

Round ~~2~~ 1

Summary of *Ceriodaphnia dubia* water effect ratio results:

Range Finding

Test Water	Hardness (mg/L)	Cu LC50 (µg/L)	Normalized ¹ LC50 (µg/L)	WER based on normalized no's.
Cu-Spiked Miller Creek Site Water	44	70.711	79.762	16.016
Cu-Spiked Walker Creek Site Water	50	33.259	33.259	6.678
Cu-Spiked Des Moines Creek Site Water	60	88.087	74.184	14.896
Cu-Spiked Laboratory Water	96	9.208	4.980	n/a
Reference Toxicant (LC50) =		10.2 ppb CuSO ₄		

WER = Calculated water effect ratio

n/a = not applicable

¹ LC50 adjusted to a hardness of 50 mg/L

- 5-200 ppb.
- good control survival
- good dose-response.
- collected 2/22/99.

AR 024924

Results

Results of the range-finding water-effect ratio tests are presented in Table 2. Control responses and reference toxicant results were within acceptable ranges for all ten tests. All raw data sheets and statistical analyses are located in the project files at Parametrix.

Table 2. Summary of *Ceriodaphnia dubia* range-finding water-effect ratio for POS:

Test Water	Hardness (mg/L)	Cu LC50 (µg/L)	Normalized ¹ LC50 (µg/L)	WER
Cu-Spiked Miller Creek Site Water	44	70.711	79.762	16.016
Cu-Spiked Walker Creek Site Water	50	33.259	33.259	6.678
Cu-Spiked Des Moines Creek Site Water	60	88.087	74.184	14.896
Cu-Spiked Laboratory Water	96	9.208	4.980	n/a
Reference Toxicant (LC50) =			Acceptable	

WER = Calculated water effect ratio

n/a = not applicable

¹ LC50 adjusted to a hardness of 50 mg/L

In summary, given the results of the preliminary screening-level bioassays (Parametrix, 1999), and the WERs estimated based on nominal concentrations (6.7 – 16.0), we recommend pursuing a definitive WER and application of a site-specific water quality standard for copper.

REFERENCES

Parametrix, Inc. 1999. Water-effect ratio screening study at Seattle-Tacoma International Airport: Toxicity evaluation of site water. Prepared for the Port of Seattle, February 1999.

U.S. EPA. 1993. Methods for measuring the acute toxicity of effluents and receiving waters to freshwater and marine organisms. EPA/600/4-90/027F, August 1993. U.S. Environmental Protection Agency, Cincinnati, Ohio.

DRAFT MEMORANDUM

To: Port of Seattle project files April 20, 1999
From: Doug Henderson / Linda Logan 55-2912-01 (61)
Subject: Range-finding water-effect ratio results

This memorandum summarizes results of range-finding toxicity tests conducted as part of the water-effect ratio (WER) study for copper in streams receiving STIA stormwater. The range-finding tests are part two of preliminary tests being conducted prior to a definitive WER study (see attached flow chart). The tests are conducted using a range of copper concentrations spiked into lab water; as cost savings, no confirmatory analytical chemistry is performed. Previous screening-level bioassays conducted on receiving water samples indicated that the streams were not toxic to *Ceriodaphnia dubia*; these results are summarized in Parametrix (1999). This memorandum presents the results of water-effect ratio tests conducted on waters simulating the estimated edge of future mixing zones following the construction of the third runway.

Sampling

Samples were collected at four pre-determined locations during a qualifying storm event on the morning of 23 February 1999. This storm event started at 1600 on 21 February and ended at 2200 on 24 February 1999. The dry antecedent period preceding this storm was at least 24 hours. Approximately 1.87 inches of rain fell at STIA during this 78-hour storm. Rainfall intensity was still increasing throughout the three hour period the grab samples were collected. Information pertaining to the date, time, location and sampler at each location is recorded in field data logbooks located in project files at Parametrix.

Parametrix staff collected two-liter grab samples at 15-minute intervals over a three-hour period from three of the four sampling sites (Miller Creek, Walker Creek, and Des Moines Creek). Sampling staff approached sampling locations carefully to avoid stirring up sediment. Port of Seattle staff collected water at the fourth location (SDS3), with an ISCO sampler. Grab samples were proportionately composited into a 10-liter cubitainer based on flow estimates. Flow estimates were calculated by entering stage measurements from each location into the Manning or empirical stage-discharge equations. ISCO samplers automatically composite samples based on flow. Water levels (stage measurements) were recorded at each location for each 15-minute interval. Temperature and pH measurements were recorded at least once during the three-hour event at each location.

POS Range-finding memorandum

Draft
08/18/99

AR 024926

Quality assurance and quality control elements addressed during sample collection included:

- bottles labeled with the location and interval designation
- bottles rinsed three times with ambient water
- samples collected in new (or washed by the laboratory) HDPE bottles
- bottles inverted before being placed in water for rinses and grabs
- interval samples placed in a cooler with ice to maintain the samples at 4°C
- exact time of each sample collection recorded in field logs.

The samples were delivered to Parametrix's toxicology laboratory with completed chain-of-custody forms in sufficient time to meet the applicable holding times. Flow-weighted compositing of the samples was completed in the laboratory. Three site waters for toxicity testing were generated in the following manner:

1. SDS3 stormwater was mixed with Miller Creek water,
2. SDS3 stormwater was mixed Walker Creek water, and
3. Des Moines Creek was sampled below the outlet of the Northwest Ponds.

The Miller Creek and Walker Creek site waters were mixed with SDS3 stormwater in ratios anticipated for the new outfalls following construction of the third runway. The Des Moines Creek site water was not mixed with any outfall as it currently receives SDS3 effluent upstream of the sampling point. The synthetic laboratory water was prepared according to U.S. EPA (1993).

Analysis

The procedure for determining a WER involves using an indicator species to evaluate and quantify the toxicity and bioavailability of a compound in a particular site water compared to that in "clean" laboratory water. To accomplish this, the chemical of concern (in this case, copper) is spiked into both the clean laboratory water and site water at known concentrations. A median lethal concentration (LC50) is then determined for each water, and the two are compared to generate a WER:

$$\frac{\text{LC50 Site Water}}{\text{LC50 Laboratory Water}} = \text{WER}$$

The WER is then applied to the generic water quality standard to derive a site-specific standard:

$$\text{WER} * \text{Generic WQS} = \text{Site-specific WQS}$$

For example, if the water quality standard for a chemical is 3 µg/L, and a WER of 3 is derived for a particular site, the resulting site-specific water quality standard would be 9 µg/L.

Nominal copper test concentrations were prepared using a 50 mg/L copper stock solution made from copper sulfate pentahydrate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) (CAS#7758-99-8). Since these were preliminary tests, concentrations were not measured; thus the WERs were calculated using nominal test concentrations.

The toxicity tests were conducted according to *Short-term Methods for Estimating the Acute Toxicity of Effluents and Receiving Waters to Freshwater Organisms and Marine Organisms*. EPA/600/4-90/027F, August 1993. A summary of test conditions for the *C. dubia* toxicity tests is presented in Table 1.

POS Range-finding memorandum

Draft
08/18/99

AR 024928

Table 1. Summary of test conditions for the acute *Ceriodaphnia dubia* toxicity tests.

