3308	8.4993	10.2436
10.0%	9.2400	8.6559	9.8636
20.0%	9.2391	8.7121	9.7980
Auto-0.0%	9.5418	8.6807	10.4884



Chironomid Acute Toxicity Test-48hr Survival

Start Date: 29/01/2013 14:30 Test ID: PR0989/03 Sample ID: RP3
End Date: 31/01/2013 13:00 Lab ID: 5823 Sample Type: AQ-Aqueous
Sample Date: Protocol: ESA 121 Test Species: CT-Chironomus tepperi
Comments:

Dose-Response Plot



Chironomid Acute Toxicity Test-48hr Survival

Start Date:	29/01/2013 14:30	Test ID:	PR0989/03	Sample ID:	RP3
End Date:	31/01/2013 13:00	Lab ID:	5823	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 121	Test Species:	CT-Chironomus tepperi
Comments:					

Auxiliary Data Summary

Conc-%	Parameter	Mean	Min	Max	SD	CV%	N
DMW Control	% Survival	95.00	80.00	100.00	10.00	3.33	4
Diluent Control		90.00	80.00	100.00	11.55	3.78	4
6.3		100.00	100.00	100.00	0.00	0.00	4
12.5		10.00	0.00	20.00	11.55	33.98	4
25		0.00	0.00	0.00	0.00		4
50		0.00	0.00	0.00	0.00		4
100		0.00	0.00	0.00	0.00		4
DMW Control	pH	8.10	8.10	8.10	0.00	0.00	1
Diluent Control		7.50	7.50	7.50	0.00	0.00	1
6.3		6.70	6.70	6.70	0.00	0.00	1
12.5		6.50	6.50	6.50	0.00	0.00	1
25		6.40	6.40	6.40	0.00	0.00	1
50		6.40	6.40	6.40	0.00	0.00	1
100		6.40	6.40	6.40	0.00	0.00	1
DMW Control	Cond uS/cm	297.00	297.00	297.00	0.00	0.00	1
Diluent Control		69.40	69.40	69.40	0.00	0.00	1
6.3		314.00	314.00	314.00	0.00	0.00	1
12.5		527.00	527.00	527.00	0.00	0.00	1
25		873.00	873.00	873.00	0.00	0.00	1
50		1471.00	1471.00	1471.00	0.00	0.00	1
100		2380.00	2380.00	2380.00	0.00	0.00	1
DMW Control	DO %	97.70	97.70	97.70	0.00	0.00	1
Diluent Control		93.10	93.10	93.10	0.00	0.00	1
6.3		95.60	95.60	95.60	0.00	0.00	1
12.5		95.00	95.00	95.00	0.00	0.00	1
25		94.60	94.60	94.60	0.00	0.00	1
50		94.30	94.30	94.30	0.00	0.00	1
100		92.10	92.10	92.10	0.00	0.00	1

Chironomid Acute Toxicity Test-48hr Survival

Start Date:	29/01/2013 14:30	Test ID:	PR0989/03	Sample ID:	RP3
End Date:	31/01/2013 13:00	Lab ID:	5823	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 121	Test Species:	CT-Chironomus tepperi
Comments:					

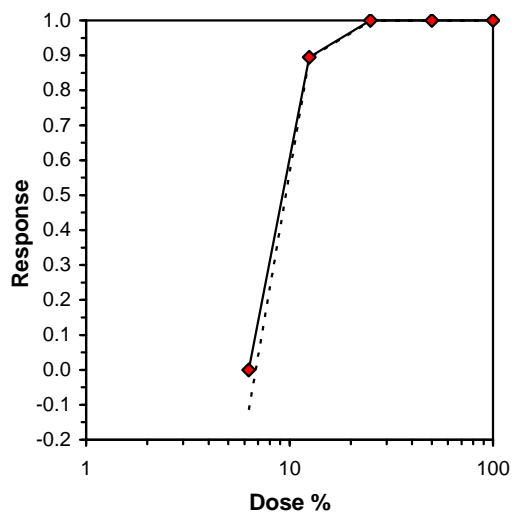
Conc-%	1	2	3	4
DMW Control	0.8000	1.0000	1.0000	1.0000
Diluent Control	0.8000	0.8000	1.0000	1.0000
6.3	1.0000	1.0000	1.0000	1.0000
12.5	0.2000	0.0000	0.2000	0.0000
25	0.0000	0.0000	0.0000	0.0000
50	0.0000	0.0000	0.0000	0.0000
100	0.0000	0.0000	0.0000	0.0000

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root					Rank Sum	1-Tailed Critical	Isotonic	
			Mean	Min	Max	CV%	N			Mean	N-Mean
DMW Control	0.9500	1.0556	1.2857	1.1071	1.3453	9.261	4				
Diluent Control	0.9000	1.0000	1.2262	1.1071	1.3453	11.212	4	*		0.9500	1.0000
6.3	1.0000	1.1111	1.3453	1.3453	1.3453	0.000	4	22.00	11.00	0.9500	1.0000
*12.5	0.1000	0.1111	0.3446	0.2255	0.4636	39.900	4	10.00	11.00	0.1000	0.1053
25	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			0.0000	0.0000
50	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			0.0000	0.0000
100	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.810646	0.859	3.39E-16	-1.65
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 0.54)	0.654654	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	6.3	12.5	8.87412	15.87302
Treatments vs Diluent Control				

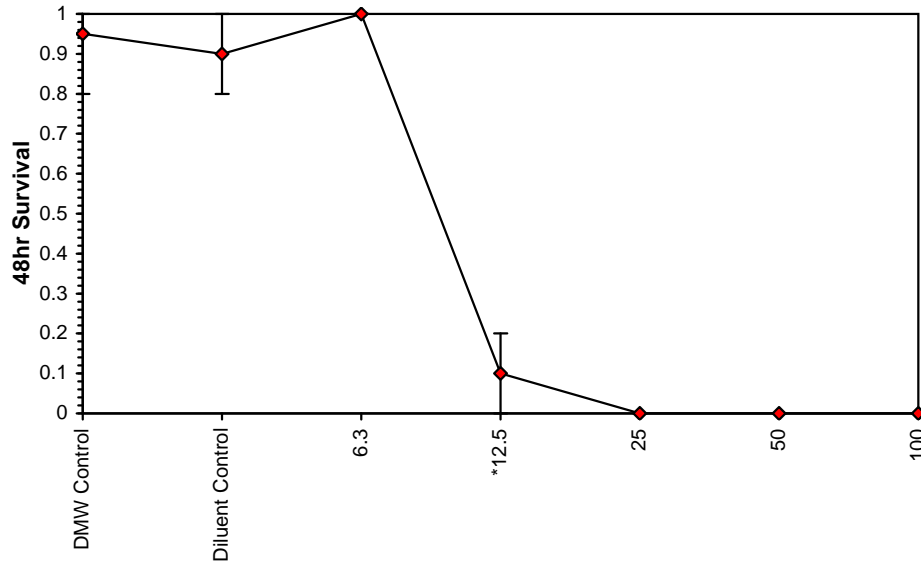
Log-Logit Interpolation (200 Resamples)					
Point	%	SD	95% CL(Exp)		Skew
IC05	6.9555	0.4893	6.3368	10.2624	3.4147
IC10	7.3963	0.5225	6.3508	10.6156	2.6264
IC15	7.7452	0.5407	6.3563	10.8006	1.9757
IC20	8.0442	0.5558	6.3572	10.9242	1.3985
IC25	8.3132	0.5710	6.3551	11.0171	0.8767
IC40	9.0368	0.6271	6.3371	11.2112	-0.3875
IC50	9.5058	0.6786	6.3163	11.3076	-0.9815



Chironomid Acute Toxicity Test-48hr Survival

Start Date: 29/01/2013 14:30 Test ID: PR0989/03 Sample ID: RP3
End Date: 31/01/2013 13:00 Lab ID: 5823 Sample Type: AQ-Aqueous
Sample Date: Protocol: ESA 121 Test Species: CT-Chironomus tepperi
Comments:

Dose-Response Plot



Chironomid Acute Toxicity Test-48hr Survival

Start Date:	29/01/2013 14:30	Test ID:	PR0989/03	Sample ID:	RP3
End Date:	31/01/2013 13:00	Lab ID:	5823	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 121	Test Species:	CT-Chironomus tepperi
Comments:					

Auxiliary Data Summary

Conc-%	Parameter	Mean	Min	Max	SD	CV%	N
DMW Control	% Survival	95.00	80.00	100.00	10.00	3.33	4
Diluent Control		90.00	80.00	100.00	11.55	3.78	4
6.3		100.00	100.00	100.00	0.00	0.00	4
12.5		10.00	0.00	20.00	11.55	33.98	4
25		0.00	0.00	0.00	0.00		4
50		0.00	0.00	0.00	0.00		4
100		0.00	0.00	0.00	0.00		4
DMW Control	pH	8.10	8.10	8.10	0.00	0.00	1
Diluent Control		7.50	7.50	7.50	0.00	0.00	1
6.3		6.70	6.70	6.70	0.00	0.00	1
12.5		6.50	6.50	6.50	0.00	0.00	1
25		6.40	6.40	6.40	0.00	0.00	1
50		6.40	6.40	6.40	0.00	0.00	1
100		6.40	6.40	6.40	0.00	0.00	1
DMW Control	Cond uS/cm	297.00	297.00	297.00	0.00	0.00	1
Diluent Control		69.40	69.40	69.40	0.00	0.00	1
6.3		314.00	314.00	314.00	0.00	0.00	1
12.5		527.00	527.00	527.00	0.00	0.00	1
25		873.00	873.00	873.00	0.00	0.00	1
50		1471.00	1471.00	1471.00	0.00	0.00	1
100		2380.00	2380.00	2380.00	0.00	0.00	1
DMW Control	DO %	97.70	97.70	97.70	0.00	0.00	1
Diluent Control		93.10	93.10	93.10	0.00	0.00	1
6.3		95.60	95.60	95.60	0.00	0.00	1
12.5		95.00	95.00	95.00	0.00	0.00	1
25		94.60	94.60	94.60	0.00	0.00	1
50		94.30	94.30	94.30	0.00	0.00	1
100		92.10	92.10	92.10	0.00	0.00	1

Statistical Printouts for the Duckweed Growth Inhibition Tests

Duckweed Growth Inhibition Test-Specific Growth Rate

Start Date: 17/01/2013 12:30	Test ID: PR0989/05	Sample ID: SW2
End Date: 21/01/2013 14:00	Lab ID: 5822	Sample Type: Diluent Control
Sample Date:	Protocol: ESA 112	Test Species: LA-Lemna aequinoctialis

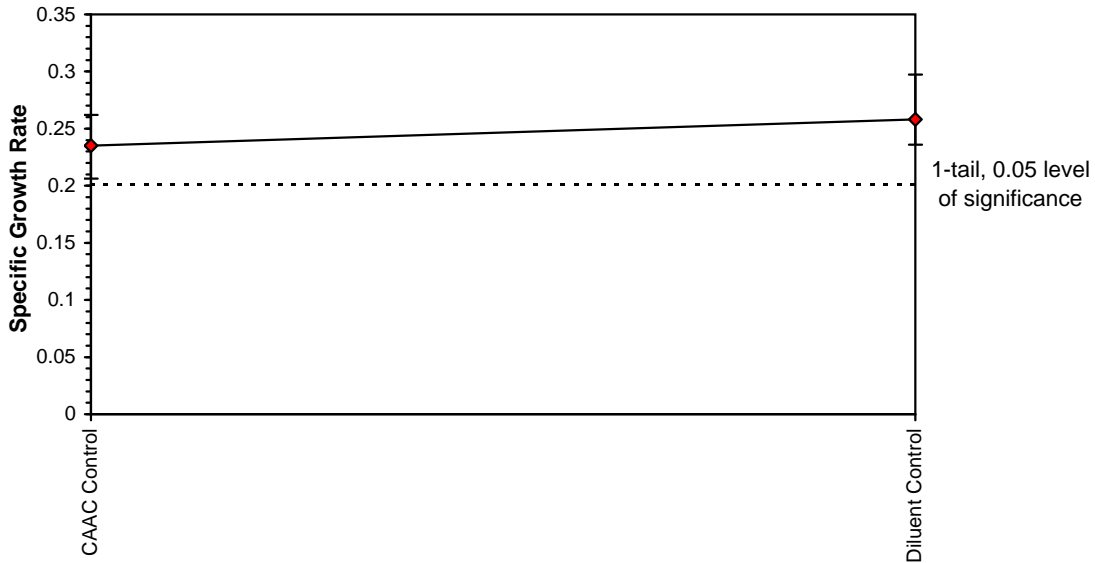
Comments:

Conc-	1	2	3	4
CAAC Control	0.2361	0.2361	0.2067	0.2625
Diluent Control	0.2361	0.2974	0.2496	0.2496

Conc-	Mean	N-Mean	Transform: Untransformed				N	t-Stat	1-Tailed	
			Mean	Min	Max	CV%			Critical	MSD
CAAC Control	0.2353	1.0000	0.2353	0.2067	0.2625	9.685	4	-1.296	1.943	0.0343
Diluent Control	0.2582	1.0971	0.2582	0.2361	0.2974	10.419	4			

Auxiliary Tests	Statistic	Critical	Skew	Kurt		
Shapiro-Wilk's Test indicates normal distribution ($p > 0.05$)	0.926865	0.818	0.6909	-0.27791		
F-Test indicates equal variances ($p = 0.79$)	1.392974	47.46723				
Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences Treatments vs CAAC Control	0.034256	0.14556	0.001045	0.000622	0.242447	1, 6

Dose-Response Plot



Duckweed Growth Inhibition Test-Specific Growth Rate

Start Date: 17/01/2013 12:30 Test ID: PR0989/05 Sample ID: SW2
End Date: 21/01/2013 14:00 Lab ID: 5822 Sample Type: Diluent Control
Sample Date: Protocol: ESA 112 Test Species: LA-Lemna aequinoctialis
Comments:

Auxiliary Data Summary

Conc-	Parameter	Mean	Min	Max	SD	CV%	N
CAAC Control	Specific Growth Rate	0.24	0.21	0.26	0.02	64.15	4
Diluent Control		0.26	0.24	0.30	0.03	63.52	4
CAAC Control	pH	6.00	6.00	6.00	0.00	0.00	1
Diluent Control		6.60	6.60	6.60	0.00	0.00	1
CAAC Control	Cond uS/cm	169.70	169.70	169.70	0.00	0.00	1
Diluent Control		51.90	78.10	78.10	0.00	0.00	1

Duckweed Growth Inhibition Test-Specific Growth Rate

Start Date:	17/01/2013 12:30	Test ID:	PR0989/06	Sample ID:	RP3
End Date:	21/01/2013 14:00	Lab ID:	5823	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 112	Test Species:	LA-Lemna aquinoctialis
Comments:					

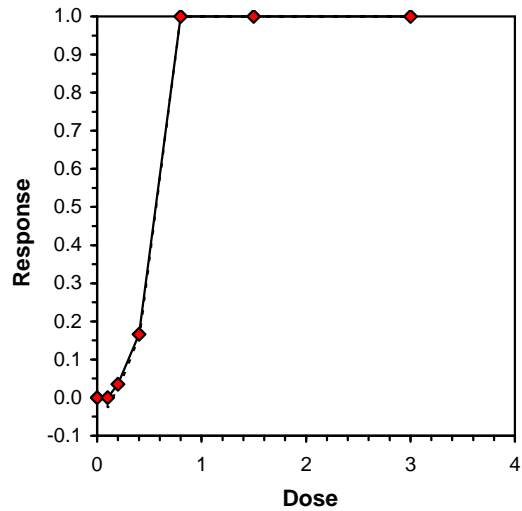
Conc-	1	2	3	4
CAAC Control	0.2361	0.2361	0.2067	0.2625
Diluent Control	0.2361	0.2974	0.2496	0.2496
0.1	0.2361	0.2496	0.2863	0.2863
0.2	0.2496	0.2218	0.2625	0.2747
0.4	0.2218	0.2218	0.2218	0.2067
0.8	0.0000	0.0000	0.0000	0.0000
1.5	0.0000	0.0000	0.0000	0.0000
3	0.0000	0.0000	0.0000	0.0000

Conc-	Mean	N-Mean	Transform: Untransformed				N	t-Stat	1-Tailed Critical	MSD	Isotonic	
			Mean	Min	Max	CV%					Mean	N-Mean
CAAC Control	0.2353	0.9115	0.2353	0.2067	0.2625	9.685	4					
Diluent Control	0.2582	1.0000	0.2582	0.2361	0.2974	10.419	4	*			0.2614	1.0000
0.1	0.2646	1.0247	0.2646	0.2361	0.2863	9.699	4	-0.409	2.290	0.0358	0.2614	1.0000
0.2	0.2521	0.9766	0.2521	0.2218	0.2747	8.981	4	0.387	2.290	0.0358	0.2521	0.9646
*0.4	0.2180	0.8445	0.2180	0.2067	0.2218	3.476	4	2.571	2.290	0.0358	0.2180	0.8342
0.8	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	4				0.0000	0.0000
1.5	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	4				0.0000	0.0000
3	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	4				0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.967965	0.887	0.252787	-0.51339
Bartlett's Test indicates equal variances (p = 0.30)	3.680906	11.34487		
The control means are not significantly different (p = 0.24)	1.296453	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs Diluent Control	0.2	0.4	0.282843		0.035775	0.138559	0.001725	0.000488	0.04843	3, 12

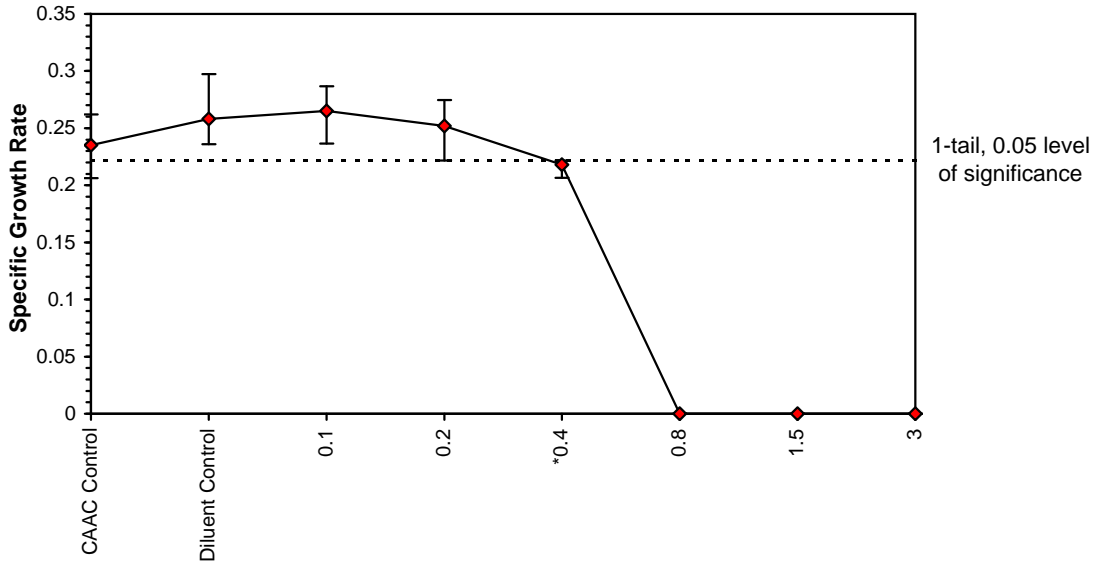
Point	Linear Interpolation (200 Resamples)				
	SD	95% CL(Exp)	Skew		
IC05	0.2224	0.0652	0.0000	0.3156	-0.5460
IC10	0.2991	0.0636	0.0663	0.4185	-0.6772
IC15	0.3757	0.0563	0.0915	0.4406	-1.4159
IC20	0.4164	0.0308	0.3078	0.4524	-4.1359
IC25	0.4404	0.0150	0.3978	0.4741	-1.7631
IC40	0.5123	0.0109	0.4783	0.5393	-0.5818
IC50	0.5602	0.0091	0.5319	0.5827	-0.5818



Duckweed Growth Inhibition Test-Specific Growth Rate

Start Date: 17/01/2013 12:30 Test ID: PR0989/06 Sample ID: RP3
End Date: 21/01/2013 14:00 Lab ID: 5823 Sample Type: AQ-Aqueous
Sample Date: Protocol: ESA 112 Test Species: LA-Lemna aequinoctialis
Comments:

Dose-Response Plot



Duckweed Growth Inhibition Test-Specific Growth Rate

Start Date: 17/01/2013 12:30	Test ID: PR0989/06	Sample ID: RP3
End Date: 21/01/2013 14:00	Lab ID: 5823	Sample Type: AQ-Aqueous
Sample Date:	Protocol: ESA 112	Test Species: LA-Lemna aequinoctialis

Comments:

Auxiliary Data Summary

Conc-	Parameter	Mean	Min	Max	SD	CV%	N
CAAC Control	Specific Growth Rate	0.24	0.21	0.26	0.02	64.15	4
Diluent Control		0.26	0.24	0.30	0.03	63.52	4
0.1		0.26	0.24	0.29	0.03	60.55	4
0.2		0.25	0.22	0.27	0.02	59.68	4
0.4		0.22	0.21	0.22	0.01	39.93	4
0.8		0.00	0.00	0.00	0.00		4
1.5		0.00	0.00	0.00	0.00		4
3		0.00	0.00	0.00	0.00		4
CAAC Control	pH	6.00	6.00	6.00	0.00	0.00	1
Diluent Control		6.60	6.60	6.60	0.00	0.00	1
0.1		6.70	6.70	6.70	0.00	0.00	1
0.2		6.70	6.70	6.70	0.00	0.00	1
0.4		6.70	6.70	6.70	0.00	0.00	1
0.8		6.60	6.60	6.60	0.00	0.00	1
1.5		6.50	6.50	6.50	0.00	0.00	1
3		6.30	6.30	6.30	0.00	0.00	1
CAAC Control	Cond uS/cm	169.70	169.70	169.70	0.00	0.00	1
Diluent Control		51.90	78.10	78.10	0.00	0.00	1
0.1		59.90	59.90	59.90	0.00	0.00	1
0.2		63.00	63.00	63.00	0.00	0.00	1
0.4		68.30	68.30	68.30	0.00	0.00	1
0.8		87.00	87.00	87.00	0.00	0.00	1
1.5		115.70	115.70	115.70	0.00	0.00	1
3		173.60	173.60	173.60	0.00	0.00	1

Statistical Printouts for the Freshwater Shrimp Tests

Freshwater Shrimp Acute Toxicity Test-96 hr Survival

Start Date: 25/01/2013 16:00	Test ID: PR0989/02	Sample ID: SW2
End Date: 29/01/2013 16:00	Lab ID: 5822	Sample Type: Diluent Control
Sample Date:	Protocol: ESA 123	Test Species: MB-Macrobrachium bullatum

