

# 1

## DRAFT MEMORANDUM

To: Port of Seattle project files April 20, 2000  
From: Doug Henderson / Linda Logan 556-2912-001 (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 purpose of these range-finding WERs is to determine if the final WERs would be robust enough to warrant the expense of conducting definitive studies. Although range-finding WERs were conducted in February 1999, these tests were conducted on simulated receiving water samples that were mixtures of outfall SDS3 stormwater and instream receiving water. Mixture ratios of these two samples were prepared in the laboratory by combining measured volumes of stormwater and upstream receiving water in proportions estimated to occur in the receiving water (based on hydrographs generated using HSPF). In the event that mixing zones cannot be granted for the creeks, it was agreed that two additional types of range-finding WERs be conducted, one without any mixing with stormwater (i.e., receiving water only) and the other one after complete mix, below outfall discharges.

### *Sampling*

Samples were collected at five pre-determined locations during a qualifying storm on the afternoon of 13 April 2000. The storm started at 2:00 PM on 13 April and ended at 1:00 AM on 14 April 2000. The dry antecedent period preceding this storm was 74 hours. Approximately 0.34 inches of rain fell at STIA during 12 hour period of rainfall.

Taylor Associates collected flow-weighted composite samples for 12 hours during the storm event from each of the five sampling sites (Miller Creek Upstream, Miller Creek Detention Facility, Northwest Ponds Outlet, Northwest Ponds Inlet, and Des Moines Creek Weir). ISCO samplers automatically composite samples based on flow.

**AR 042316**

Quality assurance and quality control elements were followed according to the Port's Procedure Manual for Stormwater Monitoring (POS, 1999).

The samples were delivered to Parametrix's toxicology laboratory with completed chain-of-custody forms in sufficient time to meet the applicable holding times. 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 500 mg/L copper stock solution made from copper sulfate pentahydrate (CuSO<sub>4</sub>•5H<sub>2</sub>O) (CAS#7758-99-8). Since these were preliminary tests, concentrations were not measured; thus the WERs were calculated using nominal test concentrations. However, the stock solution was analyzed by Battelle and verified to be 500.0 mg/L copper.

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 *D. magna* toxicity tests is presented in Table 1.

**AR 042317**

**Table 1. Summary of test conditions for the acute *Daphnia magna* toxicity tests.**

Job Name: Port of Seattle

Job Number: 556-2912-001 (61)

Date: 15-17 April 2000

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<b>Test Protocol:</b>	<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.
<b>Test Material:</b>	Copper-spiked site waters Copper-spiked synthetic laboratory water
<b>Test Organisms/age:</b>	<i>Daphnia magna</i> ; ≤24 hrs old
<b>Source:</b>	In-house culture
<b>Number/Test Chamber:</b>	5
<b>Volume/Test Chamber:</b>	20 mL
<b>Nominal Test Concentrations:</b>	Site water: 0, 12.5, 25, 50, 100, 150, and 200 µg/L copper Synthetic laboratory water: 0, 5, 10, 20, 40, and 80 µg/L copper
<b>Replicates:</b>	Four
<b>Test Duration:</b>	48 hours
<b>Control:</b>	Unspiked synthetic laboratory water Unspiked site water
<b>Test Chambers:</b>	30 mL polystyrene cups
<b>Lighting:</b>	Fluorescent bulbs (50-100 foot candles)
<b>Photoperiod:</b>	16 hours light; 8 hours dark
<b>Aeration:</b>	None
<b>Feeding:</b>	None
<b>Temperature:</b>	25 ± 1°C
<b>Chemical Data:</b>	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
<b>Effect Measured:</b>	Mortality
<b>Test Acceptability:</b>	Control mortality ≤10%

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**AR 042318**

## Results

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

**Table 2. Summary of *Daphnia magna* range-finding water-effect ratio for POS:**

Test Water	Hardness (mg/L)	Cu LC50 (µg/L)	Normalized <sup>1</sup> LC50 (µg/L)	WER
Cu-Spiked Northwest Ponds Inlet Site Water	60	143.6	120.93	28.43387
Cu-Spiked Northwest Ponds Outlet Site Water	90	132	75.87	17.83784
Cu-Spiked Miller Creek Detention Facility Site Water	92	168.8	95.03	22.34329
Cu-Spiked Miller Creek Upstream Site Water	46	111.6	120.72	28.38372
Cu-Spiked Des Moines Creek Weir Site Water	65	136.6	106.68	25.08299
Cu-Spiked Laboratory Water	90	7.4	n/a	n/a
Reference Toxicant (LC50) =		Acceptable		

WER = Calculated water effect ratio

n/a = not applicable

<sup>1</sup> 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 (17 - 28), 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.
- POS 1999. Procedure Manual for Stormwater Monitoring. Port of Seattle, April 1999.

Site	Hardness (ppm)	LC50 (µg/L)	LC50 Adjusted to 50 ppm Hardness	WER
Miller Creek Upstream	46	111.6	120.72	28.38372
Miller Creek Detention Facility	92	168.8	95.03	22.34329
Northwest Ponds Inlet	60	143.6	120.93	28.43387
Northwest Ponds Outlet	90	132	75.87	17.83784
Des Moines Creek Weir	65	136.6	106.68	25.08299
Lab Water	90	7.4	4.25	

PREPARED BY *[Signature]* 4/24/00  
 CHECKED BY *[Signature]* 4/24/00

STATIC ACUTE *Daphnia magna* TOXICITY TEST

Client Port of Seattle  
Sample Cu in Lab Water  
Test Dates 4/15/2000 - 4/17/2000

Sample Collection Date 4/14/00  
Test Initiation Time 1415  
Source/Age of Organisms In house cultures / <24 hours  
Dilution Water EPA synthetic freshwater

Temp (°C) Day 0 25 Day 1 25 Day 2 25

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	7.9	7.6	7.9	8.3	8.1	8.3	251	305
	B	5	5	5								
	C	5	5	3-2								
	D	5	5	5								
5 µg/L	A	5	5	4-1	7.9	7.7	7.9	8.3	8.1	8.3	251	316
	B	5	5	4-1								
	C	5	5	3-2								
	D	5	5	3-2								
10 µg/L	A	5	3-2	0-3	7.9	7.7	7.9	8.3	8.2	8.3	251	340
	B	5	4-1	0-4								
	C	5	5	2-3								
	D	5	2-3	2								
20 µg/L	A	5	1-4	0-1	7.9	7.7	7.9	8.3	8.3	8.3	251	332
	B	5	3-2	0-3								
	C	5	0-5	0								
	D	5	0-5	0								
40 µg/L	A	5	0-5	0	7.9	7.8	8.0	8.3	8.3	8.1	251	318
	B	5	0-5	0								
	C	5	0-5	0								
	D	5	0-5	0								
80 µg/L	A	5	0-5	0	7.9	7.8	8.0	8.3	8.3	8.1	251	293
	B	5	0-5	0								
	C	5	0-5	0								
	D	5	0-5	0								
	A											
	B											
	C											
	D											
Initials		JK	JK	PM	JK	JK	PM	JK	JK	PM	JK	PM
Date		4/15	4/16	4/17	4/15	4/16	4/17	4/15	4/16	4/17	4/15	4/17
QC												

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

Reviewed by: [Signature] 4/20/00

Comments \_\_\_\_\_

Test: AD-Acute Daphid  
 Species: DM-Daphnia magna  
 Sample ID: WA0024651-Port of Seattle  
 Start Date: 04/15/2000 14:15      End Date: 04/17/2000  
 Test ID: 2861  
 Protocol: EPAA 91-EPA Acute  
 Sample Type: SRW2-Industrial stormwater  
 Lab ID: WAPTL-Parametrix Tox Lab

Pos	ID	Rep	Group	Start	24 Hr	48 Hr	72 Hr	96 Hr	Notes
	1	1	D-Control	5	5	4			
	2	2	D-Control	5	5	5			
	3	3	D-Control	5	5	3			
	4	4	D-Control	5	5	5			
	5	1	5.000	5	5	4			
	6	2	5.000	5	5	4			
	7	3	5.000	5	5	3			
	8	4	5.000	5	5	3			
	9	1	10.000	5	3	0			
	10	2	10.000	5	4	0			
	11	3	10.000	5	5	2			
	12	4	10.000	5	2	2			
	13	1	20.000	5	1	0			
	14	2	20.000	5	3	0			
	15	3	20.000	5	0	0			
	16	4	20.000	5	0	0			
	17	1	40.000	5	0	0			
	18	2	40.000	5	0	0			
	19	3	40.000	5	0	0			
	20	4	40.000	5	0	0			
	21	1	80.000	5	0	0			
	22	2	80.000	5	0	0			
	23	3	80.000	5	0	0			
	24	4	80.000	5	0	0			

Comments: Port of Seattle - Cu in Lab Water

PREPARED BY cut 4/20/00  
 CHECKED BY [Signature] 4/20/00

AR 042322

Test: AD-Acute Daphid  
 Species: DM-Daphnia magna  
 Sample ID: WA0024651-Port of Seattle  
 Start Date: 04/15/2000 14:15      End Date: 04/17/2000  
 Test ID: 2861  
 Protocol: EPAA 91-EPA Acute  
 Sample Type: SRW2-Industrial stormwater  
 Lab ID: WAPTL-Parametrix Tox Lab

Pos	ID	Rep	Group	Start	24 Hr	48 Hr	72 Hr	96 Hr	Notes
	1	1	D-Control	5	5	4			
	2	2	D-Control	5	5	5			
	3	3	D-Control	5	5	3			
	4	4	D-Control	5	5	5			
	5	1	5.000	5	5	4			
	6	2	5.000	5	5	4			
	7	3	5.000	5	5	3			
	8	4	5.000	5	5	3			
	9	1	10.000	5	3	0			
	10	2	10.000	5	4	0			
	11	3	10.000	5	5	2			
	12	4	10.000	5	2	2			
	13	1	20.000	5	1	0			
	14	2	20.000	5	3	0			
	15	3	20.000	5	0	0			
	16	4	20.000	5	0	0			
	17	1	40.000	5	0	0			
	18	2	40.000	5	0	0			
	19	3	40.000	5	0	0			
	20	4	40.000	5	0	0			
	21	1	80.000	5	0	0			
	22	2	80.000	5	0	0			
	23	3	80.000	5	0	0			
	24	4	80.000	5	0	0			