Job Name: Port of Seattle	Job Number: 55-2912-01 (61) Date: 23-25 February 1999
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Test Protocol:	<i>Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms</i> (Fourth Edition), EPA/600/4-90/027F, August 1993.
Test Material:	Copper-spiked site waters Copper-spiked synthetic laboratory water
Test Organisms/age:	<i>Ceriodaphnia dubia</i> ; ≤ 24 hrs old
Source:	In-house culture
Number/Test Chamber:	5
Volume/Test Chamber:	20 mL
Nominal Test Concentrations:	Site water: 0, 1.56, 3.13, 6.25, 12.5, 25, 50, 100, 150, and 200 $\mu\text{g/L}$ copper Synthetic laboratory water: 0, 1.25, 2.5, 5, 10, 20, and 40 $\mu\text{g/L}$ copper
Replicates:	Two
Reference Toxicant:	Copper sulfate
Test Duration:	48 hours
Control:	Unspiked synthetic laboratory water Unspiked site water
Test Chambers:	30 mL polypropylene beakers
Lighting:	Fluorescent bulbs (50-100 foot candles)
Photoperiod:	16 hours light; 8 hours dark
Aeration:	None
Feeding:	None
Temperature:	$20 \pm 1^\circ\text{C}$
Chemical Data:	Dissolved oxygen, temperature, and pH at test initiation and every 24 hours; specific conductivity at test initiation and termination; hardness, alkalinity, ammonia, and residual chlorine at test initiation for 100% site water sample; hardness and alkalinity for laboratory and site water
Effect Measured:	Mortality
Test Acceptability:	Control mortality $\leq 10\%$

Results

Results of the range-finding water-effect ratio tests are presented in Table 2. Control responses and reference toxicant results were within acceptable ranges for all ten tests. All raw data sheets and statistical analyses are located in the project files at Parametrix.

Table 2. Summary of *Ceriodaphnia dubia* range-finding water-effect ratio for POS:

Test Water	Hardness (mg/L)	Cu LC50 (µg/L)	Normalized ¹ LC50 (µg/L)	WER
Cu-Spiked Miller Creek Site Water	44	70.711	79.762	16.016
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Cu-Spiked Des Moines Creek Site Water	60	88.087	74.184	14.896
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Reference Toxicant (LC50) =			Acceptable	

WER = Calculated water effect ratio

n/a = not applicable

¹ LC50 adjusted to a hardness of 50 mg/L

In summary, given the results of the preliminary screening-level bioassays (Parametrix, 1999), and the WERs estimated based on nominal concentrations (6.7 – 16.0), we recommend pursuing a definitive WER and application of a site-specific water quality standard for copper.

REFERENCES

Parametrix, Inc. 1999. Water-effect ratio screening study at Seattle-Tacoma International Airport: Toxicity evaluation of site water. Prepared for the Port of Seattle, February 1999.

U.S. EPA. 1993. Methods for measuring the acute toxicity of effluents and receiving waters to freshwater and marine organisms. EPA/600/4-90/027F, August 1993. U.S. Environmental Protection Agency, Cincinnati, Ohio.

STATIC ACUTE *Ceriodaphnia dubia* TOXICITY TEST

Client Port of Seattle
 Sample Cu in Lab Water
 Test Dates 2/23/99 through 2/25/99

Sample Collection Date n/a
 Test Initiation Time 1630
 Source/Age of Organisms In House / <24 hours

Temp (°C) Day 0 20 Day 1 20 Day 2 20

Conc.	Rep.	Number of Organisms			pH			Dissolved Oxygen (mg/L)			Specific Conductivity (µS)	
		0	24	48	0	24	48	0	24	48	0	48
Control	A	5	5	4-1	8.2	8.3	8.3	8.4	9.0	8.6	330	378
	B	5	5	5								
1.25 µg/L	A	5	5	5	8.2	8.3	8.3	8.4	9.0	8.6	329	382
	B	5	5	5								
2.5 µg/L	A	5	5	5	8.2	8.3	8.3	8.4	9.0	8.6	328	386
	B	5	5	5								
5 µg/L	A	5	5	5	8.2	8.3	8.3	8.4	9.0	8.6	329	391
	B	5	5	5								
10 µg/L	A	5	5	2-3	8.2	8.3	8.3	8.4	9.0	8.7	329	373
	B	5	5	2-3								
20 µg/L	A	5	0-5	0	8.2	8.3	-	8.4	9.0	-	329	-
	B	5	0-5	0								
40 µg/L	A	5	0-5	0	8.2	8.3	-	8.4	9.0	-	329	-
	B	5	0-5	0								
	A											
	B											
	A											
	B											
	A											
	B											

Initials JHM BJB NM JHM BJB NM JHM BJB NM JHM JM
 Date 2/23 2/24 2/25 2/23 2/24 2/25 2/23 2/24 2/25 2/23 2/25

NT = Not Taken

Comments _____

Parametrix Toxicology Laboratory

WATER FLEA TEST DATA

Test Number: 2182 () Chronic (x) Acute 48 hours
 Test Date: 23-Feb-99
 Source: WA0024651 Test Material: CULW (µg/L)

Conc	Rep	Cont. No. Sex	Start	Daily Survival						Prop Alive	Total Young	Max Young
				1	2	3	4	5	6 End			
0.00 D	1	F	5		4						.80	
0.00 D	2	F	5		5						1.00	
1.25 D	1	F	5		5						1.00	
1.25 D	2	F	5		5						1.00	
2.50 D	1	F	5		5						1.00	
2.50 D	2	F	5		5						1.00	
5.00 D	1	F	5		5						1.00	
5.00 D	2	F	5		5						1.00	
10.00 D	1	F	5		2						.40	
10.00 D	2	F	5		1						.20	
20.00 D	1	F	5		0						0.00	
20.00 D	2	F	5		0						0.00	
40.00 D	1	F	5		0						0.00	
40.00 D	2	F	5		0						0.00	

PREPARED BY cat 2/26/99
 CHECKED BY JH 3/2/99

Parametrix Toxicology Laboratory

WATER FLEA TEST DATA

Test Number: 2182 () Chronic (x) Acute 48 hours
 Test Date: 23-Feb-99
 Source: WA0024651 Test Material: CULW (µg/L)

Conc	Rep	Cont.		Start	Daily Survival						Prop Alive	Total Young	Max Young
		No.	Sex		1	2	3	4	5	6			
0.00	D 1		F	5		4						.80	
0.00	D 2		F	5		5						1.00	
1.25	D 1		F	5		5						1.00	
1.25	D 2		F	5		5						1.00	
2.50	D 1		F	5		5						1.00	
2.50	D 2		F	5		5						1.00	
5.00	D 1		F	5		5						1.00	
5.00	D 2		F	5		5						1.00	
10.00	D 1		F	5		2						.40	
10.00	D 2		F	5		1						.20	
20.00	D 1		F	5		0						0.00	
20.00	D 2		F	5		0						0.00	
40.00	D 1		F	5		0						0.00	
40.00	D 2		F	5		0						0.00	

Parametrix Toxicology Laboratory

Test Date: 2/23/99
 Sample Date: 2/23/99
 Species: Ceriodaphnia dubia
 Test Type: Acute - 48 hours

Test Number: 2182
 Test Material: Copper Lab Water µg/L
 Source: WA0024651
 Port of Seattle

SUMMARY

End Point	Day	Transformation	Conc	#Reps	Mean	StDev	% Surv
Proportion Alive	2	Arc sine sqrt w/ adj.	X 0.000 D	2	1.23	.168	
			X 1.250 D	2	1.35	0.000	
			X 2.500 D	2	1.35	0.000	
			X 5.000 D	2	1.35	0.000	
			X 10.000 D	2	.57	.156	
			20.000 D	2	.23	0.000	
			40.000 D	2	.23	0.000	
Proportion Alive	2	No transformation	0.000 D	2	.90	.141	
			1.250 D	2	1.00	0.000	
			2.500 D	2	1.00	0.000	
			5.000 D	2	1.00	0.000	
			10.000 D	2	.30	.141	
			20.000 D	2	0.00	0.000	
			40.000 D	2	0.00	0.000	

X = indicates concentrations used in calculations

- HYPOTHESIS TEST -

End Point	Day	Transformation/Analysis	NOEC	LOEC	TU	MSE	MSD
Proportion Alive	2	Arc sine sqrt w/ adj. Dunnett + t-test				.008	

- PROPORTION POINT ESTIMATE -

End Point	Day	Method	P	Conc	95% CI	TU
Proportion Alive	2	Spearman-Kärber	EC 50	9.208	7.53 - 11.26	10.86

AR 024934

2/26/99-10:12 am

TOXIS ANALYSIS SUMMARY

Water Flea

Lab	Species	Test Date	Test Material	Permit	Protocol	Test Number
WAPTL	CD	2/23/99	CULW ($\mu\text{g/L}$)	WAO024651	EPAA 91	2182

