

Installation of Submarine Gas Pipelines
and Associated Facilities from
To Kwa Wan to North Point for Former Kai Tak Airport Development
Consultancy Services for Feasibility Study and Detailed Design
Environmental Impact Assessment Report



Appendix C3
Laboratory Test Report on Biological Screening



Biological Testing



Amphipod Test

TEST REPORT

Report No. : 107064N
Project Name : Ground Investigations Works for installation of Submarine Gas Pipeline and Associated Facilities from Ma Tau Kok to North Point for Former Kai Tak Airport Development

Customer Name : Gammon Construction Limited

Customer Address : 28/F Devon House, Taikoo Place, 979 King's Road, Hong Kong.
Contract No. : N/A
Works Order No. : N/A

Lab. Job No. : J656
Lab. Sample Ref. No. : 21240/1-10
No. of Sample(s) : 10 vibrocore samples received on chilled condition and
& Description : 9 composite samples & one reference sediment were been tested.
as per client's instruction
Sample Receive Date : 4 Jul to 15 Aug, 2008
Test Date : 20 to 30 Aug, 2008

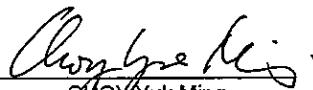
Test Parameter

Parameter	Test Method
Amphipod Sediment Bioassay	USEPA 1994

Note(s):

1. Results related to sample(s) as received.
2. NA = Not applicable.
3. Uncertainty is calculated as 2 SD.
4. Standard Method: Methods for Assessing Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods. EPA/600/R-94/025, USEPA, 1994.

Authorized signatory: _____


 CHAO Yuk Ming
 (Ecotoxicologist)

Issue Date: _____ 24-Sep-2008

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Lam Laboratories Limited Room 1412, Honour Industrial Centre, 6 Sun Yip Street, Chaiwan, Hong Kong.

Tel: (852) 2897 3282 Fax: (852) 2897 5509 Email: info@lamlab.com

Test Report

Report No.: 107064N

1. Method

This 10-day toxicity test with *Leptocheirus plumulosus* was conducted using the USEPA method (1994) "Methods for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods". *Leptocheirus plumulosus* is exposed to the test sediment overlaid with seawater for a 10-day test period and survival rate is determined as the primary endpoint.

2. Sample storage and pretreatment

Composite samples were prepared as per client's instruction from the extruded vibrocore sections and homogenized thoroughly. Debris and indigenous organisms present in the sediment were removed and the sediment samples were stored at 4°C in dark until analyzed.

3. Test organism

Species: *Leptocheirus plumulosus*
Source: Purchased from research organism supplier from USA, mortality during shipping was 0.32%
Size/age: 2-4 mm in length
Acclimation: under test conditions with feeding provided, as per USEPA 1994, mortality during acclimation was 0.0%
Health condition: healthy

4. Summary of test particulars

Type of test: static
Duration: 20 to 30 Aug, 2008
Control sediment: mud and sand collected from a clean area on the eastern coast of the New Territories and Hong Kong Island respectively, shipped to the laboratory on the same day, sieved through 425 micrometer mesh sieve, mixed and stored at 4°C in dark until use.
Control seawater: reconstituted seawater prepared with the Instant Ocean salt at 20 ppt, aerated for two days after preparation
Test temperature: 25±1°C
Lighting: continuous
Aeration: provided (around 100 bubbles/min)
Test vessel: 1000ml glass jars
Volume of sediment: 175ml
Volume of overlying water: 775 ml
No. of replicates: 5
No. of organisms/replicate: 20
Feeding: none
Monitoring: temperature, DO, pH and salinity in overlying water everyday, ammonia in overlying water at test initiation and termination
Reference toxicant test: 96 hour water only test with CdCl₂

Test Report

Report No.: 107064N

5. Summary of test results

Table 1. Survival of amphipods on Day 10

Sample ID	Number of living amphipod on Day 10					Mean	SD
	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Replicate 5		
Negative Control with sediment	19	18	18	18	19	18.4	0.5
VC16 0.90-1.90m	10	12	14	10	10	11.2	1.8
VC36 1.90-2.90m	11	14	16	11	13	13.0	2.1
VC2 1.90-2.90m	14	15	14	13	17	14.6	1.5
VC3 0.90-1.90m	9	14	8	8	9	9.6	2.5
VC2A 2.90-5.90m	6	6	6	4	2	4.8	1.8
VC1A 2.90-5.90m	11	4	5	4	7	6.2	2.9
VC1 0.00-0.90m (dilution test)	2	1	5	2	0	2.0	1.9
VC1A 0.00-0.90m (dilution test)	1	4	4	0	4	2.6	1.9
VC1A 0.90-1.90m (dilution test)	2	4	2	7	4	3.8	2.0
Reference sediment	15	18	16	17	15	16.2	1.3