Comments: Port of Seattle - Cu in Lab Water

AR 042323



**Acute Daphid-48 Hr Survival**

Start Date: 04/15/2000 14:15 Test ID: 2861 Sample ID: WA0024651-Port of Seattle  
 End Date: 04/17/2000 Lab ID: WAPTL-Parametrix Tox Lab Sample Type: SRW2-Industrial stormwater  
 Sample Date: 04/14/2000 Protocol: EPAA 91-EPA Acute Test Species: DM-Daphnia magna  
 Comments: Port of Seattle - Cu in Lab Water

Conc-ug/L	1	2	3	4
D-Control	0.8000	1.0000	0.6000	1.0000
5	0.8000	0.8000	0.6000	0.6000
10	0.0000	0.0000	0.4000	0.4000
20	0.0000	0.0000	0.0000	0.0000
40	0.0000	0.0000	0.0000	0.0000
80	0.0000	0.0000	0.0000	0.0000

Conc-ug/L	Mean	N-Mean	Transform: Arcsin Square Root				N	t-Stat	1-Tailed Critical	MSD	Number Resp	Total Number
			Mean	Min	Max	CV%						
D-Control	0.8500	1.0000	1.1709	0.8861	1.3453	18.840	4				3	20
5	0.7000	0.8235	0.9966	0.8861	1.1071	12.807	4	1.161	2.180	0.3273	6	20
*10	0.2000	0.2353	0.4551	0.2255	0.6847	58.254	4	4.768	2.180	0.3273	16	20
20	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				20	20
40	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				20	20
80	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				20	20

Auxillary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.88728	0.805	-0.1968	-1.6982
Bartlett's Test indicates equal variances (p = 0.52)	1.29929	9.21035		

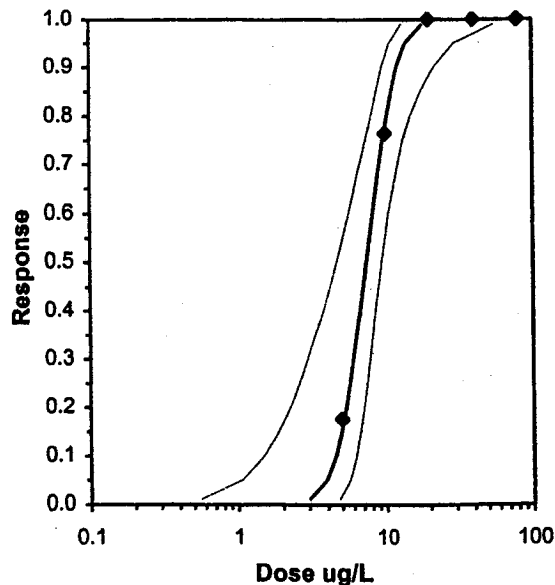
  

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	5	10	7.07107		0.29035	0.3422	0.55735	0.04508	0.00262	2, 9

Parameter	Value	SE	95% Fiducial Limits		Maximum Likelihood-Probit						
			Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter		
Slope	5.93176	1.81345	2.37741	9.48612	0.15	0.13572	7.81472	0.99	0.86892	0.16858	5
Intercept	-0.1542	1.70483	-3.4957	3.18724							
TSCR	0.15469	0.07987	-0.0019	0.31123							

Point	Probits	ug/L	95% Fiducial Limits	
EC01	2.674	2.99733	0.55368	4.72012
EC05	3.355	3.90502	1.05825	5.63791
EC10	3.718	4.49645	1.48967	6.2191
EC15	3.964	4.9453	1.87202	6.65964
EC20	4.158	5.33378	2.24052	7.04519
EC25	4.326	5.69129	2.60919	7.40717
EC40	4.747	6.70207	3.78501	8.50415
EC50	5.000	7.39467	4.67005	9.36801
EC60	5.253	8.15886	5.66233	10.5014
EC75	5.674	9.60787	7.37291	13.432
EC80	5.842	10.2519	8.01687	15.1249
EC85	6.036	11.0572	8.73009	17.5857
EC90	6.282	12.161	9.58322	21.558
EC95	6.645	14.0028	10.8068	29.6849
EC99	7.326	18.2433	13.1615	55.6444

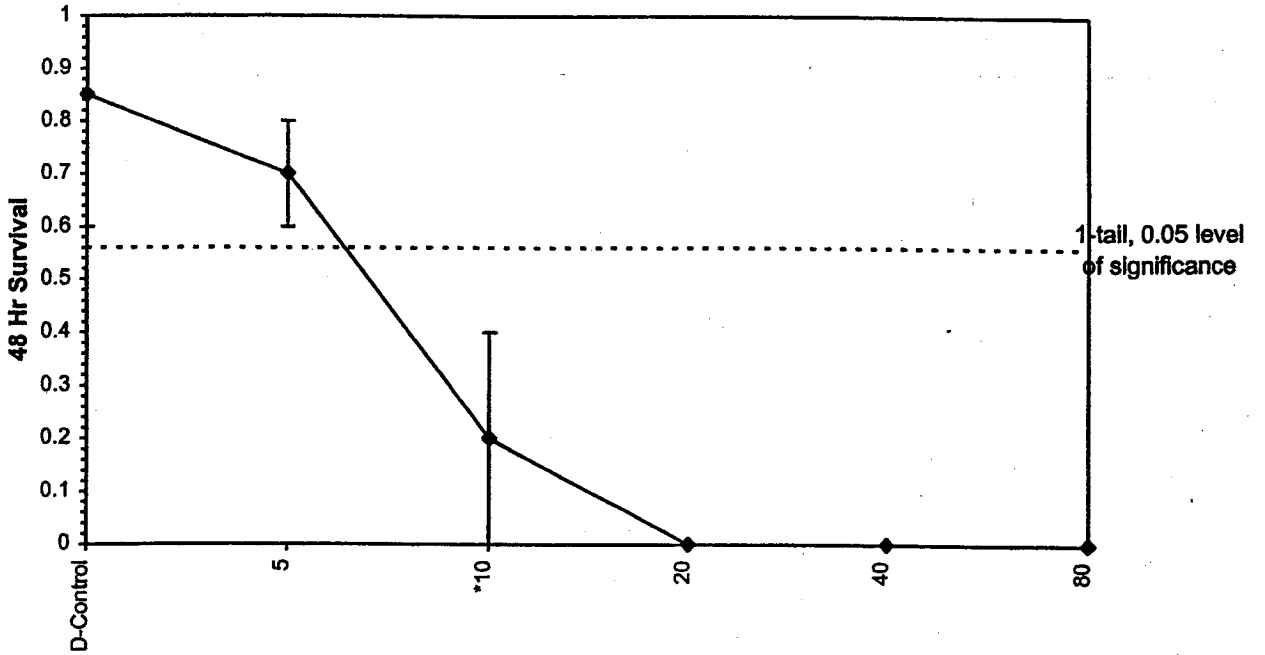


**AR 042324**

Acute Daphnid-48 Hr Survival

Start Date: 04/15/2000 14:15 Test ID: 2861 Sample ID: WA0024651-Port of Seattle  
End Date: 04/17/2000 Lab ID: WAPTL-Parametrix Tox Lab Sample Type: SRW2-Industrial stormwater  
Sample Date: 04/14/2000 Protocol: EPAA 91-EPA Acute Test Species: DM-Daphnia magna  
Comments: Port of Seattle - Cu in Lab Water

Dose-Response Plot



AR 042325

STATIC ACUTE *Daphnia magna* TOXICITY TEST

Client Port of Seattle  
Sample Cu in Northwest Ponds Inlet Water  
Test Dates 4/15/2000 - 4/17/2000

Sample Collection Date 4/14/00  
Test Initiation Time 1430  
Source/Age of Organisms In house cultures / <24 hours  
Dilution Water Northwest Ponds Inlet Water

Temp (°C) Day 0 25 Day 1 25 Day 2 25

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	7.9	7.8	8.1	8.2	8.0	8.4	157	184
	B	5	5	4-1								
	C	5	5	4-1								
	D	5	5	5								
12.5 µg/L	A	5	5	5	7.9	7.9	8.1	8.2	8.0	8.3	157	187
	B	5	5	5								
	C	5	5	4-1								
	D	5	5	4-1								
25 µg/L	A	5	5	3-2	7.9	7.9	8.1	8.2	8.0	8.3	157	185
	B	5	5	5								
	C	5	4-1	2-2								
	D	5	5	2-3								
50 µg/L	A	5	5	2-3	7.9	7.9	8.1	8.2	8.0	8.2	157	192
	B	5	5	3-2								
	C	5	5	5								
	D	5	5	5								
100 µg/L	A	5	5	5	7.9	7.9	8.1	8.2	8.0	8.2	157	180
	B	5	5	4-1								
	C	5	5	3-2								
	D	5	4-1	3-1								
200 µg/L	A	5	5*	0-5	7.9	7.9	8.1	8.2	8.0	8.0	157	172
	B	5	5*	0-5								
	C	5	5*	1-4								
	D	5	4-1	0-4								
	A											
	B											
	C											
	D											
Initials		DL	DL	FR	DL	DL	R	DL	DL	DL	DL	P
Date		4/15	4/16	4/17	4/15	4/16	4/17	4/15	4/16	4/17	4/15	4/17
QC												