Statistics Parameters

PROPORTION

End Point:	PA Proportion Alive	
Analysis:	EPA Flowchart (Chronic and Acute)	1 control
Transform:	Arc sine square root w/ Bartlett adj.	
Tail:	One-tailed, decreasing	
Constant:	-.01	Variance: .01
Root:	-1.00	Alpha Normality: .01
		NOEC: .05

EC/LC Method: F (P,S,G,L,N)

Superdunnet: 4000

GROWTH

End Point:	GR Reproduction	
Analysis:	No Analysis	
Transform:		
Tail:		
Constant:	.01	Variance: .01
Root:		Alpha Normality: .01
		NOEC: .05

Calculate IC? N (Y,N)

IC resamples: 120

Errors/Warnings

Type Number

EC	912	Chi-square test for heterogeneity significant - proceeding to Spearman Karber Analysis
EC/LC	0	Analysis completed with no errors
PROP	44	Not enough replication for Steel test

AR 024935

Spearman-Karber Analysis for EC/LC 50

Parametrix Toxicology Laboratory

Species: Ceriodaphnia dubia
Test Material: Copper Lab Water (μg)
Endpoint: Prop

Test Number: 2182
Test Date: 2/23/99

Conc	Number Exposed	Mortalities
0.00	10	1
1.25	10	0
2.50	10	0
5.00	10	0
10.00	10	7
20.00	10	10
40.00	10	10

Spearman-Karber EC/LC 50 estimate: 9.208
95% lower confidence: 7.532
95% upper confidence: 11.257

Untrimmed Spearman-Karber

2/26/99

TOXIS ANALYSIS SUMMARY

Ceriodaphnia		Proportion Alive				Day 2
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Lab	Species	Date	Test Material	Permit	Protocol	Test Number
WAPTL	CD	2/23/99	CULW ($\mu\text{g/L}$)	WA0024651	EPAA 91	2182

EPA Flowchart (Chronic and Acute)	1 control
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Transformation		Conc	Mean	SD	N
Arc sine sqrt w/ adj.	X	0.00D	1.23	.168	2
	X	1.25D	1.35	0.000	2
	X	2.50D	1.35	0.000	2
	X	5.00D	1.35	0.000	2
	X	10.00D	.57	.156	2
		20.00D	.23	0.000	2
		40.00D	.23	0.000	2
	No transformation		0.00D	.90	.141
		1.25D	1.00	0.000	2
		2.50D	1.00	0.000	2
		5.00D	1.00	0.000	2
		10.00D	.30	.141	2
		20.00D	0.00	0.000	2
		40.00D	0.00	0.000	2

Error occurred during statistics:

Not enough replication for Steel test

STATIC ACUTE *Ceriodaphnia dubia* TOXICITY TEST

Client Port of Seattle
 Sample Cu in Miller Creek Site Water
 Test Dates 2/23/99 through 2/25/99

Sample Collection Date 2/22/99
 Test Initiation Time 1:45
 Source/Age of Organisms In House / <24 hours

Temp (°C) Day 0 20 Day 1 20 Day 2 20

Conc.	Rep.	Number of Organisms			pH			Dissolved Oxygen (mg/L)			Specific Conductivity (µS)	
		0	24	48	0	24	48	0	24	48	0	48
Control	A	5	5	5	7.1	8.0	8.0	9.0	8.5	8.5	111	115
	B	5	5	5								
1.5625 µg/L	A	5	5	5	7.1	8.0	8.0	9.0	8.4	8.5	111	130
	B	5	5	5								
3.125 µg/L	A	5	5	5	7.1	8.0	8.0	9.0	8.4	8.5	111	137(1)
	B	5	5	5								
6.25 µg/L	A	5	5	5	7.1	8.0	8.1	9.1	8.4	8.5	111	124
	B	5	5	5								
12.5 µg/L	A	5	5	5	7.1	8.0	8.1	9.1	8.5	8.5	111	128
	B	5	5	5								
25 µg/L	A	5	5	5	7.1	8.0	8.1	9.1	8.5	8.5	111	117
	B	5	5	5								
50 µg/L	A	5	5	5	7.0	7.9	8.1	9.1	8.4	8.5	111	119
	B	5	5	5								
100 µg/L	A	5	3-2	0-3	7.0	7.9	8.0	9.1	8.4	8.5	111	121
	B	5	2-3	0-2								
150 µg/L	A	5	0-5	0	6.9	8.0	8.0	9.2	8.5	8.6	111	123
	B	5	0-5	0								
200 µg/L	A	5	0-5	0	6.9	8.0	8.0	9.2	8.6	8.6	111	117
	B	5	0-5	0								
Initials		THM	YHM	gm	NM	YHM	gm	NM	YHM	gm	NM	gm
Date		2/23	2/24	2/25	2/23	2/24	2/25	2/23	2/24	2/25	2/23	2/25

NT = Not Taken

Comments (1) DC gm showed read: 127 2/25/99

WATER FLEA TEST DATA

Test Number: 2183 () Chronic (x) Acute 48 hours
 Test Date: 23-Feb-99
 Source: WA0024651 Test Material: CUSW (µg/L)

Conc	Rep	Cont. No. Sex	Start	Daily Survival						Prop Alive	Total Young	Max Young
				1	2	3	4	5	6			
0.00 D	1	F	5	5							1.00	
0.00 D	2	F	5	5							1.00	
1.56 D	1	F	5	5							1.00	
1.56 D	2	F	5	5							1.00	
3.13 D	1	F	5	5							1.00	
3.13 D	2	F	5	5							1.00	
6.25 D	1	F	5	5							1.00	
6.25 D	2	F	5	5							1.00	
12.50 D	1	F	5	5							1.00	
12.50 D	2	F	5	5							1.00	
25.00 D	1	F	5	5							1.00	
25.00 D	2	F	5	5							1.00	
50.00 D	1	F	5	5							1.00	
50.00 D	2	F	5	5							1.00	
100.00 D	1	F	5	0							0.00	
100.00 D	2	F	5	0							0.00	
150.00 D	1	F	5	0							0.00	
150.00 D	2	F	5	0							0.00	
200.00 D	1	F	5	0							0.00	
200.00 D	2	F	5	0							0.00	

PREPARED BY Cent 2/26/99
 CHECKED BY DH 3/2/99

Parametrix Toxicology Laboratory

WATER FLEA TEST DATA

Test Number: 2183

() Chronic (X) Acute 48 hours

Test Date: 23-Feb-99

Source: WA0024651

Test Material: CUSW (µg/L)

Conc	Rep	Cont. No. Sex	Start	Daily Survival						Prop Alive	Total Young	Max Young
				1	2	3	4	5	6			
0.00 D	1	F	5	5						1.00		
0.00 D	2	F	5	5						1.00		
1.56 D	1	F	5	5						1.00		
1.56 D	2	F	5	5						1.00		
3.13 D	1	F	5	5						1.00		
3.13 D	2	F	5	5						1.00		
6.25 D	1	F	5	5						1.00		
6.25 D	2	F	5	5						1.00		
12.50 D	1	F	5	5						1.00		
12.50 D	2	F	5	5						1.00		
25.00 D	1	F	5	5						1.00		
25.00 D	2	F	5	5						1.00		
50.00 D	1	F	5	5						1.00		
50.00 D	2	F	5	5						1.00		
100.00 D	1	F	5	0						0.00		
100.00 D	2	F	5	0						0.00		
150.00 D	1	F	5	0						0.00		
150.00 D	2	F	5	0						0.00		
200.00 D	1	F	5	0						0.00		
200.00 D	2	F	5	0						0.00		

Parametrix Toxicology Laboratory

Test Date: 2/23/99
 Sample Date: 2/23/99
 Species: Ceriodaphnia dubia
 Test Type: Acute - 48 hours

Test Number: 2183
 Test Material: Copper Site Water #g/L
 Source: WA0024651
 Port of Seattle

