

Contract No CN-05011966B

**The Provision of Water Quality Monitoring
Services For the Perth Seawater Desalination
Plant: WET Testing**

FINAL REPORT

Prepared for

Water Corporation

Report ECX07-0811

Marine Toxicity Tests

8th February 2008

Prepared by

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Executive Summary

This report presents a study initiated by the Water Corporation to meet Ministerial condition **655:P10, Whole Effluent Toxicity (WET) Testing**, requiring the toxicity testing of the high salinity seawater discharged from the Perth Seawater Desalination Plant (PSDP) 12 months after commissioning. The program to meet the Ministerial condition comprised preliminary testing (using simulated brine) and testing at 12 months after plant commissioning. After discussions with the Marine Science Division at the Department of Environment and Conservation (DEC) in December 2004 the Water Corporation included an additional test to assess brine toxicity at plant start up. Testing has been designed and implemented as stated in the PSDP Environmental Management Plan for WET testing.

The toxicity of the brine samples was assessed using the following tests which are all NATA accredited:

- **72 hour algal growth test using the unicellular algae *Isochrysis galbana*.**
- **72 hour macroalgal germination assay using the brown kelp *Ecklonia radiata*.**
- **48 hour mussel larval development using *Mytilis edulis*.**
- **28 day copepod reproduction test using the copepod *Gladioferens imparipes*.**
- **7 day larval fish growth test using the marine fish pink snapper, *Pagrus auratus*.**

The EC50, EC10, EC5, NOEC and LOEC values for each test were calculated using the Toxcalc (Tidepool Scientific) statistics program and the results from the RO brine samples from November 2006 (at commissioning) and November 2007 (12 months post-commissioning) are summarised in Tables 1 and 2.

All toxicity tests were undertaken at Geotechnical Services (Geotech) Ecotoxicology Laboratory at Fremantle using filtered seawater obtained from Cockburn Sound as the dilution water.

Table 1 Summary of 2006 / 2007 EC/IC50, EC/IC10 Values

Test	2006 EC/IC50 % Brine	2006 EC/IC10 % Brine	2007 EC/IC50 % Brine	2007 EC/IC10 % Brine
72 Hour Algal	>83.2	>83.2	81.3	13.7
72 Hour Macroalgal	28.0	20.9	>100	92.9
48 Hour Mussel	15.1	11.7	17.9	12.5*
Copepod Reproduction	Continuous 2.24**	Continuous 0.12**	24 hr pulse 29.8***	24 hr pulse 16.8***
7 Day Larval Fish Growth	14.7	11.0	19.9	9.6

* *Toxcalc does not include the EC10 values when using the Trimmed Spearman-Kärber non-parametric analysis. The NOEC value is used to replace the EC10 value. EC10 \equiv NOEC (Moore and Caux 1997, USEPA 1991, Hoekstra and Van Ewijk 1993)*

** *The 2006 copepod reproduction test exposed the copepods to the RO brine for the duration of the test.*

****The 2007 copepod reproduction test exposed the neonate copepod to the RO brine for 24 hours at which time the brine was replaced with dilution water for the duration of the test.*

The RO brine showed similar toxicity to most species when compared to the previous tests performed on pilot plant RO brine and simulated brine in 2005 (Geotechnical Services 2006). However, the RO Brine tested in 2006 showed higher toxicity in the copepod reproduction test than in the 2005 tests. The 2005 test using a pilot plant RO plant discharge produced an EC50 of 13.3% brine for copepods, whereas, the test on the RO brine from the Cockburn Sound Desalination Plant in 2006 showed an EC50 of 2.24% brine. This is the only toxicity test that has shown a significant increase in toxicity from the preliminary testing performed in 2005.

During 2007 a project was undertaken to determine the appropriate exposure period for the copepods, taking into account the biology and the tide and current movements in Cockburn Sound. Exposure times ranges from 1 hour to 24 hours to simulate the movement of drifting organisms through the plume (Yeates et al. 2006). To simulate potential tidal movement through the plume, two ten minute exposures were performed twice a day for two days (Warne 2007). After the pulse exposure of RO brine, all copepods were maintained in Cockburn Sound diluent for the remainder of the test (28 days). The results from this study are shown in Table 2.

Previous copepod reproduction bioassays in 2005 and 2006 exposed the copepods to the RO brine for the entire duration of the test (30 days). That represented a worst case scenario, where the copepods are living in the discharge plume. This is a scenario which is extremely unlikely to occur in Cockburn Sound as neonate copepods are zooplankton and are effectively drifting organisms. The duration of exposure for planktonic copepods exposed to the RO brine discharge in Cockburn Sound would be in the order of minutes as discussed in Yeates et al. (2006). From the results in Table 2 the 16 hour and 24 hour pulse exposures show similar responses. The 24 hour exposure was selected for use in the species protection trigger level calculations as it represents a realistic exposure in Cockburn Sound on days with low wind and tidal movement. However, in most cases this will overestimate the exposure by more than 4 fold. Therefore, from an environmental realism point of view, a pulse exposure test would be more appropriate than a continuous exposure test (Warne 2008).

Table 2 Copepod Pulse Exposure Results (November 2007)

Test	Exposure	EC50 % Brine	EC10 % Brine
10 minute 2x /day	Pulse	>100	48.8
1 hour	Pulse	>100	4.8*
2 hour	Pulse	>100	4.2*
4 hour	Pulse	>100	13.3
8 hour	Pulse	65.1	50**
16 hour	Pulse	29.2	25**
24 hour	Pulse	29.8	16.8

**Results are inconsistent (Warne 2008) and may be confounded due to handling and timing of moulting.*

*** Toxcalc does not include the EC10 values when using the Trimmed Spearman-Kärber non-parametric analysis. The NOEC value is used to replace the EC10 value. EC10 \equiv NOEC (Moore and Caux 1997, USEPA 1991, Hoekstra and Van Ewijk 1993)*

Species Protection Trigger Values

The EC/IC10, EC/IC5 and NOEC values for all tests in 2006 (Table 3) and 2007 (Table 7) were used in the BurrliOZ statistics program (Campbell et al. 2000) to calculate the protection trigger values at 99%, 95%, 90% and 80% species protection with 50% confidence levels (Tables 4, 5 and 6 for 2006 results and Tables 8, 9, and 10 for 2007 results). It must be noted that the

number of data points used (5) is regarded as small for statistical analysis and, therefore, the results generated using the BurrliOZ program should be interpreted with caution.

Table 3. 2006 EC/IC10, EC/IC5 and NOEC Results used in BurrliOZ for Species Protection Trigger Values

Test	EC/IC 10/NOEC % Brine	EC/IC 5 % Brine	NOEC % Brine
72 Hour Algal	83.2	83.2	83.2
72 Hour Macroalgal	20.9	19.2	6.3
48 Hour Mussel	11.7	10.9	6.1
Copepod Reproduction Continuous	0.45*	0.23**	0.45***
7 Day Larval Fish Growth	11.0	10.2	11.0***

*EC50 divided by 5 \equiv EC10 (ANZECC and ARMCANZ 2000, Warne 2001)

**EC50 divided by 10 \equiv EC5 (ANZECC and ARMCANZ 2000, Warne 2001)

*** EC10 \equiv NOEC (Moore and Caux 1997, USEPA 1991, Hoekstra and Van Ewijk 1993)

Table 4 2006 BurrliOZ EC/IC 10 Species Protection Trigger Values

Protection Level with 50% confidence	Protection Value % Brine	Dilution Factor
99	0.03	3,333
95	0.37	270
90	1.07	93
80	3.12	32

Table 5 2006 BurrliOZ EC/IC 5 Species Protection Trigger Values

Protection Level with 50% confidence	Protection Value % Brine	Dilution Factor
99	0.01	10,000
95	0.2	500
90	0.67	149
80	2.3	43

Table 6 2006 BurrliOZ NOEC Species Protection Trigger Values

Protection Level with 50% confidence	Protection Value % Brine	Dilution Factor
99	0.06	1,666
95	0.37	270
90	0.84	119
80	1.95	51

Table 7. 2007 EC/IC10, EC/IC5 and NOEC Results used in BurrliOZ for Species Protection Trigger Values

Test	EC/IC10/NOEC % Brine	EC5 % Brine	NOEC % Brine
72 Hour Algal	13.7	12.1	10.4
72 Hour Macroalgal	92.9	77.4	50
48 Hour Mussel	12.5	12.5	12.5
Copepod Reproduction 24 Hour Pulse	5.9*	3.0**	12.5
7 Day Larval Fish Growth	9.6	7.8	12.5

*EC50 divided by 5 \equiv EC10 (ANZECC and ARMCANZ 2000, Warne 2001)

**EC50 divided by 10 \equiv EC5 (ANZECC and ARMCANZ 2000, Warne 2001)

Table 8 2007 BurrliOZ EC10 Species Protection Trigger Values

Protection Level with 50% confidence	Protection Value % Brine	Dilution Factor
99	6.64	15.1
95	8.15	12.3
90	9.23	10.8
80	10.93	9.2

Table 9 2007 BurrliOZ EC5 Species Protection Trigger Values

Protection Level with 50% confidence	Protection Value % Brine	Dilution Factor
99	1.98	50.5
95	2.87	34.8
90	3.60	27.8
80	4.92	20.3

Table 10 2007 BurrliOZ NOEC Species Protection Trigger Values

Protection Level with 50% confidence	Protection Value % Brine	Dilution Factor
99	7.91	12.6
95	9.02	11.1
90	9.78	10.2
80	10.92	9.2

Species Protection Values at Commissioning

The 2006 results listed in Tables 4, 5 and 6 show the concentrations of RO brine in the water column that will meet the species protection trigger level for a 99%, 95%, 90% and 80% species protection level and the dilutions required to meet these levels. However, the continuous exposure of the copepods to the RO brine during the 28 days of the test overestimated the amount of exposure that copepods would encounter passing through the plume in Cockburn Sound. Therefore, the species protection trigger values from 2006 overestimate the toxicity of the RO brine in Cockburn Sound. As discussed above, subsequent testing has shown that a 24 hour exposure was representative of a realistic exposure in Cockburn Sound on days with low wind and tidal movement.

Species Protection Values 12 Months After Commissioning

The 2007 results listed in Tables 8, 9 and 10 show the concentrations of RO brine in the water column that will meet the species protection trigger level for a 99%, 95%, 90% and 80% species protection level and the dilutions required to meet these levels. The diffuser at the desalination plant has always delivered at least a 45 fold dilution factor at 50 metres from the diffuser for all flow rates: 54 fold for 1/3 flow, 59.5 fold for 2/3 flow and 61.4 fold for full flow (Okely et al. 2007). Therefore, the 80% (LEPA) and 90% (MEPA) species protection trigger values will be met with a safety margin in all the scenarios listed above.

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Glossary

EC50	<p>Concentration that causes an effect on 50% of the population Eg. Growth: Concentration that results in 50% less growth when compared to controls Reproduction: Concentration that results in 50% less fecundity when compared to controls Germination: Concentration that results in 50% germination of zoospores Larval development: Concentration that results in 50% of larva deformed</p> <p>Calculated statistically</p>
IC50	<p>Concentration that causes an inhibition of growth of 50% when compared with controls (Unicellular alga bioassay)</p> <p>Calculated statistically</p>
EC10 / IC10	As above except the result is a 10% impact on the test species
EC5 / IC5	As above except the result is a 5% impact on the test species
LOEC	<p>Lowest Observed Effect Concentration</p> <p>Function of concentration tested</p>
NOEC	<p>No Observed Effect Concentration</p> <p>Function of concentration tested</p>
‰ / ppt	Parts per thousand

1. Introduction

1.1 Ministerial Conditions

This report presents the results from a study initiated for the Water Corporation to determine the toxicity of a seawater concentrate that is discharged into Cockburn Sound from the Perth Desalination Plant 12 months after commissioning. This testing was performed to satisfy the Ministerial conditions shown below.

655: P10 Whole Effluent Toxicity (WET) testing.

“To ensure that the discharge complies with the requirements of the Cockburn Sound Environmental Protection Policy and the Revised Environmental Quality Criteria Reference Document (Cockburn Sound). Conduct WET testing of the high salinity seawater discharge including added chemicals (anti-scalants and biocides) as soon as the chemicals to be used and their likely dosing rates are known to a reasonable level of certainty. Conduct the testing following the principles contained in the USEPA, APHA and ASTM protocols at a NATA accredited laboratory in accordance with the protocols set out in ANZECC/ARMCANZ (2000) whole effluent toxicity protocols, at various concentration levels as stated in the Water Quality Management Plan. Report the results of WET testing as described in commitment 10.1 to the DoE. Conduct WET testing of the high salinity seawater discharge as described in commitment 10.1 above 12 months after commissioning. “

1.2 Selected WET Tests and Laboratory

All WET tests were performed at Geotechnical Services' (Geotech) Fremantle Ecotoxicology Laboratory. All bioassays performed by Geotech in 2007 are NATA accredited. As Geotech works to a Quality Management System and is a private company all protocols are commercial-in-confidence and are controlled documents, which precludes publication in a public document. Summaries of the protocols have been included in this document.

The toxicity of both the 2006 and 2007 RO brine samples were assessed using the following tests:

- 72 hour algal growth test using the unicellular algae *Isochrysis galbana*.
- 72 hour macroalgal germination assay using the brown kelp *Ecklonia radiata*.
- 48 hour mussel larval development using the blue mussel *Mytilus edulis*

- 28 day copepod reproduction test using the copepod *Gladioferens imparipes*.
- 7 day larval fish growth test using the marine fish pink snapper, *Pagrus auratus*.

1.3 Rationale of Selected WET tests

The use of living test organisms is the only reliable way to measure the potential biological impacts of a sample. For maximum sensitivity of the WET tests, the organisms selected for testing must be relevant to or indigenous to the receiving ecosystem or appropriate surrogates. Summaries of the following tests are located in Appendix 1.

1.3.1 Microalgae

Unicellular alga form the base of the food chain in the marine system. These alga are primary producers in the marine system and provide food for larval, juvenile and adult crustaceans and molluscs. The microalgal specie *Isochrysis galbana* was selected as the microalgal species to assess the toxicity of the brine. *Isochrysis* sp. have been commonly used in toxicity tests throughout Australia for the past 15 years and, therefore, a large amount of information on these species is available (Evans et al. 2000).

1.3.2 Macroalgae

The marine macroalga *Ecklonia radiata* provides both food and habitat for a range of other organisms in near-shore coastal areas. *E. radiata* is common along the temperate Western Australian coast. Toxicity tests using *E. radiata* have been performed on marine discharges throughout temperate Australia (Bidwell et al. 1998, BurrIDGE et al. 1999).

1.3.3 Mussel

The blue mussel, *Mytilis edulis*, is a first order consumer, filtering bacteria, microalgae and other small particles from the water column. *M. edulis* is found in temperate waters throughout the world and in Western Australia is found south of Geraldton. A large population of mussels developed in Cockburn sound during the 1970s due to an increase in nutrients in the Sound. In addition to the wild population of mussels in the Sound there is now aquaculture of mussels in the Sound. Cockburn Sound is the major mussel farming area in Western Australia. *M. edulis* has been used in toxicity tests throughout the world since 1980 and methodology follows the ASTM E724-98 (ASTM 1998).

1.3.4 Copepod

Copepods are a major part of the marine food chain as they represent a first order consumer and they, in turn, provide food for larval fish and crustaceans. The Swan River copepod *Gladioferens imparipes* was

selected to represent copepod species in the marine environment. The copepod culture used has been maintained in full strength seawater for 5 years. Toxicity testing has been performed on this species for the last 15 years, therefore, a large amount of information is available (Evans et al 2000).

As marine copepods are normally in the surface water and moved by the currents and tide the amount of exposure that they will get to the RO brine discharge plume will be minimal. The reproduction test is a worst case scenario where the copepods are exposed for the duration of their life. A pulse exposure test provides a more accurate representation of exposure risk to planktonic copepod species. The copepods were exposed to the RO brine as neonates to several time durations. The most appropriate duration representing the exposure to the brine plume in Cockburn Sound was selected for use in the BurrliOZ species protection calculation.

1.3.4 Larval Fish

The pink snapper, *Pagrus auratus*, is a temperate marine fish commonly found associated with reefs. *P. auratus* is commonly found in Cockburn Sound where it spawns in spring and the larvae and juveniles find appropriate habitat and food within the seagrass beds to grow. As such, Cockburn Sound is an important habitat for *P. auratus* and the fish is recreationally and ecologically important in the area. Methodology for the larval fish growth test follows that of USEPA Method 1004.0 Sheepshead Minnow Larval Survival and Growth Test (USEPA 2003b).

2. Reverse Osmosis Brine and Diluent

2.1 RO Brine

The RO brine samples were collected transported to the Geotech's Welshpool Laboratory on 27th November 2006 and to Geotech's Fremantle Laboratory on the 8th November 2007. Sample details are given in Table 2.1 for the 2006 sample and Table 2.2 for the 2007 sample. Testing commenced immediately upon receipt of the samples. Samples were stored in at 4°C for the duration of the tests. Approximately 25 L of brine was collected in a clean polythene container for each testing. Each sample was tested as received.

2.2 Diluent

Seawater from Cockburn Sound was collected on the 26th November 2006 and the 8th November 2007 for use as the diluent in all tests. The 2006 Cockburn Sound Water was collected from coordinates S32° 12.043', E115° 45.845. The 2007 diluent water was collected from coordinates S32° 08.328' E 115° 45.130'.

