



***CEDD Contract No. GE/2009/16***

***Chemical and Biological Testing (Service Contract)***

***Service Order No. GE/2009/16.19***

***Agreement No. CE 15/2010 (DS), Upgrading of Cheung Chau  
and Tai O Sewage Collection, Treatment and Disposal Facilities  
– Design and Construction***

**Laboratory Biological Testing Report (Final Report)**

**Prepared for**

**Civil Engineering and Development Department**

**Prepared By**

**ALS Technichem (HK) Pty Ltd**

**Nov 5, 2012**



***CEDD Contract No. GE/2009/16***

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**Laboratory Biological Testing Report (Final Report)**


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ALS TECHNICHEM (HK) Pty Ltd



## SEDIMENT TOXICITY TESTS REPORT

10-day Amphipod Survival Test – *Leptocheirus plumulosus*

20-day Polychaete Growth and Survival Test – *Neanthes arenaceodentata*

48-60-hour Bivalve Larvae Survival and Normality Test – *Crassostrea gigas*

05-November-2012

Project: GE/2009/16.19 - AGREEMENT NO CE 15\_2010(DS) UPGRADING OF  
CHEUNG CHAU AND TAI O SEWAGE COLLECTION

### Biological Testing Report

Prepared for

### CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

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ALS Work Order Number HK1206244

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05 November 12

Attention: MR. SUN NG

RE: GE/2009/16.19 - AGREEMENT NO CE 15\_2010(DS) UPGRADING OF CHEUNG CHAU AND TAI O SEWAGE COLLECTION

Dear MR. SUN NG,

Toxicity Test Result for Sediment Samples

We are pleased to provide the results of the toxicity testing performed on the sediment samples and reference sediment of the captioned project. The sediment samples were received within the period of 29 December 2011 to 11 January 2012. Each sample was assigned with an ALS identification (ID) code as stated in Table 1.2. The samples were tested with the three toxicity tests:

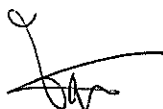
- 10-day Amphipod Survival Test – *Leptocheirus plumulosus*
- 20-day Polychaete Growth and Survival Test – *Neanthes arenaceodentata*
- 48-60-hour Bivalve Larvae Survival and Normality Test – *Crassostrea gigas*

The Amphipod testing was performed according to the United States Environmental Protection Agency (US EPA) Methods for Assessing the Toxicity of the Sediment-associated Contaminants with Estuarine and Marine Amphipods (EPA/600/R-94/025, 1994). The Polychaete Survival and Growth and the Bivalve Larval Development testing were performed according to the Puget Sound Estuary Program (PSEP, 1995) protocol.

A QA/QC review confirmed that the tests met all acceptability criteria for test validity as outlined in the respective protocols. Reference toxicant results for all three species were within warning limits (Mean  $\pm 2SD$ ) based on historical laboratory performance, indicating that the relative health and sensitivity of the test organisms were consistent with previous batches of test organisms.

Should you have any questions or comments related to the report, please feel free to contact the undersigned at 2610 1044 or via e-mail at [Ivan.leung@alsglobal.com](mailto:Ivan.leung@alsglobal.com)

Yours sincerely,



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Mr. Leung Sai Ho, Ivan  
Supervisor - Ecotoxicology Section  
ALS Technichem (HK) Pty Ltd

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## 1 SAMPLE INFORMATION

Table 1.1 Sample Details

ALS work order number:	HK1206244
Number of sample(s) for Testing:	5 testing samples, 1 reference sample
Condition of sample(s) at receipt:	Temperature: CHILLED - Ice Present Container: Miscellaneous Plastic Bag and Vibrocore
Quantity of each sample(s) at receipt:	Various
Sample storage after receipt:	Stored in dark at 4°C

Table 1.2 Sample Identifications

Lab ID	Client ID	Lab ID (Ecotox. Section)	Date Sampled	Date Received	<sup>b</sup> Category
HK1200975001	REFERENCE SEDIMENT	HK1206244001	11-Jan-12	11-Jan-12	L
HK1200964001 & 004	D10 0.00-0.90M & D10 4.90-5.90M	HK1206244002	29-Dec-11	29-Dec-11	M
HK1200955001 & 002 & 005	D11 0.00-0.90M & 0.90-1.90M & 6.90-7.90M	HK1206244003	29-Dec-11	29-Dec-11	M
HK1200967001 & 003	D8 0.00-0.90M & 1.90-2.90M	HK1206244004	31-Dec-11	31-Dec-11	M
<sup>a</sup> HK1200966005	D9 6.90-7.90M	HK1206244005	30-Dec-11	30-Dec-11	H(>10xLCEL)
HK1200966001 & 002	D9 0.00-0.90M & 0.90-1.90 M	HK1206244006	30-Dec-11	30-Dec-11	M

<sup>a</sup> Sample Sediment was diluted with 9 portions of reference sediment before testing.

<sup>b</sup> Sediments are categorized according to ETWB TCW No. 34/2002

Table 1.3 Total Organic Carbon (TOC), Moisture Content and Porewater characteristics (pH, Salinity and Ammonia) of Testing Sediments

Client ID	ALS ID (Ecotox. Section)	Total Organic Carbon (TOC) (%)	Moisture Content (%)	Grain Size (<63µm) (%)	pH	Porewater Salinity (ppt)	*Ammonia-N (Total, mgN/L)
REFERENCE SEDIMENT	HK1206244001	1.39	50.4	78.4	7.8	35	4.74
D10 0.00-0.90M & D10 4.90-5.90M	HK1206244002	0.89	48.2	98.2	7.9	35	15.9
D11 0.00-0.90M & 0.90-1.90M & 6.90-7.90M	HK1206244003	0.93	48.1	98.5	7.5	35	35.4
D8 0.00-0.90M & 1.90-2.90M	HK1206244004	1.23	34.9	70.1	7.5	35	0.83
D9 6.90-7.90M	HK1206244005	0.74	42.8	64.2	7.6	35	4.58
D9 0.00-0.90M & 0.90-1.90 M	HK1206244006	0.85	42.2	92.9	7.7	35	3.10

\* Ammonia is reported as mgN/L



Table 1.4 Summary of Test Results

ALS ID	Sample ID	Overall Result	10-Day Amphipod Survival Test			20-Day Polychaete Survival and Growth Test			48-60-hour Bivalve Survival and Normality Test		
			Survival (%)		Pass / Fail	Total Dry Weight (mg)		Pass / Fail	Normality Survival (%)		Pass / Fail
			Mean	SD		Mean	SD	Mean	SD	Mean	SD
HK1206244001	REFERENCE SEDIMENT	NA	95.0	5.0	NA	98.4	19.0	NA	78.9	1.4	NA
HK1206244002	D10 0.00-0.90M & D10 4.90-5.90M	<u>Fail</u>	#*59.0	10.2	Fail	#85.9	10.7	Pass	*68.4	2.3	Pass
HK1206244003	D11 0.00-0.90M & 0.90-1.90M & 6.90-7.90M	Pass	91.0	8.9	Pass	#79.2	15.5	Pass	86.0	5.5	Pass
HK1206244004	D8 0.00-0.90M & 1.90-2.90M	<u>Fail</u>	#*68.0	9.1	Fail	91.7	14.5	Pass	*73.7	5.3	Pass
HK1206244005	D9 6.90-7.90M	<u>Fail</u>	96.0	5.5	Pass	#85.5	13.5	Pass	#*59.2	7.2	Fail
HK1206244006	D9 0.00-0.90M & 0.90-1.90 M	<u>Fail</u>	#*59.0	10.2	Fail	#82.1	28.4	Pass	82.3	6.9	Pass

## 2 10-DAY AMPHIPOD SURVIVAL TEST - *Leptocheirus plumulosus*

Table 2.1 Test Methodology for the 10-day Amphipod Survival Test  
– *Leptocheirus plumulosus*

	Parameter	Conditions
1	Reference protocols:	USEPA (1994) & ALS (2000) (Ref. 3 & 4)
2	Organism source:	Collected from Aquatic Biosystem; body length 2-4 mm; no mature males or females
3	Testing periods:	10 Feb 2012 - 20 Feb 2012
4	Test type:	Sediment toxicity test, static, non-renewal
5	Test duration:	10 days
6	Temperature:	25 ± 1°C
7	Salinity:	20 ± 1 ppt
8	Light quality:	Wide-spectrum fluorescent lights
9	Illuminance:	500-1000 lux
10	Photoperiod:	24h : 0h (Light : Dark)
11	Test chamber:	1L glass jar with 10cm internal diameter; 175mL sediment; 800mL overlying seawater; position of test container randomized
12	Number of organisms per chamber:	20
13	Number of replicates:	5
14	Feeding regime:	None
15	Aeration:	Overlying water aerated overnight before the start of test and throughout the test at approximately 100 bubbles/min; maintains ≥60% dissolved oxygen saturation
16	Overlying water:	Reconstituted seawater made up from artificial sea salt (Brand: Red Sea®); filtered through a 0.5µm filter; sterilized by ultraviolet light
17	Overlying water quality monitoring:	Temperature, pH, salinity and dissolved oxygen measured daily; total ammonia and sulfide content taken at 0 d and 10 d
18	Control sediment:	Collected from Port Shelter at PS6 (E850234 N820057) on 12 December 2011 by grab sampler; expires on 09 June 2012; stored at -20°C after collection; sieved with 0.5mm sieve before testing; ALS Ref ID: HK1129264001
19	Endpoints:	Emergence <sup>1</sup> (recorded daily); survival; reburial <sup>2</sup>
20	Statistical analysis:	Data tested for normality and homogeneity of variance; Statistically significant differences between the mean survivals in testing sediments and reference sediment determined at a probability of p ≤ 0.05 using ToxCalc 5.0 (Ref 7)
21	Test acceptability criterion:	≥90% mean survival in control sediment

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Reference Toxicant Test		
22	Test type:	Water only test, static
23	Toxicant:	Cadmium
24	Test duration:	96 hours
25	Photoperiod:	0h : 24h (Light : Dark)
26	Test Chamber:	1L glass jar with 10cm internal diameter; 900 mL
27	Number of organisms per chamber:	10
28	Number of replicates:	2
29	Overlying seawater quality monitoring:	Temperature, pH, salinity and dissolved oxygen of the
30	Endpoints:	Survival
31	Statistical analysis:	96-h LC50 for Cadmium determined by ToxCalc 5.0
32	Test acceptability criterion:	≥ 90% mean survival in control seawater
33	Other testing conditions are the same as in the sediment test	

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<sup>1</sup> Number of amphipods appearing on the sediment surface or water column

<sup>2</sup> Number of surviving amphipods that rebury within 1 h in a separate container containing a 2-cm layer of control sediment and overlying clean seawater

Table 2.2 Results Summary of the 10-day Amphipod Survival Test  
–*Leptocheirus plumulosus*

Lab ID	Sample ID	Survival (%)		Avoidance (amphipod/jar/day)		Reburial (%)
		Mean	SD	Mean	SD	Mean
Control	Control	92.0	4.5	0.00	0.00	96.0
HK1206244001	REFERENCE SEDIMENT	95.0	5.0	0.00	0.00	98.0
HK1206244002	D10 0.00-0.90M & D10 4.90-5.90M	*59.0	10.2	0.00	0.00	97.0
HK1206244003	D11 0.00-0.90M & 0.90-1.90M & 6.90-7.90M	91.0	8.9	0.00	0.00	99.0
HK1206244004	D8 0.00-0.90M & 1.90-2.90M	*68.0	9.1	0.00	0.00	96.0
HK1206244005	D9 6.90-7.90M	96.0	5.5	0.00	0.00	98.0
HK1206244006	D9 0.00-0.90M & 0.90-1.90 M	*59.0	10.2	0.00	0.00	96.0

\* Mean survival in test sediment is significantly different ( $p \leq 0.05$ ) from that in reference sediment

# Mean survival in test sediment is <80% of that in reference sediment

Table 2.3 Water Quality Summary of 10-day amphipod survival test – *Leptocheirus plumulosus*

Lab ID	Sample ID	Ammonia (Total, mg/L)		Sulfide (mg/L)		Temp(°C)		pH		Salinity (ppt)		DO (mg/L)	
		Day 0	Day 10	Day 0	Day 10	min	max	min	max	min	max	min	max
Control	CONTROL	<1.00	<1.00	<0.1	<0.1	24	26	8.2	8.4	19	20	7.1	7.3
HK1206244001	REFERENCE SEDIMENT	<1.00	<1.00	<0.1	<0.1	25	26	8.3	8.4	20	20	7.1	7.8
HK1206244002	D10 0.00-0.90M & D10 4.90-5.90M	2.86	5.21	<0.1	<0.1	24	26	8.2	8.4	20	20	7.1	7.5
HK1206244003	D11 0.00-0.90M & 0.50-1.90M & 6.90-7.90M	<1.00	9.02	<0.1	<0.1	24	26	8.2	8.4	20	20	7.2	7.4
HK1206244004	D8 0.00-0.90M & 1.90-2.90M	<1.00	<1.00	<0.1	<0.1	24	26	8.2	8.4	20	20	7.2	7.5
HK1206244005	D9 6.90-7.90M	<1.00	<1.00	<0.1	<0.1	24	26	8.2	8.4	20	20	7.1	7.3
HK1206244006	D9 0.00-0.90M & 0.90-1.90 M	<1.00	<1.00	<0.1	<0.1	24	26	8.2	8.4	20	20	7.0	7.5

Table 2.4 Summary of Quality Control Data of the 10-day Amphipod Survival Test – *Leptocheirus plumulosus*

Date of Test	Sediment Test		Reference Toxicant Test	
	Mean survival (%) in control sediment	Acceptability	Mean survival (%) in 0 mg Cd/L seawater	96-h <sup>a</sup> LC50 (mgCd / L)
10 Feb 2012 - 20 Feb 2012	92.0%	≥ 90%	100.0%	0.64
		≥ 90%	≥ 90%	0.33 - 1.46

<sup>a</sup>Median Lethal Concentration, a concentration which kills 50% of the testing population

3 20-DAY POLYCHAETE GROWTH AND SURVIVAL TEST  
– *Neanthes arenaceodentata*

Table 3.1 Test Methodology for the 20-day Polychaete Growth and Survival Test – *Neanthes arenaceodentata*

Parameter	Conditions
1 Reference protocols:	PSEP (1995) & ALS (2000) (Ref. 2 & 5)
2 Organism source:	Collected from Aquatic Toxicology Support; 2-3 weeks post emergence; dry weight 0.5-1.0 mg
3 Organism acclimation:	Polychaetes were acclimated in plastic container (20cm x 26cm x 8cm) at $20 \pm 1^\circ\text{C}$ with $28 \pm 2$ ppt aerated seawater of 16h : 8h (light : dark) photoperiod Overlying seawater renewed; water quality (temperature, pH, salinity and dissolved oxygen) measured; organisms fed by grounded TetraMarin® in slurry form three times a week Temperature and salinity adjusted to testing condition at $<3^\circ\text{C}$ and $<5$ ppt per day respectively
4 Testing periods:	10 Feb 2012 - 01 Mar 2012
5 Test type:	Sediment toxicity test; static; renewal
6 Test duration:	20 days
7 Temperature:	$20 \pm 1^\circ\text{C}$
8 Salinity:	$28 \pm 1$ ppt
9 Light quality:	Wide-spectrum fluorescent lights
10 Illuminance:	500-1000 lux
11 Photoperiod:	24h : 0h (Light : Dark)
12 Test chamber:	1L glass jar with 10cm internal diameter; 175mL sediment; 800mL overlying seawater; position of test container randomized
13 Number of organisms per chamber:	5
14 Number of replicates:	5
15 Feeding regime:	Fed every second day (from day 0) with 40mg (dry weight) grounded TetraMarin® in slurry form in each testing chamber
16 Aeration:	Overlying water aerated overnight before the start of test and throughout the test at approximately 100 bubbles/min; maintains $>60\%$ dissolved oxygen saturation
17 Overlying water:	Reconstituted seawater made up from artificial sea salt (Brand: Red Sea®); filtered through a $0.5\mu\text{m}$ filter; sterilized by ultraviolet light
18 Overlying water quality monitoring:	Temperature monitored daily; pH, salinity and dissolved oxygen measured every third day before water renewal; total ammonia and sulfide taken at 0 d and 20 d
19 Control sediment:	Collected from Port Shelter at PS6 (E850234 N820057) on 12 December 2011 by grab sampler; expires on 09 June 2012; stored at $-20^\circ\text{C}$ after collection; sieved with 0.5mm sieve before testing; ALS Ref ID: HK1129264001

20	Endpoints:	Survival; total biomass <sup>1</sup> ; average individual biomass <sup>1</sup> ; average individual growth rate
21	Statistical analysis:	Data tested for normality and homogeneity of variance; Statistically significant differences between the mean total dry weight in testing sediments and reference sediment determined at a probability of $p \leq 0.05$ using ToxCalc 5.0 (Ref 7)
22	Test acceptability criterion:	$\geq 90\%$ mean survival and $\geq 0.38\text{mg/ind/day}$ individual growth rate in control sediment

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Reference Toxicant Test

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23	Test type:	Water only test, static
24	Toxicant:	Cadmium
25	Test duration:	96 hours
26	Photoperiod:	0h : 24h (Light : Dark)
27	Test Chamber:	1L glass jar with 10cm internal diameter; 900 mL seawater; position of test container randomized
28	Number of organisms per chamber:	10
29	Number of replicates:	2
30	Overlying seawater quality monitoring:	Temperature, pH, salinity and dissolved oxygen of the seawater measured at test initiation and termination
31	Endpoints:	Survival
32	Statistical analysis:	96-h LC50 for Cadmium determined by ToxCalc 5.0 (Ref 7)
33	Test acceptability criterion:	$\geq 90\%$ mean survival in control seawater
34	Other testing conditions are the same as in the sediment test	

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Table 3.2 Results Summary of the 20-day Polychaete Growth and Survival Test – *Neanthes arenaceodentata*