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

Reviewed by: [Signature] 4/20/00

Comments \* Very limited mobility

AR 042326

Test: AD-Acute Daphid

Test ID: 2862

Species: DM-Daphnia magna

Protocol: EPAA 91-EPA Acute

Sample ID: WA0024651-Port of Seattle

Sample Type: SRW2-Industrial stormwater

Start Date: 04/15/2000 14:30

End Date: 04/17/2000

Lab ID: WAPTL-Parametrix Tox Lab

Pos	ID	Rep	Group	Start	24 Hr	48 Hr	72 Hr	96 Hr	Notes
	1	1	D-Control	5	5	5			
	2	2	D-Control	5	5	4			
	3	3	D-Control	5	5	4			
	4	4	D-Control	5	5	5			
	5	1	12.500	5	5	5			
	6	2	12.500	5	5	5			
	7	3	12.500	5	5	4			
	8	4	12.500	5	5	4			
	9	1	25.000	5	5	3			
	10	2	25.000	5	5	5			
	11	3	25.000	5	4	2			
	12	4	25.000	5	5	2			
	13	1	50.000	5	5	2			
	14	2	50.000	5	5	3			
	15	3	50.000	5	5	5			
	16	4	50.000	5	5	5			
	17	1	100.000	5	5	5			
	18	2	100.000	5	5	4			
	19	3	100.000	5	5	3			
	20	4	100.000	5	4	3			
	21	1	200.000	5	5	0			
	22	2	200.000	5	5	0			
	23	3	200.000	5	5	1			
	24	4	200.000	5	4	0			

Comments: POS - Cu in NW Ponds Inlet Water

PREPARED BY Ced 4/20/00  
 CHECKED BY JZ 4/20/00

AR 042327

Test: AD-Acute Daphid Test ID: 2862  
 Species: DM-Daphnia magna Protocol: EPAA 91-EPA Acute  
 Sample ID: WA0024651-Port of Seattle Sample Type: SRW2-Industrial stormwater  
 Start Date: 04/15/2000 14:30 End Date: 04/17/2000 Lab ID: WAPTL-Parametrix Tox Lab

Pos	ID	Rep	Group	Start	24 Hr	48 Hr	72 Hr	96 Hr	Notes
	1	1	D-Control	5	5	5			
	2	2	D-Control	5	5	4			
	3	3	D-Control	5	5	4			
	4	4	D-Control	5	5	5			
	5	1	12.500	5	5	5			
	6	2	12.500	5	5	5			
	7	3	12.500	5	5	4			
	8	4	12.500	5	5	4			
	9	1	25.000	5	5	3			
	10	2	25.000	5	5	5			
	11	3	25.000	5	4	2			
	12	4	25.000	5	5	2			
	13	1	50.000	5	5	2			
	14	2	50.000	5	5	3			
	15	3	50.000	5	5	5			
	16	4	50.000	5	5	5			
	17	1	100.000	5	5	5			
	18	2	100.000	5	5	4			
	19	3	100.000	5	5	3			
	20	4	100.000	5	4	3			
	21	1	200.000	5	5	0			
	22	2	200.000	5	5	0			
	23	3	200.000	5	5	1			
	24	4	200.000	5	4	0			

Comments: POS - Cu in NW Ponds Inlet Water

**AR 042328**

**Acute Daphid-48 Hr Survival**

Start Date: 04/15/2000 14:30 Test ID: 2862 Sample ID: WA0024651-Port of Seattle  
 End Date: 04/17/2000 Lab ID: WAPTL-Parametrix Tox Lab Sample Type: SRW2-Industrial stormwater  
 Sample Date: 04/14/2000 Protocol: EPAA 91-EPA Acute Test Species: DM-Daphnia magna  
 Comments: POS - Cu in NW Ponds Inlet Water

Conc-ug/L	1	2	3	4
D-Control	1.0000	0.8000	0.8000	1.0000
12.5	1.0000	1.0000	0.8000	0.8000
25	0.6000	1.0000	0.4000	0.4000
50	0.4000	0.6000	1.0000	1.0000
100	1.0000	0.8000	0.6000	0.6000
200	0.0000	0.0000	0.2000	0.0000

Conc-ug/L	Mean	N-Mean	Transform: Arcsin Square Root					N	t-Stat	1-Tailed Critical	MSD	Number Resp	Total Number
			Mean	Min	Max	CV%							
D-Control	0.9000	1.0000	1.2262	1.1071	1.3453	11.212	4				2	20	
12.5	0.9000	1.0000	1.2262	1.1071	1.3453	11.212	4	0.000	2.410	0.3863	2	20	
25	0.6000	0.6667	0.9002	0.6847	1.3453	34.607	4	2.034	2.410	0.3863	8	20	
50	0.7500	0.8333	1.0653	0.6847	1.3453	31.308	4	1.004	2.410	0.3863	5	20	
100	0.7500	0.8333	1.0561	0.8861	1.3453	20.748	4	1.061	2.410	0.3863	5	20	
*200	0.0500	0.0556	0.2850	0.2255	0.4636	41.771	4	5.872	2.410	0.3863	19	20	

**Auxiliary Tests**

Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.95795	0.884	0.41562 -0.3207
Bartlett's Test indicates equal variances (p = 0.40)	5.17099	15.0863	

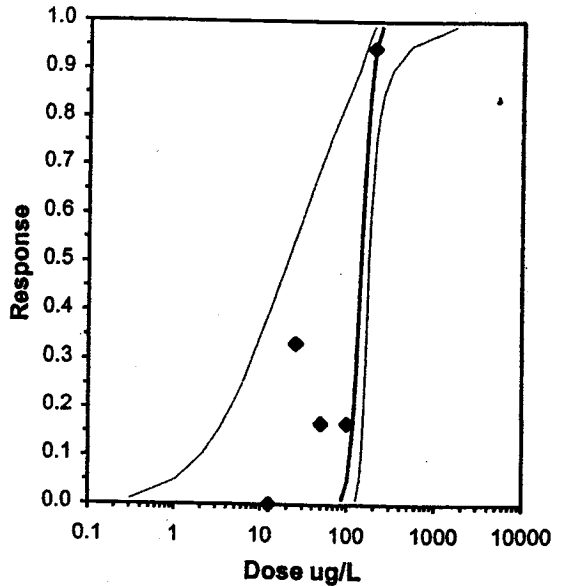
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	100	200	141.421		0.33147	0.37417	0.49698	0.05138	1.3E-04	5, 18

**Maximum Likelihood-Probit**

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	10.6117	4.76948	1.26356	19.9599	0.1	5.88238	7.81472	0.12	2.15722	0.09424	9
Intercept	-17.892	10.7861	-39.033	3.24892							
TSCR	0.2125	0.04574	0.12286	0.30214							

Point	Probits	ug/L	95% Fiducial Limits	
EC01	2.674	86.6949	0.30845	127.403
EC05	3.355	100.511	1.0603	138.812
EC10	3.718	108.755	2.0446	145.537
EC15	3.964	114.696	3.18124	150.403
EC20	4.158	119.648	4.51697	154.505
EC25	4.326	124.067	6.09755	158.226
EC40	4.747	135.939	12.9302	168.743
EC50	5.000	143.621	20.2227	176.274
EC60	5.253	151.737	31.4131	185.401
EC75	5.674	166.256	63.181	208.466
EC80	5.842	172.396	81.3097	223.935
EC85	6.036	179.84	105.178	252.51
EC90	6.282	189.664	133.834	319.086
EC95	6.645	205.22	163.273	528.79
EC99	7.326	237.926	193.908	1667.6

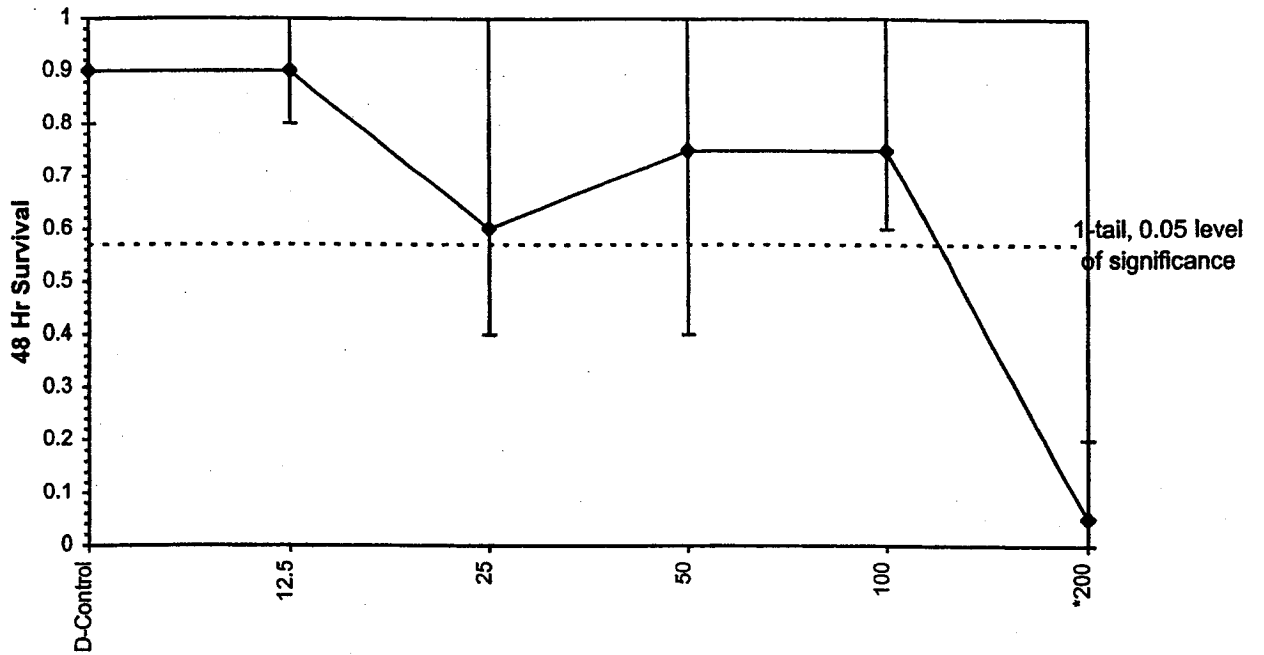


**AR 042329**

Acute Daphid-48 Hr Survival

Start Date: 04/15/2000 14:30 Test ID: 2862 Sample ID: WA0024651-Port of Seattle  
End Date: 04/17/2000 Lab ID: WAPTL-Parametrix Tox Lab Sample Type: SRW2-Industrial stormwater  
Sample Date: 04/14/2000 Protocol: EPAA 91-EPA Acute Test Species: DM-Daphnia magna  
Comments: POS - Cu in NW Ponds Inlet Water