Table 2.1 Sample Information Sheet of RO Brine ENV 06-289

Contact Company	Water Corporation
Contact Person	Michelle Rhodes
Contact Phone Number	Ph: 08 9420 3681 Fax: 08 9420 2775
Contact Address	Level 1 629 Newcastle St Leederville WA 6007
Number of Samples	1
Sample Type	RO Brine
Date Sampled	26/11/06 RO Brine 3:30 pm Diluent 9:30 am
Location Collected	Cockburn Sound Desalination Plant Brine Sampling Point, Diluent: Cockburn Sound
Sampled by	Steve Christie
Sample pH	RO Brine 7.37 Diluent 7.9
Sample Salinity	RO Brine 63 ‰ Diluent 34.3
Temperature at Sampling	RO Brine 23.7°C Diluent 21.2°C
Transport Conditions	In esky on ice direct to Welshpool Lab
Date of Arrival at Geotech	27 th November 2006
Time of Arrival at Geotech	11:30 am
Temp on Arrival	4°C
Sample Received by	Jill Woodworth
Tests Required	Algal Growth Macroalgal Germination Mollusc Larval Development Copepod Reproduction Bioassay Larval Fish Growth

Table 2.2 Sample Information Sheet of RO Brine ECX07-0811

Contact Company	Water Corporation
Contact Person	Gordon Groth
Contact Phone Number	Ph: 08 9420 2796 Fax: 08 9420 3158
Contact Address	Level 1 629 Newcastle St Leederville WA 6007
Number of Samples	RO Brine+ Cockburn Sound Diluent
Sample Type	RO Brine + Diluent
Date Sampled	08/11/07 3:30 pm
Location Collected	Cockburn Sound Desalination Plant Brine Sampling Point
Sampled by	Marc Ferguson
Sample pH	RO Brine 6.98 Diluent 8.11
Sample Salinity	RO Brine 62 ‰ Diluent 35.3 ‰
Sample Temperature at Sampling	RO Brine 19.2°C Diluent 20.1°C
Transport Conditions	In esky on ice direct to Fremantle Lab
Date of Arrival at Geotech	8 th November 2007
Time of Arrival at Geotech	3 pm
Sample Received by	Jill Woodworth
Tests Required	Algal Growth Macroalgal Germination Mollusc Larval Development Larval Fish Growth
Comments	Testing as per EMP, Copepod pulse exposure

2.3 Concentrations of RO Brine Tested

Table 2.3 shows all the concentrations of RO brine tested in the WET tests. Concentrations vary due to different methodologies for different organisms and small test volumes. Additional variability can occur due to variations in the quantity of food added to several of the tests.

Table 2.3 2006 and 2007 Actual Concentrations of RO Brine Tested

Test	Conc 1 % Brine	Conc 2 % Brine	Conc 3 % Brine	Conc 4 % Brine	Conc 5 % Brine	Conc 6 % Brine	Conc 7 % Brine	Conc 8 % Brine
Micro- algae	0.65	1.3	2.6	5.2	10.4	20.8	41.6	83.3
Macro- algae	0.8	1.6	3.125	6.25	12.5	25	50	100
Mussel	0.8	1.6	3.125	6.25	12.5	25	50	100
Copepod 2006	0.65	1.3	2.6	5.2	10.4	20.8	41.6	83.2
Copepod 2007	1.5	3.125	6.25	12.5	25	50		
Fish	0.8	1.6	3.125	6.25	12.5	25	50	100

3. Results

The results for all the toxicity tests on the Perth Desalination Plant RO brine for 2006 and 2007 follow in this section and all raw data are shown in Appendix 2.

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GEOTECHNICAL SERVICES
Ecotoxicology Laboratory Test Report
Report Date: 20th February 2007

Sample Details

Lab ID No. ENV06-289	Sample: RO Brine
Client: Water Corporation	Date Sampled: 26 / 11 / 2006
Attn: Gordon Groth	Date Received: 27 / 11 / 2006
629 Newcastle St	Sampled By: Steve Christie
Leederville WA 6007	pH: 7.37
	Salinity: 63 ppt
Phone No. 9420 2796	Test Started: 28 / 11 / 2006
Mobile: 0409 941 758	Test Finished: 01 / 12 / 2006
Order No.: 4500308764	Test Temperature: 22 ± 1.0°C

Test Performed	Microalgal
Test Protocol	WIENV-45
Reference	Stauber et al. 1994
Test Species	<i>Isochrysis galbana</i>
Deviations from Protocol	

Algal Test Results


Concentration % Brine	% Growth of Control n = 4
CS Control	100.0 ± 8.2
0.65	103.0 ± 5.6
1.3	105.9 ± 8.8
2.6	105.0 ± 5.1
5.2	106.9 ± 6.5
10.4	112.9 ± 3.9
20.8	113.9 ± 3.8
41.6	108.9 ± 7.6
83.2	110.9 ± 14.8

Sample	EC50 % Brine	EC10 % Brine	LOEC % Brine	NOEC % Brine
RO Brine	>83.2	>83.2	>83.2	83.2

Results apply to the sample in the condition as received by Geotech

Quality Assurance Limits for the Algal Toxicity Test.

	EC50	Cusum Chart Limits	Coefficient of Variation
Copper	47.7 ppb	NA	NA

Authorised Signatory: Dr Jill Woodworth  Laboratory Manager	
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Ecotoxicology Laboratory Test Report
Report Date: 20th February 2006

Sample Details

Lab ID No. ENV06-289	Sample: RO Brine
Client: Water Corporation	Date Sampled: 26 / 11 / 2006
Attn: Gordon Groth	Date Received: 27 / 11 / 2006
629 Newcastle St	Sampled By: Steve Christie
Leederville WA 6007	pH: 7.37
	Salinity: 63 ppt
Phone No. 9420 2796	Test Started: 28 / 11 / 2006
Mobile: 0409 941 758	Test Finished: 31 / 12 / 2006
Order No.: 4500308764	Test Temperature: 22 ± 1.0°C

Test Performed	Copepod Reproduction
Test Protocol	WIENV-62
Reference	USEPA 1002.0 Cladoceran 7 Day Reproduction Test
Test Species	<i>Gladioferens imparipes</i>
Deviations from Protocol	Continuous exposure

Copepod Reproduction Test Results

Concentration Tested % Brine	Av. Neonates / Female/Spawn n = 4	Av. Production %
Control	35.6 ± 3.5	100.0 ± 9.8
0.65	17.1 ± 3.8	48.1 ± 10.7
1.3	15.6 ± 7.8	46.2 ± 28.7
2.6	18.5 ± 0.8	52.0 ± 2.1
5.2	12.8 ± 1.8	35.9 ± 5.1
10.4	8.7 ± 6.1	24.4 ± 17.2
20.8	6.9 ± 5.1	19.4 ± 14.2
41.6	1.6 ± 3.2	4.45 ± 8.90
83.2	0.0 ± 0.0	0.0 ± 0.0

Sample	EC50 % Brine	EC10 % Brine	LOEC % Brine	NOEC % Brine
RO Brine	2.26	0.12	0.65	<0.65

Results apply to the sample in the condition as received by Geotech

Quality Assurance Limits for the Copepod Reproduction Toxicity Test.

	EC50	Cusum Chart Limits	Coefficient of Variation
Chromium	0.39 ppm	NA	NA

Authorised Signatory: Dr Jill Woodworth



Laboratory Manager

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Ecotoxicology Laboratory Test Report
Report Date: 20th February 2007

Sample Details

Lab ID No. ENV06-289	Sample: RO Brine
Client: Water Corporation	Date Sampled: 26 / 11 / 2006
Attn: Gordon Groth	Date Received: 27 / 11 / 2006
629 Newcastle St	Sampled By: Steve Christie
Leederville WA 6007	pH: 7.37
	Salinity: 63 ppt
Phone No. 9420 2796	Test Started: 28 / 11 / 2006
Mobile: 0409 941 758	Test Finished: 01 / 12 / 2006
Order No.: 4500308764	Test Temperature: 22 ± 1.0°C

Test Performed	Macroalgal Germination
Test Protocol	WIENV-67
Reference	Burridge <i>et al.</i> 1999
Test Species	<i>Ecklonia Radiata</i>
Deviations from Protocol	Nil

Macroalgal Test Results

Concentration Tested % Brine	% Germination n = 4
Control	93.3 ± 2.8
0.78	94.0 ± 1.8
1.56	92.8 ± 1.7
3.125	95.3 ± 2.5
6.25	94.0 ± 2.2
12.5	87.5 ± 2.9
25	64 ± 5.5
50	0.5 ± 0.6
100	0.0 ± 0.0

Sample	EC50 % Brine	EC10 % Brine	LOEC % Brine	NOEC % Brine
RO Brine	28.0	20.9	12.5	6.25

Results apply to the sample in the condition as received by Geotech

Quality Assurance Limits for the Macroalgal Toxicity Test.

	EC50	Cusum Chart Limits	Coefficient of Variation
Copper	91.3 ppb	NA	NA

Authorised Signatory: Dr Jill Woodworth



Laboratory Manager

GEOTECH
GEOTECHNICAL SERVICES
Ecotoxicology Laboratory Test Report
Report Date: 20th February 2007

Sample Details

Lab ID No. ENV06-289	Sample: RO Brine
Client: Water Corporation	Date Sampled: 26 / 11 / 2006
Attn: Gordon Groth	Date Received: 27 / 11 / 2006
629 Newcastle St	Sampled By: Steve Christie
Leederville WA 6007	pH: 7.37
	Salinity: 63 ppt
Phone No. 9420 2796	Test Started: 28 / 11 / 2006
Mobile: 0409 941 758	Test Finished: 30 / 11 / 2006
Order No.: 4500308764	Test Temperature: 22 ± 1.0°C

Test Performed	Mussel Larval Development
Test Protocol	WIENV-66
Reference	ASTM E724-98
Test Species	<i>Mytilus edulis</i>
Deviations from Protocol	Nil

Mussel Test Results


Concentration Tested % Brine	% Normal n = 4
Control	85.0 ± 2.6
0.75	86.3 ± 4.6
1.51	84.8 ± 1.9
3.02	88.3 ± 2.4
6.05	88.0 ± 2.6
12.1	74.6 ± 8.9
24.2	0.75 ± 0.96
48.4	0.0 ± 0.0
96.8	0.0 ± 0.0

Sample	EC50 % Brine	EC10 % Brine	LOEC % Brine	NOEC % Brine
RO brine	15.1	11.7	12.1	6.05

Results apply to the sample in the condition as received by Geotech

Quality Assurance Limits for the Mussel Toxicity Test.

	EC50	Cusum Chart Limits	Coefficient of Variation
Copper	27.4 ppb	NA	NA

Authorised Signatory: Dr Jill Woodworth	
	
Laboratory Manager	

GEOTECH
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Ecotoxicology Laboratory Test Report
 Report Date: 20/02/07

Sample Details

Lab ID No. ECX07-0811	Sample: RO Brine
Client: Water Corporation	Date Sampled: 26 / 11 / 2006
Attn: Gordon Groth	Date Received: 27 / 11 / 2006
629 Newcastle St	Sampled By: Steve Christie
Leederville WA 6007	pH: 7.37
	Salinity: 63 ppt
Phone No. 9420 2796	Test Started: 28 / 11 / 2006
Mobile: 0409 941 758	Test Finished: 05 / 12 / 2006
Order No.: 4500308764	Test Temperature: 22 ± 1.0°C

Test Performed	Fish Larval Growth
Test Protocol	WIENV-64
Reference	USEPA 1004.0 Larval Fish Growth Test
Test Species	<i>Pagrus auratus</i>
Deviations from Protocol	Nil

Larval Fish Test Results

Concentration Tested % Brine	Av. Length (mm) n=30	% Growth n = 30
Control	6.02 ± 0.16	100.0 ± 10.8
0.78	5.86 ± 0.15	88.9 ± 10.4
1.56	5.81 ± 0.17	84.9 ± 11.7
3.125	5.75 ± 0.17	80.9 ± 11.5
6.25	5.73 ± 0.16	79.6 ± 10.5
12.5	5.53 ± 0.16	65.7 ± 11.0
25	0.0 ± 0.0	0.0 ± 0.0
50	0.0 ± 0.0	0.0 ± 0.0
100	0.0 ± 0.0	0.0 ± 0.0

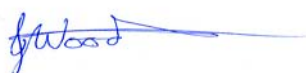
Sample	EC50 % Brine	EC10 % Brine	LOEC % Brine	NOEC % Brine
Brine	14.6	11.0	0.78	<0.78

Results apply to the sample in the condition as received by Geotech

Quality Assurance Limits for the Larval Fish Toxicity Test.

	EC50	Cusum Chart Limits	Coefficient of Variation
Chromium	2.7 ppm	NA	NA

Authorised Signatory: Dr Jill Woodworth



Laboratory Manager

GEOTECH
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Ecotoxicology Laboratory Test Report
Report Date: 30/11/07

Sample Details

Lab ID No. ECX07-0811	Sample: Brine
Client: Water Corporation	Date Sampled: 08/11/07
Attn: Gordon Groth	Date Received: 08/11/07
629 Newcastle St	Sampled By: Marc Ferguson
Leederville WA 6007	pH: 6.98
	Salinity: 62 ppt
Phone No. 9420 2796	Test Started: 16/11/07
Mobile: 0409 941 758	Test Finished: 19/11/07
Order No.: 4500308764	Test Temperature: 20°C

Test Performed	Microalgal
Test Protocol	WIENV-45
Reference	Stauber et al. 1994
Test Species	<i>Isochrysis galbana</i>
Deviations from Protocol	Nil

Algal Test Results

Concentration % Brine	% Growth of Control n = 4
Control	100.1 ± 2.7
0.65	104.6 ± 6.1
1.3	104.8 ± 4.2
2.6	111.5 ± 11.2
5.2	115.8 ± 8.5
10.4	128.0 ± 5.1
20.8	76.3 ± 11.9
41.6	76.5 ± 8.6
83.3	54.3 ± 3.9

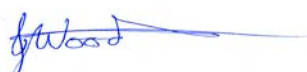
Sample	IC50 % Brine	IC10 % Brine	LOEC % Brine	NOEC % Brine
Brine	81.3	13.7	20.8	10.4

Results apply to the sample in the condition as received by Geotech

Quality Assurance Limits for the Algal Toxicity Test.

	EC50	Cusum Chart Limits	Coefficient of Variation
Copper	77.9 ppb	31.3 – 113.7	28.4%

Authorised Signatory: Dr Jill Woodworth



Laboratory Manager




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Ecotoxicology Laboratory Test Report
 Report Date: 6th December 2007

Sample Details

Lab ID No. ECX07-0409	Sample: Brine
Client: Water Corporation	Date Sampled: 06/09/07
Attn: Gordon Groth	Date Received: 06/09/07
629 Newcastle St	Sampled By: Steve Christie
Leederville WA 6007	pH: 7.4
	Salinity: 60 ppt
Phone No. 9420 2796	Test Started: 21/09/07
Mobile: 0409 941 758	Test Finished: 19/10/07
Order No.: 4500308764	Test Temperature: 22.0°C

Test Performed	Copepod Reproduction
Test Protocol	WIENV-62
Reference	USEPA 1002.0 Cladoceran 7 Day Reproduction Test
Test Species	<i>Gladioferens imparipes</i>
Deviations from Protocol	24 Hour Pulse in Cockburn Sound Diluent

Copepod Reproduction Test Results

Concentration Tested % Brine	Av. Neonates / female/Spawn n = 4	Av. Production % of Controls
Control	37.3 ± 5.1	100.0 ± 13.7
1.5	35.0 ± 2.7	93.8 ± 7.3
3.125	30.9 ± 6.4	82.9 ± 17.1
6.25	35.1 ± 0.6	94.2 ± 1.7
12.5	30.8 ± 1.1	82.4 ± 2.8
25	22.7 ± 2.3	60.8 ± 6.2
50	0.0 ± 0.0	0.0 ± 0.0

Sample	EC50 % Brine	EC10 % Brine	LOEC % Brine	NOEC % Brine
Brine	29.8	16.9	25	12.5

Results apply to the sample in the condition as received by Geotech

Quality Assurance Limits for the Copepod Reproduction Toxicity Test.

	EC50	Cusum Chart Limits	Coefficient of Variation
Chromium	285 ppb	113 – 325 ppb	24 %

Authorised Signatory: Dr Jill Woodworth



Laboratory Manager



GEOTECH
GEOTECHNICAL SERVICES
Ecotoxicology Laboratory Test Report
 Report Date: 30/11/07

Sample Details

Lab ID No. ECX07-0811	Sample: Brine
Client: Water Corporation	Date Sampled: 08/11/07
Attn: Gordon Groth	Date Received: 08/11/07
629 Newcastle St	Sampled By: Marc Ferguson
Leederville WA 6007	pH: 6.98
	Salinity: 62 ppt
Phone No. 9420 2796	Test Started: 16/11/07
Mobile: 0409 941 758	Test Finished: 19/11/07
Order No.: 4500308764	Test Temperature: 20°C

Test Performed	Macroalgal Germination
Test Protocol	WIENV-67
Reference	Burridge <i>et al.</i> 1999
Test Species	<i>Ecklonia Radiata</i>
Deviations from Protocol	Nil

Macroalgal Test Results

Concentration Tested % Brine	% Germination n = 4
Control	94.0 ± 2.2
0.8	94.3 ± 3.1
1.6	94.5 ± 3.1
3.125	94.5 ± 2.4
6.25	95.8 ± 3.0
12.5	92.5 ± 2.1
25	94.8 ± 2.2
50	93.8 ± 3.3
100	82.3 ± 6.1

Sample	EC50 % Brine	EC10 % Brine	LOEC % Brine	NOEC % Brine
Brine	>100	92.9	100	50

Results apply to the sample in the condition as received by Geotech

Quality Assurance Limits for the Macroalgal Toxicity Test.

	EC50	Cusum Chart Limits	Coefficient of Variation
Copper	170 ppb	45 – 210 ppb	32.4%

Authorised Signatory: Dr Jill Woodworth



Laboratory Manager



GEOTECH
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Ecotoxicology Laboratory Test Report
 Report Date: 30/11/07

Sample Details

Lab ID No. ECX07-0811	Sample: Brine
Client: Water Corporation	Date Sampled: 08/11/07
Attn: Gordon Groth	Date Received: 08/11/07
629 Newcastle St	Sampled By: Marc Ferguson
Leederville WA 6007	pH: 6.98
	Salinity: 62 ppt
Phone No. 9420 2796	Test Started: 16/11/07
Mobile: 0409 941 758	Test Finished: 19/11/07
Order No.: 4500308764	Test Temperature: 20°C

Test Performed	Mussel Larval Development
Test Protocol	WIENV-66
Reference	ASTM E724-98
Test Species	<i>Mytilus edulis</i>
Deviations from Protocol	Nil

Mussel Test Results

Concentration Tested % Brine	% Normal n = 4
Control	91.0 ± 1.6
0.8	92.0 ± 3.4
1.6	93.0 ± 2.6
3.125	91.5 ± 1.3
6.25	95.0 ± 2.2
12.5	91.8 ± 2.2
25	2.8 ± 1.7
50	0.0 ± 0.0
100	0.0 ± 0.0

Sample	EC50 % Brine	EC10 % Brine	LOEC % Brine	NOEC % Brine
Brine	17.9	Not Calculated	25	12.5

Results apply to the sample in the condition as received by Geotech

Quality Assurance Limits for the Mussel Toxicity Test.