Lab ID	Sample ID	Survival (%)		Individual Dry Weight (mg)		Individual Growth Rate (mg/ind/day)		Total Dry Weight (mg)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Control	CONTROL	100.0	0.0	18.6	2.2	0.90	0.11	93.0	10.9
HK1206244001	REFERENCE SEDIMENT	100.0	0.0	19.7	3.8	0.95	0.19	98.4	19.0
HK1206244002	D10 0.00-0.90M & D10 4.90-5.90M	100.0	0.0	17.2	2.1	0.83	0.11	#85.9	10.7
HK1206244003	D11 0.00-0.90M & 0.90-1.90M & 6.90-7.90M	100.0	0.0	15.8	3.1	0.76	0.16	#79.2	15.5
HK1206244004	D8 0.00-0.90M & 1.90-2.90M	100.0	0.0	18.3	2.9	0.89	0.14	91.7	14.5
HK1206244005	D9 6.90-7.90M	92.0	17.9	19.2	4.4	0.93	0.22	#85.5	13.5
HK1206244006	D9 0.00-0.90M & 0.90-1.90 M	100.0	0.0	16.4	5.7	0.79	0.28	#82.1	28.4

# Mean total dry weight in test sediment is <90% of that in reference sediment



**Table 2.3 Water Quality Summary of 20-day Polychaete Growth and Survival Test – *Neanthes arenaceodentata***

Lab ID	Sample ID	Ammonia (Total, mg/L)		Sulfide (mg/L)		Temp(°C)		pH		Salinity (ppt)		DO (mg/L)	
		Day 0	Day 10	Day 0	Day 10	min	max	min	max	min	max	min	max
Control	CONTROL	1.00	1.12	<0.1	<0.1	19	20	8.1	8.3	28	28	6.9	7.2
HK1206244001	REFERENCE SEDIMENT	<1.00	<1.00	<0.1	<0.1	19	20	8.1	8.3	28	28	6.9	7.1
HK1206244002	D10 0.00-0.90M & D10 4.90-5.90M	3.30	3.12	<0.1	<0.1	19	20	8.1	8.2	28	28	6.8	7.1
HK1206244003	D11 0.00-0.90M & 0.90-1.90M & 6.90-7.90M	5.81	2.89	<0.1	<0.1	19	20	8.0	8.3	28	28	6.8	7.2
HK1206244004	D8 0.00-0.90M & 1.90-2.90M	<1.00	<1.00	<0.1	<0.1	19	20	8.1	8.2	28	28	6.9	7.0
HK1206244005	D9 6.90-7.90M	<1.00	1.12	<0.1	<0.1	19	20	8.0	8.2	28	28	7.1	7.2
HK1206244006	D9 0.00-0.90M & 0.90-1.90 M	<1.00	1.34	<0.1	<0.1	19	20	8.1	8.2	28	28	6.9	7.1

**Table 2.4 Summary of Quality Control Data of the 20-day Polychaete Growth and Survival test – *Neanthes arenaceodentata***

Date of Test	Sediment Test				Reference Toxicant Test					
	Initial dry weight (mg/ind)	Acceptability Criterion	Mean survival (%) in control sediment	Acceptability Criterion	Mean ind growth rate (mg/ind/day) in control sediment	Acceptability Criterion	Mean survival (%) in 0 mgCd / L seawater	Acceptability Criterion	96-h <sup>a</sup> LC50 (mgCd / L)	Acceptability Criterion
10 Feb 2012 - 01 Mar 2012	0.61	0.5-1.0 (mg/ind)	100.0	≥ 90%	0.90	> 0.38 (mg/ind/day)	100.0	≥ 90%	8.22	5.32 - 8.55

<sup>a</sup> Median Lethal Concentration, a concentration which kills 50% of the testing population

#### 4.0 48-60-HOUR BIVALVE LARVAE SURVIVAL AND NORMALITY TEST – Crassostrea gigas

Table 4.1 Test Methodology for the 48-60-hour Bivalve Larvae Survival and Normality Test – Crassostrea gigas

Parameter	Condition
1 Reference protocols:	PSEP (1995) and ALS (2009) (Ref 2 and 6)
2 Organism Source:	Collected from Guernsey Sea Farm
3 Organism acclimation:	Organisms are stored in individual chambers at 20°C with aerated clean seawater for a night prior to testing.
4 Initiation and termination dates:	10 Feb 2012 - 12 Feb 2012
5 Test type:	Static; non-renewal
6 Test duration:	48 hours
7 Temperature:	20 ± 1°C
8 Salinity:	28 ± 1 ppt
9 Light quality:	Wide-spectrum fluorescent lights
10 Illuminance:	500 – 1000 lux
11 Photoperiod:	14h : 10h (Light : Dark)
12 Test chamber:	1L glass jar with 10cm internal diameter; 18.0 ± 0.5 g of sediment; 900mL overlying seawater; sediment stirred for 10sec and allowed to settle for 4h prior to the inoculation of embryos; position of test container randomized
13 Method for obtaining gametes:	Organisms were dissected to obtain the gametes
14 Life stage of organism:	<2h post-fertilization
15 Number of organisms per chamber:	20,000 – 40,000 (around 30 embryos / mL)
16 Number of replicates:	6 (5 for testing, 1 for water quality measurement)
17 Feeding regime:	None
18 Aeration:	100 bubbles/minute if dissolved oxygen drops to <60% saturation
19 Overlying water:	Natural seawater collected from uncontaminated area in Sai Kung; Filtered through a 0.5µm; sterilized by ultraviolet light; salinity adjusted to 28ppt with fresh water or artificial sea salt (Brand: Red Sea®)
20 Overlying water quality monitoring:	Temperature, pH, salinity and dissolved oxygen were recorded daily
21 Negative control:	Seawater without sediment
22 Endpoints:	Survival, normal development, and normality survival
23 Statistical analysis:	Data tested for normality and homogeneity of variance; Statistically significant differences between the mean normality survival in testing sediments and reference sediment determined at a probability of p≤0.05 using ToxCalc 5.0 (Ref 7)
24 Test acceptability criterion:	>70% mean normal survival in seawater control
Reference Toxicant Test	
25 Toxicant:	Copper
26 Test chamber:	1L glass jar with 10cm internal diameter; 900mL seawater; position of test container randomized
27 Number of replicates:	4 (3 for testing; 1 for water quality measurement)
28 Endpoints:	Normal Survival
29 Statistical analysis:	48-60-h EC50 (and 95% confidence interval) for Cu calculated using ToxCalc 5.0 (Ref. 7)
30 Other testing conditions are the same as in the sediment samples test	

<sup>1</sup> Normality survival integrates the normality and survival end points, and measures survival of only the normal larvae relative to the starting number

Table 4.2

Results Summary of the 48-60-hour Bivalve Larvae Survival and Normality Test – *Crassostrea gigas*

Lab ID	Sample ID	Survival (%)		Normality (%)		Normality Survival (%)	
		Mean	SD	Mean	SD	Mean	SD
Control	CONTROL	83.3	6.3	96.9	0.6	80.8	5.8
HK1206244001	REFERENCE SEDIMENT	81.1	1.8	97.3	1.4	78.9	1.4
HK1206244002	D10 0.00-0.90M & D10 4.90-5.90M	71.2	3.2	96.1	3.2	*68.4	2.3
HK1206244003	D11 0.00-0.90M & 0.90-1.90M & 6.90-7.90M	88.8	5.8	96.9	2.0	86.0	5.5
HK1206244004	D8 0.00-0.90M & 1.90-2.90M	76.2	6.4	96.7	2.4	*73.7	5.3
HK1206244005	D9 6.90-7.90M	60.8	7.5	97.6	2.8	#*59.2	7.2
HK1206244006	D9 0.00-0.90M & 0.90-1.90 M	83.8	7.6	98.3	1.4	82.3	6.9

\* Mean percentage in test sediment is significantly different ( $p \leq 0.05$ ) from that in reference sediment

# Mean normality survival in test sediment is <80% of that in reference sediment

Table 2.3 Water Quality Summary of 48-60-h bivalve Survival and Normality Test – Crassostrea gigas

Lab ID	Sample ID	Ammonia (Total, mg/L)		Sulfide (mg/L)		Temp(°C)		pH		Salinity (ppt)		DO (mg/L)	
		Day 0	Day 10	Day 0	Day 10	min	max	min	max	min	max	min	max
Control	CONTROL	<1.00	1.31	<0.1	<0.1	19	20	8.0	8.1	28	28	6.9	7.0
HK1206244001	REFERENCE SEDIMENT	<1.00	<1.00	<0.1	<0.1	19	20	8.0	8.1	28	28	7.0	7.1
HK1206244002	D10 0.00-0.90M & D10 4.90-5.90M	1.07	1.36	<0.1	<0.1	19	20	8.0	8.0	28	28	7.0	7.2
HK1206244003	D11 0.00-0.90M & D09-1.90M & 6.90-7.90M	1.56	1.68	<0.1	<0.1	19	20	7.9	8.0	28	28	7.1	7.3
HK1206244004	D8 0.00-0.90M & 1.90-2.90M	<1.00	<1.00	<0.1	<0.1	19	20	8.0	8.0	28	28	7.2	7.2
HK1206244005	D9 6.90-7.90M	<1.00	<1.00	<0.1	<0.1	19	20	8.0	8.1	28	28	7.0	7.3
HK1206244006	D9 0.00-0.90M & 0.90-1.90 M	<1.00	<1.00	<0.1	<0.1	19	20	8.0	8.1	28	28	7.1	7.3

Table 2.4 Summary of Quality Control Data of the 48-60-hour Bivalve Larvae Survival and Normality test – Crassostrea gigas

Date of Test	Water Control		Reference Toxicant Test	
	Mean Normality survival (%) in control	Acceptability Criterion	Mean normality survival (%) in 0 µg Cu/L seawater	48-60-h EC50 (µgCu / L)
10 Feb 2012 - 12 Feb 2012	80.8%	≥70.0%	80.8%	3.81
			Result	Acceptability Criterion
			Result	Acceptability Criterion
			80.8%	3.00 - 15.11

## 5 References

5-Nov-12

- (1) APHA (American Public Health Association) 1995. Standard Methods for the Examination of Water and Wastewater. 19th edition. American Public Health Association, American Water Works Association and Water Environment Federation, Washington, DC.
  
- (2) PSEP (Puget Sound Estuary Program) 1995. Recommended guidelines for conducting laboratory bioassays on Puget Sound sediments. U.S. Environmental Protection Agency, Region 10, Office of Puget Sound, Seattle WA.
  
- (3) USEPA (U.S. Environmental Protection Agency) 1994. Methods for assessing the toxicity of sediment-associated contaminants with estuarine and marine amphipods. Office of Research and Development. U.S. Environmental Protection Agency, Cincinnati, OH. EPA/600/R94/025.
  
- (4) ALS 2000. 10-Day Amphipod Survival Test – *Leptocheirus plumulosus*. QWI-HK/ET001. In: Ecotoxicology Work Instruction. ALS Technichem (HK) Pty Ltd, Hong Kong.
  
- (5) ALS 2000. 20-Day Polychaete Growth and Survival Test – *Neanthes arenaceodentata*. QWI-HK/ET002. In: Ecotoxicology Work Instruction. ALS Technichem (HK) Pty Ltd, Hong Kong.
  
- ALS 2009. 48 Hour Bivalve Larvae Survival and Normality Test – *Crassostrea gigas*. QWI-HK/ET012. In: Ecotoxicology Work Instruction. ALS Technichem (HK) Pty Ltd, Hong Kong.
  
- (7) TOXCALC™-Toxicity Data Analysis Software (v5.0.32) User's Guide. 1994-2008. Tidepool Scientific Software, Nckinleyville, CA 95519.

## APPENDIX A

### Sediment Description

Table A.1: Sample Identification

<sup>a</sup> Lot ID	Lab ID	Client ID	Lab ID (Ecotox. Section)
K-1	Control	Control	Control
K-2	HK1200975001	REFERENCE SEDIMENT	HK1206244001
K-3	HK1200964001 & 004	D10 4.90-5.90M & D10 0.00-0.90M	HK1206244002
K-4	HK1200955001 & 002 & 005	D11 0.00-0.90M & 0.90-1.90M & 6.90-7.90M	HK1206244003
K-5	HK1200967001 & 003	D8 0.00-0.90M & 1.90-2.90M	HK1206244004
K-6	HK1200966005	D9 6.90-7.90M	HK1206244005
K-7	HK1200966001 & 002	D9 0.00-0.90M & 0.90-1.90 M	HK1206244006

<sup>a</sup> Lot ID is identification used during testing







**ALS Technichem (HK) Pty Ltd**

## CERTIFICATE OF ANALYSIS

**CONTACT:** IR POPHIL LAM  
**CLIENT:** CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT  
**ADDRESS:** GEOTECHNICAL PROJECTS DIVISION,  
GEOTECHNICAL ENGINEERING OFFICE,  
23/F., KWUN TONG VIEW,  
410 KWUN TONG ROAD,  
KOWLOON, HONG KONG.  
**ORDER:** GE/2009/16.19 - AGREEMENT NO CE 15/2010(DS)  
UPGRADING OF CHEUNG CHAU AND TAI O SEWAGE  
COLLECTION

**WORK ORDER:** HK1206244  
**SUB-BATCH:** 1  
**LABORATORY:** HONG KONG  
**DATE RECEIVED:** 07/03/2012  
**DATE OF ISSUE:** 19/03/2012  
**SAMPLE TYPE:** SEDIMENT  
**No. of SAMPLES:** 6

### COMMENTS

Samples analysed on an as received basis. Results reported on an as dry weight basis.  
The results of particle size distribution were shown on next page.

### NOTES

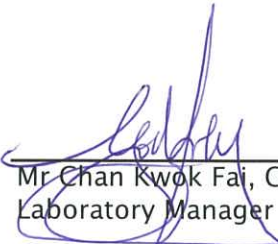
This is the Final Report and supersedes any preliminary report with this batch number.  
Results apply to sample(s) as submitted. All pages of this report have been checked and approved for release.

### ISSUING LABORATORY: HONG KONG

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Mr Chan Kwok Fai, Godfrey  
Laboratory Manager - Hong Kong

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**Abbreviations:** % SPK REC denotes percentage spike recovery  
CHK denotes duplicate check sample  
LOR denotes limit of reporting  
LCS % REC denotes Laboratory Control Sample percentage recovery

Page 1 of 2

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ALS TECHNICHEM (HK) PTY LTD Part of the ALS Laboratory Group A Campbell Brothers Limited Company

# CERTIFICATE OF ANALYSIS



**Work Order:** HK1206244  
**Sub-batch:** 1  
**Date of Issue:** 19/03/2012  
**Client:** CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT  
**Client Reference:** GE/2009/16.19 - AGREEMENT NO CE 15/2010(DS)  
 UPGRADING OF CHEUNG CHAU AND TAI O SEWAGE COLLECTION

## Particle Size Distribution

Sample	Lab no.	Total dry weight (gram)	Sieve Size									
			+2mm	+710um	+300um	+150um	+106um	+75um	+63um	-63um		
REFERENCE SEDIMENT	HK1206244 -001	62.3	< 0.1	0.2	0.4	1.4	2.2	6.8	2.3	48.9		
D10 4.90-5.90M & D10 0.00-0.90	HK1206244 -002	69.6	0.3	0.1	0.1	0.1	< 0.1	0.1	0.3	68.4		
D11 0.00-0.90M & 0.90-1.90M &	HK1206244 -003	59.5	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.3	0.4	58.6		
D8 0.00-0.90M & 1.90-2.90M	HK1206244 -004	85.9	10.7	6.8	4.6	1.8	0.4	0.7	0.7	60.2		
D9 6.90-7.90M	HK1206244 -005	77.3	12.1	2.7	1.4	1.7	2.1	5.4	2.3	49.7		
D9 0.00-0.90M & 0.90-1.90 M	HK1206244 -006	75.2	3.5	0.2	0.5	0.2	0.2	0.4	0.4	69.9		

## Percent Retained

Sample	Lab no.	Total dry weight (%)	Sieve Size									
			+2mm	+710um	+300um	+150um	+106um	+75um	+63um	-63um		
REFERENCE SEDIMENT	HK1206244 -001	100.0	< 1	< 1	< 1	2.3	3.5	11.0	3.8	78.4		
D10 4.90-5.90M & D10 0.00-0.90	HK1206244 -002	100.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1	98.2		
D11 0.00-0.90M & 0.90-1.90M &	HK1206244 -003	100.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1	98.5		
D8 0.00-0.90M & 1.90-2.90M	HK1206244 -004	100.0	12.5	7.9	5.4	2.0	< 1	< 1	< 1	70.1		
D9 6.90-7.90M	HK1206244 -005	100.0	15.7	3.5	1.8	2.2	2.7	7.0	3.0	64.2		
D9 0.00-0.90M & 0.90-1.90 M	HK1206244 -006	100.0	4.6	< 1	< 1	< 1	< 1	< 1	< 1	92.9		

## Cumulative Percentage Retained

Sample	Lab no.	Total dry weight (%)	Sieve Size									
			+2mm	+710um	+300um	+150um	+106um	+75um	+63um	-63um		
REFERENCE SEDIMENT	HK1206244 -001	---	< 1	< 1	1.0	3.3	6.9	17.8	21.6	100.0		
D10 4.90-5.90M & D10 0.00-0.90	HK1206244 -002	---	< 1	< 1	< 1	< 1	< 1	1.3	1.8	100.0		
D11 0.00-0.90M & 0.90-1.90M &	HK1206244 -003	---	< 1	< 1	< 1	< 1	< 1	< 1	1.5	100.0		
D8 0.00-0.90M & 1.90-2.90M	HK1206244 -004	---	12.5	20.4	25.8	27.8	28.3	29.1	29.9	100.0		
D9 6.90-7.90M	HK1206244 -005	---	15.7	19.2	20.9	23.1	25.8	32.8	35.8	100.0		
D9 0.00-0.90M & 0.90-1.90 M	HK1206244 -006	---	4.6	4.9	5.6	5.9	6.1	6.6	7.1	100.0		

## APPENDIX B

Complete Data for the 10-day Amphipod Survival Test  
– *Leptocheirus plumulosus*

Client: CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT  
 Batch No.: HK1206244  
 Initiation Date: 10-Feb-12