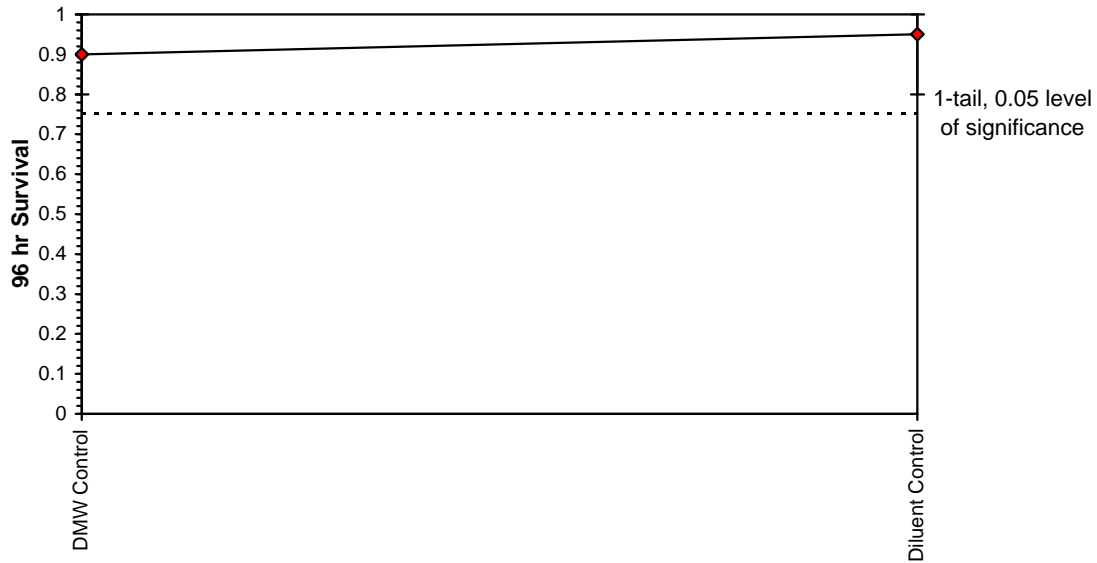
Comments:

Conc-	1	2	3	4
DMW Control	0.8000	0.8000	1.0000	1.0000
Diluent Control	1.0000	1.0000	1.0000	0.8000

Conc-	Mean	N-Mean	Transform: Arcsin Square Root				N	t-Stat	1-Tailed	
			Mean	Min	Max	CV%			Critical	MSD
DMW Control	0.9000	1.0000	1.2262	1.1071	1.3453	11.212	4	-0.655	1.943	0.1767
Diluent Control	0.9500	1.0556	1.2857	1.1071	1.3453	9.261	4			

Auxiliary Tests	Statistic	Critical	Skew	Kurt		
Shapiro-Wilk's Test indicates normal distribution ($p > 0.05$)	0.827836	0.818	-0.57143	-1.72857		
F-Test indicates equal variances ($p = 0.82$)	1.333333	47.46723				
Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences Treatments vs DMW Control	0.133894	0.151141	0.007088	0.01654	0.536963	1, 6

Dose-Response Plot



Freshwater Shrimp Acute Toxicity Test-96 hr Survival

Start Date: 25/01/2013 16:00 Test ID: PR0989/02 Sample ID: SW2
End Date: 29/01/2013 16:00 Lab ID: 5822 Sample Type: Diluent Control
Sample Date: Protocol: ESA 123 Test Species: MB-Macrobrachium bullatum
Comments:

Auxiliary Data Summary

Conc-	Parameter	Mean	Min	Max	SD	CV%	N
DMW Control	% Survival	90.00	80.00	100.00	11.55	3.78	4
Diluent Control		95.00	80.00	100.00	10.00	3.33	4
DMW Control	pH	8.20	8.20	8.20	0.00	0.00	1
Diluent Control		6.90	6.90	6.90	0.00	0.00	1
DMW Control	Cond uS/cm	174.20	174.20	174.20	0.00	0.00	1
Diluent Control		22.40	22.40	22.40	0.00	0.00	1
DMW Control	DO %	102.40	102.40	102.40	0.00	0.00	1
Diluent Control		104.40	104.40	104.40	0.00	0.00	1

Freshwater Shrimp Acute Toxicity Test-96 hr Survival

Start Date:	25/01/2013 16:00	Test ID:	PR0989/02	Sample ID:	RP3
End Date:	29/01/2013 16:00	Lab ID:	5823	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 123	Test Species:	MB-Macrobrachium bullatum
Comments:					

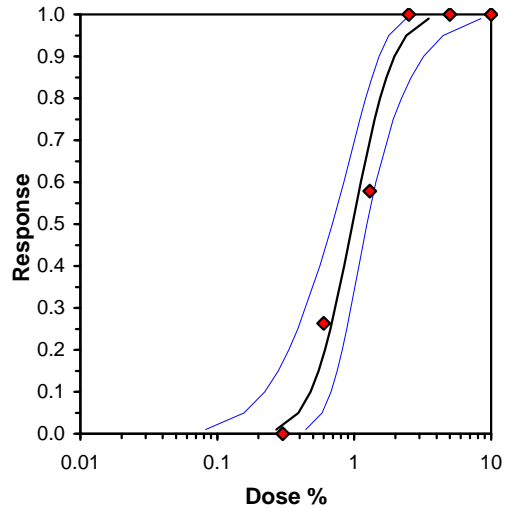
Conc-%	1	2	3	4
DMW Control	0.8000	0.8000	1.0000	1.0000
Diluent Control	1.0000	1.0000	1.0000	0.8000
0.3	0.8000	1.0000	1.0000	1.0000
0.6	0.6000	0.4000	0.8000	1.0000
1.3	0.0000	0.6000	0.2000	0.8000
2.5	0.0000	0.0000	0.0000	0.0000
5	0.0000	0.0000	0.0000	0.0000
10	0.0000	0.0000	0.0000	0.0000

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root					t-Stat	1-Tailed Critical	MSD	Number Resp	Total Number
			Mean	Min	Max	CV%	N					
DMW Control	0.9000	0.9474	1.2262	1.1071	1.3453	11.212	4					
Diluent Control	0.9500	1.0000	1.2857	1.1071	1.3453	9.261	4	*			1	20
0.3	0.9500	1.0000	1.2857	1.1071	1.3453	9.261	4	0.000	2.290	0.4196	1	20
0.6	0.7000	0.7368	1.0058	0.6847	1.3453	28.293	4	1.528	2.290	0.4196	6	20
*1.3	0.4000	0.4211	0.6706	0.2255	1.1071	59.520	4	3.357	2.290	0.4196	12	20
2.5	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				20	20
5	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				20	20
10	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				20	20

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.952861	0.887	-0.05271	-0.05443
Bartlett's Test indicates equal variances (p = 0.14)	5.42661	11.34487		
The control means are not significantly different (p = 0.54)	0.654654	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs Diluent Control	0.6	1.3	0.883176	166.6667	0.340569	0.369812	0.341976	0.067162	0.01677	3, 12

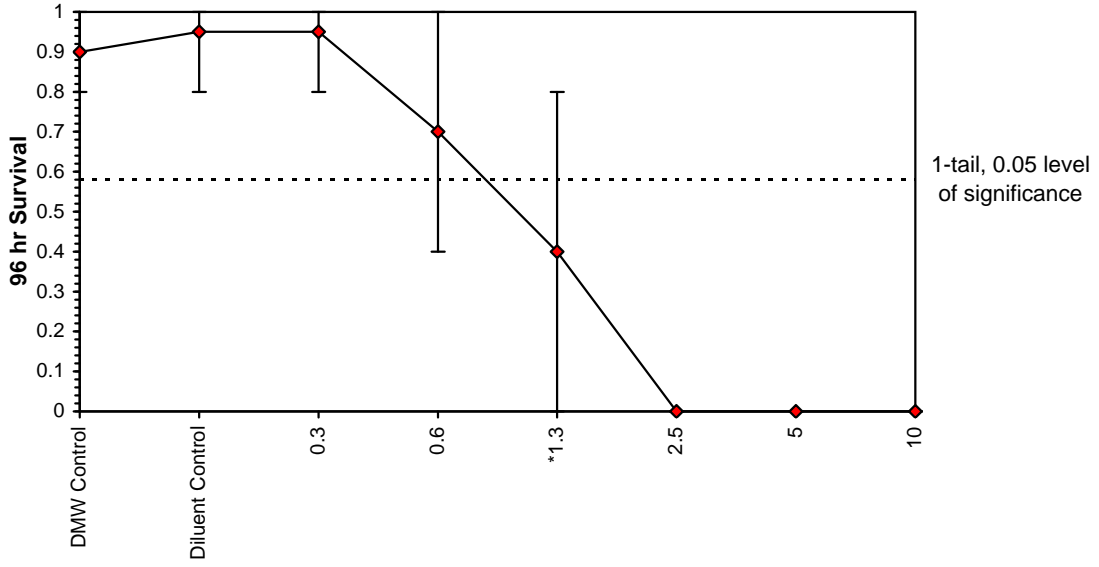
Parameter	Value	SE	95% Fiducial Limits		Maximum Likelihood-Probit						
					Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	4.179646	0.925532	2.365603	5.993689	0.05	2.82232	9.487729	0.59	-0.01265	0.239255	5
Intercept	5.052875	0.228508	4.604999	5.500752							
TSCR	0.048377	0.039808	-0.02965	0.1264							
Point	Probits	%	95% Fiducial Limits								
EC01	2.674	0.269625	0.082172	0.442411							
EC05	3.355	0.392473	0.157388	0.58259							
EC10	3.718	0.479438	0.221704	0.677254							
EC15	3.964	0.548754	0.278653	0.75158							
EC20	4.158	0.610924	0.333464	0.818172							
EC25	4.326	0.669845	0.388207	0.881792							
EC40	4.747	0.844763	0.562027	1.078858							
EC50	5.000	0.971291	0.692263	1.235421							
EC60	5.253	1.11677	0.838948	1.43786							
EC75	5.674	1.408394	1.104703	1.934184							
EC80	5.842	1.544227	1.214411	2.207564							
EC85	6.036	1.719178	1.345233	2.596188							
EC90	6.282	1.967735	1.516054	3.213163							
EC95	6.645	2.403744	1.787779	4.461947							
EC99	7.326	3.498961	2.3857	8.433532							



Freshwater Shrimp Acute Toxicity Test-96 hr Survival

Start Date: 25/01/2013 16:00 Test ID: PR0989/02 Sample ID: RP3
End Date: 29/01/2013 16:00 Lab ID: 5823 Sample Type: AQ-Aqueous
Sample Date: Protocol: ESA 123 Test Species: MB-Macrobrachium bullatum
Comments:

Dose-Response Plot



Freshwater Shrimp Acute Toxicity Test-96 hr Survival

Start Date:	25/01/2013 16:00	Test ID:	PR0989/02	Sample ID:	RP3
End Date:	29/01/2013 16:00	Lab ID:	5823	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 123	Test Species:	MB-Macrobrachium bullatum
Comments:					