	EC50	Cusum Chart Limits	Coefficient of Variation
Chromium	5.93 ppm	5.80 – 6.65 ppm	3.39%

Authorised Signatory: Dr Jill Woodworth



Laboratory Manager



GEOTECH
GEOTECHNICAL SERVICES
Ecotoxicology Laboratory Test Report
Report Date: 30/11/07

Sample Details

Lab ID No. ECX07-0811	Sample: Brine
Client: Water Corporation	Date Sampled: 08/11/07
Attn: Gordon Groth	Date Received: 08/11/07
629 Newcastle St	Sampled By: Marc Ferguson
Leederville WA 6007	pH: 6.98
	Salinity: 62 ppt
Phone No. 9420 2796	Test Started: 16/11/07
Mobile: 0409 941 758	Test Finished: 19/11/07
Order No.: 4500308764	Test Temperature: 20°C

Test Performed	Fish Larval Growth
Test Protocol	WIENV-64
Reference	USEPA 1004.0 Larval Fish Growth Test
Test Species	<i>Pagrus auratus</i>
Deviations from Protocol	Nil

Larval Fish Test Results

Concentration Tested % Brine	Av. Length (mm) n=30	% Growth n = 30
Control	4.29 ± 0.04	100.0 ± 12.2
0.75	4.27 ± 0.06	81.7 ± 7.1
1.56	4.22 ± 0.04	79.3 ± 10.5
3.125	4.07 ± 0.07	38.0 ± 18.8
6.25	4.25 ± 0.06	87.9 ± 15.4
12.5	4.13 ± 0.14	56.4 ± 38.8
25	4.06 ± 0.19	35.4 ± 51.9
50	0.0 ± 0.0	0.0 ± 0.0
100	0.0 ± 0.0	0.0 ± 0.0

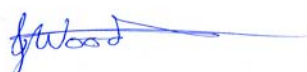
Sample	EC50 % Brine	EC10 % Brine	LOEC % Brine	NOEC % Brine
Brine	19.9	9.6	25	12.5

Results apply to the sample in the condition as received by Geotech

Quality Assurance Limits for the Larval Fish Toxicity Test.

	EC50	Cusum Chart Limits	Coefficient of Variation
Chromium	3.90 ppm	2.30 - 3.91 ppm	13.0 %

Authorised Signatory: Dr Jill Woodworth



Laboratory Manager



GEOTECH
GEOTECHNICAL SERVICES
Ecotoxicology Laboratory Test Report
Report Date: 13th December 2007

Sample Details

Lab ID No. ECX07-0409	Sample: Brine
Client: Water Corporation	Date Sampled: 06/09/07
Attn: Gordon Groth	Date Received: 06/09/07
629 Newcastle St	Sampled By: Steve Christie
Leederville WA 6007	pH: 7.4
	Salinity: 60 ppt
Phone No. 9420 2796	Test Started: 11/09/07
Mobile: 0409 941 758	Test Finished: 09/10/07
Order No.: 4500308764	Test Temperature: 22.0°C

Test Performed	Copepod Reproduction
Test Protocol	WIENV-62
Reference	USEPA 1002.0 Cladoceran 7 Day Reproduction Test
Test Species	<i>Gladioferens imparipes</i>
Deviations from Protocol	1 Hour Pulse in Cockburn Sound Diluent

Copepod Reproduction Test Results

Concentration Tested % Brine	Av. Neonates / female/Spawn n = 4	Av. Production % of Controls
Control	37.3 ± 5.1	100.0 ± 13.7
1.5	37.0 ± 3.8	99.2 ± 10.1
3.125	31.7 ± 5.7	84.9 ± 15.3
6.25	29.9 ± 4.1	80.1 ± 10.9
12.5	29.3 ± 2.7	78.6 ± 7.4
25	29.8 ± 0.7	79.9 ± 2.0
50	26.2 ± 2.3	70.1 ± 6.0


Sample	EC50 % Brine	EC10 % Brine	LOEC % Brine	NOEC % Brine
Brine	>100	4.8	50	25

Results apply to the sample in the condition as received by Geotech

Quality Assurance Limits for the Copepod Reproduction Toxicity Test.

	EC50	Cusum Chart Limits	Coefficient of Variation
Chromium	285 ppb	113 – 325 ppb	24 %

Authorised Signatory: Dr Jill Woodworth



Laboratory Manager



GEOTECH
GEOTECHNICAL SERVICES
Ecotoxicology Laboratory Test Report
Report Date: 13th December 2007

Sample Details

Lab ID No. ECX07-0409	Sample: Brine
Client: Water Corporation	Date Sampled: 06/09/07
Attn: Gordon Groth	Date Received: 06/09/07
629 Newcastle St	Sampled By: Steve Christie
Leederville WA 6007	pH: 7.4
	Salinity: 60 ppt
Phone No. 9420 2796	Test Started: 10/09/07
Mobile: 0409 941 758	Test Finished: 08/10/07
Order No.: 4500308764	Test Temperature: 22.0°C

Test Performed	Copepod Reproduction
Test Protocol	WIENV-62
Reference	USEPA 1002.0 Cladoceran 7 Day Reproduction Test
Test Species	<i>Gladioferens imparipes</i>
Deviations from Protocol	2 Hour Pulse in Cockburn Sound Diluent

Copepod Reproduction Test Results

Concentration Tested % Brine	Av. Neonates / female/Spawn n = 4	Av. Production % of Controls
Control	37.3 ± 5.1	100.0 ± 13.7
1.5	36.6 ± 7.6	98.2 ± 20.4
3.125	34.6 ± 4.7	95.4 ± 7.6
6.25	27.8 ± 7.6	70.2 ± 13.0
12.5	30.5 ± 7.8	81.7 ± 21.0
25	26.3 ± 4.7	70.6 ± 12.7
50	29.0 ± 0.0	77.7 ± 0.0

Sample	EC50 % Brine	EC10 % Brine	LOEC % Brine	NOEC % Brine
Brine	>100	4.2	>50	50

Results apply to the sample in the condition as received by Geotech

Quality Assurance Limits for the Copepod Reproduction Toxicity Test.

	EC50	Cusum Chart Limits	Coefficient of Variation
Chromium	285 ppb	113 – 325 ppb	24 %

Authorised Signatory: Dr Jill Woodworth



Laboratory Manager



GEOTECH
GEOTECHNICAL SERVICES
 Ecotoxicology Laboratory Test Report
 Report Date: 13th December 2007

Sample Details

Lab ID No. ECX07-0409	Sample: Brine
Client: Water Corporation	Date Sampled: 06/09/07
Attn: Gordon Groth	Date Received: 06/09/07
629 Newcastle St	Sampled By: Steve Christie
Leederville WA 6007	pH: 7.4
	Salinity: 60 ppt
Phone No. 9420 2796	Test Started: 10/09/07
Mobile: 0409 941 758	Test Finished: 08/10/07
Order No.: 4500308764	Test Temperature: 22.0°C

Test Performed	Copepod Reproduction
Test Protocol	WIENV-62
Reference	USEPA 1002.0 Cladoceran 7 Day Reproduction Test
Test Species	<i>Gladioferens imparipes</i>
Deviations from Protocol	4 Hour Pulse in Cockburn Sound Diluent

Copepod Reproduction Test Results

Concentration Tested % Brine	Av. Neonates / female/Spawn n = 4	Av. Production % of Controls
Control	37.3 ± 5.1	100.0 ± 13.7
1.5	34.4 ± 3.9	85.8 ± 23.3
3.125	36.3 ± 1.0	97.4 ± 2.7
6.25	32.5 ± 5.7	87.1 ± 15.5
12.5	36.8 ± 3.5	98.6 ± 9.8
25	24.8 ± 3.3	66.6 ± 8.9
50	27.8 ± 6.4	74.6 ± 17.1

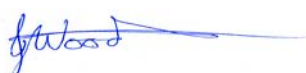
Sample	EC50 % Brine	EC10 % Brine	LOEC % Brine	NOEC % Brine
Brine	>100	13.3	25	12.5

Results apply to the sample in the condition as received by Geotech

Quality Assurance Limits for the Copepod Reproduction Toxicity Test.

	EC50	Cusum Chart Limits	Coefficient of Variation
Chromium	285 ppb	113 – 325 ppb	24 %

Authorised Signatory: Dr Jill Woodworth



Laboratory Manager



GEOTECH
GEOTECHNICAL SERVICES
Ecotoxicology Laboratory Test Report
Report Date: 13th December 2007

Sample Details

Lab ID No. ECX07-0409	Sample: Brine
Client: Water Corporation	Date Sampled: 06/09/07
Attn: Gordon Groth	Date Received: 06/09/07
629 Newcastle St	Sampled By: Steve Christie
Leederville WA 6007	pH: 7.4
	Salinity: 60 ppt
Phone No. 9420 2796	Test Started: 14/09/07
Mobile: 0409 941 758	Test Finished: 13/10/07
Order No.: 4500308764	Test Temperature: 22.0°C

Test Performed	Copepod Reproduction
Test Protocol	WIENV-62
Reference	USEPA 1002.0 Cladoceran 7 Day Reproduction Test
Test Species	<i>Gladioferens imparipes</i>
Deviations from Protocol	8 Hour Pulse in Cockburn Sound Diluent

Copepod Reproduction Test Results

Concentration Tested % Brine	Av. Neonates / female/Spawn n = 4	Av. Production % of Controls
Control	37.3 ± 5.1	100.0 ± 13.7
1.5	38.4 ± 1.1	103.0 ± 2.9
3.125	39.2 ± 5.1	105.0 ± 13.7
6.25	34.2 ± 6.3	91.6 ± 16.9
12.5	45.3 ± 10.1	121.4 ± 27.0
25	37.5 ± 3.5	100.5 ± 9.5
50	34.5 ± 0.7	92.5 ± 1.9

Sample	EC50 % Brine	EC10 % Brine	LOEC % Brine	NOEC % Brine
Brine	65.1	Not Calculated	>50	50

Results apply to the sample in the condition as received by Geotech

Quality Assurance Limits for the Copepod Reproduction Toxicity Test.

	EC50	Cusum Chart Limits	Coefficient of Variation
Chromium	285 ppb	113 – 325 ppb	24 %

Authorised Signatory: Dr Jill Woodworth



Laboratory Manager



GEOTECH
GEOTECHNICAL SERVICES
Ecotoxicology Laboratory Test Report
Report Date: 13th December 2007

Sample Details

Lab ID No. ECX07-0409	Sample: Brine
Client: Water Corporation	Date Sampled: 06/09/07
Attn: Gordon Groth	Date Received: 06/09/07
629 Newcastle St	Sampled By: Steve Christie
Leederville WA 6007	pH: 7.4
	Salinity: 60 ppt
Phone No. 9420 2796	Test Started: 19/09/07
Mobile: 0409 941 758	Test Finished: 17/10/07
Order No.: 4500308764	Test Temperature: 22.0°C

Test Performed	Copepod Reproduction
Test Protocol	WIENV-62
Reference	USEPA 1002.0 Cladoceran 7 Day Reproduction Test
Test Species	<i>Gladioferens imparipes</i>
Deviations from Protocol	16 Hour Pulse in Cockburn Sound Diluent

Copepod Reproduction Test Results

Concentration Tested % Brine	Av. Neonates / female/Spawn n = 4	Av. Production % of Controls
Control	37.3 ± 5.1	100.0 ± 13.7
1.5	42.1 ± 7.9	103.4 ± 28.1
3.125	31.5 ± 0.0	84.5 ± 0.0
6.25	30.0 ± 5.0	80.4 ± 13.4
12.5	33.0 ± 7.0	88.5 ± 18.8
25	33.9 ± 6.1	90.8 ± 16.4
50	0.0 ± 0.0	0.0 ± 0.0

Sample	EC50 % Brine	EC10 % Brine	LOEC % Brine	NOEC % Brine
Brine	29.2	Not Calculated	50	25

Results apply to the sample in the condition as received by Geotech

Quality Assurance Limits for the Copepod Reproduction Toxicity Test.

	EC50	Cusum Chart Limits	Coefficient of Variation
Chromium	285 ppb	113 – 325 ppb	24 %

Authorised Signatory: Dr Jill Woodworth



Laboratory Manager



GEOTECH
GEOTECHNICAL SERVICES
Ecotoxicology Laboratory Test Report
Report Date: 6th December 2007

Sample Details

Lab ID No. ECX07-0409	Sample: Brine
Client: Water Corporation	Date Sampled: 06/09/07
Attn: Gordon Groth	Date Received: 06/09/07
629 Newcastle St	Sampled By: Steve Christie
Leederville WA 6007	pH: 7.4
	Salinity: 60 ppt
Phone No. 9420 2796	Test Started: 21/09/07
Mobile: 0409 941 758	Test Finished: 19/10/07
Order No.: 4500308764	Test Temperature: 22.0°C

Test Performed	Copepod Reproduction
Test Protocol	WIENV-62
Reference	USEPA 1002.0 Cladoceran 7 Day Reproduction Test
Test Species	<i>Gladioferens imparipes</i>
Deviations from Protocol	24 Hour Pulse in Cockburn Sound Diluent

Copepod Reproduction Test Results

Concentration Tested % Brine	Av. Neonates / female/Spawn n = 4	Av. Production % of Controls
Control	37.3 ± 5.1	100.0 ± 13.7
1.5	35.0 ± 2.7	93.8 ± 7.3
3.125	30.9 ± 6.4	82.9 ± 17.1
6.25	35.1 ± 0.6	94.2 ± 1.7
12.5	30.8 ± 1.1	82.4 ± 2.8
25	22.7 ± 2.3	60.8 ± 6.2
50	0.0 ± 0.0	0.0 ± 0.0

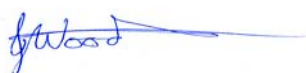
Sample	EC50 % Brine	EC10 % Brine	LOEC % Brine	NOEC % Brine
Brine	29.8	16.9	25	12.5

Results apply to the sample in the condition as received by Geotech

Quality Assurance Limits for the Copepod Reproduction Toxicity Test.

	EC50	Cusum Chart Limits	Coefficient of Variation
Chromium	285 ppb	113 – 325 ppb	24 %

Authorised Signatory: Dr Jill Woodworth



Laboratory Manager



GEOTECH
GEOTECHNICAL SERVICES
 Ecotoxicology Laboratory Test Report
 Report Date: 6th December 2007

Sample Details

Lab ID No. ECX07-0409	Sample: Brine
Client: Water Corporation	Date Sampled: 08/11/07
Attn: Gordon Groth	Date Received: 08/11/07
629 Newcastle St	Sampled By: Steve Christie
Leederville WA 6007	pH: 6.98
	Salinity: 62 ppt
Phone No. 9420 2796	Test Started: 11/10/07
Mobile: 0409 941 758	Test Finished: 11/11/07
Order No.: 4500308764	Test Temperature: 22.0°C

Test Performed	Copepod Reproduction
Test Protocol	WIENV-62
Reference	USEPA 1002.0 Cladoceran 7 Day Reproduction Test
Test Species	<i>Gladioferens imparipes</i>
Deviations from Protocol	2 x 10 minute exposures for 2 days

Copepod Reproduction Test Results

Concentration Tested % Brine	Av. Neonates / female/Spawn n = 4	Av. Production % of Controls
Control	42.9 ± 3.9	100.0 ± 9.2
0.75	42.4 ± 3.0	98.8 ± 7.0
1.5	46.2 ± 6.4	107.6 ± 14.9
3.125	38.7 ± 3.2	90.3 ± 7.4
6.25	43.0 ± 8.5	100.3 ± 19.7
12.5	41.5 ± 5.8	96.9 ± 13.4

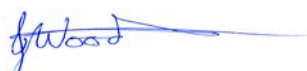
Sample	EC50 % Brine	EC10 % Brine	LOEC % Brine	NOEC % Brine
Brine	>100	48.8	>12.5	12.5

Results apply to the sample in the condition as received by Geotech

Quality Assurance Limits for the Copepod Reproduction Toxicity Test.

	EC50	Cusum Chart Limits	Coefficient of Variation
Chromium	285 ppb	113 – 325 ppb	24 %

Authorised Signatory: Dr Jill Woodworth



Laboratory Manager



4. Species Protection Trigger Values

4.1. Introduction

Following the protocol outlined in ANZECC and ARMCANZ (2000) 99%, 95%, 90% and 80% species protection trigger values were calculated using the EC10, EC5 and NOEC data from five chronic bioassays for the RO brine from the Perth Seawater Desalination Plant discharging into Cockburn Sound at plant commissioning in November 2006 and 12 months after commissioning in November 2007. The RO brine bioassays were performed on species indigenous to, or surrogate to, the receiving ecosystem. These values are shown in Table 4.1 (2006 data) and Table 4.5 (2007 data).

It is important to note that the use of NOEC values is not recommended for the calculation of species protection trigger values, as has been done in the past when only NOEC values were available. This was pointed out in ANZECC and ARMCANZ (2000) which stated that methods used to derive the trigger values are not data specific as long as only one type of data is used. Therefore, trigger values can be derived using EC10 values if there were sufficient data (Warne 1998). ANZECC and ARMCANZ (2000) also suggest that the use of NOEC data be phased out as EC10 data becomes available.

The use of toxicity values that correspond to a fixed biological effect (eg an LC5 or EC10) that would be calculated using regression analysis is recommended. The NOEC is an inappropriate number to use for regulatory purposes for the reasons discussed in Chapman (2005). Problems with the use of NOEC and LOEC data revolve around the fact that these values are determined using hypothesis based statistical techniques. Specifically the problems are that:

- Only tested concentrations can be NOEC or LOEC values (therefore the NOEC and LOEC are, to a large degree, affected by the concentrations used in the toxicity test),
- The NOEC title is misleading. A NOEC is the highest concentration used in a toxicity test that causes an effect not significantly different to the control(s). It therefore does not correspond to 'no effect'. Typically, the NOEC corresponds to a 10 to 30% effect (Hoekstra and Van Ewijk, 1993, Moore and Caux, 1997, USEPA, 1991).

Further, usually there is a high level of statistical uncertainty associated with the EC/IC5 values making these values inappropriate for use in the BurrliOZ statistics package for calculation of protection/dilution values (Chapman 2005).