Table 2. Survival percentage of amphipods on Day 10

Sample ID	Survival percentage of amphipod on Day 10 (%)					Mean	SD
	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Replicate 5		
Negative Control with sediment	95	90	90	90	95	92.0	2.7
VC16 0.90-1.90m	50	60	70	50	50	56.0	8.9
VC36 1.90-2.90m	55	70	80	55	65	65.0	10.6
VC2 1.90-2.90m	70	75	70	65	85	73.0	7.6
VC3 0.90-1.90m	45	70	40	40	45	48.0	12.5
VC2A 2.90-5.90m	30	30	30	20	10	24.0	8.9
VC1A 2.90-5.90m	55	20	25	20	35	31.0	14.7
VC1 0.00-0.90m (dilution test)	10	5	25	10	0	10.0	9.4
VC1A 0.00-0.90m (dilution test)	5	20	20	0	20	13.0	9.7
VC1A 0.90-1.90m (dilution test)	10	20	10	35	20	19.0	10.2
Reference sediment	75	90	80	85	75	81.0	6.5

Test Report

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Table 3. Summary of the amphipod survival in relation to the reference sediment

Sample ID	Survival relative to reference site (%)	Difference between sample and reference sediment (t-test)
VC16 0.90-1.90m	69.1	Significant $p < 0.05$ assuming Equal variance
VC36 1.90-2.90m	80.2	NA (Note 1)
VC2 1.90-2.90m	90.1	NA (Note 1)
VC3 0.90-1.90m	59.3	Significant $p < 0.05$ assuming Equal variance
VC2A 2.90-5.90m	29.6	Significant $p < 0.05$ assuming Equal variance
VC1A 2.90-5.90m	38.3	Significant $p < 0.05$ assuming Equal variance
VC1 0.00-0.90m (dilution test)	12.3	Significant $p < 0.05$ assuming Equal variance
VC1A 0.00-0.90m (dilution test)	16.0	Significant $p < 0.05$ assuming Equal variance
VC1A 0.90-1.90m (dilution test)	23.5	Significant $p < 0.05$ assuming Equal variance
Note 1. As the average survival of the amphipods for the test sediment was no less than 80% of that of the reference sediment, statistical analysis is not required.		

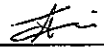
Test Report

Report No.: 107064N

6. Test validity

Table 4. Test validity criteria and water quality ranges in the amphipod test

Parameter	Minimum during the test period	Maximum during the test period	Acceptable Range in USEPA 1994
Overlying salinity	20 ppt	21 ppt	19-21 ppt
Dissolved oxygen	6.0 mg/L	6.9 mg/L	>4.7 mg/L ¹
Overlying pH	7.5	8.5	NA ²
Temperature	25.0 °C	25.6 °C	22.0-28.0 °C time-average 24.0-26.0 °C
Total ammonia in overlying water (initiation/termination)	<0.03 mg/L	4.8 mg/L	<60 mg/L ³
Interstitial salinity (initiation)	28 ppt	28 ppt	1.5-32 ppt ⁴
Interstitial pH (initiation)	7.7	7.9	NA ²
Amphipod survival in the negative control	90-95 % , averagely 92.0 %		≥ 90% average ≥ 80% in any individual replicate
96-h LC ₅₀ obtained from the reference toxicant test	1.11 mg/L 95% confidence range: 0.73 - 1.74 mg/L		0.88 ± 0.47 mg/L
Remarks on test condition:	None		
Note:	1. 60% of saturation level at 20 ppt 2. pH is not adjusted or controlled 3. The acceptance level for overlying ammonia was < 20 mg/L in ETWB TCW 34/2002. When this level is exceeded, additional set of amphipod test is conducted with purging of sediment. 4. VC3 0.90-1.90m, VC1A 2.90-5.90m and VC1A 0.90-1.90m were pre-mixed with 20 ppt reconstituted seawater, so that interstitial salinity was below 32 ppt at test initiation.		