ID	Rep	Group	Client ID	Initial no.	Final no.	Avoidance	No/Not Reburying	Duration (Days)	Survival (%)			Avoidance (%)			Reburial (%)		
									S %	S Mean	S SD	A %	A Mean	A SD	R %	R Mean	
-	1	A	Control	CONTROL	20	18	0	0	10	90	92.0	4.5	0.00	0.00	0.00	100.0	96.0
-	2	B	Control	CONTROL	20	18	0	2	10	90			0.00			88.9	
-	3	C	Control	CONTROL	20	18	0	1	10	90			0.00			94.4	
-	4	D	Control	CONTROL	20	18	0	1	10	90			0.00			94.4	
-	5	E	Control	CONTROL	20	20	0	0	10	100			0.00			100.0	
1	1	A	HK1206244001	REFERENCE SEDIMENT	20	20	0	0	10	100	95.0	5.0	0.00	0.00	0.00	100.0	98.0
2	2	B	HK1206244001	REFERENCE SEDIMENT	20	19	0	1	10	95			0.00			94.7	
3	3	C	HK1206244001	REFERENCE SEDIMENT	20	18	0	0	10	90			0.00			100.0	
4	4	D	HK1206244001	REFERENCE SEDIMENT	20	20	0	1	10	100			0.00			95.0	
5	5	E	HK1206244001	REFERENCE SEDIMENT	20	18	0	0	10	90			0.00			100.0	
6	1	A	HK1206244002	D10 4 00-5 00M & D10 0 00-0 00M	20	12	0	1	10	60	59.0	10.2	0.00	0.00	0.00	91.7	97.0
7	2	B	HK1206244002	D10 4 00-5 00M & D10 0 00-0 00M	20	12	0	0	10	60			0.00			100.0	
8	3	C	HK1206244002	D10 4 00-5 00M & D10 0 00-0 00M	20	10	0	0	10	50			0.00			100.0	
9	4	D	HK1206244002	D10 4 00-5 00M & D10 0 00-0 00M	20	10	0	0	10	50			0.00			100.0	
10	5	E	HK1206244002	D10 4 00-5 00M & D10 0 00-0 00M	20	15	0	1	10	75			0.00			93.3	
11	1	A	HK1206244003	D10 0 00-0 00M & D0 90-1 00M & D0 7 00M	20	20	0	0	10	100	91.0	8.9	0.00	0.00	0.00	100.0	99.0
12	2	B	HK1206244003	D10 0 00-0 00M & D0 90-1 00M & D0 7 00M	20	20	0	1	10	100			0.00			95.0	
13	3	C	HK1206244003	D10 0 00-0 00M & D0 90-1 00M & D0 7 00M	20	18	0	0	10	90			0.00			100.0	
14	4	D	HK1206244003	D10 0 00-0 00M & D0 90-1 00M & D0 7 00M	20	16	0	0	10	80			0.00			100.0	
15	5	E	HK1206244003	D10 0 00-0 00M & D0 90-1 00M & D0 7 00M	20	17	0	0	10	85			0.00			100.0	
16	1	A	HK1206244004	D8 0 00-0 00M & 1 50-2 00M	20	12	0	0	10	60	68.0	9.1	0.00	0.00	0.00	100.0	96.0
17	2	B	HK1206244004	D8 0 00-0 00M & 1 50-2 00M	20	13	0	1	10	65			0.00			92.3	
18	3	C	HK1206244004	D8 0 00-0 00M & 1 50-2 00M	20	15	0	1	10	75			0.00			93.3	
19	4	D	HK1206244004	D8 0 00-0 00M & 1 50-2 00M	20	16	0	1	10	80			0.00			93.8	
20	5	E	HK1206244004	D8 0 00-0 00M & 1 50-2 00M	20	12	0	0	10	60			0.00			100.0	
21	1	A	HK1206244005	D9 6.90-7.90M	20	20	0	0	10	100	96.0	5.5	0.00	0.00	0.00	100.0	98.0
22	2	B	HK1206244005	D9 6.90-7.90M	20	20	0	1	10	100			0.00			95.0	
23	3	C	HK1206244005	D9 6.90-7.90M	20	18	0	0	10	90			0.00			100.0	
24	4	D	HK1206244005	D9 6.90-7.90M	20	20	0	0	10	100			0.00			100.0	
25	5	E	HK1206244005	D9 6.90-7.90M	20	18	0	1	10	90			0.00			94.4	
26	1	A	HK1206244006	D9 0 00-0 00M & 0 90-1 00 M	20	15	0	0	10	75	59.0	10.2	0.00	0.00	0.00	100.0	96.0
27	2	B	HK1206244006	D9 0 00-0 00M & 0 90-1 00 M	20	12	0	1	10	60			0.00			91.7	
28	3	C	HK1206244006	D9 0 00-0 00M & 0 90-1 00 M	20	10	0	1	10	50			0.00			90.0	
29	4	D	HK1206244006	D9 0 00-0 00M & 0 90-1 00 M	20	12	0	0	10	60			0.00			100.0	
30	5	E	HK1206244006	D9 0 00-0 00M & 0 90-1 00 M	20	10	0	0	10	50			0.00			100.0	

Test: LP  
 Species: LP  
 Sample ID: VA  
 Start Date: 10/02/2012      End Date: 20/02/2012  
 Test ID: HK1206244a  
 Protocol: -EPA600 R-  
 Sample Type: MSE  
 Lab ID: ALS

Pos	ID	Rep	Group	Initial no.	Final no.	Avoidance	Reburying	T. Duration (Days)	Notes
	1	1	REFERENCE	20	20	0	0	10	
	2	2	REFERENCE	20	19	0	1	10	
	3	3	REFERENCE	20	18	0	0	10	
	4	4	REFERENCE	20	20	0	1	10	
	5	5	REFERENCE	20	18	0	0	10	
	6	1	1206244-02	20	12	0	1	10	
	7	2	1206244-02	20	12	0	0	10	
	8	3	1206244-02	20	10	0	0	10	
	9	4	1206244-02	20	10	0	0	10	
	10	5	1206244-02	20	15	0	1	10	
	11	1	1206244-03	20	20	0	0	10	
	12	2	1206244-03	20	20	0	1	10	
	13	3	1206244-03	20	18	0	0	10	
	14	4	1206244-03	20	16	0	0	10	
	15	5	1206244-03	20	17	0	0	10	
	16	1	1206244-04	20	12	0	0	10	
	17	2	1206244-04	20	13	0	1	10	
	18	3	1206244-04	20	15	0	1	10	
	19	4	1206244-04	20	16	0	1	10	
	20	5	1206244-04	20	12	0	0	10	
	21	1	1206244-05	20	20	0	0	10	
	22	2	1206244-05	20	20	0	1	10	
	23	3	1206244-05	20	18	0	0	10	
	24	4	1206244-05	20	20	0	0	10	
	25	5	1206244-05	20	18	0	1	10	
	26	1	1206244-06	20	15	0	0	10	
	27	2	1206244-06	20	12	0	1	10	
	28	3	1206244-06	20	10	0	1	10	
	29	4	1206244-06	20	12	0	0	10	
	30	5	1206244-06	20	10	0	0	10	

Comments:

**-Survival**

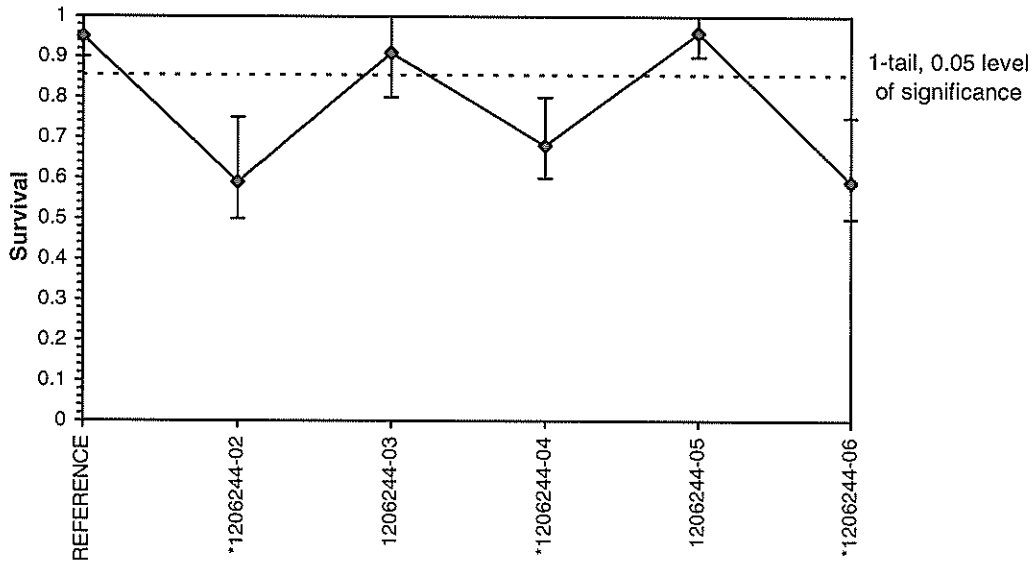
Start Date: 10/02/2012	Test ID: HK1206244a	Sample ID: VA
End Date: 20/02/2012	Lab ID: ALS	Sample Type: MSE
Sample Date:	Protocol: -EPA600 R-	Test Species: LP
Comments:		

Conc-	1	2	3	4	5
REFERENCE	1.0000	0.9500	0.9000	1.0000	0.9000
1206244-02	0.6000	0.6000	0.5000	0.5000	0.7500
1206244-03	1.0000	1.0000	0.9000	0.8000	0.8500
1206244-04	0.6000	0.6500	0.7500	0.8000	0.6000
1206244-05	1.0000	1.0000	0.9000	1.0000	0.9000
1206244-06	0.7500	0.6000	0.5000	0.6000	0.5000

Conc-	Mean	N-Mean	Transform: Untransformed					N	t-Stat	1-Tailed	
			Mean	Min	Max	CV%	Critical			MSD	
REFERENCE	0.9500	1.0000	0.9500	0.9000	1.0000	5.263	5				
*1206244-02	0.5900	0.6211	0.5900	0.5000	0.7500	17.368	5	7.060	1.860	0.0948	
1206244-03	0.9100	0.9579	0.9100	0.8000	1.0000	9.829	5	0.873	1.860	0.0852	
*1206244-04	0.6800	0.7158	0.6800	0.6000	0.8000	13.357	5	5.823	1.860	0.0862	
1206244-05	0.9600	1.0105	0.9600	0.9000	1.0000	5.705	5	-0.302	1.860	0.0617	
*1206244-06	0.5900	0.6211	0.5900	0.5000	0.7500	17.368	5	7.060	1.860	0.0948	

Auxiliary Tests	Statistic	Critical	Skew	Kurt		
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.9347	0.927	0.48713	-0.6087		
Bartlett's Test indicates equal variances (p = 0.67)	3.1875	15.0863				
Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates significant differences Treatments vs REFERENCE	0.09482	0.09981	0.1604	0.00712	2.4E-08	5, 24

**Dose-Response Plot**



Test: LP	Test ID: RTLPCD088
Species: LP	Protocol: -EPA600 R-
Sample ID: REF	Sample Type: CDCL
Start Date: 2/10/2012	End Date: 2/14/2012
	Lab ID: ALS

Pos	ID	Rep	Group	Initial no.	Final no.	Avoidance	Reburying	T. Duration (Days)	Notes
	1	1	D-Control	10	10			4	
	2	2	D-Control	10	10			4	
	3	1	0.15	10	8			4	
	4	2	0.15	10	8			4	
	5	1	0.6	10	6			4	
	6	2	0.6	10	7			4	
	7	1	1.25	10	5			4	
	8	2	1.25	10	3			4	
	9	1	2.5	10	1			4	
	10	2	2.5	10	0			4	
	11	1	5	10	0			4	
	12	2	5	10	0			4	

Comments:

**-Survival**

Start Date: 2/10/2012	Test ID: RTLPCD088	Sample ID: REF
End Date: 2/14/2012	Lab ID: ALS	Sample Type: CDCL
Sample Date:	Protocol: -EPA600 R-	Test Species: LP

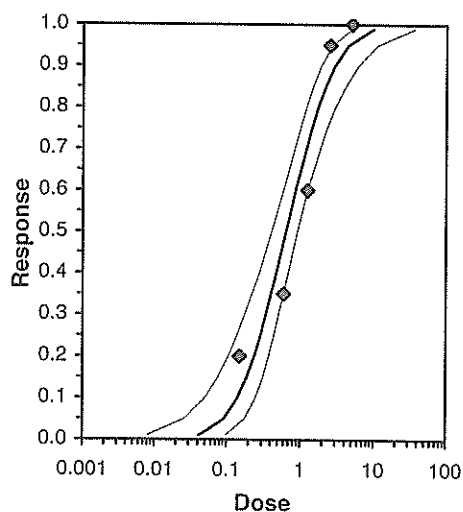
Conc-	1	2
D-Control	1.0000	1.0000
0.15	0.8000	0.8000
0.6	0.6000	0.7000
1.25	0.5000	0.3000
2.5	0.1000	0.0000
5	0.0000	0.0000

Conc-	Mean	N-Mean	Transform: Untransformed					N	Number Resp	Total Number
			Mean	Min	Max	CV%				
D-Control	1.0000	1.0000	1.0000	1.0000	1.0000	0.000	2	0	20	
0.15	0.8000	0.8000	0.8000	0.8000	0.8000	0.000	2	4	20	
0.6	0.6500	0.6500	0.6500	0.6000	0.7000	10.879	2	7	20	
1.25	0.4000	0.4000	0.4000	0.3000	0.5000	35.355	2	12	20	
2.5	0.0500	0.0500	0.0500	0.0000	0.1000	141.421	2	19	20	
5	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	2	20	20	

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Normality of the data set cannot be confirmed				
Equality of variance cannot be confirmed				

Maximum Likelihood-Probit											
Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	1.95924	0.34043	1.292	2.62648	0	6.18757	7.81473	0.10283	-0.1955	0.5104	3
Intercept	5.38303	0.15374	5.08169	5.68437							

Point	Probits	95% Fiducial Limits	
EC01	2.674	0.04141	0.00796 0.09598
EC05	3.355	0.09225	0.02632 0.17776
EC10	3.718	0.14138	0.04949 0.24832
EC15	3.964	0.18858	0.0755 0.31237
EC20	4.158	0.2371	0.10525 0.37615
EC25	4.326	0.28856	0.13949 0.44262
EC40	4.747	0.47336	0.27742 0.68194
EC50	5.000	0.63753	0.40914 0.90688
EC60	5.253	0.85864	0.58613 1.24158
EC75	5.674	1.40852	0.98881 2.2551
EC80	5.842	1.71422	1.19023 2.92175
EC85	6.036	2.15526	1.46104 3.99547
EC90	6.282	2.8748	1.86845 5.99506
EC95	6.645	4.40593	2.64924 11.1089
EC99	7.326	9.81464	4.97328 36.2322





**REFERENCE TOXICANT CONTROL CHART**  
*Leptocheirus plumulosus* - 96-h Survival LC50 Values (mg Cd / L)

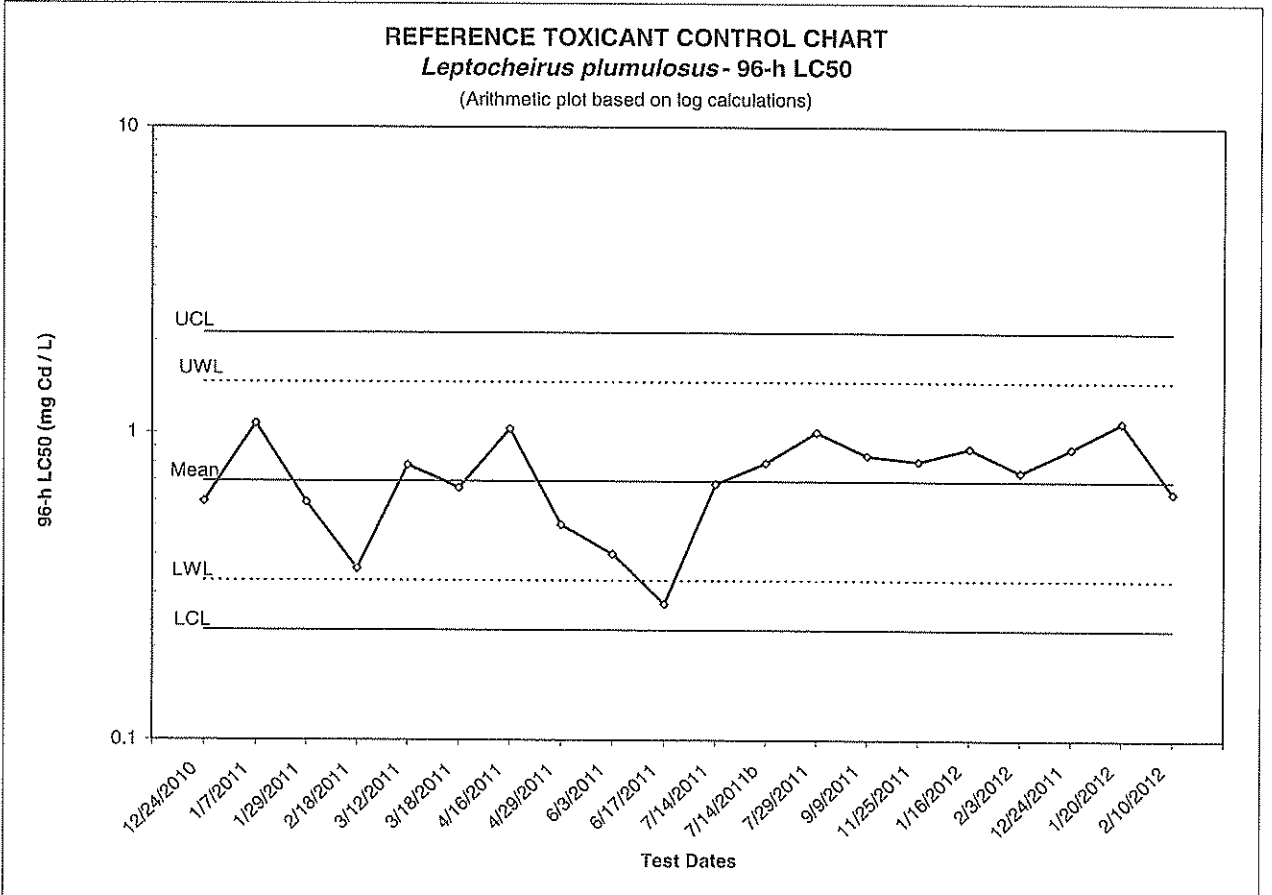
	Log	Antilog
Mean	-0.16	0.70
SD	0.16	1.45
2 x SD	0.32	2.11
UCL	0.33	2.12
UWL	0.17	1.46
LWL	-0.48	0.33
LCL	-0.64	0.23
CV(%)	-102	

