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Manitoba Hydro
Phase 3 Toxicity Tests of Groundwater Entering the Red River

Prepared by:
UMA Engineering Ltd.
1479 Buffalo Place
Winnipeg, MB R3T 1L7

UMA Project No. 0217 158 03 07 (4.6.1.1)

May 2007

UMA | AECOM

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May 1, 2007

UMA Project: 0217 158 03 (4.6.1.1)

Mr. Bob Gill, M.N.R.M.
Senior Environmental Specialist
Manitoba Hydro/Centra Gas
820 Taylor Avenue
Winnipeg, Manitoba
R3C 2P4

Dear Bob:

Re: Phase 3 Toxicity Tests of Groundwater Entering the Red River Report

UMA Engineering Ltd. (UMA) is pleased to provide three (3) copies of this report documenting the results of the Phase 3 groundwater toxicity tests at the Sutherland Avenue former Manufactured Gas Plant (MGP) site conducted in November 2006.

Thank you for the opportunity to provide our services on this project. Please do not hesitate to call Mr. Edwin Yee, B.Sc. or Mr. Clifton Samoiloff at (204) 284-0580 should you have any questions regarding this report.

Sincerely,

UMA Engineering Ltd.

Tom Wingrove, P. Eng.
Senior Vice President
Earth and Water
tom.wingrove@uma.aecom.com

PROVINCE OF MANITOBA
T. R. WINGROVE
1/5/07
REGISTERED ENGINEER

Disclaimer

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1.0 Background

This is the third in a series of technical reports documenting studies of groundwater quality entering the Red River adjacent to the former site of a Manufactured Gas Plant (MGP) site in Winnipeg (the Sutherland site). The specific intent of these studies is to evaluate whether contaminants in groundwater occur at concentrations that might result in toxicity to resident or transient fish once the groundwater enters the riverine environment. Trout fry toxicity tests were conducted in the laboratory in April 2005 (Phase 1) and December 2005 (Phase 2) using samples collected from areas of the groundwater plume immediately upgradient from the point of entry into the Red River. Results from the study are presented in UMA reports prepared in June 2005[1] and May 2006[2].

The Phase 1 toxicity testing was undertaken on groundwater samples collected from the existing groundwater monitoring wells MW-23C and D, MW-24D, MW-29B and C, MW-41C and MW-42C. Monitoring wells MW-29, MW-23, MW-24 and MW-42 were inferred to occur within the zone of groundwater contamination, based on earlier site characterization involving the installation of groundwater monitoring wells at key locations downgradient from the site and at points along the river bank (North of Rover Ave.). Piezometer MW-41 was installed in a location that is outside of the zone of groundwater contamination, based on data from groundwater samples collected in 2003, and was selected as a site reference for the laboratory toxicity tests. Each well location included 3 to 4 piezometers, installed at different depths. The samples for toxicity testing were obtained from piezometers representing groundwater depths where the highest PAH concentrations were documented previously. The toxicity test results for the groundwater from the monitoring wells that were inferred to occur within the zone of groundwater contamination exhibited trout fry mortality.

Based on the results of the Phase 1 groundwater toxicity testing, it was determined that the 96-hour trout fry test was acceptable to assess the groundwater toxicity at the Sutherland site (i.e. – the test was sufficiently sensitive given that it employs a sensitive life stage, and any true exposures are likely to be limited in duration since there is no viable spawning or atypically productive foraging habitat in the river adjacent to the groundwater outflow zone). It was further recommended that Phase 2 groundwater testing should be conducted utilizing piezometers installed at locations closer to the groundwater outflow face at the Red River down gradient from MW-42, MW-23, MW-24. This would address the concerns respecting the possible influence of local soil conditions, especially the heterogeneous presence of free-phase hydrocarbons in soil, on groundwater quality and also utilize groundwater more representative of the groundwater/river interface.

For the Phase 2 groundwater toxicity testing program, new groundwater monitoring wells MW-05-46, MW-05-47, MW-05-48 and MW-05-49 were installed closer to the Red River. There was evidence of free-phase hydrocarbons in the soil at MW-05-48; however, the groundwater results were significantly lower than the groundwater chemistry results from Phase 1. With the exception of MW-05-48, no fry mortality was observed at 100% or lower groundwater concentrations. No fry mortality was noted at a sample concentration of 56% or lower groundwater concentrations for MW-05-48. The lowest estimated 96-h trout fry LC_{50} from toxicity tests conducted on groundwater samples collected immediately adjacent to the river was 83% of the full strength of groundwater. The results suggest that the groundwater entering the Red River from beneath the former Sutherland MGP site will not be acutely toxic to sensitive life stages of

[1] UMA, 2005. Phase 1 Toxicity Tests of Groundwater Entering the Red River.

[2] UMA, 2006. Phase 2 Toxicity Tests of Groundwater Entering the Red River.

fish based on mixing within the hyporheic zone and within the riverine environment immediately adjacent to the river bed and effective groundwater outflow face.

2.0 Scope of Work

Manitoba Hydro contracted UMA to undertake toxicity testing of groundwater entering the Red River in support of their Remedial Monitoring Program at the former Manufactured Gas Plant located at 35 – 38 Sutherland Avenue in Winnipeg, Manitoba. Based on the results of the previous Phase 1 and Phase 2 toxicity testing studies, it was recommended that another phase of groundwater toxicity testing be conducted to address the temporal trends of non-aqueous phase liquids (NAPL) accumulations and dissolved concentrations in the groundwater. The following work was performed in the Phase 3 toxicity testing of groundwater entering the Red River:

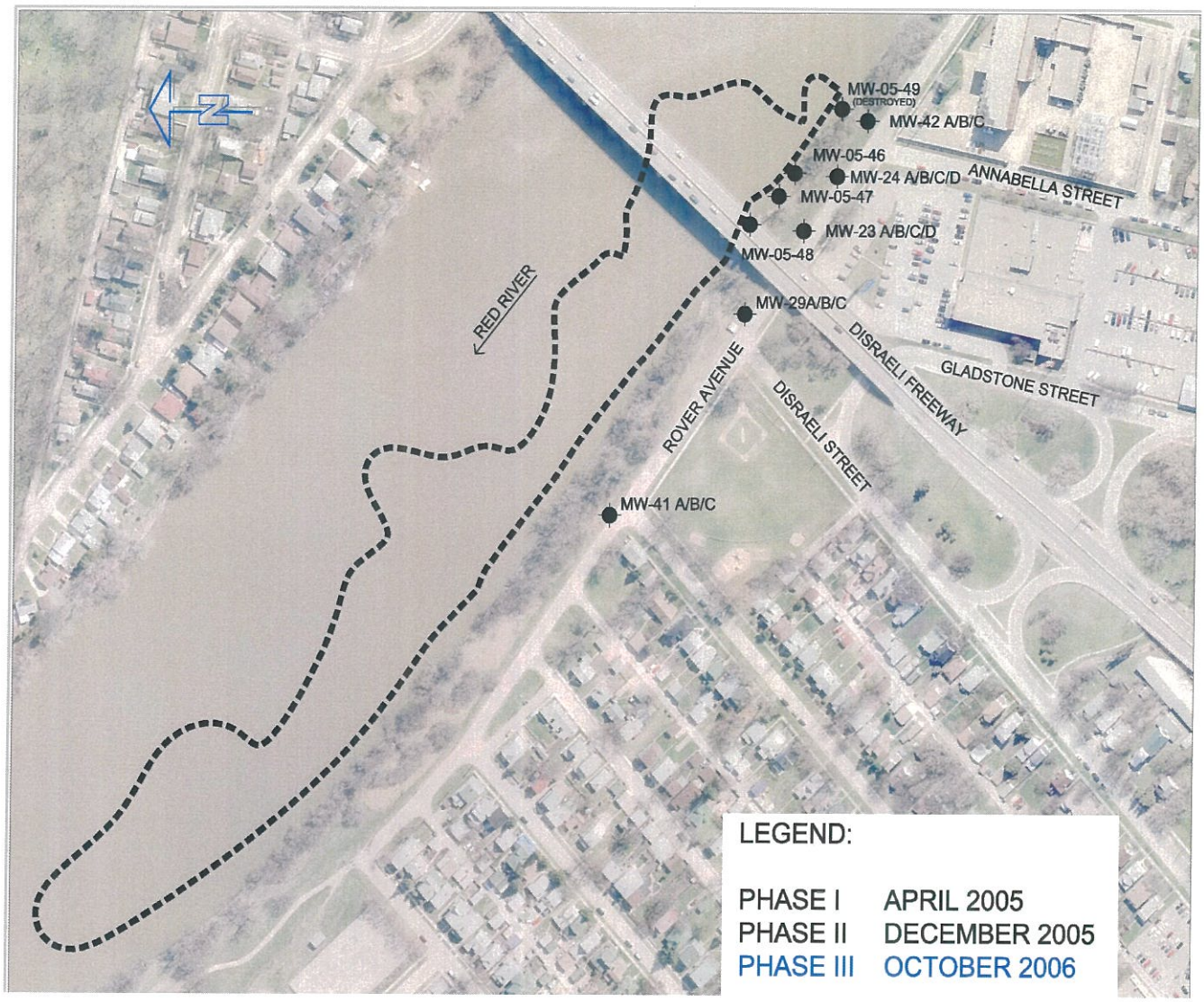
- The collection of groundwater samples from piezometers installed during Phase 2 of this study;
- Conducting 96-hour trout fry toxicity tests on three groundwater samples (MW05-46, MW05-47 and MW05-48) over a range of concentrations (MW-05-49 could not be sampled as it was destroyed possibly by ice scouring);
- Provide a report assessing the results and recommend any follow-up action if required.

3.0 Methodology

3.1 Groundwater Sampling

During Phase 1, groundwater samples were collected from existing monitoring wells MW-23C/D, MW-24D, MW-29B/C, MW-41C and MW-42C (Figure 1). New monitoring wells MW-05-46, MW-05-47, MW-05-48 and MW-05-49 were installed for Phase 2 of this study. Groundwater was collected and tested for PAHs and BTEX, and 96 hour trout fry toxicity.

Figure 1: Monitoring Well Locations



On October 31, 2006, 40 litres of groundwater sample was collected from each of the monitoring wells MW05-46, MW05-47 and MW05-48 for toxicity testing. A groundwater sample from monitoring well MW-05-49 could not be collected as the monitoring well was destroyed. Samples were collected in new 40 L flexible plastic water containers. Containers were rinsed prior to sample collection with de-ionized water, followed by a second rinse with sample water. Following collection of the 40 litre samples, the containers were immediately placed in coolers (containing frozen ice packs to keep the sample cool during shipment and storage), and shipped via overnight courier to CanTest Laboratories (formerly Vizon Scitec) in Vancouver, BC, for 96-hour acute toxicity testing using Rainbow Trout fry.

Separate groundwater samples were collected in laboratory supplied sample collection containers from each of the monitoring wells and sent to ASL Laboratories in Winnipeg for analysis of benzene, toluene, ethylbenzene and xylenes (BTEX) and PAHs.

3.2 Toxicity Testing

Each groundwater sample was tested using the undiluted test sample (100%), and sample diluted in a series of sample concentrations ranging from 56% to 10% of the groundwater concentration. Each sample was diluted in synthetic dilution water prepared from dechlorinated Vancouver tap water and hardened with the addition of chemicals (EDTA Hardness: 18 mg/L $CaCO_3$/L).

Toxicity tests were conducted in accordance with Environment Canada methodology (*2000: Reference Method for Determining Acute Lethality of Effluent to Rainbow Trout, EPS 1/RM/13,Second Edition, December 2000*). It should be noted that the fish loading density used for the toxicity testing was 0.74 g fish mass/L and not the Environment Canada prescribed 0.5 g/L loading density. Cantest Ltd. have confirmed the fish weight variation was due to the natural variation in growth rate and noted that the United States Environmental Protection Agency (USEPA) maximum loading density is 1.1 g/L for fish tests done at 15°C and the Organization for Economic Cooperation and Development (OECD) maximum loading density is 1.0 g/L for acute static fish tests. Based on the above, Cantest Ltd. has confirmed the test results are valid and representative of the acute lethality to Rainbow Trout. The sensitivity of the fish was further confirmed based on response to the reference toxicant that was within the expected range.

4.0 Results

Groundwater samples were collected from the study monitoring wells and sent to ALS Laboratory Group in Winnipeg for chemical analysis. A summary of the test results of the groundwater for BTEX and PAHs is provided in Table 1 The detailed laboratory results are provided in Appendix A.