End of reportData entry checked by: 
K.Y. Liu / H.W. Wong



Polychaete Test

TEST REPORT

Report No. : 107066N
Project Name : Ground Investigations Works for installation of Submarine Gas Pipeline and Associated Facilities from Ma Tau Kok to North Point for Former Kai Tak Airport Development

Customer Name : Gammon Construction Limited

Customer Address : 28/F Devon House, Taikoo Place, 979 King's Road, Hong Kong.
Contract No. : N/A
Works Order No. : N/A

Lab. Job No. : J656
Lab. Sample Ref. No. : 21240/1-10
No. of Sample(s) & Description : 10 vibrocore samples received on chilled condition and 9 composite samples & one reference sediment were been tested. as per client's instruction
Sample Receive Date : 4 Jul to 15 Aug, 2008
Test Date : 27 Aug to 16 Sep, 2008


Test Parameter

Parameter	Test Method
Polychaete Sediment Bioassay	PSEP 1995

Note(s):

1. Results related to sample(s) as received.
2. NA = Not applicable.
3. Uncertainty is calculated as 2 SD.
4. Standard method: Puget Sound Estuary Program Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments, USEPA, Revised July 1995.

Authorized signatory: _____


 CHOY Yuk Ming
 (Ecotoxicologist)

Issue Date: _____

24-Sep-2008

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Test report

Report No.: 107066N

1. Method

This 20-day toxicity test on sediment with *Neanthes arenaceodentata* was conducted using the PSEP method (1995) "Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments". *Neanthes arenaceodentata* is exposed to the test sediment overlaid with seawater for a 20-day test period. The endpoints are survival and growth.

2. Sample storage and pretreatment

All samples were homogenized thoroughly. Debris and indigenous organisms present in the sediment were removed and the sediment samples were stored at 4°C in dark until analyzed.

3. Test organism

Species: *Neanthes arenaceodentata*
Source: Purchased from research organism supplier from USA, mortality during shipping was 0%
Age/size: 2-3 weeks post emergence
Acclimation: under test conditions with feeding provided, as per USEPA 1994, mortality during acclimation was 0%
Health condition: healthy
Mean initial dry weight: 0.57 mg/worm

4. Summary of test particulars

Type of test: renewal every three days
Duration: 27 Aug to 16 Sep, 2008
Control sediment: mud and sand collected from a clean area on the eastern coast of the New Territories and Hong Kong Island respectively, shipped to the laboratory on the same day, sieved through 425 micrometer mesh sieve, mixed and stored at 4°C in dark until use
Control seawater: reconstituted seawater prepared with the Instant Ocean salt at 28 ppt, aerated for two days after preparation
Test temperature: 20±1°C
Lighting: continuous
Aeration: provided (around 100 bubbles/min)
Test vessel: 1000ml glass jars
Volume of sediment: 175ml
Volume of overlying water: 775 ml
No. of replicates: 5
No. of organisms/replicate: 5
Feeding: Tetramarin powder, 8 mg per worm each time, once every two days
Monitoring: temperature, DO, pH and salinity in overlying water everyday, ammonia in overlying water at test initiation and termination
Reference toxicant test: 96 hour water only test with CdCl₂

Test report

Report No.: 107066N

5. Summary of test results

Table 1. Survival of polychaetes on Day 20

Sample ID	Number of living polychaete on Day 20					Mean	SD
	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Replicate 5		
Negative control with sediment	5	5	5	5	5	5.0	0.0
VC16 0.90-1.90m	5	5	2	5	4	4.2	1.3
VC36 1.90-2.90m	5	5	4	5	5	4.8	0.4
VC2 1.90-2.90m	5	5	5	5	5	5.0	0.0
VC3 0.90-1.90m	4	5	5	2	5	4.2	1.3
VC2A 2.90-5.90m	5	5	5	4	5	4.8	0.4
VC1A 2.90-5.90m	5	5	5	4	4	4.6	0.5
VC1 0.00-0.90m (dilution test)	0	3	2	3	2	2.0	1.2
VC1A 0.00-0.90m (dilution test)	5	5	5	4	5	4.8	0.4
VC1A 0.90-1.90m (dilution test)	5	5	5	4	5	4.8	0.4
Reference sediment	4	5	5	5	4	4.6	0.5

