



MEMO

Date: May 11, 2011 **HCP Ref No.:** CZN1682

From: John Wilcockson and Martin Davies

To: David Harpley, CZN

Subject: Prairie Creek Mine – Supplementary whole effluent toxicity testing (Memo 7)

1.0 INTRODUCTION

This document stems from technical discussions between regulators and CZN at Yellowknife on April 12, 2011.

In this memo, updated whole effluent toxicity testing results are presented. On April 28, 2011, new laboratory treated process water and treated mine water samples were prepared. These were submitted to Nautilus Environmental in Burnaby for additional acute *Daphnia magna* testing (Nautilus 2011c, Attachment A) and sublethal *Ceriodapnia duba* testing (Nautilus 2011d, Attachment B). Three mixtures of the treated mine water and treated process water were tested:

- A 4:1 (80% treated mine water: 20% treated process water) sample, representing worst case (uncommon) effluent concentrations;
- An 8:1 (71.4% mine, 12.4% process, 16.2% ditch) sample, representing more typical operating conditions; and
- Treated mine water only.

The acute (*D. magna*) and sub-lethal (*C. dubia*) results are discussed separately below. These two species were chosen because whole effluent testing using simulated effluent prepared on January 28, 2011 indicated either inconsistent results (*D. magna*) or toxicity at environmentally relevant concentrations (*C. dubia*) (Nautilus 2011a, Attachment C).

The results of a Toxicity Identification Evaluation (TIE, Nautilus 2011b, Attachment D) performed at the time indicated that the observed toxicity was likely not caused by divalent metals, non-polar organic compounds or strong anions. Instead, the results suggested that the cause of toxicity may have been attributable to the treatment of the simulated effluent.

The remaining species tested indicated no toxicity; there was no acute toxicity of 100% effluent to rainbow trout (96hr-LC50 test), and no sub-lethal toxicity to *Lemna minor* (7-day growth inhibition test, Nautilus 2011a, Attachment C).

2.0 DAPNIA MAGNA

The January 28 2011 *D. magna* test using the worst case (4:1) simulated effluent mixture yielded inconsistent results (Nautilus 2011a, Attachment C). One full-strength sample exhibited toxicity, while another did not. In addition, both the 4:1 and 8:1 mixtures diluted with Prairie Creek water showed increasing mortality at lower concentrations (Nautilus 2011b). This result was both unusual and unexplained. The 8:1 mixture and mine water-only sample did not cause any acute *Daphnia magna* toxicity at full strength.

The new treated process water and treated mine water samples were prepared to be representative of operational mine treatment conditions. The *D. magna* tests (Nautilus 2011c, attached) indicated no toxicity in any of the three mixtures tested above, suggesting that full-strength effluents discharged from the mine are unlikely to cause any acute toxicity.

3.0 CERIODAPHNIA DUBIA

The initial (January 28, 2011) *C. dubia* tests using both the 4:1 and 8:1 simulated effluent mixtures showed no mortalities, but there were effects on reproduction at all dilutions tested, down to and including 5% v/v (Nautilus 2011a, Attachment C). These results indicated that there could be sub-lethal impacts to Prairie Creek organisms downstream of the IDZ in Prairie Creek.

C. dubia toxicity testing with the new laboratory-prepared treated mine water and two simulated effluent mixtures provided the following results:

- There was no mortality seen in any of the tests;
- Treated mine water only (i.e., with no process effluent added) caused no effect on reproduction;
- In the 4:1 mixture (worst case), there was no effect on reproduction at 20% or lower, but a substantial effect at 40% and higher (an IC25 of 23.8 %v/v was calculated); and
- In the 8:1 mixture (typical case), there was no effect on reproduction at 40% and lower, and a substantial effect at 60% and higher (an IC25 of 44.5 %v/v was calculated).

These results indicate an absence of *C. dubia* mortality within the IDZ and absence of sub-lethal toxicological effect at concentrations expected to occur outside the IDZ. Since mixing in the vertical water column occurs very rapidly upon release, and no sub-lethal effects to *C. dubia* were observed below 23.8% v/v, it is likely that there would also be an absence of sub-lethal effect within much of the IDZ.

4.0 CONCLUSION

In conclusion, the compiled toxicity testing results indicate that the treated Prairie Creek mine effluent (process and mine water) will not result in any acute mortality within the IDZ and no sub-lethal effects outside the IDZ. These are prerequisites of establishing a suitable IDZ for a water discharge license. During periods of low winter flows final effluent will consist only of treated mine water, which caused no effect on *C. dubia* at even 100% treated mine water.

5.0 REFERENCES

Nautilus (Nautilus Environmental). 2011a. Toxicity Testing on Synthetic Effluent Samples, Final Toxicity Test Report, April 6, 2011. Report for Hatfield Consultants, North Vancouver, BC.

Nautilus. 2011b. Toxicity Identification Evaluation of Mill Water Sample, Final Report, April 8, 2011. Report for Hatfield Consultants, North Vancouver, BC.

Nautilus. 2011c. Re: Toxicity testing on the samples identified as Mixture 4:1, Mixture 8:1, Mine Water (Collected on April 28, 2011). Report dated May 5, 2011. Report for Hatfield Consultants, North Vancouver, BC.

Nautilus. 2011d. Re: Toxicity testing on prepared effluent samples, final toxicity test report. Report dated May 10, 2011. Report for Hatfield Consultants, North Vancouver, BC.



Attachment A

April 28, 2011 Whole Effluent Toxicity Testing *D. magna*



8664 Commerce Court, Burnaby, BC V5A 4N7

WO#: 11201

Mr. John Wilcockson Hatfield Consultants 850 Harbourside Drive North Vancouver, BC V7P 0A3

May 5, 2011

Dear Mr. Wilcockson:

Re: Toxicity testing on the samples identified as Mixture 4:1, Mixture 8:1, Mine Water (Collected on April 28, 2011)

Nautilus Environmental is pleased to provide you the results of the 48-h LC50 *Daphnia magna* toxicity tests on the above samples, received on April 28, 2011. Testing was conducted according to Environment Canada and 1/RM/14, (Second Edition, 2000). The results of these tests are provided in the table below and are based on the appended data. All acceptability criteria outlined in the Environment Canada protocol were met.

Table A. Results for the 48-h D. magna test.

Sample ID	Collection Date and Time	48-h LC50 (% v/v) 1
Mixture 4:1	April 28, 2011 @ 1600h	>100
Mixture 8:1	April 28, 2011 @ 1600h	>100
Mine Water	April 28, 2011 @ 1600h	>100

Results relate only to the sample tested.

Please feel free to contact the undersigned at 604-420-8773 should you have any questions or require any additional information.

Yours truly,

Nautilus Environmental

Krysta Banack, B.Sc. Laboratory Biologist

Daphnia magna Summary Sheet

Client: Work Order No.:	Halfreld/(madia)	Test	ate/Time: <u>Apr</u> Species: <u>D.ma</u> et up by: <u>Y.C.B</u>		20h_
Sample Information	n:				
Sample ID: Sample Date: Date Received: Sample Volume:	4:1 Mixture M April 28111 April 28111 aoL	lixture 4:1			
Test Organism Info	rmation:				
Broodstock No.: Age of young (Day 0 Avg No. young per b Mortality (%) in previ Days to first brood:	rood in previous 7 d:	041311B <24 hours 25 0			
NaCl Reference Tox	xicant Results:				
Reference Toxicant I Stock Solution ID: Date Initiated: 48-h LC50 (95% CL)	10 NaOl April 19/4	g/LNaCL			
Reference Toxicant (Mean (2SD Range): CV (%):	4,0 63,6 -4.4)	g/L NaCL		
Test Results:	The 48-h LLS	D is 7100%.	.v/v)		
Reviewed by:	A. Tong	· ·	Date reviewed:	May 5,2	2011

Freshwater Acute 48 Hour Toxicity Test Data Sheet

Client: Sample ID:	Hatfield 1(anadian Zinc. Start Date/Time: April 28/11@14201 D: Weit Mixture Mixture Mixture 411 No. Organisms/volume: 10/200mL											9dh			
Work Order No.:	::	HA 11/2	(O)			-			st Org	anism:	D.ma	gna			
	W.								Set	up by:	rc	>			
DO meter:	DO-1		-		рН	meter:		pH-1		- (Condu	ctivity	meter	<u>C-1</u>	
Concentration		lumber Orgar		No. Immobilized	Temperature Dissolved (°C) (mg/			olved o (mg/L					Conductivity (µS/cm)		
4.(010)		24	48	48	0	24	48	0	24	48	0	24	48	0	48
Control	Α	10	10	9	බං , ර	30 <i>.0</i>	195	8.5		8.4	7,9		<i>ጉ</i> ၵ	352	369
	В		,		14 Table 1		394		764	164	24.0	7-1	44		
	С	ļ	<u> </u>		Page 1	1000	160				200	11.0	estage estage	1	12000 F
/ ==	D					7,000					0.11	All and a second		0:0	.24
6.25	A	10	10	0	30,5	20,0	19/5	8.5		34	8.4	MACH.	P.1	218	5/8
	В							100				11.7	- 10		1000 L
	C D	ļ			i de la companya de l	289							100		
12.5	A	10	10	0	20.5	30.0	195	8.5		85	8.5		ይ 3	679	683
10.5	В		1		4013		11/2	0.3		14894	015		,	1011	
	С				1						400	31-1			[33]
	D				Party Control				S	7.53			100	1	1000
_as	Α	10	10	0	20,5	20,0	195	8.5		24	8,8	T-72 T	2,5	1002	/0/0
	В					1779		Ħ.		200			787	MH.	
	С				NAME OF THE PARTY	A STATE	rate .	- 749	Section 1		100 mm		1944	100 mm	
	D	· .			The state of										
50	Α	10	10	0	91.0	30.0	19,5	8.5		24	9.0		58	1595	1626
	В				786	7		2001-13-13-13-13-13-13-13-13-13-13-13-13-13		Electronic	100	fire and	1000 27		
	C	<u> </u>			394	1700 11000 11000		Magn.	70 miles	Charles Co.	100	90.00	77.0		
1000	D A	10		<u> </u>	91.0	200	10	9 (٤.4	a a	7.0	£9	ବ୍ୟେଠ	222
1000	В	10	10	<u> </u>	ano	au	14/8	6.5			7100	1		9690	2730
	c							1		3300 a		110		12 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
	D							and it		Educa.		100			
Technician In	itials	NB			Kib	RB	~	rib	27% 178	^	-riB	69 (63)	^	KCB	~
						•									
	Hardness	*		Alkalinity*					I WQ	A	djustme	nt		Adjusted V	VQ
Conc.			/L as Ca			Temp (21.0							
Control (MHW)		8	140	8		DO (mg	g/L)	8.5							
Highest conc.	(oS	<u> </u>	140)	-	pH Cond (ıS/cm)		ື່ງ					14,4	
Sample Descripti	ion:	d	ew	O Test				_		(OH)	3.E)	in ado	lation .	to regula	v sample:sun
Comments:	Batch#⋅ A	HISUB	7-d prev	ious # young/brod		1	•	1st Bro	•	•	Previou				@94-h=10
	Datoim.0	1	To	. O	-u. 43				Ju. 10						Su
Reviewed by:		4.		$\overline{\chi}$		Da	te revi	ewed:		M	3y	Di-	200		
				\cup							ſ				

Nautilus Environmental

Version 1.3 Issued November 26, 2008

Client: Hatfield/(anadian Zinc

w.o.#:_\(20)

Hardness and Alkalinity Datasheet

			Alkalinity				Hardnes	s	
Sample ID	Sample Date	Sample Volume (mL)	(mL) 0.02N HCL/H ₂ SO ₄ used to pH 4.5	(mL) of 0.02N HCL/H ₂ SO ₄ used to pH 4.2	Total Alkalinity (mg/LCaCO₃)	Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness (mg/L CaCO ₃)	Techni
Mixture 4:1 Mixture	Apra8/11	100	1,5	1.6	140	100	6.5	650	KUB
	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \								
		,							
				. `					<u> </u>
						-			
			:						
							<u> </u>		
									<u> </u>
		1							ļ <u>-</u>
								-	
		Notes:	ODiluted	to 100ml h	ith 07 vater		.		
			D HOLES				110 (100 11 11		
		1					. /		
Reviewed by:		4.7	to g		_ Date Review	ved:	May	5,201	

Daphnia magna Summary Sheet

Client: Work Order No.:	Hatfield Konadion Zinc 11201	Start Date/Time: Test Species: Set up by:		14256
Sample Information				
Sample ID: Sample Date: Date Received: Sample Volume:	2:1 Mixture Mixture 8 April 28/11 April 28/11 201	- - -		
Test Organism Info	ormation:			
Broodstock No.: Age of young (Day 0 Avg No. young per b Mortality (%) in prev Days to first brood:	orood in previous 7 d:	SILB < 24 hours		
NaCl Reference To	xicant Results:			
Reference Toxicant Stock Solution ID: Date Initiated: 48-h LC50 (95% CL)	10 Nao) April 19/11	g/LNaCL		
Reference Toxicant Reference Toxicant		3,6-4.4) g/L NaC	CL	
Test Results:	The 48-h 2CSC) 15 71007.L.	/u)	
Reviewed by:	1. Tog	Date revie	ewed: May E	5,2011

Freshwater Acute 48 Hour Toxicity Test Data Sheet

Client: Sample ID: Work Order No.:	8:1	<u>Mix</u>	ture.	adian Zinc	Start Date/Time: April 28/11@1425h No. Organisms/volume: 10/200mL Test Organism: D.magna Set up by: KCB											
DO meter:	DO-1		_		рН	meter:		pH-1		_ (Condu	ctivity r	neter:	<u>C-1</u>		
Concentration		lumber Orgar		No. Immobilized	Те	mpera (°C)	ture		olved o (mg/L)			рН			uctivity /cm)	
y.(v/v)	<u> </u>	24	48	48	0	24	48	0	24	48	0	24	48	0	48	
V.(UN)	Α	10	10	٥	∂0,0	90°0	195	8.5		8.4	7.9		7,9	358	365	
	В															
	С		ļ													
	D			0		0 .		0.0	-					14.0		
6,25	A	10	10		20.S	30,0	19,5	8.8		کج	8.3		8.1	469	480	
	В															
	C D	ļ														
12.5	A	10	10	9	2n C	20.0	195	05		RY	8 6		872	586	594	
1017	В			<u> </u>	40.3	auto	(1/2	817			017			200	317	
	C						28.00								2.51	
	D			·									-			
a5	Α	10	10	9	20.5	20:0	1965	8.5		B.4	7.8		£4	817	819	
	В									•						
	С															
	D															
50	Α	10	10	0	3015	2010	19.5	8.5		sy.	8.9		8-6	1332	1238	
	В												100			
	C															
1000	D A	10			200	20:0	19 (0 (<u>د</u> ک	Q I		£ 0	lanci	0.15	
1000	В	10	10		aus	auic	1/0	80		د بر	1. (מרי	1994	7213	
	C												ii.			
· · · · · · · · · · · · · · · · · · ·	D	1														
Technician In	itials	rub.	<i>~</i>		KiB	rub	~	KIB		~	KUB		~	LLB	$\overline{}$	
				•												
	Hardness	*	,	Alkalinity*] .			Initial	IWQ	Ad	djustme	nt	ļ	Adjusted V	VQ	
Conc.			/L as Ca]	Temp (°C)	20,5	5							
Control (MHW)	9,		68			DO (mg	g/L)	8.5								
Highest conc.	5	60	13	<u>0</u>]	pΗ	0 ()	1,9								
Canada Dagasinti	·	واء	<u>a</u> ~		•	Cond (<u> 199</u>			(p#8.	.5) .11.				2
Sample Descripti Comments:				rious # young/bro		Tested		H adi	,						ular sample @ 24 @ 44	€;suviv 4-h=100) f-h/æ9
Comments.	Datcii#.()	<u> </u>	r-u piev		ou 35		Day OI	1st Broo	<u>/</u>	, ,	TEVIOL	ıs 7-d %	iviorial	ity. C		-1100% J uni
Reviewed by:		Ao	0	Z	.	Dat	e revi	ewed: _		M	By	5, 2	<u> 2011 </u>		<u> </u>	3-100 Urvi50
Version 1.3 Iss	sued Nove	mber 26	, 2008	U							V	N	Nautilus	Environm	nental	

Client: Hatfield / Conadian Zinc

w.o.#:_\(20\

Hardness and Alkalinity Datasheet

			Alkalinity					Hardnes	s	
Sample ID	Sample Date	Sample Volume (mL)	(mL) 0.02N HCL/H ₂ SO ₄ used to pH 4.5	(mL) of 0.02N HCL/H ₂ SO ₄ used to pH 4.2	Total Alkalinity (mg/LCaCO ₃)		Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness (mg/L CaCO ₃)	Technicia
8:1 Mixture	Apr28/11	100	1.4	1.5	130		100	5,6	560	KB
,										
										<u> </u>
										ļ
		_		1						
		<u> </u>							·	
		 								
		<u> </u>								
							<u> </u>			
									<u> </u>	
						l				
				1		<u> </u>				
		Notes:	ODiluted to	100ml L	ith DI w	ater				

7		/ -			Data David			11- ==	5 0011	
Reviewed by:			Torg		_ Date Revi	ewed:		May 5	12011	
			()					(

Daphnia magna Summary Sheet

Client: Work Order No.:	Hatfield / Canadian	Zinc ——	Start Date/Time: _ Test Species: _ Set up by: _		-
Sample Information	n:				
Sample ID: Sample Date: Date Received: Sample Volume:	Mine Water Aprila8111 Aprila8111 aol				
Test Organism Info	ormation:				,
Broodstock No.: Age of young (Day 0 Avg No. young per b Mortality (%) in prev Days to first brood:	prood in previous 7 d:	041311B <24 ho 25 0	urs		
NaCl Reference To	xicant Results:				
Reference Toxicant Stock Solution ID: Date Initiated: 48-h LC50 (95% CL)	10Na01 April 19/11	-4,8 [°])	g/LNaCL		
Reference Toxicant Reference Toxicant		4.0(3.6	g/L NaC	<u></u>	
Test Results:	The 48-h	LC50 is	5 7 100%.(<u>U</u>	v)	
Reviewed by:	1. Tong	2	Date revie	wed: May 5, 2011	

Freshwater Acute 48 Hour Toxicity Test Data Sheet

Client:	Hatfi	eld 10	onadio	an Zinc		Start Date/Time: <u>Apr โปลิโกเ © โปโร้ค</u> No. Organisms/volume: <u>10/200mL</u>									<u>h</u>
Sample ID:	<u>///i</u>	ne Wa	<u> </u>			Test Organism: D.magna									
Work Order No.:	+1	A 1130	יום			-		16			Life				
									OCI	up by.		,			
DO meter:	DO-1	ŕ	-		рН	meter:		pH-1		_ '	Conduc	ctivity	meter	<u>C-1</u>	
Concentration	Live	lumber Organ	nber of No. rganisms Immobilized			Temperature Dissolved ox (°C) (mg/L)							Conductivity (µS/cm)		
7. V/v	Rep	24	48	48	0	24	48	0	24	48	0	24	48	0	4,8
Control	Α	10	10	3		30.0	_	8.5		5.4	7,9		73	352	362
CONTION	В	10	15		30,0	duio	เรล	0,3	180	7.1	7,1		19.0	355	36~
	C				ulus Georgia	7150	225		100			Transaction of the second			296,001 200,00 25,000,00
	D	-			Server .		36	ikas Markas	340		-156	Bar.	egili.	260	11000
1.05		10	10	5	200	200	10/	8,5	25	25	84	Silver Silver	٠,	401	418
6.25	A B	10	(5	, <u>, , , , , , , , , , , , , , , , , , </u>	10.S	30.0	15/5	6,5		123	0.9	n maydilda)	8,1	401	11,5
	C	-			CONT.		200 M	APRIL III	- 60		5,250,00		5.0	9	
	D				2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		Troffich Pyring	26800					1,0000		(1987) (1987) (1988)
12,5		10	10	Э	26.5	200.00	195	2 (er Stranger	24	8.6		8-2	454	463
1013	A	10	(1)		00,2	20:0	מניו	813	1996	7	0.0	Maria Maria	-	131	763
	В					Sage S	-Chain	100	Tillari.			March	-86		Table 1
	C D	-			Single Carried Carried La	THE STATE OF	- 2000		1966		2000		***		
26.		10	10	3	0 - 6	200	10 (56		Lu	8.8	(A) (A) (A)	54	549	521
25	A B	10_	(1)		30.5	au.u	19,5	0,5	110000	0 1	0.0			311	361
	C								1		2.0			CONTROL OF	1000
	D							Take.							1000
50		10	10		30.0	200	196	8.6	290121 2001	84	9.1		s,s	735	751
30	A	10	10	3	40.0	QUIU	(G)	0,0		9~1	1,1			735	731
	В				144 124	- mag	TAKE A		107 tolera		76,770gg	7011 10111			2614 120 <u>00</u>
	C D						- 7		A			e I sondani		193441 193441	
100 0	A	10	10	0 .	20.0	20.0	tak	8.8	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	5.3	۹,2	11111111111111111111111111111111111111	F-8	1054	1075
	В	<u> </u>	,		40,0	25.0	- 17				- 21			10000	2000 1000 1000 1000 1000 1000 1000 1000
	С					55.		1589	100			(Care	707		100
	D				111 64	780g 1845	- 33		77.00		21,000,000	Middle)		The	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Technician Ir		KUB	^	~	CiB	ruB		KLB		~	CIB	100 (CAT)	_	KIB	
The state of the s								1-03			,	post 250 (1994)		1 1	
Hardness* Alkalinity*]			Initia	ıl WQ	A	djustme	nt		Adjusted	wq
Conc.				Temp ((°C)	80.0									
Control (MHW)	98		6	8		DO (m	g/L)	8.8	3						
Highest conc.	55	C	।५	0		рН		9,5							

1) Tested a pit adjusted sample (pit 8.5) in addition to regular sample, survival extraor Day of 1st Brood: A 10 @48-h Batch#: 04131167-d previous # young/brood: 25 Previous 7-d % Mortality: O Comments: Date reviewed: Reviewed by:

Cond (µS/cm) 1054

Sample Description:

clear

Client: Halfield (Canadian Zinc

w.o.#:<u>1(20)</u>

Hardness and Alkalinity Datasheet

			Alkalinity						
Sample ID	Sample Date	Sample Volume (mL)	(mL) 0.02N HCL/H₂SO ₄ used to pH 4.5	(mL) of 0.02N HCL/H ₂ SO ₄ used to pH 4.2	Total Alkalinity (mg/LCaCO ₃)	Sample Volume (mL)	EDTA Used (mL)	Total Hardness (mg/L CaCO ₃)	Techniciar
Mine Water	Apr 28/11	100	1.5	1.6	140	100	5.5	550	KIB
		1							
								-	
		<u> </u>				<u> </u>			
								_	-
		Notes:	O Di luted	to loom	~ith 07 w	ate			
r									
Reviewed by:		4	(. terg		_ Date Revie	wed:	May :	5,2011	
			$\langle \rangle$				(,	

Attachment B

April 28, 2011 Whole Effluent Toxicity Testing *C. dubia*



Toxicity Testing on Prepared Effluent Samples

Final Toxicity Test Report

Report date: May 10, 2011

Submitted to:

Hatfield Consultants

North Vancouver, BC

8664 Commerce Court Burnaby, BC V5A 4N7

TABLE OF CONTENTS

		Page
TAB	LE OF CONTENTS	2
1.0	INTRODUCTION	3
2.0	METHODS	
3.0	RESULTS	
4.0	REFERENCES	8
	LIST OF TABLES	
Tabl Tabl Tabl	e 2. Toxicity test results for the <i>Ceriodaphnia dubia</i> survival and reproduction tests	7

LIST OF APPENDICES

APPENDIX A - Ceriodaphnia dubia Toxicity Test Data

1.0 INTRODUCTION

Nautilus Environmental conducted chronic toxicity tests for Hatfield Consultants on samples identified as Mine Water, Mixture 1 and Mixture 2. The mixtures were prepared in the laboratory on April 28, 2011, from samples identified as Process Water and Mine Water (received on April 28, 2011) and Ditch Water (received in December 2010).

Mixture 1 was a 4:1 combination of Mine Water (80%) and Mill Water (20%) and Mixture 2 was a combination of Mine Water (71.4%), Mill Water (12.4%), and Ditch Water (16.2%). The following toxicity tests were performed on the Mine Water, Mixture 1 and Mixture 2 samples:

• 7-d Ceriodaphnia dubia survival and reproduction test

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

2.0 METHODS

Methods for the toxicity tests are summarized in Table 1. Testing was conducted according to procedures described by Environment Canada (2007). Statistical analyses for the tests were performed using CETIS (Tidepool Scientific Software, 2009).

2.1 Quality Assurance/Quality Control (QA/QC)

Nautilus follows a comprehensive QA/QC program to ensure that the data generated are of high quality and are scientifically defensible. To meet these objectives, Nautilus has implemented a number of quality control procedures that include the following:

- Negative controls to ensure that appropriate testing performance criteria are met;
- Positive controls to assess the health and sensitivity of the test organisms;
- Use of appropriate species and life stage to meet the study objectives;
- Appropriate number of replicates to allow proper statistical analyses;
- Calibration and proper maintenance of instruments to ensure accurate measurements;
- Proper documentation and recordkeeping to allow traceability of performance;
- Adequate supervision and training of staff to ensure that methods are followed;
- Proper handling and storage of samples to ensure their integrity;
- Procedures in place to address issues that may arise during testing and ensure the implementation of appropriate corrective actions; and
- Rigorous review of data by a Registered Professional Biologist to ensure they are of good quality and scientifically defensible prior to releasing to the client.

Table 1. Summary of test conditions: *Ceriodaphnia dubia* survival and reproduction test.

Test organism Ceriodaphnia dubia Test organism source In-house culture Test organism age <24 hr old neonates produced within 12 hr Static renewal Test type Test duration $7 \pm 1 \text{ day}$ Test chamber 20 mL test tube 15 mL Test solution volume 10 Number of replicates Control/dilution water 20% Perrier water (hardness 80-100mg/L CaCO₃) Test solution renewal Daily 25 ± 1°C Test temperature Number of organisms/chamber Feeding Daily, with 0.1 ml Pseudokirchneriella subcapitata and 0.05 mL YCT 100 to 600 lux Light intensity Photoperiod 16 hours light/8 hours dark Aeration None Test protocol Environment Canada (2007), EPS 1/RM/21 Survival and reproduction Test endpoints Test acceptability criterion for controls ≥80% survival; ≥15 young per surviving control;

Reference Toxicant

≥60% of controls producing three or more broods

Sodium chloride

3.0 RESULTS

There were no effects on survival of *Ceriodaphnia dubia*; the LC50 value for all these samples was >100%. Conversely, effects were observed on reproduction of *C. dubia* in both Mixtures 1 and 2. The IC50 was 28.4% for Mixture 1 and 49.8% for Mixture 2, respectively (Table 2). No adverse effects on reproduction were observed in the toxicity tests using Mine Water.