SUMMARY							
End Point	Day	Transformation	Conc	#Reps	Mean	StDev	% Surv
Proportion Alive	2	Arc sine sqrt w/ adj.	X 0.000 D	2	1.35	0.000	
			X 1.563 D	2	1.35	0.000	
			X 3.125 D	2	1.35	0.000	
			X 6.250 D	2	1.35	0.000	
			X 12.500 D	2	1.35	0.000	
			X 25.000 D	2	1.35	0.000	
			X 50.000 D	2	1.35	0.000	
			100.000 D	2	.23	0.000	
			150.000 D	2	.23	0.000	
			200.000 D	2	.23	0.000	
Proportion Alive	2	No transformation	0.000 D	2	1.00	0.000	
			1.563 D	2	1.00	0.000	
			3.125 D	2	1.00	0.000	
			6.250 D	2	1.00	0.000	
			12.500 D	2	1.00	0.000	
			25.000 D	2	1.00	0.000	
			50.000 D	2	1.00	0.000	
			100.000 D	2	0.00	0.000	
			150.000 D	2	0.00	0.000	
			200.000 D	2	0.00	0.000	

X = indicates concentrations used in calculations

- HYPOTHESIS TEST -							
End Point	Day	Transformation/Analysis	NOEC	LOEC	TU	MSE	MSD
Proportion Alive	2	Arc sine sqrt w/ adj. Dunnett + t-test					

- PROPORTION POINT ESTIMATE -						
End Point	Day	Method	P	Conc	95% CI	TU
Proportion Alive	2	Graphical Interpolation	EC 50	70.711	-	1.41

2/26/99-10:14 am

TOXIS ANALYSIS SUMMARY

Water Flea

Lab	Species	Test Date	Test Material	Permit	Protocol	Test Number
WAPTL	CD	2/23/99	CUSW ($\mu\text{g/L}$)	WA0024651	EPAA 91	2183

Statistics Parameters

PROPORTION

End Point: PA Proportion Alive
 Analysis: EPA Flowchart (Chronic and Acute) 1 control
 Transform: Arc sine square root w/ Bartlett adj.
 Tail: One-tailed, decreasing
 Constant: -.01 Variance: .01
 Root: -1.00 Alpha Normality: .01
 NOEC: .05

EC/LC Method: F (P,S,G,L,N) Superdunnet: 4000

GROWTH

End Point: GR Reproduction
 Analysis: No Analysis
 Transform:
 Tail:
 Constant: .01 Variance: .01
 Root: Alpha Normality: .01
 NOEC: .05

Calculate IC? N (Y,N) IG resamples: 120

Errors/Warnings

Type Number

EC/LC 0 Analysis completed with no errors

PROP 40 No variation in the data

Graphical Interpolation Analysis For EC/LC

Parametrix Toxicology Laboratory

Species: Ceriodaphnia dubia
 Test Material: Copper Site Water ($\mu\text{g/L}$)
 Endpoint: Prop

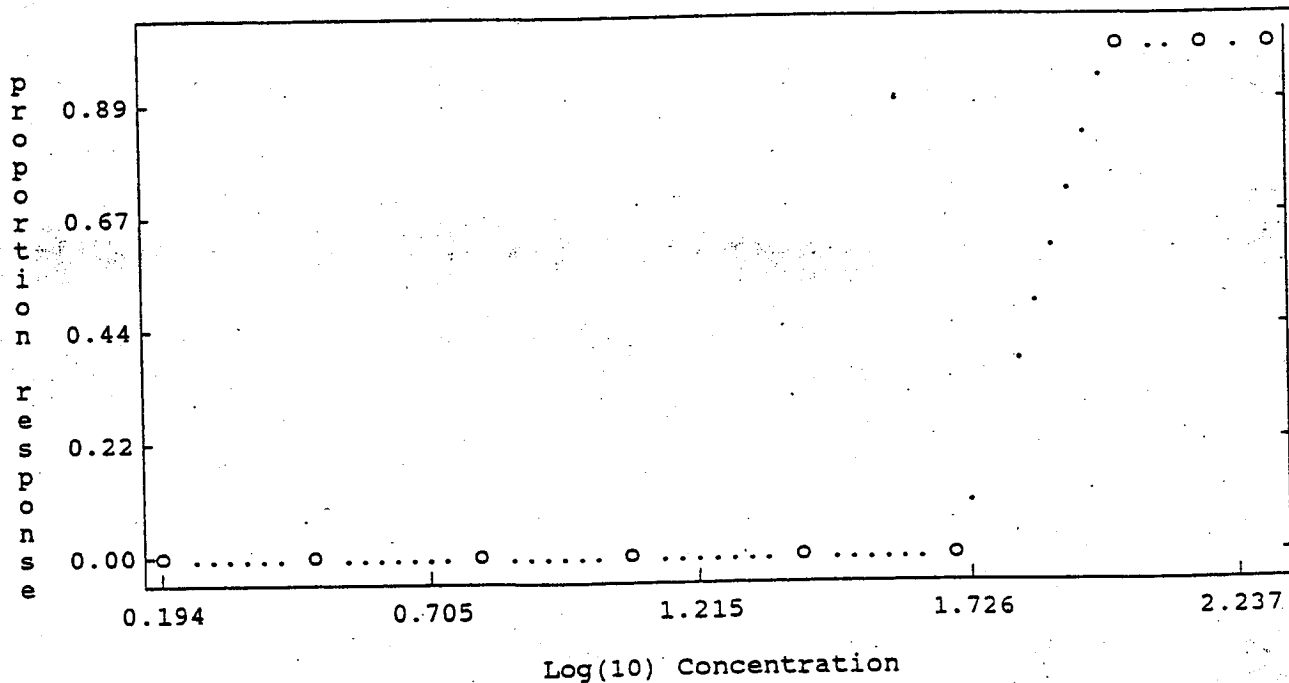
Test Number: 2183
 Test Date: 2/23/99

Concentration	Mean	Pooled Mean	Proportion Response
0.0000	0.0000	0.0000	
1.5625	0.0000	0.0000	0.0000
3.1250	0.0000	0.0000	0.0000
6.2500	0.0000	0.0000	0.0000
12.5000	0.0000	0.0000	0.0000
25.0000	0.0000	0.0000	0.0000
50.0000	0.0000	0.0000	0.0000
100.0000	1.0000	1.0000	1.0000
150.0000	1.0000	1.0000	1.0000
200.0000	1.0000	1.0000	1.0000

Note: Quantal data were input.

Note: Proportion response computed by applying Abbott's formula to the pooled means.

P Value	Estimated Concentration
100	70.7107



2/26/99

TOXIS ANALYSIS SUMMARY

Ceriodaphnia				Proportion Alive		Day 2
--------------	--	--	--	------------------	--	-------

Lab	Species	Date	Test Material	Permit	Protocol	Test Number
WAPTL	CD	2/23/99	CUSW (µg/L)	WA0024651	EPAA 91	2183

EPA Flowchart (Chronic and Acute)	1 control
-----------------------------------	-----------

Transformation		Conc	Mean	SD	N
Arc sine sqrt w/ adj.	X	0.00D	1.35	0.000	2
	X	1.56D	1.35	0.000	2
	X	3.13D	1.35	0.000	2
	X	6.25D	1.35	0.000	2
	X	12.50D	1.35	0.000	2
	X	25.00D	1.35	0.000	2
	X	50.00D	1.35	0.000	2
		100.00D	.23	0.000	2
		150.00D	.23	0.000	2
		200.00D	.23	0.000	2
No transformation		0.00D	1.00	0.000	2
		1.56D	1.00	0.000	2
		3.13D	1.00	0.000	2
		6.25D	1.00	0.000	2
		12.50D	1.00	0.000	2
		25.00D	1.00	0.000	2
		50.00D	1.00	0.000	2
		100.00D	0.00	0.000	2
		150.00D	0.00	0.000	2
		200.00D	0.00	0.000	2

Error occurred during statistics:

No variation in the data

AR 024944

STATIC ACUTE *Ceriodaphnia dubia* TOXICITY TEST

Client Port of Seattle
 Sample Cu in Walker Creek Site Water
 Test Dates 2/23/99 through 2/25/99