Table 2. Survival percentage of polychaetes on Day 20

Sample ID	Survival percentage of polychaete on Day 20 (%)					Mean	SD
	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Replicate 5		
Negative control with sediment	100	100	100	100	100	100.0	0.0
VC16 0.90-1.90m	100	100	40	100	80	84.0	26.1
VC36 1.90-2.90m	100	100	80	100	100	96.0	8.9
VC2 1.90-2.90m	100	100	100	100	100	100.0	0.0
VC3 0.90-1.90m	80	100	100	40	100	84.0	26.1
VC2A 2.90-5.90m	100	100	100	80	100	96.0	8.9
VC1A 2.90-5.90m	100	100	100	80	80	92.0	11.0
VC1 0.00-0.90m (dilution test)	0	60	40	60	40	40.0	24.5
VC1A 0.00-0.90m (dilution test)	100	100	100	80	100	96.0	8.9
VC1A 0.90-1.90m (dilution test)	100	100	100	80	100	96.0	8.9
Reference sediment	80	100	100	100	80	92.0	11.0

Test report

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Table 3. Total dry weight of polychaetes on Day 20

Sample ID	Total dry weight of polychaete on Day 20 (mg)					Mean	SD
	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Replicate 5		
Negative control with sediment	116.91	61.47	84.54	83.26	67.73	82.8	21.5
VC16 0.90-1.90m	61.73	26.99	14.51	44.18	31.90	35.9	17.9
VC36 1.90-2.90m	32.81	27.30	33.81	28.46	33.95	31.3	3.1
VC2 1.90-2.90m	70.27	43.55	68.82	34.92	63.45	56.2	16.0
VC3 0.90-1.90m	57.44	39.29	64.25	17.37	37.43	43.2	18.5
VC2A 2.90-5.90m	69.47	62.18	36.71	34.48	50.91	50.8	15.4
VC1A 2.90-5.90m	49.73	55.23	27.76	18.44	30.86	36.4	15.5
VC1 0.00-0.90m (dilution test)	0.00	4.16	5.47	3.24	6.29	3.8	2.4
VC1A 0.00-0.90m (dilution test)	62.32	83.58	68.96	35.05	47.61	59.5	18.8
VC1A 0.90-1.90m (dilution test)	30.58	54.04	61.64	11.86	31.84	38.0	20.0
Reference sediment	89.02	44.90	67.53	73.91	50.32	65.1	17.9

Table 4. Summary of the total dry weight of polychaetes in relation to the reference sediments

Sample ID	Total dry weight relative to reference site (%)	Difference between sample and reference sediment (t-test)
VC16 0.90-1.90m	55.1	Significant assuming Equal variance p< 0.05
VC36 1.90-2.90m	48.0	Significant assuming Unequal variance p< 0.05
VC2 1.90-2.90m	86.3	Insignificant assuming Equal variance p= 0.215
VC3 0.90-1.90m	66.3	Significant assuming Equal variance p< 0.05
VC2A 2.90-5.90m	77.9	Insignificant assuming Equal variance p= 0.105
VC1A 2.90-5.90m	55.9	Significant assuming Equal variance p< 0.05
VC1 0.00-0.90m (dilution test)	5.9	Significant assuming Unequal variance p< 0.05
VC1A 0.00-0.90m (dilution test)	91.4	NA (Note 1)
VC1A 0.90-1.90m (dilution test)	58.3	Significant assuming Equal variance p< 0.05

Note 1. As the average total dry weight for the test sediment is no less than 90% of that of the reference sediment, statistical analysis is not required.

Test report

Report No.: 107066N


6. Test validity

Table 5. Test validity criteria and water quality ranges in the polychaete test

Parameter	Minimum during the test period	Maximum during the test period	Control Limit
Overlying salinity	27 ppt	28 ppt	26-30 ppt
Dissolved oxygen	6.0 mg/L	6.6 mg/L	> 4 mg/L
Overlying pH	6.9	8.1	NA ¹
Temperature	20.0 °C	20.9 °C	19-21°C
Unionized ammonia in overlying water (initiation / termination)	<0.002 mg/L	0.12 mg/L	NA ²
Interstitial salinity (initiation/termination)	28 ppt	28 ppt	>20ppt
Interstitial pH (initiation/termination)	7.7	7.9	NA ¹
Polychaete survival in the negative control	100 % , averagely 100 %		≥ 90% average ≥ 80% in any individual replicate
96-h LC ₅₀ obtained from the reference toxicant test	6.82 mg/L 95% confidence range: 4.72 - 9.50 mg/L		9.79 ± 4.00 mg/L
Remarks on test condition:			
Note: 1. pH is not adjusted or controlled 2. Overlying ammonia is not controlled. Results could be qualified as possible false positive when unionized ammonia greater than 0.7 mg/L			