3.1 Quality Assurance/Quality Control

All the tests reported here met the acceptability criteria for test validity specified in the respective protocol. Water quality parameters measured during the toxicity tests were within acceptable ranges and results of the reference toxicant tests conducted during the testing program were all within the in-house historical mean and range. The reference toxicant test results are summarized in Table 3.

It should be noted that the Ditch water used in Mixture 2 was received in December 2010 and therefore exceeded holding time requirements.

Table 2. Toxicity test results for the *Ceriodaphnia dubia* survival and reproduction tests.

	Mi	ne Water	M	ixture 1	Mixture 2			
(0//)	Survival	Reproduction	Survival	Reproduction	Survival	Reproduction		
(% v/v)	(%)	(# offspring)	(%)	(# offspring)	(%)	(# offspring)		
Control	100	22.8 ± 3.0	100	26.1 ± 4.3	100	24.2 ± 3.5		
5	100	20.9 ± 4.8	100	29.1 ± 5.3	100	29.8 ± 2.7		
10	100	25.9 ± 2.8	100	29.3 ± 3.6	100	27.9 ± 4.8		
20	90	23.7 ± 9.1	100	28.0 ± 4.7	100	27.6 ± 3.1		
40	100	31.3 ± 3.6	100	0.2 ± 0.6	100	27.0 ± 4.6		
60	100	22.6 ± 5.5	100	0.0 ± 0.0	100	2.2 ± 2.7		
80	100	25.7 ± 3.3	100	0.0 ± 0.0	100	0.6 ± 1.9		
100	100	21.9 ± 3.7	90	0.0 ± 0.0	100	0.0 ± 0.0		
Test endpoint	t (% v/v)							
LC50		>100		>100	>100			
IC25 (95% CL)		>100		(22.4 – 23.9)	44.5 (42.7 – 44.9)			
IC50 (95% CL)	>100		28.4 (27.2 – 28.6)	49.8 (48.3 – 50.4)			

LC = Lethal Concentration.

Table 3. Reference toxicant test results.

Test Species	Endpoint	Mean (2SD Range)	CV(%)	Initiation Date
	Survival (IC50): 1.7 g/L NaCl	1.8 (1.5-2.3)	11	April 20,
C. dubia	Reproduction (IC50): 1.1 g/L NaCl	1.2 (0.9-1.4)	12	2011

IC = Inhibition Concentration.

SD = Standard Deviation.

CL = Confidence Limits.

4.0 REFERENCES

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

Tidepool Scientific Software. 2009. CETIS comprehensive environmental toxicity information system, version 1.8.0. Tidepool Scientific Software, McKinleyville, CA. 222 pp.



Ceriodaphnia dubia Summary Sheet

Client: Work Order No.:	Hatfield 11200	Start Date/Time: Set up by:	April 30,2011@1	136h
Sample Information	n:			
Sample ID: Sample Date: Date Received: Sample Volume:	Mine Water April 28 April 28 1×20L			
Test Organism Info	ormation:			
Mortality (%) in prev	st 3 broods of previous 7 d	0.0		
NaCl Reference To	xicant Results:			
Reference Toxicant Stock Solution ID: Date Initiated:	ID: <u>Cd 66</u> <u>[INaOl</u> <u>April 20/11</u>			
7-d LC50 (95% CL): 7-d IC50 (95% CL):	2.1(1.7-7.6) 1.2 (1.1-1.6)	g/L NaCL g/L NaCL		
	Toxicant Mean (2SD Rang Toxicant Mean (2SD Rang		g/L NaCL	11_12
Test Results:	LC50 %(v/v) (95% CL) IC25 %(v/v) (95% CL) IC50 %(v/v) (95% CL)	Survival	Reproduction 7100	na E
Reviewed by:		Date revie		

Chronic Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client:	Half	eld/	andi	an Zi	۸(Star	t Date 8	& Time:	A	ml30	110	e 1	1306
Sample ID:		e Water		<u> </u>		-		Sto	p Date:		Marc	2 1 .	@ 1V	looh
Work Order #:	1120			l		•		Test Sp	ecies:	Cerioda	apkinia d	dubia	-	
, ,														
(دار دره							Da	ays						
Concentration	0		1		2		3		4		5		6	7
loshol	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	14/2	14.5	WP	28.5	24.0	35.5	24.0	250	24.0	2815	24,0	as.5		
DO (mg/L)	20	6.8	80	7,0		6.9	7.8	6.7	8.0	6.6	7.8	67		
pH	81	77	21	79	8.	7,9	8.1	7.5	80	7.7	8.2	7.7		
Cond. (µS/cm)	216	2	[]	3	160	91			N		310	ale	λ	
Initials	<u>~</u>				B		B)	B	v	LB	R		
muuo	1			, , , , , , , , , , , , , , , , , , ,										
				• • • • • • • • • • • • • • • • • • • •			Da	ays						
Concentration	0		1	Ι .	2		3		4		5		6	7
Concentiation	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	250	ws	প্তাত	25.5	24.0	25.5	apg	25.0	24,0	35.5	240	25.5	\	migr
DO (mg/L)	20	69	La	7.0	7.7	7.0	8.0	6.7	7.6	66	7.8	68		
	79	79	6.4	7,9	8'3	7.9	8,3	3.7	8.3	7.7	8,2	7.8		
pH			62	90			360	36		26		36	7	
Cond. (µS/cm)	259		~		WB		CUB		UB			Le		
Initials	, –	-				L	<u></u>		M		iB	<u> </u>	<u>v</u>	<u> </u>
	Ι													
				1		I		ays						7
Concentration	0		1		2	CONTRACTOR DE	3		4		5 		6	7
40	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	2500	nus	2510	25.5	340		34.0	25.0	240	35.5	246	355		
DO (mg/L)	20	65	7-9	7.0	7.8	7.0	79	6.7	7.7	67	79	6.7	$\vdash \bigvee$	
рН	26	gr -	Eg	8.1	8.8	8.2	8.7	7.9	8.8	7.9	8,9	7,9	\vdash	
Cond. (µS/cm)	608		87		<u>82</u>	_	87		10	58		599		$\overline{}$
Initials	_~_	•		1	LUB_	X	ub		ib_)C	ib_	Ki	B	$-\lambda$
	1													
				1			Da	ys						
Concentration	0		1		2		3		4		5		6	7
100	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	25.0	245	250	38.2	240	35 5	940	35.0	24.0	25.5	24.0	25.5		
DO (mg/L)	79	69	81,20	6.7	7.9	70	7.7	6.9	7.7	6.9	8.5	6.6		
рН	9.1	5	22	8.3	9.1	8.4	9.0	8.4	8.8	8.1	9,1	8,3		
Cond. (µS/cm)	1047	10	53	10	اور	10	,41	u	36	10	33	104	3	
Initials					iB	X	ib	<u></u> γ	us	K	ib	L	B	
									1			1 1.		
		trol	1001							Analys	ts:	CCBIA	WP	
Hardness*	10		55										7-	
Alkalinity*	8	1	140	5]		ved by:	-	-1	7/
* mg/L as CaCO3					1				l	Date rev	newed:	M	24 9	411
Sample Description:	: (1)	Cle	ar		41				~	· · · · · · · · · · · · · · · · · · ·				
Comments:	Broodl	ooard U	sed: උ	MIGIL										

Version 1.1 Issued July 29, 2009

Chronic Freshwater Toxicity Test C. dubia Reproduction Data

Clien	t:		Ha	Hfiel	dl	r. Onal	dian	Zinc													S	tart Da	ite & T	Time:		Am	13	» /	116	2 14	50h		
Samp	le ID:		M	line	wate	r															S	top Da	ite & 1	Time:		1	36	1	11 €	2 14	000		
Work	Orde	r:				900)									0/	. (ردں)				Set u	p by:			0	1 /	w				
	Conc	ontra	tion:		10	ntro	1					Conc	entra	tion:			<u>, c</u>	11° /					Conc	entra	tion.			1	0				
Days	A	В	C	D	E	<i>F</i>	G	Н	1	J	Init	A	В	C	D	E	F	G	Н	1	J	Init	A	В	C	D	E	F	G	Н	ī	J	Init
1	/	/	1	1	/	/	1	/	/	1	<u>ب</u>		/	/	7	7	1	1	/	/	1	^		/	1	/	/	/	/	/	/	/	~
2		/	/	/							KLB		/		/	/		/				rus		/				/	/				rus
3	1	V	/	/	/	/	9	/	$\overline{}$	/	rub		1	1	/	1	V		~		/	KCB	/		/				-				rus
4		6	5	3	3	/	5	4	V	3	KiB		3	5	63	~	6	3	5	3	3	KLB		4	4	Ч	3	4	3	4	3		KUG
5		13	13	10		9	11	9	9	10	ub	9	10	10	2	5	4	7	٦	9		rub	1	q		9		13 ·		9			rus
6	9	6	8	19	8	7	10	8	14	8	Kub	14	13	8	8	6	11	9	9	13	11	COR	15	13	13	10	13	14	10	14	13	11	KUB
7							ļ									-					7												
8	20	200	~	25	02	110	21-	21	02	31	V. D	77	2	00	V-L	1	21	10	.0	OE.	27	20.0	21	~	SE	02	27	27		01	~	25	20.0
Total	99	do	do	25	3	10	dV	d1	CK	Q1	uy	Q'T	CP.	40	17	Π	31	19	10	dフ	92	W	31	do	do	(d)	da	30	dT	27	W	92	KU=
_	Conc	entra	tion:				20					Conc	entra	tion:				40					Conc	entra	tion:			6	0				
Days	Α	В	С	D	E	F	G	Н	1	J	Init	Α	В	С	D	Ε	F	G	Н	1	J	Init	Α	В	С	D	E	F	G	Н	1	J	Init
1		/	1	/	/	/	/		/		~	/	/	1	/	/	/		1	/	/	~		/	/	/	/	/	/			.//	~
2			/	4	/	/	/	/	1/		UB	/	/	/	1	1/		/	/	/		ub		No.	/			/	/	//			UB
3	1	/	/	/	X	/	/	1		1	Ub		~	1	0	/		1		/	/	CB	/	/	/	/		/	/		- 4	//	CLG
4	5	5	U	/		/	4	3	4	/	M	5	Ó	6	6	4	6	ع	3	5	5	xce		3	3	_	~	ခ	<u> </u>		2	4	KUB
5		11	8	5		98	9	9	8	6	W	19	13	10	11	9	10-	13	9	۹,	M_	Kip	12	9	7	3	6	11	6	9	9	10	w
6	15	15	14	15	\perp	16	14	15	14	17	UB	10	17	15	14	15	15	16	13	14	17	rus	15	13	13	19	10	15	14	14	13	13	LUB
7	` '							,	. 5		L					<u> </u>																	
8	-7		20	210		2.4	-1	- 4			_	200		-		20		2/	~_	- 0	20	. 0	~~		~~			00					
Total	30	31	90	90	0	24	24	27	96	25	MB	32	36	31	31	98	31	35	92	28	55	mo	23	74	99	15	IV	38	30	18	94	27	W
-	Conc	ontra	tion:			9	Ø					Cone	entra	tion:			100		-				Conc	entra	tion:								
Days	A	В	C	D	E	F	G	Н	ı	J	Init	A	В	C	D	E	F	G	н	1	J	Init	A	В	C	D	E	F	G	Н		J	Init
1	/	/	/	/	/	1	/	1	1	/	~	/	/	/	/	/	1	/	/	/	/	~											
2		1	/	1	/	/	/	/	/	/	UB	/	/	/	/	/	/	/	/	/	/	CCB											
3	1	/	1	1	1	/	/	1	1		w	~	/	~	1	~		1	J.		1	rib											
4	3	5	a	3	a	6	5		3	7	CUB	4	3	4	4	4	4	3	3	3	3	Vic											
5	io	19		9	19	9	9	7	10	8	wo	1	9	7	Q	7	11	9	9	٩	٩	w										7-	
6	10	13	13	15	14	15	13	13	13	14	WB	(S	13	12	10	la	19	10	12	13	4	rus											
7																				,													
8																																	
Total	25	30	99	27	36	30	27	19	96	35	rip	16	25	123	30	23	27	91	34	94	100	rub							<u></u>				
Notes	: X = 1	morta	lity.										I																		-		
Samp				Young	only bas	ed on th	ne first 3	Broods	Fourth	and su	bsequer	ot brood	s not in	cluded in	n total c	ount.																	
					1		7	0																			11-	, .	a	20	711		
	wed	-	ulv 29. 20	200	-4	<u> </u>	9	X			-											Date	revie	wed:			0	Y	()		701		

CETIS Analytical Report

Report Date: Test Code: 09 May-11 15:37 (p 1 of 4) 11200c | 15-5776-2313

												Test (Code:		11200c 1	15-5776-231
Ceriod	aphnia	7-d Survival an	d Repro	duct	ion Te	est								N	lautilus En	vironmenta
Analys	is ID:	10-6497-0093		Endp	oint:	Repro	duction					CETIS	Version:	CETISV	1.8.0	
Analyz		09 May-11 15:3	,	Analy		Linear	Interpola	tion (ICPIN)		(Offici	al Results:	Yes		
Batch I	D:	13-9282-0988		Test 1	Type:	Repro	duction-S	urvival (7d)				Analy	st:			
Start D		30 Apr-11 11:3		Proto	-		S 1/RM/2				- 1	Dilue	nt:			
Ending	Date:	06 May-11 14:0	00 \$	Speci	ies:	Ceriod	laphnia d	ubia			1	Brine	:			
Ouratio	n:	6d 3h	,	Sourc	ce:	In-Hou	ıse Cultur	re				Age:				
Sample		02-3579-8115		Code	:	E0DF	E63				(Client	: Hatfi	eld		
Sample	e Date:	28 Apr-11 16:0	0 1	Mater	rial:	Water	Sample				J	Proje	ct:			
Receiv	e Date:	28 Apr-11 16:0		Sourc		Hatfiel										
Sample	Age:	44h		Statio	n:	Mine V	Vater									
inear	Interpo	lation Options														
(Trans		Y Transform		Seed		Resan	nples	Exp 95%	CL	Meth						, ,
-og(X+	1)	Linear	1	1.275	E+09	200		Yes		Two-	Point In	terpo	lation			
oint E	stimate	es														
_evel	%	95% LCL	95% U	JCL	TU	9	5% LCL	95% UCL								
C5	83.87	47.31	N/A		1.192	N	I/A	2.114								
C10	94.9	55.93	N/A		1.054	N	I/A	1.788								
C15	>100	N/A	N/A		<1	N	I/A	N/A								
C20	>100	N/A	N/A		<1	N	I/A	N/A								
C25	>100	N/A	N/A		<1	N	I/A	N/A								
C40	>100	N/A	N/A		<1	N	I/A	N/A								
C50	>100	N/A	N/A		<1	N	l/A	N/A								
Reproc	luction	Summary						Cal	cula	ed Va	riate					
Conc-%	6 С	ontrol Type	Count	:	Mean	N	lin	Max	Std	Err	Std D	ev	CV%	%Effect		
)	N	egative Control	10		22.8	1	6	26	0.9	538	3.048	-	13.37%	0.0%		
,			10		20.9	1	1	27	1.5	09	4.771		22.83%	8.33%		
0			10		25.9	2	2	31	0.9		2.846		10.99%	-13.6%		
.0			10		23.7	0		33	2.8	33	9.117		38.47%	-3.95%		
0			10		31.3	2		36	1.12		3.561		11.38%	-37.28%		
0			10		22.6	1:	5	32	1.73	33	5.481		24.25%	0.88%		
80			10	:	25.7	19	9	30	1.0	55	3.335		12.98%	-12.72%		
00			10		21.9	10	6	27	1.1	59 	3.665		16.74%	3.95%		
Reprod	luction	Detail														
Conc-%		ontrol Type	Rep 1		Rep 2		ep 3	Rep 4	Rep	5	Rep 6	i	Rep 7	Rep 8	Rep 9	Rep 10
)	N	egative Control	22		25	26		25	23		16		26	21	23	21
5			27	:	25	23		17	11		21		19	18	25	23
0			31	:	26	2	5	23	22		30		24	27	26	25
20			33	;	31	26	6	20	0		24		27	27	26	23
10			35	;	36	3	1	31	28		31		35	25	28	33
60			32	:	24	2		15	16		28		20	18	24	27
						-	_							4.0		

Analyst: QA: May (O) (1)

CETIS Analytical Report

Report Date: Test Code:

09 May-11 15:37 (p 2 of 4)

11200c | 15-5776-2313

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: Analyzed:

10-6497-0093

Endpoint: Reproduction

CETIS Version:

CETISv1.8.0

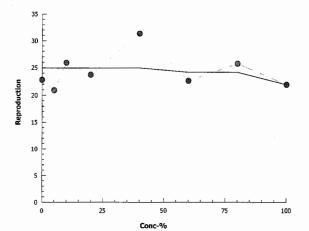
09 May-11 15:34

Analysis:

Linear Interpolation (ICPIN)

Official Results: Yes

Graphics



CAMBY 10/11

000-089-170-2

CETIS™ v1.8.0.11

Report Date: Test Code: 09 May-11 15:37 (p 3 of 4) 11200c | 15-5776-2313

									1621	Code.		112000	15-5110-25
Ceriod	aphnia	7-d Survival an	d Reprod	uction T	est						Na	autilus En	vironment
Analys	is ID:	08-0167-1560	Er	ndpoint:	6d Survival Rat	te			CET	S Version:	CETISv1	1.8.0	
Analyz	ed:	09 May-11 15:	34 A r	nalysis:	Linear Interpola	ation (ICPI	N)		Offic	ial Results	: Yes		
Batch i	ID:	13-9282-0988	Te	st Type:	Reproduction-S	Survival (7	d)		Anal	yst:			
Start D	ate:	30 Apr-11 11:3		otocol:	EC/EPS 1/RM/				Dilue	ent:			
Ending	Date:	06 May-11 14:0	00 S p	ecies:	Ceriodaphnia d	lubia			Brin	e:			
Ouratio	on:	6d 3h	Sc	ource:	In-House Cultu	re			Age:				
Sample	e ID:	02-3579-8115	Co	ode:	E0DFE63				Clier	nt: Hat	field	,	
Sample	e Date:	28 Apr-11 16:0	0 M a	aterial:	Water Sample				Proje	ect:			
Receiv	e Date:	28 Apr-11 16:0	0 S c	ource:	Hatfield								
Sample	e Age:	44h	St	ation:	Mine Water								
.inear	Interpo	lation Options											
(Tran		Y Transform		ed	Resamples	Exp 95	% CL	Method					
_og(X+	1)	Linear	1.5	599E+09	200	Yes		Two-Point	Interp	olation			
oint E	stimate	es											
_evel	%	95% LCL	95% UC	L TU	95% LCL	95% UC	L						
C5	>100	N/A	N/A	<1	N/A	N/A							
C10	>100	N/A	N/A	<1	N/A	N/A							
C15	>100	N/A	N/A	<1	N/A	N/A							
C20	>100	N/A	N/A	<1	N/A	N/A							
C25	>100	N/A	N/A	<1	N/A	N/A							
C40	>100	N/A	N/A	<1	N/A	N/A							
C50	>100	N/A	N/A	<1	N/A	N/A						•	
d Sur	vival Ra	ate Summary				Calc	culated	Variate(A/I	3)				
onc-%	6 С	ontrol Type	Count	Mean	Min	Max	Std	Err Std	Dev	C V %	%Effect	Α	В
)	N	egative Control	10	1	1	1	0	0		0.0%	0.0%	10	10
;			10	1	1	1	0	0		0.0%	0.0%	10	10
0			10	1	1	1	0	0		0.0%	0.0%	10	10
0			10	0.9	0	1	0.1	0.3	162	35.14%	10.0%	9	10
0			10	1	1	1	0	0		0.0%	0.0%	10	10
0			10	1	1	1	0	0		0.0%	0.0%	10	10
0			10	1	1	1	0	0		0.0%	0.0%	10	10
00			10	1	1	1	0	0		0.0%	0.0%	10	10
d Sur	vival Ra	nte Detail											
onc-%		ontrol Type	Rep 1	Rep 2		Rep 4	Rep		6	Rep 7	Rep 8	Rep 9	Rep 10
1	N	egative Control	1	1	1	1	1	1		1	1	1	1
5			1	1	1	1	1	1		1	1	1	1
0			1	1	1	1	1	1		1	1	1	1
0			1	1	1	1	0	1		1	1	1	1
0			1	1	1	1	1	1		1	1	1	1
0			1	1	1	1 .	1	1		1	1	1	1
0			1	1	1	1	1	1		1	1	1	1

Analyst:____QA:Moy 10/11

100

CETIS Analytical Report

Report Date: Test Code:

09 May-11 15:37 (p 4 of 4) 11200c | 15-5776-2313

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID:

08-0167-1560 09 May-11 15:34 Endpoint: 6d Survival Rate Analysis:

Linear Interpolation (ICPIN)

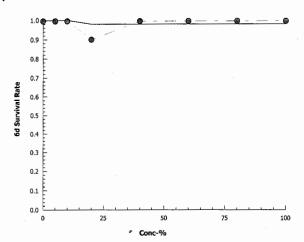
CETIS Version:

CETISv1.8.0

Official Results: Yes

Graphics

Analyzed:



Ceriodaphnia dubia Summary Sheet

Client:	Hatfield 1200	Start Date/Time	
Work Order No.:	11200	Set up by	: KLB
Sample Information	n:		
Sample ID: Sample Date: Date Received: Sample Volume:	4:1 Mixture April 28, 2011 April 28, 2011		
Test Organism Info	ormation:		
Mortality (%) in prev	st 3 broods of previous 7 d	0.0	
NaCl Reference To	xicant Results:		
Reference Toxicant Stock Solution ID: Date Initiated:	ID: <u>Cd66</u> <u>11Na01</u> <u>April20/11</u>		
7-d LC50 (95% CL): 7-d IC50 (95% CL):	2.1 (1.7-2.6) 1.2 (1.1-1.6)	g/L NaCL g/L NaCL	
	Toxicant Mean (2SD Ran Toxicant Mean (2SD Rang	ge): 1.8(1.5-2.3) ge): 1.2(0.9-1.4)	g/L NaCL CV (%): 12
Test Results:		Survival	Reproduction
	LC50 %(v/v) (95% CL)	7100	
	IC25 %(v/v) (95% CL)		23.8(22.4-23.9)
	IC50 %(v/v) (95% CL)		26.4 (27.2-28.6)
Reviewed by:		Date revi	iewed:

Chronic Freshwater Toxicity Test Initial and Final Water Quality Measurements

		. HI	ılıaı ai	iiu Fii	iai vva	iter Q	ианцу	ivicas	urenne	;IILS					
Client	Stop Date:														
			·i M:sa	Ichahar De	÷ P	- Notec)				-					
•	Start Date & Time: April 29/11 P(015 h) Stork Order #: Storp Date: Test Species: May 5/11 P(015 h) Work Order #: Storp Date: Test Species: Ceriodaphnia dubia														
	K	(F	·			-					•				
% (v/v)	1						Da	ays							
1	0		1		2		3		4		5	, ,	6	7	
Control	Stop Date:														
Temperature (°C)	24.0	200	24,0	200	ves	25.5	24.0	25.0	94.0	35,0	24,0	25,0			
DO (mg/L)		629	H			1		8.0	7.8	6.7	0.8	6,5			
	8,6	29	31	77	21	7.8	8.1	7.8	8.1	7.7	0.8	7.9			
Cond. (µS/cm)	215		216		211	9	10	1	310	a	V	33	3		
	res		<u>~</u>	~	•			1	eiB	K	iB	Ke	В		
		•													
	Days Concentration 0 1 2 3 4 5 6 7 7 5 init. old new old old new old old old old old old old														
Concentration	Concentration 0 1 2 3 4 5 6 7 5 init. old new final														
Concentration O															
Temperature (°C)	24,0	2500	1935		96/p	25.5	240	350							
DO (mg/L)	7.5	64	75			6.5		6.6		6.7	7.7				
Cilient:															
Cond. (µS/cm)	347	3	23	3	25	3	50	3	50	2	349	350)		
Cilient:															
Mission of the Control of the Contro															
							Da	ays		,					
Concentration	DO (mg/L) 7.5 64 7.7 68 7.8 6.6 1.9 6.7 7.7 6.3 pH 8.1 8ν 61 79 86 7.8 8.3 7.8 8.3 7.7 8.0 7.8 Cond. (μS/cm) 347 355 326 350 349 350 Initials μιβ Συβ μιβ μιβ μιβ Concentration 0 1 2 3 4 5 6 7 40 init. old new old new old new old new old new old new final														
40	Cond. (μS/cm) 347 355 325 350 349 350														
Temperature (°C)	24.0	250		20)0	9500	25.5						35,0			
DO (mg/L)			78	6.9	PP				7.9	6.4	7.8	64			
pН	8.7	84	8,2	DI	28					7.9	8.8	0,8			
Cond. (µS/cm)	1274	- 0	300	ľ	278	13.	77			13	301	130	1		
Initials	COP		~	^		٠	rib_		KLB	<u> </u>	JUB	ris			
						•				·				Т	
Concentration	0		1		2			MANAGEMENT OF THE STATE OF	4			2	6	7	
100			new										new	final	
Temperature (°C)	_						-			25.0					
DO (mg/L)															
pH	9,0	86	9.1	84	19M							83		<u> </u>	
Cond. (µS/cm)	1	2	7700	1	690										
Initials	MB		ب		~		we_	1	ub		lik_	Ku	<u>B</u>		
,															
			400	<u> </u>					1		4	w. 01	Λ.Λ		
Uprel									-	Analys	is:	KUSI	7W1)		
Alkalinity*										Revie	ved hv	1/2	2-		
* mg/L as CaCO3	1	0	17		L		J		ا	Date rev	-		7, 10	5/1 <i>i</i>	
													~~ ``	-/	
													(
Sample Description	:	(lear										(

Version 1.1 Issued July 29, 2009

Comments:

Broodboard Used: 041911

Chronic Freshwater Toxicity Test C. dubia Reproduction Data

	nt: ple ID: c Orde		Hatf 4:11		e (80	'I. Miz	e Wat	er ac	51. fr	oces	wate	۲)		*4 (St St	op Da	te & 1	Time: Time: p by:	M	La 1351	9/110	2 10 140	151 un	^			
	1-														īΝ)																		
Days	Conc	entra	tion: (ONTO	<u> ۲</u>							Conc			5								Conc	entrat		10							
-	A	В	<u>c</u>	D	E	F	G	Н	!	J	Init	_A_	В	C	D	E	F	G	H		J	Init	A	В	С	D	E	F	G	Н	_!_	J	Init
1			/	/_	/		1		۷,			(/							//	. ~											
2											_		//	/		/						1											\sim
3	./	√	u		1	/	· ·	1		0	(B			1	/	3		1			/	KB			1	. /	2	5	/				MA
4	4	3	J	4	Š	6	Ц	ч	6	4	WB.	U	4	u	5	./	u	ŭ	5	4	./	WB	3	4	u	ŭ	10	1	u	u	2	4	Rep
	q	7	Th	ģ	9	V-		9			nit	11	10	11	5	V	_		10	10	ů	YUB	χ	A-	_	ď		10	9	•	11	2	KUB
5		17	10						10	10	N.	11	-5	11	19	10	17	15	19				١	0	6	17	13			13	11	0	
6	17	13	16	11	13	13	N	13	lv	۱5	KUB	いつ	13	16	16	Yd_	15	17	17	18	13	WB	1+	18	14	17	17	30	17	10	16	13	MD
7				<i>'</i>														,						1 4					17				
8													,																				
Tota	30	23	30	37	24	18	33	26	39	24	reb	38	30	31	33	36	30	30	22	32	17	KLB	28	30	aa	<u> 32</u>	20	35	30	31	30	25	YLB
		-							4				<u> </u>			V 1		, W		0.20		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	0.0	\$ - 1		J.						0,0	000
Days	Cond	entra	tion:	90								Conc	entra	tion:	40							,	Conc	entrat	ion:	60							
Days	Α	В	С	D	E	F	G	Н	1	J	Init	Α	В	С	D	E	F	G	Н	ı	J	Init	Α	В	С	D	Е	F	G	Н	1	J	Init
1	/			/	/	/	/		/	/				//		/				/	/	~					/						
2	/		/						- 2					1	/					/	/				/	/				-/	- Annual Control	-	_
	u	//	-	-		1	1	1	ú	5	W		//	//	1/	<u> </u>	ーン	9	-		1	KIB						1	<i>-</i>			-	7.60
3	 		~	11		-	1_	11	-1		W	V	\sim	-	-	7			. /		-	6		/									ug
4	_	4	2	4	5	کے	6	٦	<u>/</u>	4	us	✓	×	~	$\overline{}$	<u> </u>					-	Wb							-				KUG
_ 5	11	11	9	10	14	15	15	8	9	10	Colo	1	a						_			ILLE			~	_							KLB
6	15	18	19	lo	V	5	/	18	18	17	UB	✓	✓		1				_	_	<u> </u>	MB									<u> </u>		CLB
7								12																									
8	<u> </u>										_					-																	
	20	23	20	30	\a	25	21	30	21	21	b	0	a	0	O	0	(1)	0	0	0	0	KIE	· A	0	0	0	0	3	0	0	~~	63	KIB
lota	170	フノ	70	30	17	ده	a\	20	SI.	101	JUL	Q	a		\cup				\mathcal{O}		U		U	\mathcal{O}	0	$\mathcal{O}_{\mathcal{O}}$	0		0	\cup	0	\mathcal{O}	eu-
<u> </u>	TC		41	00										41	100																		
Days	Conc	B	C	D	Е	F	G	н	-				entra B	tion:	D	-	F	_	ш		J	In it		entra			E	F	_				lm²4
-	-	-	-	-	-	+-	9		' -	J	Init	Α	-	C	<u> </u>	E	-	G	Н		J	Init	Α	В	_С	D			G	Н	'-	_J	Init
1	 '		-	\ <u>'</u>	-		/				_	/										~											
2	/	-	/	/	/	/	4	1		/	~	/		/_	/_		/				_												
3	~	1		V	/		_			-	MB	/	4	/						_		KUB											
4	1				/		/			V	KLB	义	/	6	/	/	/			· •		rub											
5	/		_				-		1	سا	KIB	T		-		_	-			-	-	KIP											
6	1	~						/		_	Cub		7					-		_		KIR			7		 -						
	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	<u> </u>		-	<u> </u>					-	w	-		 							-	Ku-						-					
7	 			 								\vdash		 				-	<u> </u>														
8	-	_		A			-				<u> </u>	1																<u> </u>					
Tota	0	0	U	U		0	0	0	Q	0	XIF	0	0	0	0	0	0	0	0	0	0	cor											
	s: X =	mortal							•											,—,—													
Carr	nla Da		lian.																														
	ple De ments			Young	only be	sed on t	no first ?	Broods	Fourth	and e	heerus	t hroad	e not in-	cluded 1	n total a	nun*																	
2011			10141#	1 cang	/		- mat s	Diodus	, , our an	anu su	pacquel	, proods	- not me	-ruueu I	. iotal C	varn.											/						
Revi	ewed	by:			4.	70	~	2_														Date	revie	wed:		1	12	11	O	2	<u> </u>		

Nautilus Environmental

Version 2.1 Issued July 29, 2009

CETIS Analytical Report

Report Date:

09 May-11 15:35 (p 1 of 4) 11200b | 15-2917-3949

		,							Test	Code:		11200b 1	5-2917-394
Ceriod	aphnia	7-d Survival an	d Reprodu	ction T	est						Na	autilus Env	vironmenta
Analys	is ID:	12-4446-6416	En	dpoint:	Reproduction				CETI	S Version:	CETISv1	1.8.0	
Analyz	ed:	09 May-11 15:3	33 An	alysis:	Linear Interpola	ation (ICPIN)		Offic	ial Results:	Yes		
Batch I	D:	10-5584-2752	Tes	t Type:	Reproduction-S	Survival (7d)			Analy	/st:			
Start D	ate:	29 Apr-11 10:1	5 Pro	tocol:	EC/EPS 1/RM/				Dilue	nt:			
_	Date:	05 May-11 14:1		ecies:	Ceriodaphnia d				Brine	:			
Duratio	on:	6d 4h	So	urce:	In-House Cultu	re			Age:				
Sample		20-7896-6862	Co	de:	7BEA844E				Clien		eld		
-		28 Apr-11 16:00		terial:	Water Sample				Proje	ect:			
		28 Apr-11 16:00	0 So	ırce:	Hatfield								
Sample	Age:	18h	Sta	tion:	4:1 Mixture								
_inear	Interpo	lation Options											
K Trans	sform	Y Transform			Resamples	Exp 95%	CL	Method					
_og(X+	1)	Linear	2.0	68E+09	200	Yes		Two-Point	Interpo	olation			
Point E	stimate	es											
evel	%	95% LCL			95% LCL	95% UCL							
C5	20.64	12.68	20.73	4.846		7.887							
C10	21.38		21.49	4.677		5.276							
C15	22.15		22.27	4.514		4.838							
C20	22.95		23.08	4.357		4.65							
C25	23.78		23.91	4.205		4.47							
C 40	26.43		26.6	3.783		3.972							
C50	28.35	27.24	28.56	3.527	3.502	3.672							
Reprod	luction	Summary				Cal	lculate	ed Variate				-	
Conc-%		ontrol Type	Count	Mean		Max	Std		Dev	CV%	%Effect		
)	N	egative Control	10	26.1	18	32	1.37			16.6%	0.0%		
5			10	29.1	17	36	1.67			18.14%	-11.49%		
10			10	29.3	22 19	35	1.14			12.36%	-12.26% -7.28%		
20 10			10 10	28 0.2	0	33 2	1.48 0.2	3 4.69 0.63		16.75% 316.2%	99.23%		
30			10	0.2	0	0	0.2	0.00	20	310.270	100.0%		
30			10	0	0	0	0	0			100.0%		
100			10	0	0	0	0	0			100.0%		
Reprod	luction	Detail		-								1930	
Conc-%		ontrol Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep	5 Rep	6	Rep 7	Rep 8	Rep 9	Rep 10
)	N	egative Control	30	23	30	23	27	18		23	26	32	29
5			28	26	31	33	26	30		36	32	32	17
10			28	30	22	32	30	35		30	31	30	25
20			30	33	30	30	19	25		21	30	31	31
40			0	2	0	0	0	0		0	0	0	0

Analyst:_____ QA: May 10 (11

000-089-170-2 CETIS™ v1.8.0.11

Report Date: **Test Code:**

09 May-11 15:35 (p 2 of 4) 11200b | 15-2917-3949

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: Analyzed:

12-4446-6416 09 May-11 15:33 Endpoint: Reproduction Analysis:

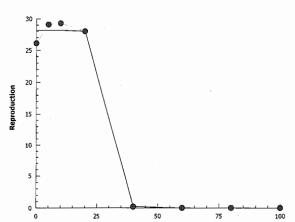
Linear Interpolation (ICPIN)

CETIS Version:

CETISv1.8.0

Official Results: Yes

Graphics



Conc-%

60 80

100

000-089-170-2

Report Date: Test Code: 09 May-11 15:35 (p 3 of 4) 11200b | 15-2917-3949

										res	t Code:		112000	15-2917-394
Ceriod	aphnia	7-d Survival an	d Rep	roduc	tion To	est						N	autilus Er	vironmenta
Analys	is ID:	10-2650-9634	-	End	point:	6d Survival Rat	te			CE.	ΓIS Version	n: CETISV	1.8.0	
Analyz		09 May-11 15:3	33		ysis:	Linear Interpola)			cial Result			
Batch I	 ID:	10-5584-2752		Test	Type:	Reproduction-S	Survival (7d)			Ana	ılyst:			
Start D		29 Apr-11 10:1	5		ocol:	EC/EPS 1/RM/					ient:			
Ending		05 May-11 14:1		Spec		Ceriodaphnia d	lubia			Bris	ne:			
Duratio		6d 4h		Sou		In-House Cultu				Age):			
Sample	e ID:	20-7896-6862		Cod	e:	7BEA844E				Clie	ent: Ha	atfield		ψ-·
Sample	e Date:	28 Apr-11 16:0	0	Mate	erial:	Water Sample				Pro	ject:			
Receiv	e Date:	28 Apr-11 16:0	0	Sou	rce:	Hatfield								
Sample	e Age:	18h		Stati	on:	4:1 Mixture								
Linear	Interpo	lation Options												
X Trans	sform	Y Transform	1	Seed	i	Resamples	Exp 95%	CL	Method	<u> </u>				
_og(X+	1)	Linear		1.25	2E+09	200	Yes		Two-Po	oint Inter	oolation			
Point E	stimate	es								-				
_evel	%	95% LCL	95%	UCL	TU	95% LCL	95% UCL							
EC5	89.45	83.03	N/A		1.118	N/A	1.204							
EC10	100	86.18	N/A		1	N/A	1.16							
EC15	>100	N/A	N/A		<1	N/A	N/A							
EC20	>100	N/A	N/A		<1	N/A	N/A							
EC25	>100	N/A	N/A		<1	N/A	N/A							
EC40	>100	N/A	N/A		<1	N/A	N/A							
EC50	>100	N/A	N/A		<1	N/A	N/A							
6d Sur	vival Ra	ate Summary					Calcu	lated	Variate((A/B)				
Conc-%	6 С	ontrol Type	Cour	nt	Mean	Min	Max	Std	Err S	Std Dev	CV%	%Effect	Α	В
)	N	egative Control	10		1	1	1	0	C)	0.0%	0.0%	10	10
5			10		1	1	1	0	C)	0.0%	0.0%	10	10
0			10		1	1	1	0	C)	0.0%	0.0%	10	10
20			10		1	1	1	0	C)	0.0%	0.0%	10	10
10			10		1	1	1	0	C)	0.0%	0.0%	10	10
60			10		1	1	1	0	C)	0.0%	0.0%	10	10
30			10		1	1	1	0	0		0.0%	0.0%	10	10
100			10		0.9	0	1	0.1).3162	35.14%	10.0%	9	10
d Sur	/ival Ra	te Detail											***	
Conc-%		ontrol Type	Rep	1	Rep 2		Rep 4	Rep		Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
)	N	egative Control	1		1	1	1	1	1		1	1	1	1
5			1		1	1	1	1	1		1	1	∞1	1
0			1		1	1	1	1	1		1	1	1	1
20			1		1	1	1	1	1		1	1	1	1
10			1		1	1	1	1	1		1	1	1	1

nalyst:____QA;Moy10/11

CETIS™ v1.8.0.11

1

1

Report Date: Test Code: 09 May-11 15:35 (p 4 of 4) 11200b | 15-2917-3949

Nautilus Environmental

Ceriodaphnia 7-d Survival and Reproduction Test

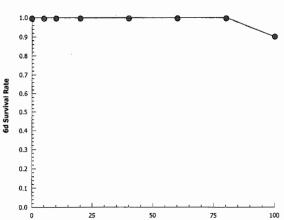
Analysis ID: Analyzed: 10-2650-9634 09 May-11 15:33 Endpoint: 6d Survival Rate

Analysis: Linear Interpolation (ICPIN)

CETIS Version: CET Official Results: Yes

CETISv1.8.0

Graphics



___ OA: May 10/11

Analyst:_____

Ceriodaphnia dubia Summary Sheet

Client: Work Order No.:	HatField 11200	Start Date/Time	
Sample Information	Mine Water 8:11	hixture	
Sample Date: Date Received: Sample Volume:	April 28,2011 April 28,2011 1×201		
Test Organism Inf	ormation:		
Mortality (%) in prev	rst 3 broods of previous 7 d	0,0	
NaCl Reference To	oxicant Results:		
Reference Toxicant Stock Solution ID: Date Initiated:	11D: <u>Cd66</u> 11NaO1 April 20/11		
7-d LC50 (95% CL) 7-d IC50 (95% CL):	1 1	g/L NaCL	
	e Toxicant Mean (2SD Ran Toxicant Mean (2SD Rang		g/L NaCL CV (%): 11 g/L NaCL CV (%): 12
Test Results:		Survival	Reproduction
	LC50 %(v/v) (95% CL)	7100	1111 (112 2 111 2)
	IC25 %(v/v) (95% CL) IC50 %(v/v) (95% CL)		49.8 (48.2-50.4)
Reviewed by:		Date rev	viewed:

Chronic Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client:	Hatfiel							rt Date 8	& Time:	Agril	29/11	@- 	s 1000h	
Sample ID: 811 mix			18.47.	ProcessWa	ter 16.2	1. Ditch I	uater)					2 1415	n	
Work Order #:	46174 EID	11900				-		rest Sp	becles:	Ceriou	арппа (Juvia		
%(J))							D:	ays						
Concentration	0		1		2		3	T	4		5	Ι	<u> </u>	7
Contentiation	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	1	2570	14/2	18:0	240	25.5	24.0	28.5	240	380	24.0	255	1	1111141
	7.8	711	31	67	8,0	7.0	7.9	6.8	7,8	65	8.0	6.4		
DO (mg/L) pH	8,0	77	2,1	76	81	7.9	81	7.8	8.1	7.7	8.0	7,7		
Cond. (µS/cm)	215	77	216		u1		910		aib	a		210		
Initials	Kip	_				RIB		rib	LIB	rus	rus	YUB		
Illiudis	1 100-	A	n		<u> </u>	200	Cox	<u> </u>	, Co.		LUD	Lu		
	1						Da	ays						
Concentration	0		1		2 .	-	3	T	4		 5		3	7
Concentiation	init	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	34.0	1500	101°	2050	250	35.5	240	25.5	34,0	95.0	24.0	25.5	<u> </u>	
DO (mg/L)	7.8	28	79	68	ميع	7.1	7.8	67	8.0	66	7.7	64	1	
pH	8.1	53	53	23	5.4	7.9	8.9	7.8	8.8	7.7	8,2	7.7		
Cond. (µS/cm)	390	33			1		10		390		10	30	9	
Initials	KLB			_		KUB	rib	ris	PLB	VID				
			1			1 100								
40							Da	ays						
Concentration	0		1		2		3		4		5		3	7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	240	2000	1570	15.0	2000	28.5	ano	25.5	240	3 \$.0	24.0	25,5		
DO (mg/L)	7.8	7.3	29	6,8	ጸ >	6.7	7,9	6.5	0.8	6,4	7.8	6,5		
рН	8.7	85	8.8	8.2	81	8.0	9.8	0.8	8.7	7.9	8.7	7.9		
Cond. (µS/cm)	993	7	i 8	98	4	9	1 7	10	6	0	184	97	S	
Initials	RCB	_ ~				rub	KIB	KiB	KiB	KIB	NB	KIB		
100				T				ays				1		
Concentration	0	STANLAND BEI	1	General Control	2	CRAMO SIN	3	CANAGE VEGETORS	4		5	•	5	7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	240	2000	2513		2000	as.5	<u>a40</u>	25.5	94.0	32.0	940	25.5	_	
DO (mg/L)	8.3	7.3	ሕግ	67	80	6.8	7.9	6.6	7,9	6.5	7.9	6.6	$\overline{}$	
рН	9,0	26	न्०	8.4	911	8.3	8.8	8,2	9.0	8,2	9.0	8.3		
Cond. (µS/cm)	1999	1.	385	J.	39 %		58		200		0000	90	0	
Initials	MB	~				kib	rib	ILIB	rib	YIB	LiB	XIB	_	-
	Con	itrol	100%	(4.1)	· ·					Analys	te ·	rubl	4.10	-
Hardness*	w		560	6101		· · · · · · · · · · · · · · · · · · ·				Allulys	ω.	LCDI	JWU	
Alkalinity*	80		130							Reviev	ved by:	A	27	
* mg/L as CaCO3									1		•	Ma		5/11
		.1.											((
Sample Description:		cle	ar											
Comments:	Bro	odboo	d use	d; o	uan									

Chronic Freshwater Toxicity Test C. dubia Reproduction Data

	t: Hatfield Start Date & Time: April 2011 @ 10 00h Stop Date & Time: May 5/11 @ 14 15h Set up by: TUB																																
****	Orac	••		C16	, CO									1.	(ખા)	1	.,						001 4	P ~,·		· -							
Days	Conc	entra	tion:	(ontro)	ol					-		Conc	entrat	ion:	5								Conc	entrat	ion: 1	0							
Days	Α	В	С	D	E	F	G	Н	١	J	Init	Α	В	С	D	E	F	G	Н	1	J	Init	Α	В	С	D	E	F	G	H		J	Init
1_	1										~								/			/					1					(~
2	/		/				/	/			~											~											~
3	1	/	/	/		~	//	7			KLF	/	5	3	4	√	4	U		V	4	COS			6			5,	1			6	rub !
4	9	5	a	9	4	4	ч	J	ч	4	VO	5	V	1	Q.	Ġ	8	1	3	5	\checkmark	CUB	2	3	V	4	4		5	3	4	V	KUB
5	6	1	10	1	10	9	8	G	8	10	418	9	10	9	J	10		10	8	٩	0	KID	4	10	W	10	Q	7	12	7	10	10	RUB
6	16			14	YLA.	13	13	13	12	ia	KUB	12	۸۱۸	16	VE	26	ماد	12	17	18	'n	YIP	15	18	17	160	14				16		
7	10	1.7	1.	• 1	.14_	. ~	1	'/	• •	101	N.y	168	14	10.	1810	8 ×		` /	1	10	••	A	16		` '	,,,	, 2	-		10	12	1	
					-			-							we																		
Tatal	วน	20	52	30	36	26	25	19	25	8/-	VIB	32	31	20	38	26	28	27	28	2)	38	VIE	าน	21	23	36	26	25	17	3 2	30	32	FIR
Tota	al	1 av	a T	au	80	ac	90		as	40	W.	Ø I	JI	as	A U		uo	0.1	au	U.A	90	LLV.		101	91	30				CNO	00	//	u
Dave	Conc	entra	tion:	30								Conc	entra	ion:	40								Conc	entra	tion:	60							
Days	Α	В	С	D	E	F	G	Н	I	J	Init	Α	В	С	D	E	F	G	Н	1	J	Init	Α	В	С	D	E	F	G	Н	1	J	Init
1	1								/	1	-			/		/				/	/	~											~
2	/	6	/	1		/	1		6	1	~						1					~	/	/				/				_	~
3	1	1	3	9	J	1	V		V	V	N	5	1	/	1	4	/	1	\checkmark		3	rub			V				/	/			ub
4	3	4	1	4	4	4	4	5_	3	a	rib	Ø	V	3	3	1	a	9	4	4		Cub	\	/	/						7		KUB
5	6	10	8	10	B	9	6	10		iO	w	7	10	٩	10	8	10	1	11	1	9	rub	/	~			-			1	-	_	X19
6		16	16			16	12	17	17	160	KUB	17	15	17	10	15	15	15	16	12	30	rie	77	a	a	9	1	/	3		/		KUB
7	1-2							•	*-1		P/					-						.,-			-								
8	-		<u> </u>																		- YUF												
	વર	30	a1	2(つ	21	29	23	33	28	28	YLB	30	25	38	30	77	27	24	31	16	33	rie	7	2	2	a	O	0	3	0	7	0	YUS
TOTA	1 ~100		- I	~	<u> </u>	~ 1	u.		40	au		حري	<u> </u>	<u> </u>		62 1	<u> </u>		<u> </u>	110			L <u>-</u>										
Days	Cond	entra	tion:	80								Conc	entra	tion:	100								Conc	entra	tion:								
Days	Α	В	С	D	E	F	G	Н	1	J	Init	Α	В	С	D	E	F	G	Н	1	J	Init	Α	В	С	D	E	F	G	н		J	Init
1	/	/	/	/	/		/			/	_		/				/	/		/	/	~						<u> </u>					
2						/				/	~						/		/	/	/	~						<u> </u>					
3		/				J -				V	UB	/	\checkmark		<u> </u>		V		/	~	/	KLB											
4			1		1		/		6	1	W		\checkmark	1	/	0			V	1	1	KUB	1.										
5			/	~			/		~		KUB	۷					_				_	KIP											
6	\		/	/						~	UB		/									XIB											
7																										1							
8																																	
Tota	0	0	O	0	0	0	()	0	Cor	\circ	NIB	0	0	0	0	O	0	0	O	0	0	Y CE							*.				
	s: X =																						•										
	ple De ments	•		Young	only be	end on 4	no firet 3	Broods	Fourth	and e	hearus	t brood	s not in	luded :	n total a	oun+																	-
COII	menc	·	I OTAL T	roung	/ Das	seu on ti	ne mrst 3	, aroods	. Fourt	and su	psequer	r prood	a not me	Judea I	ii iotai C	ount.											11		·		αI		
Revi	ewed	by:		7	4.	0	\sim	·			_											Dat	e revi	ewed:		Λ	10	4. (\mathcal{O}	, 2	011		

Nautilus Environmental

Version 2.1 Issued July 29, 2009

Report Date: Test Code: 09 May-11 15:34 (p 1 of 4) 11200a | 19-1455-8098

		,						Tes	t Code:		11200a 1	9-1455-809
Ceriod	aphnia	7-d Survival an	d Repro	duction Te	est					N	autilus En	vironmenta
Analys	is ID:	02-7523-4331	E	ndpoint:	Reproduction			CET	IS Version:	CETISV	1.8.0	
Analyz		09 May-11 15:3	32 A	nalysis:	Linear Interpola	ation (ICPIN)	Offi	cial Results	: Yes		
Batch I	ID:	10-2191-8202	Т	est Type:	Reproduction-S	Survival (7d)		Ana	lyst:			
Start D	ate:	29 Apr-11 10:0	0 P	rotocol:	EC/EPS 1/RM/	21		Dilu	ent:			
Ending	Date:	05 May-11 14:1	15 S	pecies:	Ceriodaphnia d	ubia		Brir	ne:			
Duratio	on:	6d 4h	S	ource:	In-House Cultu	re		Age	:			
Sample		00-0037-4702		ode:	5B7AE			Clie		field		
-		28 Apr-11 16:0		laterial:	Water Sample			Pro	ject: .			
		28 Apr-11 16:0		ource:	Hatfield							
Sample	e Age:	18h	s	tation:	8:1 Mixture			•				
inear	interpo	lation Options										
(Trans		Y Transform		eed	Resamples	Exp 95%		hod				
.og(X+	1) 	Linear	1	.833E+09	200	Yes	IWO	-Point Inter	polation			
Point E	stimate	es										
_evel	%	95% LCL			95% LCL				***			
C5	40.66		40.93	2.46	2.443	5.031						
C10	41.58 42.53		41.89 42.86	2.405 2.352		3.016 2.468						
C15 C20	43.49		43.86	2.299		2.400						
C25	44.48		44.88	2.248		2.341						
C40	47.57		48.11	2.102		2.179						
C50	49.75		50.39	2.01	1.985	2.072						
Reproc	luction	Summary				Ca	Iculated Va	ariate			· · · · · · · · · · · · · · · · · · ·	
onc-%		ontrol Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	-	
1	N	egative Control	10	24.2	19	30	1.114	3.521	14.55%	0.0%		
			10	29.8	27	36	0.8537	2.7	9.06%	-23.14%		
0			10	27.9	17	33	1.516	4.795	17.19%	-15.29%		
0			10	27.6	22	32	0.9798	3.098	11.23%	-14.05%		
0			10	27	16	32	1.468	4.643	17.2%	-11.57%		
0			10	2.2	0	7	0.8537	2.7	122.7%	90.91%		
30			10	0.6	0	6	0.6	1.897	316.2%	97.52%		
100			10	0	0	0	0	0		100.0%		
•	luction											
Conc-%		ontrol Type	Rep 1	Rep 2	<u>-</u>	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
)	N	egative Control	24	20	27	20	30	26	25	19	25	26
5			30	31	28	30	36	28	27	28	32	28
10			24	31	33	30	26	30	17	26	30	32
20			22	30	27	30	27	29	23	32	28	28
10			30	25	28	30	27	27	24	31	16	32
			-	•	•	•	^	•	•	^	7	•

Analyst:____QA:May 10/11

Report Date: Test Code: 09 May-11 15:34 (p 2 of 4) 11200a | 19-1455-8098

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: Analyzed: 02-7523-4331 09 May-11 15:32

Endpoint: Analysis:

Endpoint: Reproduction

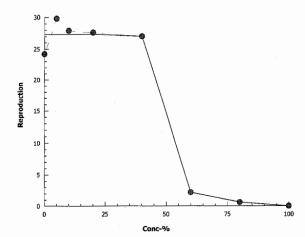
Linear Interpolation (ICPIN)