Dose-Response Plot



AR 042330

STATIC ACUTE *Daphnia magna* TOXICITY TEST

Client Port of Seattle  
Sample Cu in Des Moines Creek Weir Water  
Test Dates 4/15/2000 - 4/17/2000

Sample Collection Date 4/14/00  
Test Initiation Time 1530  
Source/Age of Organisms In house cultures / <24 hours  
Dilution Water Des Moines Creek Weir Water

Temp (°C) Day 0 25 Day 1 25 Day 2 25

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	7.9	8.0	8.0	8.3	8.1	8.4	159	182
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
12.5 µg/L	A	5	5	5	7.9	8.0	8.1	8.3	8.1	8.4	159	187
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
25 µg/L	A	5	5	5	7.9	8.0	8.1	8.3	8.2	8.4	159	190
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
50 µg/L	A	5	5	5	7.9	8.0	8.1	8.3	8.1	8.2	159	188
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
100 µg/L	A	5	5	5	7.9	8.0	8.1	8.3	8.3	8.1	159	187
	B	5	5	5								
	C	5	5	5								
	D	5	5	4								
200 µg/L	A	5	4-1	0-4	7.9	8.0	8.1	8.3	8.3	8.0	159	176
	B	5	5	0-5								
	C	5	2-3	0-2								
	D	5	4-1	0-4								
	A											
	B											
	C											
	D											
Initials		DH	DM	PM	DH	DM	PM	DH	DM	PM	DH	PM
Date		4/15	4/16	4/17	4/15	4/16	4/17	4/15	4/16	4/17	4/15	4/17
QC												

Shading represents areas for which data collection is not required.

NT = Not Taken

Reviewed by: pr 4/20/00

Comments \* Very limited mobility

AR 042331



Test: AD-Acute Daphid Test ID: 2864  
 Species: DM-Daphnia magna Protocol: EPAA 91-EPA Acute  
 Sample ID: WA0024651-Port of Seattle Sample Type: SRW2-Industrial stormwater  
 Start Date: 04/15/2000 15:30 End Date: 04/17/2000 Lab ID: WAPTL-Parametrix Tox Lab

Pos	ID	Rep	Group	Start	24 Hr	48 Hr	72 Hr	96 Hr	Notes
	1	1	D-Control	5	5	5			
	2	2	D-Control	5	5	5			
	3	3	D-Control	5	5	5			
	4	4	D-Control	5	5	5			
	5	1	12.500	5	5	5			
	6	2	12.500	5	5	5			
	7	3	12.500	5	5	5			
	8	4	12.500	5	5	5			
	9	1	25.000	5	5	5			
	10	2	25.000	5	5	5			
	11	3	25.000	5	5	5			
	12	4	25.000	5	5	5			
	13	1	50.000	5	5	5			
	14	2	50.000	5	5	5			
	15	3	50.000	5	5	5			
	16	4	50.000	5	5	5			
	17	1	100.000	5	5	5			
	18	2	100.000	5	5	5			
	19	3	100.000	5	5	5			
	20	4	100.000	5	5	4			
	21	1	200.000	5	4	0			
	22	2	200.000	5	5	0			
	23	3	200.000	5	2	0			
	24	4	200.000	5	4	0			

Comments: POS - Cu in Des Moines Creek Weir Water

PREPARED BY cat 4/20/00  
 CHECKED BY AL 4/20/00

AR 042332

Test: AD-Acute Daphid

Test ID: 2864

Species: DM-Daphnia magna

Protocol: EPAA 91-EPA Acute

Sample ID: WA0024651-Port of Seattle

Sample Type: SRW2-Industrial stormwater

Start Date: 04/15/2000 15:30

End Date: 04/17/2000

Lab ID: WAPTL-Parametrix Tox Lab

Pos	ID	Rep	Group	Start	24 Hr	48 Hr	72 Hr	96 Hr	Notes
	1	1	D-Control	5	5	5			
	2	2	D-Control	5	5	5			
	3	3	D-Control	5	5	5			
	4	4	D-Control	5	5	5			
	5	1	12.500	5	5	5			
	6	2	12.500	5	5	5			
	7	3	12.500	5	5	5			
	8	4	12.500	5	5	5			
	9	1	25.000	5	5	5			
	10	2	25.000	5	5	5			
	11	3	25.000	5	5	5			
	12	4	25.000	5	5	5			
	13	1	50.000	5	5	5			
	14	2	50.000	5	5	5			
	15	3	50.000	5	5	5			
	16	4	50.000	5	5	5			
	17	1	100.000	5	5	5			
	18	2	100.000	5	5	5			
	19	3	100.000	5	5	5			
	20	4	100.000	5	5	4			
	21	1	200.000	5	4	0			
	22	2	200.000	5	5	0			
	23	3	200.000	5	2	0			
	24	4	200.000	5	4	0			

Comments: POS - Cu in Des Moines Creek Weir Water

AR 042333

**Acute Daphid-48 Hr Survival**

Start Date: 04/15/2000 15:30 Test ID: 2864 Sample ID: WA0024651-Port of Seattle  
 End Date: 04/17/2000 Lab ID: WAPTL-Parametrix Tox Lab Sample Type: SRW2-Industrial stormwater  
 Sample Date: 04/14/2000 Protocol: EPAA 91-EPA Acute Test Species: DM-Daphnia magna  
 Comments: POS - Cu in Des Moines Creek Weir Water

Conc-ug/L	1	2	3	4
D-Control	1.0000	1.0000	1.0000	1.0000
12.5	1.0000	1.0000	1.0000	1.0000
25	1.0000	1.0000	1.0000	1.0000
50	1.0000	1.0000	1.0000	1.0000
100	1.0000	1.0000	1.0000	0.8000
200	0.0000	0.0000	0.0000	0.0000

Conc-ug/L	Mean	N-Mean	Transform: Arcsin Square Root					Rank Sum	1-Tailed Critical	Number Resp	Total Number
			Mean	Min	Max	CV%	N				
D-Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4			0	20
12.5	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
25	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
50	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
100	0.9500	0.9500	1.2857	1.1071	1.3453	9.261	4	16.00	10.00	1	20
200	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20

**Auxiliary Tests**

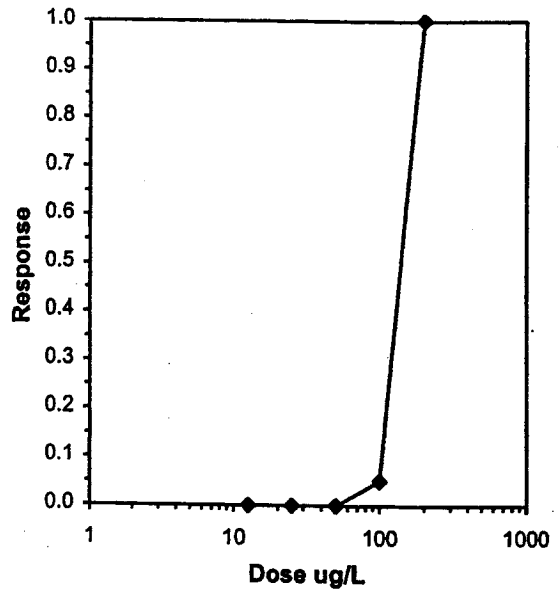
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)      Statistic: 0.5089      Critical: 0.868      Skew: -2.7962      Kurt: 11.6732  
 Equality of variance cannot be confirmed

**Hypothesis Test (1-tail, 0.05)**      NOEC      LOEC      ChV      TU

Steel's Many-One Rank Test      100      200      141.421

**Trimmed Spearman-Kärber**

Trim Level	EC50	95% CL
0.0%	136.60	127.68 146.15
5.0%	138.87	133.76 144.16
10.0%	138.87	133.76 144.16
20.0%	138.87	133.76 144.16
Auto-0.0%	136.60	127.68 146.15