Table 1: Summary of Groundwater Results for BTEX and PAHs

Groundwater BTEX and PAHs (µg/L)				
Parameter/Monitoring Well	**MW-05-46**	**MW-05-47**	**MW-05-48**	**Guideline[1]**
Benzene	88	<0.5	**530**	**370**
Toluene	**24[3]**	<0.5	**500**	**2**
Ethylbenzene	22	0.7	**460**	**90**
Xylenes	22	4.5	580	
Acridine	<0.01	<0.01	0.8[2]	**4.4**
Benzo(a)anthracene	**0.17**	**0.38**	**33**	**0.018**
Benzo(b)fluoranthene	0.23	0.81	35	
Benzo(k)Fluoranthene	0.05	0.19	9.7	
Benzo(a)pyrene	**0.22**	**0.83**	**39**	**0.015**
Fluoranthene	**0.41**	**0.65**	**92**	**0.04**
Dibenzo(ah)anthracene	0.04	0.15	5.3	
Indeno(1,2,3cd)pyrene	0.22	0.67	28	
Pyrene	**0.37**	**1.0**	**130**	**0.025**
Qinoline	<0.01	<0.01	<1[2]	**3.4**
Naphthalene	0.86	0.08	**8,600**	**1.1**

1 – Canadian Council of Ministers of the Environment (CCME) Freshwater Aquatic Life
2 – Detection Limit Adjustment for Sample Matrix Effects
3 – Results that exceed the CCME guideline are highlighted in bold and in a yellow-shaded cell.

During the installation of the monitoring wells in Phase 2, free product was noted in MW-05-47 (LNAPL). Free product was also noted in MW-05-48, at the bottom of the piezometer (DNAPL). The groundwater chemistry results were compared to the Canadian Council of Ministers of the Environment (CCME) Environmental Quality Guidelines for the protection of Freshwater Aquatic Life. The Phase 3 MW-05-48 groundwater results for benzene, ethylbenzene and toluene and exceed the applicable guidelines. All of the other groundwater benzene, toluene and ethylbenzene results, with the exception of the toluene result for MW-05-46, were below the available applicable guidelines. There is no Freshwater Aquatic Life guideline for xylenes. Groundwater results for benzo(a)anthracene, benzo(a)pyrene, fluoranthene and pyrene exceed the applicable guidelines for all three of the monitoring wells. The MW-05-48 groundwater result for naphthalene also exceeds the applicable guideline.

Groundwater samples were collected from the study monitoring wells and sent to Can Test Laboratories (formerly Vizon Scitec) in Vancouver, B.C, for the 96-hour acute toxicity testing using Rainbow Trout. Table 2 provides a summary of the toxicity of the groundwater samples collected from the Sutherland Site to rainbow trout fry based on 96-h (4 d) exposures in static test systems. The groundwater samples were tested at 100% strength and at diluted strength (56%, 32%, 18%, and 10% along a roughly geometric

series, using as a diluent, Vancouver tap water hardened and dechlorinated. Detailed laboratory results are presented in Appendix A.

No mortality was observed in any replicates of fish exposed to each of the undiluted tests samples and all sample dilutions. None of the exposed fish displayed any abnormal swimming behaviour in any of the tested samples, and no mortality or abnormal behaviour was observed in fish exposed to the control sample.

Table 2: Summary of Phase III Sutherland Site Groundwater Toxicity Results (average number of dead fry at 96 h, out of 10)

Well/ Sample ID	MW05-46	MW05-47	MW05-48
Sample Concentration (%v/v)			
0%	0	0	0
10%	0	0	0
18%	0	0	0
32%	0	0	0
56%	0	0	0
100%	0	0	0
96-h Estimated LC50: %v/v (95% lower and upper CL)	**>100**	**>100**	**>100**

5.0 Discussion

Toxicity testing conducted in Phase 1 of the study indicated that groundwater samples from MW-23C and D, and MW-24D, in their undiluted form, were acutely toxic to rainbow trout fry over a 96-h period. At test initiation, the fish exposed to groundwater from MW-23C appeared to be stressed; i.e., exhibited rapid gill movement in all concentrations. In the top 3 concentrations (100%, 56%, 32%), there was loss of equilibrium, some fry were lying on the bottom, and in the 100% test units they appeared dead. All control fish appeared and behaved normally during the test. Similar results were noted when fish were exposed to groundwater samples from MW-23D and MW-24D, but with less severity. Monitoring wells MW-29, MW-23, MW-24 and MW-42 were inferred to occur within the zone of groundwater contamination, based on earlier site characterization involving the installation of groundwater monitoring wells at key locations down gradient from the site and at points along the river bank (west of Rover Ave.).

Based on the results of the Phase 1 groundwater toxicity testing, it was determined that the 96-hour trout fry test was acceptable to assess the groundwater toxicity at the Sutherland site and that Phase 2 groundwater testing should be conducted utilizing piezometers installed closer to the Red River down gradient from MW-42, MW-23 and MW-24.

For Phase 2 of this study, monitoring wells MW-05-46, -47, -48 and -49 were established on the bank of the Red River within the flood zone, and at a point intended to better reflect actual groundwater introductions to the riverine environment. There was evidence of free-phase hydrocarbons in soil (coal tar) at MW-05-48, but not the other three locations. In MW-05-48 naphthalene was observed in the soil sample from 3 m depth at a concentration of 200 mg/kg and benzo(a)pyrene was present at 5.2 mg/kg. The piezometer placed in this borehole was also observed to accumulate coal tar. The groundwater results for benzene, toluene, ethylbenzene, acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, fluoranthene, fluorene, naphthalene, phenanthrene and pyrene exceeded the Freshwater Aquatic Life guidelines.

Toxicity testing conducted in Phase 2 of the study indicated no fry mortality in samples MW-05-46, MW-05-47 and MW-05-49. However, mortality was observed in the undiluted sample from MW-05-48 (calculated LC50 of 83.3%).

For the sample from MW-05-48, no fry mortality was noted at a sample concentration of 56% or lower groundwater concentrations. In other words, a dilution between the groundwater and uncontaminated reference water of ≥44 parts: 56 parts river water: groundwater is predicted to result in mortality of less than 50% of fry over a 96-h exposure period. The 96-h LC50 estimate for MW-05-48 was 83.3% groundwater strength (95% Confidence Limits: 56%, 100%).

Phase 3 of groundwater toxicity testing was conducted to address the temporal trends of non-aqueous phase liquids (NAPL) accumulations and dissolved concentrations in the groundwater. A groundwater sample could not be collected from MW-05-49 as this well was destroyed. NAPL was not found in any of the groundwater samples. Although the Phase 2 results for MW-05-49 exhibited no trout fry mortality, this well should be replaced as the water chemistry results indicated some PAH and benzene and toluene values exceeding the Freshwater Aquatic Life guidelines. The results of the Phase 3 toxicity testing conducted in this study indicate that there is no mortality in fish exposed to samples MW-05-46, MW-05-47 and MW-05-48. These results suggest that groundwater entering the Red River from beneath the Site, at the time of sample collection; will not be acutely toxic to sensitive life stages of fish (to the extent that rainbow trout swim-up fry are at least as sensitive as any other potentially exposed fish species).