CETIS Version:

CETISv1.8.0

Official Results: Yes

Graphics



Analyst:_____ QA;<u>Nay (0</u>/ (1

Report Date:

09 May-11 15:34 (p 3 of 4)

11200a | 19-1455-8098

		.,								Tes	t Code:		11200a 1	9-1455-809
Cerioda	aphnia	7-d Survival an	d Rep	rodu	ction T	est						Na	autilus Env	vironmenta
Analysi	is ID:	10-8727-1085		End	point:	6d Survival Ra	te			CET	TIS Version:	: CETISv1	1.8.0	
Analyze	ed:	09 May-11 15:3	32	Ana	lysis:	Linear Interpola	ation (ICPI	N)		Offi	cial Results	: Yes		
Batch I	D:	10-2191-8202		Tes	t Type:	Reproduction-S	Survival (7d	l)		Ana	ılyst:			
Start D	ate:	29 Apr-11 10:0		Pro	tocol:	EC/EPS 1/RM/	/21			Dilu	ient:			
Ending	Date:	05 May-11 14:1	15	Spe	cies:	Ceriodaphnia o				Brir				
Duratio	n:	6d 4h		Sou	rce:	In-House Cultu	ıre			Age) :			
Sample	D:	00-0037-4702		Cod	le:	5B7AE				Clie	ent: Hat	field		
Sample	Date:	28 Apr-11 16:0	0	Mat	erial:	Water Sample				Pro	ject:			
Receive	e Date:	28 Apr-11 16:0	0	Sou	rce:	Hatfield								
Sample	Age:	18h		Stat	ion:	8:1 Mixture				****				
inear	Interpo	lation Options												
(Trans		Y Transform	1	See	d	Resamples	Exp 95%	% CL	Method					
.og(X+	1)	Linear		1.25	9E+09	200	Yes		Two-Po	int Interp	oolation			
oint E	stimate	es												
.evel	%	95% LCL		UCL	ΤU	95% LCL		_						
C5	>100	N/A	N/A		<1	N/A	N/A							
C10	>100	N/A	N/A		<1	N/A	N/A							
C15	>100	N/A	N/A		<1	N/A	N/A							
C20	>100	N/A	N/A		<1	N/A	N/A							
C25	>100	N/A	N/A		<1	N/A	N/A							
C40	>100	N/A	N/A		<1	N/A	N/A							
C50	>100	N/A	N/A		<1	N/A	N/A						10.1	2150
d Surv	vival Ra	ate Summary					Calc	ulated	Variate(A/B)			-	
onc-%		ontrol Type	Cour	nt	Mean		Max	Std		td Dev	CV%	%Effect	Α	В
	N	egative Control	10		1	1	1	0	0		0.0%	0.0%	10	10
_			10		1	1	1	0	0		0.0%	0.0%	10	10
0			10		1	1	1	0	0		0.0%	0.0%	10	10
0			10		1	1	1	0	0		0.0%	0.0%	10	10
0			10		1	1	1	0	0		0.0%	0.0%	10	10
0			10		1 .	. 1	1	0	0		0.0%	0.0%	10	10
0 00			10 10		1 1	1 1	1	0	0		0.0% 0.0%	0.0% 0.0%	10 10	10 10
	ival Ra	nte Detail					<u> </u>							
onc-%		ontrol Type	Rep	1	Rep 2	Rep 3	Rep 4	Rep	5 R	ep 6	Rep 7	Rep 8	Rep 9	Rep 10
		egative Control	1		1	1	1	1	1	•	1	1	1	1
;			1		1	1	1	1	1		1	1	1	1
0			1		1	1	1	1	1		1	1	1	1
0			1		1	1	1	1	1		1	1	1	1
_														

Analyst:_

Report Date: Test Code:

09 May-11 15:34 (p 4 of 4) 11200a | 19-1455-8098

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: Analyzed: 10-8727-1085 09 May-11 15:32 Endpoint: 6d Survival Rate

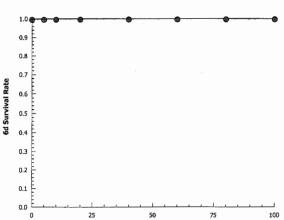
Analysis: Linear Interpolation (ICPIN)

CETIS Version:

CETISv1.8.0

Official Results: Yes

Graphics



Conc-%

TESTING LOCATION (Please Circle)

Nautilus Environmental

California

5550 Morehouse Drive, Suite 150 San Diego, CA 92121 Phone 858.587.7333 Fax 858.587.3961

Washington

5009 Pacific Highway East, Suite 2 Tacoma, WA 98424 Phone 253.922.4296 Fax 253.922.5814 British Columbia

British Columbia
864 Commerce Court
Burnaby, British Columbia, Cardada V5A 4N3
Phone 604.420.8773
Fax 604.357.1361

Chain of Custody

Date April 26/1 Page L of L

ANALYSES REQUIRED Sample Collection By: ပ္ Invoice To: Report to: Canadian Zinc Canadian Zinc Receipt Temperature Company Company **Address Address** dobia City/State/Zip City/State/Zip John Wilcockson (Hatfield) Contact Contact 604-926-3261 Phone **Phone** 48-hr **Email** Email CONTAINER NO. OF SAMPLE ID DATE TIME **MATRIX** COMMENTS CONTAINERS TYPE Mixture 4:1 80% Mine + 20% Process Doci128/11 1600h 20 L Water 71.4% Mine + 12.4% Praess+162% Mixture 8:1 20 L Mine Water 10 **RELINQUISHED BY (COURIER)** PROJECT INFORMATION SAMPLE RECEIPT **RELINQUISHED BY (CLIENT)** (Signature) (Time) 6 Client: **Total No. of Containers** (Printed Name) (Date) Received Good Condition? PO No.: J. Wilcockson Kail 28/11 Shipped Matches Test Schedule? 565 Via: SPECIAL INSTRUCTIONS/COMMENTS: RECEIVED BY (LABORATORY) RECEIVED BY (COURIER) Received 4 × 20L of Mine Water, 2×20L of (Time) (Signature) Process Water. Also used Ditch Water received previously (Company) Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

Attachment C

April 6, 2011 Whole Effluent Toxicity Testing *D. magna*, *C. dubia*, O. mykiss and *L. minor*



Toxicity Testing on Synthetic Effluent Samples

Final Toxicity Test Report

Report date: April 6, 2011

Submitted to:

Hatfield Consultants

North Vancouver, BC

8664 Commerce Court Burnaby, BC V5A 4N7

TABLE OF CONTENTS

1.0	INT	RODUCTION1	
2.0	MET	THODS	
	2.1	Quality Assurance/Quality Control (QA/QC)	
3.0	RES	ULTS7	
	3.1	Quality Assurance/Quality Control	
4.0	REF	ERENCES	
		LIST OF TABLES	
Tabl	e 1.	Summary of test conditions: Ceriodaphnia dubia survival and reproduction test 3	3
Tabl	e 2.	Summary of test conditions: Lemna minor growth inhibition test	Ł
Tabl	e 3.	Summary of test conditions: 96-h rainbow trout test.	5
Tabl	e 4.	Summary of test conditions: 48-h Daphnia magna test	ó
Tabl	e 5.	Toxicity test results for the Ceriodaphnia dubia survival and reproduction tests 9)
Tabl	e 6.	Toxicity test results for the Lemna minor growth inhibition tests)
Tabl	e 7.	Acute toxicity test results for rainbow trout using dechlorinated water for dilution	1
Tabl	e 8.	Acute toxicity test results for rainbow trout using Prairie Creek water for dilution	L
Tabl	e 9.	Acute toxicity test results for <i>Daphnia magna</i> using moderately hard water for dilution	2
Tabl	e 10 .	Acute toxicity test results for <i>Daphnia magna</i> using Prairie Creek water for dilution	
Tabl	e 11.	Acute toxicity test results for <i>Daphnia magna</i> single concentration screening test using Mine Water	
Tabl	e 12.	Reference toxicant test results	

Page

LIST OF APPENDICES

APPENDIX A - Ceriodaphnia dubia Toxicity Test Data

APPENDIX B - Lemna minor Toxicity Test Data

APPENDIX C - Rainbow Trout Toxicity Test Data

APPENDIX D - Daphnia magna Toxicity Test Data

1.0 INTRODUCTION

Nautilus Environmental conducted acute and chronic toxicity tests for Hatfield Consultants on samples identified as Mixture 1 and Mixture 2, prepared on January 28, 2011. The mixtures were prepared in the laboratory from samples identified as Process Water, Mine Water and Ditch Water.

Mixture 1 was a 4:1 combination of Mine Water (80%) and Mill Water (20%) and Mixture 2 was a combination of Mine Water (77%), Mill Water (11%), and Ditch Water (12%), reflecting a 7:1 ratio of Mine to Mill Water, with a small contribution of Ditch Water. The following toxicity tests were performed on the Mixture 1 and Mixture 2 samples:

- 7-d Ceriodaphnia dubia survival and reproduction test
- 7-d *Lemna minor* growth inhibition test
- 96-h rainbow trout (*Oncorhynchus mykiss*) acute toxicity test (conducted with lab water and Prairie Creek water as dilution water)
- 48-h *Daphnia magna* acute toxicity test (conducted with lab water and Prairie Creek water as dilution water)

In addition, a single concentration screening test was conducted with *D. magna* on the full-strength Mine Water sample. Due to a technician error in producing Mixture 2, there was insufficient volume of remaining Mine Water sample available to conduct a 96-h single concentration screening test with rainbow trout.

This report describes the results of these toxicity tests. Copies of raw laboratory data sheets and statistical analysis for each test species are provided in Appendices A through F.

2.0 METHODS

Methods for the toxicity tests are summarized in Tables 1 through 6. Testing was conducted according to procedures described by Environment Canada (2000a, 2000b, 2007a and 2007b).

Statistical analyses for the tests were performed using CETIS (Tidepool Scientific Software, 2009).

2.1 Quality Assurance/Quality Control (QA/QC)

Nautilus follows a comprehensive QA/QC program to ensure that the data generated are of high quality and are scientifically defensible. To meet these objectives, Nautilus has implemented a number of quality control procedures that include the following:

- Negative controls to ensure that appropriate testing performance criteria are met;
- Positive controls to assess the health and sensitivity of the test organisms;
- Use of appropriate species and life stage to meet the study objectives;
- Appropriate number of replicates to allow proper statistical analyses;
- Calibration and proper maintenance of instruments to ensure accurate measurements;
- Proper documentation and recordkeeping to allow traceability of performance;
- Adequate supervision and training of staff to ensure that methods are followed;
- Proper handling and storage of samples to ensure their integrity;
- Procedures in place to address issues that may arise during testing and ensure the implementation of appropriate corrective actions; and
- Rigorous review of data by a Registered Professional Biologist to ensure they are of good quality and scientifically defensible prior to releasing to the client.

Table 1. Summary of test conditions: *Ceriodaphnia dubia* survival and reproduction test.

Test organism Ceriodaphnia dubia Test organism source In-house culture Test organism age <24 hr old neonates produced within 12 hr Test type Static renewal Test duration $7 \pm 1 \text{ day}$ Test chamber 20 mL test tube 15 mL Test solution volume 10 Number of replicates Control/dilution water 20% Perrier water (hardness 80-100mg/L CaCO₃) Test solution renewal Daily 25 ± 1°C Test temperature Number of organisms/chamber Feeding Daily, with 0.1 ml Pseudokirchneriella subcapitata and 0.05 mL YCT 100 to 600 lux Light intensity 16 hours light/8 hours dark Photoperiod Aeration None Test protocol Environment Canada (2007a), EPS 1/RM/21 Survival and reproduction Test endpoints Test acceptability criterion for controls ≥80% survival; ≥15 young per surviving control; ≥60% of controls producing three or more broods

Sodium chloride

Reference Toxicant

Table 2. Summary of test conditions: *Lemna minor* growth inhibition test.

Test organism

Lemna minor

Test organism source

In-house culture

Test organism age

7- to 10-day old

Test type Static
Test duration 7 days

Test chamber 250-mL glass containers

Test solution volume 150 mL

Number of replicates 4

Control/Dilution water Deionized or distilled water with nutrients added

Test solution renewal None
Test temperature $25 \pm 2^{\circ}$ C

Number of organisms/chamber Two 3-frond plants

Light intensity 3600 to 4400 lux full spectrum light

Photoperiod Continuous

Aeration None

Test protocol Environment Canada (2007b), EPS 1/RM/37

Test endpoint Number of fronds and dry weight

Test acceptability criteria for controls \geq 8-fold increase in number of fronds

Reference toxicant Potassium chloride

Table 3. Summary of test conditions: 96-h rainbow trout test.

Test organism Oncorhynchus mykiss

Test organism source Commercial hatchery
Test organism age Juveniles

Test type Static

Test duration 96 hours

Test chamber 20 L glass aquarium

Test solution volume 10 L
Number of replicates 1

Dechlorinated municipal tapwater;

and Prairie Creek Water

Test solution renewal None

Test temperature $15 \pm 1^{\circ}$ C

Number of organisms/chamber Ten

Feeding None

Light intensity 100 to 500 lux

Photoperiod 16 hours light/8 hours dark

Aeration $6.5 \pm 1 \text{ mL/min/L}$

Test protocol Environment Canada (2000a), EPS 1/RM/13

Test endpoint 96-h LC50

Test acceptability criteria for controls Survival ≥ 90%

Reference toxicant Sodium dodecyl sulphate

Table 4. Summary of test conditions: 48-h *Daphnia magna* test.

Test organism	Daphnia magna
Test organism source	In-house culture

Test organism age < 24 h

Test type Static

Test duration 48 hours

Test chamber 250-mL glass beakers

Test solution volume 200 mL

Three (Single Concentration Screening), One Number of replicates

(LC50)

Moderately-hard reconstituted water (hardness 80-Control/Dilution water

100 mg/L); and Prairie Creek Water

Test solution renewal None

Test temperature $20 \pm 2^{\circ}$ C

Number of organisms/chamber Ten
Feeding None

Light intensity 400 to 800 lux

Photoperiod 16 hours light/8 hours dark

Aeration None

Test protocol Environment Canada (2000b), EPS 1/RM/14

Test endpoint 48-h LC50

Test acceptability criteria for controls Survival $\geq 90\%$ Reference toxicant Sodium chloride

3.0 RESULTS

Effects on survival of *Ceriodaphnia dubia* were minimal; the LC50 value for both samples was >100%. Conversely, effects were observed on reproduction of *C. dubia* in all concentrations of both Mixtures 1 and 2. The IC25 was <5% in both samples, and the IC50 was <5% for Mixture 1 and 16.1% for Mixture 2, respectively (Table 5). These values indicate that more than a 25% reduction in reproduction was observed in all test concentrations of both mixtures (the lowest test concentration was 5% sample).

The *Lemna minor* growth inhibition test exhibited enhanced growth in all test concentrations compared to the negative control for both Mixture 1 and Mixture 2 (Table 6). The IC25 and IC50 values for both samples were >97%, indicating that there was no evidence of an adverse toxicological effect associated with either of the samples to this species.

Acute toxicity tests using rainbow trout tests exhibited 100% survival in all concentration tested with Mixtures 1 and 2, using both dechlorinated and Prairie Creek water for dilution (Tables 7 and 8). Therefore the 96-h LC50 results were >100%, and there was no evidence of an adverse toxicological effect to this species.

Acute toxicity tests using *Daphnia magna* resulted in an LC50 value of 89% for Mixture 1 and >100% for Mixture 2 when diluted with laboratory-prepared moderately hard water (Table 9). The samples diluted with Prairie Creek water exhibited an unusual pattern of mortality in both tests; specifically, elevated mortality was observed at the lower concentrations of sample, and not in higher concentrations (Table 10). This is an unusual result, since you would typically anticipate a larger adverse effect associated with a larger dose, and in this case, the opposite occurred. This finding suggests that toxicity occurred as a result of some interaction between the water types. Regardless, the fact that mortalities were not observed in the higher concentrations of sample tends to suggest that this was not indicative of a substantial degree of toxicity in the samples.

It should be noted that the full-strength Mixture 1 elicited a 60% reduction in survival of *Daphnia magna* in one test (the one using moderately hard water) and no reduction in survival in the other (using Prairie Creek water for dilution). Since there is no dilution in the full-strength sample, these two treatments are equivalent to one another, and reflect two, somewhat different measures of effect in the Mixture 1 sample. Based on the partial effect observed in one of the

two tests, and the lack of effect in the second test, it would appear that this mixture contained a toxicant at close to its threshold for toxicity to this species.

In the *Daphnia magna* 48-h single concentration screening test with Mine Water, survival was 100% in the undiluted sample, indicating that the Mine Water did not exhibit an adverse effect on this species (Table 11).

Collectively, the results indicated that rainbow trout and duckweed were not sensitive to the samples. Conversely, *C. dubia* displayed a substantial reduction in reproduction in both mixtures, with a greater adverse effect associated with Mixture 1 than Mixture 2. Consistent with this finding, Mixture 1 exhibited a small degree of adverse effect on survival of *D. magna*, whereas Mixture 2 did not. These results suggest that the toxicity observed to cladocerans was from the Mill Water sample, since Mixture 1 contained a higher concentration of Mill Water than Mixture 2. This conclusion is supported by the fact that the full-strength Mine Water did not have any adverse effect on *D. magna*.

3.1 Quality Assurance/Quality Control

All the tests reported here met the acceptability criteria for test validity specified in the respective protocol. Water quality parameters measured during the toxicity tests were within acceptable ranges and results of the reference toxicant tests conducted during the testing program were all within the in-house historical mean \pm two standard deviations. The reference toxicant test results are summarized in Table 12.

It should be noted that the samples produced for this testing project were derived from samples that had been collected previously, and treated in a manner that was similar to that anticipated at the mine site. Consequently, holding times associated with these samples exceeded those specified in the test methods. However, the time period in between preparation of the treated Mine and Mill Water samples and initiation of the toxicity tests fell within the required holding times associated with the various tests.

Table 5. Toxicity test results for the *Ceriodaphnia dubia* survival and reproduction tests.

		Mean	± SD	
Concentration		Mixture 1		Mixture 2
(% v/v)	Survival	Reproduction	Survival	Reproduction
	(%)	(No. of Young/Female)	(%)	(No. of Young/Female)
Control	100	16.1 ± 4.5	100	16.1 ± 1.9
5	100	6.3 ± 3.5	100	11.6 ± 2.6
10	100	7.1 ± 3.8	100	11.2 ± 3.2
20	100	9.1 ± 1.4	90	6.6 ± 2.8
40	100	0.0 ± 0.0	80	3.0 ± 3.1
60	90	0.0 ± 0.0	100	0.0 ± 0.0
80	80	0.0 ± 0.0	70	0.0 ± 0.0
100	100	0.0 ± 0.0	100	0.0 ± 0.0
Test endpoint				
(% v/v)				
LC50	>100		>100	
IC25 (95% CL)		< 5%		< 5%
IC50 (95% CL)		< 5%		16.1 (13.1 - 20.2) %

LC = Lethal Concentration.

IC = Inhibition Concentration.

SD = Standard Deviation.

CL = Confidence Limits.

Table 6. Toxicity test results for the *Lemna minor* growth inhibition tests.

		Mea	nn ± SD	
Concentration	Mixto	ure 1	Mixtu	ıre 2
(% v/v)	Frond Growth	Dry Weight	Frond Growth	Dry Weight
	(No. of Fronds)	(mg)	(No. of Fronds)	(mg)
Control	67.8 ± 5.6	6.7 ± 0.4	69.0 ± 6.0	7.0 ± 0.9
1.5	92.2 ± 22.0	9.1 ± 1.6	69.2 ± 7.9	7.2 ± 1.1
3.0	90.5 ± 14.5	8.7 ± 1.5	89.0 ± 16.5	9.3 ± 1.3
6.1	104.0 ± 9.9	10.1 ± 1.0	83.0 ± 10.9	8.7 ± 1.0
12.1	122.8 ± 23.2	12.6 ± 2.6	107.8 ± 25.0	11.1 ± 2.7
24.2	120.3 ± 14.5	11.9 ± 0.9	103.8 ± 16.5	10.9 ± 1.2
48.5	116.5± 12.4	13.9 ± 2.9	111.3± 22.9	12.0 ± 2.7
97	122.8 ± 14.0	14.7 ± 0.5	101.3 ± 32.3	13.9 ± 2.6
Test endpoint				
(% v/v)				
IC25	>97	>97	>97	>97
IC50	>97	>97	>97	>97

IC = Inhibition Concentration.

SD = Standard Deviation.

Table 7. Acute toxicity test results for rainbow trout using dechlorinated water for dilution.

	% Survival								
Concentration (% v/v)	Mixture 1	Mixture 2							
Control	100	100							
6.25	100	100							
12.5	100	100							
25.0	100	100							
50.0	100	100							
100.0	100	100							
Test endpoint									
LC50	>100	>100							

Table 8. Acute toxicity test results for rainbow trout using Prairie Creek water for dilution.

	% Survival							
Concentration (% v/v)	Mixture 1	Mixture 2						
Control	100	100						
6.25	100	100						
12.5	100	100						
25.0	100	100						
50.0	100	100						
100.0	100	100						
Test endpoint								
LC50	>100	>100						

Table 9. Acute toxicity test results for *Daphnia magna* using moderately hard water for dilution.

	% Survival								
Concentration (% v/v)	Mixture 1	Mixture 2							
Control	100	100							
6.25	90	80							
12.5	100	90							
25.0	100	90							
50.0	100	80							
100.0	40	90							
Test endpoint									
LC50 (95% CL)	89 (65 and 100)	>100							

CL = Confidence Limits.

Table 10. Acute toxicity test results for *Daphnia magna* using Prairie Creek water for dilution.

	% Survival								
Concentration (% v/v)	Mixture 1	Mixture 2							
Control	100	100							
6.25	30	50							
12.5	40	60							
25.0	70	90							
50.0	100	100							
100.0	100	100							
Test endpoint									
LC50	>100 1	>100 1							

¹ See text for discussion of results.

Table 11. Acute toxicity test results for *Daphnia magna* single concentration screening test using Mine Water.

Concentration (% v/v)	Survival (%)
Control	100
100	100

 Table 12.
 Reference toxicant test results.

Test Species	Endpoint	Mean (2SD Range)	CV(%)	Initiation Date
C. dubia	Survival (IC50): 1.7 g/L NaCl	1.8 (1.4 - 2.3)	12	January 27, 2011
C. uuvu	Reproduction (IC50): 1.1 g/L NaCl	1.2 (0.9 – 1.5)	13	January 27, 2011
L.minor	Frond Count (IC50): 3.6 mg/L KCL	3.7 (2.8 – 5.0)	15	January 19, 2011
O.mykiss	Survival (LC50): 5.0 mg/L SDS	$5.2 \pm (4.4 - 6.1)$	8	December 16, 2010
D. magna	Survival (LC50): 4.2 g/L NaCl	4.0 (3.6 - 4.3)	5	January 21, 2011

4.0 REFERENCES

Environment Canada. 2000a. Biological test method: reference method for determining acute lethality of effluents to rainbow trout. Environmental Protection Series. Report EPS 1/RM/13, Second Edition, December 2000, including May 2007 amendments. Environment Canada, Method Development and Application Section, Environmental Technology Centre, Ottawa, ON. 23 pp.

Environment Canada. 2000b. Biological test method: reference method for determining acute lethality of effluents to *Daphnia magna*. Environmental Protection Series. Report EPS 1/RM/14, Second Edition, December 2000. Environment Canada, Method Development and Application Section, Environmental Technology Centre, Ottawa, ON. 21 pp.

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

Environment Canada. 2007b. Biological test method: tests for measuring the inhibition of growth using the freshwater macrophyte, *Lemna minor*. Environmental Protection Series, Report EPS 1/RM/37. Second Edition. January 2007. Environment Canada, Method Development and Application Section, Environmental Technology Centre, Ottawa, ON. 112 pp.

Tidepool Scientific Software. 2009. CETIS comprehensive environmental toxicity information system, version 1.8.0. Tidepool Scientific Software, McKinleyville, CA. 222 pp.