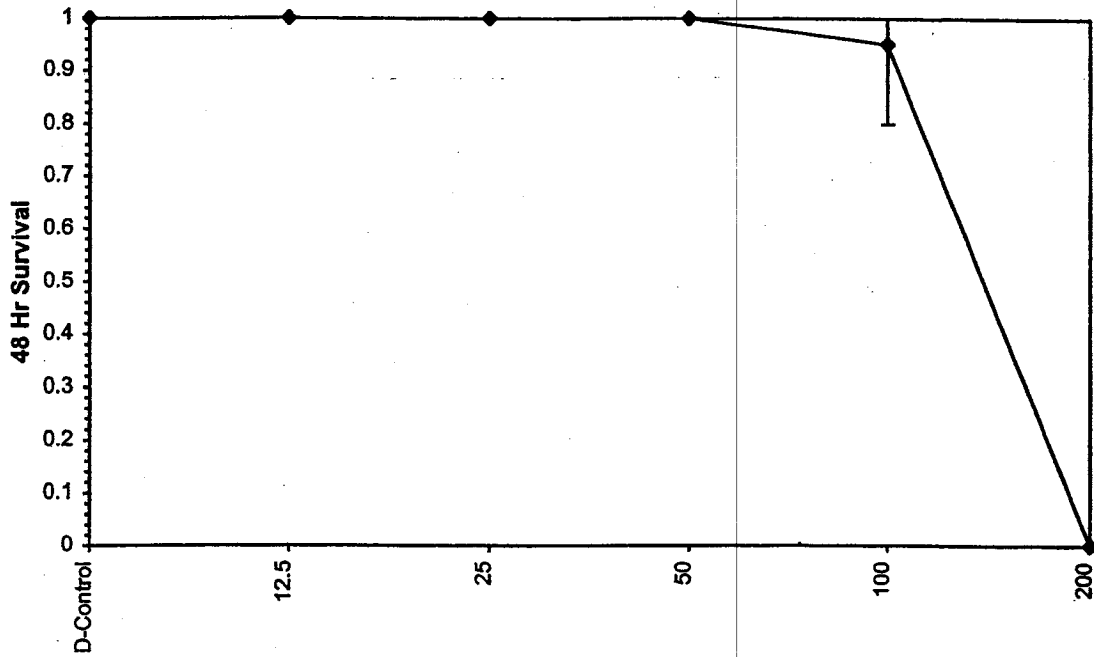


**AR 042334**

Acute Daphid-48 Hr Survival

Start Date: 04/15/2000 15:30 Test ID: 2864 Sample ID: WA0024651-Port of Seattle  
End Date: 04/17/2000 Lab ID: WAPTL-Parametrix Tox Lab Sample Type: SRW2-Industrial stormwater  
Sample Date: 04/14/2000 Protocol: EPAA 91-EPA Acute Test Species: DM-Daphnia magna  
Comments: POS - Cu in Des Moines Creek Weir Water

Dose-Response Plot



AR 042335

STATIC ACUTE *Daphnia magna* TOXICITY TEST

Client Port of Seattle  
Sample Cu in Miller Creek Upstream Water  
Test Dates 4/15/2000 - 4/17/2000

Sample Collection Date 4/14/00  
Test Initiation Time 1500  
Source/Age of Organisms In house cultures / <24 hours  
Dilution Water Miller Creek Upstream Water

Temp (°C) Day 0 25 Day 1 26 Day 2 25

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	7.7	7.5	7.6	8.3	8.2	8.1	121	147
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
12.5 µg/L	A	5	6	5	7.7	7.5	7.7	8.3	8.2	8.1	121	149
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
25 µg/L	A	5	5	5	7.7	7.6	7.8	8.3	8.3	8.2	121	154
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
50 µg/L	A	5	5	5	7.7	7.6	7.8	8.3	8.3	8.2	121	157
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
100 µg/L	A	5	5	3-2	7.7	7.6	7.9	8.3	8.3	8.1	121	152
	B	5	6	3-2								
	C	5	5	4-1								
	D	5	5	3-2								
200 µg/L	A	5	0-5	0	7.7	7.7	7.9	8.3	8.4	8.0	121	155
	B	5	4-1	0-4								
	C	5	5	0-5								
	D	5	5	0-5								
	A											
	B											
	C											
	D											
Initials		DH	DH	Pm	DH	DH	Pm	DH	DH	Pm	DH	Pm
Date		4/15	4/16	4/17	4/15	4/16	4/17	4/15	4/16	4/17	4/15	4/17
QC												

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

Reviewed by: JP 4/20/00

Comments \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

AR 042336

Test: AD-Acute Daphid

Test ID: 2866

Species: DM-Daphnia magna

Protocol: EPAA 91-EPA Acute

Sample ID: WA0024651-Port of Seattle

Sample Type: SRW2-Industrial stormwater

Start Date: 04/15/2000 15:00

End Date: 04/17/2000

Lab ID: WAPTL-Parametrix Tox Lab

Pos	ID	Rep	Group	Start	24 Hr	48 Hr	72 Hr	96 Hr	Notes
	1	1	D-Control	5	5	4			
	2	2	D-Control	5	5	5			
	3	3	D-Control	5	5	5			
	4	4	D-Control	5	5	5			
	5	1	12.500	5	5	5			
	6	2	12.500	5	5	5			
	7	3	12.500	5	5	5			
	8	4	12.500	5	5	5			
	9	1	25.000	5	5	5			
	10	2	25.000	5	5	5			
	11	3	25.000	5	5	5			
	12	4	25.000	5	5	5			
	13	1	50.000	5	5	5			
	14	2	50.000	5	5	5			
	15	3	50.000	5	5	5			
	16	4	50.000	5	5	5			
	17	1	100.000	5	5	3			
	18	2	100.000	5	5	3			
	19	3	100.000	5	5	4			
	20	4	100.000	5	5	3			
	21	1	200.000	5	0	0			
	22	2	200.000	5	4	0			
	23	3	200.000	5	5	0			
	24	4	200.000	5	5	0			

Comments: POS - Cu in Miller Creek Upstream Water

PREPARED BY cas 4/20/00  
 CHECKED BY jl 4/20/00

AR 042337

Test: AD-Acute Daphid Test ID: 2866  
 Species: DM-Daphnia magna Protocol: EPAA 91-EPA Acute  
 Sample ID: WA0024651-Port of Seattle Sample Type: SRW2-Industrial stormwater  
 Start Date: 04/15/2000 15:00 End Date: 04/17/2000 Lab ID: WAPTL-Parametrix Tox Lab

Pos	ID	Rep	Group	Start	24 Hr	48 Hr	72 Hr	96 Hr	Notes
	1	1	D-Control	5	5	4			
	2	2	D-Control	5	5	5			
	3	3	D-Control	5	5	5			
	4	4	D-Control	5	5	5			
	5	1	12.500	5	5	5			
	6	2	12.500	5	5	5			
	7	3	12.500	5	5	5			
	8	4	12.500	5	5	5			
	9	1	25.000	5	5	5			
	10	2	25.000	5	5	5			
	11	3	25.000	5	5	5			
	12	4	25.000	5	5	5			
	13	1	50.000	5	5	5			
	14	2	50.000	5	5	5			
	15	3	50.000	5	5	5			
	16	4	50.000	5	5	5			
	17	1	100.000	5	5	3			
	18	2	100.000	5	5	3			
	19	3	100.000	5	5	4			
	20	4	100.000	5	5	3			
	21	1	200.000	5	0	0			
	22	2	200.000	5	4	0			
	23	3	200.000	5	5	0			
	24	4	200.000	5	5	0			

Comments: POS - Cu in Miller Creek Upstream Water

AR 042338

**Acute Daphid-48 Hr Survival**

Start Date: 04/15/2000 15:00 Test ID: 2866 Sample ID: WA0024651-Port of Seattle  
 End Date: 04/17/2000 Lab ID: WAPTL-Parametrix Tox Lab Sample Type: SRW2-Industrial stormwater  
 Sample Date: 04/14/2000 Protocol: EPAA 91-EPA Acute Test Species: DM-Daphnia magna  
 Comments: POS - Cu in Miller Creek Upstream Water

Conc-ug/L	1	2	3	4
D-Control	0.8000	1.0000	1.0000	1.0000
12.5	1.0000	1.0000	1.0000	1.0000
25	1.0000	1.0000	1.0000	1.0000
50	1.0000	1.0000	1.0000	1.0000
100	0.6000	0.6000	0.8000	0.6000
200	0.0000	0.0000	0.0000	0.0000

Conc-ug/L	Mean	N-Mean	Transform: Arcsin Square Root				Rank Sum	1-Tailed Critical	Number Resp	Total Number
			Mean	Min	Max	CV%				
D-Control	0.9500	1.0000	1.2857	1.1071	1.3453	9.261	4	1	20	
12.5	1.0000	1.0526	1.3453	1.3453	1.3453	0.000	4	0	20	
25	1.0000	1.0526	1.3453	1.3453	1.3453	0.000	4	0	20	
50	1.0000	1.0526	1.3453	1.3453	1.3453	0.000	4	0	20	
100	0.6500	0.6842	0.9413	0.8861	1.1071	11.742	4	7	20	
200	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4	20	20	

**Auxillary Tests**

Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)      Statistic: 0.81017      Critical: 0.868      Skew: -0.22      Kurt: 4.10888

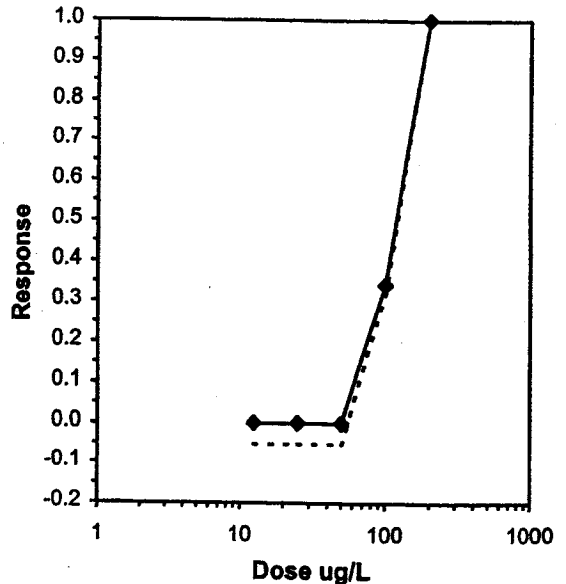
Equality of variance cannot be confirmed

Hypothesis Test (1-tail, 0.05)      NOEC      LOEC      ChV      TU

Steel's Many-One Rank Test      100      200      141.421

**Trimmed Spearman-Kärber**

Trim Level	EC50	95% CL
0.0%	111.59	96.33 129.27
5.0%	112.81	95.68 133.00
10.0%	114.00	94.32 137.79
20.0%	116.22	88.21 153.11
Auto-0.0%	111.59	96.33 129.27