For the Phase 3 testing, it was noted that the groundwater chemistry data exhibited higher concentrations of PAHs than the Phase 2 groundwater samples, while the Phase 2 MW-05- 47 and MW-05-48 groundwater samples exhibited higher benzene concentrations. The difference in biological response might be attributed to the difference in benzene concentrations, with PAHs having a lesser contribution to toxicity in the 96-hour acute toxicity testing.

6.0 Conclusions

The results of the Phase 3 groundwater toxicity testing suggest that groundwater entering the Red River from beneath the former MGP site will not be acutely toxic to sensitive life stages of fish (to the extent that rainbow trout swim-up fry are at least as sensitive as any other potentially exposed fish species). The Phase 1 and Phase 2 groundwater toxicity studies identified non-aqueous phase liquid (NAPL) in monitoring wells MW-23C, MW-24D, MW-05-47 and MW-05-48, while NAPL was not identified in any of the Phase 3 groundwater samples. The results of the groundwater chemistry for Phase 3 show a reduction in benzene concentrations while PAH concentrations were higher. The presence of NAPL and groundwater chemistry appears to be variable between sampling events.

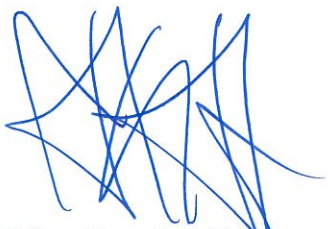
7.0 Recommendations

Based on the toxicity testing studies, it is clear that groundwater chemistry can vary between sampling events and the results of the toxicity testing are difficult to correlate with groundwater chemistry results. The following recommendations should be considered:

- Monitoring well MW-05-49 should be re-established;
- Groundwater monitoring of the wells along the river bank for BTEX and PAHs should be continued as part of the Remedial Monitoring Program; and
- Toxicity testing of groundwater to establish the temporal trends of NAPL accumulations and dissolved concentrations in the groundwater and their toxicity to sensitive life stages of fish.

Respectfully Submitted,

UMA Engineering Ltd.



Clifton Samoiloff, B.Sc.
Senior Environmental Scientist
Earth and Water

Reviewed By:

Edwin Yee, B.Sc.
Environmental Specialist
Earth and Water

Appendix A
Laboratory Reports

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

ANALYTICAL REPORT

UMA ENGINEERING
ATTN: ANDREA HACHKOWSKI
1479 BUFFALO PLACE
WINNIPEG MB R3T 1L7

Reported On: 30-APR-07 01:42 PM

Lab Work Order #: L449423 **Date Received:** 31-OCT-06

Project P.O. #:
Job Reference:
Legal Site Desc:
CofC Numbers:

Other Information:

Comments:

APPROVED BY:
GERRY VERA
Project Manager

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L449423-1	MW - 46								
Sampled By:	M.R. on 31-OCT-06								
Matrix:	Water								
BTEX									
	Benzene	0.088		0.0005	mg/L		01-NOV-06	TJJ	R461627
	Toluene	0.024		0.0005	mg/L		01-NOV-06	TJJ	R461627
	Ethylbenzene	0.022		0.0005	mg/L		01-NOV-06	TJJ	R461627
	m+p-Xylenes	0.014		0.0005	mg/L		01-NOV-06	TJJ	R461627
	o-Xylene	0.0080		0.0005	mg/L		01-NOV-06	TJJ	R461627
	Xylenes	0.022		0.0005	mg/L		01-NOV-06	TJJ	R461627
L449423-2	MW - 47								
Sampled By:	M.R. on 31-OCT-06								
Matrix:	Water								
BTEX									
	Benzene	<0.0005		0.0005	mg/L		01-NOV-06	TJJ	R461627
	Toluene	<0.0005		0.0005	mg/L		01-NOV-06	TJJ	R461627
	Ethylbenzene	0.0007		0.0005	mg/L		01-NOV-06	TJJ	R461627
	m+p-Xylenes	0.0035		0.0005	mg/L		01-NOV-06	TJJ	R461627
	o-Xylene	0.0010		0.0005	mg/L		01-NOV-06	TJJ	R461627
	Xylenes	0.0045		0.0005	mg/L		01-NOV-06	TJJ	R461627
L449423-3	MW - 48								
Sampled By:	M.R. on 31-OCT-06								
Matrix:	Water								
BTEX									
	Benzene	0.53		0.0005	mg/L		01-NOV-06	TJJ	R461627
	Toluene	0.50		0.0005	mg/L		01-NOV-06	TJJ	R461627
	Ethylbenzene	0.46		0.0005	mg/L		01-NOV-06	TJJ	R461627
	m+p-Xylenes	0.37		0.0005	mg/L		01-NOV-06	TJJ	R461627
	o-Xylene	0.21		0.0005	mg/L		01-NOV-06	TJJ	R461627
	Xylenes	0.58		0.0005	mg/L		01-NOV-06	TJJ	R461627

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
BTX-WP	Water	BTEX		EPA SW846,5030,8015

Volatile organic compounds are extracted (purged) by bubbling nitrogen through a water sample. The purged sample components are trapped in a tube containing a sorbent material. When purging is complete, the tube is heated and back flushed with helium to desorb the trapped compounds onto a gas chromatographic column. The gas chromatograph is temperature programmed to separate the method analytes which are then detected with a photoionization detector (PID) followed by a flame ionization detector (FID).

** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

Chain of Custody numbers:

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
WP	ALS LABORATORY GROUP - WINNIPEG, MANITOBA, CANADA		

GLOSSARY OF REPORT TERMS
Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds. The reported surrogate recovery value provides a measure of method efficiency. The Laboratory control limits are determined under column heading D.L.
mg/kg (units) - unit of concentration based on mass, parts per million.
mg/L (units) - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
UNLESS OTHERWISE STATED, SAMPLES ARE NOT CORRECTED FOR CLIENT FIELD BLANKS.
Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.