WARNING / CONTROL LIMIT CALCULATIONS	
Mean: Mean is calculated for the last 20 logarithms of EC50, convert to antilogarithm to give Geomean	
SD: Standard deviation is calculated for the last 20 logarithms of EC50	
UCL: Upper Control Limit = Mean + 3 x SD, illustrated as antilogarithms in Control Chart	
UWL: Upper Warning Limit = Mean + 2 x SD, illustrated as antilogarithms in Control Chart	
LWL: Lower Warning Limit = Mean - 2 x SD, illustrated as antilogarithms in Control Chart	
LCL: Lower Control Limit = Mean - 3 x SD, illustrated as antilogarithms in Control Chart	

Point No.	LC50	log LC50
0	0.73	-0.14
1	0.60	-0.22
2	1.07	0.03
3	0.59	-0.23
4	0.36	-0.44
5	0.78	-0.11
6	0.66	-0.18
7	1.03	0.01
8	0.50	-0.30
9	0.40	-0.40
10	0.28	-0.56
11	0.68	-0.17
12	0.80	-0.10
13	1.00	0.00
14	0.84	-0.07
15	0.81	-0.09
16	0.89	-0.05
17	0.74	-0.13
18	0.89	-0.05
19	1.08	0.03

CONTROL CHART - DATA PLOT				
Point No.	Test Date	96-h LC50	Acceptable Result?	Calculation Method
0	12/18/2010	0.73	-----	Trimmed Spearman Karber
1	12/24/2010	0.60	OK	Trimmed Spearman Karber
2	01/07/2011	1.07	OK	Trimmed Spearman Karber
3	01/29/2011	0.59	OK	Trimmed Spearman Karber
4	02/18/2011	0.36	OK	Trimmed Spearman Karber
5	03/12/2011	0.78	OK	Trimmed Spearman Karber
6	03/18/2011	0.66	OK	Trimmed Spearman Karber
7	04/16/2011	1.03	OK	Trimmed Spearman Karber
8	04/29/2011	0.50	OK	Trimmed Spearman Karber
9	06/03/2011	0.40	OK	Trimmed Spearman Karber
10	06/17/2011	0.28	OUTSIDE 2SD	Trimmed Spearman Karber
11	07/14/2011	0.68	OK	Trimmed Spearman Karber
12	7/14/2011b	0.80	OK	Trimmed Spearman Karber
13	07/29/2011	1.00	OK	Trimmed Spearman Karber
14	09/09/2011	0.84	OK	Trimmed Spearman Karber
15	11/25/2011	0.81	OK	Maximum Likelihood-Probit
16	01/16/2012	0.89	OK	Maximum Likelihood-Probit
17	02/03/2012	0.74	OK	Maximum Likelihood-Probit
18	12/24/2011	0.89	OK	Maximum Likelihood-Probit
19	01/20/2012	1.08	OK	Maximum Likelihood-Probit
20	02/10/2012	0.64	OK	Maximum Likelihood-Probit

**REFERENCE TOXICANT CONTROL CHART**  
*Leptocheirus plumulosus* - 96-h LC50  
(Arithmetic plot based on log calculations)



# 10-d MARINE AMPHIPOD SEDIMENT TOXICITY TEST - AMMONIA and SULPHIDE MONITORING

Client: CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT  
 Batch No.: HK1206244  
 Sample ID: 1 - 6  
 Photometer: HK896

Test Species: \_\_\_\_\_  
 Source/Date Received: \_\_\_\_\_  
 Test Initiation Date (Day 0): \_\_\_\_\_  
 Test Termination Date (Day 10): \_\_\_\_\_

Sample ID	Ammonia (mg/L)		Sulphide (mg/L)	
	Day 0	Day 10	Day 0	Day 10
K-1	0.73	0.65	<0.1	0.1
K-2	0.61	0.20	<0.1	0.1
K-3	2.86	5.21	<0.1	0.1
K-4	0.52	9.02	<0.1	0.1
K-5	0.51	0.32	<0.1	0.1
K-6	0.70	0.17	<0.1	0.1
K-7	0.58	0.75	<0.1	0.1

Sample ID	Ammonia (mg/L)		Sulphide (mg/L)	
	Day 0	Day 10	Day 0	Day 10

Initial				
Sample ID		Sam Dup		Spike (mg/L)
Day 0 - Ammonia (mg/L)				
K-1	0.73	0.79		1.56
	RPD	7.89	% Recovery	105.3
Day 0 - Sulphide (mg/L)				
				-
	RPD		% Recovery	-

Initial				
Sample ID	NH <sub>3</sub> (mg/L)	Sam Dup		Spike (mg/L)
Day 10 - Ammonia (mg/L)				
K-1	0.65	0.71		1.58
	RPD	8.82	% Recovery	117.8
Day 10 - Sulphide (mg/L)				
				-
	RPD		% Recovery	-

Comment: \_\_\_\_\_  
 Data Checked By: MS Date: 5/4

10-d MARINE AMPHIPOD SEDIMENT TOXICITY TEST – DAILY WATER QUALITY

Client CZD  
 Batch No. HK1206244  
 Sample ID 1-6

Test Initiation Date (Day 0) 10-Feb-12  
 Test Termination Date (Day 10) 20-Feb-12  
 Test Species/Date Collected Leptocheirus plumulosus-09/Feb/12

Day	0	1	2	3	4	5	6	7	8	9	10
Sample ID	Salinity (ppt)										
K-1	20	20	20	20	20	20	20	20	19	20	20
Initial	20	20	20	20	20	20	20	20	20	20	20
Sample ID	pH										
K-1	8.4	8.3	8.4	8.2	8.3	8.3	8.4	8.3	8.4	8.2	8.3
Initial	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2
Sample ID	Temperature (°C)										
K-1	26	25	25	25	25	25	24	24	25	25	25
Initial	22	22	22	22	22	22	22	22	22	22	22
Sample ID	Dissolved Oxygen (mg/L)										
K-1	7.2	7.3	7.1	7.2	7.2	7.2	7.3	7.3	7.2	7.2	7.3
Initial	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2

WQ instrument pH HK895 temp. HK384  
 DO HK412 Salinity HK897

Comment \_\_\_\_\_

Test Set up By JK Data verified by JK Date Verified 3/1/12

**10-d MARINE AMPHIPOD SEDIMENT TOXICITY TEST – DAILY WATER QUALITY**

Client CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT Test Initiation Date (Day 0) 10-Feb-12  
 Batch No. HK1206244 Test Termination Date (Day 10) 20-Feb-12  
 Sample ID 1-6 Test Species/Date Collected Leptocheirus plumulosus-09/Feb/12

Day	0	1	2	3	4	5	6	7	8	9	10
Sample ID	Salinity (ppt)										
K-2	20	20	20	20	20	20	20	20	20	20	20
K-3	20	20	20	20	20	20	20	20	20	20	20
K-4	20	20	20	20	20	20	20	20	20	20	20
K-5	20	20	20	20	20	20	20	20	20	20	20
K-6	20	20	20	20	20	20	20	20	20	20	20
K-7	20	20	20	20	20	20	20	20	20	20	20
Initial	20	20	20	20	20	20	20	20	20	20	20
Sample ID	pH										
K-2	8.4	8.3	8.3	8.4	8.4	8.3	8.4	8.3	8.3	8.3	8.4
K-3	8.4	8.4	8.2	8.3	8.3	8.3	8.3	8.4	8.4	8.3	8.3
K-4	8.4	8.2	8.4	8.3	8.3	8.3	8.4	8.4	8.3	8.4	8.3
K-5	8.3	8.3	8.3	8.2	8.3	8.4	8.4	8.3	8.3	8.2	8.2
K-6	8.4	8.3	8.2	8.2	8.3	8.3	8.3	8.3	8.2	8.3	8.4
K-7	8.4	8.2	8.3	8.3	8.3	8.3	8.3	8.2	8.4	8.3	8.4
Initial	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2
Sample ID	Temperature (°C)										
K-2	26	26	25	25	25	25	25	25	25	25	25
K-3	26	25	25	25	25	25	24	24	25	24	24
K-4	26	25	25	26	24	25	24	24	25	25	25
K-5	26	26	25	25	25	25	25	24	24	25	25
K-6	26	26	25	25	25	25	24	23	25	25	25
K-7	26	26	25	25	25	25	25	24	25	25	25
Initial	26	26	26	26	26	26	26	26	26	26	26
Sample ID	Dissolved Oxygen (mg/L)										
K-2	7.8	7.5	7.2	7.2	7.2	7.3	7.2	7.3	7.1	7.1	7.3
K-3	7.2	7.3	7.5	7.3	7.3	7.2	7.2	7.2	7.2	7.1	7.2
K-4	7.3	7.4	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.2	7.2
K-5	7.3	7.4	7.3	7.5	7.2	7.3	7.2	7.3	7.2	7.2	7.2
K-6	7.2	7.3	7.2	7.2	7.2	7.3	7.1	7.2	7.2	7.1	7.3
K-7	7.1	7.3	7.2	7.5	7.4	7.2	7.0	7.2	7.2	7.2	7.2
Initial	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2

WQ instrument pH HK895 temp. HK384  
 DO HK412 Salinity HK897

Comment \_\_\_\_\_

Test Set up By FW Data verified by MD Date Verified 3/4/12

**10-d AMPHIPOD SEDIMENT TOXICITY TEST  
EMERGENCE, SURVIVAL AND DAY 10 WATER QUALITY**

Client CEPI  
Batch No. H1206244

Test Initiation Date (Day 0) 10-Feb-12  
Test Termination Date (Day 10) 20-Feb-12  
Test Species Leptocheirus plumulosus  
Source/Collection Date Aquatic Biosystem-09/Feb/12

SAMPLE ID K-1

Rep.	Number of Amphipods Emerged From Sediment at Days 1-10										NUMBER ALIVE AT DAY 10	initial	NO. NOT REBURYSING AT DAY 10	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10				Temp. (°C)	pH	Sal. (ppt)	DO (mg/L)
A	0	0	0	0	0	0	0	0	0	0	18	fr	0	24	8.0	20	7.0
B	0	0	0	0	0	0	0	0	0	0	18	fr	2	24	7.9	20	7.1
C	0	0	0	0	0	0	0	0	0	0	18	fr	1	24	8.1	20	7.1
D	0	0	0	0	0	0	0	0	0	0	18	fr	1	24	8.1	20	7.0
E	0	0	0	0	0	0	0	0	0	0	20	fr	0	24	8.2	20	7.3
Initial	2	2	2	2	2	2	2	2	2	2							

(# dead: # missing) - A (0:2) B (0:2) C (0:2) D (0:2) E (0:0)

SAMPLE ID

Rep.	Number of Amphipods Emerged From Sediment at Days 1-10										NUMBER ALIVE AT DAY 10	initial	NO. NOT REBURYSING AT DAY 10	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10				Temp. (°C)	pH	Sal. (ppt)	DO (mg/L)
A																	
B																	
C																	
D																	
E																	
Initial																	

(# dead: # missing) - A ( : ) B ( : ) C ( : ) D ( : ) E ( : )

SAMPLE ID

Rep.	Number of Amphipods Emerged From Sediment at Days 1-10										NUMBER ALIVE AT DAY 10	initial	NO. NOT REBURYSING AT DAY 10	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10				Temp. (°C)	pH	Sal. (ppt)	DO (mg/L)
A																	
B																	
C																	
D																	
E																	
Initial																	

(# dead: # missing) - A ( : ) B ( : ) C ( : ) D ( : ) E ( : )

SAMPLE ID

Rep.	Number of Amphipods Emerged From Sediment at Days 1-10										NUMBER ALIVE AT DAY 10	initial	NO. NOT REBURYSING AT DAY 10	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10				Temp. (°C)	pH	Sal. (ppt)	DO (mg/L)
A																	
B																	
C																	
D																	
E																	
Initial																	

(# dead: # missing) - A ( : ) B ( : ) C ( : ) D ( : ) E ( : )

WQ Instruments Used:

Temp. HK384 Salinity HK897 pH HK895 DO HK412

Data Verified By [Signature]

Date Verified 3/4/12

**10-d AMPHIPOD SEDIMENT TOXICITY TEST  
EMERGENCE, SURVIVAL AND DAY 10 WATER QUALITY**

Client CIVIL ENGINEERING AND DEVELOPMENT D  
Batch No. 17K1206244

Test Initiation Date (Day 0) 10-Feb-12  
Test Termination Date (Day 10) 20-Feb-12  
Test Species Leptocheirus plumulosus  
Source/Collection Date Aquatic Biosystem-09/Feb/12

SAMPLE ID K-2

Rep.	Number of Amphipods Emerged From Sediment at Days 1-10										NUMBER ALIVE AT DAY 10	initial	NO. NOT REBURYING AT DAY 10	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10				Temp. (°C)	pH	Sal. (ppt)	DO (mg/L)
A	0	0	0	0	0	0	0	0	0	0	20	Fr	0	24	8.2	20	6.9
B	0	0	0	0	0	0	0	0	0	0	19	R	1	24	8.3	20	6.9
C	0	0	0	0	0	0	0	0	0	0	18	Fr	0	24	8.2	20	7.2
D	0	0	0	0	0	0	0	0	0	0	20	Fr	1	24	8.2	20	7.1
E	0	0	0	0	0	0	0	0	0	0	18	R	0	24	8.2	20	7.1
Initial	R	R	R	R	R	R	R	R	R	R				R	R	R	R

(# dead: # missing) - A (0:0) B (0:1) C (0:2) D (0:0) E (0:2)

SAMPLE ID K-3

Rep.	Number of Amphipods Emerged From Sediment at Days 1-10										NUMBER ALIVE AT DAY 10	initial	NO. NOT REBURYING AT DAY 10	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10				Temp. (°C)	pH	Sal. (ppt)	DO (mg/L)
A	0	0	0	0	0	0	0	0	0	0	12	Fr	1	24	8.2	20	7.0
B	0	0	0	0	0	0	0	0	0	0	12	R	0	24	8.1	20	7.0
C	0	0	0	0	0	0	0	0	0	0	10	Fr	0	24	8.1	20	7.0
D	0	0	0	0	0	0	0	0	0	0	10	Fr	0	24	8.1	20	7.0
E	0	0	0	0	0	0	0	0	0	0	15	R	1	24	8.0	20	6.9
Initial	R	R	R	R	R	R	R	R	R	R				R	R	R	R

(# dead: # missing) - A (0:8) B (0:8) C (0:10) D (0:10) E (0:5)

SAMPLE ID K-4

Rep.	Number of Amphipods Emerged From Sediment at Days 1-10										NUMBER ALIVE AT DAY 10	initial	NO. NOT REBURYING AT DAY 10	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10				Temp. (°C)	pH	Sal. (ppt)	DO (mg/L)
A	0	0	0	0	0	0	0	0	0	0	20	Fr	0	24	8.3	20	6.9
B	0	0	0	0	0	0	0	0	0	0	20	R	1	24	8.4	20	7.2
C	0	0	0	0	0	0	0	0	0	0	18	Fr	0	24	8.2	20	7.0
D	0	0	0	0	0	0	0	0	0	0	16	Fr	0	24	8.4	20	7.0
E	0	0	0	0	0	0	0	0	0	0	17	Fr	0	24	8.3	20	7.1
Initial	R	R	R	R	R	R	R	R	R	R				R	R	R	R

(# dead: # missing) - A (0:0) B (0:0) C (0:2) D (0:4) E (0:3)

SAMPLE ID K-5

Rep.	Number of Amphipods Emerged From Sediment at Days 1-10										NUMBER ALIVE AT DAY 10	initial	NO. NOT REBURYING AT DAY 10	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10				Temp. (°C)	pH	Sal. (ppt)	DO (mg/L)
A	0	0	0	0	0	0	0	0	0	0	12	Fr	0	24	8.2	20	7.1
B	0	0	0	0	0	0	0	0	0	0	13	R	1	24	8.1	20	7.0
C	0	0	0	0	0	0	0	0	0	0	15	Fr	1	24	8.3	20	7.2
D	0	0	0	0	0	0	0	0	0	0	16	Fr	1	24	8.2	20	7.2
E	0	0	0	0	0	0	0	0	0	0	12	R	0	24	8.2	20	7.1
Initial	R	R	R	R	R	R	R	R	R	R				R	R	R	R

(# dead: # missing) - A (0:8) B (0:7) C (0:5) D (0:4) E (0:8)

WQ Instruments Used:

Temp. HK384 Salinity HK897 pH HK895 DO HK412

Data Verified By SWB

Date Verified 3/4/12

**10-d AMPHIPOD SEDIMENT TOXICITY TEST  
EMERGENCE, SURVIVAL AND DAY 10 WATER QUALITY**

Client CIVIL ENGINEERING AND DEVELOPMENT D  
Batch No. HF1206249

Test Initiation Date (Day 0) 10-Feb-12  
Test Termination Date (Day 10) 20-Feb-12  
Test Species Leptocheirus plumulosus  
Source/Collection Date Aquatic Biosystem-09/Feb/12

SAMPLE ID K-6

Rep.	Number of Amphipods Emerged From Sediment at Days 1-10										NUMBER ALIVE AT DAY 10	initial	NO. NOT REBURYING AT DAY 10	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10				Temp. (°C)	pH	Sal. (ppt)	DO (mg/L)
A	0	0	0	0	0	0	0	0	0	0	20	7	0	24	8.2	20	7.1
B	0	0	0	0	0	0	0	0	0	0	20	7	1	24	8.2	20	7.1
C	0	0	0	0	0	0	0	0	0	0	18	7	0	24	8.2	20	7.0
D	0	0	0	0	0	0	0	0	0	0	20	7	0	24	8.2	20	7.0
E	0	0	0	0	0	0	0	0	0	0	18	7	1	24	8.2	20	7.1
Initial	2	2	2	2	2	2	2	2	2	2				12	12	12	12

(# dead: # missing) - A (0:0) B (0:0) C (0:2) D (0:0) E (0:2)