Values in Tables 4.1 and 4.5 were placed in the BurrliOZ software to calculate trigger values designed to protect 99%, 95%, 90% and 80% of the species from adverse effects during exposure to the RO brine plume from the desalination plant entering Cockburn Sound. It is important to note that, the number of data points used (5) is regarded as small for statistical analysis

and, therefore, these results generated using the BurrliOZ program should be interpreted with caution. The trigger values calculated for 2006 at plant commissioning are shown in Tables 4.2, 4.3 and 4.4. The trigger values calculated for 2007 at 12 months after commissioning are shown in Tables 4.6, 4.7 and 4.8. The graphs for the species protection trigger values for 2006 and 2007 are shown in Appendix 3.

The dilution factors calculated for the 99% species protection value using the EC10 values will theoretically result in only 1% of the exposed species showing a 10% reduction in growth or reproduction if those levels are exceeded outside the mixing zone.

4.2. Methodology

The BurrliOZ software was developed by the CSIRO Environmetrics Group for Environment Australia to implement ANZECC and ARMCANZ (2000) requirements to generate species protection trigger values (ie the maximum concentration of a chemical that should permit the integrity and function of aquatic environments to be maintained) for local conditions within Australia. BurrliOZ uses a flexible family of distributions, the Burr Type III, to estimate the protecting concentrations of chemicals such that a given percentage of species will not be adversely affected (Campbell et al. 2000)

4.3. Results

Table 4.1. 2006 EC/IC10, EC/IC5 and NOEC Results used in BurrliOZ

Test	EC/IC 10/NOEC % Brine	EC/IC 5 % Brine	NOEC % Brine
72 Hour Algal	83.2	83.2	83.2
72 Hour Macroalgal	20.9	19.2	6.3
48 Hour Mussel	11.7	10.9	6.1
Copepod Reproduction Continuous	0.45*	0.23**	0.45***
7 Day Larval Fish Growth	11.0	10.2	11.0***

*EC50 divided by 5 \equiv EC10 (ANZECC and ARMCANZ 2000, Warne 2001)

**EC50 divided by 10 \equiv EC5 (ANZECC and ARMCANZ 2000, Warne 2001)

*** EC10 \equiv NOEC (Hoekstra and Van Ewijk 1993, Moore and Caux 1997, USEPA 1991)

Table 4.2 2006 BurrliOZ EC/IC10 Species Protection Trigger Values

Protection Level with 50% confidence	Protection Value % Brine	Dilution Factor
99	0.03	3,333
95	0.37	270
90	1.07	93
80	3.12	32

Table 4.3 2006 BurrliOZ EC/IC5 Species Protection Trigger Values

Protection Level with 50% confidence	Protection Value % Brine	Dilution Factor
99	0.01	10,000
95	0.2	500
90	0.67	149
80	2.3	43

Table 4.4 2006 BurrliOZ NOEC Species Protection Trigger Values

Protection Level with 50% confidence	Protection Value % Brine	Dilution Factor
99	0.06	1,666
95	0.37	270
90	0.84	119
80	1.95	51

Table 4.5 2007 EC/IC10, EC/IC5 and NOEC Results used in BurrliOZ for Species Protection Trigger Values

Test	EC/IC10/NOEC % Brine	EC5 % Brine	NOEC % Brine
72 Hour Algal	13.7	12.1	10.4
72 Hour Macroalgal	92.9	77.4	50
48 Hour Mussel	12.5	12.5	12.5
Copepod Reproduction 24 Hour Pulse	5.9*	3.0**	12.5
7 Day Larval Fish Growth	9.6	7.8	12.5

*EC50 divided by 5 \equiv EC10 (ANZECC and ARMCANZ 2000, Warne 2001)

**EC50 divided by 10 \equiv EC5 (ANZECC and ARMCANZ 2000, Warne 2001)

Table 4.6 2007 BurrliOZ EC/IC10 Species Protection Trigger Values

Protection Level with 50% confidence	Protection Value % Brine	Dilution Factor
99	6.64	15.1
95	8.15	12.3
90	9.23	10.8
80	10.93	9.2

Table 4.7 2007 BurrliOZ EC/IC5 Species Protection Trigger Values

Protection Level with 50% confidence	Protection Value % Brine	Dilution Factor
99	1.98	50.5
95	2.87	34.8
90	3.60	27.8
80	4.92	20.3

Table 4.8 2007 BurrliOZ NOEC Species Protection Trigger Values

Protection Level with 50% confidence	Protection Value % Brine	Dilution Factor
99	7.91	12.6
95	9.02	11.1
90	9.78	10.2
80	10.92	9.2

4.4 Discussion

4.4.1 RO Brine Toxicity

The RO brine showed similar toxicity to most species when compared to the previous tests performed on pilot plant RO brine and simulated brine in 2005. However, the RO Brine tested in 2006 showed higher toxicity in the copepod reproduction test than was observed in the 2005 tests. The 2005 test using a pilot plant RO plant discharge produced an EC50 of 13.3% Brine, whereas, the test on the RO brine from the Cockburn Sound Desalination Plant in 2006 showed an EC50 of 2.24% Brine. This is the only toxicity test that has shown a significant increase in toxicity from the preliminary testing performed in 2005. During 2007 a project was undertaken to determine the appropriate exposure period for the copepods, taking into account the biology and the tide and current movements in Cockburn Sound. The results from this study are shown in Table 2 in the Executive Summary and Section 3: Results.

The RO brine showed a decrease in toxicity from 2006 to 2007 with no toxicity being detected in the macroalga *Ecklonia radiata* test in 2007. The larval fish

growth test and the mussel larval development test showed similar toxicities in both 2006 and 2007. As chemical analysis of the RO brine and Cockburn seawater was not undertaken in 2007, it is difficult to attribute any changes in toxicity to a particular constituent of the RO brine. However, based on these results from 2006 and 2007, the species tested are appropriate for calculating the species protection values using the BurrliOZ statistics package as a wide range of sensitivities were tested.

4.4.2 Copepod Tests

Previous copepod reproduction bioassays in 2005 and 2006 exposed the copepods to the RO brine for the entire duration of the test (28 – 30 days). That represented a worst case scenario, where the copepods are living in the discharge plume. This is a scenario which is extremely unlikely to occur in Cockburn Sound as neonate copepods are zooplankton. Copepods at risk of being exposed to the RO brine discharge in Cockburn Sound would be planktonic species and the duration of exposure would be in the order of minutes as discussed in Yeates et al. (2006). From the results in Table 2 the 16 hour and 24 hour pulse exposures show similar toxicities. The 24 hour exposure was selected for use in the species protection trigger level calculations as it represents an environmentally realistic exposure in Cockburn Sound on days with low wind and tidal movement.

Even though the 24 hour pulse exposure was selected to represent an appropriate (though at times overestimating) exposure, the EC10 generated by the results (shown on page 19) is not reliable (Warne 2008). To overcome this, ANZECC and ARMCANZ (2000) recommend that a conversion factor of five is used to convert EC50 data to NOEC data (Warne 2001). As the EC10 is considered to be equivalent to the NOEC (Warne 2008), this conversion factor can be used to calculate an EC10 value from a reliable EC50 value (Moore and Caux 1997, USEPA 1991, Hoekstra and Van Ewijk 1993). Warne (2008) has shown that the use of the conversion factor will result in more conservative dilution factors when compared to using the EC50 value in the calculations and has stated that this is the most appropriate approach to use. This approach has also been used for the 2006 copepod data which showed a similar unreliable EC10 value. Therefore, copepod results shown in Tables 4.1 and 4.5 consist of;

- the EC10 value equivalent to the EC50 value divided by five and
- the EC5 value equivalent to the EC50 divided by 10.

The results from the 2006 microalgal tests show that the alga is probably using the constituents in the RO brine as nutrients as there was increased growth in the low and mid concentrations of brine tested. This may have implications for the copepod test as algae is added as a food source for the copepods and increased algal growth may slightly increase the availability of food within the test in low to mid concentrations. However, as water changes occur daily in the copepod test, algal concentrations within the replicates may not increase to a level where they impact on the test. If algal growth does increase in the copepod tests, then the nutrients may also be masking toxic effects in the 2006 copepod test. This will not impact on the pulse exposure

copepod tests performed in 2007 as no RO brine was added after the initial pulse.

4.4.3 Species Protection Values at Commissioning

The 2006 results listed in Tables 4.2, 4.3 and 4.4 show the concentrations of RO brine in the water column that will meet the species protection trigger level for a 99%, 95%, 90% and 80% species protection level and the dilutions required to meet these levels. However, the continuous exposure of the copepods to the RO brine during the 28 days of the test overestimated the amount of exposure that copepods would encounter passing through the plume in Cockburn Sound. As discussed above, subsequent testing has shown that a 24 hour exposure was representative of a realistic exposure in Cockburn Sound on days with low wind and tidal movement. Therefore, the species protection trigger values from 2006 overestimate the toxicity of the RO brine in Cockburn Sound.

4.4.4 Species Protection Values 12 Months After Commissioning

The 2007 results listed in Tables 4.6, 4.7 and 4.8 show the concentrations of RO brine in the water column that will meet the species protection trigger level for a 99%, 95%, 90% and 80% species protection level and the dilutions required to meet these levels. The diffuser at the desalination plant has always delivered at least a 45 fold dilution factor at 50 metres from the diffuser for all flow rates: 54 fold for 1/3 flow, 59.5 fold for 2/3 flow and 61.4 fold for full flow (Okely et al. 2007). Therefore, the 80% (LEPA) and 90% (MEPA) species protection trigger values will be met with a safety margin in all the scenarios listed above.

5. References

ANZECC and ARMCANZ. (Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand). 2000. National water quality management strategy, Australian and New Zealand guidelines for fresh and marine water quality. ANZECC and ARMCANZ, Canberra, Australia.

ASTM E724-98. 1998. Standard Guide for Conducting Static Acute Toxicity Tests Starting with Embryos of Four Species of Saltwater Bivalve Molluscs ASTM International.

Bidwell J.R., Wheeler K.W. and Burrige T.R 1998. Toxicant effects on the zoospore stage of the marine macroalga *Ecklonia radiata*. Marine Ecology Series. 163:259-265.

Burrige T.R., Karistianos M. and Bidwell J. 1999. The use of aquatic macrophyte ecotoxicological assays in monitoring coastal effluent discharges in southern Australia. Marine Pollution Bulletin 39(1-12):89-96

Campbell E., Palmer M.J., Shao Q., Warne M. StJ. and Wilson D. 2000. BurrliOZ: A computer program for calculating toxicant trigger values for the ANZECC and ARMCANZ water quality guidelines. Perth, Western Australia, Australia.

Chapman P. M. 2005. Recommendations for whole effluent toxicity (WET) testing approaches for the Water Corporation of Western Australia. Draft Report. Golder Associates, North Vancouver, BC, Canada.

Evans L., Tsvetnenko Y. and Woodworth J. 2000. Improving the precision of ecotoxicity testing protocols for crude oil and drilling fluids. MERIWA Project No. M290. Report No. 220. 169 pp.

Geotechnical Services 2006. The provision of water quality monitoring services for Cockburn Sound (WET testing): Test Report ENV05-214 & ENV05-389. January 2006. Perth, Western Australia.

Hoekstra J.A and Van Ewijk P.H. 1993. Alternatives for the no-observed effect level. Environmental Toxicology and Chemistry. 12:187-194

Moore D.R.J. and Caux P.Y. 1997. Estimating low toxic effects. Environmental Toxicology and Chemistry. 16:794-801

Okely P., Antenucci J.P., Marti C.L. and Imberger J. 2007. The near-field characteristics of the Perth seawater desalination plant discharge. Final Report. December 2007. Centre for Water Research. University of Western Australia. Report No. WP2175PO

Rippingale R.J. and Hodgkin E.P. 1974. Predation effects on the distribution of a copepod. Australian Journal of Marine and Freshwater Research. 25:81-91.

Stauber J.L. Tsai J., Vaughn G.T., Peterson S.M. and Brockbank C.I. 1994. Algae as indicators of toxicity of the effluent from bleached eucalypt kraft pulp mills. National Pulp Mills Research Program. Technical Report No. 3. CSIRO, Canberra 146 pp.

USEPA (United States Environmental Protection Agency). 1994. Technical support document for water quality based toxics control. Report No. EPA 505/2-90-001. Washington DC. USA.

USEPA. 2003a. Short-term methods for estimating the chronic toxicity of effluents and receiving water to freshwater organisms. Washington DC. USA.

USEPA. 2003b. Short-term methods for estimating the chronic toxicity of effluents and receiving water to marine and estuarine organisms. Washington DC. USA.

Warne M. StJ, 1998. Critical review of methods to derive water quality guidelines for toxicants and a proposal for a new framework. Supervising Scientists Report 135, Supervising Scientist Canberra, ACT, Australia.

Warne M. StJ. 2007. Reassessment of the derivation of a single dilution factor for the saline brine discharge from a proposed desalination plant. For Olympic Dam EIS. CSIRO Land and Water Science Report 18/07.

Warne M. StJ. 2008. Review of Geotechnical Services reports (2006-2007) and recommendations on methods to calculate dilution factors, ongoing WET monitoring and appropriateness of using the copepod *Gladioferens imparipes*. Centre for Environmental Contaminants Research. CSIRO. Adelaide. SA

Yeates P.S., Okely J.P., Antenucci J.P. and Imberger J. 2006. Hydrodynamic modelling of the impact of the Perth Seawater Desalination Plant discharge on Cockburn Sound. Final Report, November 2006. University of Western Australia. Report No WP2127PY.

APPENDIX 1

Summary of Toxicity Test Methodologies

Summary 1.1 Test Conditions for the Unicellular Algal Growth Test

Test type	Static
Test organism	<i>Isochrysis galbana</i> (Tahitian isolate)
Source of test organism	Laboratory Culture
Age of test organisms	5 day old culture
Salinity	34.2 - 63 ppt
Temperature	21 ± 1.0 °C
Light	Ambient laboratory illumination
Photoperiod	12 hour light / 12 hour dark
Test chamber size	3.2 mL
Test solution volume	3 mL
Renewal of test solutions	nil
Volume of algae per test chamber	500 µL
No of replicates per concentration	4
Dilution water	Cockburn Sound filtered seawater
Test concentrations	0, 0.65, 1.3, 2.6, 5.2, 10.4, 20.8, 41.6 and 83.3 % Brine
Test duration	72 Hours
Endpoints	Inhibition of growth when compared with controls
Test acceptability criteria	Reference Toxicant EC50 between Cusum Chart limits

Summary 1.2 Test Conditions for the Macroalgae Germination Test

Test type	Static
Test organism	<i>Ecklonia radiata</i>
Age of test organisms	Newly released gametes
Source of test organisms	Point Peron
Date collected	28/11/06 & 16/11/07
Salinity	34.2 - 63 ppt
Temperature	21 ± 1.0 °C
Light	Ambient laboratory illumination
Photoperiod	12 hour light / 12 hour dark
Test chamber size	25 mL
Test solution volume	20 mL
Renewal of test solutions	nil
No zygotes per test chamber	Minimum of 100
No of replicates per concentration	4
Dilution water	Cockburn Sound filtered seawater
Test concentrations	0, 0.8, 1.6, 3.2, 6.3, 12.5, 25, 50, 100% Brine
Test duration	72 hours
Endpoints	Number of zygotes with germination tubes
Test acceptability criteria	80% or greater germination in the controls and Reference Toxicant EC50 between Cusum Chart limits

Summary 1.3 Test Conditions for the Mollusc Larval Development Test

Test type	Static
Species tested	Blue Mussel: <i>Mytilis edulis</i>
Age of test organisms	Fertilized zygotes
Source of test organisms	Blue Lagoon Mussels, Cockburn Sound
Salinity	34.2 - 63 ppt
Temperature	21± 1.0 °C
Light	Ambient laboratory illumination
Photoperiod	12 hour light / 12 hour dark
Test chamber size	3.5 mL
Test solution volume	3 mL
Renewal of test solutions	nil
No zygotes/larvae per test chamber	Minimum of 100
No of replicates per concentration	4
Dilution water	Cockburn Sound filtered seawater
Test concentrations	0, 0.8, 1.6, 3.2, 6.3, 12.5, 25, 50, 100% Brine
Test duration	48 hours
Endpoints	Percentage of normal larvae
Test acceptability criteria	80% or greater normal larvae in the controls and Reference Toxicant EC50 between Cusum Chart limits

Summary 1.4 Test Conditions for the Copepod Reproduction 28 Day Test

Test type	Static Renewal
Test organism	<i>Gladioferens imparipes</i>
Age of test organisms	Newly hatched neonates (<24 hrs old)
Source of test organisms	Laboratory culture
Salinity	34.2 - 63 ppt
Temperature	21.0 ± 1.0 °C
Light	Ambient laboratory illumination
Photoperiod	12 hour light / 12 hour dark
Test chamber size	3.2 mL
Test solution volume	3 mL
Renewal of test solutions	100 % Brine / day
No Adults per test chamber	2
No of replicates per concentration	4-6
Source of food	<i>Isochrysis galbana</i>
Feeding regime	Fed 0.5 mL algae once/day
Cleaning	Siphon daily prior to test solution renewal and feeding
Aeration	None
Dilution water	Cockburn Sound filtered seawater
Test concentrations	0, 1.5, 3.125, 6.25, 12.5, 25 and 50 % Brine
Test duration	28 Days
Pulses	Copepods exposed for pulse at <24 hrs old then clean diluent replaces RO Brine for duration of the test
Endpoints	Number of neonates produced by female copepod per spawn
Test acceptability criteria	80% or greater survival in the controls and Reference Toxicant EC50 between Cusum Chart limits

Summary 1.6 Test Conditions for the 7 Day Larval Fish Growth Test

Test type	Static
Test organism	Pink snapper: <i>Pagrus auratus</i>
Source of species	Challenger TAFE, Fremantle, WA
Salinity	34.2 – 63 ppt
Temperature	21 ± 1.0 °C
Light	Ambient laboratory illumination
Photoperiod	12 hour light / 12 hour dark
Test chamber size	500 mL
Test solution volume	400 mL
Renewal of test solutions	Nil
Age of test organisms	Newly hatched larvae (<24 hrs old)
No larvae per test chamber	20
No of replicates per concentration	3
No larvae per concentration	60
Source of food	Rotifers
Feeding regime	Fed once/day @ 40 / mL from day 3
Aeration	None
Dilution water	Cockburn Sound filtered seawater
Test concentrations	0, 0.75, 1.6, 3.2, 6.25, 12.5, 25, 50, and 100% Brine
Test duration	7 Days
Endpoints	Growth – measured as total length
Test acceptability criteria	80% or greater survival in the controls and Reference Toxicant EC50 between Cusum Chart limits