ALS Laboratory Group
ANALYTICAL CHEMISTRY & GEOCHEMISTRY SERVICES
12 - 1329 Niakwa Road East
Winnipeg, Manitoba, Canada R2J 3T4
Tel: (204) 255-9720
Fax: (204) 255-9721
Toll Free: 1-800-607-7555

CHAIN OF CUSTODY / ANALYTICAL REQUEST FORM

DATE SUBMITTED: 02/31/06 DATE REQUIRED:

[redacted]

PRICING (CHECK ONE)
AS PER QUOTE #: [redacted] ☐
AS PER LIST PRICE: ☐

ANALYSIS REQUESTED:

[redacted]

SAMPLE ID	SAMPLED BY	DATE / TIME SAMPLED	SAMPLE TYPE	[redacted]	SAMPLE RECEIVED (Y OR N)	SAMPLE BROKEN (Y OR N)	LAB SAMPLE NO.
MW 46	[redacted]	02/31/06	Water	X			1
MW 47				X			2
MW 48				X			3
			PRESERVED / FILTERED				

NOTES & CONDITIONS:
1. Quote number must be provided to ensure proper pricing.
2. All hazardous samples submitted must be labeled in accordance with WHMIS regulations. This must include the nature of the hazard, as well as a contact name and phone number that the lab can contact for further information.
3. ALS's liability limited to cost of analysis.

NOTE: Failure to properly complete all portions of this form may delay analysis.

[redacted]

NO. SAMPLES SUBMITTED: 3

NO. BOTTLES/CARTONS: 3

[redacted]

E-MAIL: YES ☐ NO ☐

E-MAIL ADDRESS:

P.O. NO:

JOB NO:

RELINQUISHED BY:	DATE / TIME	RECEIVED BY:	DATE / TIME
[redacted]	02/31/06 2:00	ALS Lab	10/3/06 13:55
RELINQUISHED BY:	DATE / TIME	RECEIVED BY:	DATE / TIME
		ALS Lab	

SAMPLE CONDITION UPON RECEIPT: ☐ ACCEPTABLE ☐ NON ACCEPTABLE

FROZEN: COOL: AMBIENT:

OTHER (BREAKAGE, LEAKAGE, ETC.):

WHITE - File Copy
GREEN - Final Report
PINK - Invoice
BLUE - Client Support
YELLOW - Customer

REV. OCT. / 2006

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

ANALYTICAL REPORT

UMA ENGINEERING
ATTN: MARK RODDY / EDWIN YEE
1479 BUFFALO PLACE
WINNIPEG MB R3T 1L7

Reported On: 04-APR-07 08:53 AM

Lab Work Order #: L453530 **Date Received:** 14-NOV-06

Project P.O. #: NO CHARGE
Job Reference: 0217-158-03
Legal Site Desc:
CofC Numbers:

Other Information:

Comments:

APPROVED BY: Paul Nicolas
PAUL NICOLAS
Project Manager

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L453530-4 MW-05-46								
Sampled By: MR on 13-NOV-06								
Matrix: WATER								
PAH CCME								
Acridine	<0.00001		0.00001	mg/L	15-NOV-06	15-NOV-06	JAP	R465847
Benzo(a)anthracene	0.00017		0.00001	mg/L	15-NOV-06	15-NOV-06	JAP	R465847
Benzo(b)fluoranthene	0.00023		0.00001	mg/L	15-NOV-06	15-NOV-06	JAP	R465847
Benzo(k)fluoranthene	0.00005		0.00001	mg/L	15-NOV-06	15-NOV-06	JAP	R465847
Benzo(a)pyrene	0.00022		0.00001	mg/L	15-NOV-06	15-NOV-06	JAP	R465847
Fluoranthene	0.00041		0.00001	mg/L	15-NOV-06	15-NOV-06	JAP	R465847
Dibenzo(ah)anthracene	0.00004		0.00001	mg/L	15-NOV-06	15-NOV-06	JAP	R465847
Indeno(1,2,3 cd)pyrene	0.00022		0.00001	mg/L	15-NOV-06	15-NOV-06	JAP	R465847
Pyrene	0.00037		0.00001	mg/L	15-NOV-06	15-NOV-06	JAP	R465847
Quinoline	<0.00001		0.00001	mg/L	15-NOV-06	15-NOV-06	JAP	R465847
Naphthalene	0.00086		0.00005	mg/L	15-NOV-06	15-NOV-06	JAP	R465847
Surr: 2-Fluorobiphenyl Surr	83		25-175	%	15-NOV-06	15-NOV-06	JAP	R465847
Surr: Terphenyl Surr	83		25-175	%	15-NOV-06	15-NOV-06	JAP	R465847
L453530-5 MW-05-47								
Sampled By: MR on 13-NOV-06								
Matrix: WATER								
PAH CCME								
Acridine	<0.00001		0.00001	mg/L	15-NOV-06	16-NOV-06	JAP	R465847
Benzo(a)anthracene	0.00038		0.00001	mg/L	15-NOV-06	16-NOV-06	JAP	R465847
Benzo(b)fluoranthene	0.00081		0.00001	mg/L	15-NOV-06	16-NOV-06	JAP	R465847
Benzo(k)fluoranthene	0.00019		0.00001	mg/L	15-NOV-06	16-NOV-06	JAP	R465847
Benzo(a)pyrene	0.00083		0.00001	mg/L	15-NOV-06	16-NOV-06	JAP	R465847
Fluoranthene	0.00065		0.00001	mg/L	15-NOV-06	16-NOV-06	JAP	R465847
Dibenzo(ah)anthracene	0.00015		0.00001	mg/L	15-NOV-06	16-NOV-06	JAP	R465847
Indeno(1,2,3 cd)pyrene	0.00067		0.00001	mg/L	15-NOV-06	16-NOV-06	JAP	R465847
Pyrene	0.0010		0.00001	mg/L	15-NOV-06	16-NOV-06	JAP	R465847
Quinoline	<0.00001		0.00001	mg/L	15-NOV-06	16-NOV-06	JAP	R465847
Naphthalene	0.00008		0.00005	mg/L	15-NOV-06	16-NOV-06	JAP	R465847
Surr: 2-Fluorobiphenyl Surr	80		25-175	%	15-NOV-06	16-NOV-06	JAP	R465847
Surr: Terphenyl Surr	83		25-175	%	15-NOV-06	16-NOV-06	JAP	R465847
L453530-6 MW-05-48								
Sampled By: MR on 13-NOV-06								
Matrix: WATER								
PAH CCME								
Acridine	0.0008	DLM	0.0001	mg/L	15-NOV-06	17-NOV-06	JAP	R465847
Benzo(a)anthracene	0.033		0.00001	mg/L	15-NOV-06	17-NOV-06	JAP	R465847
Benzo(b)fluoranthene	0.035		0.00001	mg/L	15-NOV-06	17-NOV-06	JAP	R465847
Benzo(k)fluoranthene	0.0097		0.00001	mg/L	15-NOV-06	17-NOV-06	JAP	R465847
Benzo(a)pyrene	0.039		0.00001	mg/L	15-NOV-06	17-NOV-06	JAP	R465847
Fluoranthene	0.092		0.00001	mg/L	15-NOV-06	17-NOV-06	JAP	R465847
Dibenzo(ah)anthracene	0.0053		0.00001	mg/L	15-NOV-06	17-NOV-06	JAP	R465847
Indeno(1,2,3 cd)pyrene	0.028		0.00001	mg/L	15-NOV-06	17-NOV-06	JAP	R465847
Pyrene	0.13		0.00001	mg/L	15-NOV-06	17-NOV-06	JAP	R465847
Quinoline	<0.001	DLM	0.001	mg/L	15-NOV-06	17-NOV-06	JAP	R465847
Naphthalene	8.6		0.00005	mg/L	15-NOV-06	17-NOV-06	JAP	R465847
Surr: 2-Fluorobiphenyl Surr	84		25-175	%	15-NOV-06	17-NOV-06	JAP	R465847
Surr: Terphenyl Surr	80		25-175	%	15-NOV-06	17-NOV-06	JAP	R465847