SAMPLE ID K-7

Rep.	Number of Amphipods Emerged From Sediment at Days 1-10										NUMBER ALIVE AT DAY 10	initial	NO. NOT REBURYING AT DAY 10	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10				Temp. (°C)	pH	Sal. (ppt)	DO (mg/L)
A	0	0	0	0	0	0	0	0	0	0	15	7	0	24	8.0	20	6.9
B	0	0	0	0	0	0	0	0	0	0	12	7	1	24	8.1	20	6.8
C	0	0	0	0	0	0	0	0	0	0	10	7	1	24	8.0	20	6.9
D	0	0	0	0	0	0	0	0	0	0	12	7	0	24	8.0	20	7.0
E	0	0	0	0	0	0	0	0	0	0	10	7	0	24	8.0	20	7.0
Initial	2	2	2	2	2	2	2	2	2	2				12	12	12	12

(# dead: # missing) - A (0:5) B (0:8) C (0:10) D (0:8) E (0:10)

SAMPLE ID \_\_\_\_\_

Rep.	Number of Amphipods Emerged From Sediment at Days 1-10										NUMBER ALIVE AT DAY 10	initial	NO. NOT REBURYING AT DAY 10	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10				Temp. (°C)	pH	Sal. (ppt)	DO (mg/L)
A	0																
B																	
C																	
D																	
E																	
Initial																	

(# dead: # missing) - A ( : ) B ( : ) C ( : ) D ( : ) E ( : )

SAMPLE ID \_\_\_\_\_

Rep.	Number of Amphipods Emerged From Sediment at Days 1-10										NUMBER ALIVE AT DAY 10	initial	NO. NOT REBURYING AT DAY 10	Water Chemistry at Day 10			
	1	2	3	4	5	6	7	8	9	10				Temp. (°C)	pH	Sal. (ppt)	DO (mg/L)
A																	
B																	
C																	
D																	
E																	
Initial																	

(# dead: # missing) - A ( : ) B ( : ) C ( : ) D ( : ) E ( : )

WQ Instruments Used:

Temp. HK384 Salinity HK897 pH HK895 DO HK412

Data Verified By SD

Date Verified 3/4/12

**MARINE SPECIES REFERENCE TOXICANT TEST DATA**

Test Species Leptocheirus plumulosus

Test Initiation Date (Time) 10-Feb-12 Client C517 P Reference Toxicant Cd Source/Collection Date Aquatic Biosystem-09/Feb/12  
 Test Termination Date (Time) 14-Feb-12 Batch No./Sample ID 141206244 Stock ID 4511771-02 No. Organisms/Test Volume 10, 900ml

Rep	Ref. Toxicant Conc.	Number of Survivors (24 to 96 hours)				Dissolved Oxygen (mg/L)				Temperature (°C)				pH				Salinity (ppt)				
		24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96		
A	0.00				10	7.3				7.2	26				75	8.5				8.2	20	20
	0.15				8	7.3				7.1	26				75	8.5				8.4	20	20
	0.60				6	7.3				7.2	26				75	8.5				8.3	20	20
	1.25				5	7.3				7.1	26				75	8.5				8.3	20	20
	2.50				1	7.2				7.0	26				75	8.5				8.3	20	20
B	5.00				0	7.2				7.3	25				25	8.5				8.2	20	20
	0.00				10	7.3				7.2	26				75	8.5				8.4	20	20
	0.15				8	7.3				7.2	26				75	8.5				8.4	20	20
	0.60				7	7.3				7.1	26				75	8.5				8.5	20	20
	1.25				3	7.1				7.1	26				75	8.5				8.4	20	20
	2.50				0	7.3				7.2	26				25	8.5				8.3	20	20
	5.00				0	7.3				7.1	26				25	8.5				8.3	20	20
	Initials																					

Instruments Used:

- Auto Pipette HK903, HK338
- Temperature HK384
- pH HK895
- DO HK412
- Salinity HK897
- Balance HK565

Test Set Up By           
 Data Verified By           
 Date Verified



## APPENDIX C

Complete Data for the 20-day Polychaete Growth and Survival Test  
– *Neanthes arenaceodentata*

Client: CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT  
 Batch No.: HK1206244  
 Initiation Date: 10-Feb-12  
 Termination Date: 01-Mar-12

**Summary Results for the 20-d Polychaete Growth and Survival Test - *Neanthes arenaceodentata***

ID	Rep	Group	CimetID	Duration (Days)	Initial no.	Final no.	No. weighed	Initial weight (mg)	pan weight (mg)	pan + worm weight (mg)	Survival (%)			Total Dry Weight (mg)			Ind. Dry Weight (mg)			Ind. Growth Rate (mg/d)		
											S (%)	S-Mean	S-SD	TDW	TDW Mean	TDW SD	IDW	IDW Mean	IDW SD	IGR	IGR Mean	IGR SD
-	1	Control	Control	20	5	5	5	0.61	1222.90	1324.35	100.0	100.0	0.0	101.45	93.0	10.9	20.3	18.6	2.2	0.98	0.90	0.11
-	2	Control	Control	20	5	5	5	0.61	1211.25	1305.27	100.0	100.0	0.0	94.01	81.04	16.2	18.8	16.2	2.2	0.91	0.78	0.13
-	3	Control	Control	20	5	5	5	0.61	1214.71	1295.75	100.0	100.0	0.0	105.69	105.69	0.0	21.1	21.1	0.0	1.03	1.03	0.00
-	4	Control	Control	20	5	5	5	0.61	1197.27	1302.96	100.0	100.0	0.0	82.99	82.99	0.0	16.6	16.6	0.0	0.80	0.80	0.00
1	1	HK1206244001	REFERENCE SEDIMENT	20	5	5	5	0.61	1203.68	1282.62	100.0	100.0	0.0	78.94	98.4	19.0	15.8	19.7	3.8	0.76	0.95	0.19
2	2	HK1206244001	REFERENCE SEDIMENT	20	5	5	5	0.61	1195.93	1303.38	100.0	100.0	0.0	107.45	112.11	4.66	21.5	21.5	0.0	1.04	1.04	0.00
3	3	HK1206244001	REFERENCE SEDIMENT	20	5	5	5	0.61	1216.75	1328.86	100.0	100.0	0.0	76.85	76.85	0.0	15.4	15.4	0.0	1.09	1.09	0.00
4	4	HK1206244001	REFERENCE SEDIMENT	20	5	5	5	0.61	1194.04	1270.89	100.0	100.0	0.0	89.46	89.46	0.0	17.9	17.9	0.0	0.86	0.86	0.00
5	5	HK1206244001	REFERENCE SEDIMENT	20	5	5	5	0.61	1184.57	1301.06	100.0	100.0	0.0	97.51	97.51	0.0	19.5	19.5	0.0	0.94	0.94	0.00
6	1	HK1206244002	D10.4, 50-5.50M & D10.0 00-0.50M	20	5	5	5	0.61	1202.76	1295.76	100.0	100.0	0.0	83.00	85.9	10.7	18.6	17.2	2.1	0.90	0.83	0.11
7	2	HK1206244002	D10.4, 50-5.50M & D10.0 00-0.50M	20	5	5	5	0.61	1195.73	1266.74	100.0	100.0	0.0	73.01	73.01	0.0	14.6	14.6	0.0	0.70	0.70	0.00
8	3	HK1206244002	D10.4, 50-5.50M & D10.0 00-0.50M	20	5	5	5	0.61	1191.05	1267.46	100.0	100.0	0.0	76.41	76.41	0.0	15.3	15.3	0.0	0.73	0.73	0.00
9	4	HK1206244002	D10.4, 50-5.50M & D10.0 00-0.50M	20	5	5	5	0.61	1196.82	1286.28	100.0	100.0	0.0	89.46	89.46	0.0	17.9	17.9	0.0	0.86	0.86	0.00
10	5	HK1206244002	D10.4, 50-5.50M & D10.0 00-0.50M	20	5	5	5	0.61	1206.06	1303.57	100.0	100.0	0.0	97.51	97.51	0.0	19.5	19.5	0.0	0.94	0.94	0.00
11	1	HK1206244003	D11.00-0.50M & D9.6.90-7.90M	20	5	5	5	0.61	1200.09	1253.04	100.0	100.0	0.0	52.95	79.2	15.5	10.6	15.8	3.1	0.50	0.76	0.16
12	2	HK1206244003	D11.00-0.50M & D9.6.90-7.90M	20	5	5	5	0.61	1205.00	1295.85	100.0	100.0	0.0	90.85	90.85	0.0	18.2	18.2	0.0	0.88	0.88	0.00
13	3	HK1206244003	D11.00-0.50M & D9.6.90-7.90M	20	5	5	5	0.61	1192.02	1269.97	100.0	100.0	0.0	77.95	77.95	0.0	15.6	15.6	0.0	0.75	0.75	0.00
14	4	HK1206244003	D11.00-0.50M & D9.6.90-7.90M	20	5	5	5	0.61	1197.02	1281.68	100.0	100.0	0.0	84.66	84.66	0.0	16.9	16.9	0.0	0.82	0.82	0.00
15	5	HK1206244003	D11.00-0.50M & D9.6.90-7.90M	20	5	5	5	0.61	1195.64	1285.24	100.0	100.0	0.0	89.60	89.60	0.0	17.9	17.9	0.0	0.87	0.87	0.00
16	1	HK1206244004	D8.0.00-0.50M & 1.90-2.90M	20	5	5	5	0.61	1193.22	1268.30	100.0	100.0	0.0	75.08	91.7	14.5	15.0	18.3	2.9	0.72	0.89	0.14
17	2	HK1206244004	D8.0.00-0.50M & 1.90-2.90M	20	5	5	5	0.61	1204.26	1316.59	100.0	100.0	0.0	112.33	112.33	0.0	22.5	22.5	0.0	1.09	1.09	0.00
18	3	HK1206244004	D8.0.00-0.50M & 1.90-2.90M	20	5	5	5	0.61	1191.84	1290.68	100.0	100.0	0.0	98.64	98.64	0.0	19.8	19.8	0.0	0.96	0.96	0.00
19	4	HK1206244004	D8.0.00-0.50M & 1.90-2.90M	20	5	5	5	0.61	1191.22	1273.92	100.0	100.0	0.0	82.70	82.70	0.0	16.5	16.5	0.0	0.80	0.80	0.00
20	5	HK1206244004	D8.0.00-0.50M & 1.90-2.90M	20	5	5	5	0.61	1212.85	1302.59	100.0	100.0	0.0	89.74	89.74	0.0	17.9	17.9	0.0	0.87	0.87	0.00
21	1	HK1206244005	D9.6.90-7.90M	20	5	5	5	0.61	1181.65	1258.08	100.0	100.0	17.9	76.43	85.5	13.5	15.3	19.2	4.4	0.73	0.93	0.22
22	2	HK1206244005	D9.6.90-7.90M	20	5	3	3	0.61	1186.24	1263.16	60.0	60.0	0.0	76.92	76.92	0.0	25.6	25.6	0.0	1.25	1.25	0.00
23	3	HK1206244005	D9.6.90-7.90M	20	5	5	5	0.61	1183.44	1285.07	100.0	100.0	0.0	101.63	101.63	0.0	20.3	20.3	0.0	0.99	0.99	0.00
24	4	HK1206244005	D9.6.90-7.90M	20	5	5	5	0.61	1181.97	1255.96	100.0	100.0	0.0	73.99	73.99	0.0	14.8	14.8	0.0	0.71	0.71	0.00
25	5	HK1206244005	D9.6.90-7.90M	20	5	5	5	0.61	1189.99	1288.73	100.0	100.0	0.0	98.74	98.74	0.0	19.7	19.7	0.0	0.96	0.96	0.00
26	1	HK1206244006	D9.0.00-0.50M & 0.90-1.90M	20	5	5	5	0.61	1185.59	1241.32	100.0	100.0	0.0	55.73	82.1	28.4	11.1	16.4	5.7	0.53	0.79	0.28
27	2	HK1206244006	D9.0.00-0.50M & 0.90-1.90M	20	5	5	5	0.61	1198.42	1289.76	100.0	100.0	0.0	91.34	91.34	0.0	18.3	18.3	0.0	0.88	0.88	0.00
28	3	HK1206244006	D9.0.00-0.50M & 0.90-1.90M	20	5	5	5	0.61	1195.32	1294.61	100.0	100.0	0.0	99.29	99.29	0.0	19.9	19.9	0.0	0.96	0.96	0.00
29	4	HK1206244006	D9.0.00-0.50M & 0.90-1.90M	20	5	5	5	0.61	1189.21	1238.48	100.0	100.0	0.0	49.27	49.27	0.0	9.9	9.9	0.0	0.46	0.46	0.00
30	5	HK1206244006	D9.0.00-0.50M & 0.90-1.90M	20	5	5	5	0.61	1197.37	1312.18	100.0	100.0	0.0	114.81	114.81	0.0	23.0	23.0	0.0	1.12	1.12	0.00

Test: NA										Test ID: HK1206244b									
Species: NA										Protocol: PSEP 1995									
Sample ID: VA										Sample Type: MS									
Start Date: 10/02/2012					End Date: 1/03/2012					Lab ID: ALS									
Pos ID	Rep	Group	T. Duration (Days)	Initial no.	Final no.	No. weighed	Initial weight	pan weight	pan + worm weight (mg)										
1	1	REFERENCE	20	5	5	5	0.61	1203.68	1282.62										
2	2	REFERENCE	20	5	5	5	0.61	1195.93	1303.38										
3	3	REFERENCE	20	5	5	5	0.61	1216.75	1328.86										
4	4	REFERENCE	20	5	5	5	0.61	1194.04	1270.89										
5	5	REFERENCE	20	5	5	5	0.61	1184.57	1301.06										
6	1	1206244-02	20	5	5	5	0.61	1202.76	1295.76										
7	2	1206244-02	20	5	5	5	0.61	1195.73	1268.74										
8	3	1206244-02	20	5	5	5	0.61	1191.05	1267.46										
9	4	1206244-02	20	5	5	5	0.61	1196.82	1286.28										
10	5	1206244-02	20	5	5	5	0.61	1206.06	1303.57										
11	1	1206244-03	20	5	5	5	0.61	1200.09	1253.04										
12	2	1206244-03	20	5	5	5	0.61	1205	1295.85										
13	3	1206244-03	20	5	5	5	0.61	1192.02	1269.97										
14	4	1206244-03	20	5	5	5	0.61	1197.02	1281.68										
15	5	1206244-03	20	5	5	5	0.61	1195.64	1285.24										
16	1	1206244-04	20	5	5	5	0.61	1193.22	1268.3										
17	2	1206244-04	20	5	5	5	0.61	1204.26	1316.59										
18	3	1206244-04	20	5	5	5	0.61	1191.84	1290.68										
19	4	1206244-04	20	5	5	5	0.61	1191.22	1273.92										
20	5	1206244-04	20	5	5	5	0.61	1212.85	1302.59										
21	1	1206244-05	20	5	5	5	0.61	1181.65	1258.08										
22	2	1206244-05	20	5	3	3	0.61	1186.24	1263.16										
23	3	1206244-05	20	5	5	5	0.61	1183.44	1285.07										
24	4	1206244-05	20	5	5	5	0.61	1181.97	1255.96										
25	5	1206244-05	20	5	5	5	0.61	1189.99	1288.73										
26	1	1206244-06	20	5	5	5	0.61	1185.59	1241.32										
27	2	1206244-06	20	5	5	5	0.61	1198.42	1289.76										
28	3	1206244-06	20	5	5	5	0.61	1195.32	1294.61										
29	4	1206244-06	20	5	5	5	0.61	1189.21	1238.48										
30	5	1206244-06	20	5	5	5	0.61	1197.37	1312.18										

Comments:

**-Total Dry Weight (mg)**

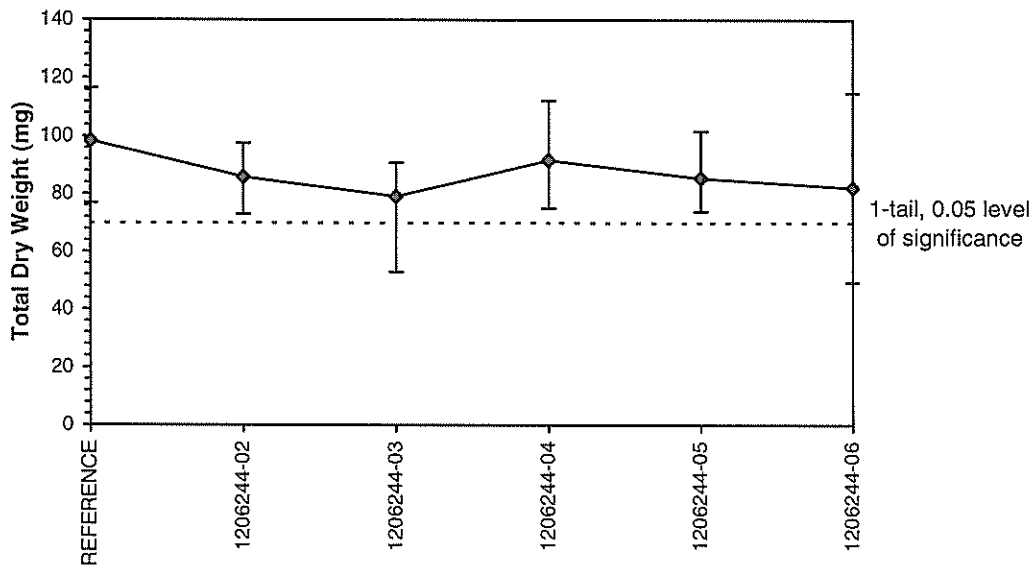
Start Date: 10/02/2012	Test ID: HK1206244b	Sample ID: VA
End Date: 1/03/2012	Lab ID: ALS	Sample Type: MS
Sample Date:	Protocol: PSEP 1995	Test Species: NA
Comments:		

Conc-	1	2	3	4	5
REFERENCE	78.940	107.450	112.110	76.850	116.490
1206244-02	93.000	73.010	76.410	89.460	97.510
1206244-03	52.950	90.850	77.950	84.660	89.600
1206244-04	75.080	112.330	98.840	82.700	89.740
1206244-05	76.430	76.920	101.630	73.990	98.740
1206244-06	55.730	91.340	99.290	49.270	114.810

Conc-	Mean	N-Mean	Transform: Untransformed					N	t-Stat	1-Tailed Critical	MSD
			Mean	Min	Max	CV%					
REFERENCE	98.368	1.0000	98.368	76.850	116.490	19.290	5				
1206244-02	85.878	0.8730	85.878	73.010	97.510	12.407	5	1.283	1.860	18.097	
1206244-03	79.202	0.8052	79.202	52.950	90.850	19.604	5	1.748	1.860	20.390	
1206244-04	91.738	0.9326	91.738	75.080	112.330	15.774	5	0.621	1.860	19.845	
1206244-05	85.542	0.8696	85.542	73.990	101.630	15.726	5	1.233	1.860	19.343	
1206244-06	82.088	0.8345	82.088	49.270	114.810	34.585	5	1.066	1.860	28.398	