Sample Collection Date 2/22/99
 Test Initiation Time 1650
 Source/Age of Organisms In House / <24 hours

Temp (°C) Day 0 20 Day 1 20 Day 2 20

Conc.	Rep.	Number of Organisms			pH			Dissolved Oxygen (mg/L)			Specific Conductivity (µS)	
		0	24	48	0	24	48	0	24	48	0	48
Control	A	5	5	5	7.1	8.1	7.9	8.9	8.4	8.4	79	82
	B	5	5	5								
1.5625 µg/L	A	5	5	5	7.1	8.0	7.9	8.9	8.5	8.4	79	87
	B	5	5	5								
3.125 µg/L	A	5	5	5	7.1	8.0	7.8	8.9	8.4	8.5	78	87
	B	5	5	5								
6.25 µg/L	A	5	5	4-1	7.1	7.9	7.8	8.9	8.5	8.5	79	87
	B	5	5	5								
12.5 µg/L	A	5	5	5	7.1	7.9	7.8	8.9	8.5	8.5	79	85
	B	5	5	5								
25 µg/L	A	5	3-2	3	7.1	7.9	7.8	8.9	8.5	8.5	79	86
	B	5	5	5								
50 µg/L	A	5	4-1	1-3	7.1	7.9	7.8	8.9	8.6	8.6	79	85
	B	5	2-3	2								
100 µg/L	A	5	0-5	0	7.1	7.9	-	8.9	8.6	-	79	-
	B	5	0-5	0								
150 µg/L	A	5	0-5	0	7.0	7.9	-	9.0	8.6	-	79	-
	B	5	0-5	0								
200 µg/L	A	5	0-5	0	7.0	7.9	-	9.0	8.6	-	79	-
	B	5	0-5	0								

Initials FAM 2/23 2/24 2/25 2/23 2/24 2/25 2/23 2/24 2/25 2/23 2/25
 Date 2/23 2/24 2/25 2/23 2/24 2/25 2/23 2/24 2/25 2/23 2/25

NT = Not Taken

Comments _____

Parametrix Toxicology Laboratory

WATER FLEA TEST DATA

Test Number: 2184

() Chronic (x) Acute 48 hours

Test Date: 23-Feb-99

Source: WA0024651

Test Material: CUSW (µg/L)

Conc	Rep	Cont. No. Sex	Start	Daily Survival						Prop Alive	Total Young	Max Young
				1	2	3	4	5	6 End			
0.00 D	1	F	5	5						1.00		
0.00 D	2	F	5	5						1.00		
1.56 D	1	F	5	5						1.00		
1.56 D	2	F	5	5						1.00		
3.13 D	1	F	5	5						1.00		
3.13 D	2	F	5	5						1.00		
6.25 D	1	F	5	4						.80		
6.25 D	2	F	5	5						1.00		
12.50 D	1	F	5	5						1.00		
12.50 D	2	F	5	5						1.00		
25.00 D	1	F	5	3						.60		
25.00 D	2	F	5	5						1.00		
50.00 D	1	F	5	1						.20		
50.00 D	2	F	5	2						.40		
100.00 D	1	F	5	0						0.00		
100.00 D	2	F	5	0						0.00		
150.00 D	1	F	5	0						0.00		
150.00 D	2	F	5	0						0.00		
200.00 D	1	F	5	0						0.00		
200.00 D	2	F	5	0						0.00		

PREPARED BY cat 2/26/99

CHECKED BY JH 3/2/99

Parametrix Toxicology Laboratory

WATER FLEA TEST DATA

Test Number: 2184 () Chronic (x) Acute 48 hours
 Test Date: 23-Feb-99
 Source: WA0024651 Test Material: CUSW (µg/L)

Conc	Rep	Cont. No. Sex	Start	Daily Survival						Prop Alive	Total Young	Max Young
				1	2	3	4	5	6 End			
0.00 D	1	F	5	5						1.00		
0.00 D	2	F	5	5						1.00		
1.56 D	1	F	5	5						1.00		
1.56 D	2	F	5	5						1.00		
3.13 D	1	F	5	5						1.00		
3.13 D	2	F	5	5						1.00		
6.25 D	1	F	5	5	4					.80		
6.25 D	2	F	5	5	5					1.00		
12.50 D	1	F	5	5	5					1.00		
12.50 D	2	F	5	5	5					1.00		
25.00 D	1	F	5	5	3					.60		
25.00 D	2	F	5	5	5					1.00		
50.00 D	1	F	5	5	1					.20		
50.00 D	2	F	5	5	2					.40		
100.00 D	1	F	5	5	0					0.00		
100.00 D	2	F	5	5	0					0.00		
150.00 D	1	F	5	5	0					0.00		
150.00 D	2	F	5	5	0					0.00		
200.00 D	1	F	5	5	0					0.00		
200.00 D	2	F	5	5	0					0.00		

Parametrix Toxicology Laboratory

Test Date: 2/23/99
 Sample Date: 2/23/99
 Species: Ceriodaphnia dubia
 Test Type: Acute - 48 hours

Test Number: 2184
 Test Material: Copper Site Water #9/L
 Source: WA0024651
 Port of Seattle

SUMMARY

End Point	Day	Transformation	Conc	#Reps	Mean	StDev	% Surv	
Proportion Alive	2	Arc sine sqrt w/ adj.	X	0.000 D	2	1.35	0.000	
			X	1.563 D	2	1.35	0.000	
			X	3.125 D	2	1.35	0.000	
			X	6.250 D	2	1.23	.168	
			X	12.500 D	2	1.35	0.000	
			X	25.000 D	2	1.12	.325	
			X	50.000 D	2	.57	.156	
			X	100.000 D	2	.23	0.000	
			X	150.000 D	2	.23	0.000	
			X	200.000 D	2	.23	0.000	
			Proportion Alive	2	No transformation	X	0.000 D	2
X	1.563 D	2				1.00	0.000	
X	3.125 D	2				1.00	0.000	
X	6.250 D	2				.90	.141	
X	12.500 D	2				1.00	0.000	
X	25.000 D	2				.80	.283	
X	50.000 D	2				.30	.141	
X	100.000 D	2				0.00	0.000	
X	150.000 D	2				0.00	0.000	
X	200.000 D	2				0.00	0.000	

X = indicates concentrations used in calculations

- HYPOTHESIS TEST -

End Point	Day	Transformation/Analysis	NOEC	LOEC	TU	MSE	MSD
Proportion Alive	2	Arc sine sqrt w/ adj. Dunnnett + t-test				.016	

- PROPORTION POINT ESTIMATE -

End Point	Day	Method	P	Conc	95% CI	TU
Proportion Alive	2	Probit	EC 50	33.259	23.40 - 46.10	3.01

2/26/99-10:19 am

TOXIS ANALYSIS SUMMARY

Water Flea

Lab	Species	Test Date	Test Material	Permit	Protocol	Test Number
WAPTL	CD	2/23/99	CUSW ($\mu\text{g/L}$)	WA0024651	EPAA 91	2184

Statistics Parameters

PROPORTION

End Point:	PA Proportion Alive	
Analysis:	EPA Flowchart (Chronic and Acute)	1 control
Transform:	Arc sine square root w/ Bartlett adj.	
Tail:	One-tailed, decreasing	
Constant:	-.01	Variance: .01
Root:	-1.00	Alpha Normality: .01
		NOEC: .05

EC/LC Method: F (P,S,G,L,N)

Superdunnet: 4000

GROWTH

End Point:	GR Reproduction	
Analysis:	No Analysis	
Transform:		
Tail:		
Constant:	.01	Variance: .01
Root:		Alpha Normality: .01
		NOEC: .05

Calculate IC? N (Y,N)

IC resamples: 120

Errors/Warnings

Type Number

EC/LC 0 Analysis completed with no errors

PROP 44 Not enough replication for Steel test

Probit Analysis For EC/LC

Parametrix Toxicology Laboratory

Species: Ceriodaphnia dubia
 Test Material: Copper Site Water ($\mu\text{g/L}$)
 Endpoint: Prop