Ceriodaphnia dubia Summary Sheet

Client: Work Order No.:	Hatfield	Start Date/Time: Set up by:	Am 29/11@ 1100L
Sample Information	ı:		
Sample ID: Sample Date: Date Received: Sample Volume:	10-28/4 Ja-28/4 Je-28/11 242-6		
Test Organism Info	rmation:		
Mortality (%) in previ	st 3 broods of previous 7 d	3	1,15)1L
NaCl Reference To	xicant Results:		
Reference Toxicant Stock Solution ID: Date Initiated: 7-d LC50 (95% CL): 7-d IC50 (95% CL):	10	63 Nco/ 24/11 13) g/L NaCL Y) g/L NaCL	
	Toxicant Mean (2SD Ran Toxicant Mean (2SD Rang		g/L NaCL CV (%): 12 g/L NaCL CV (%): 13
Test Results:	LC50 %(v/v) (95% CL) IC25 %(v/v) (95% CL) IC50 %(v/v) (95% CL)	Survival > /oo	Reproduction 1.3 (1.1 - 2.0) 4.4 (3.2. 22.2)
Reviewed by:	A. Tong	Date revie	ewed: <u>March</u> 24,2011

Chronic Freshwater Toxicity Test C. dubia Reproduction Data

Cilent: Sample ID: Work Order:	MI	he Sob	<u>a</u>		4:()												S	tart Da top Da	ate &	Time: Time: p by:	لَـــــَ	an Eeb	29 4	2	20 L(2-12-10 P->	120	illo	oh_
· · · · · · · · · · · · · · · · · · ·						,					%(v/																			
Days Concentra	tion: Con	trol			T		r		Conc			5		-	T				8	Conc	entra		10 D		F		T 10			land.
AB	CD	E	F	G	H	-	- -	Init	A	В	C	D	E	F	G	H		J	Init	^	В	C	<u>u</u>	E	<u> </u>	G	H	-	J	Init
1 /	///	-							-	/	_	-	 	· .	-				~			_				-	-			
2 /	1	14	4	/	1		/	WB.	/		/	_	-	4	4	/	/	/	UB	/	-	/		/	1		1			c cs
3 /	V V	<u>/</u>	3	/	<u>a</u>	1	<u>~</u>	KIB	×	<u> </u>	1	Y.	س	3	3	<u> </u>	/	1	MB	/		<u>~</u>	2	$\frac{\mathcal{L}}{\mathcal{L}}$	-		1		-	CCA
4 3 4	9 9	4_	5	4	3	3	3	ris	6	3	3	6	5	4	4	4	/	/	ras	<u>/</u>	٦,	<u></u>	2	٦	V	4	4	1	3	sue
5 5	8 7	7	/	2	5		8	KIL	1	1	1	/	100		0	८६		1	KI	6		5	2	<u>/</u>	2	2	6		3	खि
6 10 7	11 8	10	8	4	10	10	8	rus	✓	A	/	2	4	3	2	7		1	KJL	Z	7	4	6	2	1)_	1	<u></u>	4	
7																		<u></u>												
8																														
Total 18 11	23 19	31	16	iO	10	17	ملا	UB	6	7	3	8	a	10	8	10	1	l	KIL	6	6	13	10	6	3	7	11	\mathcal{D}	9	KIL
Days Concentra					T	· ·			Conc			40		r- <u>-</u>	-			· · ·			entra		60	-			T			114
AB	C D	E	F	G	H		1	Init	A	В	C	D	E	F	G	H		J	Init	A	В	_ <u>C</u> _	D	E	F	G	H		J	Init
1/2/		/	/	4	-	/	-	~	/	-		-	-	/	-	/	/	/	~	_	_			-					-	<i>V</i>
2 /	1/	4	20	8	1	4	1	REP	/_	_	4	/_	/	/_	/	/	/	/	YUB	1	\sim	\sim				. /				Cip
3 0	00/	/	253		~	V	1	Rib	-1	٧_	<u> </u>	1	0	<u> </u>		/	\rightarrow		KU	, ,	-		<u> </u>	<u> </u>						KUB
4 2 3	3 4	4	5	5	3	V	5	we	/		9		1	4	1	•	/	<u></u>	Krp	✓,	<u> </u>	<u> </u>			/	-			9	KUB
5 3 7	5 4	8	1	YE.	પ્	3	٤٤	KOL	1		1	4		<u>ر</u>	<u>٧</u>	6	V	1	K3		/	<u> </u>	V		<u> </u>			X	<u> </u>	खि
6 4 0	3 4	/	5	3	/	7	/		/		1	1	0	1	1	1	~	-	KJL	0		<u></u>			~	_	1	_		KJU
7												<u> </u>															<u> </u>	_		
8				<u> </u>								<u> </u>				,	-^-													
Total O (0	118	10	150	10	6	10	9	1450	0	0	0	0	0	0	0	٥	\mathcal{O}_{-}	0	KIL	O	O	ಲ	0	0	0	0	0	0,	Ò	CSV
			YL.	3																_										
Days Concentra	tion: 80	,	-	_				B 1 2 4	Conc		tion:	100 D	E	F	G	ш			init	Conc A	entrat B	ion: C	D	E	F	G	н			Init
AB	CD	E	F	G	H	-	J	Init	_A_	В	-	ט		-	9	#			init	^	-				_ <u>r</u> _	<u> </u>	<u> </u>	-		
1//	1/1	1	5	1	1	/	5	-6.0	/				0		-		-		× 16											-
2 0			1		2		-	icip	V			7			-	-			46											
3 0 0	7/		1			-		KIB	-	. /		-	1	1		9	<u> </u>												-	
4 × /	V .	-	/		1		1	rub		y		5		-	1	\mathcal{F}	$\frac{1}{2}$		V (B VISU			···								_
5	10/	-	<i>'</i>	P-X	4	7	9	KR			<u>~</u> /	1	,	Y-	,	7	4		-		-									
6	00	~	<u> </u>	Н-	-		0	KSU	V	0/	V	<u> </u>	V	<u> </u>		\(\sigma\)	<u> </u>	1	ESL											
7				1					_						ļ															
8								4 145				_	3					3	loss											
Total 0 0	0 0	0	0	0,	0	0	0	45L	0	_ပ	0	0	0	0_	v	၁	_6_	0	620											
Notes: X = mortal	lity																													
Notes. A - mona	iity.	-	C																					-						
Sample Descrip			\overline{U}																											
Comments:	Total # Young	only bas	ed on th	e first 3	Broods	. Fourth	and sul	sequen	t broods	not inc	luded i	n total c	ount.									-								
Reviewed by:		\mathcal{A} .	. 10	2/	Q														Date	revie	wed:			Na	Cl	- 5	24,	20) (
Version 2.1 Issued Ju	ıly 29, 2009				\bigcap																						Í			lus Environme

Report Date:

09 Feb-11 17:20 (p 1 of 2)

OLIIC	Alla	iyucai Nepc	<i>)</i> 1 L					Te	st Code:		11063a 1	7-1586-074
Ceriod	aphnia	7-d Survival an	d Repro	duction Te	est					Na	autilus Env	/ironmental
Analys		06-7520-1693		Endpoint:	6d Survival Ra				TIS Version		.8.0	
Analyz	ed:	09 Feb-11 17:0	5 4	Analysis:	Linear Interpol	ation (ICPII	N)	Of	ficial Results	s: Yes		
Batch I	D:	03-7225-7749	1	Test Type:	Reproduction-	Survival (7d	i)	Ar	alyst: Kry	sta Banack		
Start D	ate:	29 Jan-11 11:0	0 F	Protocol:	EC/EPS 1/RM	/21		Di	luent: Pe	rrier Water		
Ending	Date:	04 Feb-11 12:0	0 5	Species:	Ceriodaphnia o	dubia		Br	ine:		•	
Duratio	n:	6d 1h		Source:				Ag	je:			
Sample		08-2902-6478	(Code:	3169F0AE			CI	ient: Ha	tfield		
Sample	Date:	28 Jan-11	ľ	Material:	Water Sample			Pr	oject:			
Receiv	e Date:	28 Jan-11	5	Source:	Hatfield							
Sample	Age:	35h		Station:	Mixture 1							
Linear	Interpo	lation Options										
X Trans	sform	Y Transform	1 5	Seed	Resamples	Exp 95	% CL Me	thod				
Log(X+	1)	Linear	2	2.08E+09	200	Yes	Tw	o-Point Inte	rpolation			
Point E	stimate	es						***				
Level	%	95% LCL	95% U	ICL TU	95% LCL	. 95% UC	L					
EC5	49.01	44.28	N/A	2.04	N/A	2.258	,	•				
EC10	100	49.01	N/A	1	N/A	2.04		,				
EC15	>100	N/A	N/A	<1	N/A	N/A						
EC20	>100	N/A	N/A	<1	N/A	N/A						
EC25	>100	N/A	N/A	<1	N/A	N/A						
EC40	>100	N/A	N/A	<1	N/A	N/A						
EC50	>100	N/A	N/A	<1	N/A	N/A						
6d Sur	vival Ra	ate Summary				Calc	ulated Var	iate(A/B)				
Conc-%	6 C	ontrol Type	Count	Mean	Min	Max	Std Err	Std De	v CV%	%Effect	A	В
0	N	legative Control	10	1	1	1	0	0	0.0%	0.0%	10	10
5			10	1	1	1	0	0	0.0%	0.0%	10	10
10			10	1	1	1	0	0	0.0%	0.0%	10	10
20			10	1	1	1	0	0	0.0%	0.0%	10	10
40			10	1	1	1	0	0	0.0%	0.0%	10	10
60			10	0.9	0	1	0.1	0.3162	35.14%	10.0%	9	10
80			10	0.8	0	1	0.1333	0.4216	52.7%	20.0%	8	10
100			10	1	1	1	0	0	0.0%	0.0%	10	10
6d Sur	vival Ra	ate Detail										
Conc-9		ontrol Type	Rep 1	Rep 2		Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	N	legative Control	1	1	1	1	1	1	1	1	1	1

	127 02.M21.2411
Analyet:	May 24/1

Report Date: Test Code:

09 Feb-11 17:20 (p 2 of 2) 11063a | 17-1586-0743

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: Analyzed:

06-7520-1693 09 Feb-11 17:05 Endpoint: 6d Survival Rate

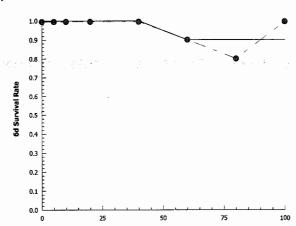
CETIS Version:

CETISv1.8.0

Linear Interpolation (ICPIN) Analysis:

Official Results: Yes

Graphics



Report Date: **Test Code:**

09 Feb-11 17:20 (p 1 of 2) 11063a | 17-1586-0743

Ceriodaphnia 7-d Survival and Reproduction Test **Nautilus Environmental** Analysis ID: 20-8319-6722 Endpoint: Reproduction **CETIS Version: CETISv1.8.0** Analyzed: 09 Feb-11 16:58 Analysis: Linear Interpolation (ICPIN) Official Results: Yes Reproduction-Survival (7d) Krysta Banack Batch ID: 03-7225-7749 Test Type: Analyst: Start Date: 29 Jan-11 11:00 Protocol: EC/EPS 1/RM/21 Diluent: Perrier Water 04 Feb-11 12:00 Ending Date: Species: Ceriodaphnia dubia Brine: Duration: 6d 1h Source: Age: 3169F0AE 08-2902-6478 Code: Client: Hatfield Sample ID: Sample Date: 28 Jan-11 Material: Water Sample Project: Receive Date: 28 Jan-11 Hatfield Source: Mixture 1 Sample Age: 35h Station: **Linear Interpolation Options** Method Resamples X Transform Y Transform Seed **Exp 95% CL** Log(X+1) Linear 1.639E+09 200 Yes Two-Point Interpolation **Point Estimates** Level % 95% LCL 95% UCL TU 95% LCL 95% UCL 547.6 IC5 0.1826 0.1546 0.2432 411.1 647 IC10 0.3985 0.333 0.5456 250.9 183.3 300.3 IC15 0.6539 0.539 0.9216 152.9 108.5 185.5 72 0.9559 1.389 128.7 IC20 0.7769 104.6 IC25 1.313 1.052 1.97 76.16 50.76 95.1 IC40 2.826 2.157 4.707 35.39 21.24 46.35 IC50 22.99 4.35 3.209 22.22 4.5 31.16

Reproduct	Reproduction Summary			Calculated Variate								
Conc-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect			
0	Negative Control	10	16.1	10	23	1.433	4.533	28.15%	0.0%			
5		10	6.3	1	10	1.096	3.466	55.01%	60.87%			
10		10	7.1	0	13	1.215	3.843	54.12%	55.9%			
20		10	9.1	6	11	0.4583	1.449	15.92%	43.48%			
40		10	0	0	0	0	0		100.0%			
60		10	0	0	0	0	0		100.0%			
80		10	0	0	0	0	0		100.0%			
100		10	0	0	0	0	0		100.0%			

Reproduction Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	18	11	23	19	21	16	10	10	17	16
5 .		6	7	3	8	9	10	8	10	1	1
10		6	6	13	10	6	3 .	7	11	0	9
20	*	9	10	11	8	10	8	10	6	10	9
40		0	0	0	0	0	0	0	0	0	0
60		0	0	0	0	0	0	0	0	0	0
80		0	0	0	0	0	0	0	0	0	0
100		0	0	0	0	0	0	0	0	0	0

Analyst:

Report Date: Test Code: 09 Feb-11 17:20 (p 2 of 2)

11063a | 17-1586-0743

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID:

20-8319-6722

Endpoint: Reproduction

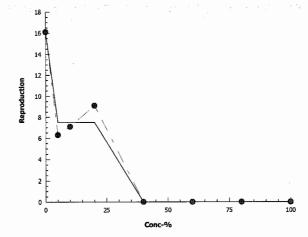
CETIS Version:

CETISv1.8.0

Analyzed: 09 Feb-11 16:58 Analysis: Linear Interpolation (ICPIN)

Official Results: Yes

Graphics



Ceriodaphnia dubia Summary Sheet

Client: Work Order No.:	Hatfield 11 066	Start Date/Time: _ Set up by: _	for 30/110	<u>116</u> 6
Sample Information	n:			
Sample ID: Sample Date: Date Received: Sample Volume:	10-28/4 Ja-28/4 Je-28/11 2+2-6	- - - -		
Test Organism Info	ormation:			
Mortality (%) in prev	st 3 broods of previous 7 d: rious 7 d: used ≥8 young on test day	01/81) <24-h (within 12-h) 28 0 1, 2, 4, 5, 6, 7,8	7/3	
Reference Toxicant Stock Solution ID: Date Initiated:	ID: Cd 63		•*	
7-d LC50 (95% CL): 7-d IC50 (95% CL):	1.1(0,9-1.4)	g/L NaCL		
	e Toxicant Mean (2SD Range): Toxicant Mean (2SD Range):	- A	g/L NaCL	12
Test Results:	LC50 %(v/v) (95% CL) IC25 %(v/v) (95% CL) IC50 %(v/v) (95% CL)	Survival > /oo	Reproduction 3.5 (202-105- 16.1 (13.7-20.9)	10.8
Reviewed by:	1. Tog	Date revie	ewed: March 25;	2011

Chronic Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client:	
Sample	ın.

Hatfield

Start Date & Time:

Jan 30 2011 R 11151 Tols 6 2011 P. 14004

Sample ID: Work Order #: m, +tune a (8:1)

Stop Date: Test Species:

Test Species: Ceriodaphnia dubia

% (v/v)				Days										
Concentration	0	1		2		3		4		5		6		7
Control	init.	old	new	old	new	old	new	old	new	old	пем	old	new	final
Temperature (°C)	24,0	36,0	0.46	24.0	24.0	26.0	24.0	25.0	24.0	25,0	as.0,	200	2500	2570
DO (mg/L)	K2	7.9	6,5	7.3	8.0	71	8.4	7.1	8.3	7.1	87,1	71	7-9	6,7
pН	3-1	80	1.8	3.8	8.3	7.9	8.1	8.0	8.3	8.0	8.3	75	Si	39
Cond. (µS/cm)	219		288	\sim	99 <i>3</i>		aa3		ત્રે વવે		3 92		w	235
Initials	~		riß		UB		Kib		rif		xcb	ŕ		

	Days													
Concentration	0		1		2		3		4		5		6	7
5	init	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	2010	36.0	94.0	240	24.0	260	24,0	34.0	24.0	35:0	24.0	2000	2500	105
DO (mg/L)	2-8	7.8	6.5	7.4	7.8	7.2	8.2	7,0	8.2	70	7.(20	73	65
рН	8.1	8.0	8,2	7.9	8.2	7.9	8.1	7.8	8.2	29	82	79	81	79
Cond. (µS/cm)	343	3	40	35	21	39	6	39	; 3	3	29	33	4	348
Initials)	K	iB	K	B	r	B	١	uB)	cib	,	_	^

		Days												
Concentration	0		1		2	·	3		4		5		6	7
40	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	2573	a60	240	0,26	24.0	260	24.5	25.0	24.5	35.0	25.0	3000	252	2005
DO (mg/L)	78	7,6	6.7	7.4	7.8	7.2	8.0	7.1	8.2	30	7.1	ho	78	6.3
pН	2.3	80	8.5	8.0	8.4	7.9	8.3	7.8	8.6	8.2	8.4	カラ	53	79
Cond. (µS/cm)	916	9	40	((પ)	92	3	86	97	9	73		745	915
Initials	_		ab		rub	V.	B	y	LB	K	ib		_	_

	Days													
Concentration	0		1		2		3		4		5		6	7
100	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	2515	260	a 4.0	24.0	0.VC	96.O	24.5	25.5	345	25.0	25.5	200	2070	255
DO (mg/L)	27	7,0	68	73	7.60	7.2	7,9	7.1	8.2	7.0	7.1	65	78	5)9
pH	25	7,9	8.8	8.1	8,5	8.0	83	7.9	8.9	1.8	8.5	820	5.4	77
Cond. (µS/cm)	1895	18:	Ю	18	13	18	69		887	18	75	1	900	1885
Initials	~	Y	UB	V	B	1	CIB		iB		CB	~		~

	Control	100 7(6/6)	
Hardness*	100	500	
Alkalinity*	86	110	

Analysts:

CLB An

* mg/L as CaCO3

Reviewed by:

Date reviewed: March 24, 20!

Sample Description:

1 115ht yelow - den

Comments:

Broodboard Used:

011811

Chronic Freshwater Toxicity Test C. dubia Reproduction Data

Client: Sample ID:	Hat held mixture a			Stop Date & Time: F.e	130 2011 @ 12007 TUSh
Work Order:	11010	%(v/	(A)	Set up by:	KHB / Ans
Days Concentra	tion: Control	Concentration:	5	Concentration:	10
Days A B	C D E F G H	I J Init A B C	D E F G H I		D E F G H I J Init
1 / /		/ rus / /	///////	/ KUB / / /	//////ws
2 / /		((3 / /	///////////////////////////////////////	/ KB / / /	/// kus
3 / /	100042	5 4 Wb ~ V	0 0 0 3 3	/ KUB / / /	UJ J J J J KIB
4 2	300/ / 3 / / .	14 45 11	レノソフン	4 KUB 1 V 4 4	V3 V V3 4 KB
5 4 5	15 V V 2 7 8		3 5 6 2 2 2	2 rue 4 4 V 6	
6 4 5	4546679		854611	~ 45 4 1	3 / 4 / / ~
7 /	8 6 8 9 9 1	1 1 6 4 4	116158	6~ 17 4 5	5185162
8			100		
Total 15 18	15 16 12 18 17 18 18	7 15 - 13 04 13	8 12 16 8 17 13	11 - 8 16 12 14	5 14 7 9 11 8 12 0
Total P 3 78	13 10 12 14 17 170 12	V (10) A 1 V / V V / V V			
Days Concentra	tion: 20	Concentration:	40		60
A B	C D E F G H	I J Init A B C	D E F G H I		D E F G H I J Init
1 / /		LUB/	44444	/ YUB / /	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
2		/ rub / /		/ KUB / /	us
3 7 7	0000 a	/ vut / /	77777	~ KIB / ~ ~ ~	- Lug
4 0 2	34 / / / 3 3		1 * " " " "	Why I I	LUP KUP
5 4	V X 3 3 2 3 5	3 4 4 3 2 4	5/ /3//	V KIB V V V	uB
6 / 3			1 33 4/	1/2////////	
7 6 6	6 1 5 6	3 / ~ / /	5 / / / /	- / / /	
8					
Total 9 10	9 48 3 3 7 8 9	i 4 - 3 hor 4	100 3 6 20	3 2 0	
		<u> </u>	400	I Composition .	
Days Concentra		Concentration:	100 D E F G H I	J Init A B C	D E F G H I J Init
1 2 2		- Jub VV		- KIR	2 2 1 3 11 1 1 1 1 1 1
2 X V	777777	X WB VVV	7 7 7 7 7 7 7	- VIB	
	11/1/1/	1 rue VV		- CLB	
3	/ / / × / /	1 108 /	1///////	VIB	
4		Tue /	111111	- KLP	
5					
6					
7 /					
8 1 Total ()* 5	2000000	0 0 - 0 -		3 1	
Total ()	0 2 0 9	0 0 -		7 5	
Notes: X = morta	lity.				
Sample Descript Comments:	tion: Total # Young only based on the first 3 Broods. Fo	urth and subsequent broads not included i	in total count		
		and and address of the state of			112-0 211 2011
Reviewed by:	A. Tong			Date reviewed:	March 24, 2011
Version 2.1 Issued Ju	ıly 29, 2009			•.	Nautilus Environment

Report Date:

24 Mar-11 16:46 (p 1 of 2) 11066b | 08-0216-2913

	Allai	yucai Nepc	<i>,</i> , ,					T	est Code:		11066	ь 08-0216-2913
Cerioda	aphnia i	7-d Survival and	d Reproduc	tion Te	est						Nautilus	Environmental
Analysis ID: 11-6431-9337 Endpoint: Analyzed: 24 Mar-11 16:46 Analysis:			Reproduction Linear Interpolation (ICPIN)				ETIS Versio fficial Resul		ETISv1.8.0			
Batch I	D:	01-6136-4903	Test	Туре:	Reproduction-S	Survival (7d)		Α	nalyst: K	rysta Ba	ana c k	
Start D	ate:	30 Jan-11 11:19	5 Prot	ocol:	EC/EPS 1/RM/	21		. D	iluent: P	errier W	a ter	
Ending	Date:	06 Feb-11 14:0	0 Spe	cies:	Ceriodaphnia d	ubia		В	rine:			
Duratio	n:	7d 3h	Sou	rce:				Α	ge:			
Sample	e ID:	11-7008-1972	Code	e:	45BE08B4			С	lient: H	atfield		
Sample	Date:	28 Jan-11	Mate	erial:	Water Sample			P	roject:			
Receive	e Date:	28 Jan-11	Sou	rce:	Hatfield							
Sample	Age:	59h	Stati	ion:	Mixture 2							
Linear	Interpo	lation Options										
X Trans	sform	Y Transform	n Seed	t	Resamples	Exp 95%	CL Met	thod				
Log(X+	1)	Linear	2.02	5E+09	200	Yes	Two	o-Point Int	erpolation			
Point E	stimate	es										
Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL						
IC5	0.3779	9 0.2763	0.6173	264.7	162	361.9						
IC10	0.898		1.616	111.3		159						
IC15	1.616	1.079	3.231	61.89		92.68						
IC20	2.604	1.653	7.782	38.4	12.85	60.48						
IC25	3.966	2.386	10.85	25.21	9.212	41.9						
IC40	12.66	8.251	15.71	7.9	6.367	12.12						
IC50	16.13	12.3	20.8	6.201	4.809	8.127						
Reprod	luction	Summary				Ca	culated V	ariate				
Conc-%	6 С	ontrol Type	Count	Mean	Min	Max	Std Err	Std De	ev CV%	%E	ffect	
0	N	egative Control	10	16.1	12	18	0.6046	1.912	11.88%	0.0	%	
5			10	11.6	8	16	0.8327	2.633	22.7%	27.	95%	
10			10	11.2	7	16	0.9978	3.155	28.17%		43%	
20			10	6.6	3	10	0.8844	2.797	42.38%		01%	
40			10	3	0	10	0.9888	3.127	104.2%		37%	
60			10	0	0	0	0	0			0.0%	
80			10	0	0	0	0	0			0.0%	
100			10	0	0	0	0	0		100	0.0%	

	ART ,
	QAM2(24/11
Analyst:	QA:/VLON / LII

Conc-%

Control Type

Negative Control

Rep 1

Rep 2

Rep 3

Rep 4

Rep 5

Rep 6

Rep 7

Rep 8

Rep 9

Rep 10

Report Date: Test Code:

24 Mar-11 16:46 (p 2 of 2)

11066b | 08-0216-2913

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: Analyzed:

11-6431-9337 24 Mar-11 16:46 Endpoint: Reproduction

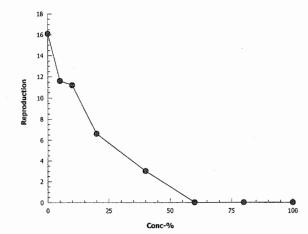
Linear Interpolation (ICPIN) Analysis:

CETIS Version:

CETISv1.8.0

Official Results: Yes

Graphics



Report Date: Test Code: 09 Feb-11 17:17 (p 1 of 2) 11066b | 08-0216-2913

		•						T	est Code:		11066b	o 08-0216-291:
Ceriod	aphnia	7-d Survival and	d Reproduc	ction To	est					N	autilus	Environmenta
Analys	is ID:	12-1557-5387	End	point:	7d Survival Rat	e		c	ETIS Versi	on: CETISV	1.8.0	
Analyz	ed:	09 Feb-11 17:1	7 Ana	lysis:	Linear Interpola	tion (ICPIN))	o	fficial Resu	ults: Yes		
Batch i	ID:	01-6136-4903	Tes	Type:	Reproduction-S	Survival (7d)	.,	A	nalyst:	Krysta Banack		
Start D	ate:	30 Jan-11 11:15	5 Pro f	ocol:	EC/EPS 1/RM/2	21		D	iluent:	Perrier Water	* 4	
Ending	Date:	06 Feb-11 14:0	0 Spe	cies:	Ceriodaphnia d	ubia		В	rine:			
Duratio	on:	7d 3h	Sou	rce:				A	ge:			
Sample	e iD:	11-7008-1972	Cod	e:	45BE08B4			С	lient:	Hatfield		
Sample	e Date:	28 Jan-11	Mat	erial:	Water Sample			Р	roject:			
Receiv	e Date:	28 Jan-11	Sou	rce:	Hatfield							
Sample	e Age:	59h	Stat	ion:	Mixture 2						•	
Linear	Interpo	lation Options							100			
X Trans	sform	Y Transform	See	d	Resamples	Exp 95%	CL Me	ethod				
Log(X+	1)	Linear	1.32	8E+09	200	Yes	Tw	vo-Point Int	erpolation			
Point E	Estimate	es			* * * * * * * * * * * * * * * * * * * *							
Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL						
EC5	14.2	12.35	69.29	7.043	1.443	8.094						
EC10	60	15.21	N/A	1.667	N/A	6.573						
EC15	100	18.69	N/A	1	N/A	5.352						
EC20	>100	N/A	N/A	<1	N/A	N/A						
EC25	>100	N/A	N/A	<1	N/A	N/A						
EC40	>100	N/A	N/A	<1	N/A	N/A						
EC50	>100	N/A	N/A	<1	N/A	N/A						
7d Sur	vival Ra	ate Summary				Calcu	lated Va	riate(A/B)		и		
Conc-%	% C	ontrol Type	Count	Mean	Min	Max	Std Err	Std De	ev CV%	%Effect	Α	В
0	N	legative Control	10	1 -	1	1	0	0	0.0%	0.0%	10	10
5			10	1	1	1	0	.0	0.0%	0.0%	10	10
10			10	1	1	1	0	0	0.0%	0.0%	10	10
20			10	0.9	0	1	0.1	0.3162	35.149	% 10.0%	9	10
40			10	8.0	0	1	0.1333	0.4216	52.7%	20.0%	8	10
60			10	1	1	1	0	0	0.0%	0.0%	10	10
					_							

74	Sum	leviv	Rate	Detail

10

10

0.7

1

0

1

80

100

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	1	1	1	1	1 ·	1	1	1	1	1
5		1	1	1	1	1	1	1	1	1	1
10		1	1	1	1	1	1	1	1	1	1
20		1	1	1	0	1	1	1	1	1	1
40		1	0	1	1	0	1	1	1	1	1
60		1	1	1	1	1	1	1	1	1	1
80		0	1	1	1	1	0	1	1	1	0
100		1	1	1	1	1	1	1	1	1	1