Auxiliary Tests	Statistic	Critical	Skew	Kurt		
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.96335	0.927	-0.2566	-0.6832		
Bartlett's Test indicates equal variances (p = 0.48)	4.53435	15.0863				
Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences Treatments vs REFERENCE	28.3976	0.28869	239.89	318.503	0.59201	5, 24

**Dose-Response Plot**



Test: NA  
 Species: NA  
 Sample ID: REF  
 Start Date: 2/10/2012  
 End Date: 2/14/2012  
 Test ID: rthacd085  
 Protocol: PSEP 1995  
 Sample Type: CDCL  
 Lab ID: ALS

Pos ID	Rep	Group	T. Duration (Days)	Initial no.	Final no.	No. weighed	Initial weight	pan weight	pan + worm weight (mg)
1	1	D-Control	4	10	10				
2	2	D-Control	4	10	10				
3	1	2.4	4	10	10				
4	2	2.4	4	10	10				
5	1	6.9	4	10	10				
6	2	6.9	4	10	8				
7	1	9.8	4	10	2				
8	2	9.8	4	10	0				
9	1	14	4	10	0				
10	2	14	4	10	0				
11	1	20	4	10	0				
12	2	20	4	10	0				

Comments:

**-Survival**

Start Date: 2/10/2012	Test ID: rtnacd085	Sample ID: REF
End Date: 2/14/2012	Lab ID: ALS	Sample Type: CDCL
Sample Date:	Protocol: PSEP 1995	Test Species: NA

Comments:

Conc-mg/L	1	2
D-Control	1.0000	1.0000
2.4	1.0000	1.0000
6.9	1.0000	0.8000
9.8	0.2000	0.0000
14	0.0000	0.0000
20	0.0000	0.0000

Conc-mg/L	Transform: Untransformed							Number Resp	Total Number
	Mean	N-Mean	Mean	Min	Max	CV%	N		
D-Control	1.0000	1.0000	1.0000	1.0000	1.0000	0.000	2	0	8
2.4	1.0000	1.0000	1.0000	1.0000	1.0000	0.000	2	0	8
6.9	0.9000	0.9000	0.9000	0.8000	1.0000	15.713	2	1	8
9.8	0.1000	0.1000	0.1000	0.0000	0.2000	141.421	2	7	8
14	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	2	8	8
20	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	2	8	8

**Auxiliary Tests**

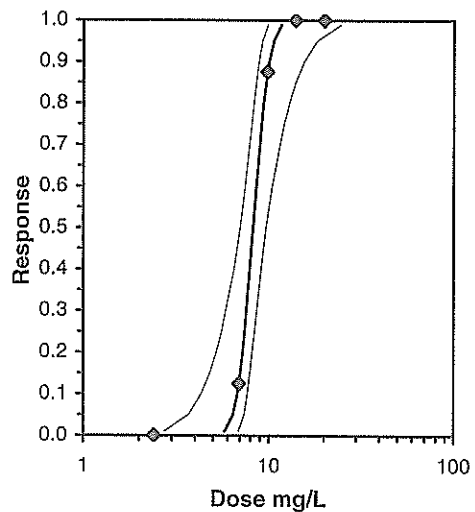
Statistic	Critical	Skew	Kurt
Normality of the data set cannot be confirmed			
Equality of variance cannot be confirmed			

**Maximum Likelihood-Probit**

Parameter	Value	SE	95% Fiducial Limits	Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	15.1435	5.18026	4.99022 25.2968	0	0.00194	7.81473	0.99998	0.91496	0.06603	3
Intercept	-8.8558	4.76173	-18.189 0.47722							

**TSCR**

Point	Probits	mg/L	95% Fiducial Limits
EC01	2.674	5.77223	2.71773 6.85473
EC05	3.355	6.40244	3.6823 7.37197
EC10	3.718	6.76607	4.31361 7.69175
EC15	3.964	7.023	4.78697 7.93625
EC20	4.158	7.23414	5.18785 8.15508
EC25	4.326	7.42033	5.54559 8.36694
EC40	4.747	7.91104	6.46413 9.05829
EC50	5.000	8.22173	6.98451 9.64282
EC60	5.253	8.54462	7.44654 10.4032
EC75	5.674	9.10968	8.07648 12.1044
EC80	5.842	9.34414	8.29004 12.9332
EC85	6.036	9.62507	8.5219 14.011
EC90	6.282	9.99057	8.79573 15.5432
EC95	6.645	10.558	9.18011 18.2025
EC99	7.326	11.7107	9.87565 24.6557



### REFERENCE TOXICANT CONTROL CHART

*Neanthes arenaceodentata* - 96-h Survival LC50 Values (mg Cd / L)

	Log	Antilog
Mean	0.83	6.75
SD	0.05	1.13
2 x SD	0.10	1.27
UCL	0.98	9.62
UWL	0.93	8.55
LWL	0.73	5.32
LCL	0.67	4.73
CV(%)	6.20	

WARNING / CONTROL LIMIT CALCULATIONS	
Mean:	Mean is calculated for the last 20 logarithms of EC50, convert to antilogarithm to give Geomean
SD:	Standard deviation is calculated for the last 20 logarithms of EC50
UCL:	Upper Control Limit = Mean + 3 x SD, illustrated as antilogarithms in Control Chart
UWL:	Upper Warning Limit = Mean + 2 x SD, illustrated as antilogarithms in Control Chart
LWL:	Lower Warning Limit = Mean - 2 x SD, illustrated as antilogarithms in Control Chart
LCL:	Lower Control Limit = Mean - 3 x SD, illustrated as antilogarithms in Control Chart

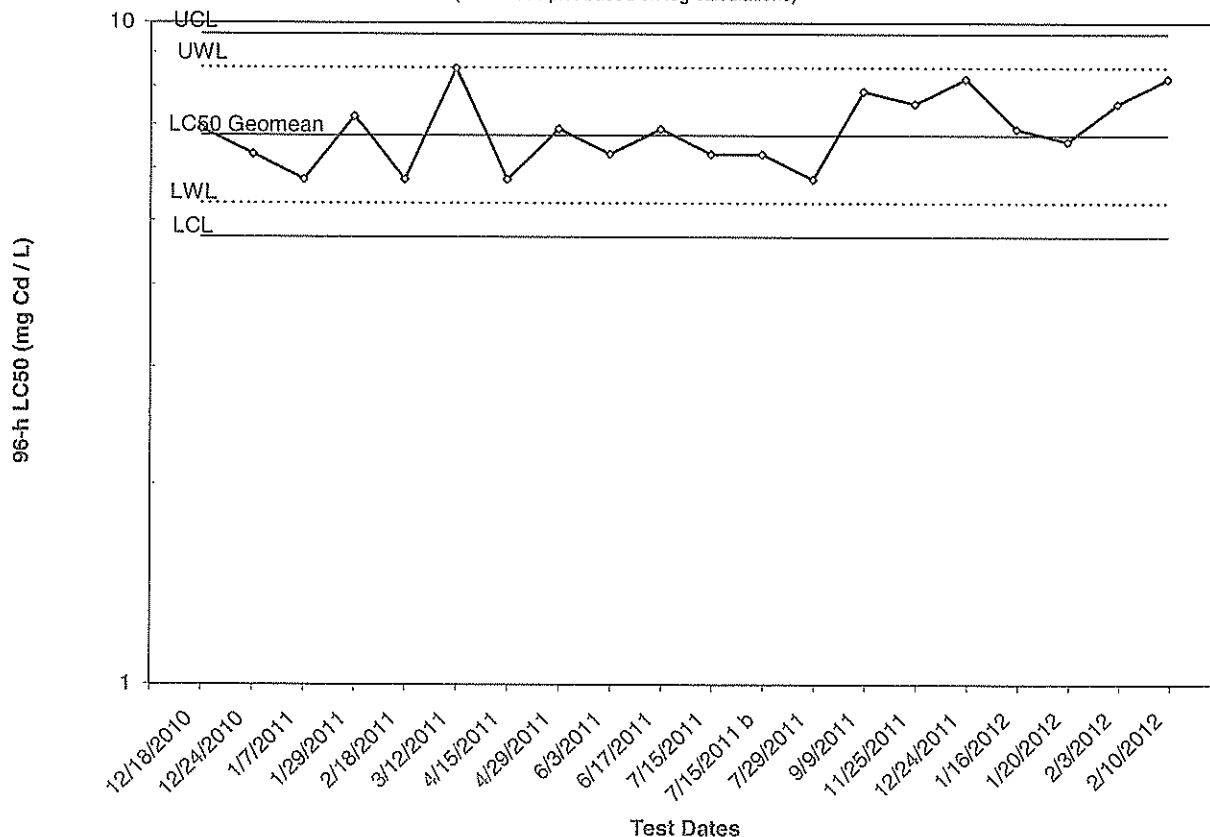
Point No.	LC50	log LC50
0	6.32	0.80
1	6.90	0.84
2	6.32	0.80
3	5.78	0.76
4	7.21	0.86
5	5.78	0.76
6	8.54	0.93
7	5.78	0.76
8	6.90	0.84
9	6.32	0.80
10	6.90	0.84
11	6.32	0.80
12	6.32	0.80
13	5.78	0.76
14	7.88	0.90
15	7.54	0.88
16	8.22	0.92
17	6.90	0.84
18	6.60	0.82
19	7.53	0.88

CONTROL CHART - DATA PLOT				
Point No.	Test Date	96-h LC50	Acceptable Result?	Calculation Method
0	09/12/2010	6.32	-----	Trimmed Spearman Karber
1	18/12/2010	6.90	OK	Trimmed Spearman Karber
2	24/12/2010	6.32	OK	Trimmed Spearman Karber
3	07/01/2011	5.78	OK	Trimmed Spearman Karber
4	29/01/2011	7.21	OK	Trimmed Spearman Karber
5	18/02/2011	5.78	OK	Trimmed Spearman Karber
6	12/03/2011	8.54	OK	Trimmed Spearman Karber
7	15/04/2011	5.78	OK	Trimmed Spearman Karber
8	29/04/2011	6.90	OK	Trimmed Spearman Karber
9	03/06/2011	6.32	OK	Trimmed Spearman Karber
10	17/06/2011	6.90	OK	Trimmed Spearman Karber
11	15/07/2011	6.32	OK	Trimmed Spearman Karber
12	7/15/2011 b	6.32	OK	Trimmed Spearman Karber
13	29/07/2011	5.78	OK	Trimmed Spearman Karber
14	09/09/2011	7.88	OK	Trimmed Spearman Karber
15	25/11/2011	7.54	OK	Trimmed Spearman Karber
16	24/12/2011	8.22	OK	Trimmed Spearman Karber
17	16/01/2012	6.90	OK	Trimmed Spearman Karber
18	20/01/2012	6.60	OK	Trimmed Spearman Karber
19	03/02/2012	7.53	OK	Trimmed Spearman Karber
20	10/02/2012	8.22	OK	Maximum Likelihood-Probit

### REFERENCE TOXICANT CONTROL CHART

*Neanthes arenaceodentata* - 96-h Survival LC50 Values (mg Cd / L)

(Arithmetic plot based on log calculations)







### POLYCHAETE SEDIMENT TOXICITY TESTS – SURVIVAL, DRY WEIGHT AND FINAL WATER QUALITY DATA

*Ensure that another technician carries out one of the tear down replicates*

Client: CEED      *Neanthes arenaceodentata / Static; Renewal*  
 Batch No. HK1206244      Test Species/Test Type:  
 Sample ID 1-6      Test Initiation Date (day 0): 10-Feb-2012  
 Test Termination Date (day 20): 01-Mar-2012

Sample ID	Rep.	Pan No.	Pan Weight (g)	Final Weight (g)	No. Alive	No. Dead	Total Recovered	No. Missing	Init.	Temp. (°C)	pH	Salinity (ppt)	DO (mg/L)
K-1	A	1	1.22290	1.32435	5	0	5	0	R	19	7.8	28	7.1
	B	2	1.21126	1.30527	5	0	5	0	R	20	8.1	28	7.0
	C	3	1.21471	1.29575	5	0	5	0	R	21	8.1	28	7.1
	D	4	1.19727	1.30296	5	0	5	0	R	21	8.1	28	7.0
	E	5	1.21130	1.29429	5	0	5	0	R	21	8.0	28	7.1
Initials													

WQ Instruments Us Temp. HK384      pH HK895      DO HK412      Balance HK565  
 Data Verified By SPJ      Date Verified 31/12.  
 Main technician performing tear down R      Second technician performing replicate tear down R

**POLYCHAETE SEDIMENT TOXICITY TESTS - SURVIVAL, DRY WEIGHT AND FINAL WATER QUALITY DATA**

*Ensure that another technician carries out one of the tear down replicates*

*Neanthes arenaceodentata / Static; Renewal*

Client **CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT**

Test Species/Test Type: \_\_\_\_\_

Batch No. \_\_\_\_\_

Test Initiation Date (Day 0): \_\_\_\_\_

10-Feb-2012

Sample ID \_\_\_\_\_

Test Termination Date (Day 20): \_\_\_\_\_

01-Mar-2012

Sample ID	Rep.	Pan No.	Pan Weight (g)	Final Weight (g)	No. Alive	No. Dead	Total Recovered	No. Missing	Init.	Temp. (°C)	pH	Salinity (ppt)	DO (mg/L)
K-2	A	6K	1.20368	1.28262	5	0	5	0	✓	20	8.0	28	7.1
	B	7K	1.19593	1.30338	5	0	5	0	✓	21	8.0	28	7.0
	C	8K	1.21675	1.32886	5	0	5	0	✓	21	8.1	28	6.9
	D	9K	1.19404	1.27089	5	0	5	0	✓	21	8.1	28	7.2
	E	10K	1.18457	1.30106	5	0	5	0	✓	21	8.1	28	7.1
K-3	A	11K	1.20276	1.29576	5	0	5	0	✓	21	8.0	28	7.1
	B	12K	1.19573	1.26874	5	0	5	0	✓	21	8.0	28	7.0
	C	13K	1.19105	1.26746	5	0	5	0	✓	21	8.0	28	7.0
	D	14K	1.19682	1.28628	5	0	5	0	✓	21	8.1	28	7.1
	E	15K	1.20606	1.30357	5	0	5	0	✓	21	8.0	28	7.0
K-4	A	16K	1.20009	1.25304	5	0	5	0	✓	20	8.1	28	7.0
	B	17K	1.20500	1.29585	5	0	5	0	✓	20	8.0	28	7.1
	C	18K	1.19202	1.26997	5	0	5	0	✓	21	8.1	28	7.1
	D	19K	1.19702	1.28168	5	0	5	0	✓	21	8.1	28	7.0
	E	20K	1.19564	1.28524	5	0	5	0	✓	21	8.1	28	7.0
Initials										✓	✓	✓	✓

WQ Instruments Us Temp. HK384      pH HK895      Sal. HK897      DO HK412      Balance HK565

Data Verified By 208      Date Verified 3/4/12

Main technician performing tear down ✓      Second technician performing replicate tear down ✓

**POLYCHAETE SEDIMENT TOXICITY TESTS - SURVIVAL, DRY WEIGHT AND FINAL WATER QUALITY DATA**

*Ensure that another technician carries out one of the tear down replicates*

Client CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

Test Species/Test Type: Neanthes arenaceodentata / Static; Renewal

Batch No. \_\_\_\_\_

10-Feb-2012

Sample ID \_\_\_\_\_

01-Mar-2012

Sample ID	Rep.	Pan No.	Pan Weight (g)	Final Weight (g)	No. Alive	No. Dead	Total Recovered	No. Missing	Init.	Temp. (°C)	pH	Salinity (ppt)	DO (mg/L)
K-5	A	21K	1.19322	1.26830	5	0	5	0	✓	21	8.1	28	2.1
	B	22K	1.20426	1.31659	5	0	5	0	✓	21	8.0	28	2.0
	C	23K	1.19184	1.29068	5	0	5	0	✓	21	8.0	28	2.0
	D	24K	1.19122	1.27392	5	0	5	0	✓	21	8.0	28	2.1
	E	25K	1.21285	1.30259	5	0	5	0	✓	21	8.0	28	2.1
K-6	A	26K	1.18165	1.25808	5	0	5	0	✓	20	8.0	28	2.0
	B	27K	1.18624	1.26216	3	0	5	0	✓	21	8.2	28	2.0
	C	28K	1.18344	1.28507	5	0	5	0	✓	21	8.1	28	2.1
	D	29K	1.18197	1.25596	5	0	5	0	✓	21	8.1	28	2.2
	E	30K	1.18999	1.28873	5	0	5	0	✓	21	8.1	28	2.0
K-7	A	31K	1.18559	1.24132	5	0	5	0	✓	21	8.1	28	2.1
	B	32K	1.19842	1.28976	5	0	5	0	✓	20	8.0	28	2.2
	C	33K	1.19532	1.29461	5	0	5	0	✓	20	8.0	28	2.2
	D	34K	1.18921	1.23848	5	0	5	0	✓	21	8.1	28	2.1
	E	35K	1.19737	1.31218	5	0	5	0	✓	21	8.0	28	2.0
Initials										✓	✓	✓	✓

WQ Instruments Us Temp. HK384 pH HK895 Sal. HK897 DO HK412 Balance HK565

Data Verified By ✓ Date Verified 3/4/12

Main technician performing tear down ✓ Second technician performing replicate tear down ✓

**20-d Neanthes SEDIMENT TOXICITY TEST - DAILY WATER QUALITY MONITORING**

Client CEDP  
 Batch No. HK1206244  
 Sample ID 1-6

Test Species  
 Source/Date Received  
 Test Initiation Date (Day 0)  
 Test Termination Date (Day 20)

Neanthes arenaceodentata  
Aquatic Toxicology Support-09/Feb/12  
10-Feb-12  
01-Mar-12