Auxiliary Data Summary

Conc-%	Parameter	Mean	Min	Max	SD	CV%	N
DMW Control	% Survival	90.00	80.00	100.00	11.55	3.78	4
Diluent Control		95.00	80.00	100.00	10.00	3.33	4
0.3		95.00	80.00	100.00	10.00	3.33	4
0.6		70.00	40.00	100.00	25.82	7.26	4
1.3		40.00	0.00	80.00	36.51	15.11	4
2.5		0.00	0.00	0.00	0.00		4
5		0.00	0.00	0.00	0.00		4
10		0.00	0.00	0.00	0.00		4
DMW Control	pH	8.20	8.20	8.20	0.00	0.00	1
Diluent Control		6.90	6.90	6.90	0.00	0.00	1
0.3		6.90	6.90	6.90	0.00	0.00	1
0.6		6.80	6.80	6.80	0.00	0.00	1
1.3		6.70	6.70	6.70	0.00	0.00	1
2.5		6.60	6.60	6.60	0.00	0.00	1
5		6.60	6.60	6.60	0.00	0.00	1
10		6.60	6.60	6.60	0.00	0.00	1
DMW Control	Cond uS/cm	174.20	174.20	174.20	0.00	0.00	1
Diluent Control		22.40	22.40	22.40	0.00	0.00	1
0.3		35.60	35.60	35.60	0.00	0.00	1
0.6		47.80	47.80	47.80	0.00	0.00	1
1.3		74.00	74.00	74.00	0.00	0.00	1
2.5		129.00	129.00	129.00	0.00	0.00	1
5		227.00	227.00	227.00	0.00	0.00	1
10		400.00	400.00	400.00	0.00	0.00	1
DMW Control	DO %	102.40	102.40	102.40	0.00	0.00	1
Diluent Control		104.40	104.40	104.40	0.00	0.00	1
0.3		109.40	109.40	109.40	0.00	0.00	1
0.6		106.10	106.10	106.10	0.00	0.00	1
1.3		102.40	102.40	102.40	0.00	0.00	1
2.5		104.20	104.20	104.20	0.00	0.00	1
5		104.20	104.20	104.20	0.00	0.00	1
10		103.50	103.50	103.50	0.00	0.00	1

**Statistical Printouts for the
Chlorella Growth Inhibition
Tests**

Microalgal Cell Yield-Cell Yield

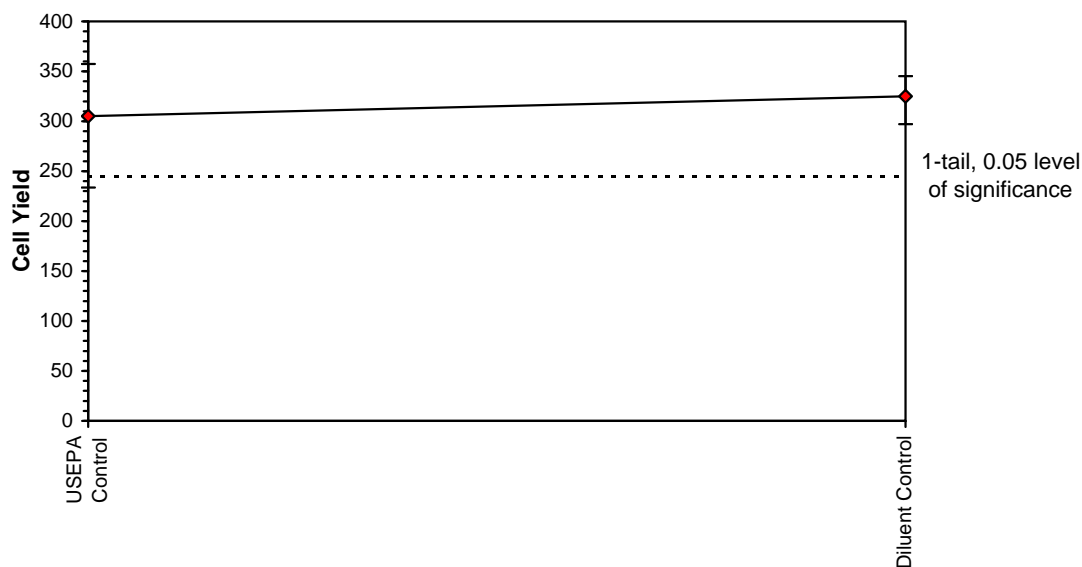
Start Date: 18/01/2013 16:15	Test ID: PR0989/02	Sample ID: SW2
End Date: 21/01/2013 16:40	Lab ID: 5822	Sample Type: Diluent Control
Sample Date:	Protocol: ESA 103	Test Species: CV-Chlorella vulgaris

Conc-	1	2	3	4
USEPA Control	233.52	282.52	346.52	357.52
Diluent Control	325.52	332.52	345.52	297.52

Conc-	Mean	N-Mean	Transform: Untransformed				N	t-Stat	1-Tailed	
			Mean	Min	Max	CV%			Critical	MSD
USEPA Control	305.02	1.0000	305.02	233.52	357.52	19.020	4	-0.659	1.943	59.71
Diluent Control	325.27	1.0664	325.27	297.52	345.52	6.232	4			

Auxiliary Tests	Statistic	Critical	Skew	Kurt		
Shapiro-Wilk's Test indicates normal distribution ($p > 0.05$)	0.969389	0.818	-0.5073	0.036526		
F-Test indicates equal variances ($p = 0.12$)	8.190631	47.46723				
Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences Treatments vs USEPA Control	59.70802	0.195751	820.125	1888.292	0.534336	1, 6

Dose-Response Plot



Microalgal Cell Yield-Cell Yield

Start Date: 18/01/2013 16:15 Test ID: PR0989/02 Sample ID: SW2
End Date: 21/01/2013 16:40 Lab ID: 5822 Sample Type: Diluent Control
Sample Date: Protocol: ESA 103 Test Species: CV-Chlorella vulgaris
Comments:

Auxiliary Data Summary

Conc-	Parameter	Mean	Min	Max	SD	CV%	N
USEPA Control	Cell Yield	305.02	233.52	357.52	58.01	2.50	4
Diluent Control		325.27	297.52	345.52	20.27	1.38	4
USEPA Control	pH	7.60	7.60	7.60	0.00	0.00	1
Diluent Control		7.40	7.40	7.40	0.00	0.00	1
USEPA Control	Conductivity uS/cm	462.00	462.00	462.00	0.00	0.00	1
Diluent Control		111.40	111.40	111.40	0.00	0.00	1

Microalgal Cell Yield-Cell Yield

Start Date: 18/01/2013 16:15	Test ID: PR0989/03	Sample ID: RP3
End Date: 21/01/2013 16:40	Lab ID: 5823	Sample Type: AQ-Aqueous
Sample Date:	Protocol: ESA 103	Test Species: CV-Chlorella vulgaris

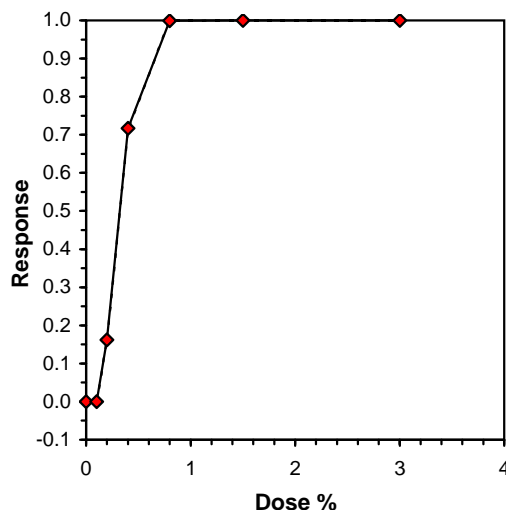
Conc-%	1	2	3	4
USEPA Control	233.52	282.52	346.52	357.52
Diluent Control	325.52	332.52	345.52	297.52
0.1	340.52	359.52	313.52	288.52
0.2	232.52	340.52	256.52	260.52
0.4	77.52	101.52	114.52	74.52
0.8	0.00	0.00	1.52	0.00
1.5	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00

Conc-%	Transform: Untransformed							Rank Sum	1-Tailed Critical	Isotonic	
	Mean	N-Mean	Mean	Min	Max	CV%	N			Mean	N-Mean
USEPA Control	305.02	0.9377	305.02	233.52	357.52	19.020	4				
Diluent Control	325.27	1.0000	325.27	297.52	345.52	6.232	4	*		325.39	1.0000
0.1	325.52	1.0008	325.52	288.52	359.52	9.541	4	18.00	10.00	325.39	1.0000
0.2	272.52	0.8378	272.52	232.52	340.52	17.243	4	13.00	10.00	272.52	0.8375
*0.4	92.02	0.2829	92.02	74.52	114.52	20.932	4	10.00	10.00	92.02	0.2828
*0.8	0.38	0.0012	0.38	0.00	1.52	200.000	4	10.00	10.00	0.38	0.0012
1.5	0.00	0.0000	0.00	0.00	0.00	0.000	4			0.00	0.0000
3	0.00	0.0000	0.00	0.00	0.00	0.000	4			0.00	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.947384	0.905	0.847102	1.735358
Bartlett's Test indicates unequal variances (p = 5.95E-04)	19.61403	13.2767		
The control means are not significantly different (p = 0.53)	0.65903	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test Treatments vs Diluent Control	0.2	0.4	0.282843	500

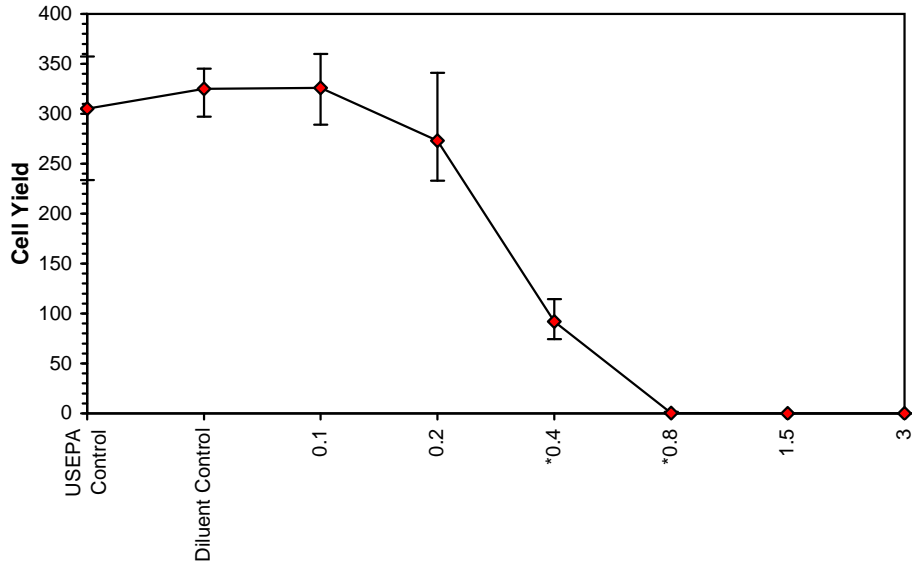
Linear Interpolation (200 Resamples)					
Point	%	SD	95% CL(Exp)		Skew
IC05	0.1308	0.0317	0.0085	0.2479	0.2079
IC10	0.1615	0.0310	0.0729	0.2533	0.1965
IC15	0.1923	0.0268	0.1139	0.2592	0.0498
IC20	0.2135	0.0228	0.1427	0.2691	-0.1078
IC25	0.2315	0.0206	0.1661	0.2824	-0.1349
IC40	0.2856	0.0149	0.2356	0.3220	-0.1175
IC50	0.3217	0.0117	0.2848	0.3510	-0.0865



Microalgal Cell Yield-Cell Yield

Start Date: 18/01/2013 16:15 Test ID: PR0989/03 Sample ID: RP3
End Date: 21/01/2013 16:40 Lab ID: 5823 Sample Type: AQ-Aqueous
Sample Date: Protocol: ESA 103 Test Species: CV-Chlorella vulgaris
Comments:

Dose-Response Plot



Microalgal Cell Yield-Cell Yield

Start Date: 18/01/2013 16:15 Test ID: PR0989/03 Sample ID: RP3
 End Date: 21/01/2013 16:40 Lab ID: 5823 Sample Type: AQ-Aqueous
 Sample Date: Protocol: ESA 103 Test Species: CV-Chlorella vulgaris
 Comments:

Auxiliary Data Summary

Conc-%	Parameter	Mean	Min	Max	SD	CV%	N
USEPA Control	Cell Yield	305.02	233.52	357.52	58.01	2.50	4
Diluent Control		325.27	297.52	345.52	20.27	1.38	4
0.1		325.52	288.52	359.52	31.06	1.71	4
0.2		272.52	232.52	340.52	46.99	2.52	4
0.4		92.02	74.52	114.52	19.26	4.77	4
0.8		0.38	0.00	1.52	0.76	229.44	4
1.5		0.00	0.00	0.00	0.00		4
3		0.00	0.00	0.00	0.00		4
USEPA Control	pH	7.60	7.60	7.60	0.00	0.00	1
Diluent Control		7.40	7.40	7.40	0.00	0.00	1
0.1		7.30	7.30	7.30	0.00	0.00	1
0.2		7.30	7.30	7.30	0.00	0.00	1
0.4		7.30	7.30	7.30	0.00	0.00	1
0.8		7.20	7.20	7.20	0.00	0.00	1
1.5		7.20	7.20	7.20	0.00	0.00	1
3		7.10	7.10	7.10	0.00	0.00	1
USEPA Control	Conductivity uS/cm	462.00	462.00	462.00	0.00	0.00	1
Diluent Control		111.40	111.40	111.40	0.00	0.00	1
0.1		122.00	122.00	122.00	0.00	0.00	1
0.2		102.50	102.50	102.50	0.00	0.00	1
0.4		160.80	160.80	160.80	0.00	0.00	1
0.8		170.00	170.00	170.00	0.00	0.00	1
1.5		191.90	191.90	191.90	0.00	0.00	1
3		259.00	259.00	259.00	0.00	0.00	1

Statistical Printouts for the Larval Fish Imbalance Tests

Fish Imbalance Test-96 hr Imbalance

Start Date:	31/01/2013 15:30	Test ID:	PR0989	Sample ID:	RP3
End Date:	4/02/2013 15:30	Lab ID:	5823	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 117	Test Species:	MS-Melanotaenia splendida
Comments:					

Conc-%	1	2	3	4
DMW Control	1.0000	1.0000	1.0000	
Diluent control	1.0000	0.6000	0.8000	
0.0625	0.8000	0.8000	1.0000	0.8000
0.125	0.6000	0.6000	0.4000	0.4000
0.25	0.2000	0.2000	0.0000	0.6000
0.5	0.0000	0.0000	0.0000	0.0000
1	0.0000	0.0000	0.0000	0.0000

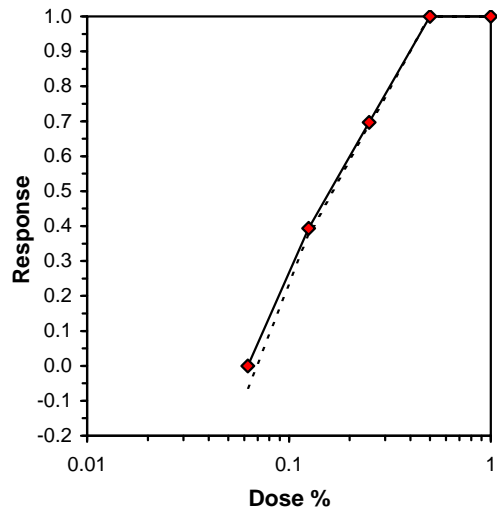
Conc-%	Mean	N-Mean	Transform: Arcsin Square Root					t-Stat	1-Tailed Critical	MSD	Isotonic	
			Mean	Min	Max	CV%	N				Mean	N-Mean
DMW Control	1.0000	1.2500	1.3453	1.3453	1.3453	0.000	3					
Diluent control	0.8000	1.0000	1.1128	0.8861	1.3453	20.637	3	*			0.8250	1.0000
0.0625	0.8500	1.0625	1.1667	1.1071	1.3453	10.206	4	-0.363	2.431	0.3608	0.8250	1.0000
0.125	0.5000	0.6250	0.7854	0.6847	0.8861	14.802	4	2.207	2.431	0.3608	0.5000	0.6061
*0.25	0.2500	0.3125	0.5097	0.2255	0.8861	53.926	4	4.064	2.431	0.3608	0.2500	0.3030
0.5	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				0.0000	0.0000
1	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.945272	0.881	0.582816	0.431517
Bartlett's Test indicates equal variances (p = 0.42)	2.826027	11.34487		
The control means are not significantly different (p = 0.15)	1.7531	2.776445		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	0.125	0.25	0.176777	800	0.337845	0.419929	0.358531	0.037748	0.002182	3, 11
Treatments vs Diluent control										

Log-Logit Interpolation (200 Resamples)

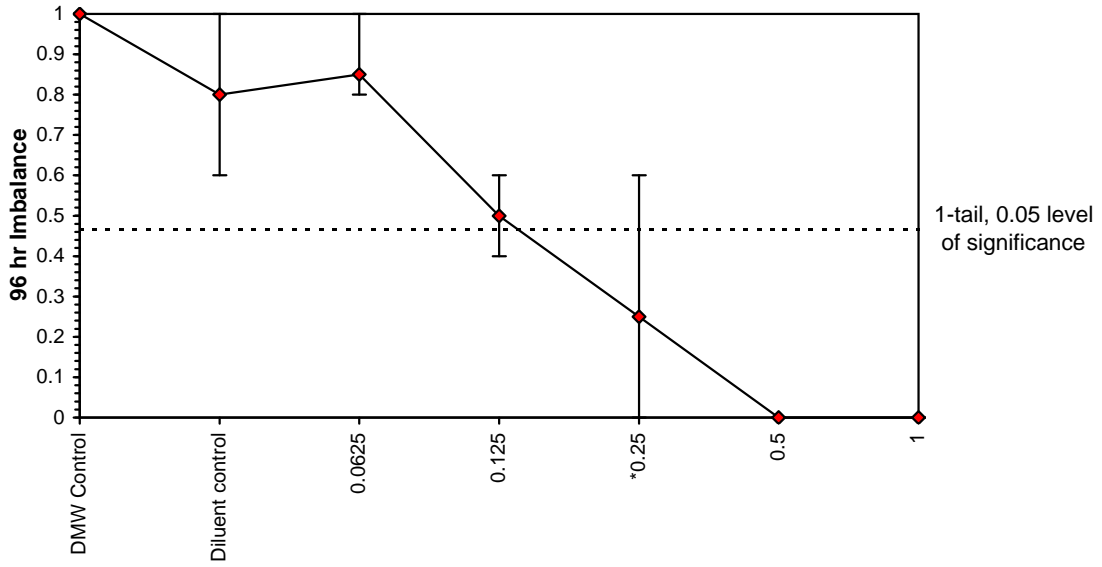
Point	%	SD	95% CL(Exp)		Skew
IC05	0.0728	0.0124	0.0195	0.0798	-1.8162
IC10	0.0819	0.0087	0.0399	0.0937	-1.6352
IC15	0.0902	0.0086	0.0484	0.1079	-1.0796
IC20	0.0978	0.0089	0.0628	0.1225	-0.4082
IC25	0.1051	0.0094	0.0751	0.1371	0.2729
IC40	0.1272	0.0241	0.0983	0.2270	2.3662
IC50	0.1638	0.0348	0.0938	0.3076	0.9942



Fish Imbalance Test-96 hr Imbalance

Start Date: 31/01/2013 15:30 Test ID: PR0989 Sample ID: RP3
End Date: 4/02/2013 15:30 Lab ID: 5823 Sample Type: AQ-Aqueous
Sample Date: Protocol: ESA 117 Test Species: MS-Melanotaenia splendida
Comments:

Dose-Response Plot



Fish Imbalance Test-96 hr Imbalance

Start Date:	31/01/2013 15:30	Test ID:	PR0989	Sample ID:	RP3
End Date:	4/02/2013 15:30	Lab ID:	5823	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 117	Test Species:	MS-Melanotaenia splendida
Comments:					

Auxiliary Data Summary

Conc-%	Parameter	Mean	Min	Max	SD	CV%	N
DMW Control	% Un-affected	100.00	100.00	100.00	0.00	0.00	3
Diluent control		80.00	60.00	100.00	20.00	5.59	3
0.0625		85.00	80.00	100.00	10.00	3.72	4
0.125		50.00	40.00	60.00	11.55	6.80	4
0.25		25.00	0.00	60.00	25.17	20.07	4
0.5		0.00	0.00	0.00	0.00		4
1		0.00	0.00	0.00	0.00		4
DMW Control	pH	8.00	8.00	8.00	0.00	0.00	1
Diluent control		6.50	6.50	6.50	0.00	0.00	1
0.0625		6.50	6.50	6.50	0.00	0.00	1
0.125		6.50	6.50	6.50	0.00	0.00	1
0.25		6.40	6.40	6.40	0.00	0.00	1
0.5		6.40	6.40	6.40	0.00	0.00	1
1		6.30	6.30	6.30	0.00	0.00	1
DMW Control	DO %	97.30	97.30	97.30	0.00	0.00	1
Diluent control		86.30	86.30	86.30	0.00	0.00	1
0.0625		92.50	92.50	92.50	0.00	0.00	1
0.125		93.70	93.70	93.70	0.00	0.00	1
0.25		94.30	94.30	94.30	0.00	0.00	1
0.5		93.60	93.60	93.60	0.00	0.00	1
1		89.30	89.30	89.30	0.00	0.00	1
DMW Control	Conductivity uS/cm	168.40	168.40	168.40	0.00	0.00	1
Diluent control		18.40	18.40	18.40	0.00	0.00	1
0.0625		21.00	21.00	21.00	0.00	0.00	1
0.125		24.10	24.10	24.10	0.00	0.00	1
0.25		30.40	30.40	30.40	0.00	0.00	1
0.5		42.40	42.40	42.40	0.00	0.00	1
1		64.80	64.80	64.80	0.00	0.00	1

Fish Imbalance Test-96 hr Imbalance

Start Date:	31/01/2013 15:30	Test ID:	PR0989	Sample ID:	RP3
End Date:	4/02/2013 15:30	Lab ID:	5823	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 117	Test Species:	MS-Melanotaenia splendida
Comments:					

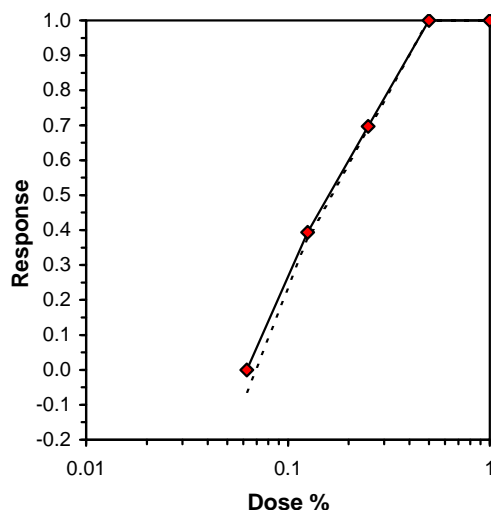
Conc-%	1	2	3	4
DMW Control	1.0000	1.0000	1.0000	
Diluent control	1.0000	0.6000	0.8000	
0.0625	0.8000	0.8000	1.0000	0.8000
0.125	0.6000	0.6000	0.4000	0.4000
0.25	0.2000	0.2000	0.0000	0.6000
0.5	0.0000	0.0000	0.0000	0.0000
1	0.0000	0.0000	0.0000	0.0000

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root					t-Stat	1-Tailed Critical	MSD	Number Resp	Total Number
			Mean	Min	Max	CV%	N					
DMW Control	1.0000	1.2500	1.3453	1.3453	1.3453	0.000	3					
Diluent control	0.8000	1.0000	1.1128	0.8861	1.3453	20.637	3	*			3	15
0.0625	0.8500	1.0625	1.1667	1.1071	1.3453	10.206	4	-0.363	2.431	0.3608	3	20
0.125	0.5000	0.6250	0.7854	0.6847	0.8861	14.802	4	2.207	2.431	0.3608	10	20
*0.25	0.2500	0.3125	0.5097	0.2255	0.8861	53.926	4	4.064	2.431	0.3608	15	20
0.5	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				20	20
1	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				20	20