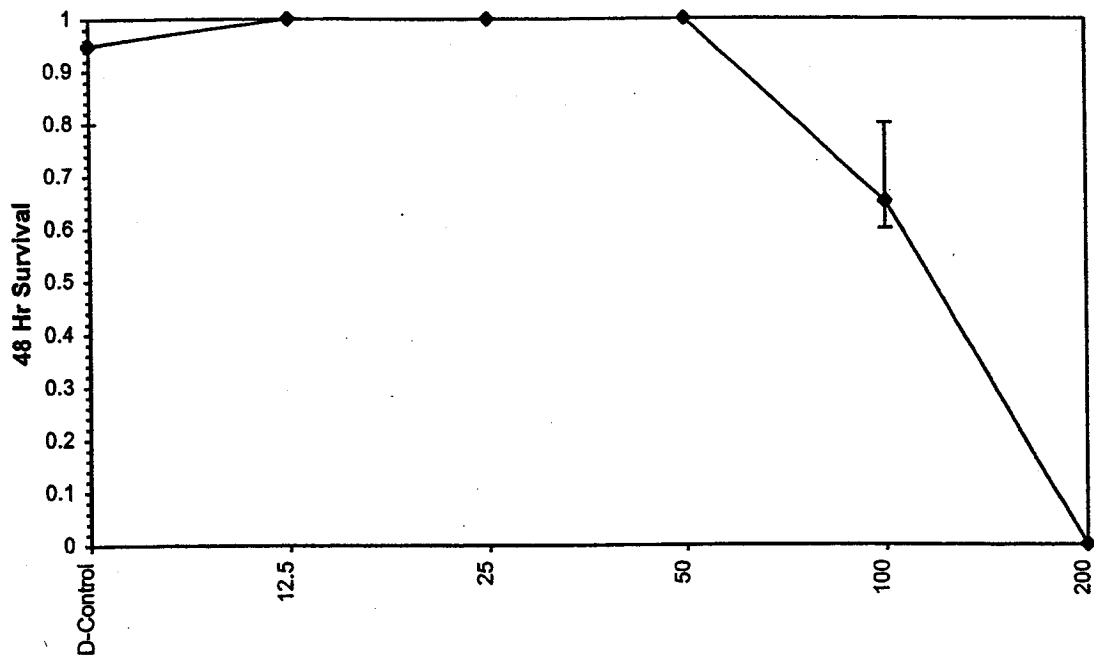
**AR 042339**



Acute Daphnid-48 Hr Survival

Start Date: 04/15/2000 15:00 Test ID: 2866 Sample ID: WA0024651-Port of Seattle  
End Date: 04/17/2000 Lab ID: WAPTL-Parametrix Tox Lab Sample Type: SRW2-Industrial stormwater  
Sample Date: 04/14/2000 Protocol: EPAA 91-EPA Acute Test Species: DM-Daphnia magna  
Comments: POS - Cu in Miller Creek Upstream Water

Dose-Response Plot



AR 042340

STATIC ACUTE *Daphnia magna* TOXICITY TEST

Client Port of Seattle  
Sample Cu in Miller Creek Detention Facility Water  
Test Dates 4/15/2000 - 4/17/2000

Sample Collection Date 4/14/00  
Test Initiation Time 15:5  
Source/Age of Organisms In house cultures / <24 hours  
Dilution Water Miller Creek Detention Facility Water

Temp (°C) Day 0 25 Day 1 25 Day 2 25

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	8.0	8.3	8.3	8.2	8.3	8.3	218	257
	B	5	5	5								
	C	5	5	5								
	D	5	6	5								
12.5 µg/L	A	5	5	4-1	8.0	8.3	8.3	8.2	8.3	8.3	218	255
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
25 µg/L	A	5	5	5	8.0	8.3	8.3	8.2	8.3	8.3	218	256
	B	5	5	5								
	C	5	5	4-1								
	D	5	5	4-1								
50 µg/L	A	5	5	5	8.0	8.3	8.3	8.2	8.3	8.2	218	255
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
100 µg/L	A	5	5	5	8.0	8.3	8.3	8.2	8.3	8.1	218	251
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
200 µg/L	A	5	5	1-4	8.0	8.3	8.3	8.2	8.3	8.0	218	245
	B	5	4-1	2-2								
	C	5	5	2-3								
	D	5	3-2	2-1								
	A											
	B											
	C											
	D											
Initials		DA	DA	PM	DA	DA	PM	DA	DA	PM	DA	PM
Date		4/15	4/16	4/17	4/15	4/16	4/17	4/15	4/16	4/17	4/15	4/17
QC												

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

Reviewed by: JD 4/20/00

Comments \_\_\_\_\_

AR 042341

Test: AD-Acute Daphid Test ID: 2865  
 Species: DM-Daphnia magna Protocol: EPAA 91-EPA Acute  
 Sample ID: WA0024651-Port of Seattle Sample Type: SRW2-Industrial stormwater  
 Start Date: 04/15/2000 15:15 End Date: 04/17/2000 Lab ID: WAPTL-Parametrix Tox Lab

Pos	ID	Rep	Group	Start	24 Hr	48 Hr	72 Hr	96 Hr	Notes
	1	1	D-Control	5	5	5			
	2	2	D-Control	5	5	5			
	3	3	D-Control	5	5	5			
	4	4	D-Control	5	5	5			
	5	1	12.500	5	5	4			
	6	2	12.500	5	5	5			
	7	3	12.500	5	5	5			
	8	4	12.500	5	5	5			
	9	1	25.000	5	5	5			
	10	2	25.000	5	5	5			
	11	3	25.000	5	5	4			
	12	4	25.000	5	5	4			
	13	1	50.000	5	5	5			
	14	2	50.000	5	5	5			
	15	3	50.000	5	5	5			
	16	4	50.000	5	5	5			
	17	1	100.000	5	5	5			
	18	2	100.000	5	5	5			
	19	3	100.000	5	5	5			
	20	4	100.000	5	5	5			
	21	1	200.000	5	5	1			
	22	2	200.000	5	4	2			
	23	3	200.000	5	5	2			
	24	4	200.000	5	3	2			

Comments: POS - Cu in Miller Creek Detention Facility Water

PREPARED BY cat 4/20/00  
 CHECKED BY 92 4/20/00

AR 042342

Test: AD-Acute Daphid

Test ID: 2865

Species: DM-Daphnia magna

Protocol: EPAA 91-EPA Acute

Sample ID: WA0024651-Port of Seattle

Sample Type: SRW2-Industrial stormwater

Start Date: 04/15/2000 15:15

End Date: 04/17/2000

Lab ID: WAPTL-Parametrix Tox Lab

Pos	ID	Rep	Group	Start	24 Hr	48 Hr	72 Hr	96 Hr	Notes
	1	1	D-Control	5	5	5			
	2	2	D-Control	5	5	5			
	3	3	D-Control	5	5	5			
	4	4	D-Control	5	5	5			
	5	1	12.500	5	5	4			
	6	2	12.500	5	5	5			
	7	3	12.500	5	5	5			
	8	4	12.500	5	5	5			
	9	1	25.000	5	5	5			
	10	2	25.000	5	5	5			
	11	3	25.000	5	5	4			
	12	4	25.000	5	5	4			
	13	1	50.000	5	5	5			
	14	2	50.000	5	5	5			
	15	3	50.000	5	5	5			
	16	4	50.000	5	5	5			
	17	1	100.000	5	5	5			
	18	2	100.000	5	5	5			
	19	3	100.000	5	5	5			
	20	4	100.000	5	5	5			
	21	1	200.000	5	5	1			
	22	2	200.000	5	4	2			
	23	3	200.000	5	5	2			
	24	4	200.000	5	3	2			

Comments: POS - Cu in Miller Creek Detention Facility Water

AR 042343

**Acute Daphnid-48 Hr Survival**

Start Date: 04/15/2000 15:15	Test ID: 2865	Sample ID: WA0024651-Port of Seattle
End Date: 04/17/2000	Lab ID: WAPTL-Parametrix Tox Lab	Sample Type: SRW2-Industrial stormwater
Sample Date: 04/14/2000	Protocol: EPAA 91-EPA Acute	Test Species: DM-Daphnia magna
Comments: POS - Cu in Miller Creek Detention Facility Water		

Conc-ug/L	1	2	3	4
D-Control	1.0000	1.0000	1.0000	1.0000
12.5	0.8000	1.0000	1.0000	1.0000
25	1.0000	1.0000	0.8000	0.8000
50	1.0000	1.0000	1.0000	1.0000
100	1.0000	1.0000	1.0000	1.0000
200	0.2000	0.4000	0.4000	0.4000

Conc-ug/L	Mean	N-Mean	Transform: Arcsin Square Root					Rank Sum	1-Tailed Critical	Number Resp	Total Number
			Mean	Min	Max	CV%	N				
D-Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4			0	20
12.5	0.9500	0.9500	1.2857	1.1071	1.3453	9.261	4	16.00	10.00	1	20
25	0.9000	0.9000	1.2262	1.1071	1.3453	11.212	4	14.00	10.00	2	20
50	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
100	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
*200	0.3500	0.3500	0.6295	0.4636	0.6847	17.561	4	10.00	10.00	13	20

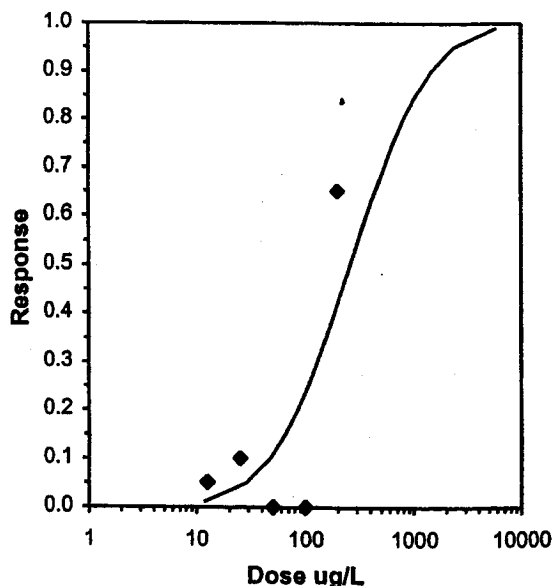
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.83783	0.884	-0.952	0.83974
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	100	200	141.421	