End of report

Data entry checked by:


 K.Y. Liu / H.W. Wong



Bivalve Test

TEST REPORT

Report No. : 107065N
 Project Name : Ground Investigations Works for installation of Submarine Gas Pipeline and Associated Facilities from Ma Tau Kok to North Point for Former Kai Tak Airport Development

Customer Name : Gammon Construction Limited


Customer Address : 28/F Devon House, Taikoo Place, 979 King's Road, Hong Kong.
 Contract No. : N/A
 Works Order No. : N/A

Lab. Job No. : J656
 Lab. Sample Ref. No. : 21240/1-10
 No. of Sample(s) & Description : 10 vibrocore samples received on chilled condition and 9 composite samples & one reference sediment were been tested. as per client's instruction
 Sample Receive Date : 4 Jul to 15 Aug, 2008
 Test Date : 26 to 28 Aug, 2008

Test Parameter

Parameter	Test Method
Bivalve Larvae Sediment Bioassay	PSEP 1995

- Note(s):
1. Results related to sample(s) as received.
 2. NA = Not applicable.
 3. Uncertainty is calculated as 2 SD.
 4. Standard method: Puget Sound Estuary Program Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments, USEPA, Revised July 1995.

Authorized signatory: 
 Choy Yuk Ming
 (Ecotoxicologist)

Issue Date: 24-Sep-2008

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Test report

Certificate no.: 107065N

1. Method

This bivalve larvae test with *Crassostrea gigas* was conducted using the PSEP method (1995) "Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments". Bivalve adults are induced to spawn and gametes are fertilized. After fertilization the embryos are immediately exposed to the test sediment overlaid with seawater and allowed to develop for 48-60 hours. The normality survival of larvae is determined as endpoint.

2. Sample storage and pretreatment

Composite samples were prepared as per client's instruction from the extruded vibrocore sections and homogenized thoroughly. Debris and indigenous organisms present in the sediment were removed and the sediment samples were stored at 4°C in dark until analyzed.

3. Test organism

Species:	<i>Crassostrea gigas</i>
Source:	purchased from a research organism supplier in UK
Acclimation:	24 hours under test conditions, as per PSEP 1995, mortality during acclimation was 0 %
Conditions of eggs:	mature and clean
Conditions of sperms:	active
Fertilization rate:	92.7%
Mean initial stocking:	28552 fertilized eggs per test chamber

4. Summary of test particulars

Type of test:	static and non-renewal
Duration:	26 to 28 Aug, 2008, 48 hours in total
Control seawater:	collected from a clean area on the eastern coast of the Hong Kong Island, filtered through 0.45 mm filter paper, adjusted to 28 ppt, aerated for two days after preparation
Test temperature:	20±1°C
Lighting:	14h light : 10h dark cycle
Aeration:	provided (around 100 bubbles/min)
Test vessel:	1000ml glass jars
Volume of sediment:	18g
Volume of overlying water:	900 ml
No. of replicates:	5
Feeding:	none
Monitoring:	temperature, DO, pH and salinity in overlying water everyday, and termination ammonia in overlying water at test initiation
Reference toxicant test:	48 hour water only test with CdCl ₂