Reference Information

Sample Parameter Qualifier key listed:

Qualifier	Description
DLM	Detection Limit Adjustment For Sample Matrix Effects

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
PAH-CCME-WP	Water	PAH CCME		EPA SW846 8270B Sep 1994,3510B Sep 1992

Samples are stored in the dark at 4 degrees C until extraction. Samples are partitioned at basic and acidic pH with dichloromethane, concentrated and esterified (if run in conjunction with pentachlorophenol).
Extracts are analyzed by Gas Chromatography / Mass Spectrometry in the selected ion monitoring mode.

** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

Chain of Custody numbers:

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
WP	ALS LABORATORY GROUP - WINNIPEG, MANITOBA, CANADA		

GLOSSARY OF REPORT TERMS
Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds. The reported surrogate recovery value provides a measure of method efficiency. The Laboratory control limits are determined under column heading D.L.
mg/kg (units) - unit of concentration based on mass, parts per million.
mg/L (units) - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
UNLESS OTHERWISE STATED, SAMPLES ARE NOT CORRECTED FOR CLIENT FIELD BLANKS.
Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
12 - 1329 Niakwa Road East
Winnipeg, Manitoba, Canada R2J 3T4
Tel: (204) 255-9720
Fax (204) 255-9721
Toll Free: 1-800-607-7555

CHAIN OF CUSTODY
ANALYTICAL REQUEST FORM

analysis to be completed at the labs cost due to lab error - MR.

DATE SUBMITTED: Nov 13/06 DATE REQUIRED: ASAP

PRICING (CHECK ONE):
AS PER QUOTE #:
AS PER LIST PRICE:

ANALYSIS REQUESTED

SAMPLE ID	SAMPLED BY	DATE / TIME SAMPLED	*SAMPLE TYPE														LAB SAMPLE
MW-42A	MR	Nov 13/06		X													1
MW-42B				X													2
MW-42C				X													3
MW-05-46				X													4
MW-05-47				X													5
MW-05-43				X													6
MW-05-53B				X													7
MW-05-54B				X													8
MW-05-53B				X													9
MW-05-52B				X													10
MW-05-50B				X													11
MW-05-51A				X													12
MW-06-61A			PRESERVED / FILTERED	X													13

SAMPLE RECEIVED (Y OR N)
SAMPLE BROKEN (Y OR N)

L45

NOTES & CONDITIONS:
1. Obtain number must be provided to ensure proper pricing.
2. All hazardous samples submitted must be labeled to comply with WHMIS regulations. This must include the nature of the hazard, as well as a contact name and phone number that the lab can contact for further information.
3. ALS's liability limited to cost of analysis.

NOTE: Failure to properly complete all portions of this form may delay analysis

14/06

NO. SAMPLES SUBMITTED:

NO. BOTTLES/SAMPLES:

E-MAIL: YES ☐ NO ☐

E-MAIL ADDRESS:

P.O. NO.:

RELINQUISHED BY:	DATE: Nov 14/06	RECEIVED BY:	DATE: Nov
	TIME: 3:30	ALS LAB:	TIME: 11:
RELINQUISHED BY:	DATE:	RECEIVED BY:	DATE:
	TIME:	ALS LAB:	TIME:

SAMPLE CONDITION UPON RECEIPT: ☐ ACCEPTABLE ☐ NON ACCEPTABLE

FROZEN: COOLED: AMBIENT:

OTHER (BREAKAGE, LEAKAGE, ETC.):

WHITE - Fi
GREEN - Fi
PINK - Im
BLUE - Cl
YELLOW - Cu

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

12 - 1329 Niakwa Road East
Winnipeg, Manitoba, Canada R2J 3T4
Tel: (204) 255-9720
Fax (204) 255-9721
Toll Free: 1-800-607-7555

CHAIN OF CUSTODY
ANALYTICAL REQUEST FORM

DATE SUBMITTED: Nov. 13/06 DATE REQUIRED: ASAP

PRICING (CHECK ONE):
AS PER QUOTE #: ☐
AS PER LIST PRICE: ☐

ANALYSIS REQUESTED:

PAH's

SAMPLE RECEIVED (Y OR N)
SAMPLE BROKEN (Y OR N)

L45353

SAMPLE ID	SAMPLED BY	DATE / TIME SAMPLED	SAMPLE TYPE		LAB SAMPLE
MW-06-62A	MK	Nov. 7 '06	water	X	14
MW-06-62B				X	15
MW-06-62C				X	16
MW-06-63A				X	17
MW-06-63C				X	18
MW-06-58B				X	19
			PRESERVED		
			ROTRED		

NOTES & CONDITIONS:
1. Quote number must be provided to ensure proper pricing.
2. All hazardous samples submitted must be labeled to comply with WHMIS regulations. This must include the nature of the hazard, as well as a contact name and phone number that the lab can contact for further information.
3. ALS's liability limited to cost of analysis.