Maximum Likelihood-Probit											
Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	1.71858	1.15876	-1.9691	5.40626	0	17.4984	7.81472	5.6E-04	2.42024	0.58188	5
Intercept	0.84061	2.28474	-6.4305	8.11168							

Point	Probits	ug/L	95% Fiducial Limits
EC01	2.674	11.6574	
EC05	3.355	29.0499	
EC10	3.718	47.2652	
EC15	3.964	65.6401	
EC20	4.158	85.2169	
EC25	4.326	106.605	
EC40	4.747	187.425	
EC50	5.000	263.175	
EC60	5.253	369.539	
EC75	5.674	649.701	
EC80	5.842	812.761	
EC85	6.036	1055.16	
EC90	6.282	1465.37	
EC95	6.645	2384.21	
EC99	7.326	5941.4	

Significant heterogeneity detected (p = 5.58E-04)

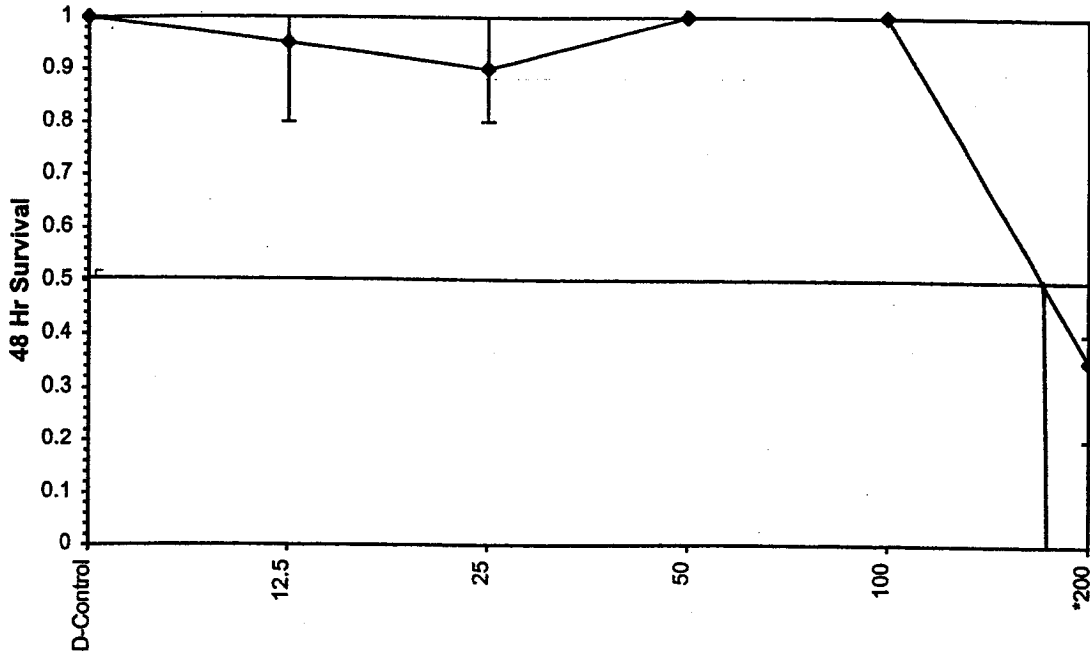


**AR 042344**

Acute Daphnid-48 Hr Survival

Start Date: 04/15/2000 15:15 Test ID: 2865 Sample ID: WA0024651-Port of Seattle  
End Date: 04/17/2000 Lab ID: WAPTL-Parametrix Tox Lab Sample Type: SRW2-Industrial stormwater  
Sample Date: 04/14/2000 Protocol: EPAA 91-EPA Acute Test Species: DM-Daphnia magna  
Comments: POS - Cu in Miller Creek Detention Facility Water

Dose-Response Plot



AR 042345

TRIMMED SPEARMAN-KARBER METHOD. MONTANA STATE UNIV

FOR REFERENCE, CITE:

HAMILTON, M.A., R.C. RUSSO, AND R.V. THURSTON, 1977.  
TRIMMED SPEARMAN-KARBER METHOD FOR ESTIMATING MEDIAN  
LETHAL CONCENTRATIONS IN TOXICITY BIOASSAYS.  
ENVIRON. SCI. TECHNOL. 11(7): 714-719;  
CORRECTION 12(4):417 (1978).

DATE: 4/15/00  
CHEMICAL: CU

TEST NUMBER: POS

DURATION: 48 HOURS  
SPECIES: DM

RAW DATA:

CONCENTRATION(UG/L)	12.50	25.00	50.00	100.00	200.00
NUMBER EXPOSED:	20	20	20	20	20
MORTALITIES:	1	2	0	0	13
SPEARMAN-KARBER TRIM:	35.00%				

SPEARMAN-KARBER ESTIMATES: LC50: 168.78  
95% LOWER CONFIDENCE: 140.44  
95% UPPER CONFIDENCE: 202.83

NOTE: MORTALITY PROPORTIONS WERE NOT MONOTONICALLY INCREASING.  
ADJUSTMENTS WERE MADE PRIOR TO SPEARMAN-KARBER ESTIMATION.

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AR 042346

STATIC ACUTE *Daphnia magna* TOXICITY TEST

Client Port of Seattle  
Sample Cu in Northwest Ponds Outlet Water  
Test Dates 4/15/2000 - 4/17/2000

Sample Collection Date 4/14/00  
Test Initiation Time 1445  
Source/Age of Organisms In house cultures / <24 hours  
Dilution Water Northwest Ponds Outlet Water

Temp (°C) Day 0 25 Day 1 25 Day 2 25

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	8.0	8.3	8.2	8.3	8.3	7.8	202	213
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
12.5 µg/L	A	5	5	5	8.0	8.3	8.2	8.3	8.3	7.9	202	215
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
25 µg/L	A	5	5	5	8.0	8.3	8.3	8.3	8.3	7.9	202	239
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
50 µg/L	A	5	5	5	8.0	8.4	8.3	8.3	8.3	7.9	202	234
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
100 µg/L	A	5	5	5	8.0	8.4	8.3	8.3	8.3	7.8	202	225
	B	5	5	5								
	C	5	5	2-2								
	D	5	5	5								
200 µg/L	A	5	5	0-5	8.0	8.4	8.3	8.3	8.3	7.8	202	214
	B	5	5	0-5								
	C	5	5	0-5								
	D	5	5	0-5								
	A											
	B											
	C											
	D											
Initials		JH	JH	DM	JH	PM	PM	JH	JH	PM	JH	PM
Date		4/15	4/16	4/17	4/15	4/16	4/17	4/15	4/16	4/17	4/15	4/17
QC												

Shading represents areas for which data collection is not required.

NT = Not Taken

Reviewed by: JZ 4/20/00

Comments

AR 042347



Test: AD-Acute Daphid

Test ID: 2863

Species: DM-Daphnia magna

Protocol: EPAA 91-EPA Acute

Sample ID: WA0024651-Port of Seattle

Sample Type: SRW2-Industrial stormwater

Start Date: 04/15/2000 14:45

End Date: 04/17/2000

Lab ID: WAPTL-Parametrix Tox Lab

Pos	ID	Rep	Group	Start	24 Hr	48 Hr	72 Hr	96 Hr	Notes
	1	1	D-Control	5	5	5			
	2	2	D-Control	5	5	5			
	3	3	D-Control	5	5	5			
	4	4	D-Control	5	5	5			
	5	1	12.500	5	5	5			
	6	2	12.500	5	5	5			
	7	3	12.500	5	5	5			
	8	4	12.500	5	5	5			
	9	1	25.000	5	5	5			
	10	2	25.000	5	5	5			
	11	3	25.000	5	5	5			
	12	4	25.000	5	5	5			
	13	1	50.000	5	5	5			
	14	2	50.000	5	5	5			
	15	3	50.000	5	5	5			
	16	4	50.000	5	5	5			
	17	1	100.000	5	5	5			
	18	2	100.000	5	5	5			
	19	3	100.000	5	5	3			
	20	4	100.000	5	5	5			
	21	1	200.000	5	5	0			
	22	2	200.000	5	5	0			
	23	3	200.000	5	5	0			
	24	4	200.000	5	5	0			

Comments: POS - Cu in NW Ponds Outlet Water

PREPARED BY cat 4/20/00  
 CHECKED BY Q2 4/20/00

AR 042348

Test: AD-Acute Daphid Species: DM-Daphnia magna Sample ID: WA0024651-Port of Seattle Start Date: 04/15/2000 14:45	Test ID: 2863 Protocol: EPAA 91-EPA Acute Sample Type: SRW2-Industrial stormwater Lab ID: WAPTL-Parametrix Tox Lab End Date: 04/17/2000
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Pos	ID	Rep	Group	Start	24 Hr	48 Hr	72 Hr	96 Hr	Notes
	1	1	D-Control	5	5	5			
	2	2	D-Control	5	5	5			
	3	3	D-Control	5	5	5			
	4	4	D-Control	5	5	5			
	5	1	12.500	5	5	5			
	6	2	12.500	5	5	5			
	7	3	12.500	5	5	5			
	8	4	12.500	5	5	5			
	9	1	25.000	5	5	5			
	10	2	25.000	5	5	5			
	11	3	25.000	5	5	5			
	12	4	25.000	5	5	5			
	13	1	50.000	5	5	5			
	14	2	50.000	5	5	5			
	15	3	50.000	5	5	5			
	16	4	50.000	5	5	5			
	17	1	100.000	5	5	5			
	18	2	100.000	5	5	5			
	19	3	100.000	5	5	3			
	20	4	100.000	5	5	5			
	21	1	200.000	5	5	0			
	22	2	200.000	5	5	0			
	23	3	200.000	5	5	0			
	24	4	200.000	5	5	0			