Test report

Certificate no.: 107065N

5. Summary of test results

Table 1. Total number of normal larvae in each test chamber at test termination

Sample ID	Number of normal larvae in each test chamber at test termination						Mean	SD
	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Replicate 5			
Negative Control with Seawater I	22400	24900	21900	24800	22300	23260.0	1463.9	
Negative Control with Seawater II	24600	29600	21800	23500	22900	24480.0	3036.0	
VC16 0.90-1.90m	2200	2600	3200	2100	3000	2620.0	481.7	
VC36 1.90-2.90m	18100	14300	14800	17700	14000	15780.0	1961.4	
VC2 1.90-2.90m	18500	17400	13600	13900	15900	15860.0	2138.5	
VC3 0.90-1.90m	8400	8000	8400	9100	8500	8480.0	396.2	
VC2A 2.90-5.90m	8400	7600	9000	7000	9000	8200.0	883.2	
VC1A 2.90-5.90m	5500	6400	7300	6100	6500	6360.0	654.2	
VC1 0.00-0.90m (dilution test)	2000	2400	2500	2100	3000	2400.0	393.7	
VC1A 0.00-0.90m (dilution test)	400	900	300	500	900	600.0	282.8	
VC1A 0.90-1.90m (dilution test)	11500	11100	12500	12000	12700	11960.0	669.3	
Reference sediment	17800	16700	18900	19000	18900	18260.0	1001.5	

Table 2. Combined normality/survival of the bivalve larvae at test termination

Sample ID	Normality survival of bivalve larvae at test termination (%)						Mean	SD
	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Replicate 5			
Negative Control with Seawater I	78.5	87.2	76.7	86.9	78.1	81.5	5.1	
Negative Control with Seawater II	86.2	103.7	76.4	82.3	80.2	85.7	10.6	
VC16 0.90-1.90m	7.7	9.1	11.2	7.4	10.5	9.2	1.7	
VC36 1.90-2.90m	63.4	50.1	51.8	62.0	49.0	55.3	6.9	
VC2 1.90-2.90m	64.8	60.9	47.6	48.7	55.7	55.5	7.5	
VC3 0.90-1.90m	29.4	28.0	29.4	31.9	29.8	29.7	1.4	
VC2A 2.90-5.90m	29.4	26.6	31.5	24.5	31.5	28.7	3.1	
VC1A 2.90-5.90m	19.3	22.4	25.6	21.4	22.8	22.3	2.3	
VC1 0.00-0.90m (dilution test)	7.0	8.4	8.8	7.4	10.5	8.4	1.4	
VC1A 0.00-0.90m (dilution test)	1.4	3.2	1.1	1.8	3.2	2.1	1.0	
VC1A 0.90-1.90m (dilution test)	40.3	38.9	43.8	42.0	44.5	41.9	2.3	
Reference sediment	62.3	58.5	66.2	66.5	66.2	64.0	3.5	

Test report

Certificate no.: 107065N

Table 3. Summary of the normality survival of bivalve larvae in relation to the reference sediments

Sample ID	Normality survival in relation to reference site (%)	Difference between sample and reference sediment (t-test)
VC16 0.90-1.90m	14.3	Significant assuming Equal variance p < 0.05
VC36 1.90-2.90m	86.4	NA (Note 1)
VC2 1.90-2.90m	86.9	NA (Note 1)
VC3 0.90-1.90m	46.4	Significant assuming Unequal variance p < 0.05
VC2A 2.90-5.90m	44.9	Significant assuming Equal variance p < 0.05
VC1A 2.90-5.90m	34.8	Significant assuming Equal variance p < 0.05
VC1 0.00-0.90m (dilution test)	13.1	Significant assuming Unequal variance p < 0.05
VC1A 0.00-0.90m (dilution test)	3.3	Significant assuming Unequal variance p < 0.05
VC1A 0.90-1.90m (dilution test)	65.5	Significant assuming Equal variance p < 0.05

Note 1. As the average normality survival of the bivalve larvae for the test sediment was no less than 80% of that of the reference sediment, statistical analysis is not required.

Test report


Certificate no.: 107065N

6. Test validity

Table 4. Test validity criteria and water quality ranges in the bivalve test

Parameter	Minimum during the test period	Maximum during the test period	Acceptable Range
Overlying salinity	28 ppt	28 ppt	27-29ppt
Dissolved oxygen	6.0 mg/L	6.5 mg/L	>4.5mg/L ¹
Overlying pH	7.6	8.5	NA ²
Temperature	20.1 °C	20.8 °C	19.0-21.0°C
Unionized ammonia in overlying water (initiation/termination)	<0.002 mg/L	0.0045 mg/L	NA ³
Larvae normality survival in the negative control	76.4-103.7 % , averagely 83.6 %		≥ 70% averagely
48-h EC ₅₀ obtained from the reference toxicant test	0.85 mg/L 95% confidence range: 0.67-1.08 mg/L		1.29 ± 0.49 mg/L
Remarks on test condition:	None		
1. 60% of saturation level at 28 ppt 2. pH is not adjusted or controlled 3. Overlying ammonia is not controlled. Results could be qualified as possible false positive when ammonia (unionized) is greater than 0.13 mg/L			