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.945272	0.881	0.582816	0.431517
Bartlett's Test indicates equal variances (p = 0.42)	2.826027	11.34487		
The control means are not significantly different (p = 0.15)	1.7531	2.776445		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	0.125	0.25	0.176777	800	0.337845	0.419929	0.358531	0.037748	0.002182	3, 11
Treatments vs Diluent control										

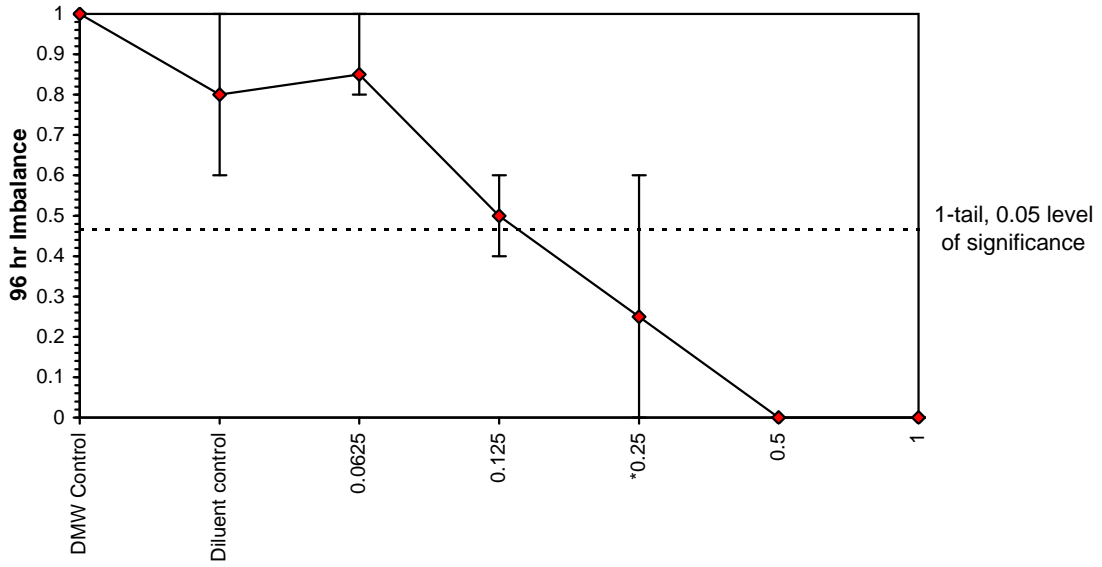
Trimmed Spearman-Kärber			
Trim Level	EC50	95% CL	
0.0%	0.1660	0.1348	0.2043
5.0%	0.1649	0.1312	0.2073
10.0%	0.1639	0.1278	0.2102
20.0%	0.1620	0.1215	0.2160
Auto-0.0%	0.1660	0.1348	0.2043



Fish Imbalance Test-96 hr Imbalance

Start Date: 31/01/2013 15:30 Test ID: PR0989 Sample ID: RP3
End Date: 4/02/2013 15:30 Lab ID: 5823 Sample Type: AQ-Aqueous
Sample Date: Protocol: ESA 117 Test Species: MS-Melanotaenia splendida
Comments:

Dose-Response Plot



Fish Imbalance Test-96 hr Imbalance

Start Date:	31/01/2013 15:30	Test ID:	PR0989	Sample ID:	RP3
End Date:	4/02/2013 15:30	Lab ID:	5823	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 117	Test Species:	MS-Melanotaenia splendida
Comments:					

Auxiliary Data Summary

Conc-%	Parameter	Mean	Min	Max	SD	CV%	N
DMW Control	% Un-affected	100.00	100.00	100.00	0.00	0.00	3
Diluent control		80.00	60.00	100.00	20.00	5.59	3
0.0625		85.00	80.00	100.00	10.00	3.72	4
0.125		50.00	40.00	60.00	11.55	6.80	4
0.25		25.00	0.00	60.00	25.17	20.07	4
0.5		0.00	0.00	0.00	0.00		4
1		0.00	0.00	0.00	0.00		4
DMW Control	pH	8.00	8.00	8.00	0.00	0.00	1
Diluent control		6.50	6.50	6.50	0.00	0.00	1
0.0625		6.50	6.50	6.50	0.00	0.00	1
0.125		6.50	6.50	6.50	0.00	0.00	1
0.25		6.40	6.40	6.40	0.00	0.00	1
0.5		6.40	6.40	6.40	0.00	0.00	1
1		6.30	6.30	6.30	0.00	0.00	1
DMW Control	DO %	97.30	97.30	97.30	0.00	0.00	1
Diluent control		86.30	86.30	86.30	0.00	0.00	1
0.0625		92.50	92.50	92.50	0.00	0.00	1
0.125		93.70	93.70	93.70	0.00	0.00	1
0.25		94.30	94.30	94.30	0.00	0.00	1
0.5		93.60	93.60	93.60	0.00	0.00	1
1		89.30	89.30	89.30	0.00	0.00	1
DMW Control	Conductivity uS/cm	168.40	168.40	168.40	0.00	0.00	1
Diluent control		18.40	18.40	18.40	0.00	0.00	1
0.0625		21.00	21.00	21.00	0.00	0.00	1
0.125		24.10	24.10	24.10	0.00	0.00	1
0.25		30.40	30.40	30.40	0.00	0.00	1
0.5		42.40	42.40	42.40	0.00	0.00	1
1		64.80	64.80	64.80	0.00	0.00	1

Statistical Printouts for *Hydra* Population Growth Tests

Hydra Population Growth Test-Growth Rate

Start Date: 4/02/2013 13:30	Test ID: PR0989/10	Sample ID: RP3
End Date: 8/02/2013 14:00	Lab ID: 5823	Sample Type: AQ-Aqueous
Sample Date:	Protocol: ESA 125	Test Species: HV-Hydra viridissima

Comments:

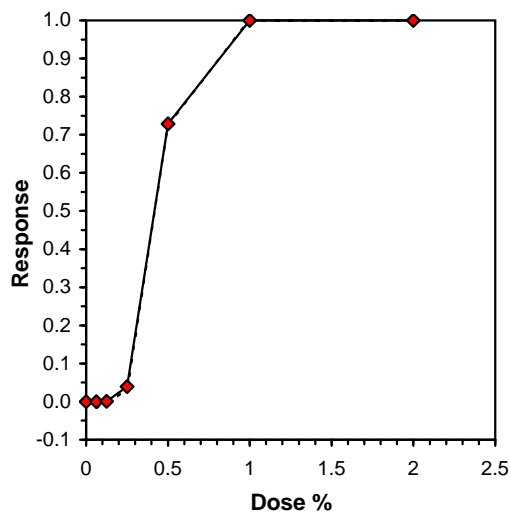
Conc-%	1	2	3	4
Lab Control	0.3033	0.2894	0.3289	0.2590
Diluent Control	0.3289	0.2670	0.3227	0.2670
0.063	0.3227	0.2964	0.3164	0.2670
0.125	0.3099	0.2508	0.3289	0.3033
0.25	0.2964	0.3099	0.2508	0.2894
0.5	0.0775	0.1088	0.1366	0.0000
1	0.0000	0.0000	0.0000	0.0000
2	0.0000	0.0000	0.0000	0.0000

Conc-%	Mean	N-Mean	Transform: Untransformed				N	t-Stat	1-Tailed Critical	MSD	Isotonic	
			Mean	Min	Max	CV%					Mean	N-Mean
Lab Control	0.2951	0.9958	0.2951	0.2590	0.3289	9.868	4					
Diluent Control	0.2964	1.0000	0.2964	0.2670	0.3289	11.499	4	*			0.2985	1.0000
0.063	0.3006	1.0143	0.3006	0.2670	0.3227	8.349	4	-0.160	2.360	0.0626	0.2985	1.0000
0.125	0.2982	1.0062	0.2982	0.2508	0.3289	11.207	4	-0.069	2.360	0.0626	0.2982	0.9991
0.25	0.2866	0.9670	0.2866	0.2508	0.3099	8.843	4	0.368	2.360	0.0626	0.2866	0.9602
*0.5	0.0808	0.2724	0.0808	0.0000	0.1366	73.063	4	8.132	2.360	0.0626	0.0808	0.2705
1	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	4				0.0000	0.0000
2	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	4				0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.944838	0.905	-0.72702	0.298269
Bartlett's Test indicates equal variances (p = 0.57)	2.916687	13.2767		
The control means are not significantly different (p = 0.96)	0.056037	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs Diluent Control	0.25	0.5	0.353553	400	0.062582	0.211144	0.036997	0.001406	1.3E-06	4, 15

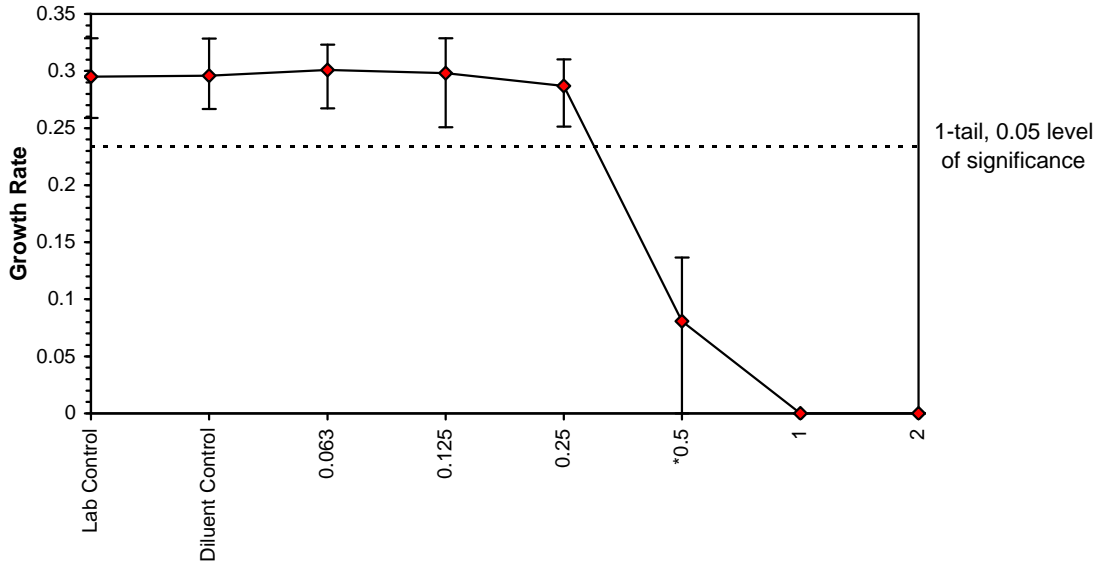
Linear Interpolation (200 Resamples)					
Point	%	SD	95% CL(Exp)	Skew	
IC05	0.2537	0.0751	0.0000	0.2774	-0.7586
IC10	0.2718	0.0392	0.0627	0.2961	-2.7805
IC15	0.2899	0.0200	0.2235	0.3162	-3.5854
IC20	0.3081	0.0151	0.2452	0.3354	-0.6572
IC25	0.3262	0.0148	0.2678	0.3629	-0.2104
IC40	0.3806	0.0176	0.3255	0.4353	0.3395
IC50	0.4168	0.0214	0.3514	0.4887	0.4167



Hydra Population Growth Test-Growth Rate

Start Date: 4/02/2013 13:30 Test ID: PR0989/10 Sample ID: RP3
End Date: 8/02/2013 14:00 Lab ID: 5823 Sample Type: AQ-Aqueous
Sample Date: Protocol: ESA 125 Test Species: HV-Hydra viridissima
Comments:

Dose-Response Plot



Hydra Population Growth Test-Growth Rate

Start Date: 4/02/2013 13:30	Test ID: PR0989/10	Sample ID: RP3
End Date: 8/02/2013 14:00	Lab ID: 5823	Sample Type: AQ-Aqueous
Sample Date:	Protocol: ESA 125	Test Species: HV-Hydra viridissima

Comments:

Auxiliary Data Summary

Conc-%	Parameter	Mean	Min	Max	SD	CV%	N
Lab Control	Growth Rate	0.30	0.26	0.33	0.03	57.82	4
Diluent Control		0.30	0.27	0.33	0.03	62.29	4
0.063		0.30	0.27	0.32	0.03	52.70	4
0.125		0.30	0.25	0.33	0.03	61.30	4
0.25		0.29	0.25	0.31	0.03	55.55	4
0.5		0.07	-0.02	0.14	0.07	353.84	4
1		-0.60	-0.60	-0.60	0.00		4
2		-0.60	-0.60	-0.60	0.00		4
Lab Control	Conductivity	22.50	22.50	22.50	0.00	0.00	1
Diluent Control		16.40	16.40	16.40	0.00	0.00	1
0.063		18.80	18.80	18.80	0.00	0.00	1
0.125		21.30	21.30	21.30	0.00	0.00	1
0.25		26.40	26.40	26.40	0.00	0.00	1
0.5		37.10	37.10	37.10	0.00	0.00	1
1		58.20	58.20	58.20	0.00	0.00	1
2		99.50	99.50	99.50	0.00	0.00	1
Lab Control	pH	8.00	8.00	8.00	0.00	0.00	1
Diluent Control		6.90	6.90	6.90	0.00	0.00	1
0.063		6.80	6.80	6.80	0.00	0.00	1
0.125		6.70	6.70	6.70	0.00	0.00	1
0.25		6.70	6.70	6.70	0.00	0.00	1
0.5		6.60	6.60	6.60	0.00	0.00	1
1		6.50	6.50	6.50	0.00	0.00	1
2		6.50	6.50	6.50	0.00	0.00	1
Lab Control	DO, % sat	99.90	99.90	99.90	0.00	0.00	1
Diluent Control		95.20	95.20	95.20	0.00	0.00	1
0.063		98.60	98.60	98.60	0.00	0.00	1
0.125		99.50	99.50	99.50	0.00	0.00	1
0.25		100.20	100.20	100.20	0.00	0.00	1
0.5		100.10	100.10	100.10	0.00	0.00	1
1		99.80	99.80	99.80	0.00	0.00	1
2		99.60	99.60	99.60	0.00	0.00	1

Hydra Population Growth Test-Growth Rate

Start Date:	22/01/2013 15:30	Test ID:	PR0989/02	Sample ID:	RP3
End Date:	26/01/2013 14:30	Lab ID:	5823	Sample Type:	Aqueous
Sample Date:		Protocol:	ESA 125	Test Species:	HV-Hydra viridissima

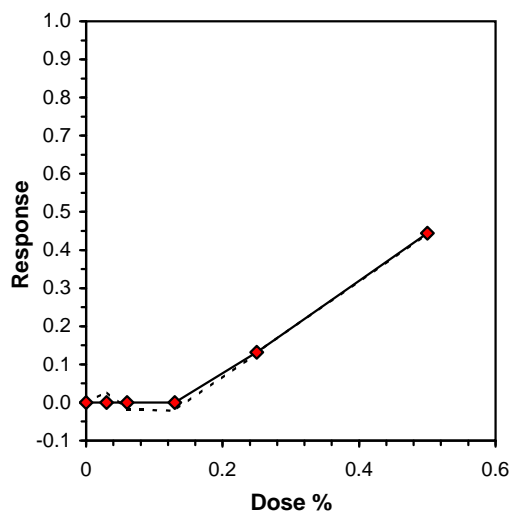
Conc-%	1	2	3	4
Diluent Control	0.4479	0.3931	0.4765	0.4113
0.03	0.4199	0.4282	0.4113	
0.06	0.4591	0.4241	0.4363	
0.13	0.4441	0.4517	0.4282	
0.25	0.3735	0.3978	0.3577	
0.5	0.1733	0.2821	0.2670	

Conc-%	Mean	N-Mean	Transform: Untransformed				N	t-Stat	1-Tailed Critical	MSD	Isotonic	
			Mean	Min	Max	CV%					Mean	N-Mean
Diluent Control	0.4322	1.0000	0.4322	0.3931	0.4765	8.636	4				0.4333	1.0000
0.03	0.4198	0.9713	0.4198	0.4113	0.4282	2.020	3	0.513	2.650	0.0640	0.4333	1.0000
0.06	0.4398	1.0176	0.4398	0.4241	0.4591	4.032	3	-0.315	2.650	0.0640	0.4333	1.0000
0.13	0.4414	1.0211	0.4414	0.4282	0.4517	2.712	3	-0.378	2.650	0.0640	0.4333	1.0000
0.25	0.3763	0.8707	0.3763	0.3577	0.3978	5.366	3	2.314	2.650	0.0640	0.3763	0.8685
*0.5	0.2408	0.5571	0.2408	0.1733	0.2821	24.481	3	7.925	2.650	0.0640	0.2408	0.5557

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.967023	0.901	-0.61284	1.063498
Bartlett's Test indicates equal variances (p = 0.14)	8.259734	15.08627		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	0.25	0.5	0.353553	400	0.064022	0.148124	0.018446	0.001	1.7E-05	5, 13

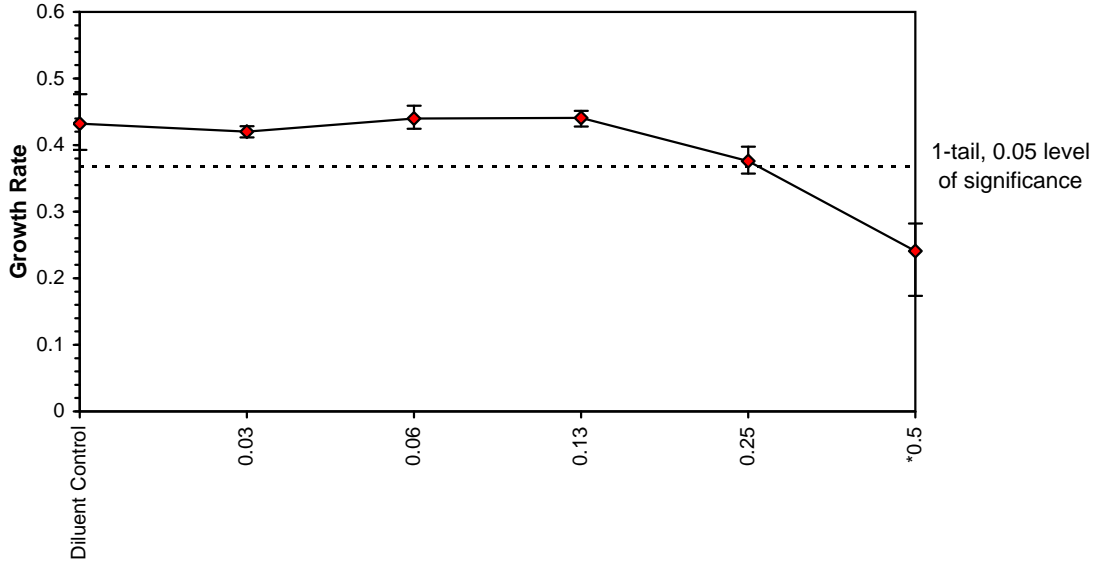
Linear Interpolation (200 Resamples)					
Point	%	SD	95% CL(Exp)		Skew
IC05	0.1756	0.0434	0.0000	0.2203	-2.2798
IC10	0.2212	0.0238	0.0858	0.2970	-0.1919
IC15	0.2648	0.0229	0.1455	0.3247	-0.3601
IC20	0.3047	0.0233	0.1875	0.3712	-0.2706
IC25	0.3447	0.0260	0.2250	0.4363	0.0698
IC40	0.4646				
IC50	>0.5				



Hydra Population Growth Test-Growth Rate

Start Date: 22/01/2013 15:30 Test ID: PR0989/02 Sample ID: RP3
End Date: 26/01/2013 14:30 Lab ID: 5823 Sample Type: Aqueous
Sample Date: Protocol: ESA 125 Test Species: HV-Hydra viridissima
Comments:

Dose-Response Plot



Hydra Population Growth Test-Growth Rate

Start Date:	22/01/2013 15:30	Test ID:	PR0989/02	Sample ID:	RP3
End Date:	26/01/2013 14:30	Lab ID:	5823	Sample Type:	Aqueous
Sample Date:		Protocol:	ESA 125	Test Species:	HV-Hydra viridissima
Comments:					

Auxiliary Data Summary

Conc-%	Parameter	Auxiliary Data Summary					
		Mean	Min	Max	SD	CV%	N
Diluent Control	Growth Rate	0.43	0.39	0.48	0.04	44.70	4
0.03		0.42	0.41	0.43	0.01	21.93	3
0.06		0.44	0.42	0.46	0.02	30.28	3
0.13		0.44	0.43	0.45	0.01	24.79	3
0.25		0.38	0.36	0.40	0.02	37.76	3
0.5		0.24	0.17	0.28	0.06	100.83	3
Diluent Control	Conductivity	17.70	17.70	17.70	0.00	0.00	1
0.03		20.50	20.50	20.50	0.00	0.00	1
0.06		21.50	21.50	21.50	0.00	0.00	1
0.13		26.20	26.20	26.20	0.00	0.00	1
0.25		30.40	30.40	30.40	0.00	0.00	1
0.5		43.10	43.10	43.10	0.00	0.00	1
Diluent Control	pH	7.30	7.30	7.30	0.00	0.00	1
0.03		7.30	7.30	7.30	0.00	0.00	1
0.06		7.20	7.20	7.20	0.00	0.00	1
0.13		7.20	7.20	7.20	0.00	0.00	1
0.25		7.10	7.10	7.10	0.00	0.00	1
0.5		7.00	7.00	7.00	0.00	0.00	1
Diluent Control	DO, % sat	100.10	100.10	100.10	0.00	0.00	1
0.03		100.10	100.10	100.10	0.00	0.00	1
0.06		100.10	100.10	100.10	0.00	0.00	1
0.13		99.40	99.40	99.40	0.00	0.00	1
0.25		99.90	99.90	99.90	0.00	0.00	1
0.5		99.50	99.50	99.50	0.00	0.00	1

Statistical Printouts for the Rainbowfish Embryonic Hatching Survival Tests

Fish Embryonic Development and Post-Hatch Survival Test-Survival

Start Date: 6/02/2013 15:15	Test ID: PR0989/01	Sample ID: RP3
End Date: 16/02/2013 15:15	Lab ID: 5823	Sample Type: AQ-Aqueous
Sample Date:	Protocol: ESA 126	Test Species: MS-Melanotaenia splendida

Comments:

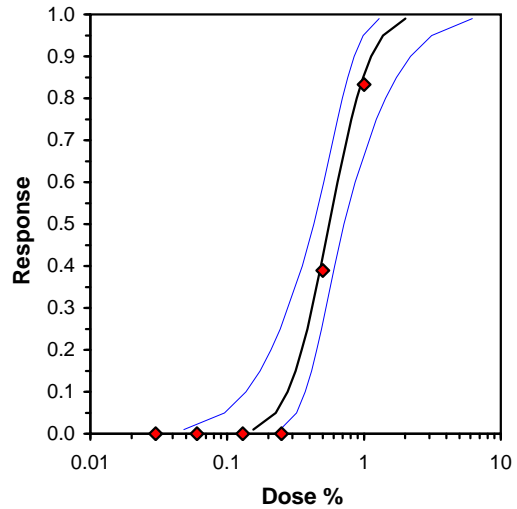
Conc-%	1	2	3	4
DMW Control	1.0000	1.0000	1.0000	1.0000
Diluent Control	0.8000	0.8000	1.0000	1.0000
0.03	1.0000	1.0000	1.0000	1.0000
0.06	1.0000	1.0000	1.0000	1.0000
0.13	1.0000	1.0000	1.0000	1.0000
0.25	1.0000	1.0000	1.0000	0.6000
0.5	0.4000	0.4000	0.6000	0.8000
1	0.2000	0.0000	0.2000	0.2000