Date	0	3	6	9	12	15	18	20
Sample ID	Salinity (ppt)							
K-1	28	28	28	28	28	28	28	28
Initial	12	12	12	12	12	12	12	12
Sample ID	pH							
K-1	8.1	8.2	8.1	8.2	8.2	8.3	8.3	8.3
Initial	12	12	12	12	12	12	12	12
Sample ID	DO (mg/L)							
K-1	7.0	7.0	7.1	6.9	7.0	7.1	7.1	7.2
Initial	12	12	12	12	12	12	12	12

WQ Instrument: pH HK895 Sal. HK897 DO HK412

Comments \_\_\_\_\_

**20-d Neanthes SEDIMENT TOXICITY TEST - DAILY WATER QUALITY MONITORING**

Client PORTLAND ENVIRONMENT DEPARTMENT  
 Batch No. HK1206244  
 Sample ID 1-6

Test Species  
 Source/Date Received  
 Test Initiation Date (Day 0)  
 Test Termination Date (Day 20)

Neanthes arenaceodentata  
Aquatic Toxicology Support-09/Feb/12  
10-Feb-12  
01-Mar-12

Date	0	3	6	9	12	15	18	20
Sample ID	Salinity (ppt)							
K-2	28	28	28	28	28	28	28	28
K-3	28	28	28	28	28	28	28	28
K-4	28	28	28	28	28	28	28	28
K-5	28	28	28	28	28	28	28	28
K-6	28	28	28	28	28	28	28	28
K-7	28	28	28	28	28	28	28	28
Initial	28	28	28	28	28	28	28	28
Sample ID	pH							
K-2	8.1	8.2	8.1	8.2	8.2	8.2	8.3	8.3
K-3	8.1	8.1	8.1	8.1	8.2	8.2	8.2	8.2
K-4	8.0	8.0	8.0	8.2	8.2	8.2	8.2	8.5
K-5	8.1	8.1	8.2	8.1	8.1	8.1	8.2	8.2
K-6	8.1	8.1	8.1	8.0	8.2	8.1	8.2	8.2
K-7	8.1	8.1	8.1	8.1	8.1	8.1	8.2	8.2
Initial	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1
Sample ID	DO (mg/L)							
K-2	7.1	7.1	6.9	7.0	7.1	7.0	7.0	7.1
K-3	7.0	7.0	6.8	6.9	6.9	7.1	7.1	7.1
K-4	7.0	7.2	7.2	7.1	7.1	7.1	6.8	7.1
K-5	6.9	7.0	7.0	7.0	7.0	7.0	7.0	7.0
K-6	7.1	7.1	7.1	7.1	7.1	7.2	7.1	7.1
K-7	7.0	7.0	7.0	6.9	6.9	7.1	7.1	7.1
Initial	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1

WQ Instrument: pH HK895 Sal. HK897 DO HK412  
 Comments \_\_\_\_\_

Test Set Up By JV Data Verified By MD Date Verified 3/4/12

**20-d *Neanthes* SEDIMENT TOXICITY TEST - DAILY WATER QUALITY MONITORING**

Client CEPD  
 Batch No. HK 1206244  
 Sample ID 1-6

Test Species *Neanthes arenaceodentata*

Source/Date Received Aquatic Toxicology Support-09/Feb/12

Test Initiation Date (Day 0) 10-Feb-12

Test Termination Date (Day 20) 01-Mar-12

Sample ID	Temperature (°C)																					
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Control	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	19	19	20	
Technician Initials	P.L.S.																					

WQ Instruments Used: \_\_\_\_\_ Temp. HK384  
 Comments \_\_\_\_\_  
 Test Set Up By JK Data Verified By JK Date Verified 3/4/12

**20-d *Neanthes* SEDIMENT TOXICITY TEST - DAILY WATER QUALITY MONITORING**

CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

*Neanthes arenaceodentata*

Test Species

Client

Aquatic Toxicology Support-09/Feb/12

Batch No. H/K1206244

Source/Date Received

Sample ID 1-6

Test Initiation Date (Day 0)

10-Feb-12

Test Termination Date (Day 20)

01-Mar-12

Sample ID	Temperature (°C)																				
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
K-2	20	20	20	20	20	20	20	20	20	20	20	20	20	20	19	20	20	20	20	20	20
K-3	20	20	20	20	20	20	20	20	20	20	20	20	19	20	20	20	20	19	19	19	20
K-4	20	20	20	20	20	20	20	20	20	20	20	20	20	20	19	20	20	20	19	19	20
K-5	20	20	20	20	20	20	20	20	20	20	20	20	19	20	20	20	20	20	20	20	20
K-6	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	19	19
K-7	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	19	19	20
Technician Initials	J.E. - J																				

WQ Instruments Used: \_\_\_\_\_ Temp. HK384

Comments \_\_\_\_\_

Test Set Up By J.E.

Data Verified By JWS

Date Verified 3/4/12

MARINE SPECIES REFERENCE TOXICANT TEST DATA

Test Species Neanthes arenaceodentata

Test Initiation Date (Time) 10-Feb-12 Client         

Aquatic Toxicology Support 09/Feb/12

Reference Toxicant          Cd

Source/Collection Date         

Test Termination Date (Time) 14-Feb-12 Batch No./Sample ID          Stock ID         

No. Organisms/Test Volume 10, 900ml

Rep	Ref. Toxicant Conc.	Number of Survivors (24 to 96 hours)				Dissolved Oxygen (mg/L)				Temperature (°C)				pH				Salinity (ppt)	
		24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	96		
A	0.0				10	8.3				20	8.1				8.1		28	28	
	2.4				10	8.2				20	8.1				8.0		28	24	
	6.9				10	8.3				20	8.0				7.9		28	28	
	9.8				2	8.1				20	8.0				7.9		28	26	
	14.0				0	8.2				20	8.1				7.8		28	28	
	20.0				0	8.1				20	8.1				7.9		28	24	
B	0.0				10	8.2				20	8.1				8.0		28	28	
	2.4				10	8.1				20	8.1				8.0		28	24	
	6.9				8	8.2				20	8.0				7.8		28	26	
	9.8				10	8.3				20	8.1				7.8		28	26	
	14.0				0	8.2				20	8.1				7.8		28	28	
	20.0				0	8.1				20	8.1				7.1		28	28	
	Initials																		

Instruments Used:

- Auto Pipette HK903.HK338
- Temperature HK384
- pH HK895
- DO HK412
- Salinity HK897
- Balance HK565

Dry Weight (g) Determination of Organism

rep	org. no.	wt pan	wt pan+org.	dry wt of pan + org.	dry wt of each org.	mean dry wt of each org.
1	5	1.19874	1.20125	1.20121	0.00057	0.00061
2	5	1.20114	1.20477	1.20433	0.00064	
3	5	1.19863	1.20180	1.20176	0.00063	

Test Set Up By         

Data Verified By         

Date Verified



## APPENDIX D

Complete Data for the 48-60-hour Bivalve Larvae Survival and Normality Test  
– *Crassostrea gigas*

Client: CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

Batch No.: HK1206244

Initiation Date: 10-Feb-12

**Summary of Results for the 48-60-hr Bivalve Larval Survival and Development Test - Crassostrea gigas**

ID	Rep	Group	Clinet ID	Initial Density	Number Normal	Number Abnormal	Normal Survival%			Survival %			Normality %		
							NS (%)	NS Mean	NS SD	S (%)	S Mean	S SD	N (%)	N Mean	N SD
-	1	Control	Control	319	266	10	83.4	80.8	5.8	86.5	83.3	6.3	96.4	96.9	0.6
-	2	Control	Control	319	230	5	72.1			73.7			97.9		
-	3	Control	Control	319	258	8	80.9			83.4			97.0		
-	4	Control	Control	319	280	9	87.8			90.6			96.9		
-	5	Control	Control	319	254	9	79.6			82.5			96.6		
1	1	HK1206244001	REFERENCE SEDIMENT	319	251	13	78.7	78.9	1.4	82.8	81.1	1.8	95.1	97.3	1.4
2	2	HK1206244001	REFERENCE SEDIMENT	319	254	4	79.6			80.9			98.5		
3	3	HK1206244001	REFERENCE SEDIMENT	319	249	8	78.1			80.6			96.9		
4	4	HK1206244001	REFERENCE SEDIMENT	319	246	4	77.1			78.4			98.4		
5	5	HK1206244001	REFERENCE SEDIMENT	319	258	6	80.9			82.8			97.7		
6	1	HK1206244002	D10 4.90-5.90M & D10 0.00-0.90M	319	219	23	68.7	68.4	2.3	75.9	71.2	3.2	90.5	96.1	3.2
7	2	HK1206244002	D10 4.90-5.90M & D10 0.00-0.90M	319	211	6	66.1			68.0			97.2		
8	3	HK1206244002	D10 4.90-5.90M & D10 0.00-0.90M	319	228	4	71.5			72.7			98.3		
9	4	HK1206244002	D10 4.90-5.90M & D10 0.00-0.90M	319	222	4	69.6			70.9			98.2		
10	5	HK1206244002	D10 4.90-5.90M & D10 0.00-0.90M	319	211	8	66.1			68.7			96.4		
11	1	HK1206244003	D11 0.00-0.90M & 0.90-1.90M & 6.90-7.90M	319	276	18	86.5	86.0	5.5	92.2	88.8	5.8	93.9	96.9	2.0
12	2	HK1206244003	D11 0.00-0.90M & 0.90-1.90M & 6.90-7.90M	319	262	5	82.1			83.7			98.1		
13	3	HK1206244003	D11 0.00-0.90M & 0.90-1.90M & 6.90-7.90M	319	298	3	93.4			94.4			99.0		
14	4	HK1206244003	D11 0.00-0.90M & 0.90-1.90M & 6.90-7.90M	319	253	7	79.3			81.5			97.3		
15	5	HK1206244003	D11 0.00-0.90M & 0.90-1.90M & 6.90-7.90M	319	283	12	88.7			92.5			95.9		
16	1	HK1206244004	D8 0.00-0.90M & 1.90-2.90M	319	251	19	78.7	73.7	5.3	84.6	76.2	6.4	93.0	96.7	2.4
17	2	HK1206244004	D8 0.00-0.90M & 1.90-2.90M	319	213	8	66.8			69.3			96.4		
18	3	HK1206244004	D8 0.00-0.90M & 1.90-2.90M	319	247	8	77.4			79.9			96.9		
19	4	HK1206244004	D8 0.00-0.90M & 1.90-2.90M	319	221	4	69.3			70.5			98.2		
20	5	HK1206244004	D8 0.00-0.90M & 1.90-2.90M	319	243	2	76.2			76.8			99.2		
21	1	HK1206244005	D9 6.90-7.90M	319	190	15	59.6	59.2	7.2	64.3	60.8	7.5	92.7	97.6	2.8
22	2	HK1206244005	D9 6.90-7.90M	319	228	2	71.5			72.1			99.1		
23	3	HK1206244005	D9 6.90-7.90M	319	181	3	56.7			57.7			98.4		
24	4	HK1206244005	D9 6.90-7.90M	319	169	1	53.0			53.3			99.4		
25	5	HK1206244005	D9 6.90-7.90M	319	177	3	55.5			56.4			98.3		
26	1	HK1206244006	D9 0.00-0.90M & 0.90-1.90 M	319	289	12	90.6	82.3	6.9	94.4	83.8	7.6	96.0	98.3	1.4
27	2	HK1206244006	D9 0.00-0.90M & 0.90-1.90 M	319	277	1	86.8			87.2			99.6		
28	3	HK1206244006	D9 0.00-0.90M & 0.90-1.90 M	319	239	3	74.9			75.9			98.8		
29	4	HK1206244006	D9 0.00-0.90M & 0.90-1.90 M	319	241	5	75.6			77.1			98.0		
30	5	HK1206244006	D9 0.00-0.90M & 0.90-1.90 M	319	266	3	83.4			84.3			98.9		

Test: BV-Bivalve Larval Survival and Development Test ID: HK1206244c  
 Species: CG-Crassostrea gigas Protocol: CG  
 Sample ID: VA Sample Type: MS  
 Start Date: 10/02/2012 End Date: 12/02/2012 Lab ID: ALS

Pos	ID	Rep	Group	Initial Density	Normal Count	Abnormal Count	Notes
	1	1	REFERENCE	319	251	13	
	2	2	REFERENCE	319	254	4	
	3	3	REFERENCE	319	249	8	
	4	4	REFERENCE	319	246	4	
	5	5	REFERENCE	319	258	6	
	6	1	1206244-02	319	219	23	
	7	2	1206244-02	319	211	6	
	8	3	1206244-02	319	228	4	
	9	4	1206244-02	319	222	4	
	10	5	1206244-02	319	211	8	
	11	1	1206244-03	319	276	18	
	12	2	1206244-03	319	262	5	
	13	3	1206244-03	319	298	3	
	14	4	1206244-03	319	253	7	
	15	5	1206244-03	319	283	12	
	16	1	1206244-04	319	251	19	
	17	2	1206244-04	319	213	8	
	18	3	1206244-04	319	247	8	
	19	4	1206244-04	319	221	4	
	20	5	1206244-04	319	243	2	
	21	1	1206244-05	319	190	15	
	22	2	1206244-05	319	228	2	
	23	3	1206244-05	319	181	3	
	24	4	1206244-05	319	169	1	
	25	5	1206244-05	319	177	3	
	26	1	1206244-06	319	289	12	
	27	2	1206244-06	319	277	1	
	28	3	1206244-06	319	239	3	
	29	4	1206244-06	319	241	5	
	30	5	1206244-06	319	266	3	

Comments:

**Bivalve Larval Survival and Development Test-Normality Survival**

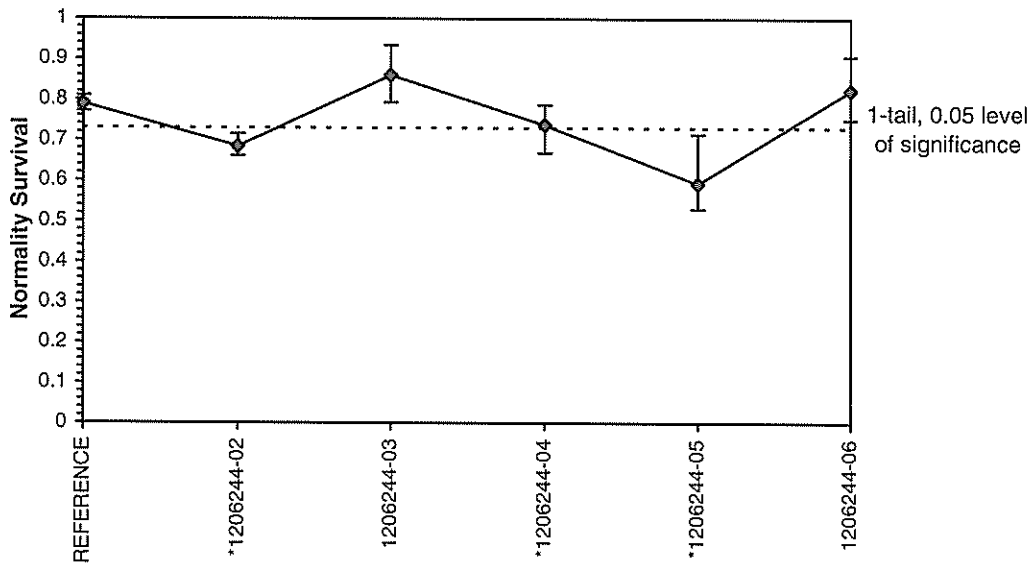
Start Date: 10/02/2012	Test ID: HK1206244c	Sample ID: VA
End Date: 12/02/2012	Lab ID: ALS	Sample Type: MS
Sample Date:	Protocol: CG	Test Species: CG-Crassostrea gigas
Comments:		

Conc-	1	2	3	4	5
REFERENCE	0.7868	0.7962	0.7806	0.7712	0.8088
1206244-02	0.6865	0.6614	0.7147	0.6959	0.6614
1206244-03	0.8652	0.8213	0.9342	0.7931	0.8871
1206244-04	0.7868	0.6677	0.7743	0.6928	0.7618
1206244-05	0.5956	0.7147	0.5674	0.5298	0.5549
1206244-06	0.9060	0.8683	0.7492	0.7555	0.8339

Conc-	Mean	N-Mean	Transform: Untransformed					N	t-Stat	1-Tailed Critical	MSD
			Mean	Min	Max	CV%					
REFERENCE	0.7887	1.0000	0.7887	0.7712	0.8088	1.834	5				
*1206244-02	0.6840	0.8672	0.6840	0.6614	0.7147	3.358	5	8.624	1.860	0.0226	
1206244-03	0.8602	1.0906	0.8602	0.7931	0.9342	6.430	5	-2.795	1.860	0.0475	
*1206244-04	0.7367	0.9340	0.7367	0.6677	0.7868	7.196	5	2.117	1.860	0.0457	
*1206244-05	0.5925	0.7512	0.5925	0.5298	0.7147	12.210	5	5.948	1.860	0.0613	
1206244-06	0.8226	1.0429	0.8226	0.7492	0.9060	8.391	5	-1.073	1.860	0.0586	

Auxiliary Tests	Statistic	Critical	Skew	Kurt		
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.96531	0.927	0.45486	0.16464		
Bartlett's Test indicates equal variances (p = 0.06)	10.728	15.0863				
Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates significant differences Treatments vs REFERENCE	0.05865	0.07436	0.04821	0.00277	2.7E-07	5, 24

**Dose-Response Plot**



**Bivalve Larval Survival and Development Test-Normality Survival**

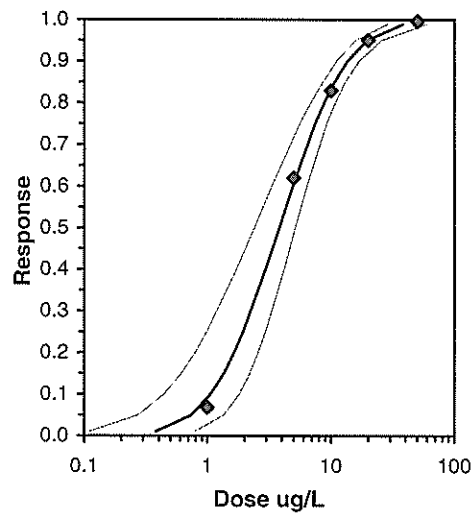
Start Date:	10/02/2012	Test ID:	RTCGCU024	Sample ID:	REF
End Date:	12/02/2012	Lab ID:	ALS	Sample Type:	CUCL
Sample Date:		Protocol:	CG	Test Species:	CG-Crassostrea gigas
Comments:					