NOTE: Failure to properly complete all portions of this form may delay analysis

NO. SAMPLES SUBMITTED:
NO. BOTTLES/SAMPLE:
E-MAIL: YES ☐ NO ☐
E-MAIL ADDRESS:
P.O. NO.:

RELINQUISHED BY:	DATE: Nov. 14/06	RECEIVED BY:	DATE: NOV
MK	TIME: 3:30		TIME: 11:
RELINQUISHED BY:	DATE:	RECEIVED BY:	DATE:
	TIME:	ALS LAB:	TIME:

SAMPLE CONDITION UPON RECEIPT: ☐ ACCEPTABLE ☐ NON ACCEPTABLE
FROZEN: COLD: AMBIENT:
OTHER (BREAKAGE, LEAKAGE, ETC.):

WHITE - Fi
GREEN - Fi
PINK - In
BLUE - Cl
YELLOW - Cu

UMA Engineering Ltd.
Winnipeg
W46 A&B- Peristaltic Pump- Grab

Rainbow Trout Bioassay
96-h LC50 %v/v: >100%

CANTEST Ltd.
3650 Wesbrook Mall
Vancouver, BC
Canada V6S 2L2
tel: 604 224 4331
fax: 604 224 0540
web: http://cantest.com

Cantest Sample # : 061101K-01			Report # : 2-11-200-134-06-001
Sample Taken:	Oct. 31, 2006 9:00 AM	Sample pH:	6.9
Sample Collected By:	Mark Reddy	Sample Dissolved Oxygen:	1.8 mg/L
Sample Received:	Nov. 1, 2006	Sample Temperature:	13.6 °C
Start Date/Time:	Nov. 2, 2006 4:10 PM	Sample Conductance:	1801 µmho/cm

Conc. (%v/v)	Cond. (µmho/cm)	Temp. Initial (°C)	Temp. Final (°C)	pH Initial	pH Final	D.O. Initial (mg/L)	D.O. Final (mg/L)	Percent Mortality 24 hr	48 hr	72 hr	96 hr	Number of Mortalities
0	53	14.5	14.8	7.5	7.4	10.3	9.2	0	0	0	0	0
10	289	14.4	14.8	7.7	8.1	10.7	9.8	0	0	0	0	0
18	389	14.2	14.9	7.4	8.1	10.3	8.9	0	0	0	0	0
32	669	14.2	15.0	7.5	8.5	10.2	9.6	0	0	0	0	0
56	1100	14.2	14.8	7.5	8.3	9.8	9.5	0	0	0	0	0
100	1814	14.1	14.8	7.2	8.3	8.4	9.8	0	0	0	0	0

Comments:
At 24 hours the fish in the 10%, 32%, 56% & 100% concentrations were swimming very fast. All fish appeared and behaved normally during the remainder of the test.

Test Conditions:

Organisms per Replicate:	10	Preaeration Time:	110 min.
Test Volume:	15 L	Rate of aeration:	6.5 ml/min/L
Loading Density:	0.74 g/L		

Test Organism: Rainbow Trout (*Oncorhynchus mykiss*)

Weight (Mean + SD):	1.11 ± 0.43 g	Length (Mean + SD):	4.8 ± 0.5 cm
Weight (Range):	0.53– 2.12 g	Length (Range):	3.9– 5.7 cm

Reference Toxicant: Phenol
Test was conducted on: 10/27/2006
Test gave a 96-h LC50 of 9.65 (8.34, 10.9) mg/L

Dilution Water: Vancouver Tapwater hardened and dechlorinated
EDTA Hardness: 18 mg $CaCO_3$/L Other parameters available on request

Test Method: Biological Test Method: Reference Method for Determining Acute Lethality of Effluent to Rainbow Trout, EPS 1/RM/13, Second Edition, December 2000.

Analyst **Verified By**

V. Comeau J. Pickard

UMA Engineering Ltd.
Winnipeg
MW47 A&B- Peristaltic Pump- Grab

Rainbow Trout Bioassay
96-h LC50 %v/v: >100%

CANTEST Ltd.
3650 Wesbrook Mall
Vancouver, BC
Canada V6S 2L2
tel: 604 224 4331
fax: 604 224 0540
web: http://cantest.com

Cantest Sample # : 061101K-02 Report # : 2-11-200-134-06-002

Sample Taken:	Oct. 31, 2006 9:00 AM	Sample pH:	6.9
Sample Collected By:	Mark Reddy	Sample Dissolved Oxygen:	<1 mg/L
Sample Received:	Nov. 1, 2006	Sample Temperature:	13.4 °C
Start Date/Time:	Nov. 2, 2006 4:25 PM	Sample Conductance:	2040 µmho/cm

Conc. (%v/v)	Cond. (µmho/cm)	Temp. Initial (°C)	Temp. Final (°C)	pH Initial	pH Final	D.O. Initial (mg/L)	D.O. Final (mg/L)	Percent Mortality 24 hr	48 hr	72 hr	96 hr	Number of Mortalities
0	53	14.5	14.7	7.5	7.5	10.3	9.5	0	0	0	0	0
10	262	14.3	14.7	7.7	8.1	10.0	9.2	0	0	0	0	0
18	464	14.3	14.7	7.5	8.3	9.7	9.5	0	0	0	0	0
32	730	14.2	14.8	7.3	8.4	9.4	9.6	0	0	0	0	0
56	1276	14.0	14.8	7.3	8.4	9.2	9.7	0	0	0	0	0
100	2010	14.1	14.7	7.3	8.1	4.5	8.6	0	0	0	0	0

Comments:
At test initiation the fish in the 100% concentration were gasping for air. All fish appeared and behaved normally during the remainder of the test.

Test Conditions:

Organisms per Replicate:	10	Preaeration Time:	110 min.
Test Volume:	15 L	Rate of aeration:	6.5 ml/min/L
Loading Density:	0.74 g/L		

Test Organism: Rainbow Trout (*Oncorhynchus mykiss*)

Weight (Mean + SD):	1.11 ± 0.43 g	Length (Mean + SD):	4.8 ± 0.5 cm
Weight (Range):	0.53– 2.12 g	Length (Range):	3.9– 5.7 cm

Reference Toxicant: Phenol
Test was conducted on: 10/27/2006
Test gave a 96-h LC50 of 9.65 (8.34, 10.9) mg/L

Dilution Water: Vancouver Tapwater hardened and dechlorinated
EDTA Hardness: 18 mg $CaCO_3$/L Other parameters available on request

Test Method:
Biological Test Method: Reference Method for Determining Acute Lethality of Effluent to Rainbow Trout, EPS 1/RM/13, Second Edition, December 2000.