End of Report

Data entry checked by: 
 K.Y. Liu / H.W. Wong



Ancillary Tests



Interstitial Ammonia

TEST REPORT

Report No. : 107067N
 Project Name : Ground Investigations Works for installation of Submarine Gas Pipeline and Associated Facilities from Ma Tau Kok to North Point for Former Kai Tak Airport Development

Customer Name : Gammon Construction Limited

Customer Address : 28/F Devon House, Taikoo Place, 979 King's Road, Hong Kong.

Contract No. : N/A

Works Order No. : N/A

Lab. Job No. : J656

Lab. Sample Ref. No. : 21240/1-10

No. of Sample(s) : 10 vibrocore samples received on chilled condition and

& Description : 9 composite samples & one reference sediment were been tested.
 as per client's instruction

Sample Receive Date : 4 Jul to 15 Aug, 2008

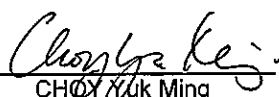
Test Date : 18-Aug-08

Test Parameter

Parameter	Test Method
Interstitial ammonia	APHA 4500-NH3 F. Phenate Method

Note(s): 1. Results related to sample(s) as received.
 2. NA = Not applicable.

Authorized signatory: _____


 CHOY Yuk Ming
 (Ecotoxicologist)

Issue Date: _____ 24-Sep-2008

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Lam Laboratories Limited Room 1412, Honour Industrial Centre, 6 Sun Yip Street, Chaiwan, Hong Kong.
 Tel: (852) 2897 3282 Fax: (852) 2897 5509 Email: info@lamlab.com

Test report

Report No. : 107067N
 Project Name : Ground Investigations Works for installation of Submarine Gas Pipeline and Associated Facilities from Ma Tau Kok to North Point for Former Kai Tak Airport Development

Customer Name : Gammon Construction Limited

Contract No. : N/A
 Works Order No. : N/A
 Lab. Sample Ref. No. : 21240/1-10

Test Result

Sample ID	Interstitial ammonia (mgNH ₃ /L)
VC16 0.90-1.90m	0.11
VC36 1.90-2.90m	Note 1
VC2 1.90-2.90m	0.20
VC3 0.90-1.90m	0.92
VC2A 2.90-5.90m	0.03
VC1A 2.90-5.90m	0.17
VC1 0.00-0.90m (dilution test)	3.2
VC1A 0.00-0.90m (dilution test)	<0.03
VC1A 0.90-1.90m (dilution test)	0.94
Reference Sediment	0.58
Detection limit	0.030

Note 1 - Analysis was not performed due to insufficient amount of porewater obtained.


Sample duplicate

Sample ID	Relative deviation (%)
Reference Sediment	-0.4
Control limits	±20% from the mean

Sample Spike

Sample ID	Spike recovery (%)
Reference Sediment	99.1
Control limits	80-120% from the nominal value

End of Report

Data entry checked by: 
 K.Y. Liu / H.W. Wong



Interstitial Salinity

TEST REPORT

Report No. : 107068N
 Project Name : Ground Investigations Works for installation of Submarine Gas Pipeline and Associated Facilities from Ma Tau Kok to North Point for Former Kai Tak Airport Development

Customer Name : Gammon Construction Limited

Customer Address : 28/F Devon House, Taikoo Place, 979 King's Road, Hong Kong.
 Contract No. : N/A
 Works Order No. : N/A


Lab. Job No. : J656
 Lab. Sample Ref. No. : 21240/1-10
 No. of Sample(s) & Description : 10 vibrocore samples received on chilled condition and 9 composite samples & one reference sediment were been tested. as per client's instruction
 Sample Receive Date : 4 Jul to 15 Aug, 2008
 Test Date : 15 August 2008

Test Parameter

Parameter	Test Method
Interstitial salinity	APHA 2502 B

Note(s):
 1. Results related to sample(s) as received.
 2. NA = Not applicable.