Test Number: 2184
 Test Date: 2/23/99

Conc.	Number Exposed	Number Resp.	Observed Proportion Responding	Proportion Responding Adjusted for Controls	Predicted Proportion Responding
1.5625	10	0	0.0000	0.0000	0.0000
3.1250	10	0	0.0000	0.0000	0.0003
6.2500	10	1	0.1000	0.1000	0.0080
12.5000	10	0	0.0000	0.0000	0.0791
25.0000	10	2	0.2000	0.2000	0.3403
50.0000	10	7	0.7000	0.7000	0.7217
100.0000	10	10	1.0000	1.0000	0.9438
150.0000	10	10	1.0000	1.0000	0.9851
200.0000	10	10	1.0000	1.0000	0.9952

Chi-square for heterogeneity (calculated) = 13.279
 Probability(Chi-square > 13.279) = 0.06560

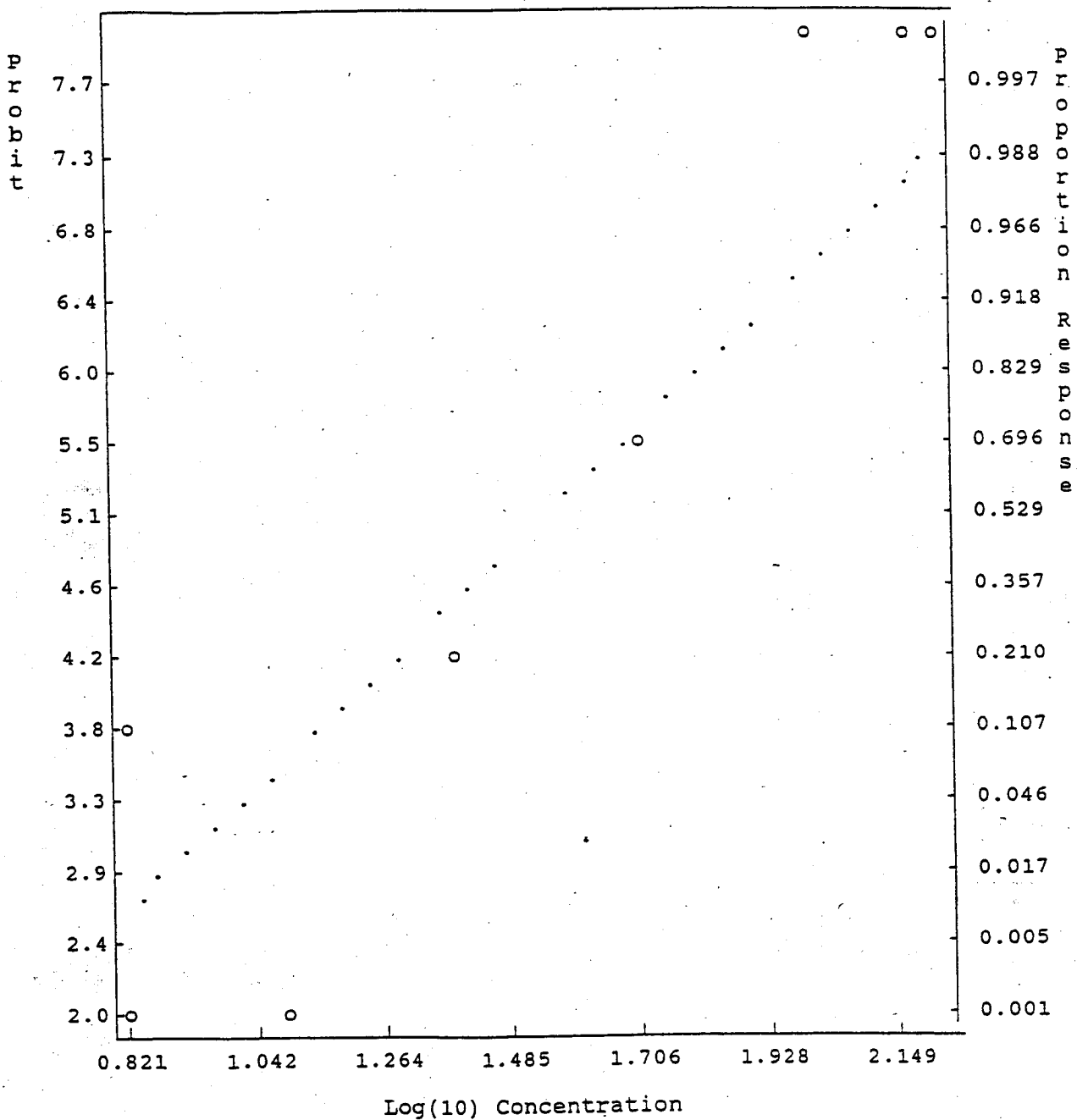
Parameter	Estimate	Std. Err.	95% Confidence Limits	
			Lower	Upper
Intercept	-0.052987	1.035378	-2.082328	1.976354
Slope	3.320171	0.649817	2.046529	4.593813

Theoretical spontaneous response rate = 0.0000

Estimated LC/EC values

Point	Exposure Conc.	95% Confidence Limits	
		Lower	Upper
50.00	33.259	23.395	46.099

Plot of adjusted probits and predicted regression line



2/26/99

TOXIS ANALYSIS SUMMARY

Ceriodaphnia		Proportion Alive			Day 2
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Lab	Species	Date	Test Material	Permit	Protocol	Test Number
WAPTL	CD	2/23/99	CUSW ($\mu\text{g/L}$)	WA0024651	EPAA 91	2184

EPA Flowchart (Chronic and Acute)	1 control
-----------------------------------	-----------

Transformation		Conc	Mean	SD	N
Arc sine sqrt w/ adj.	X	0.00D	1.35	0.000	2
	X	1.56D	1.35	0.000	2
	X	3.13D	1.35	0.000	2
	X	6.25D	1.23	.168	2
	X	12.50D	1.35	0.000	2
	X	25.00D	1.12	.325	2
	X	50.00D	.57	.156	2
		100.00D	.23	0.000	2
		150.00D	.23	0.000	2
		200.00D	.23	0.000	2
No transformation		0.00D	1.00	0.000	2
		1.56D	1.00	0.000	2
		3.13D	1.00	0.000	2
		6.25D	.90	.141	2
		12.50D	1.00	0.000	2
		25.00D	.80	.283	2
		50.00D	.30	.141	2
		100.00D	0.00	0.000	2
		150.00D	0.00	0.000	2
		200.00D	0.00	0.000	2

Error occurred during statistics:

Not enough replication for Steel test

STATIC ACUTE *Ceriodaphnia dubia* TOXICITY TEST

Client Port of Seattle Sample Collection Date 2/22/99
 Sample Cu in Des Moines Creek Site Water Test Initiation Time 16:00
 Test Dates 2/23/99 through 2/25/99 Source/Age of Organisms In House / <24 hours

Temp (°C) Day 0 20 Day 1 20 Day 2 20

Conc.	Rep.	Number of Organisms			pH			Dissolved Oxygen (mg/L)			Specific Conductivity (µS)	
		0	24	48	0	24	48	0	24	48	0	48
Control	A	5	5	5	7.2	8.2	8.2	9.1	8.9	8.8	142	149
	B	5	5	5								
1.5625 µg/L	A	5	5	5	7.3	8.2	8.2	9.1	8.9	8.8	142	152
	B	5	5	5								
3.125 µg/L	A	5	5	5	7.3	8.2	8.2	9.1	9.0	8.9	141	155
	B	5	5	5								
6.25 µg/L	A	5	5	5	7.2	8.2	8.2	9.1	9.0	8.9	141	159
	B	5	5	5								
12.5 µg/L	A	5	5	5	7.2	8.2	8.2	9.1	9.1	8.9	141	156
	B	5	5	5								
25 µg/L	A	5	5	5	7.2	8.2	8.2	9.1	9.1	8.9	141	160
	B	5	5	5								
50 µg/L	A	5	5	5	7.2	8.2	8.2	9.1	9.2	8.9	141	158
	B	5	5	5								
100 µg/L	A	5	2-3	2	7.2	8.2	8.2	9.1	9.1	8.9	141	158
	B	5	4-1	2-2								
150 µg/L	A	5	0-5	0	7.3	8.2	8.2	9.1	9.1	8.9	141	160
	B	5	1-5	0								
200 µg/L	A	5	0-5	0	7.2	8.2	8.2	9.1	9.1	8.9	141	152
	B	5	0-5	0								