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root					Rank Sum	1-Tailed Critical	Number Resp	Total Number
			Mean	Min	Max	CV%	N				
DMW Control	1.0000	1.1111	1.3453	1.3453	1.3453	0.000	4				
Diluent Control	0.9000	1.0000	1.2262	1.1071	1.3453	11.212	4	*		2	20
0.03	1.0000	1.1111	1.3453	1.3453	1.3453	0.000	4	22.00	10.00	0	20
0.06	1.0000	1.1111	1.3453	1.3453	1.3453	0.000	4	22.00	10.00	0	20
0.13	1.0000	1.1111	1.3453	1.3453	1.3453	0.000	4	22.00	10.00	0	20
0.25	0.9000	1.0000	1.2305	0.8861	1.3453	18.660	4	19.00	10.00	2	20
0.5	0.5500	0.6111	0.8407	0.6847	1.1071	23.960	4	11.00	10.00	9	20
*1	0.1500	0.1667	0.4041	0.2255	0.4636	29.464	4	10.00	10.00	17	20

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.905671	0.924	-0.71785	1.957951
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 0.13)	1.732051	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	0.5	1	0.707107	200
Treatments vs Diluent Control				

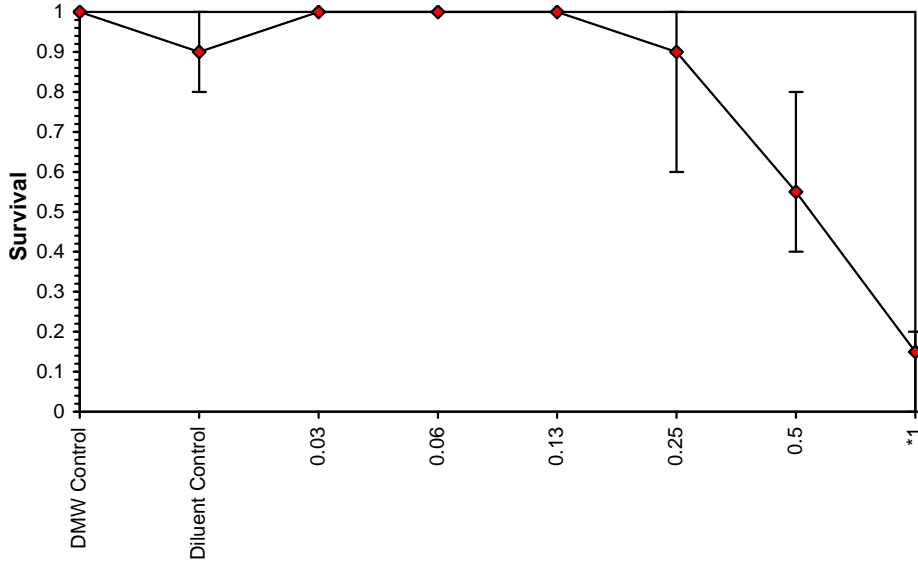
Parameter	Value	SE	95% Fiducial Limits		Maximum Likelihood-Probit						
					Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	4.185474	0.990903	2.243305	6.127644	0.1	1.684102	9.487729	0.79	-0.25335	0.238922	5
Intercept	6.060398	0.326545	5.42037	6.700427							
TSCR	0.025408	0.01828	-0.01042	0.061236							
Point	Probits	%	95% Fiducial Limits								
EC01	2.674	0.155179	0.048118	0.244436							
EC05	3.355	0.225765	0.095406	0.320557							
EC10	3.718	0.275713	0.136695	0.372361							
EC15	3.964	0.315516	0.173558	0.413563							
EC20	4.158	0.35121	0.20909	0.451116							
EC25	4.326	0.385033	0.244436	0.487789							
EC40	4.747	0.48542	0.353546	0.608714							
EC50	5.000	0.558018	0.429813	0.714266							
EC60	5.253	0.641473	0.509122	0.860194							
EC75	5.674	0.80872	0.642075	1.231103							
EC80	5.842	0.886604	0.695959	1.435733							
EC85	6.036	0.986903	0.760678	1.726198							
EC90	6.282	1.129375	0.846273	2.188009							
EC95	6.645	1.379237	0.984518	3.13022							
EC99	7.326	2.006609	1.29287	6.197986							



Fish Embryonic Development and Post-Hatch Survival Test-Survival

Start Date: 6/02/2013 15:15 Test ID: PR0989/01 Sample ID: RP3
End Date: 16/02/2013 15:15 Lab ID: 5823 Sample Type: AQ-Aqueous
Sample Date: Protocol: ESA 126 Test Species: MS-Melanotaenia splendida
Comments:

Dose-Response Plot



Fish Embryonic Development and Post-Hatch Survival Test-Survival

Start Date: 6/02/2013 15:15	Test ID: PR0989/01	Sample ID: RP3
End Date: 16/02/2013 15:15	Lab ID: 5823	Sample Type: AQ-Aqueous
Sample Date:	Protocol: ESA 126	Test Species: MS-Melanotaenia splendida

Comments:

Auxiliary Data Summary

Conc-%	Parameter	Mean	Min	Max	SD	CV%	N
DMW Control	% Survival	100.00	100.00	100.00	0.00	0.00	4
Diluent Control		90.00	80.00	100.00	11.55	3.78	4
0.03		100.00	100.00	100.00	0.00	0.00	4
0.06		100.00	100.00	100.00	0.00	0.00	4
0.13		100.00	100.00	100.00	0.00	0.00	4
0.25		90.00	60.00	100.00	20.00	4.97	4
0.5		55.00	40.00	80.00	19.15	7.96	4
1		15.00	0.00	20.00	10.00	21.08	4
DMW Control	pH	8.10	8.10	8.10	0.00	0.00	1
Diluent Control		6.90	6.90	6.90	0.00	0.00	1
0.03		6.80	6.80	6.80	0.00	0.00	1
0.06		6.80	6.80	6.80	0.00	0.00	1
0.13		6.70	6.70	6.70	0.00	0.00	1
0.25		6.70	6.70	6.70	0.00	0.00	1
0.5		6.60	6.60	6.60	0.00	0.00	1
1		6.50	6.50	6.50	0.00	0.00	1
DMW Control	Conductivity (uS/cm)	151.80	151.80	151.80	0.00	0.00	1
Diluent Control		17.20	17.20	17.20	0.00	0.00	1
0.03		19.50	19.50	19.50	0.00	0.00	1
0.06		21.60	21.60	21.60	0.00	0.00	1
0.13		25.00	25.00	25.00	0.00	0.00	1
0.25		31.40	31.40	31.40	0.00	0.00	1
0.5		43.20	43.20	43.20	0.00	0.00	1
1		66.10	66.10	66.10	0.00	0.00	1
DMW Control	DO (% sat)	105.80	105.80	105.80	0.00	0.00	1
Diluent Control		100.50	100.50	100.50	0.00	0.00	1
0.03		103.10	103.10	103.10	0.00	0.00	1
0.06		103.70	103.70	103.70	0.00	0.00	1
0.13		104.20	104.20	104.20	0.00	0.00	1
0.25		104.70	104.70	104.70	0.00	0.00	1
0.5		103.60	103.60	103.60	0.00	0.00	1
1		103.30	103.30	103.30	0.00	0.00	1

Appendix B – Chemistry Reports

Reference	Sample Description	Sample No.	Replicate	Date prepared	Aluminium Total µg/L	Cadmium Total µg/L	Cobalt Total µg/L	Chromium Total µg/L	Copper Total µg/L	Iron Total µg/L	Lead Total µg/L	Manganese Total µg/L	Mercury Total µg/L	Nickel Total µg/L	Zinc Total µg/L	Magnesium Total mg/L	Calcium Total mg/L	Sodium Total mg/L	Aluminium (.45µm filtere) µg/L	Cadmium (.45µm filtere) µg/L	Cobalt (.45µm filtere) µg/L
Units	-				10	0.1	1	1	1	10	1	5	0.05	1	1	0.5	0.5	0.5	10	0.1	1
PQL																					
Method					Metals-022 ICP-tals-022	ICP-tals-022	ICP-tals-022	ICP-tals-022	ICP-tals-022	ICP-tals-022	ICP-tals-022	ICP-tals-021 CV-Atals-022	ICP-tals-022	ICP-tals-022	ICP-tals-020	ICP-tals-020	ICP-tals-020	ICP-tals-022	ICP-tals-022	ICP-tals-022	ICP-tals-022
84493	RP3 (sample)	1	0	23/01/2013	<10	180	1800	<1	4500	<10	100	23000	<0.05	2000	45000	240	350	56	<10	130	1300
84493	RP3 (sample)	1	1	23/01/2013	<10	190	1900	<1	4800	<10	100	25000 [NT]		2100	42000	240	340	56	<10	130	1300
84493	SW2 (diluent)	2	0	23/01/2013	210	<0.1	<1	<1	<1	830	<1	<5	<0.05	<1	4	0.7	0.7	1.6	110	<0.1	<1

Chromium (.45µm filtered) µg/L 1	Copper (.45µm filtered) µg/L 1	Iron (.45µm filtered) µg/L 10	Lead (.45µm filtered) µg/L 1	Manganese (.45µm filtered) µg/L 5	Mercury (.45µm filtered) µg/L 0.05	Nickel (.45µm filtered) µg/L 1	Zinc (.45µm filtered) µg/L 1	Calcium (Dissolved) mg/L 0.5	Magnesium (0.45µm filtered) mg/L 0.5	Hardness mgCaCO ₃ /L 3	Chloride, Cl mg/L 1	TSS @ 103-105°C mg/L 5	TDS (grav) mg/L 5	TS mg/L 5	Carbonate mg/L 5	Bicarbonate mg/L 5	Alkalinity as CaCO ₃ mg/L 5	Total Alkalinity as CaCO ₃ mg/L 5	Sulphate, SO ₄ ²⁻ mg/L 1	WAD CN mg/L 0.004	DOC mg/L 1
tals-022 ICP	tals-022 ICP	tals-022 ICP	tals-022 ICP	tals-022 ICP	tals-021 CV-Atals-022 ICP	tals-022 ICP	tals-022 ICP	als-020 ICP	als-020 ICP	AES	Inorg-081	Inorg-019	Inorg-018	Inorg-041	Inorg-006	Inorg-006	Inorg-006	Inorg-006	Inorg-081	Inorg-083	Inorg-079
<1	3400	<10	65	19000	<0.05	1300	38000	300	200	1600	27	11	2000	2000	22	<5	<5	22	1800	<0.004	<1
<1	3400	<10	66	19000	[NT]	1300	38000	300	200	1600											
<1	<1	290	<1	<5	<0.05	<1	2	0.5	0.5	3	2	5	35	40	8	<5	<5	8	<1	<0.004	<1

TOC	Nitrate as N	Phosphate as P
mg/L	mg/L	mg/L
1	0.005	0.005
Inorg-079	Inorg-055	Inorg-060
3	1.6	<0.005
3	0.008	<0.005

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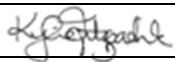
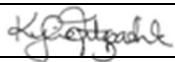
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		Name	Signature	Name	Signature	Date
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0	J. Woodworth	K. Fitzpatrick		K. Fitzpatrick		28/02/13

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