Authorized signatory:


 CHEUK Ming
 (Ecotoxicologist)

Issue Date:

24-Sep-2008

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Test report

Report No. : 107068N
 Project Name : Ground Investigations Works for installation of Submarine Gas Pipeline and Associated Facilities from Ma Tau Kok to North Point for Former Kai Tak Airport Development

Customer Name : Gammon Construction Limited

Contract No. : N/A
 Works Order No. : N/A
 Lab. Sample Ref. No. : 21240/1-10

Test Result

Sample ID	Interstitial salinity (ppt)
VC16 0.90-1.90m	32
VC36 1.90-2.90m	Note 1
VC2 1.90-2.90m	32
VC3 0.90-1.90m	33
VC2A 2.90-5.90m	31
VC1A 2.90-5.90m	33
VC1 0.00-0.90m (dilution test)	30
VC1A 0.00-0.90m (dilution test)	32
VC1A 0.90-1.90m (dilution test)	35
Reference sediment	32
Detection limit	NA

Note 1 - Analysis was not performed due to insufficient amount of porewater obtained.


Sample duplicate

Sample ID	Relative deviation (%)
Reference Sediment	0.0
Control limits	±20% from the mean

Standard check

Sample ID	Recovery (%)
Reference standard	97.8
Control limits	80-120% from the nominal value

End of Report

Data entry checked by: 
 K.Y. Liu / H.W. Wong



TOC, Grains Size & Moisture Content

TEST REPORT

Report No. : 107069N
 Project Name : Ground Investigations Works for installation of Submarine Gas Pipeline and Associated Facilities from Ma Tau Kok to North Point for Former Kai Tak Airport Development

Customer Name : Gammon Construction Limited

Customer Address : 28/F Devon House, Taikoo Place, 979 King's Road, Hong Kong.
 Contract No. : N/A
 Works Order No. : N/A

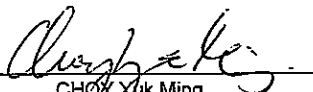
Lab. Job No. : J655
 Lab. Sample Ref. No. : 21240/1-10
 No. of Sample(s) & Description : 10 vibrocore samples received on chilled condition and 9 composite samples & one reference sediment were been tested. as per client's instruction
 Sample Receive Date : 4 Jul to 15 Aug, 2008
 Test Date : 18 to 27 Aug, 2008.

Test Parameter

Parameter	Test Method
Grain size	Geospec 3: Test 8.1
Moisture content	Geospec 3: Test 5.2
Total Organic Carbon	ALS EP-009

- Note(s):
1. Results related to sample(s) as received.
 2. NA = Not applicable.
 3. The TOC samples were subcontracted to ALS Technichem (HK) Pty Ltd.

Authorized signatory: _____


 CHOY Yuk Ming
 (Ecotoxicologist)

Issue Date: _____

24-Sep-2008

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Test report

Report No. : 107069N
 Project Name : Ground Investigations Works for installation of Submarine Gas Pipeline and Associated Facilities from Ma Tau Kok to North Point for Former Kai Tak Airport Development

Customer Name : Gammon Construction Limited

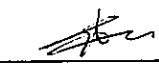
Contract No. : N/A
 Works Order No. : N/A
 Lab. Sample Ref. No. : 21240/1-10

Test Result

Sample ID	Grain Size < 63 mm (%)	Moisture Content ¹ (%)	TOC (% Wet Weight)	TOC (% Dry Weight)
VC16 0.90-1.90m	21	29	0.33	0.43
VC36 1.90-2.90m	99	35	<0.05	<0.05
VC2 1.90-2.90m	87	60	0.42	0.67
VC3 0.90-1.90m	55	41	0.42	0.59
VC2A 2.90-5.90m	48	50	1.7	2.55
VC1A 2.90-5.90m	45	28	0.29	0.37
VC1 0.00-0.90m (dilution test)	91	105	0.96	1.97
VC1A 0.00-0.90m (dilution test)	82	133	0.60	1.40
VC1A 0.90-1.90m (dilution test)	90	122	0.58	1.29
Reference sediment	87	124	0.48	1.08
Detection Limit	NA	NA	0.05	0.1

Note 1. Moisture content is calculated as: (Sample Wet Weight – Sample Dry Weight) / Sample Dry Weight x 100%

End of Report

Data entry checked by: 
 K.Y. Liu / H.W. Wong