Comments: POS - Cu in NW Ponds Outlet Water

**AR 042349**

**Acute Daphid-48 Hr Survival**

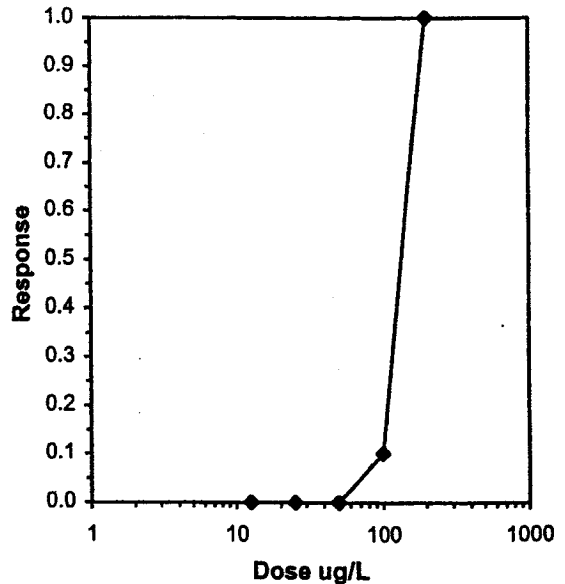
Start Date: 04/15/2000 14:45	Test ID: 2863	Sample ID: WA0024651-Port of Seattle
End Date: 04/17/2000	Lab ID: WAPTL-Parametrix Tox Lab	Sample Type: SRW2-Industrial stormwater
Sample Date: 04/14/2000	Protocol: EPAA 91-EPA Acute	Test Species: DM-Daphnia magna
Comments: POS - Cu in NW Ponds Outlet Water		

Conc-ug/L	1	2	3	4
D-Control	1.0000	1.0000	1.0000	1.0000
12.5	1.0000	1.0000	1.0000	1.0000
25	1.0000	1.0000	1.0000	1.0000
50	1.0000	1.0000	1.0000	1.0000
100	1.0000	1.0000	0.6000	1.0000
200	0.0000	0.0000	0.0000	0.0000

Conc-ug/L	Mean	N-Mean	Transform: Arcsin Square Root					N	Rank Sum	1-Tailed Critical	Number Resp	Total Number
			Mean	Min	Max	CV%						
D-Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4			0	20	
12.5	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20	
25	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20	
50	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20	
100	0.9000	0.9000	1.2305	0.8861	1.3453	18.660	4	16.00	10.00	2	20	
200	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20	

Auxillary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution ( $p \leq 0.01$ )	0.5089	0.868	-2.7962	11.6732
Equality of variance cannot be confirmed				
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	100	200	141.421	

Trimmed Spearman-Kärber			
Trim Level	EC50	95% CL	
0.0%	131.95	120.23	144.81
5.0%	134.92	120.13	151.53
10.0%	136.08	128.49	144.12
20.0%	136.08	128.49	144.12
Auto-0.0%	131.95	120.23	144.81

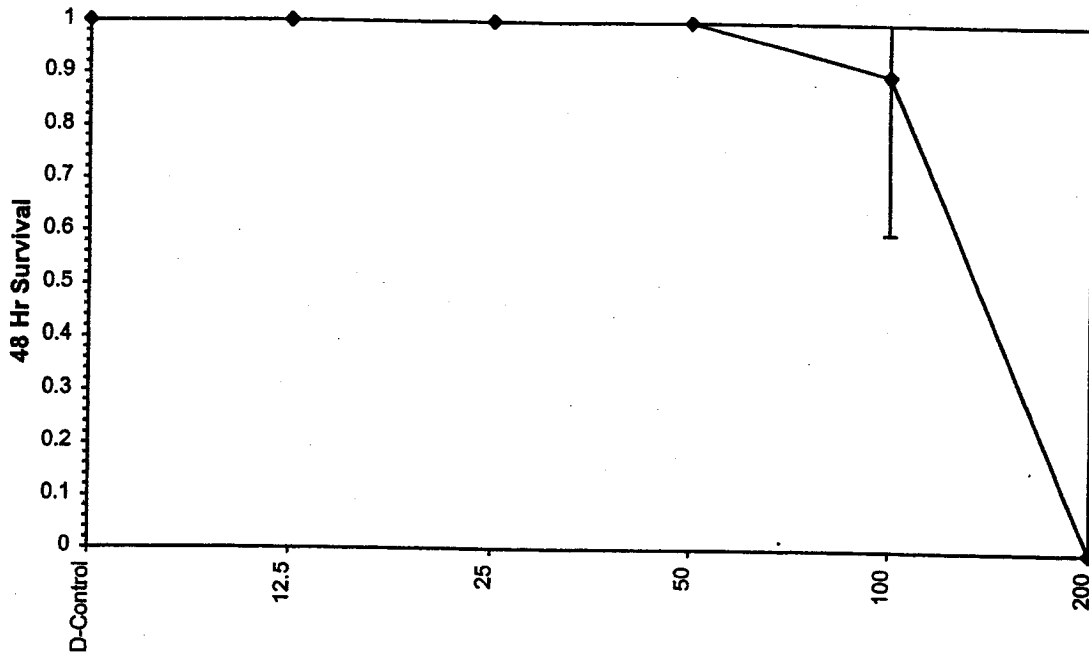


**AR 042350**

Acute Daphid-48 Hr Survival

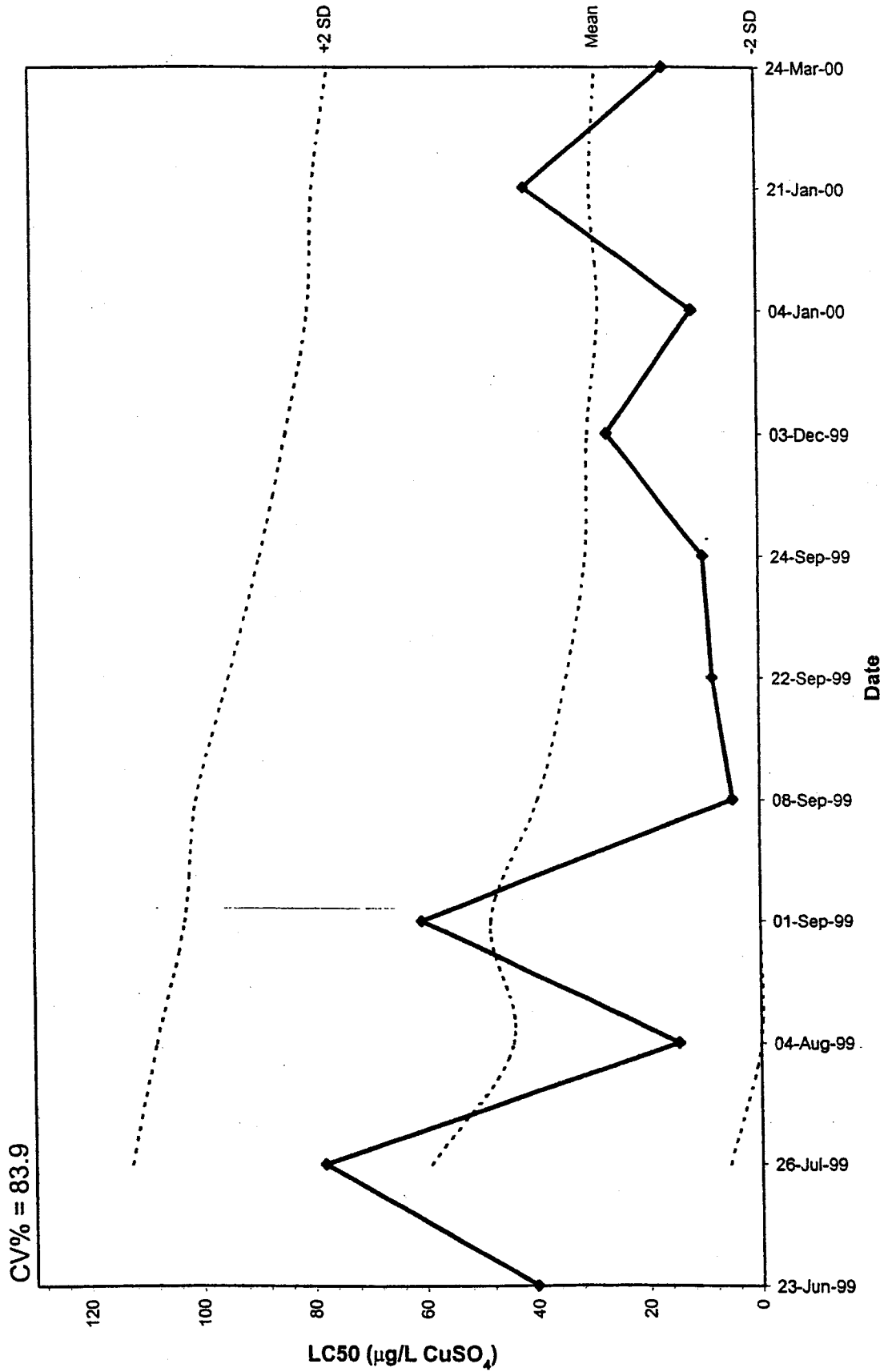
Start Date: 04/15/2000 14:45 Test ID: 2863 Sample ID: WA0024651-Port of Seattle  
End Date: 04/17/2000 Lab ID: WAPTL-Parametrix Tox Lab Sample Type: SRW2-Industrial stormwater  
Sample Date: 04/14/2000 Protocol: EPAA 91-EPA Acute Test Species: DM-Daphnia magna  
Comments: POS - Cu in NW Ponds Outlet Water

Dose-Response Plot



AR 042351

# Cum Sum Control Chart for *D. magna* Survival



AR 042352