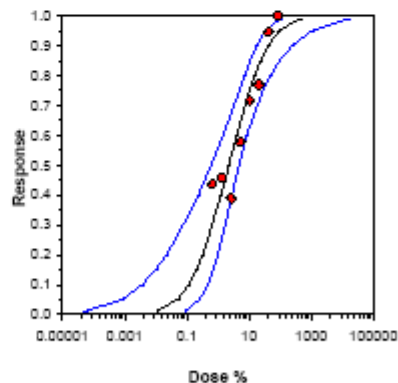
APPENDIX 2

Summary of Toxicity Test Data

Copepod Reproduction Toxcalc Summary Sheet 2006

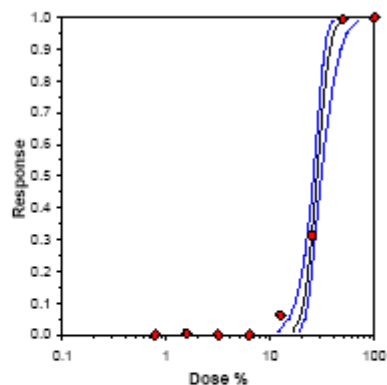
Copepod Reproduction										
Start Date:	28/11/2006	Test ID:	ENV06-289	Sample ID:	Desalination Plant Discharge					
End Date:	31/12/2006	Lab ID:	Freo	Sample Type:	RO Brine					
Sample Date:		Protocol:	GEOTECH WI 62	Test Species:	Gladioliferens imparipes					
Comments:										
Conc-%	1	2	3	4	5	6	7			
CS Diluent	0.8610	0.9740	1.0000	1.0000						
CS Control	1.0000	0.8710	0.7210	0.8990	0.7310	0.7490	1.0000			
0.65	0.3930	0.4500	0.6370	0.4450						
1.3	0.2440	0.7310	0.3000	0.4780	0.8710	0.1500				
2.6	0.4920	0.5250	0.5200	0.5430						
5.2	0.3510	0.3090	0.3470	0.4310						
10.4	0.3280	0.0000	0.3930	0.2530						
20.8	0.2900	0.0000	0.3090	0.1780						
41.6	0.0000	0.0000	0.0000	0.1780						
83.2	0.0000	0.0000	0.0000	0.0000						
Transform: Arcsin Square Root										
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Rank Sum	1-Tailed Critical	Number Resp
CS Diluent	0.9638	1.1298	1.4172	1.2186	1.5208	10.059	4			
CS Control	0.8530	1.0000	1.2255	1.0143	1.5208	18.006	7			103
*0.65	0.4613	0.5642	0.7668	0.6776	0.9242	14.096	4	10.00	11.00	208
1.3	0.4623	0.5420	0.7477	0.3977	1.2034	41.835	6	26.00	25.00	323
*2.6	0.5200	0.6096	0.8054	0.7774	0.8285	2.625	4	10.00	11.00	192
*5.2	0.3595	0.4215	0.6424	0.5894	0.7162	8.274	4	10.00	11.00	256
*10.4	0.2435	0.2855	0.4661	0.0500	0.6776	60.960	4	10.00	11.00	303
*20.8	0.1943	0.2277	0.4109	0.0500	0.5894	60.857	4	10.00	11.00	322
*41.6	0.0445	0.0522	0.1464	0.0500	0.4355	131.666	4	10.00	11.00	382
83.2	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4			400
Auxiliary Tests								Statistic	Critical	Skew
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)								0.977543	0.914	0.04957
Bartlett's Test indicates unequal variances (p = 8.44E-03)								18.91955	18.47532	
The control means are not significantly different (p = 0.16)								1.544783	2.262159	
Hypothesis Test (1-tail, 0.05)			NOEC	LOEC	Chv	TU				
Wilcoxon Rank Sum Test			<0.65	0.65						

Maximum Likelihood-Probit										
Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma
Slope	1.004229	0.184988	0.55158	1.456678	0.147143	97.22941	12.59158	9.5E-19	0.353787	0.995789
Intercept	4.644717	0.188639	4.183134	5.106301						
TSCR	0.157535	0.055145	0.0226	0.29247						
Point	Probits	%	95% Fiducial Limits							
EC01	2.674	0.010896	5.17E-05	0.087595						
EC05	3.355	0.051983	0.000863	0.264808						
EC10	3.718	0.119573	0.00384	0.48172						
EC15	3.964	0.209758	0.010448	0.725596						
EC20	4.158	0.327876	0.023032	1.009999						
EC25	4.326	0.480991	0.045143	1.348298						
EC40	4.747	1.2633	0.237261	2.895616						
EC50	5.000	2.258326	0.614214	4.806811						
EC60	5.253	4.037077	1.483059	8.555158						
EC75	5.674	10.60318	4.997073	28.65917						
EC80	5.842	15.55478	7.39474	50.67347						
EC85	6.036	24.31397	11.15964	103.0296						
EC90	6.282	42.65222	17.90971	263.1267						
EC95	6.645	98.11015	34.32495	1110.892						
EC99	7.326	468.1004	108.337	17775.22						



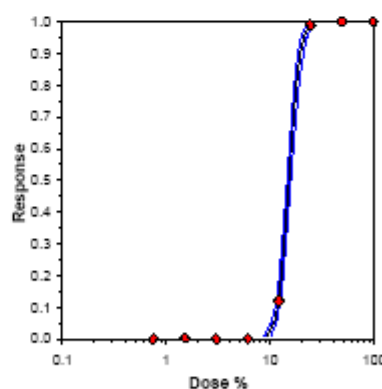
Ecklonia Germination Toxcalc Summary Sheet 2006

-Proportion Germinated											
Start Date:	28/11/2006	Test ID:	ENV06-289	Sample ID:	Cockburn Sound Desal Plant						
End Date:	1/12/2006	Lab ID:	Freo	Sample Type:	Brine						
Sample Date:		Protocol:	Geotech WI 67	Test Species:	Ecklonia radiata						
Comments:											
Conc-%	1	2	3	4							
Control	0.9200	0.9600	0.9000	0.9500							
Cockburn Sound	0.9300	0.9000	0.9200	0.9000							
0.78	0.9600	0.9200	0.9500	0.9300							
1.56	0.9200	0.9500	0.9100	0.9300							
3.13	0.9500	0.9200	0.9800	0.9600							
6.25	0.9300	0.9700	0.9200	0.9400							
12.5	0.8400	0.8700	0.9100	0.8800							
25	0.6100	0.7200	0.6000	0.6300							
50	0.0100	0.0000	0.0000	0.0100							
100	0.0000	0.0000	0.0000	0.0000							
Transform: Arcsin Square Root											
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	1-Tailed Critical	MSD	Number Resp
Control	0.9325	1.0219	1.3120	1.2490	1.3694	4.210	4				27
Cockburn Sound	0.9125	1.0000	1.2713	1.2490	1.3030	2.111	4				
0.78	0.9400	1.0301	1.3254	1.2840	1.3694	2.937	4	-0.403	2.480	0.0830	24
1.56	0.9275	1.0164	1.2996	1.2661	1.3453	2.614	4	0.369	2.480	0.0830	29
3.13	0.9525	1.0438	1.3569	1.2840	1.4289	4.419	4	-1.344	2.480	0.0830	19
6.25	0.9400	1.0301	1.3268	1.2840	1.3967	3.716	4	-0.443	2.480	0.0830	24
*12.5	0.8750	0.9589	1.2111	1.1593	1.2661	3.640	4	3.015	2.480	0.0830	50
*25	0.6400	0.7014	0.9281	0.8861	1.0132	6.265	4	11.473	2.480	0.0830	144
*50	0.0050	0.0055	0.0751	0.0500	0.1002	38.554	4	36.970	2.480	0.0830	398
100	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400
Auxiliary Tests								Statistic	Critical	Skew	
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)								0.960705	0.904	0.377891	
Bartlett's Test indicates equal variances (p = 0.93)								2.395807	18.47532		
The control means are not significantly different (p = 0.23)								1.324344	2.446914		
Hypothesis Test (1-tail, 0.05)			NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob
Dunnett's Test			6.25	12.5	8.838835	16	0.04684	0.050124	0.768682	0.002239	1.8E-22
Maximum Likelihood-Probit											
Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	
Slope	10.05874	1.607675	6.124902	13.99258	0.0675	21.97117	12.59156	1.2E-03	1.446884	0.099416	
Intercept	-9.55384	2.292057	-15.1623	-3.94537							
TSCR	0.072	0.010104	0.047276	0.096725							
Point	Probits	%	95% Fiducial Limits								
EC01	2.674	16.42888	11.89801	19.08018							
EC05	3.355	19.20257	15.27418	21.48171							
EC10	3.718	20.86783	17.40389	22.94351							
EC15	3.964	22.07222	18.96702	24.03503							
EC20	4.158	23.07881	20.26973	24.98763							
EC25	4.326	23.97889	21.41578	25.86633							
EC40	4.747	26.40568	24.29323	28.65338							
EC50	5.000	27.98235	25.92217	30.7936							
EC60	5.253	29.65315	27.45263	33.34384							
EC75	5.674	32.65421	29.87341	38.47437							
EC80	5.842	33.92772	30.82332	40.81392							
EC85	6.036	35.47498	31.93798	43.76324							
EC90	6.282	37.52242	33.36339	47.82823							
EC95	6.645	40.7764	35.54465	54.6336							
EC99	7.326	47.66069	39.92882	70.29392							



Mussel Larval Development Toxcalc Summary Sheet 2006

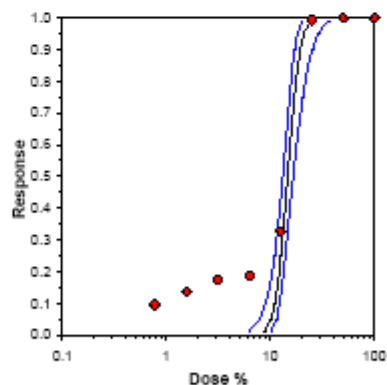
Bivalve Larval Development Test-Proportion Normal											
Start Date:	28/11/2006	Test ID:	ENV06-289	Sample ID:	Desalination Plant						
End Date:	30/11/2006	Lab ID:	Free	Sample Type:	Brine						
Sample Date:		Protocol:	ASTM 87 and Geotech W1 66	Test Species:	ME-Mytilus edulis						
Comments:											
Conc-%	1	2	3	4							
Control	0.8200	0.8400	0.8600	0.8800							
Cockburn Sound	0.8400	0.8100	0.8300	0.8900							
0.75	0.8700	0.8500	0.9200	0.8100							
1.51	0.8500	0.8200	0.8600	0.8600							
3.02	0.9000	0.8500	0.8800	0.9000							
6.05	0.9100	0.8700	0.8500	0.8900							
12.1	0.8500	0.7900	0.7000	0.6500							
24.2	0.0100	0.0200	0.0000	0.0000							
48.4	0.0000	0.0000	0.0000	0.0000							
95.8	0.0000	0.0000	0.0000	0.0000							
Transform: Arcsin Square Root											
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	1-Tailed Critical	MSD	Number Resp
Control	0.8500	1.0089	1.1741	1.1326	1.2171	3.093	4				60
Cockburn Sound	0.8425	1.0000	1.1644	1.1198	1.2327	4.158	4				
0.75	0.8625	1.0237	1.1947	1.1198	1.2840	5.741	4	-0.513	2.451	0.0986	55
1.51	0.8475	1.0059	1.1701	1.1326	1.1873	2.208	4	0.099	2.451	0.0986	61
3.02	0.8825	1.0475	1.2221	1.1731	1.2490	2.942	4	-1.194	2.451	0.0986	47
6.05	0.8800	1.0445	1.2185	1.1731	1.2661	3.284	4	-1.104	2.451	0.0986	48
*12.1	0.7475	0.8872	1.0492	0.9377	1.1731	10.029	4	3.106	2.451	0.0986	101
*24.2	0.0075	0.0089	0.0855	0.0500	0.1419	51.910	4	27.075	2.451	0.0986	397
48.4	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400
95.8	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400
Auxiliary Tests								Statistic	Critical	Skew	
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)								0.965848	0.896	0.219038	
Bartlett's Test indicates equal variances (p = 0.24)								7.934973	16.81187		
The control means are not significantly different (p = 0.76)								0.319541	2.446914		
Hypothesis Test (1-tail, 0.05)			NOEC	LOEC	Chv	TU	MSDu	MSDp	MSB	MSE	F-Prob
Dunnett's Test			6.05	12.1	8.555992	16.52893	0.076588	0.09003	0.687334	0.003233	1.1E-17
Maximum Likelihood-Probit											
Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	
Slope	11.56272	0.809038	9.977	13.14843	0.15	2.927813	12.59158	0.82	1.17805	0.086485	
Intercept	-8.62146	0.937702	-10.4594	-6.78356							
TSCR	0.1355	0.007653	0.1205	0.1505							
Point	Probits	%	95% Fiducial Limits								
EC01	2.674	9.481045	8.76108	10.09699							
EC05	3.355	10.85913	10.20578	11.43212							
EC10	3.718	11.67388	11.05688	12.22884							
EC15	3.964	12.25785	11.6621	12.80713							
EC20	4.158	12.74273	12.15998	13.29346							
EC25	4.326	13.17398	12.59835	13.73157							
EC40	4.747	14.32648	13.74498	14.93245							
EC50	5.000	15.06781	14.46167	15.72962							
EC60	5.253	15.8475	15.19833	16.5883							
EC75	5.674	17.23389	16.47115	18.15997							
EC80	5.842	17.81712	16.99502	18.83563							
EC85	6.036	18.52192	17.62068	19.66173							
EC90	6.282	19.44845	18.43281	20.76173							
EC95	6.645	20.90764	19.69253	22.52155							
EC99	7.326	23.94661	22.26016	26.27296							



Fish Larval Development Toxcalc Summary Sheet 2006

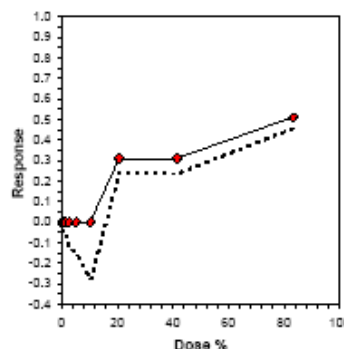
Larval Fish Growth											
Start Date:	28/11/2006	Test ID:	ENV06-289	Sample ID:	Desalination Plant Discharge						
End Date:	5/12/2006	Lab ID:	Freo	Sample Type:	Brine						
Sample Date:		Protocol:	GEOTECH WI 64	Test Species:	Pagrus auratus						
Comments:											
Conc-%	1	2	3								
Control	0.9650	0.9790	1.0000								
Cockburn Sound	0.9650	0.9650	0.9930								
0.78	0.9230	0.8450	0.9010								
1.56	0.8240	0.8520	0.8730								
3.125	0.7820	0.7960	0.8520								
6.25	0.7680	0.8240	0.7960								
12.5	0.6690	0.6480	0.6550								
25	0.0100	0.0100	0.0000								
50	0.0000	0.0000	0.0000								
100	0.0000	0.0000	0.0000								
Transform: Arcsin Square Root											
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	1-Tailed Critical	MSD	Number Resp
Control	0.9813	1.0072	1.4429	1.3826	1.5208	4.902	3				6
Cockburn Sound	0.9743	1.0000	1.4174	1.3826	1.4870	4.254	3				
*0.78	0.8897	0.9131	1.2355	1.1661	1.2896	5.110	3	5.548	2.530	0.0946	34
*1.56	0.8497	0.8720	1.1734	1.1379	1.2064	2.926	3	7.208	2.530	0.0946	46
*3.125	0.8100	0.8313	1.1210	1.0850	1.1759	4.308	3	8.609	2.530	0.0946	57
*6.25	0.7960	0.8170	1.1028	1.0682	1.1379	3.158	3	9.098	2.530	0.0946	61
*12.5	0.6573	0.6746	0.9455	0.9356	0.9578	1.193	3	13.304	2.530	0.0946	102
*25	0.0067	0.0068	0.0835	0.0500	0.1002	34.693	3	36.360	2.530	0.0946	298
50	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	3				300
100	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	3				300
Auxiliary Tests								Statistic	Critical	Skew	
Shapiro-Wilk's Test indicates normal distribution (p = 0.01)								0.982219	0.873	0.151151	
Bartlett's Test indicates equal variances (p = 0.49)								5.4171	16.81187		
The control means are not significantly different (p = 0.66)								0.475254	2.776451		
Hypothesis Test (1-tail, 0.05)											
Dunnnett's Test		NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	
		<0.78	0.78			0.032419	0.032955	0.574189	0.002097	1.1E-13	

Maximum Likelihood-Probit										
Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma
Slope	10.4237	1.720637	6.213445	14.63395	0.02	21.10008	12.59158	1.8E-03	1.165796	0.095935
Intercept	-7.1519	1.968016	-11.9675	-2.33634						
TSCR	0.135971	0.0166	0.095351	0.17659						
Point	Probits	%	95% Fiducial Limits							
EC01	2.674	8.762279	6.27197	10.2467						
EC05	3.355	10.18583	7.991087	11.52477						
EC10	3.718	11.03697	9.058579	12.31613						
EC15	3.964	11.65106	9.832267	12.91458						
EC20	4.158	12.16339	10.47076	13.44069						
EC25	4.326	12.62085	11.02877	13.93772						
EC40	4.747	13.85131	12.43208	15.44304						
EC50	5.000	14.64859	13.24524	16.56926						
EC60	5.253	15.49176	14.02643	17.88554						
EC75	5.674	17.00212	15.27606	20.51141						
EC80	5.842	17.64156	15.76513	21.70844						
EC85	6.036	18.41732	16.3363	23.2187						
EC90	6.282	19.44204	17.06214	25.30216						
EC95	6.645	21.06664	18.16383	28.79254						
EC99	7.326	24.4892	20.35318	36.82183						



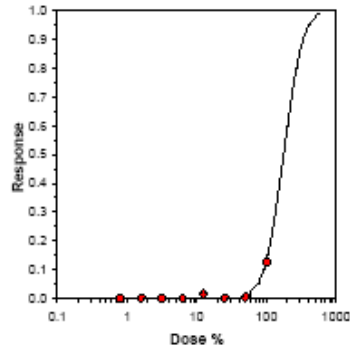
Microalgal Growth Toxcalc Summary Sheet 2007