Conc-ug/L	1	2	3	4	5
D-Control	0.8339	0.7210	0.8088	0.8777	0.7962
1	0.7837	0.7774	0.7806		
5	0.3229	0.3135	0.3072		
10	0.1317	0.1505	0.1191		
20	0.0470	0.0376	0.0313		
50	0.0031	0.0000	0.0063		

Conc-ug/L	Mean	N-Mean	Transform: Untransformed					N	Number Resp	Total Number
			Mean	Min	Max	CV%				
D-Control	0.8075	1.0000	0.8075	0.7210	0.8777	7.124	5	8	41	
1	0.7806	0.9666	0.7806	0.7774	0.7837	0.402	3	6	24	
5	0.3145	0.3895	0.3145	0.3072	0.3229	2.508	3	50	72	
10	0.1338	0.1656	0.1338	0.1191	0.1505	11.797	3	132	153	
20	0.0387	0.0479	0.0387	0.0313	0.0470	20.405	3	171	178	
50	0.0031	0.0039	0.0031	0.0000	0.0063	100.000	3	287	288	

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.74495	0.905	-0.8243	7.19784
Bartlett's Test indicates unequal variances (p = 2.79E-04)	23.432	15.0863		

Maximum Likelihood-Probit											
Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	2.31681	0.30357	1.72181	2.9118	0.19512	0.09592	7.81473	0.99232	0.58049	0.43163	3
Intercept	3.65512	0.33003	3.00825	4.30198							
TSCR	0.19165	0.05675	0.08042	0.30288							
Point	Probits	ug/L	95% Fiducial Limits								
EC01	2.674	0.37703	0.11037	0.78651							
EC05	3.355	0.74221	0.27319	1.35504							
EC10	3.718	1.06497	0.4424	1.81286							
EC15	3.964	1.35874	0.61205	2.20768							
EC20	4.158	1.64901	0.79178	2.58324							
EC25	4.326	1.94698	0.98705	2.95732							
EC40	4.747	2.95896	1.71548	4.16942							
EC50	5.000	3.8062	2.38526	5.14131							
EC60	5.253	4.89602	3.30446	6.36292							
EC75	5.674	7.44081	5.59759	9.20408							
EC80	5.842	8.78535	6.83967	10.7501							
EC85	6.036	10.6622	8.55581	13.0087							
EC90	6.282	13.6033	11.133	16.8432							
EC95	6.645	19.519	15.8478	25.6352							
EC99	7.326	38.4247	28.6659	60.4345							



Test: BV-Bivalve Larval Survival and Development Test ID: RTCGCU024

Species: CG-Crassostrea gigas

Protocol: CG

Sample ID: REF

Sample Type: CUCL

Start Date: 10/02/2012

End Date: 12/02/2012 Lab ID: ALS

Pos	ID	Rep	Group	Initial Density	Normal Count	Abnormal Count	Notes
	1	1	D-Control	319	266	10	
	2	2	D-Control	319	230	5	
	3	3	D-Control	319	258	8	
	4	4	D-Control	319	280	9	
	5	5	D-Control	319	254	9	
	6	1	1	319	250	8	
	7	2	1	319	248	9	
	8	3	1	319	249	7	
	9	1	5	319	103	20	
	10	2	5	319	100	23	
	11	3	5	319	98	29	
	12	1	10	319	42	50	
	13	2	10	319	48	53	
	14	3	10	319	38	50	
	15	1	20	319	15	76	
	16	2	20	319	12	55	
	17	3	20	319	10	47	
	18	1	50	319	1	102	
	19	2	50	319	0	99	
	20	3	50	319	2	87	

Comments:



LARVAL DEVELOPMENT TOXICITY TEST - AMMONIA and SULPHIDE MONITORING

M1

Client: L ENGINEERING AND DEVELOPMENT DEPARTM  
 Batch No.: HK1206244  
 Sample ID: 1-6  
 Photometer: \_\_\_\_\_

Test Species: Crassostrea gigas  
 Source/Date Received: Guernsey Sea Farm-08/Feb/12  
 Test Initiation Date (0 Hour): 160949.625 10-Feb-12  
 Test Termination Date (48 Hour): 1640051.625 12-Feb-12

Sample ID	Ammonia (mg/L)		Sulphide (mg/L)		Sample ID	Ammonia (mg/L)		Sulphide (mg/L)	
	0 Hour	48 Hour	0 Hour	48 Hour		0 Hour	48 Hour	0 Hour	48 Hour
K-1	0.44	1.31	<0.1	<0.1					
K-2	0.84	0.98	<0.1	<0.1					
K-3	1.07	1.36	<0.1	<0.1					
K-4	1.56	1.68	<0.1	<0.1					
K-5	0.21	0.47	<0.1	<0.1					
K-6	0.51	0.52	<0.1	<0.1					
K-7	0.28	0.72	<0.1	<0.1					
Initial	<i>BW</i>	<i>B</i>	<i>B</i>	<i>B</i>	Initial				
Sample ID	NH <sub>3</sub> (mg/L)	Sam Dup	Spike (mg/L)	RPD	Sample ID	S (mg/L)	Sam Dup	Spike (mg/L)	RPD
0 Hour					0 Hour				
K-5	1.07	1.09	2.55	7.85 72.2	K-4	1.68	1.71	3.41	1.77 89.9
48 Hour					48 Hour				

Comment: \_\_\_\_\_  
 Data Checked By: WB Date: 3/4/12



## LARVAL DEVELOPMENT TOXICITY TEST - DAILY WATER QUALITY DATA

Client AFSC CEDD      Test Initiation Date/Time 10-Feb-12/15:00  
 Batch No. HK1206233<sup>5</sup> HK1206244      Test Termination Date 12-Feb-12/15:00  
 Sample ID WJ12 1-6      Test Species / Date Collected Crassostrea gigas-08/Feb/12

Sample ID	Temperature (°C)			pH			Salinity (ppt)			Dissolved Oxygen (mg/L)		
	0	24	48	0	24	48	0	24	48	0	24	48
	K-1	19	20	20	8.1	8.0	8.0	28	28	28	7.0	6.9
Technician Initials	ra	ra	ra	ra	ra	ra	ra	ra	ra	ra	ra	ra

WQ Instruments Used:  
 Temp. HK384      pH HK895      Salinity HK897      DO HK412

Comments \_\_\_\_\_

Test Set Up By F      Data Verified By ra      Date Verified 3/4/12

## LARVAL DEVELOPMENT TOXICITY TEST - DAILY WATER QUALITY DATA

Client CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT  
 Batch No. HK1206244  
 Sample ID 1 - 6

Test Initiation Date/Time 10-Feb-12/15:00  
 Test Termination Date 12-Feb-12/15:00  
 Test Species / Date Collected Crassostrea gigas-08/Feb/12

Sample ID	Temperature (°C)			pH			Salinity (ppt)			Dissolved Oxygen (mg/L)		
	0	24	48	0	24	48	0	24	48	0	24	48
K-2	19	20	20	8.1	8.0	8.0	28	28	28	2.1	2.0	2.1
K-3	19	20	20	8.0	8.0	8.0	28	28	28	2.0	2.0	2.2
K-4	19	20	20	8.0	7.9	8.0	28	28	28	2.3	2.1	2.3
K-5	19	20	20	8.0	8.0	8.0	28	28	28	2.2	2.2	2.2
K-6	19	20	20	8.1	8.0	8.1	28	28	28	2.3	2.3	2.0
K-7	19	20	20	8.1	8.1	8.0	28	28	28	2.3	2.2	2.1
Technician Initials	<i>br</i>	<i>br</i>	<i>br</i>	<i>br</i>	<i>br</i>	<i>br</i>	<i>br</i>	<i>br</i>	<i>br</i>	<i>br</i>	<i>br</i>	<i>br</i>

WQ Instruments Used:  
 Temp. HK384      pH HK895      Salinity HK897      DO HK412

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

Set Up By *br*      Data Verified By *br*      Date Verified 3/4/12

LARVAL DEVELOPMENT TOXICITY TEST - SEDIMENT (SAMPLES)

Client AFSC C870  
 Batch No. HK20622 Heno:94  
 Initial Embryo Density 319  
 Test Volume (mL) 900  
 Aliquot Size (mL) 10

Test Initiation Date 10-Feb-12  
 Test Termination Date 12-Feb-12  
 Fertilization initiation time 13:00  
 Inoculation time 15:00  
 Test Species Crassostrea gigas  
 Source/Date Received Guernsey Sea Farm-08/Feb/12

Sample ID	Rep.	Primary Count		Backup Count		Comments	Tech. Init.
		Normal Larvae	Abnormal Larvae	Normal Larvae	Abnormal Larvae		
K-1	A	266	10				✓
	B	230	5				✓
	C	258	8				✓
	D	280	9				✓
	E	254	9				✓

	Rep.	Count / 10 mL		Backup Count		Comments	Tech. Init.
		Fertilized Egg	Unfertilized Egg	Fertilized Egg	Unfertilized Egg		
Day 0 Count	A	294	117				✓
	B	356	142				✓
	C	311	124				✓
	D	306	122				✓
	E	328	130				✓

\* Embryo must be inoculated within 2 hours after initiation of fertilization

Data Verified By 308

Date Verified 3/4/12,

**LARVAL DEVELOPMENT TOXICITY TEST - SEDIMENT (SAMPLES)**

Client CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT  
 Batch No. HK1206244

Test Initiation Date 10-Feb-12  
 Test Termination Date 12-Feb-12  
 Fertilization initiation time 13:00  
 Inoculation time 15:00  
 Test Species Crassostrea gigas  
 Source/Date Received Guernsey Sea Farm-08/Feb/12

Initial Embryo Density 319  
 Test Volume (mL) 900  
 Aliquot Size (mL) 10

Sample ID	Rep.	Primary Count		Backup Count		Comments	Tech. Init.
		Normal Larvae	Abnormal Larvae	Normal Larvae	Abnormal Larvae		
HK1206244001 K-2	A	251	13				✓
	B	254	4				✓
	C	249	8				✓
	D	246	4				✓
	E	258	6				✓
HK1206244002 K-3	A	219	23				✓
	B	211	6				✓
	C	228	4				✓
	D	222	4				✓
	E	211	8				✓
HK1206244003 K-4	A	276	18				✓
	B	262	5				✓
	C	298	3				✓
	D	253	7				✓
	E	283	12				✓
HK1206244004 K-5	A	251	19				✓
	B	213	8				✓
	C	247	8				✓
	D	221	4				✓
	E	243	2				✓
HK1206244005 K-6	A	190	15				✓
	B	228	2				✓
	C	181	3				✓
	D	169	1				✓
	E	177	3				✓
HK1206244006 K-7	A	289	12				✓
	B	277	1				✓
	C	239	3				✓
	D	241	5				✓
	E	266	3				✓
	A						
	B						
	C						
	D						
	E						

\* Embryo must be inoculated within 2 hours after initiation of fertilization

Data Verified By JAB

Date Verified 3/4/12

## LARVAL DEVELOPMENT TOXICITY TEST - SEDIMENT (CONTROLS)

Client DESC 0617D  
 Batch No. HK1206233 HK1206244  
 Reference Toxicant Cu  
 Stock ID HK1117761-01  
 Initial Embryo Density 319  
 Test Volume (mL) 900  
 Aliquot Size (mL) 10

Test Initiation Date/Time 10-Feb-12/15:00  
 Test Termination Date/Time 12-Feb-12/15:00  
 Fertilization initiation Time 13:00  
 Inoculation Time 15:00  
 Test Species Crassostrea gigas  
 Source/Date Received Guernsey Sea Farm-08/Feb/12

Concentration (µg/L)	Rep.	Primary Count		Backup Count		Comments	Tech. Init.
		Normal Larvae	Abnormal Larvae	Normal Larvae	Abnormal Larvae		
<b>Reference Toxicant</b>							
1.0	A	250	8				✓
	B	248	9				✓
	C	249	7				✓
5.0	A	703	20				✓
	B	100	23				✓
	C	98	29				✓
10.0	A	42	50				✓
	B	48	53				✓
	C	38	50				✓
20.0	A	15	76				✓
	B	12	55				✓
	C	10	47				✓
50.0	A	1	102				✓
	B	0	99				✓
	C	2	87				✓
<b>Control Seawater</b>							
0.0	A	266	10				✓
	B	230	5				✓
	C	258	8				✓
	D	280	9				✓
	E	254	9				✓

Data Verified By JAB

Date Verified 3/14/12

LARVAL DEVELOPMENT TOXICITY TEST - REFERENCE TOXICANT TEST DATA

Client AFSC CERD Test Initiation Date/Time 10 Feb 12 / 15:00  
 Batch No. 145106233 HK120244 Test Termination Date 12 Feb 12 / 15:00  
 Test Species Crassostrea gigas  
 Source/Date Received Guernsey Sea Farm / 5 Feb 12  
 Test Volume (mL) 800  
 Aliquot Size (mL) 10

Initial Embryo Density 319

Concentration (µg/L)	Dissolved Oxygen (mg/L)			Temperature (°C)			pH			Salinity (ppt)	
	0	24	48	0	24	48	0	24	48	0	48
0.0	7.1		7.1	19			8.3		8.2	28	28
1.0	7.2		7.0	19		20	8.2		8.2	28	28
5.0	7.0		7.0	19		20	8.4		8.4	28	28
10.0	7.0		7.0	19		20	8.1		8.1	28	28
20.0	6.9		6.5	20		20	8.2		8.1	28	28
50.0	7.1		7.0	19		20	8.2		8.2	28	28
Technician	Re		Re	Re		Re	Re		Re	Re	Re

WC Instruments Used: Temp. HK384 pH HK895 Salinity HK897 DO HK412  
 Comments \_\_\_\_\_  
 Test Set Up By Re Date Verified By Re Date Verified 2/4/12

APPENDIX E

Analytical Reports



### CERTIFICATE OF ANALYSIS

Client	: CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Laboratory	: ALS Technichem HK Pty Ltd	Page	: 1 of 3
Contact	: IR POPHIL LAM	Contact	: Chan Kwok Fai, Godfrey	Work Order	: HK1206244
Address	: GEOTECHNICAL PROJECTS DIVISION, GEOTECHNICAL ENGINEERING OFFICE, 23/F., KWUN TONG VIEW, 410 KWUN TONG ROAD, KOWLOON, HONG KONG	Address	: 1/F., Chung Shun Knitting Centre, 1 - 3 Wing Yip Street, Kwai Chung, N.T., Hong Kong		
E-mail	: Pophilkiam@cedd.gov.hk	E-mail	: Godfrey.Chan@alsglobal.com		
Telephone	: +852 2716 8609	Telephone	: +852 2610 1044		
Facsimile	: ----	Facsimile	: +852 2610 2021		
Project	: GE_2009_16 19 - AGREEMENT NO CE 15_2010(DS) UPGRADING OF CHEUNG CHAU AND TAI O SEWAGE COLLECTION	Quote number	: ----	Date received	: 07-MAR-2012
Order number	: ----			Date of issue	: 19-MAR-2012
C-O-C number	: ----			No. of samples - Received	: 6
Site	: ----			- Analysed	: 6

### Report Comments

This report for ALS Technichem (HK) Pty Ltd work order reference HK1206244 supersedes any previous reports with this reference. The completion date of analysis is 16-MAR-2012. Results apply to sample(s) as submitted. All pages of this report have been checked and approved for release. When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for process purposes. Abbreviations: CAS number = Chemical Abstract Services number. LOR = Limit of reporting.

Specific comments for Work Order HK1206244 : Sample(s) were received in an ambient condition.

Sediment sample(s) analysed on an as received basis. Result(s) reported on a dry weight basis.

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This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in the 'Electronic Transactions Ordinance' of Hong Kong, Chapter 553, Section 6.

Signature

PP Fung Lim Chee, Richard

Position

General Manager

Authorised results for:-

Inorganics





**Analytical Results**

Sub-Matrix: SEDIMENT

Client sample ID	Client sampling date / time	Laboratory sample ID	Compound	EA055: Moisture Content (dried @ 103° C)	EP005: Total Organic Carbon
			LOR Unit	0.1 %	0.05 %
				EAVED: Physical and Aggregate Properties	EP: Aggregate Organics
REFERENCE SEDIMENT	[05-MAR-2012]	HK1206244-001		50.4	1.39
D10 4.90-5.90M & D10 0.00-0.90	[05-MAR-2012]	HK1206244-002		48.2	0.89
D11 0.00-0.90M & 0.90-1.90M & 6.90-7.90M	[05-MAR-2012]	HK1206244-003		48.1	0.93
D8 0.00-0.90M & 1.90-2.90M	[05-MAR-2012]	HK1206244-004		34.9	1.23
D9 6.90-7.90M	[05-MAR-2012]	HK1206244-005		42.8	0.74
D9 0.00-0.90M & 0.90-1.90 M	[05-MAR-2012]	HK1206244-006		42.2	0.85



### Laboratory Duplicate (DUP) Report

Laboratory sample ID		Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)
<b>EA/ED: Physical and Aggregate Properties (QC Lot: 2207163)</b>									
HK1206260-002	Anonymous		EA055: Moisture Content (dried @ 103°C)	----	0.1	%	12.8	15.6	19.6
HK1206272-001	Anonymous		EA055: Moisture Content (dried @ 103°C)	----	0.1	%	19.0	21.7	13.5
<b>EP: Aggregate Organics (QC Lot: 2206296)</b>									
HK1206233-001	Anonymous		EP005: Total Organic Carbon	----	0.05	%	1.44	1.67	14.5
HK1206233-003	Anonymous		EP005: Total Organic Carbon	----	0.05	%	0.83	0.87	4.4

### Method Blank (MB), Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report

Method Blank (MB) Report				Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report							
Method: Compound	CAS Number	LOR	Unit	Result	Spike Concentration	LCS	Spike Recovery (%)	DCS	Recovery Limits (%)	Value	Control Limit
EP: Aggregate Organics (QCLot: 2206296)	EP005: Total Organic Carbon	----	0.05	%	<0.05	113	40 %	----	85	115	----

### Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report										
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Spike Concentration	MS	Spike Recovery (%)	MSD	Recovery Limits (%)	Value	Control Limit
EP: Aggregate Organics (QCLot: 2206296)	Anonymous	EP005: Total Organic Carbon	EP005: Total Organic Carbon	----	80 %	119	----	75	125	----