0.1528

0

0.483

0

69.01%

0.0%

30.0%

0.0%

7

10

10

10

1

1

427 Analyst:_____ QA:MAY 24/11

000-089-170-1 CETIS™ v1.8.0.11

Report Date: Test Code:

09 Feb-11 17:17 (p 2 of 2) 11066b | 08-0216-2913

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

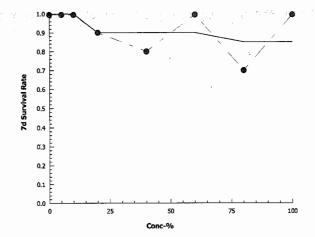
Analysis ID: Analyzed:

12-1557-5387 09 Feb-11 17:17 Endpoint: 7d Survival Rate

Analysis: Linear Interpolation (ICPIN) **CETIS Version:**

CETISv1.8.0 Official Results: Yes

Graphics



Analyst:



Lemna minor Summary Sheet

Client: Hat held	Start Date:	Jan 28, 2011
Work Order No.: 11067	Set up by:	
Sample Information:		
Sample ID: In the Sample Date: Jan 28/11		
Date Received: Jan 28/11	·	
Sample Volume: 2-20L		
Test Organism Information:		
Culture Date:	12 1914	
Age of culture (Day 0):	A	
>8X growth in APHA?:	Les 27 Rondo	day It
		U
KCI Reference Toxicant Results:		
Reference Toxicant ID:	Lm 60	*
Date Initiated:	19/11	
7 I No. of Francis 1050 (05% CI.):	3.6 (26-45)	
7-d No. of Fronds IC50 (95% CL):	3.6 7.6 - 4.5	
	i	
7-d No. Fronds IC50 Reference Toxicant Med	an (2 SD Range): 3 <u>.7(2.</u> 2	-20 CA (%): (2) 3
		,
	Number of Fronds	Dry Weight
Test Results: IC25 %(v/v) (95% CL)	>92	> 97

Reviewed by:

IC50 %(v/v) (95% CL)

Date reviewed: March 24, 2011

Plant Growth Inhibition Toxicity Test Water Quality Measurements

Client :	Het,	fild		_								
Sample ID:	mixt	ure 1 L	4:1)		Test Date:	Ja	KAB, Aw ~ 28	2011				
Work Order No.:	1106	-			Test Species: Lemna minor							
Culture Source:	u1ce t	¥ 490		_					1			
Test Culture Age:		9 day	15	> 8X Gro	wth? (Y/N):	froids	.)					
Light Intensity Range:	4	i	,		Date Measured: Jana8111							
	· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·	T		1		1			
Day	0	1	2	3	4	5	6	7				
Shelf Temp (°C)	24,5	2005	<i>U,⊃</i>	26,0	96.0		25.0	27.0				
Initials	KLB	~		iecb	nce	rus	146	MB				
Sample Characteristics Temperature (°C) DO (mg/L)	0, PG 8, F			Aeration?	25.0 8,3	20	min -	-				
pН	8.9			-	9.1			_				
Conductivity (µS)	2786			-	3410			-				
Concentration	οú	Tempera	ture (°C)	р	Н	(Conductivity	(μ S)				
% (1)	(ر	Day 0	Day 7	Day 0	Day 7	1	0 h					
Control		15.5	28.526.5	2.3	9.4		861					
1.5		24.5	38 1 28	8,2	9.1		906					
3.05		24.5	27.0	8,3	8.9		956					
6.1		24.5	26.5	8,4	9.1	j	046					
12.1		24.5	26.5	8.5	9,2	13	24					
24.2		a4.5	26.5	8.8	9,0	156	5					
48.5		24.5	27.0	9,0	8.9	99	10	-				
97		a4.5	27.0	9.1	8.8	3410)					
Initials		~	IUB	~	KiB	:	~					
	Calibrated T	hermometer	Cond. Meter:	C-1		pH meter:	pH-1					
Reviewed:	A	a Ton	2 ·	Date Review	ved:	Mas	ch 24	,2011				

Lemna minor Toxicity Test Data Sheet - 7-d Frond Counts

Client: Sample ID: Work Order #:		1at1	Reld							St	tart Date:	Jan 2	8 2011		
Sample ID:		<u>ηγι-</u>	-tury	7						Terminat	ion Date:	1700 9	Jan 28 2011 Tab 4 2011 KLS, AND		
vvoik Order #.			207							rests	set up by:	<u> </u>	5 , AWD		
ျာ (၂)၂) Concentration	Rep		fronds	Chlorosis	Necrosis	Yellow	Abnormal	Gibbosity	Single	Root	Loss of	Col	mments	lr	nitials
			Day 7				size		fronds	destruction	buoyancy				
Control	Α	6	69											K	LB
	В	<u> </u>	80												f
	С	Ц	77							·					↓
	D	Ц	<u>ها</u>												
1.5	A		84												—
	В		199	ļ											-
	С	Ш	49												
	D		81			· ·									-
3.05	Α		49												—
-	В		77						<u> </u>						
	С	Ц	119												\bot
	D		98	<u> </u>											
6.1	A		191												\bot
	В	(,	111												
	С		97												
	D		Ш												
12.1	Α		139												
	В		142												
	С		99												
	D		140	<u> </u>							l				
24.2	Α_		127												\perp
	В		132												
	С		140												
	D	V	100			٠									Y
Comments:	-														
Comments.				- W-											
Reviewed by:	Δ	1-10	ie,							Date F	Reviewed:	March	24,2011		

Lemna minor Toxicity Test Data Sheet - 7-d Frond Counts

Client: Sample ID: Work Order #:	Hatfield m, x ture 1 #: 11067								Si Terminat Test s	Jan 28 2011 Fab 4 2011 KLB DWD					
Concentration	Rep	No. of	fronds Day 7	Chlorosis	Necrosis	Yellow	Abnormal size	Gibbosity	Single fronds	Root destruction	Loss of buoyancy	Comme	ents	Initials	
48.5	A	6							 		-			KUB	
70.5	В		136		<u> </u>						 			1	
	C	 	F11								 				
	٥		109												
97	A		113					-			1				
	В		141			<u> </u>									
	С		131												
	D		140											V	
	Α														
	В														
	O														
	D														
	Α														
	В														
	O														
	۵														
	Α														
	В														
	С														
	D													_	
]	Α														
	В														
	С														
	D					<u> </u>		İ	<u> </u>	<u> </u>					
Comments:															
Reviewed by:	A	. 6	2							Date F	Reviewed: _	March	24,2011	<u> </u>	

7-d Lemna minor Weight Data Sheet

Client:	Hatfield	Start Date:	Agn 28 2011
Sample ID:	Mitturel	Termination Date:	VFCBY 2011
Work Order #	11067	-	

0/2 1/1			Parple		
Concentration	Rep	Pan No.	Pan weight (mg)	Pan + plant (mg)	Initials
Control	Α	J	1309,12	1315.52	KLB
	В	2	1304.47	1311.04	1
	С	7	1292.60	1299.85	
	D	4	1312,25	1318.65	
1.5	Α	5	1304.11 Fine	1310.97 0	
	В	Ь	1298.33	1308.95	
	С	ょ	1310.86	1319.99	
	D	8	1365.17	1314.99	
3.05	Α	9	1313-51	1322.93	
	В	19	1308.28	1314.86	
	C	11	1297.28	1307.12	
	D	12	1291.04	1299.94	
6.1	Α	13	1312.75	1328.84	
	В	14	1288.14	1298.85	
	C	15	13i3.01	1321.74 @	
	Đ	ط۱	1291.69	1302.45	
12.1	Α	17	189.81	1304.18	
	В	18	1363.18	1316.85	
	С	19	1288.86	1297.62	
	Đ	20	1312.10	1325.66	
24.2	Α	21	1315.15	1326.85	\ \·
	В	22	1308.50	1331.36 3	
	С	23	1304.06	1316,49	
	D	24	1308.35	139.02	
48.5	Α	25	1305.66	1320.95	
	В	26	1306.97	1324.25	
	С	27	1307.25	1318.44	
	Ð	28	1305.21	1316.93	

Comments:	Okeweigh = 1310.64	@ leneigh= 1321.70 (3) Keneigh= 1321.69
Reviewed by:	1. Terg	Date Reviewed: <u>March</u> 24,2011

7-d Lemna minor Weight Data Sheet

Client: Sample ID: Work Order #:	M12 110	1ctAeld hnel 67		Start Date: Jan 28 2011 Termination Date: Teb 4 2011						
Concentration	Rep	Pan No.	ρ _{ωτρ} ∈ Pan weight	(mg)	Pan + pla	nt (mg)	Initials			
97	Α	29	1299.41	1	314.72		KUB			
	В	30	1307.96		322.47					
	С	31	1297.41	13	310.60					
	D	32	1298.43		313.36		\bigvee			
	Α									
	В									
	С									
	D									
	Α									
	В									
	С									
	D									
	Α									
	В									
	С									
	D									
	Α									
	В									
	С									
	D									
	Α									
	В									
	С									
	D									
	Α									
	В						·			
	C									
	D									
Comments:					W-10					
Reviewed by:		1. Ton	l,	Date	Reviewed	March:	24,2011			

Report Date:

09 Feb-11 15:56 (p 1 of 2)

												Test Co	de:		11067a	01-3402-0	364
Lemna	Growt	h Inhibition Tes	t											N	autilus Er	nvironmen	tal
Analys Analyz		17-1959-8257 09 Feb-11 15:5	5	End _l Anal	ooint: ysis:		nd Count ear Interpola	tion (ICPIN)				CETIS V	ersion: Results:	CETISv Yes	1.8.0		
Batch I	D:	14-8278-7197		Test	Type:	Len	na Growth					Analyst:	Krys	ta Banack			
Start D	ate:	28 Jan-11			ocol:		EPS 1/RM/3	37				Diluent:					
Ending	Date:	04 Feb-11		Spec	ies:	Len	nna minor				1	Brine:					
Duratio	on:	7d 0h		Sour	ce:	UTO	CC #490					Age:	9 d				
Sample		20-5730-8353		Code	e:	7A.A	.008C1				(Client:	Hatf	ield			
		28 Jan-11		Mate	rial:		er Sample				ı	Project:					
		28 Jan-11		Soul	ce:	Hat											
Sample	e Age:	N/A		Stati	on:	Mixt	ture 1										
Linear	Interpo	olation Options															
X Trans	sform	Y Transform	1	Seed			amples	Exp 95%	CL		hod						
Log(X+	1)	Linear		2415	44450	200		Yes		Two	-Point Ir	terpolati	on				
Point E	stimat	es															
Level	%	95% LCL	95%	UCL	TU		95% LCL	95% UCL									
IC5	>97	N/A	N/A		<1.03	1	N/A	N/A									
IC10	>97	N/A	N/A		<1.03	1	N/A	N/A									
IC15	>97	N/A	N/A		<1.03	1	N/A	N/A									
IC20	>97	N/A	N/A		<1.03	1	N/A	N/A									
IC25	>97	N/A	N/A		<1.03	1	N/A	N/A									
IC40	>97	N/A	N/A	,	<1.03	1	N/A	N/A									
IC50	>97	N/A	N/A		<1.03	1	N/A	N/A									
Frond	Count S	Summary						Cal	culat	ed Va	ariate						
Conc-%	6 C	Control Type	Cour	nt	Mean		Min	Max	Std	Err	Std D	ev C	V %	%Effect			
0	N	legative Control	4		67.75		63	74	2.81	I	5.62	8.	3%	0.0%			
1.5			4		92.25		75	123	10.9	8	21.96	23	3.81%	-36.16%			
3.05			4		90.5		71	106	7.24		14.48	16	6.0%	-33.58%			
6.1			4		104		91	115	4.93		9.866		49%	-53.51%			
12.1			4		122.8		88	136	11.6		23.2		3.9%	-81.18%			
24.2			4		120.3		100	134	7.26		14.52		2.08%	-77.49%			
48.5			4		116.5		103	132	6.22		12.45		0.69%	-71.96%			
97			4		122.8		107	135	6.98	31	13.96	. 11	.37%	-81.18%			
Frond																	
Conc-9		Control Type	Rep	1	Rep 2	!	Rep 3	Rep 4									
0	N	legative Control	63		74		71	63									
1.5			78		123		93	75									
3.05			93		71		106	92									
6.1			115		105		91	105									
12.1			133		136		88	134									
24.2			121		126		134	100									

Analyst: YUB QA: M212411

48.5

97

120

107

132

135

111

115

103

134

Report Date: Test Code:

09 Feb-11 15:56 (p 2 of 2)

11067a | 01-3402-0664

Lemna Growth Inhibition Test

Nautilus Environmental

Analysis ID:

17-1959-8257

Endpoint: Frond Count

CETIS Version:

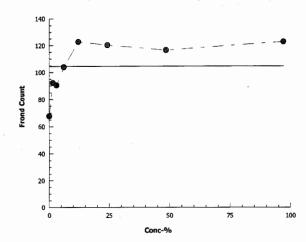
CETISv1.8.0

Analyzed: 09 Feb-11 15:55 Analysis:

Linear Interpolation (ICPIN)

Official Results: Yes

Graphics



Report Date: Test Code:

09 Feb-11 15:56 (p 1 of 2) 11067a | 01-3402-0664

										Test	Code:		1106	7a 01-3	402-0664
Lemna	Growt	h Inhibition Tes	t										Nautilus	s Enviro	nmental
Analys	is ID:	02-8606-1810		End	ooint:	Total Dry Weig	ht-ma			CET	IS Version	: CET	ISv1.8.0		
Analyz		09 Feb-11 15:5	55	-	ysis:	Linear Interpola	-				ial Result	-			
Batch I	D:	14-8278-7197		Test	Туре:	Lemna Growth			· <u>·</u>	Anal	yst: Kn	/sta Ban	ack		
Start D	ate:	28 Jan-11		Prot	ocol:	EC/EPS 1/RM/	37			Dilu	ent:				
Ending	Date:	04 Feb-11		Spec	cies:	Lemna minor				Brin	e:				
Duratio	n:	7d Oh		Soul	ce:	UTCC #490				Age:	9 0	l			
Sample	e ID:	20-5730-8353		Code	9:	7AA008C1				Clie	nt: Ha	tfield			
		28 Jan-11		Mate	rial:	Water Sample				Proj	ect:				
Receiv	e Date:	28 Jan-11		Soul	ce:	Hatfield									
Sample	Age:	N/A		Stati	on:	Mixture 1									
Linear	Interpo	olation Options													
X Trans	sform	Y Transform	1	Seed	1	Resamples	Exp 95%	CL	Method						
Log(X+	1)	Linear		2.00	1E+09	200	Yes		Two-Poin	t Interp	olation				
Point E	stimat	es													
Level	%	95% LCL	95%	UCL	TU	95% LCL	95% UCL					•			
IC5	>97	N/A	N/A		<1.03	1 N/A	N/A								
IC10	>97	N/A	N/A		<1.03	1 N /A	N/A								
IC15	>97	N/A	N/A		<1.03		N/A								
IC20	>97	N/A	N/A		<1.03	1 N /A	N/A		•						
IC25	>97	N/A	N/A		<1.03		N/A								
IC40	>97	N/A	N/A		<1.03	1 N /A	N/A								
IC50	>97	N/A	N/A		<1.03	1 N/A	N/A								
Total D	ry Wei	ght-mg Summai	ry				Cal	lculate	ed Variate	<u> </u>					
Conc-%		Control Type	Cour	nt	Mean		Max	Std		d Dev	CV%	%Effe			
0	N	legative Control	4		6.655	6.4	7.25	0.20		4047	6.08%	0.0%			
1.5			4		9.122		10.62	0.80		318	17.73%	-37.0			
3.05			4		8.685	6.58	9.84	0.72		455	16.75%	-30.5			
6.1			4		10.07	8.73	10.76	0.47		9455	9.39%	-51.3			
12.1			4		12.6	8.82	14.37	1.27		549	20.22%	-89.4			
24.2			4		11.89	10.67	12.76	0.46		9261	7.79%	-78.6			
48.5			4		13.87	11.19	17.28	1.45		913	21.0%	-108.4	4%		
97 			4		14.66	13.19	15.31	0.49	66 0.9	9931	6.77%	-120.3	3%		
Total D	ry Wei	ght-mg Detail													
Conc-%		ontrol Type	Rep 1	1	Rep 2		Rep 4								
0	N	legative Control	6.4		6.57	7.25	6.4								
1.5			6.86		10.62	9.19	9.82								
3.05			9.42		6.58	9.84	8.9								
6.1			10.09)	10.71	8.73	10.76								
12.1			14.37		13.67	8.82	13.56								
24.2			11.7		12.76	12.43	10.67				•				
48.5			15.29)	17.28	11.19	11.72				£				

14.93

97

15.31

15.21

13.19

Report Date: Test Code:

09 Feb-11 15:56 (p 2 of 2) 11067a | 01-3402-0664

Lemna Growth Inhibition Test

Nautilus Environmental

Analysis ID:

02-8606-1810

Endpoint: Total Dry Weight-mg

CETIS Version:

CETISv1.8.0

Analyzed:

09 Feb-11 15:55

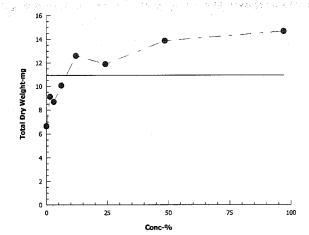
Analysis:

Linear Interpolation (ICPIN)

Official Results:

Yes

Graphics



Lemna minor Summary Sheet

Client: Hat Reld Work Order No.: 11067	Start Date: Set up by: _	
Sample Information:	:	
Sample ID: Sample Date: Date Received: Sample Volume: Sample Volume: Sample Volume: Sample Volume: Sample Volume:		
Test Organism Information:		
Culture Date: Age of culture (Day 0): >8X growth in APHA?:	19/11 Tes 27 Romes	day 7
KCI Reference Toxicant Results:		
Reference Toxicant ID: Date Initiated:	Lm 60	
7-d No. of Fronds IC50 (95% CL):	3.6 (2.6-4.5)	
7-d No. Fronds IC50 Reference Toxicant Mear	n (2 SD Range): 3 7 (2.8	-50)CV (%): (5)3
	Number of Fronds	Dry Weight
Test Results: IC25 %(v/v) (95% CL)	>97	> 97

Date reviewed: March 24, 2011

Reviewed by:

IC50 %(v/v) (95% CL)

Plant Growth Inhibition Toxicity Test Water Quality Measurements

Client :	Heta	Gul		-	Setup by:		28, AW	D	_			
Sample ID:	Mixtu	ire 26	F: 1)		Test Date:	<u>J.</u>	2 28	2011				
Work Order No.:	1106	}		_ Tes	st Species:	Lemna mine	or	.,	_Blue bearers			
Culture Source:	UTCC #			-					1			
Test Culture Age:		9 da	5	> 8X Gro	wth? (Y/N):	frond.	<u>s</u>)					
Light Intensity Range:	4100	7 4300)	Date	Date Measured: Jan 28/11							
Day	0	1	2	3	4	5	6	7				
Shelf Temp (°C)	24.5	255	us	36.0	36.0	26.0	25.0	0.FG	_			
Initials	rib	~	~	KIB	KLB	RCB	116	KCB	j			
Sample Characteristic Temperature (°C) DO (mg/L) pH Conductivity (µS)	24.0 7.7 8.5 1895			Aeration? - - -	24.0 85 9.1 249 241		min -	- - -				
Concentrati	ion	Tempera	ture (°C)	р	Н		Conductivity	(µS)	7			
% (1	`	Day 0	Day 7	Day 0	Day 7		0 h		1			
Control		25%	वेरेश	23	9.3		861					
1.5		24.5	27,0	8.2	9.0		895		7			
3.05		24.0	27.0	8.3	9.0	(9	124					
6.1		34.0	27.0	8.4	8.8	9:	79					
12.1		24.0	27.0	8.5	9,0	109	<i>11</i>					
24.2		24.0	27,0	8.8	9.0		1301					
48.5		24.0	27.0	9.0	9.1	2	390-16	992				
97		24.0	27.0	9.1	9.1		410		7			
Initials		_	NB	~	ICIB							
Thermometer: Sample Description:	Clear	Thermometer	Cond. Meter	:_ C-1_		pH meter:	pH-1		- -			
Comments:									_			
Reviewed:		1. Tore	3	_Date Review	wed:	Ma	sch 24	t,2011	_			

Lemna minor Toxicity Test Data Sheet - 7-d Frond Counts

Client: Sample ID: Work Order #:		Hatfield Mixture 11067			• •				Terminat	tart Date: ion Date: set up by:	Fab 4	2011 2011 Also	
ျာ (၂)၂) Concentration	Rep	No. of fronds Day 0 Day 7	Chlorosis	Necrosis	Yellow	Abnormal size	Gibbosity	Single fronds	Root destruction	Loss of buoyancy	Comn	nents	Initials

ျာ (၂)၂) Concentration	No. of fronds			Chlorosis	Necrosis	Yellow	Abnormal	Gibbosity	Single	Root	Loss of	Comments	Initials
Concentration	ТСР	Day 0	Day 7	0111010010	140010313	1011011	size	Cibbosity	fronds	destruction	buoyancy	Comments	l madio
Control	Α	و	83	,									WB
	В	1	62										
	С		68										
	D		87										
1.5	Α		73										
	В		81										
	С		65										
	D		83 0	3									
3.05	Α		24192										
	В		110										
	С		105										
	D		43										
6.1	Α		75										
	В	,	96										
	С		99										
	D		86										
12.1	Α		86										
	В		100										
	С		129										
	D		140										
24.2	Α		139										
	В		124										
	С		86										11/
	D	V	1110			•							V

Comments:		
Reviewed by:	A. Tong	Date Reviewed: March 24, 2011

Lemna minor Toxicity Test Data Sheet - 7-d Frond Counts

Client: Sample ID: Work Order #:		Hate MIX 1100	field fure:	2					S Terminat Test s	tart Date: _ tion Date: _ set up by: _	011 011(0214	() > ((かい)			
Concentration	Rep		fronds Day 7	Chlorosis	Necrosis	Yellow	Abnormal size	Gibbosity	Single fronds	Root destruction	Loss of buoyancy	Comments		lni	tials
48.5	Λ		131	<u> </u>		ļ		<u> </u>		<u> </u>				1	0
40.5	A B	6					<u> </u>							1XC	B_
	C	H	191											+	
	D	 	91							· · · · · · · · · · · · · · · · · · ·	 			┼┼	
97	A	 	83	 										++	
]	В			<u> </u>										†	
	C	1	76 139											H	
	D		131								 			H	7
	A		1.7.						<u> </u>					⇈	
	В														***************************************
	С													\top	
	D					····					1				
	Α	İ													
	В														
	C									,					
1.4	D														
77	Α														
	В														
	C														
	D														
	Α														
	В													$oldsymbol{ol}}}}}}}}}}}}}}}}}$	
	С		<u> </u>											<u> </u>	
	D	L	L					<u> </u>		<u> </u>				<u></u>	
Comments:		- 1		···· · · · · · · · · · · · · · · · · ·											
Reviewed by:	+	1. 70	5	,						Date F	Reviewed:	March	24,2011	, 	

7-d Lemna minor Weight Data Sheet

Client:	Hatfield	Start Date:	Aan 28 2011
Sample ID:	Mixturea	Termination Date:	VEOS 4 2011
Work Order #/	11067		

0/2 4/1	east Contract		and the same and the same and the same and the same and the same and the same and the same and the same and the		
Concentration	Rep	Pan No	Pair weight (mg)	Pan Aplani(IIII)	
Control	Α	1	1300.81	1308.45	KLB
	В	2	1300.08	1306.25	
	С	7	1306.89	1313.30 0	
	D	4	1313.07	1320.93	
1.5	Α	5	1308.20	1315.36	
	В	Ь	1312.83	1320,73	
	С	ょ	1312,06	1317.68	
	D	8	1312.33	1320.34	
3.05	Α	9	1321.74	1330.81	
	В	19	1305.14	1315,47	
	С	11	1314.26	1324.570	
,	D	12	1310.50	1318.10	
6.1	Α	13	1308,81	1316.08	
	В	14	1310.52	1320.23	
	С	15	1308.42	1317.46	
	D	160	1308-33	1317.20	
12.1	Α	17	1304.85	1312-73	
	В	18	1313.77	1323.86	
	С	19	1299,33	1311.96	
	D	20_	1311.78	1325.57	
24.2	Α	21	1308.43	1319.24	
	В	22	1312.34	1324.29	
	С	23	1319,58	1328.86	
	D	24	1307.63	1319.23	
48.5	A	25	1310.31	1324,07	
	В	26	1310.16	1321.19 3	
	С	27	1312.69	1327.28	
	D	28	1309,48	1318,12	1

Comments:	Olaveigh=1813.65	@leweigh=1324.21 3	11321.09
			:
Reviewed by:	A. Tere	Date Reviewed	1: March 24, 2011
	\bigcirc		

7-d Lemna minor Weight Data Sheet

Client:	Ė	1ctAeld		Start Date: Jan 282011 Termination Date: Teb 4 2011						
Sample ID:	MIZ	1ctAeld hne2		Term	ination Date: _	Yes 4	2011			
Work Order#: \	110	F6								
9/2 (11)					Derivation of the State of the Paris	and the same and a same as				
Concentration	Rep	Pan No.	Pan weight	(ng)	e Pali Hol					
97	Α	25	1306,72		1318.45		KLB			
	В	30	1308.65		1320.25					
	С	31	1306.07		1323.48					
	D	32	1305.37		1319,50					
	Α									
	В									
	С									
	D						, '			
	Α									
	В			:						
	С									
	D						·			
	Α									
	В									
	С									
	D									
	Α									
	В									
	С									
	D			·						
	Α									
	В									
	С									
	D									
	_ A									
	В									
	С									
	D		İ							
Comments:					···					
Reviewed by:		1. Ton	e,	Da	te Reviewed: _	March	24,2011			

Report Date:

09 Feb-11 15:55 (p 1 of 2)

	, , ,,,,,	nytioui itopo								Tes	st Code:			11067	b 01-1	544-3984
Lemna	Growt	th Inhibition Test	:								-		N	autilus	Enviro	nmental
Analys	is ID:	18-8027-6706	E	ndpoint:	Fronc	d Count				CE	TIS Vers	ion:	CETISV	1.8.0		
Analyz		09 Feb-11 15:5		nalysis:			tion (ICPIN)		Off	icial Res	ults:	Yes			,
Batch I	D:	07-7819-4315	To	est Type:	Lemr	a Growth	-			Ana	alyst:	Kryst	a Banack			
Start D	ate:	28 Jan-11	P	rotocol:	EC/E	PS 1/RM/3	37			Dil	uent:					
Ending	Date:	04 Feb-11	S	pecies:	Lemr	na minor				Bri	ne:					
Duratio	n:	7d 0h	S	ource:	UTC	C #490				Ag	e:	9d				
Sample	D:	03-5204-2099	С	ode:	14FB	BC73				Cli	ent:	Hatfie	eld			
-		28 Jan-11	M	laterial:		r Sample				Pro	oject:					
Receiv	e Date:	: 04 Feb-11	S	ource:	Hatfie											
Sample	Age:	N/A	S	tation:	Mixtu	re 2					-					
Linear	Interpo	olation Options		•												
X Tran	sform	Y Transform		eed		mples	Exp 95%	CL	Meth							
Log(X+	1)	Linear	1.	.034E+09	200		Yes		Two-l	Point Inter	polation					
Point E	stimat	tes														
Level	%	95% LCL	95% U	CL TU		95% LCL	95% UCL									
IC5	>97	N/A	N/A	<1.03	31	N/A	N/A									
IC10	>97	N/A	N/A	<1.03	31	N/A	N/A									
IC15	>97	N/A	N/A	<1.03	31	N/A	N/A									
IC20	>97	N/A	N/A	<1.03	31	N/A	N/A									
IC25	>97	N/A	N/A	<1.03	31	N/A	N/A									
IC40	>97	N/A	N/A	<1.03	31	N/A	N/A									
IC50	>97	N/A	N/A	<1.03	31	N/A	N/A									
Frond	Count	Summary					Ca	lculat	ed Vai	riate						
Conc-9	6 (Control Type	Count	Mea	n	Min	Max	Std	Err	Std Dev	CV%		%Effect			
0	١	Negative Control	4	69		56	81	5.95	8	11.92	17.27	%	0.0%			
1.5			4	69.2	5	59	76	3.96	66	7.932	11.45	%	-0.36%			
3.05			4	89		67	104	8.25		16.51	18.55		-28.99%			
6.1			4	83		69	93	5.43		10.86	13.09		-20.29%			
12.1			4	107.8		80	134	12.5		25.04	23.24		-56.16%			
24.2			4	103.8		80	118	8.25		16.5	15.9%		-50.36%			
48.5			4	111.3		85	135	11.4		22.87	20.55		-61.23%			
97			4	101.3	3 	70	133	16.1	17	32.34	31.94	·% 	-46.74%			
Frond	Count	Detail														
Conc-9		Control Type	Rep 1	Rep		Rep 3	Rep 4									
0	1	Negative Control	77	56		62	81									
1.5			67	75		59	76									
3.05			86	104		99	67									
6.1			69	90		93	80									
12.1			80	94		123	134									
24.2			107	118		80	110									
			405	400		405	0.5									

125

77

100

70

135

133

85

125

48.5

97

Report Date:

09 Feb-11 15:55 (p 2 of 2)

Nautilus Environmental

Test Code: 11067b | 01-1544-3984

Lemna Growth Inhibition Test

18-8027-6706

Endpoint: Frond Count

09 Feb-11 15:54 Analysis:

Linear Interpolation (ICPIN)

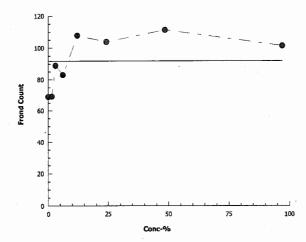
CETIS Version:

CETISv1.8.0

Official Results: Yes

Analyzed: Graphics

Analysis ID:



Report Date: Test Code: 09 Feb-11 15:55 (p 1 of 2) 11067b | 01-1544-3984

									1691	Coue.			110071	0 01-13	77-330
Lemna	Growt	h Inhibition Test	t									Na	autilus	Environ	menta
Analysi	is ID:	05-2626-0683	End	point:	Total Dry Weigl	nt-mg			CETI	S Versi	on:	CETISv1	1.8.0		
Analyz	ed:	09 Feb-11 15:5	4 Ana	ysis:	Linear Interpola	tion (ICPIN	l)		Offic	ial Resu	ılts:	Yes			
Batch I	D:	07-7819-4315	Test	Type:	Lemna Growth				Anal	yst: h	(rysta	Banack			
Start D	ate:	28 Jan-11	Prot	ocol:	EC/EPS 1/RM/	37			Dilue	ent:					
Ending	Date:	04 Feb-11	Spe	cies:	Lemna minor				Brine	ə:					
Duratio	n:	7d 0h	Sou	rce:	UTCC #490				Age:		9d				
Sample	D:	03-5204-2099	Cod	e:	14FBBC73				Clier	nt: H	latfie	ld			
Sample	Date:	28 Jan-11	Mate	erial:	Water Sample				Proje	ect:					
Receiv	e Date:	04 Feb-11	Sou	rce:	Hatfield										
Sample	Age:	N/A	Stat	ion:	Mixture 2										
Linear	Interpo	lation Options					, , ,								
X Trans	sform	Y Transform	see	d	Resamples	Exp 95%	6 CL	Method							
Log(X+	1)	Linear	1.61	4E+09	200	Yes	·	Two-Poin	t Interp	olation					
Point E	stimat	es				, ,									
Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL	•								
IC5	>97	N/A	N/A	<1.03	1 N /A	N/A						•			
IC10	>97	N/A	N/A	<1.03	1 N /A	N/A									
IC15	>97	N/A	N/A	<1.03		N/A									
IC20	>97	N/A	N/A	<1.03		N/A									
IC25	>97	N/A	N/A	<1.03	1 N/A	N/A									
IC40	>97	N/A	N/A	<1.03	1 N /A	N/A									
IC50	>97	N/A	N/A	<1.03	1 N/A	N/A									
Total D	ry Wei	ght-mg Summar	ry			Са	lculat	ed Variate)						
Conc-%	6 C	ontrol Type	Count	Mean	Min	Max	Std	Err St	d Dev	CV%		%Effect			
0	N	legative Control	4	7.02	6.17	7.86	0.42		3533	12.16%		0.0%			
1.5			4	7.215		8.12	0.5		103	15.28%		-2.78%			
3.05			4	9.327		10.33	0.64		294	13.87%		-32.87%			
6.1			4	8.722		9.71	0.5		034	11.859		-24.25%			
12.1			4	11.12		13:79	1.33		663	23.949		-58.44%			
24.2			4	10.9	9.22	11.95	0.60		214	11.149		-55.23%			
48.5			4	12.03		14.59	1.36		732	22.719		-71.37%			,
97 			4	13.87	11.73	17.41	1.29	2.5		18.6%		-97.54%			
	-	ght-mg Detail													
Conc-%		ontrol Type	Rep 1	Rep 2		Rep 4		,							
0	N	legative Control	7.64	6.17	6.41	7.86									
1.5			7.16	7.9	5.68	8.12									
3.05			9.07	10.33		7.6									
6.1			7.27	9.71	9.04	8.87									
12.1			7.88	10.09	12.73	13.79									
24.2			10.82	11.95	9.22	11.6									
48.5			13.86	11.03	14.59	8.64									
97			11.73	12.2	17.41	14.13									

Report Date: Test Code:

09 Feb-11 15:55 (p 2 of 2)

11067b | 01-1544-3984 Nautilus Environmental

Lemna Growth Inhibition Test

05-2626-0683 09 Feb-11 15:54 Endpoint: Total Dry Weight-mg

Analysis:

Linear Interpolation (ICPIN)

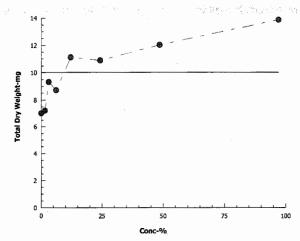
CETIS Version: Official Results:

CETISv1.8.0

Yes

Graphics

Analysis ID: Analyzed:





Rainbow Trout Summary Sheet

Client:	Hatfield	Start Date/Time	: Jan 31/11 e 1630h
Work Order No.:	11065	Test Species	: Oncorhynchus mykiss
Sample Information:			
Sample ID: Sample Date: Date Received: Sample Volume: Other:	Mixture 1 Jan 28/11 Jan 28/11	•	
Dilution Water:			
Type: Hardness (mg/L CaC Alkalinity (mg/L CaCC		Tap Water	
Test Organism Infor	mation:		
Batch No.: Source: No. Fish/Volume (L): Loading Density: Mean Length ± SD (note that the second seco			Range: <u>33-44</u> Range: <u>0,30-0,</u> 74
SDS Reference Toxi	icant Results:		
Reference Toxicant III Stock Solution ID: Date Initiated: 96-h LC50 (95% CL):	10510 Dec 16/10		
Reference Toxicant M Reference Toxicant C		1.4-6.1) 5	
Test Results:	The 96-hr LCSO	7100% 5/0	
Reviewed by:	1. torg	_ Date re	viewed: March 24,2011

96-Hour Rainbow Trout Toxicity Test Data Sheet

Client/Project Sample I.D. W.O. # RBT Batch #: Date Collecte Date Setup/Ti Sample Setup D.O. meter: pH meter: Cond. Meter:	e:	M I	1810 106, 1810 Jan DO-1 pH-1 C-1	-e 5 28/ 31/ JAB	11	4 W		2.163	30	- - - -	Number Fish/Volume: 7-d % Mortality: Total Pre-aeration Time (mins) Aeration rate adjusted to 6.5 ± Undiluted Sample WQ Parameters Initial WQ Temp °C 14.5 pH 9.4 D.O. (mg/L) 9.9 Cond. (µS/cm) 2710														
Concentration # Survivors								-	Гетр	eratu	re (°C	;)	Diss	olved	Oxyg	gen (r	ng/L)			рН		:		Conductivity (µS/cm)	
1 (7)	1	2	4	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	96	
Control				10	(0	10	10	14,0	14.0	14.0	14.0	14.0	9.9	10.0	/a.b	9.9	9.9	7.1	6.9	7-1	7.1	7.0	30	34	
6.75				10	(0	10								10.0				8.2	7.1	7-2	7.3	22	287	292	
12.5			-	10	10	10		14.0				14.0				98		L 22	7.2	7-3	74	7.4	432	438	
25				10	10	10	 							9.9					7.4			7.5	800	807	
50				10	(0	10	10							9,9						7.7	37	7.6	1469	1479	
100				10	(0	10	10							9.8								78	2710	2740	
							<u> </u>	1.0	- 100						, ,	<u> </u>			G,=		<u> </u>				
Initials			1	JAB	KJU	JAB	TAG	JAB	SAB	KJU	IAB	TAB	JAB	JAB	KJL	JAB	БИВ	JAB	JAB	765L	JAB	JAB	Jab	JAB	
Sample Descr	iption/	Comr	nents	S :	VR	ly s	ligh	tor	ànge	tin	it in	h	ghe	st co	ncer	itorit	bn,	cle	ear			 -			
Fish Description	on at 9	6?		All	451	n orp	pecr	- ok															· .		
Other Observa	tions:																								
Reviewed by:		1	. (0	*		-									Date	Revie	ewed:		М	arc	h 2	4,20	n(

Rainbow Trout Summary Sheet

Client: _	Hatfield	Start Date/Time: Jan 31/11 @ 1615h									
Work Order No.:	11065	Test Species: Oncorhynchus mykiss									
Sample Information:											
Sample ID: Sample Date: Date Received: Sample Volume: Other:	Mixture 2 Jan 28/11 Jan 28/11 2420L										
Dilution Water:											
Type: Hardness (mg/L CaC0 Alkalinity (mg/L CaC0	· <u> </u>	Tap Water									
Test Organism Inform	nation:										
Batch No.: Source: No. Fish/Volume (L): Loading Density: Mean Length ± SD (m) Mean Weight ± SD (g)	A 4	Range: 34-43 Range: 0,31-0.69									
SDS Reference Toxic	cant Results:										
Reference Toxicant ID Stock Solution ID: Date Initiated: 96-h LC50 (95% CL):	RT66 10510 Dec 16/10 5.0 (4.3-5.6)										
Reference Toxicant M Reference Toxicant C	lean (2SD Range): 5.2 (4 V (%): 8.5	.u-6.1) 5									
Test Results:	The 96-hr LCSO	7 100% V/V									
Reviewed by:	1. Tong	Date reviewed: <u>March</u> 24, 2011									

96-Hour Rainbow Trout Toxicity Test Data Sheet

Client/Projects Sample I.D. W.O. # RBT Batch #: Date Collected Date Setup/Til Sample Setup D.O. meter: pH meter: Cond. Meter:	e: -	Hatfield Mixture 2 11065 11810 Jan 28/11 AM Jan 31/11 @ 1615 TAB DO-1 pH-1 C-1										Number Fish/Volume: 7-d % Mortality: Total Pre-aeration Time (mins Aeration rate adjusted to 6.5 ± Undiluted Sample WQ Parameters Initial WQ Temp °C 14.5 pH 9.2 D.O. (mg/L) 9.8 Cond. (µS/cm) 2060												
Concentration		# 5	Surviv	ors			٦	Гетр	eratu	re (°C	Dissolved			Oxygen (mg/L)					рН				nductivity µS/cm)	
	1	2	4	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	96
CHO				10	10	10	10	14.0	14.5	14-5	140	19.5	10.0	0.0	101	ю.0	9.9	7.1	70	70	7.1	3.0	30	35
6.25				10	10	10	10							10.0			_	7.6	7.1	71	22	7.1	197	201
12.5				10	10	10	10							9.9		9.8		85	71	71	2.3	3 .2	333	339
25				10	10	io	10							0.01		9.7	9.7	8.9	7.3	94	7.5	73	610	618
50				10	10	10	10							0,0						7-8	18	7.7	1106	1117
1600	•			10	10	į0	ιυ	W.0	14.5	14.0	14.0	14.5	99	10.0	9-8	10.0	2,2	9.2	:79	8.0				2070
Initials				JAB	KJL	JAB	348	JAB	JAB	KJU	TAB	HB.	JAB	JAB	KJL	JAB	<u> 44</u> 5	SAB	TAB	1-JL	SAB	JAB	JAB	JA9
Sample Descri	ption/	Comn	nents	S :	_51	ight	ora	nge	, cle	۵/-				-										
Fish Descriptio	n at 9	6?		s: <u>All re</u>	emai	ning	fisl	299	Pear	ok					-			<u> </u>					The second	
Other Observa	tions:											****												
Reviewed by:		1.	To	iq	<u> </u>											Date	Revie	ewed:		Ma	accl	24	,2011	

Rainbow Trout Summary Sheet

Client:	Hatfield	Start Date/Time:	31/11@1630h
Work Order No.:	11065	Test Species: Oncor	hynchus mykiss
Sample Information: Sample ID: Sample Date: Date Received: Sample Volume:			
Other: Dilution Water:			
Type: Hardness (mg/L CaCo			
Test Organism Infor	mation:		
Batch No.: Source: No. Fish/Volume (L): Loading Density: Mean Length ± SD (m Mean Weight ± SD (g			33-44 0.33-0.72
SDS Reference Toxi	cant Results:		
Reference Toxicant III Stock Solution ID: Date Initiated: 96-h LC50 (95% CL):	10510 Dec 16/10		
Reference Toxicant M Reference Toxicant C		-6.1)	·
Test Results:	The 96-hr LCSO	7100%//	
Reviewed by:	- As tong	. Date reviewed:	March 24,2011

96-Hour Rainbow Trout Toxicity Test Data Sheet

Client/Projects Sample I.D. W.O. # RBT Batch #: Date Collected Date Setup/Til Sample Setup D.O. meter: pH meter: Cond. Meter:	Hatfield Mixture 1 - Prairie Creek 11065 111810 Van 28/11 e AM Jan 31/11 @ 1630h TAB DO-1 pH-1 C-1								-	Temp °C (4, 5									30 19): <u>Yes</u> 30 min WQ 14.5 9.4 9.9 2710				
Concentration	# \$	Surviv	ors			٦	Гетр	eratu	re (°C	;)	Diss	olved	Охус	gen (r	ng/L)			рН				nductivity µS/cm)		
, , ,	1	2	4	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	96
Control				10	10	10	10	14.0			14.0		9.7	9.9	10.0		9.8	8.0		8-3		8,3	584	587
6.25				10	10	10	10	[4.D			14.0			10.0	10.0	10.1		8.1	8.1	8.Z	8.2	8.2	731	739
12.5		-		10	10	10	Ю	14.0		14-0	14.0	14.5	9.9	9.9	9.9		9.8	8.2	8.1	٤.٧	8.2	8.2	8415	854
25				10	10	10	10	4.0		,	14.0			9,9	10,0			8.5	8.0	8-2	8,2	81	1136	1148
50				10	10	10	10	14.5	14.0	14.0	14.0	14.5	9.7	9.7	9.9	10.0		88		8.2	9.2	8,1	1675	1694
100				10	10	10		14.5				14.5		9,9						8.0	29	7.8	2710	2340
Initials			-	JAB	KJL	JAG	JAB	JAB	JAB	KJĹ	JAB	JAB	JAB	JAB	とてし	JHB	JAB	JAB	JAB	KIL	JAB	JAB	JAB	JAB
Sample Descri		٠.	ments	s: .Au																				
Fish Descriptio	n at 9)6?		All	cema	<u>zinir</u>	5 t	ish_	app.	gar c	>K_													
Other Observa	tions:		•																					
Reviewed by:		1		2	<u>e</u>											Date	Revie	wed:		Mã	rcl	- 24	1,2011	

Rainbow Trout Summary Sheet

Client:	Hatfield	Start Date/Time: Jan 31/11 @ 1615h
Work Order No.:	11065	Test Species: Oncorhynchus mykiss
Sample Information:		
Sample ID: Sample Date: Date Received: Sample Volume: Other:	Mixture 2-Prairie (reek Jan 28/11 Jan 28/11 2400	·
Dilution Water:	_	
Type: Hardness (mg/L CaCo Alkalinity (mg/L CaCo		_
Test Organism Infor	mation:	
Batch No.: Source: No. Fish/Volume (L): Loading Density: Mean Length ± SD (m Mean Weight ± SD (g		Range: 34-43 Range: 0.34-0.7a
SDS Reference Toxi	cant Results:	
Reference Toxicant III Stock Solution ID: Date Initiated: 96-h LC50 (95% CL):	10510 Dec 16/10	
Reference Toxicant M Reference Toxicant C		6.1)
Test Results:	The 96-hr LC50 >1	00% (~/u)
Reviewed by:	1. Tong	Date reviewed: March 24, 2011

96-Hour Rainbow Trout Toxicity Test Data Sheet

Client/Projects Sample I.D. W.O. # RBT Batch #: Date Collected Date Setup/Til Sample Setup D.O. meter: pH meter: Cond. Meter:	d/Tim me:	e:	Mi N	106 1810 1810 an 3 an DO-1 pH-1	2-5 5 18/ 31/	'11	D 1	(M 615				7-d % Tota Aera Undi Pa Tota	% Mo I Pre- tion luted rame emp pH D. (mg	°C	ion T djust ble W	Q itial W	6.5 ±	: 1 m		0,2 3 C /L? (30	min W 1.0 1.2 9.9		
Concentration			# 5	Surviv	ors			7	emp	eratu	re (°C	;)	Diss	olved	Оху	gen (n	ng/L)			pН				uctivity (/cm)
	1	2	4	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	96
Ctvl				10	(0	Q	10	140	14.5	14.0	CyD	14.5	9.9	9.8	9-8	10.0	98	8.1	8.1	5-2	8.3	8.2	582	587
6.25				10	10	10	10	4.0	14.5	14.0	14.0	14.5	9.8	9.7	9.9	9.9	9.9	8.1	8.0	8-2	82	8.1	670	618
12.5				10	10	10	10	14.0	14.5	440	14.0	14.5	9,8	9,9	9.9	9.9	98	2.2	8.1	れて	8.2	8.1	760	168
25				10	(0)	10	10	140	14.5	14,0	14.0	14.5	9.7	99	9.9	9.9	9.8	8.4	8.0	8-3	8.2	8ત	934	941
50				10	10	10	10	14.0	14.5	40	14.0	14.5	9.9	9,9	9.9	4.8	97	8.7	8.0	8-1	8.2	8.0	1319	1330
100				10	10	10	10	14.0	14.5	14.0	14.5	14.5	9,9	9,9	4-8	99	9.7	9.2	7.9	8-0	29	7.9	2070	2070
																				g	£ 0			
Initials				510	15.	€0	700	600	na	V11	540	-10	40	JAB	沙索	140	T it A	TIR	JAB	W	TAO	JAD	TAB	JAB
Sample Description Fish Description Other Observation Reviewed by:	n at 9	96?		s: 411 re								Unu		<u>Μ</u> υ									24,20	



Client: Work Order No.:	Hadfuld 41064	Start Date/Tir Test Speci Set up	ies: D.magna /	/4 3 o C
Sample Information	1:			
Sample ID: Sample Date: Date Received: Sample Volume:	190 28/11 Jan 28/11 Jan 28/11 2 + 2=	<u> </u>		
Test Organism Info	rmation:			
Broodstock No.: Age of young (Day 0 Avg No. young per b Mortality (%) in prev Days to first brood:	rood in previous 7 d:	011911 A < 24 hours 17 0		
NaCl Reference To	xicant Results:			
Reference Toxicant Stock Solution ID: Date Initiated: 48-h LC50 (95% CL)	10 1	66 Va 01 In 21/11 48 g/LNaCL		
Reference Toxicant Reference Toxicant	Mean (2SD Range): CV (%):	4.0(3.6-4.3) g/L	- NaCL	
Test Results:	The 48-h	Leso so estendel	@ 89% (y)	<u> </u>
Reviewed by:	1. tog		reviewed: MascL 25	5 2011

Client: Sample ID: Work Order No.:	<u> 491</u> <u>m</u> 1:	ficid Hure 1100	1 (4:1)			No. 0	Organis	st Orga	lume: nism:	10/2 D.mag	00ml/ gna		3	1 <u>21400</u> h
DO meter:	DO-1		_		pH ı	meter:		pH-1			Conduc	tivity ı	meter:	<u>C-1</u>	
Concentration	E .	lumber Organ		No. Immobilized	Tei	mpera (°C)	ture	1	lved o (mg/L)			рН			uctivity 6/cm)
% (v/v)		24	48	48	0	24	48	0	24	48	0	24	48	0	48
Control	Α	Į0	10	0	20.0	ross	90.0	4.8		8,9	8.0		8.1	359	406
	В							j.		1		ur v.;		44	1.2
	С														1.0
	D				11.7			al .							
6.25	Α	10	9	0	90.0	1005	20-0	8,7		8.8	8.3		80	3216	571
	В											ă.			
	С						40.0		7						
·	D					110			*				2		
12.5	Α	10	10	้อ	30.0	105	200	8.8		8-8	8,5		8-0	988	942
	В											4.1		2 142	1-2-
	С								110						Francis
	D								ų.	i. ii	1	34			
25	Α	10	10	0	90.0	20/6	20-0	8.8		89	8.50		8-0	997	1065
	В	ļ	<u> </u>					14.00		- 1		1.0	100	25	1 9 31
	<u> </u>	ļ	<u> </u>					1. 12.2	100				1		
	D	ļ					1.								4
50	A	10	10	0	20.0	20.5	40.0	8.8		89	8,50		800	1590	4693
	В	<u> </u>													10000
	C	 	 											(a)	
	D	-	 					- 0		Λο.					
100	Α	10	14	0	90.0	226	1000	8.8		9.0	8,50		8/i	2710	2920
	B		ļ												
	C	<u> </u>					25. 9							Part III	1000
T I 1 - 1	D	 	25.00	NB			KJL-	M. B		ピケレ	ив		180	2	Kol
Technician II	nitiais	ــــــــــــــــــــــــــــــــــــــ	res	LUD	UB	1~		IMP		1-30	шь		130	Rib	173 C
	Handaaa	*	Τ.	A Bom Dimits of	7			la idi	-1340		-17 1	.1	T -	.	
Conc.	Hardness		JL as C	Alkalinity*	1	Temp	(°C)	90.0	al WQ	A	djustme	111	ત્રેઇ	Adjusted	WQ
Control (MHW)	100		74		1	DO (m		8.8		Added	CUB		8.8		
Highest conc.	440)0]	pH	.v1	9,2		Added	COAS W	etmade			
-					-	ř –	(µS/cm)	T	5				271		
Sample Descrip	tion:	Clea						O Adj	isted to	PH 8	is with	h 0.1.m	HCl as	Fle dilud	ions were no
Comments:	Batch#:	AIP#O	7-d pre	vious # young/bro	od: 17		Day of	1st Bro	od: 8		Previo	us 7-d ⁹	% Morta	ality:Ò	
Reviewed by:		1	· 70	~	-	Da	ate rev			l				2011	

CETIS Analytical Report

Report Date:

24 Mar-11 16:43 (p 1 of 1)

11064 | 01-9925-2974

Daphnia magna 48-h Acute Survival Test

Test Code:

Maria Milana	E
Nautiius	Environmental

Analysis ID:	17-8561-1589	Endpoint:	Survival Rate	CETIS Version:	CETISv1.8.0
Analyzed:	24 Mar-11 16:32	Analysis:	Trimmed Spearman-Kärber	Official Results:	Yes

Batch ID:	00-6731-0545	Test Type:	Survival	Analyst:	andy diewald
Start Date:	01 Feb-11 14:00	Protocol:	EC/EPS 1/RM/14	Diluent:	
Ending Date:	03 Feb-11 15:05	Species:	Daphnia magna	Brine:	
Duration:	49h	Source:		Age:	

5	ample ID:	14-5936-7144	Code:	56FC2CE8	Client:	Hatfield

Mixture 1

Sample Date: 28 Jan-11	Material:	Effluent	Project:
Receive Date: 28 Jan-11	Source:	Hatfield	

Station:

Trimmed Spearman-Kärber Estimates

Sample Age: 4d 14h

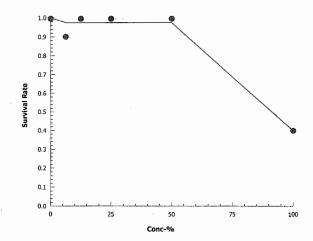
Threshold Option	Threshold	Trim	Mu	Sigma	EC50	95% LCL	95% UCL
Control Threshold	 0	40.00%	1.948	0.06715	88.64	65.06	120.8