Phytoplankton Test-Growth-Absorbance											
Start Date:	12/11/2007	Test ID:	ECX07-0811	Sample ID:	Fert Desalination Plant						
End Date:	15/11/2007	Lab ID:	Freo	Sample Type:	Brine						
Sample Date:	8/11/2007	Protocol:	Geotech WIENV45	Test Species:	Isochrysis galbana						
Comments:											
Conc-%	1	2	3	4							
Control	0.1000	0.1010	0.1030	0.0965							
0.65	0.1050	0.1010	0.0994	0.1130							
1.3	0.1050	0.1060	0.0990	0.1090							
2.6	0.1088	0.1040	0.1050	0.1280							
5.2	0.1190	0.1070	0.1110	0.1260							
10.4	0.1260	0.1280	0.1230	0.1350							
20.8	0.0865	0.0596	0.0630	0.0760							
41.6	0.0880	0.0730	0.0678	0.0772							
83.3	0.0591	0.0556	0.0500	0.0526							
Transform: Untransformed											
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	1-Tailed Critical	MSD	Isot Mean
Control	0.1001	1.0000	0.1001	0.0965	0.1030	2.716	4				0.1108
0.65	0.1046	1.0447	0.1046	0.0994	0.1130	5.808	4	-0.835	2.513	0.0135	0.1108
1.3	0.1049	1.0462	0.1048	0.0990	0.1090	4.003	4	-0.863	2.513	0.0135	0.1108
2.6	0.1115	1.1131	0.1115	0.1040	0.1280	10.072	4	-2.113	2.513	0.0135	0.1108
5.2	0.1158	1.1561	0.1158	0.1070	0.1260	7.309	4	-2.915	2.513	0.0135	0.1108
10.4	0.1280	1.2784	0.1280	0.1230	0.1350	3.984	4	-5.201	2.513	0.0135	0.1108
*20.8	0.0763	0.7618	0.0763	0.0596	0.0865	15.658	4	4.450	2.513	0.0135	0.0764
*41.6	0.0765	0.7640	0.0765	0.0678	0.0880	11.211	4	4.408	2.513	0.0135	0.0764
*83.3	0.0543	0.5426	0.0543	0.0500	0.0591	7.216	4	6.546	2.513	0.0135	0.0543
Auxiliary Tests								Statistic	Critical	Skew	
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)								0.962338	0.912	0.228559	
Bartlett's Test indicates equal variances (p = 0.29)								9.682064	20.09016		
Hypothesis Test (1-tail, 0.05)			NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob
Dunnnett's Test			10.4	20.8	14.70782	9.615385	0.01347	0.134535	0.00216	5.74E-05	1.1E-12
Linear Interpolation (200 Resamples)											
Point	%	SD	95% CL(Exp)	Skew							
IC05	12.075	0.216	11.678	12.943	0.6437						
IC10	13.750	0.431	12.956	15.485	0.6437						
IC15	15.425	0.647	14.235	18.028	0.6437						
IC20	17.100	0.863	15.513	20.570	0.6437						
IC25	18.775	3.547	16.791	33.225	5.0992						
IC40	60.350	5.016	43.774	69.902	-2.3745						
IC50	81.288										



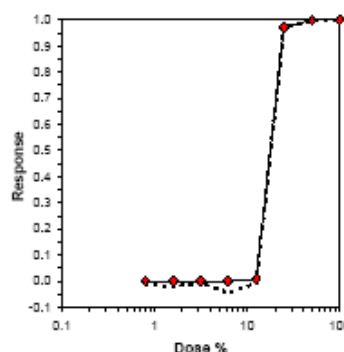
Ecklonia Germination Toxcalc Summary Sheet 2007

-Proportion Germinated												
Start Date:	16/11/2007	Test ID:	ECX07-0811	Sample ID:	Perth Desalination Plant							
End Date:	19/11/2007	Lab ID:	Freo	Sample Type:	Brine							
Sample Date:	8/11/2007	Protocol:	Geotech WIENV - 67	Test Species:	Ecklonia radiata							
Comments:												
Conc-%	1	2	3	4								
Control	0.9400	0.9700	0.9300	0.9200								
0.8	0.9600	0.9700	0.9400	0.9000								
1.6	0.9600	0.9100	0.9300	0.9800								
3.125	0.9600	0.9300	0.9200	0.9700								
6.25	0.9700	0.9900	0.9200	0.9500								
12.5	0.9500	0.9000	0.9300	0.9200								
25	0.9200	0.9400	0.9700	0.9600								
50	0.9400	0.9300	0.9800	0.9000								
100	0.7900	0.8400	0.7600	0.9000								
Transform: Arcsin Square Root												
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	1-Tailed Critical	MSD	Number Resp	
Control	0.9400	1.0000	1.3268	1.2840	1.3967	3.716	4				24	
0.8	0.9425	1.0027	1.3346	1.2490	1.3967	4.840	4	-0.172	2.513	0.1149	23	
1.6	0.9450	1.0053	1.3419	1.2661	1.4289	5.371	4	-0.330	2.513	0.1149	22	
3.125	0.9450	1.0053	1.3383	1.2840	1.3967	3.994	4	-0.252	2.513	0.1149	22	
6.25	0.9575	1.0186	1.3742	1.2840	1.4706	5.756	4	-1.036	2.513	0.1149	17	
12.5	0.9250	0.9840	1.2954	1.2490	1.3453	3.096	4	0.687	2.513	0.1149	30	
25	0.9475	1.0060	1.3434	1.2840	1.3967	3.709	4	-0.363	2.513	0.1149	21	
50	0.9375	0.9973	1.3261	1.2490	1.4289	5.684	4	0.015	2.513	0.1149	25	
*100	0.8225	0.8750	1.1405	1.0588	1.2490	7.318	4	4.074	2.513	0.1149	71	
Auxiliary Tests								Statistic	Critical	Skew		
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)								0.956335	0.912	0.249118		
Bartlett's Test indicates equal variances (p = 0.95)								2.589103	20.09016			
Hypothesis Test (1-tail, 0.05)			NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	
Dunnnett's Test			50	100	70.71068	2	0.065042	0.069074	0.01852	0.004183	0.001619	
Maximum Likelihood-Probit												
Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma		
Slope	4.585166	2.693062	-0.69324	9.863568	0.06	4.192441	12.59158	0.65	2.247747	0.218095		
Intercept	-5.30629	5.374129	-15.8396	5.227001								
TSCR	0.056794	0.004389	0.048192	0.065396								
Point	Probits	%	95% Fiducial Limits									
EC01	2.674	55.00259										
EC05	3.355	77.44857										
EC10	3.718	92.94963										
EC15	3.964	105.1251										
EC20	4.158	115.9295										
EC25	4.326	126.0795										
EC40	4.747	155.7735										
EC50	5.000	176.9079										
EC60	5.253	200.9097										
EC75	5.674	248.2274										
EC80	5.842	269.9605										
EC85	6.036	297.7061										
EC90	6.282	336.7027										
EC95	6.645	404.0926										
EC99	7.326	568.9986										



Mussel Larval Development Toxcalc Summary Sheet 2007

Bivalve Larval Survival and Development Test-Proportion Normal											
Start Date:	16/11/2007	Test ID:	ECX07-0811	Sample ID:	Perth Desalination Plant						
End Date:	19/11/2007	Lab ID:	Freo	Sample Type:	Brine						
Sample Date:	8/11/2007	Protocol:	Geotech WIENV- 66	Test Species:	ME-Mytilus edulis						
Comments:											
Conc-%	1	2	3	4							
Control	0.9100	0.9300	0.8900	0.9100							
0.8	0.9100	0.9000	0.9700	0.9000							
1.6	0.9200	0.9400	0.9600	0.9000							
3.125	0.9100	0.9300	0.9000	0.9200							
6.25	0.9500	0.9600	0.9200	0.9700							
12.5	0.8900	0.9100	0.9300	0.9400							
25	0.0300	0.0200	0.0500	0.0100							
50	0.0000	0.0000	0.0000	0.0000							
100	0.0000	0.0000	0.0000	0.0000							
Transform: Arcsin Square Root											
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	1-Tailed Critical	MSD	Number Resp
Control	0.9100	1.0000	1.2670	1.2327	1.3030	2.267	4				36
0.8	0.9200	1.0110	1.2902	1.2490	1.3967	5.537	4	-0.690	2.451	0.0825	32
1.6	0.9300	1.0220	1.3065	1.2490	1.3694	3.965	4	-1.172	2.451	0.0825	28
3.125	0.9150	1.0055	1.2756	1.2490	1.3030	1.821	4	-0.254	2.451	0.0825	34
6.25	0.9500	1.0440	1.3489	1.2840	1.3967	3.563	4	-2.432	2.451	0.0825	20
12.5	0.9175	1.0082	1.2813	1.2327	1.3233	3.131	4	-0.425	2.451	0.0825	33
25	0.0275	0.0302	0.1604	0.1002	0.2255	32.981	4	32.867	2.451	0.0825	369
50	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400
100	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400
Auxiliary Tests								Statistic	Critical	Skew	
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)								0.971224	0.896	0.528837	
Bartlett's Test indicates equal variances (p = 0.65)								4.205174	16.81187		
Hypothesis Test (1-tail, 0.05)			NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob
Dunnnett's Test			12.5	25	17.67767	8	0.052467	0.057646	0.738399	0.002267	1.3E-19
Trimmed Spearman-Kärber											
Trim Level	EC50	95% CL									
0.0%	17.945	17.707	18.185								
5.0%	17.816	17.691	17.941								
10.0%	17.816	17.691	17.941								
20.0%	17.816	17.691	17.941								
Auto-0.0%	17.945	17.707	18.185								



Copepod Reproduction 24 Hour Pulse Toxcalc Summary Sheet 2007

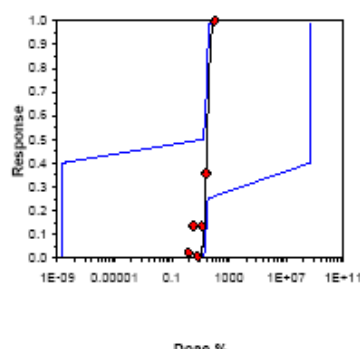
Copepod Reproduction					
Start Date:	21/09/2007	Test ID:	ECX07-0409	Sample ID:	Brine
End Date:	19/10/2007	Lab ID:	Freo	Sample Type:	24 hr Pulse In CS Diluent
Sample Date:	6/09/2007	Protocol:	GEOTECH WIENV 62	Test Species:	Gladioliferens imparipes
Comments:					
Conc-%	1	2	3	4	
Control	1.0000	0.9650	0.8650		
1.5	0.9200	0.9030	0.8650	1.0000	
3.125	0.7150	0.6700	1.0000	0.8650	
6.25	0.9250	0.9360	0.9650	0.9380	
12.5	0.8040	0.8440			
25	0.5360	0.6430	0.6430		
100	0.0000	0.0000	0.0000		

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root				N	t-Stat	1-Tailed Critical	MSD	Number Resp
			Mean	Min	Max	CV%					
Control	0.9500	1.0000	1.3761	1.2248	1.5208	10.762	3				16
1.5	0.9270	0.9758	1.3209	1.2248	1.5208	10.251	4	0.486	2.624	0.2979	30
3.125	0.8175	0.8605	1.1760	0.9589	1.5208	21.738	4	1.745	2.624	0.2979	72
6.25	0.9415	0.9911	1.3286	1.2934	1.3826	2.861	4	0.418	2.624	0.2979	24
12.5	0.8240	0.8674	1.1385	1.1122	1.1648	3.267	2	1.751	2.624	0.3561	36
25	0.6073	0.6393	0.8941	0.8214	0.9304	7.038	3	3.972	2.624	0.3185	118
100	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	3				300

Auxiliary Tests	Statistic	Critical	Skew
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.940141	0.868	0.874098
Bartlett's Test indicates equal variances (p = 0.08)	9.787023	15.08632	
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	Chv
Bonferroni t Test	12.5	25	17.67767

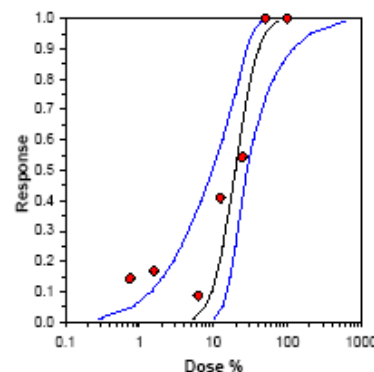
Parameter	Value	SE	95% Fiducial Limits	Maximum Likelihood-Probit						
				Control	Chi-Sq	Critical	P-value	Mu	Sigma	
Slope	5.155023	1.856523	0.000477	10.30957	0.053333	45.81729	9.487728	2.7E-09	1.473513	0.193986
Intercept	-2.69699	2.65083	-9.95589	4.763909						
TSCR	0.099835	0.025502	0.02903	0.17064						
Point	Probits	%	95% Fiducial Limits							
EC01	2.674	10.3253	2.06E-09	17.87932						
EC06	3.355	14.27035	2.06E-09	21.50334						
EC10	3.718	16.78456	2.06E-09	24.14514						
EC15	3.964	18.72662	2.06E-09	26.58658						
EC20	4.158	20.42914	2.06E-09	29.41639						
EC25	4.326	22.0126	2.06E-09	33.46573						
EC40	4.747	26.56849	2.06E-09	4.85E+08						
EC50	5.000	29.75175	16.25356	4.85E+08						
EC60	5.253	33.31641	22.66157	4.85E+08						
EC75	5.674	40.21183	28.18921	4.85E+08						
EC80	5.842	43.32862	29.93442	4.85E+08						
EC85	6.036	47.26783	31.86701	4.85E+08						
EC90	6.282	52.73695	34.24033	4.85E+08						
EC95	6.645	62.02837	37.77848	4.85E+08						
EC99	7.326	84.09893	44.84077	4.85E+08						

Significant heterogeneity detected (p = 2.69E-09)



Larval Fish Growth Toxcalc Summary Sheet 2007

Larval Fish Growth													
Start Date:	13/11/2007	Test ID:	ECX07-0811	Sample ID:	Pert Desalination Plant								
End Date:	21/11/2007	Lab ID:	Freo	Sample Type:	Brine								
Sample Date:	8/11/2007	Protocol:	GEOTECH WIENV62	Test Species:	Pink Snapper								
Comments:													
Conc-%	1	2	3										
Control	1.0000	1.0000	0.8600										
0.75	0.7780	0.8980	0.7740										
1.56	0.7930	0.8980	0.8870										
6.25	1.0000	0.9010	0.7080										
12.5	0.9880	0.2280	0.4740										
25	0.6350	0.6700	0.0000										
50	0.0000	0.0000	0.0000										
100	0.0000	0.0000	0.0000										
Transform: Arcsin Square Root													
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	1-Tailed Critical	MSD	Number Resp		
Control	0.9533	1.0000	1.4096	1.1873	1.5208	13.659	3				14		
0.75	0.8167	0.8566	1.1338	1.0754	1.2457	8.555	3	1.030	2.500	0.6694	55		
1.56	0.7927	0.8315	1.1071	0.9771	1.2457	12.153	3	1.130	2.500	0.6694	62		
6.25	0.8697	0.9122	1.2571	0.9999	1.5208	20.721	3	0.570	2.500	0.6694	39		
12.5	0.5633	0.5909	0.9081	0.4978	1.4810	54.972	3	1.881	2.500	0.6694	131		
*25	0.4350	0.4563	0.6437	0.0500	0.9589	79.923	3	2.861	2.500	0.6694	169		
50	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	3				300		
100	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	3				300		
Auxiliary Tests													
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)								Statistic	0.986881	Critical	0.858	Skew	-0.19624
Bartlett's Test indicates equal variances (p = 0.24)								Statistic	6.708817	Critical	15.08632		
Hypothesis Test (1-tail, 0.05)													
		NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob			
Dunnett's Test		12.5	25	17.67767	8	0.519316	0.533045	0.218525	0.107527	0.145816			
Maximum Likelihood-Probit													
Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma			
Slope	4.056298	1.024871	1.421788	6.690807	0.046667	77.35906	11.07048	3.0E-15	1.297978	0.24653			
Intercept	-0.26499	1.431818	-3.94559	3.415613									
TSCR	0.145332	0.042455	0.036199	0.254466									
Point	Probits	%	95% Fiducial Limits										
EC01	2.674	5.302286	0.280284	10.38933									
EC05	3.355	7.806783	0.829059	13.38894									
EC10	3.718	9.594824	1.469681	15.41459									
EC15	3.964	11.02722	2.15422	17.01773									
EC20	4.158	12.31667	2.909477	18.47192									
EC25	4.326	13.54241	3.752679	19.88452									
EC40	4.747	17.19969	6.964837	24.49601									
EC50	5.000	19.85995	9.825192	28.55744									
EC60	5.253	22.93168	13.35356	34.55551									
EC75	5.674	29.12462	19.81851	53.23448									
EC80	5.842	32.02309	22.31125	65.65528									
EC85	6.036	35.76765	25.12227	85.48113									
EC90	6.282	41.10734	28.58367	121.5758									
EC95	6.645	50.52244	33.77445	209.9909									
EC99	7.326	74.38637	44.51368	607.3974									



Significant heterogeneity detected (p = 2.99E-15)

Copepod Reproduction 2 x 10 minute/day Pulse Exposure

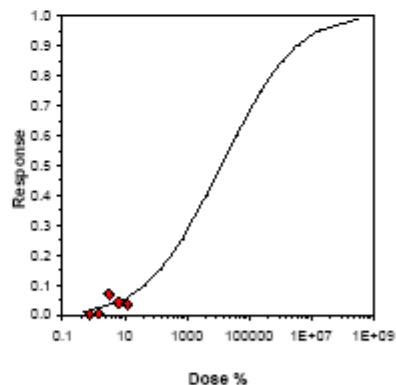
Copepod Reproduction					
Start Date:	11/10/2007	Test ID:	ECX07-0409	Sample ID:	Perth Desalination Plant
End Date:	11/11/2007	Lab ID:	Freo	Sample Type:	Brine 2x10 min pulse
Sample Date:	11/10/2007	Protocol:	Geotech WIENV - 62	Test Species:	Gladiferens imparipes
Comments:					