Initials: JHM JHM NM JHM JHM NM JHM JHM NM JHM NM
 Date: 2/23 2/24 2/25 2/23 2/24 2/25 2/23 2/24 2/25 2/23 2/25

Shading represents areas for which data collection is not required.
 NT = Not Taken

Comments _____

Parametrix Toxicology Laboratory

WATER FLEA TEST DATA

Test Number: 2185

() Chronic (x) Acute 48 hours

Test Date: 23-Feb-99

Source: WA0024651

Test Material: CUSW (µg/L)

Conc	Rep	Cont. No. Sex	Start	Daily Survival						Prop Alive	Total Young	Max Young
				1	2	3	4	5	6			
0.00 D	1	F	5		5					1.00		
0.00 D	2	F	5		5					1.00		
1.56 D	1	F	5		5					1.00		
1.56 D	2	F	5		5					1.00		
3.13 D	1	F	5		5					1.00		
3.13 D	2	F	5		5					1.00		
6.25 D	1	F	5		5					1.00		
6.25 D	2	F	5		5					1.00		
12.50 D	1	F	5		5					1.00		
12.50 D	2	F	5		5					1.00		
25.00 D	1	F	5		5					1.00		
25.00 D	2	F	5		5					1.00		
50.00 D	1	F	5		5					1.00		
50.00 D	2	F	5		5					1.00		
100.00 D	1	F	5		5		2			.40		
100.00 D	2	F	5		5		2			.40		
150.00 D	1	F	5		5		0			0.00		
150.00 D	2	F	5		5		0			0.00		
200.00 D	1	F	5		5		0			0.00		
200.00 D	2	F	5		5		0			0.00		

PREPARED BY cat 2/26/99
 CHECKED BY [Signature] 3/2/99

Parametrix Toxicology Laboratory

WATER FLEA TEST DATA

Test Number: 2185

() Chronic (x) Acute 48 hours

Test Date: 23-Feb-99

Source: WA0024651

Test Material: CUSW (µg/L)

Conc	Rep	Cont.		Start	Daily Survival						Prop Alive	Total Young	Max Young	
		No.	Sex		1	2	3	4	5	6				End
0.00 D	1		F	5		5						1.00		
0.00 D	2		F	5		5						1.00		
1.56 D	1		F	5		5						1.00		
1.56 D	2		F	5		5						1.00		
3.13 D	1		F	5		5						1.00		
3.13 D	2		F	5		5						1.00		
6.25 D	1		F	5		5						1.00		
6.25 D	2		F	5		5						1.00		
12.50 D	1		F	5		5						1.00		
12.50 D	2		F	5		5						1.00		
25.00 D	1		F	5		5						1.00		
25.00 D	2		F	5		5						1.00		
50.00 D	1		F	5		5						1.00		
50.00 D	2		F	5		5						1.00		
100.00 D	1		F	5		5		2				.40		
100.00 D	2		F	5		5		2				.40		
150.00 D	1		F	5		5		0				0.00		
150.00 D	2		F	5		5		0				0.00		
200.00 D	1		F	5		5		0				0.00		
200.00 D	2		F	5		5		0				0.00		

Parametrix Toxicology Laboratory

Test Date: 2/23/99
 Sample Date: 2/23/99
 Species: Ceriodaphnia dubia
 Test Type: Acute - 48 hours

Test Number: 2185
 Test Material: Copper Site Water #g/L
 Source: WA0024651
 Port of Seattle

SUMMARY

End Point	Day	Transformation	Conc	#Reps	Mean	StDev	% Surv
Proportion Alive	2	Arc sine sqrt w/ adj.	X 0.000 D	2	1.35	0.000	
			X 1.563 D	2	1.35	0.000	
			X 3.125 D	2	1.35	0.000	
			X 6.250 D	2	1.35	0.000	
			X 12.500 D	2	1.35	0.000	
			X 25.000 D	2	1.35	0.000	
			X 50.000 D	2	1.35	0.000	
			X 100.000 D	2	.68	0.000	
			150.000 D	2	.23	0.000	
			200.000 D	2	.23	0.000	
Proportion Alive	2	No transformation	0.000 D	2	1.00	0.000	
			1.563 D	2	1.00	0.000	
			3.125 D	2	1.00	0.000	
			6.250 D	2	1.00	0.000	
			12.500 D	2	1.00	0.000	
			25.000 D	2	1.00	0.000	
			50.000 D	2	1.00	0.000	
			100.000 D	2	.40	0.000	
			150.000 D	2	0.00	0.000	
			200.000 D	2	0.00	0.000	

X = indicates concentrations used in calculations

- HYPOTHESIS TEST -

End Point	Day	Transformation/Analysis	NOEC	LOEC	TU	MSE	MSD
Proportion Alive	2	Arc sine sqrt w/ adj. Dunnnett + t-test					

- PROPORTION POINT ESTIMATE -

End Point	Day	Method	P	Conc	95% CI	TU
Proportion Alive	2	Spearman-Karber	EC 50	88.087	74.30 - 104.43	1.14

Water Flea

Lab	Species	Test Date	Test Material	Permit	Protocol	Test Number
WAPTL	CD	2/23/99	CUSW ($\mu\text{g/L}$)	WA0024651	EPAA 91	2185

Statistics Parameters

PROPORTION

End Point:	PA Proportion Alive	
Analysis:	EPA Flowchart (Chronic and Acute)	1 control
Transform:	Arc sine square root w/ Bartlett adj.	
Tail:	One-tailed, decreasing	
Constant:	-.01	Variance: .01
Root:	-1.00	Alpha Normality: .01
		NOEC: .05

EC/LC Method: F (P,S,G,L,N)

Superdunnet: 4000

GROWTH

End Point:	GR Reproduction	
Analysis:	No Analysis	
Transform:		
Tail:		
Constant:	.01	Variance: .01
Root:		Alpha Normality: .01
		NOEC: .05

Calculate IC? N (Y,N)

IC resamples: 120

Errors/Warnings

Type Number

EC/LC 0 Analysis completed with no errors

PROP 40 No variation in the data

Spearman-Karber Analysis for EC/LC 50

Parametrix Toxicology Laboratory

Species: Ceriodaphnia dubia
Test Material: Copper Site Water (μ)
Endpoint: Prop

Test Number: 2185
Test Date: 2/23/99

Conc	Number Exposed	Mortalities
0.00	10	0
1.56	10	0
3.13	10	0
6.25	10	0
12.50	10	0
25.00	10	0
50.00	10	0
100.00	10	6
150.00	10	10
200.00	10	10

Spearman-Karber EC/LC 50 estimate: 88.087
95% lower confidence: 74.301
95% upper confidence: 104.430

Untrimmed Spearman-Karber

2/26/99

TOXIS ANALYSIS SUMMARY

Ceriodaphnia		Proportion Alive			Day 2
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Lab	Species	Date	Test Material	Permit	Protocol	Test Number
WAPTL	CD	2/23/99	CUSW (µg/L)	WA0024651	EPAA 91	2185

EPA Flowchart (Chronic and Acute)	1 control
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Transformation		Conc	Mean	SD	N
Arc sine sqrt w/ adj.	X	0.00D	1.35	0.000	2
	X	1.56D	1.35	0.000	2
	X	3.13D	1.35	0.000	2
	X	6.25D	1.35	0.000	2
	X	12.50D	1.35	0.000	2
	X	25.00D	1.35	0.000	2
	X	50.00D	1.35	0.000	2
	X	100.00D	.68	0.000	2
		150.00D	.23	0.000	2
		200.00D	.23	0.000	2
	No transformation		0.00D	1.00	0.000
		1.56D	1.00	0.000	2
		3.13D	1.00	0.000	2
		6.25D	1.00	0.000	2
		12.50D	1.00	0.000	2
		25.00D	1.00	0.000	2
		50.00D	1.00	0.000	2
		100.00D	.40	0.000	2
		150.00D	0.00	0.000	2
		200.00D	0.00	0.000	2

Error occurred during statistics:

No variation in the data

Parametrix, Inc.