Survival R	tate Summary				Cal	culated Varia	ate(A/B)				
Conc-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	Α	В
0	Negative Control	1	1	1	1	0	0	0.0%	0.0%	10	10
6.25		1	0.9	0.9	0.9	0	0	0.0%	10.0%	9	10
12.5		1	. 1	1	1	0	0	0.0%	0.0%	10	10
25		1	1	1	1	0	0	0.0%	0.0%	10	10
50		1	1	1	1	0	0	0.0%	0.0%	10	10
100		1	0.4	0.4	0.4	0 .	0	0.0%	60.0%	4	10

Survival Rate Detail

Conc-%	Control Type	Rep 1		
0	Negative Control	1		
6.25		0.9		
12.5		1		
25		1		
50		1		
100		0.4		

Graphics



Client: Work Order No.:	Hodpel &	Start Date/Time: Test Species: Set up by:	D.magna
Sample Information	1:		
Sample ID: Sample Date: Date Received: Sample Volume:	Mixture 2 Jan 28/11 Jan 28/11 Z-120	<u> </u>	
Test Organism Info	rmation:		
Broodstock No.: Age of young (Day 0 Avg No. young per b Mortality (%) in previ Days to first brood:	rood in previous 7 d:	011911 A < 24 hours 17 0	- - -
NaCl Reference To	kicant Results:		
Reference Toxicant I Stock Solution ID: Date Initiated: 48-h LC50 (95% CL)	10 N	66 n 21/11 (8) g/LNaCL	
Reference Toxicant (4,0(3.6-4.3) g/L Na	CL
Test Results:	The 48-h	Loso no estended @	> > 100 42 (V/U)
Reviewed by:	A. Tong	Date revi	ewed: <u>Mascl</u> 24, 2011

00 meter:	DO-1	1, 1799						organis Tes	st Orga	ınism:	D.ma	gna	14 . 0	> ayer (*	
	<u>DO-1</u>				nH i	meter:		pH-1	Set		Conduc	ctivity r		*	
			•												
Concentration	1	umber Organ		No. Immobilized	Tei	mpera (°C)	ture	1	lved o (mg/L)			pН			uctivity /cm)
% (v/v)		24	48	48	0	24	48	0	24	48	0	24	48	0	48
Control	Α	(0	10	0	30.0	125	20-0	8.7		89	80		8માં	359	406
	В					,					100		1	71	
	С														
	D														
6.25	Α	10	8	0	30.0	mo	20-0	8.7		9.0	8,3	V.	80	472	815
	В									- 4		8.9			
	С								4.5						
	D	ļ.,								Α		- 11			
12.5	A	IP	9	0	90'0	245	20-0	8.4		8-9	8,5		8-0	571	62L
	В	<u> </u>													100
	С					-			10			100			
	D										0				
25	A	10	9	0	ने0,0	W	20-6	8.8		₈ ,9	8.5°	100	8-5	781	844
	В		-	ļ		H									39.42
	C					100		3.0							
	D	<u> </u>	-	2	20.0	20/	900	0.0		४५	9.60		8-1	i - (1208
50	A	10	8	0	40.0	W	1000	8.8		0 1	850		0 (1126	1203
	B	 	 				Tarres.								1
	C		-			- 32									a de la compansión de l
100	+	10	q	0	20.0	120	20.0	8.8		9.0	8.50		81	1881	20490
100	A B	10	+ 1		au.u	140	40,0	8.0		100	8.2		8,	1001	
	C	<u> </u>	1					1		e a	100		j.		
	D						2 - 2					77 - TE.	i	en e	
Technician Ir		~	xis	KiB	KiB	~	KUL	MB		FJL	KIB		KSL	KLB	ksi
			1.6-0				- L	17					**	I.E.	
	Hardness	*		Alkalinity*	7			Initia	al WQ	Α	djustm	ent		Adjusted	wo
Conc.			g/L as C			Temp	(°Ć)	30						20.0	
Control (MHW)	100		70			DO (n		8.8						8.8	
Highest conc.	50		1	10	_	рН		9,3		added	only H	ci after		8.5	
						Cond	(µS/cm)	188	1	<u> </u>			<u> </u>	891	
Sample Descrip	tion:	Clea	./				① _A	justed.	to of	8,5 w	ith o	JMHC	l of	er dilu	ations were

Date reviewed:

Reviewed by:

Client: Work Order No.:	Hodfult 1004	Start Date/Time: Test Species: Set up by:	
Sample Information			_
Sample ID: Sample Date: Date Received: Sample Volume:	Mixhae 1 Jan 28/11 for 28/11 2 + 20	(duluked wif Prairie)	neck with)
Test Organism Info	rmation:		
Broodstock No.: Age of young (Day 0 Avg No. young per b Mortality (%) in previ Days to first brood:	rood in previous 7 d:	৩/12/1/A < 24 hours	
NaCl Reference Tox	cicant Results:		
Reference Toxicant Stock Solution ID: Date Initiated: 48-h LC50 (95% CL)	10 N	ン/リ イタ) g/LNaCL アイタ)	
Reference Toxicant (4,0 (3.6 - 4.3) g/L Nac	<u></u>
Test Results:	The 48-h	hiso is estanded e	7.1200/5(1/1)
Reviewed by:	1. tog	Date revie	ewed: <u>March</u> 24,2011

						•						_			
Client:	491	field	<u>'</u>					Star	t Date	/Time:		Wills	Feb	1 201	12133
Sample ID:	Hat mr	ture	16	4:1		•	No. C	Organi	sms/vo	olume:	10/2	200mZ			
Work Order No.:	:	11064						Te	st Orga	anism:	D.ma	gna			
	, .			e, rapig e stati	San g		a day d		Set	up by:			KL	<u> </u>	<u> </u>
DO meter:	DO-1		_		рН	meter:		pH-1		_ (Conduc	ctivity	meter:	C-1	
Concentration	l N	lumber	of	No.	Те	mpera	ture	Disso	olved c	xygen		pН		Cond	uctivity
0	Live Rep	Orgar	nisms	Immobilized		(°C)			(mg/L)				(µS	/cm)
% (v/v)		24	48	48	0	24	48	0	24	48	0	24	48	0	48
Control	Α	10	10	0	20.0	12°2	20-5	8.4		8-9			8,3	389569	598
	В	_	-				1000			Marie Marie	Kr	2		W.B	
	С	<u> </u>								Printing.		1			
	D	ļ									0 -				4.00
6.25	Α	10	3	0	90.0	205	200	8.9		9.0	8,3		8.3	704	747
	В	ļ			22.1				1557		R 1000 2000				1
	C	<u> </u>	-						100		10 de -	2.00		A STATE OF THE STA	
	D	-	4	2			0-				0.11		6 (1	0.27	COL
12.5	A	10	4	Ø	90.0	200	20.0	189		9.0	8,4		8-4	896	884
	В	.	ļ		3.96	Barryur.					Photos and				ar anathr
	C	-	<u> </u>		1,000	2753		1 mil			200			100 mm	
	D	 	-				705	D (1			~ ~		21	0	007
25	A	LO	4	מ	20,0	0,0	205	8.9	Georgia.	9.0	8.5		8-4	1119	1197
	B					1				777785		3627		-34-	2,000
	C	 				16983	5 (6) T		(House)		5.5	- 4		A series	
50		10	10	0	200		20.0	Qa	Patenyau Ale	Cal	8,5 ©		Q iL	1536	1628
50	В	+	1,0		90,0	200		0.,	2011 0000 2010 0000 2010 0000	1-1-1	8,>		0, (σε	.0 -2
<u> </u>	C	 			- 4		200200		- Alexandria - Alexandria - Alexandria		6.27 1. 1885				4
	T D	 	1		1.50		200								771.5
100	A	10	10	0	30.0	206	20.0	Qq		9-1	8,50		8-2	2710	2940
100	В		1		0,0	V.3		07			013			4,710	1000
	C					15.0000									
	D								-000		100				
Technician II	nitials	~	y LB	XIB	rub	~	*JL	riß		bes	rib	2 T	KLB	rib	KUB
	Hardness	<u></u>		Alkalinity*	7			Initia	al WQ	ΤΑ	.djustme	-nt		Adjusted '	wo
Conc.		*(m	g/L as Ca		1	Temp	(°C)	20,0			ajaoani		90		710
Control (MHW) 418	3	Sub	7	4224418		DO (m		8.9					8,9		
Highest conc.	4-		10	9 <i>O</i>		рН		4.3		added	oshallo os wo	enacle	8,5		
						Cond	(µS/cm)	2710	>				27	10	
Sample Descrip	tion:	_cl	ear									-			
Comments:	Batch#:	Oliziio	7-d pre	vious # young/bro	ood: 9 0)	Day of	1st Bro	ood: 9	•	Previo	us 7-d '	% Morta	ality: 💍	
Reviewed by:		A	16	Te		Da	ate rev	iewed:		Λ	laso	2	24.	2011	

Version 1.3 Issued November 26, 2008

(3) Adjusted of to 85 mits oil attel of diluters or rado

Client: Work Order No.:	Hodfuld 11064	Start Date/Time: Test Species: _ Set up by: _	D.magna KLB
Sample Information	1:		
Sample ID: Sample Date: Date Received: Sample Volume:	160 28/11 150 28/11 12 28/11 2 2021	(delated a) Pranie	Crack water)
Test Organism Info	rmation:		
Broodstock No.: Age of young (Day 0 Avg No. young per b Mortality (%) in previ Days to first brood:	rood in previous 7 d:	0/1211 A < 24 hours 20 0	
NaCl Reference Tox	kicant Results:		
Reference Toxicant I Stock Solution ID: Date Initiated: 48-h LC50 (95% CL)	10 Nac	21/11	vall
Reference Toxicant (- · · · · · · · · · · · · · · · · · · ·	4.0 (3.6-4.3) g/L NaC	<u>L</u>
Test Results:	7/2 86 h	LC50 us estinated	Q>100°/0 (J/J)
Reviewed by:	1. Torg	Date revie	wed: March 24,2011

Client: Sample ID: Work Order No.:	Hat Miz	ficid tune 1064	2 (F:()			No. C	Organia	t Date/ sms/vo st Orga Set	lume:	10/2 D.ma	200mL gna	Feb Feb KL		<u> </u>
DO meter:	DO-1				ı Hq	meter:		pH-1			Condu	ctivity r	neter:	C-1	
Concentration (1)		umber Organ	-	No. Immobilized	Ter	mperature (°C)		Dissolved oxy (mg/L)			gen pH				uctivity /cm)
% (v/v)		24	48	48	0	24	48	0	24	48	0	24	48	0	48
Control	Α	IP	10	Ð	න ර	105	20.5	8.9		89	808	2	7-3	38956	598
	В										, ic	16	į,	ALB	
	С														No.
	D								est 1						362 .1
6.25	Α	10	5	0	90.0	20,6	20-5	8.8		9.0	8,3	146	8-3	653	693
	В														
	С				1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		3								7 1303
	D						- 64				0 7	200		710	7776
12.5	A	10	6_	0	90.O	20/	20,0	8.4	4 22	9.1	8.3	475	8-4	414	774
	В										eles il			- 1	2 1 1 4
	C D					-	N L	4		*					
25	A	10	109	0	20.0	26	70.0	8,9	190	9.1	8,5		2.4	867	924
	В	(1)	KUE		3	20.	1	10,1	1 42	1 1	510	Section 1		VA4	
	С				e de la companya de l						- 100	10000			
	D					774	300	2.1	H40		1	1			140
50	A	10	16	0	കര	20/5	205	2,9		9.2	850	3.49	8-4	1186	1248
	В	- ;					102	i ki							14
	С				ű.				34		1				
	D									1 1		121	14		
100	Α	10	10	0	0.06	20	20.0	8.9	7. a	9.1	8,50		8.2	1867	2040
	В									1.	4 1			416	ant.
	С		ļ				1			B	1	7.5		1.00	
<u> </u>	D	_								4 1			Y		10.464
Technician In	itials		rie	<i>kib</i>	KiB	~	rib	rus		Kir	Kib		KUB	KLB	KiB
	Hardness	*		Alkalinity*	1			Initis	al WQ	Δ	djustme	ant .	Γ	Adjusted \	NO.
Conc.	larancoo		J/L as Ca		1	Temp	(°C)	30.0			ajustin	5110	20.0		NQ
Control (MH IVA) Jus	-10	03 %		Ļ 234	1	DO (m		8,9		,			8,9		
Highest conc.	50	00	11(]	рН		9,2		Added	oilm4cl ions wer	after enade	8.5		
						Cond	(µS/cm)	166	7				186	7	
Sample Descripti	ion:	<u>Cle</u>	ar_							_					·
Comments:	Batch#: (AISIK	7-d pre	vious # young/bro				1st Bro			Previo	us 7-d 9	% Morta	ılity: 🛆	
Reviewed by:		1.	6	8		Da	ate rev	iewed:	:	Má	scl	25	-29	4,20	U
Version 1.3 Iss	sued Nove	ember 2	6, 2008	82	(I) (D) A(A)	del justal	sted	ر د ه ه	Pres	re O	heek	Wale	Nautilu	s Environ	mental

Client:	Hed feld	_ Start Date/Time:	Ed 1	/110 1020h
Work Order No.:	71064	_ Test Species: Set up by:		kis
		Set up by.		
Sample Information	:			
Sample ID: Sample Date: Date Received: Sample Volume:	Mine Water Jan 28/11 for 28/11 V +222	- - -		
Test Organism Info	rmation:			
Broodstock No.:		21121 9		
Age of young (Day 0)): 	< 24 hours		
Avg No. young per b	rood in previous 7 d:	20		
Mortality (%) in previ	ous 7 d:	0		
Days to first brood:		9		
NaCl Reference Tox	kicant Results:			•
Reference Toxicant I	D: 3m 66			
Stock Solution ID:	10 Na0	ſ		
Date Initiated:	10-21	111		
48-h LC50 (95% CL)	4.26 3.7-4	g/LNaCL_		
Reference Toxicant (5 (3.6 - 4.3) g/L Nai	CL	
Test Results:	100 % ourm	I m the undelste	d 100 %	(4) 0 40h
Reviewed by:	1. Tong	Date revi	ewed: Ma	sch 24,2011

Client: Sample ID: Work Order No.:		Hat 2 M 10 11064	field ne w	ter		Start Date/Time: Feb\/II @ 10 20h No. Organisms/volume: 10/200mL Test Organism: D.magna Set up by: YUB										
DO meter:	DO-1	рΗι	meter: pH-1 Conductivity meter: C-1													
Concentration		umber Organ		No. Immobilized	Tei	mpera (°C)			lved o (mg/L)			pН		Conductivity (µS/cm)		
% (V/V)	l Veb	24	48	48	0	24	48	0	24	48	0	24	48	0	48	
Control	Α	10	10	0	_		20.5	_			8.0		8.1	359	405	
	В	10	10	Ô			-1-							200		
	С	10	10	0							metral er	1 200		-1000000		
	D						111111			***	June 3					
100	Α	19	10	0	20.0	26	19.5	8.6	1747	8.7	8.6		8.1	36000	41158	
	В	12	10	0		1 12				12.42	24,00					
	С	10	10	0			13					E STATE OF THE STA		100		
	D											44.		- 1969 - 1969 - 1969		
	Α								111.00000		Sign makes	124 111				
	В		ļ		15/14/65		-	Electricans	100							
	С														10.00	
	D													4.52		
	A				713											
	B C					- 1	= 0000kg			-	100 48 600 100				31000 2000 2000 2000	
	D								1	and Th			P.	194	Para Santa	
	A				2000				1114					186	A SALE SERVICE	
	В								5254			Marian.				
	c				6.2		198									
	D				1. 1			e de la company	427		Contract Contract	10000			Mill Transition	
	Α															
	В					100		e de la companya del companya de la companya del companya de la co		1000					Control of the contro	
	С										77.5			10.75	The Land	
	D													167	145	
Technician In	nitials	<u>~</u>	KB	KiB	rib	~	UB	rib		KLB	rib	W. Salah	XLB	rib	KLB	
			Т		7								1			
Conc.	Hardness		-// C	Alkalinity*	1	T	(%C)		I WQ	<u> </u>	djustme	ent	-	Adjusted	WQ	
Control (MHW)	100		g/L as Ca		1	Temp DO (n		8.6								
Highest conc.	550		86		1	pH	19/ L)	8.1	<u> </u>			_				
					_		(µS/cm)		5					-		
Sample Descript	ion:	_cle	ar													
Comments:	Batch#:	AIISIG	7-d pre	vious # young/bro	od: 30)	Day of	f 1st Bro	od: 9		Previo	us 7-d '	% Morta	ality: 💍		
Reviewed by:	Reviewed by:															

Client:_\	atfield	
W.O.#:	11064	

Hardness and Alkalinity Datasheet

			Alkalinity				Hardnes	s	
Sample ID	Sample Date	Sample Volume (mL)	(mL) 0.02N HCL/H₂SO₄ used to pH 4.5	(mL) of 0.02N HCL/H ₂ SO ₄ used to pH 4.2	Total Alkalinity (mg/LCaCO ₃)	Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness (mg/L CaCO ₃)	Technicia
Mixture (4:1)	Jan31/11	100	1.1	1,2	100	100	4,7	470	KIB
Mixtura (8:1)	Jan 31/11	100	1.3	1,3	110	100	5,0	500	KLB
Mine Water	Feb3/11	50	4.2	4.3	82	100	5.5	550	KCB
Prairie Creek Water	Jan 12/11	50	11.6	しかの	aay	50	15.0	300	KLB
:									
:									
	-								
		Notes:	ODiluked bolow	ome with DI	water				
Reviewed by:		1	tong		Date Review	ed:	March	24,20	Dl l

Attachment D

April 8, 2011 Toxicity Identification Evaluation (TIE)



Toxicity Identification Evaluation of Mill Water Sample

Final Report

Report date: April 8, 2011

Submitted to:

Hatfield Consultants

North Vancouver, BC

8664 Commerce Court Burnaby, BC V5A 4N7

TABLE OF CONTENTS

			Page
TAB	LE OF CO	ONTENTS	I
1.0	INTROI	DUCTION	1
2.0	METHC	DDS	1
3.0	RESULT	TS	3
4.0	DISCUS	SSION	5
5.0	REFERE	ENCES	6
		LIST OF TABLES	
Tabl	e 1.	Results of TIE treatments conducted on 10% Mill Water	4
Tabl	e 2.	Results of toxicity test conducted on Magnafloc 10.	4

1.0 INTRODUCTION

Toxicity tests conducted on two mixtures of Mine Water and Mill Water produced to reflect future anticipated conditions at the Canadian Zinc operation indicated that reproduction of the freshwater cladoceran, *Ceriodaphnia dubia*, was adversely affected by the mixtures. Conversely, rainbow trout and duckweed were not adversely affected in acute and chronic tests, respectively, and only a marginal adverse effect was apparent in one of the mixtures using acute tests with *Daphnia magna*. The results of these tests are provided in a separate test report.

Adverse effects on reproduction of *Ceriodaphnia* appeared to be derived from the Mill Water, since the degree of toxicity observed was related to the proportion of Mill Water in the samples, and the Mine Water tested alone exhibited no adverse effect on *Daphnia*. Consequently, efforts were undertaken to establish the cause of toxicity to *Ceriodaphnia* in the Mill Water using a Toxicity Identification Evaluation. This process involves conducting a series of physicochemical manipulations on the sample, following by toxicity tests on the treated and untreated samples. Alterations in the degree of toxicity present as a result of the treatments provides an indication of the characteristics of the contaminant that is responsible for toxicity in the sample. The actual identity of the toxicant can then be established through a series of follow-up procedures.

2.0 METHODS

The following treatments were conducted:

EDTA treatment – Chelation of the sample with EDTA was used to identify whether divalent metals, such as copper, cadmium and zinc, were responsible for toxicity. This chemical binds to divalent metals and reduces their bioavailability and, therefore, toxicity. Treatments were conducted at 5 mg/L EDTA.

C18 solid phase extraction – Treatment of the sample through a C18 substrate was utilized to identify whether toxicity was caused by a non-polar organic contaminant. This material binds and removes these materials and, therefore, if toxicity is reduced following treatment with C18, this indicates that organic contaminants are responsible for toxicity.

Anion Exchange – Extraction of the sample through a strong anion exchange column was used to establish whether strong anions were responsible for toxicity. This treatment is similar to the

C18 treatment, except that the substrate contains positively charged amine groups which have an affinity for anions in the sample. Anions that would be expected to be removed include anionic surfactants, but not major anions such as sulphate, carbonate or chloride.

Filtration – Filtration of the sample through a $0.45~\mu m$ filter was conducted to remove particulate-bound contaminants.

pH adjustment – Adjustment of the pH of a sample can alter the characteristics of the toxicant, resulting in an alteration in toxicity, or a change in the effectiveness of other TIE procedures. In this case, adjustment of the pH of the sample to 5 and 9 was used in conjunction with C18 and anion exchange in an attempt to establish whether the toxicant exhibited a higher affinity for these materials under different pH conditions. In addition, the sample was filtered after adjustment to pH 10, which would be expected to remove metals, such as zinc.

In order to evaluate the potential contribution to toxicity of a flocculent (Magnafloc 10) that was used in preparation of the sample, a sample of this chemical was obtained from SGS and evaluated for toxicity using *Ceriodaphnia*.

Test procedures used here were consistent with those typically applied for chronic tests using this species, with the exception that the degree of replication was reduced from 10 to 5. This stream-lining of the procedure is appropriate in Toxicity Identification Evaluations, where the purpose is to look for substantial changes in effect as a result of the treatments.

3.0 RESULTS

Initial treatments were conducted on the Mill Water sample diluted to 10%. None of the treatments (filtration, C18 extraction, anion exchange and EDTA) had an appreciable effect on toxicity to *Ceriodaphnia*, indicating that toxicity did not appear to be caused by particulate-bound contaminants, non-polar organic contaminants, strong anions, or divalent metals (Table 1).

These treatments were repeated using a sample diluted to 5% in case there had been too much toxicity present in the 10% sample for the treatments to be effective; however, the results of these treatments were not useful because the reproduction in the untreated sample diluted to 5% (21.2 \pm 1.8 offspring per adult) were not significantly lower than the control (22.8 \pm 2.9 offspring per adult). Thus, since the 5% sample did not exhibit toxicity, no information with respect to the cause of toxicity could be obtained from these treatments.

Adjusting the pH of the sample to 5 or 9 prior to treatment using C18 and anion exchange did not improve the effectiveness of these treatments at reducing toxicity in the 10% sample. Results of these treatments are also shown in Table 1. These results did not provide further indication as to the cause of toxicity, but are consistent with the initial findings described above.

The results described above are consistent with a number of contaminants, including charged or highly soluble organic contaminants, cations, total dissolved solids, and other chemicals. In order to establish whether one of the process chemicals used in preparation of the samples might have been responsible, the characteristics of the materials were reviewed and Magnafloc 10 was identified as being potentially consistent with the results, and of unknown toxicity to *Ceriodaphnia*. The results of a toxicity test conducted using this chemical are provided in Table 2; in general, this chemical resulted in no adverse effect on reproduction at 1.25 mg/L or less, but reduced reproduction was observed in the 2.5 and 5 mg/L solutions. Since the treatment rate of this material was 14 mg/L in the Mill Water, and most of the material would be expected to be removed during the treatment process, it appears unlikely that this was the cause of toxicity.

Table 1. Results of TIE treatments conducted on 10% Mill Water.

	Survival	Reproduction
	(%)	(offspring per adult)
Control	100	23.6 ± 5.2
Untreated	100	1.2 ± 1.8
Filtered sample	100	1.0 ± 1.4
C18-treated sample	100	0.6 ± 1.3
Anion Exchange-treated sample	100	2.6 ± 1.8
EDTA treated sample	100	0.0 ± 0.0
Control	100	18.0 ± 3.3
Untreated	100	0.0 ± 0.0
pH 5 + anion exchange	100	0.0 ± 0.0
pH 9 + anion exchange	100	0.0 ± 0.0
pH 5 + C18	100	0.0 ± 0.0
pH 9 + C18	100	0.0 ± 0.0
pH 10 + filtration	100	1.4 ± 1.9

Table 2. Results of toxicity test conducted on Magnafloc 10.

Mangafloc 10 (mg/L)	Survival	Reproduction
	(%)	(offspring per adult)
Control	100	21.8 ± 6.6
0.08	100	22.2 ± 10.1
0.16	100	25.0 ± 2.0
0.31	100	20.8 ± 4.2
0.62	100	20.8 ± 6.9
1.25	100	20.2 ± 4.3
2.5	100	14.0 ± 5.7
5.0	100	13.2 ± 2.7

4.0 DISCUSSION

The results of the TIE procedures described here were not conclusive in establishing the cause of toxicity in the Mill Water; however, the results indicate that non-polar organic contaminants, strong anions and divalent metals did not appear to be the primary cause of toxicity in the sample, although it should be noted that these materials may have contributed to toxicity at higher concentrations of sample.

The concentration of sulphate present in the Mill Water would most likely have contributed some portion of the adverse effect observed to *Ceriodaphnia*. For example, Elphick et al. (2011) reported an IC25 value for effects of sulphate for this species of 1212 mg/L sulphate at a hardness of 160 mg/L. Since the Mill Water contained 4500 mg/L sulphate, there was clearly sufficient sulphate present to cause some proportion of the observed effect. Total dissolved solids, in general, which includes sulphate and other major ions, such as calcium, magnesium, sodium, potassium, chloride and carbonate causes effects on this species when elevated as a result of osmotic stress, and so sulphate, or major ions in general, likely explains some of the observed effect. However, the sample diluted to 10% would likely not have contained sufficient major ions to explain the effect observed in the diluted sample.

The Mill Water exhibited toxicity to *Ceriodaphnia* in the sample diluted to 10%, but not when tested at 5%. This result differs somewhat from the initial tests using the Mixtures, in which toxicity was observed in all concentrations tested, as low as 5% sample. Since the Mixtures were comprised of only a portion of Mill Water, the adverse effect observed here with the Mill Water is not consistent with the extent of adverse effect observed in the mixtures. This implies that either: 1) the toxicity of the Mill Water dissipated in between when the original test was conducted and when the TIE treatments were performed; 2) other components of the mixtures (i.e., Mine Water) also contributed to toxicity in the mixtures; or 3) there was some interaction between components in the mixture that exacerbated toxicity. The most likely explanation would be that toxicity dissipated over time in the sample; however, additional investigation would be necessary to fully characterize and identify the cause of toxicity in this sample.

5.0 REFERENCES

Elphick, J.R., Davies, M. Gilron, G., Canaria, E.C., Lo, B. and Bailey, H.C. 2011a. An aquatic toxicological evaluation of sulphate: the case for considering hardness as a modifying factor in setting water quality guidelines. *Environ. Toxicol. Chem.* 30:247-253.