Conc-%	1	2	3	4
Control	1.0000	1.0000	1.0000	0.8700
0.75	1.0000	0.9900	0.9100	
1.5	1.0000	0.8540	1.0000	1.0000
3.125	0.8500	0.9500		
6.25	1.0000	1.0000	1.0000	0.7100
12.5	1.0000	0.8700		

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root					N	t-Stat	1-Tailed Critical	MSD	Number Resp
			Mean	Min	Max	CV%						
Control	0.9675	1.0000	1.4411	1.2019	1.5208	11.063	4				13	
0.75	0.9667	0.9991	1.4192	1.2661	1.5208	9.506	3	0.151	2.650	0.3840	10	
1.5	0.9635	0.9959	1.4353	1.1787	1.5208	11.916	4	0.043	2.650	0.3555	15	
3.125	0.9000	0.9302	1.2592	1.1731	1.3453	9.669	2	1.107	2.650	0.4354	20	
6.25	0.9275	0.9587	1.3911	1.0021	1.5208	18.642	4	0.372	2.650	0.3555	29	
12.5	0.9350	0.9664	1.3614	1.2019	1.5208	16.561	2	0.485	2.650	0.4354	13	

Auxiliary Tests				Statistic	Critical	Skew
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)				0.79503	0.863	-1.21351
Bartlett's Test indicates equal variances (p = 0.93)				1.378999	15.08632	
Hypothesis Test (1-tail, 0.05)				NOEC	LOEC	ChV
Bonferroni t Test				12.5	>12.5	8
				MSDu	MSDp	MSB
				MSE	F-Prob	
				0.270049	0.274646	0.011145
				0.035985	0.898387	

Parameter	Value	SE	95% Fiducial Limits		Maximum Likelihood-Probit					
			Control	Chi-Sq	Critical	P-value	Mu	Sigma		
Slope	0.527935	0.512649	-1.10354	2.159413	0.0325	9.404836	7.614725	0.02	4.116032	1.894173
Intercept	2.827004	0.442981	1.41724	4.236767						
TSCR	0.030237	0.015028	-0.01759	0.078063						
Point	Probits	%	95% Fiducial Limits							
EC01	2.674	0.512302								
EC05	3.355	10.00908								
EC10	3.718	48.81476								
EC15	3.964	142.183								
EC20	4.158	332.5489								
EC25	4.326	689.3368								
EC40	4.747	4326.619								
EC50	5.000	13062.67								
EC60	5.253	39438.05								
EC75	5.674	247532.6								
EC80	5.842	513107.7								
EC85	6.036	1200098								
EC90	6.282	3495526								
EC95	6.645	17047851								
EC99	7.326	3.33E+08								



Copepod 1 Hour Pulse Exposure

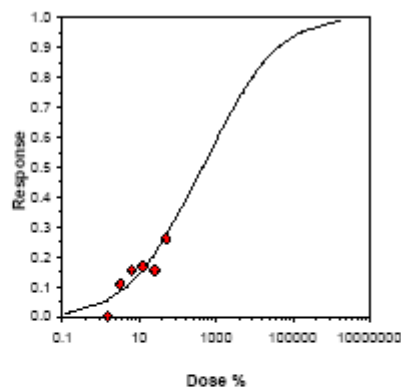
Copepod Reproduction					
Start Date:	11/09/2007	Test ID:	ECX07-0409	Sample ID:	Brine
End Date:	9/10/2007	Lab ID:	Freo	Sample Type:	1 hour pulse in CS diluent
Sample Date:	6/09/2007	Protocol:	GEOTECH WIENV 62	Test Species:	Gladioferens imparipes
Comments:					

Conc-%	1	2	3	4
Control	1.0000	0.9650	0.8850	
1.5	1.0000	0.9290	1.0000	0.8850
3.125	0.8040	1.0000	0.9110	0.6610
6.25	0.7150	0.9250	0.7640	
12.5	0.7910	0.7100	0.8580	
25	0.8180	0.7770	0.8040	
50	0.6970	0.7640	0.6430	

Conc-%	Transform: Arcsin Square Root						N	t-Stat	1-Tailed Critical	MSD	Number Resp
	Mean	N-Mean	Mean	Min	Max	CV%					
Control	0.9500	1.0000	1.3761	1.2248	1.5208	10.762	3				16
1.5	0.9535	1.0037	1.3919	1.2248	1.5208	10.926	4	-0.137	2.673	0.3077	18
3.125	0.8440	0.8884	1.2125	0.9493	1.5208	20.057	4	1.421	2.673	0.3077	63
6.25	0.8013	0.8435	1.1215	1.0076	1.2934	13.504	3	2.069	2.673	0.3289	60
12.5	0.7863	0.8277	1.0942	1.0021	1.1844	8.332	3	2.291	2.673	0.3289	64
25	0.7997	0.8418	1.1071	1.0790	1.1301	2.341	3	2.186	2.673	0.3289	60
*50	0.7013	0.7382	0.9939	0.9304	1.0635	6.716	3	3.105	2.673	0.3289	90

Auxiliary Tests	Statistic	Critical	Skew
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.967824	0.881	0.283447
Bartlett's Test indicates equal variances (p = 0.23)	8.048014	16.81187	
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV
Bonferroni t Test	25	50	35.35534
	TU	MSDu	MSDp
	4	0.21261	0.22088
	MSB	MSE	F-Prob
	0.074293	0.022714	0.027036

Maximum Likelihood-Probit										
Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma
Slope	0.649953	0.246008	-0.03308	1.332982	0.053333	25.48044	9.487728	4.0E-05	2.653886	1.538573
Intercept	3.275099	0.319206	2.38884	4.161358						
TSCR	0.046536	0.030297	-0.03758	0.130655						
Point	Probits	%	95% Fiducial Limits							
EC01	2.674	0.118749								
EC05	3.355	1.327881								
EC10	3.718	4.809787								
EC15	3.964	11.46194								
EC20	4.158	22.8555								
EC25	4.326	41.31755								
EC40	4.747	183.6933								
EC50	5.000	450.6986								
EC60	5.253	1105.807								
EC75	5.674	4916.292								
EC80	5.842	8887.542								
EC85	6.036	17722.07								
EC90	6.282	42232.44								
EC95	6.645	152972.3								
EC99	7.326	1710575								



Copepod 2 Hour Pulse Exposure

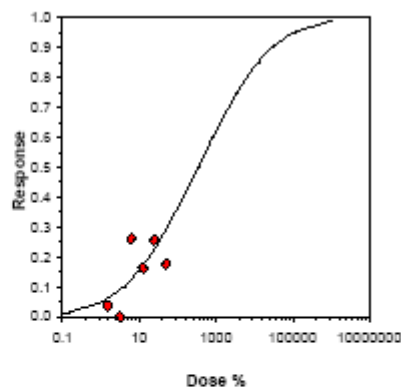
Copepod Reproduction					
Start Date:	10/09/2007	Test ID:	ECX07-0409	Sample ID:	Brine
End Date:	8/10/2007	Lab ID:	Freo	Sample Type:	2 hour pulse in CS diluent
Sample Date:	6/09/2007	Protocol:	GEOTECH WIENV 62	Test Species:	Gladioferens Imparipes
Comments:					

Conc-%	1	2	3	4
Control	1.0000	0.9650	0.8850	
1.5	0.7640	1.0000	0.8940	1.0000
3.125	0.9740	0.9780	0.8440	1.0000
6.25	0.6700	0.5890	0.8440	
12.5	0.8040	0.5890	1.0000	0.7770
25	0.8040	0.5630	0.7510	
50	0.7770	0.7770		

Conc-%	Transform: Arcsin Square Root						N	t-Stat	1-Tailed Critical	MSD	Number Resp
	Mean	N-Mean	Mean	Min	Max	CV%					
Control	0.9500	1.0000	1.3761	1.2248	1.5208	10.762	3				16
1.5	0.9145	0.9626	1.3361	1.0635	1.5208	16.842	4	0.278	2.673	0.3841	35
3.125	0.9490	0.9989	1.3791	1.1648	1.5208	10.976	4	-0.021	2.673	0.3841	21
6.25	0.7010	0.7379	0.9995	0.8749	1.1648	14.923	3	2.451	2.673	0.4106	90
12.5	0.7925	0.8342	1.1467	0.8749	1.5208	23.594	4	1.596	2.673	0.3841	83
25	0.7060	0.7432	1.0030	0.8486	1.1122	13.711	3	2.428	2.673	0.4106	89
50	0.7770	0.8179	1.0790	1.0790	1.0790	0.000	2	1.730	2.673	0.4591	44

Auxiliary Tests	Statistic	Critical	Skew						
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.976381	0.881	0.195906						
Equality of variance cannot be confirmed									
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob
Bonferroni t Test	50	>50		2	0.332516	0.34545	0.095351	0.035401	0.052951

Parameter	Value	SE	95% Fiducial Limits	Maximum Likelihood-Probit					
				Control	Chi-Sq	Critical	P-value	Mu	Sigma
Slope	0.665111	0.430777	-0.53092 1.861142	0.053333	74.35181	9.487728	2.7E-15	2.545792	1.503508
Intercept	3.306765	0.530994	1.832488 4.781043						
TSCR	0.045846	0.051532	-0.09723 0.188923						
Point	Probits	%	95% Fiducial Limits						
EC01	2.674	0.111714							
EC05	3.355	1.182337							
EC10	3.718	4.158806							
EC15	3.964	9.71641							
EC20	4.158	19.07249							
EC25	4.326	34.0166							
EC40	4.747	146.1781							
EC50	5.000	351.3918							
EC60	5.253	844.6972							
EC75	5.674	3629.88							
EC80	5.842	6474.046							
EC85	6.036	12708.01							
EC90	6.282	29690.28							
EC95	6.645	104434							
EC99	7.326	1105286							



Copepod 4 Hour Pulse Exposure

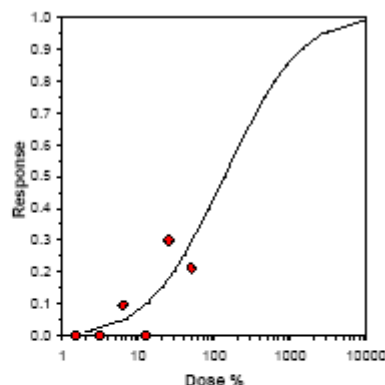
Copepod Reproduction					
Start Date:	10/09/2007	Test ID:	ECX07-0409	Sample ID:	Brine
End Date:	8/10/2007	Lab ID:	Freo	Sample Type:	4 hour pulse in CS diluent
Sample Date:	6/09/2007	Protocol:	GEOTECH WIENV 62	Test Species:	Gladioferens imparipes
Comments:					

Conc-%	1	2	3	4
Control	1.0000	0.9650	0.8850	
1.5	0.9740	0.9920	0.9560	
3.125	0.9520	1.0000	0.9650	
6.25	0.7510	1.0000	0.8180	
12.5	0.9250	1.0000	1.0000	0.8860
25	0.6430	0.7640	0.5890	
50	0.8580	0.8310	0.5490	

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root				N	t-Stat	1-Tailed Critical	MSD	Number Resp
			Mean	Min	Max	CV%					
Control	0.9500	1.0000	1.3761	1.2248	1.5208	10.762	3				16
1.5	0.9740	1.0253	1.4165	1.3595	1.4812	4.324	3	-0.321	2.694	0.3399	8
3.125	0.9723	1.0235	1.4178	1.3499	1.5208	6.397	3	-0.330	2.694	0.3399	8
6.25	0.8563	0.9014	1.2331	1.0484	1.5208	20.477	3	1.133	2.694	0.3399	43
12.5	0.9528	1.0029	1.3903	1.2264	1.5208	11.011	4	-0.121	2.694	0.3180	19
25	0.6653	0.7004	0.9563	0.8749	1.0635	10.138	3	3.327	2.694	0.3399	101
50	0.7460	0.7853	1.0553	0.8345	1.1844	18.211	3	2.542	2.694	0.3399	76

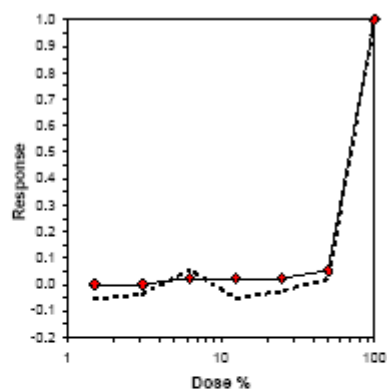
Auxiliary Tests	Statistic	Critical	Skew
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.965074	0.878	0.205974
Bartlett's Test indicates equal variances (p = 0.63)	4.310843	16.81187	
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV
Bonferroni t Test	12.5	25	17.67767
			TU
			MSDu
			MSDp
			MSB
			MSE
			F-Prob
			0.007566

Parameter	Value	SE	95% Fiducial Limits	Maximum Likelihood-Probit						
				Control	Chi-Sq	Critical	P-value	Mu	Sigma	
Slope	1.26704	0.831105	-1.04048	3.574562	0.053333	83.27015	9.487728	3.5E-17	2.135976	0.789241
Intercept	2.293631	1.166447	-0.94495	5.532213						
TSCR	0.036325	0.039576	-0.07356	0.146207						
Point	Probits	%	95% Fiducial Limits							
EC01	2.674	1.994933								
EC05	3.355	6.88322								
EC10	3.718	13.32053								
EC15	3.964	20.79511								
EC20	4.158	29.63029								
EC25	4.326	40.14606								
EC40	4.747	86.30305								
EC50	5.000	136.766								
EC60	5.253	216.7356								
EC75	5.674	465.9221								
EC80	5.842	631.2777								
EC85	6.036	899.4444								
EC90	6.282	1404.208								
EC95	6.645	2717.469								
EC99	7.326	9376.233								



Copepod 8 Hour Pulse Exposure

Copepod Reproduction												
Start Date:	14/09/2007	Test ID:	ECX07-0409	Sample ID:	Brine							
End Date:	13/10/2007	Lab ID:	Freo	Sample Type:	8 hour pulse in CS diluent							
Sample Date:	6/09/2007	Protocol:	GEOTECH WIENV 62	Test Species:	Gladioferens imparipes							
Comments:												
Conc-%	1	2	3									
Control	1.0000	0.9650	0.8850									
1.5	1.0000	1.0000	1.0000									
3.125	1.0000	0.9520	0.9920									
6.25	0.9380	0.7370	1.0000									
12.5	1.0000	0.9900	1.0000									
25	0.9380	1.0000										
50	0.9110	0.9380										
100	0.0000	0.0000	0.0000									
Transform: Arcsin Square Root												
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	1-Tailed Critical	MSD	Number Resp	
Control	0.9500	1.0000	1.3761	1.2248	1.5208	10.762	3				16	
1.5	1.0000	1.0526	1.5208	1.5208	1.5208	0.000	3	-1.360	2.779	0.2957	0	
3.125	0.9813	1.0330	1.4506	1.3499	1.5208	6.166	3	-0.701	2.779	0.2957	6	
6.25	0.8917	0.9386	1.2907	1.0323	1.5208	19.017	3	0.802	2.779	0.2957	32	
12.5	0.9967	1.0491	1.5041	1.4706	1.5208	1.925	3	-1.203	2.779	0.2957	1	
25	0.9690	1.0200	1.4200	1.3192	1.5208	10.040	2	-0.369	2.779	0.3306	6	
50	0.9245	0.9732	1.2935	1.2679	1.3192	2.804	2	0.694	2.779	0.3306	15	
100	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	3				300	
Auxiliary Tests								Statistic	Critical	Skew		
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)								0.944522	0.863	-0.31833		
Equality of variance cannot be confirmed												
Hypothesis Test (1-tail, 0.05)			NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	
Bonferroni t Test			50	100	70.71068	2	0.214031	0.222357	0.023593	0.016974	0.294804	
Trimmed Spearman-Kärber												
Trim Level	EC50	95% CL										
0.0%	65.060	63.064	67.119									
5.0%	69.381	67.014	71.832									
10.0%	69.384	68.550	70.227									
20.0%	69.384	68.550	70.227									
Auto-0.0%	65.060	63.064	67.119									



Copepod 16 Hour Pulse Exposure

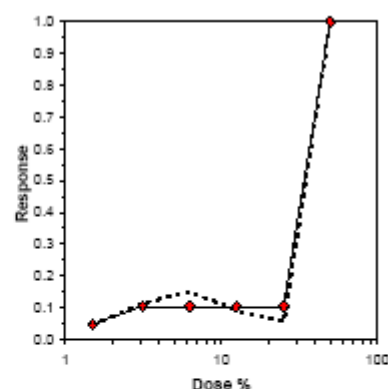
Copepod Reproduction					
Start Date:	19/09/2007	Test ID:	ECX07-0409	Sample ID:	Brine
End Date:	17/10/2007	Lab ID:	Freo	Sample Type:	16 hour pulse in CS diluent
Sample Date:	6/09/2007	Protocol:	GEOTECH WIENV 62	Test Species:	Gladioferens Imparipes
Comments:					

Conc-%	1	2	3	4
Control	1.0000	0.9650	0.8850	
1.5	0.8490	1.0000	1.0000	0.7600
3.125	0.8450	0.8440	0.8440	
6.25	0.8040	0.6700	0.9380	
12.5	0.8850	1.0000	0.6970	
25	1.0000	0.9650	0.7240	
50	0.0000	0.0000	0.0000	

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root				N	t-Stat	1-Tailed Critical	MSD	Number Resp
			Mean	Min	Max	CV%					
Control	0.9500	1.0000	1.3761	1.2248	1.5208	10.762	3				16
1.5	0.9023	0.9497	1.3180	1.0588	1.5208	18.104	4	0.367	2.650	0.4193	39
3.125	0.8443	0.8888	1.1652	1.1648	1.1661	0.068	3	1.247	2.650	0.4482	48
6.25	0.8040	0.8463	1.1301	0.9589	1.3192	16.000	3	1.455	2.650	0.4482	59
12.5	0.8607	0.9060	1.2445	0.9879	1.5208	21.454	3	0.778	2.650	0.4482	42
25	0.8963	0.9435	1.3070	1.0177	1.5208	19.888	3	0.408	2.650	0.4482	32
50	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	3				300

Auxiliary Tests	Statistic	Critical	Skew
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.936453	0.863	-0.14125
Bartlett's Test indicates unequal variances (p = 2.90E-03)	18.04111	15.08632	
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV
Bonferroni t Test	25	50	35.35534
	TU	MSDu	MSDp
	4	0.322038	0.334565
	MSB	MSE	F-Prob
	0.027767	0.042904	0.668667