5808 Lake Washington Blvd. N.E., Suite 200, Kirkland, WA 98033-7350
425-822-8880

FAX TRANSMISSION COVER PAGE

FAX # 425-889-8808

To: Scott Tobiason
Company Name: Port of Seattle
Telephone #: _____
Fax #: (206) 431-4980
PMX Project #: 55-2912-01 (61)
From: Rex Simmons Ext. 3486
Sent By: _____
Date: 3/29/99
Number of Pages (Total): 7

Comments/Message:

Linda Logan asked me to fax you the datalogs
for the WGR samples we collected from
receiving streams on (2/22/99) I have included
the compositing sheets for these three sites
as well.
Please call me if I can help you in any way.
Rex

Backup Copy Will Will Not Be Sent Via _____

This facsimile is confidential and may also be attorney-privileged. If you are not the intended recipient or the person responsible for its distribution, please call us collect immediately at (425) 822-8880 and return the original to us via the U.S. Postal Service. Thank you.

AR 024960

SITE: WC
 DATE: 2/22/99
 LER(S): _____
 R TEMP: _____
 ATHER: _____

Field Measurements:			
TIME	pH	Temp.(°C)	DO (mg/l)
1630	7.5	8.0	—

BOTTLE	TIME	WATER (L)		COMMENTS	(for lab use)
		cul. LEVEL 10'			FLOW
1	1215	6.0	7.0	Light rain; Sheen near surface	
2	1230	6.0	7.0	"	
3	1245	6.0	7.0	"	
4	1300	6.0	7.0	Rain; sheen very light	
5	1315	6.0	7.0	"	
6	1330	7.0	8.0	Rain; sheen gone	
7	1345	7.5	8.0	Rain; water darker	
8	1400	8.0	8.5	Rain	
9	1415	7.5	9.0	Rain	
10	1430	7.5	9.0	Rain	
11	1445	8.0	11.0	Heavy Rain	
12	1500	8.0	12.5	Rain *	
13	1515	9.0	12.5	Rain	

WATER LEVEL: Take depth measurements as far into the culvert as possible.

Circle one: tape down / water level

Measuring Point (describe and/or sketch):

* Flow noticeably higher - spread out wider in both culvert + channel, reference rock in channel completely covered; water dark brown.

K:\working\2912\55291201\61\data\g

258 (706) 948-6160

AR 024961

Flow Weighting Calculation Worksheet

Site	Walker
Date	23-Feb
Pipe Size	30

Subsample Number	fill in this column		fill in this column		Subsample Volume (L) mL
	Water Level	Flow	%		
1	6	2	0.054495913		436
2	6	2	0.054495913		436
3	6	2	0.054495913		436
4	6	2	0.054495913		436
5	6	2	0.054495913		436
6	7	2.7	0.073569482		589
7	7.5	3.2	0.08719346		698
8	8	3.6	0.098092643		785
9	7.5	3.2	0.08719346		698
10	7.5	3.2	0.08719346		698
11	8	3.6	0.098092643		785
12	8	3.6	0.098092643		785
13	8	3.6	0.098092643		785
14			0		0
15			0		0
16			0		0
17			0		0
18			0		0
19			0		0
20			0		0
		36.7	1		8000 mL (should total 8 L)

total storm flow	33030
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SITE: DMC-W (Des Moines Creek)
 DATE: 2/21/99
 RIVER(S): S Belway
 AIR TEMP: _____
 WEATHER: 50° RAINY & WINDY

Field Measurements:			
TIME	pH	Temp.(°C)	DO (mg/l)
1246	6.8	7.3	

BOTTLE	TIME	WATER LEVEL (in)	COMMENTS	(for lab use) FLOW
1	1246	6.6"		
2	1301	6.8"		
3	1316	7"		
4	1331	7.2		
5	1346	7.3"		
6	1401	7.5"		
7	1416	7.7"		
8	1431	8.0		
9	1446	8.8	VERY HEAVY ECHO	
10	1501	9.4		
11	1516	9.9		
12	1531	10.5		
13	1546	11.5"		

WATER LEVEL: Take depth measurements as far into the culvert as possible.

Circle one: tape down / water level

Measuring Point (describe and/or sketch):

19.5"

6.6" — | — (6.6" ON 10-PLACE STICK)
 THIS IS REALLY 6.6"

— BEGINNING

K:\working\2912\55291201\61\datalog

PK 706) 942-6110)

Flow Weighting Calculation Worksheet

Site	DMC W
Date	23-Feb
Pipe Size	30

Subsample Number	fill in this column		%	Subsample Volume (mL)
	Water Level	Flow		
1	6.6	4.7	0.049111808	295
2	6.8	4.9	0.051201672	307
3	7	5	0.052246604	313
4	7.2	5.1	0.053291536	320
5	7.3	5.2	0.054336468	326
6	7.5	5.5	0.057471264	345
7	7.7	6.3	0.065830721	395
8	8	6.4	0.066875653	401
9	8.8	6.5	0.067920585	408
10	9.4	7.8	0.081504702	489
11	9.9	10.8	0.112852665	677
12	10.5	12.5	0.13061651	784
13	11.5	15	0.156739812	940
14			0	0
15			0	0
16			0	0
17			0	0
18			0	0
19			0	0
20			0	0
		95.7	1	6000

(should total 6 L)

total storm flow	86130
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SITE: MC1
 DATE: 2/22/99
 LER(S): 13
 R TEMP: _____
 ATHER: precip. rain
until ~ 1515.

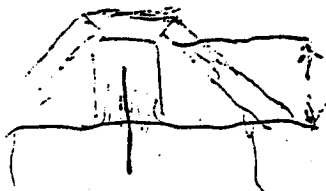
Field Measurements:			
TIME	pH	Temp.(°C)	DO (mg/l)
1335	7.5	7.3	—

BOTTLE	TIME	WATER LEVEL	COMMENTS	(for lab use) FLOW
1	1314	20 5/8" 20 7/8"		
2	1329	20 1/8"		
3	1345	20 1/8"		
4	1400	21 1/8"		
5	1415	21 3/8"		
6	1430	22"		
7	1445	22 3/8"		
8	1500	22 4/8"		
9	1515	23 1/8"		
10	1530	23 5/8"		
11	1545	23 5/8"		
12	1600	23 5/8"		
13	1615	22 5/8"		

WATER LEVEL: Take depth measurements as far into the culvert as possible.

Circle one: tape down water level

Measuring Point (describe and/or sketch):



water depth @ 1314 is 20 7/8" deep.
 water surface to measuring point (tape down)
 is 28.5" @ 1314.
 I am measuring depth @ stream
 center, just inside culvert. I am
 using a 5' piece of rebar & measuring
 portion of rebar that equals water depth.

RS @ (206) 946-6160

WC
 1630
 7.5 pH
 8.0°C

NGPL
 1650
 8.2 pH
 7.5°C

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Flow Weighting Calculation Worksheet

Site	MC D ✓
Date	23-Feb
Pipe Size	30

Subsample Number	fill in this column		%	Subsample Volume (mL)
	Water Level	Flow		
1	20.75	6	0.054545455	436
2	20.12	4.8	0.043636364	349
3	20.12	4.8	0.043636364	349
4	21.25	6.5	0.059090909	473
5	21.37	7	0.063636364	509
6	22	8.2	0.074545455	596
7	22.37	9	0.081818182	655
8	22.5	9.5	0.086363636	691
9	23.12	10.2	0.092727273	742
10	23.67	11	0.1	800
11	23.67	11	0.1	800
12	23.67	11	0.1	800
13	23.67	11	0.1	800
14			0	0
15			0	0
16			0	0
17			0	0
18			0	0
19			0	0
20			0	0
		110	1	8000

(should total 8 L)

total storm flow	99000
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