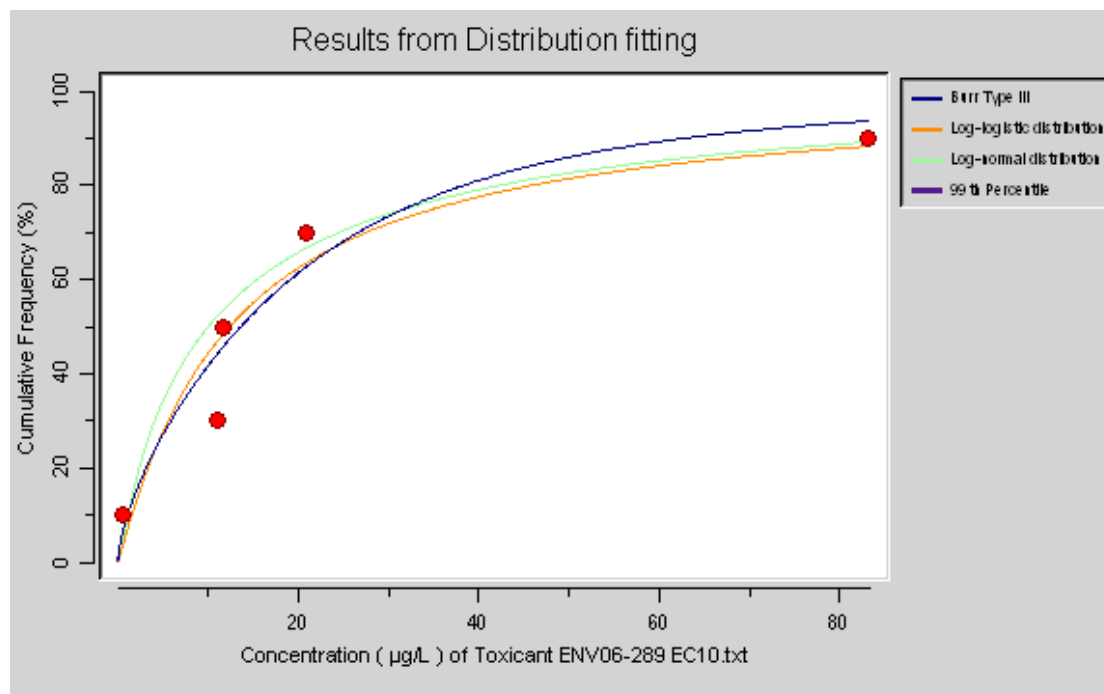
Trimmed Spearman-Kärber			
Trim Level	EC50	95% CL	
0.0%			
5.0%	29.491	27.915	31.157
10.0%	33.710	31.900	35.624
20.0%	33.976	33.466	34.494
Auto-4.7%	29.224	27.668	30.868



Appendix 3

BURRLIOZ Data

**2006 BurrliOZ EC/IC10 Results
ENV06-289
Perth Desalination Plant Brine
Protection Values**



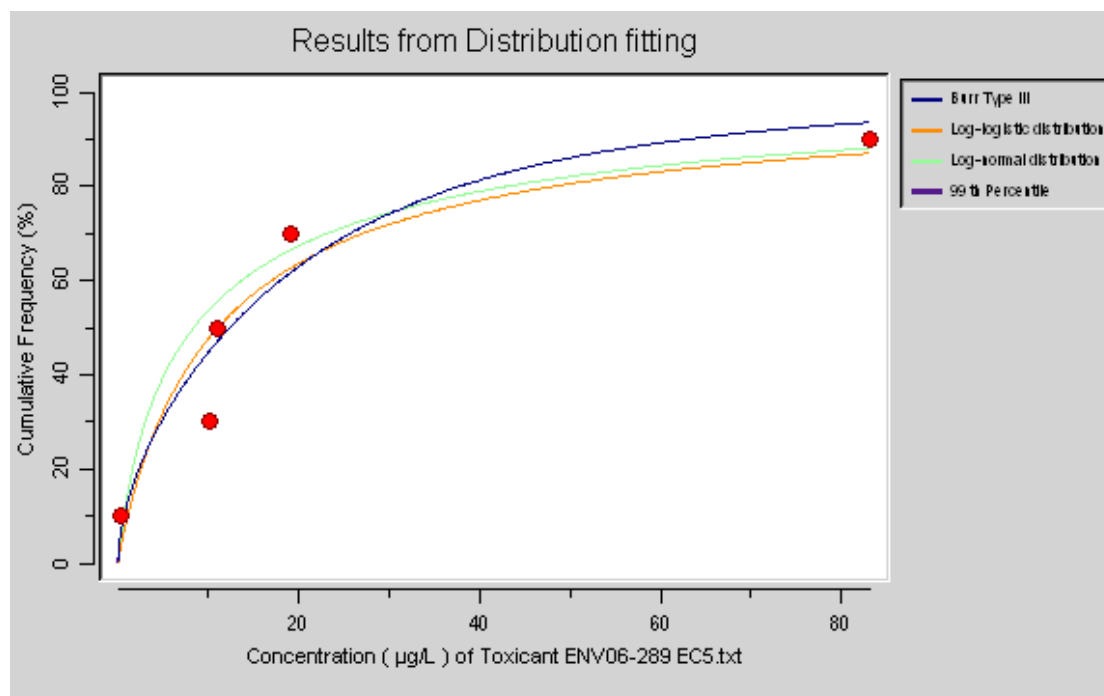
PC 99 50% = 0.03 (501 Bootstrap Samples)
Burr Type III distribution fitted to 5 observations

PC 95 50% = 0.37 (501 Bootstrap Samples)
Burr Type III distribution fitted to 5 observations

PC 90 50% = 1.07 (501 Bootstrap Samples)
Burr Type III distribution fitted to 5 observations

PC 80 50% = 3.12 (501 Bootstrap Samples)
Burr Type III distribution fitted to 5 observations

2006 BurrliOZ EC/IC5 Results
ENV06-289
Perth Desalination Plant Brine
Protection Values



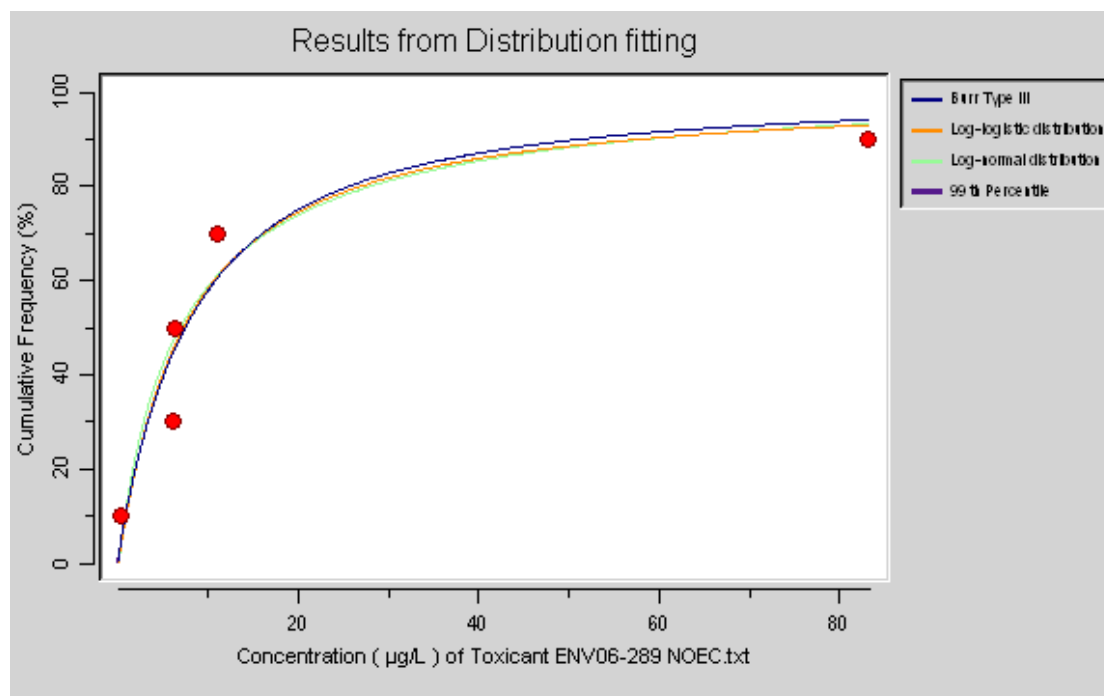
PC 99 50% = 0.01 (501 Bootstrap Samples)
Burr Type III distribution fitted to 5 observations

PC 95 50% = 0.2 (501 Bootstrap Samples)
Burr Type III distribution fitted to 5 observations

PC 90 50% = 0.67 (501 Bootstrap Samples)
Burr Type III distribution fitted to 5 observations

PC 80 50% = 2.3 (501 Bootstrap Samples)
Burr Type III distribution fitted to 5 observations

2006 BurrliOZ NOEC Results
ENV06-289
Perth Desalination Plant Brine
Protection Values



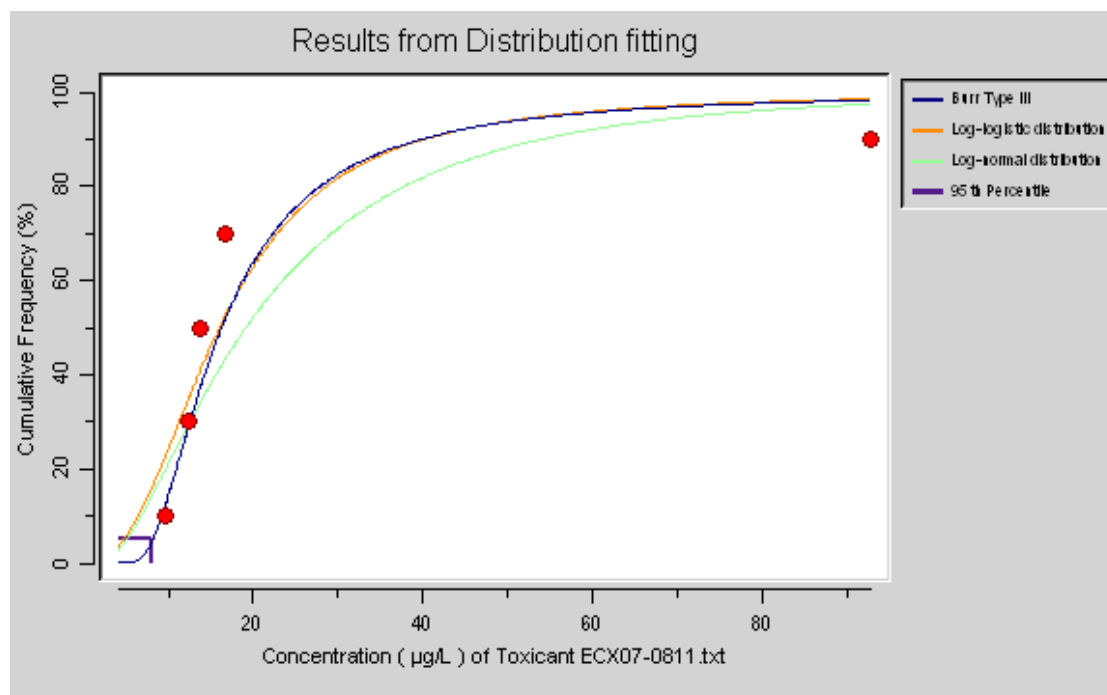
PC 99 50% = 0.06 (501 Bootstrap Samples)
Burr Type III distribution fitted to 5 observations

PC 95 50% = 0.37 (501 Bootstrap Samples)
Burr Type III distribution fitted to 5 observations

PC 90 50% = 0.84 (501 Bootstrap Samples)
Burr Type III distribution fitted to 5 observations

PC 80 50% = 1.95 (501 Bootstrap Samples)
Burr Type III distribution fitted to 5 observations

2007 BurrliOZ EC/IC10 Results
ECX07-0811
Perth Desalination Plant Brine
Protection Values



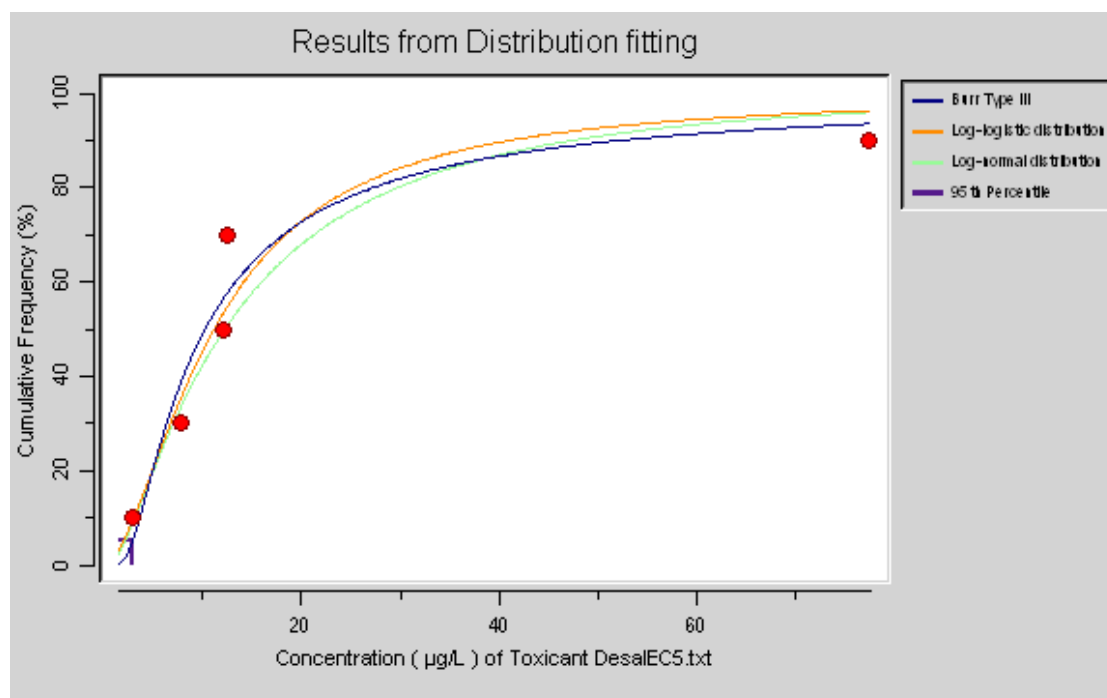
PC99 50% = 6.64 (501 Bootstrap Samples)
Burr Type III Distribution fitted to 5 observations

PC95 50% = 8.15 (501 Bootstrap Samples)
Burr Type III Distribution fitted to 5 observations

PC90 50% = 9.23 (501 Bootstrap Samples)
Burr Type III Distribution fitted to 5 observations

PC80 50% = 10.93 (501 Bootstrap Samples)
Burr Type III Distribution fitted to 5 observations

2007 BurrliOZ EC/IC5 Results
ECX07-0811
Perth Desalination Plant Brine
Protection Values



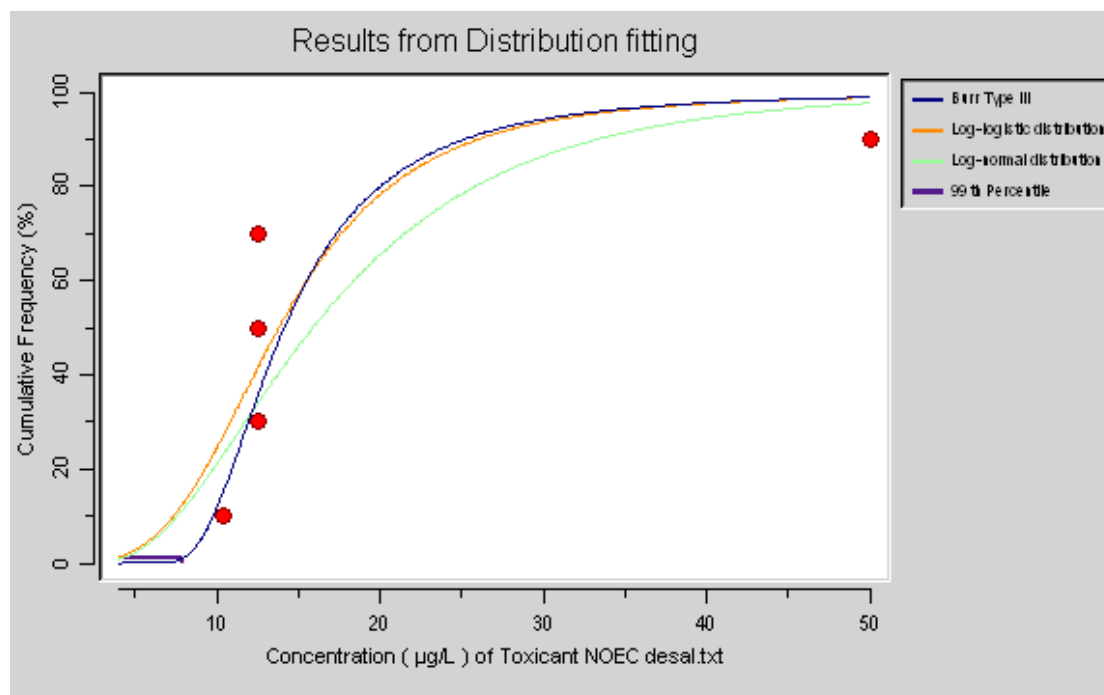
PC99 50% = 1.98 (501 Bootstrap Samples)
Burr Type III Distribution fitted to 5 observations

PC95 50% = 2.87 (501 Bootstrap Samples)
Burr Type III Distribution fitted to 5 observations

PC90 50% = 3.60 (501 Bootstrap Samples)
Burr Type III Distribution fitted to 5 observations

PC80 50% = 4.92 (501 Bootstrap Samples)
Burr Type III Distribution fitted to 5 observations

2007 BurrliOZ NOEC Results
ECX07-0811
Perth Desalination Plant Brine
Protection Values



PC99 50% = 7.91 (501 Bootstrap Samples)
Burr Type III Distribution fitted to 5 observations

PC95 50% = 9.02 (501 Bootstrap Samples)
Burr Type III Distribution fitted to 5 observations

PC90 50% = 9.78 (501 Bootstrap Samples)
Burr Type III Distribution fitted to 5 observations

PC80 50% = 10.92 (501 Bootstrap Samples)
Burr Type III Distribution fitted to 5 observations