Analyst **Verified By**

V. Cameau J. Rickard

UMA Engineering Ltd.
Winnipeg
MW48 A&B- Peristaltic Pump- Grab

Rainbow Trout Bioassay
96-h LC50 %v/v: >100%

CANTEST Ltd.
3650 Wesbrook Mall
Vancouver, BC
Canada V6S 2L2
tel: 604 224 4331
fax: 604 224 0540
web: http://cantest.com

Cantest Sample # : 061101K-03 Report # : 2-11-200-134-06-003

Sample Taken:	Oct. 31, 2006 10:30 AM	Sample pH:	7.2
Sample Collected By:	Mark Reddy	Sample Dissolved Oxygen:	3.1 mg/L
Sample Received:	Nov. 1, 2006	Sample Temperature:	13.6 °C
Start Date/Time:	Nov. 2, 2006 4:45 PM	Sample Conductance:	5810 µmho/cm

Conc. (%v/v)	Cond. (µmho/cm)	Temp. Initial (°C)	Temp. Final (°C)	pH Initial	pH Final	D.O. Initial (mg/L)	D.O. Final (mg/L)	Percent Mortality 24 hr	48 hr	72 hr	96 hr	Number of Mortalities
0	53	14.6	14.7	7.5	7.5	10.2	9.3	0	0	0	0	0
10	746	14.3	14.7	7.5	8.1	9.9	8.8	0	0	0	0	0
18	1152	14.3	14.8	7.6	7.9	9.9	7.6	0	0	0	0	0
32	1919	14.3	14.6	7.5	8.2	9.9	9.7	0	0	0	0	0
56	3250	14.1	14.6	7.6	8.2	9.3	9.1	0	0	0	0	0
100	5800	14.2	14.7	7.7	8.1	8.3	7.2	0	0	0	0	0

Comments:
All fish appeared and behaved normally during the test.

Test Conditions:

Organisms per Replicate:	10	Preaeration Time:	130 min.
Test Volume:	15 L	Rate of aeration:	6.5 ml/min/L
Loading Density:	0.74 g/L		

Test Organism: Rainbow Trout (*Oncorhynchus mykiss*)

Weight (Mean + SD):	1.11 ± 0.43 g	Length (Mean + SD):	4.8 ± 0.5 cm
Weight (Range):	0.53– 2.12 g	Length (Range):	3.9– 5.7 cm

Reference Toxicant: Phenol
Test was conducted on: 10/27/2006
Test gave a 96-h LC50 of 9.65 (8.34, 10.9) mg/L

Dilution Water: Vancouver Tapwater hardened and dechlorinated
EDTA Hardness: 18 mg $CaCO_3$/L Other parameters available on request

Test Method: Biological Test Method: Reference Method for Determining Acute Lethality of Effluent to Rainbow Trout, EPS 1/RM/13, Second Edition, December 2000.

Analyst **Verified By**

V. Comeau J. Pickard

BC RESEARCH Inc.

TOXICITY TEST REQUEST SHEET

FOR LAB USE ONLY	PROJECT NUMBER	DATE
	CLIENT	SAMPLE NUMBER

REPORTING AND BILLING INFORMATION

RESULTS TO:		INVOICE TO (IF DIFFERENT):	
NAME	DR. ALEX MAN	NAME	
COMPANY	UMA ENGINEERING	COMPANY	
ADDRESS	1479 BUFFALO PLACE	ADDRESS	
CITY	WINNIPEG	PROVINCE	MB
COUNTRY		POSTAL CODE	R3T 1L7
TELEPHONE	204-284-0580	FAX	

SAMPLE INFORMATION

SAMPLE NAME	MW 96 A&B
SAMPLING METHOD	PERISTALTIC PUMP
SAMPLED BY	MARK REDDY
DATE	Oct. 31/06
TIME	9:00-10:30
CONTAINER TYPE AND NUMBER	2-20L CONTAINERS
SPECIAL INSTRUCTIONS	

TOXICITY TESTS REQUIRED

PROTOCOL		100% SCREEN	LC_X/EC_X	COMMENTS
ACUTE	DAPHNIA MAGNA 48H STATIC ACUTE			
	RAINBOW TROUT 96H STATIC ACUTE	✓		AS PER e-MAIL
	FATHEAD MINNOW 96H ACUTE			
	MICROTOX			
CHRONIC	SALMONID 7D EMBRYO VIABILITY			
	FATHEAD MINNOW 7D SURVIVAL AND GROWTH			
	CERIODAPHNIA DUBIA 7D SURVIVAL AND REPRODUCTION			
	SELENASTRUM GROWTH 72H INHIBITION			
	TOPSMELT 7D SURVIVAL AND GROWTH			
	ECHINODERM FERTILIZATION TEST (SEA URHCINS/SAND DOLLARS)			
	CHAMPIA PARVULA REPRODUCTION			
OTHER				

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: MARK KOODY

RECEIVED BY:

NAME	DATE	TIME	NAME	DATE	TIME
	10/31/06	14:30			

BC Research Inc.
3650 Wesbrook Mall
Vancouver, BC
Canada V6S 2L2
Canada
Tel: (604) 224-4331
Fax: (604) 224-0540
USA
Tel: (360) 738-0958
Fax: (360) 733-3590

Revised March 12, 2002

BC RESEARCH Inc.

TOXICITY TEST REQUEST SHEET

FOR LAB USE ONLY	PROJECT NUMBER	DATE
	CLIENT	SAMPLE NUMBER

REPORTING AND BILLING INFORMATION

RESULTS TO:		INVOICE TO (IF DIFFERENT):	
NAME DR. ALEX MAN		NAME	
COMPANY UMA ENGINEERING		COMPANY	
ADDRESS 1479 BUFFALO PLACE		ADDRESS	
CITY WINNIPEG	PROVINCE MB	CITY	PROVINCE
COUNTRY	POSTAL CODE R3T 1L7	COUNTRY	POSTAL CODE
TELEPHONE 204-284-0580	FAX	TELEPHONE	FAX

SAMPLE INFORMATION

SAMPLE NAME MW 47 A&B	
SAMPLING METHOD PERISTALTIC PUMP	SPECIAL INSTRUCTIONS
SAMPLED BY MARK RODDY	
DATE Oct. 31/06 TIME 9:00-10:30	
CONTAINER TYPE AND NUMBER 2-20L CONTAINERS	

TOXICITY TESTS REQUIRED

PROTOCOL		100% SCREEN	LC_X/EC_X	COMMENTS
ACUTE	DAPHNIA MAGNA 48H STATIC ACUTE			
	RAINBOW TROUT 96H STATIC ACUTE	✓		AS-PER E-MAIL
	FATHEAD MINNOW 96H ACUTE			
	MICROTOX			
CHRONIC	SALMONID 7D EMBRYO VIABILITY			
	FATHEAD MINNOW 7D SURVIVAL AND GROWTH			
	CERIODAPHNIA DUBIA 7D SURVIVAL AND REPRODUCTION			
	SELENASTRUM GROWTH 72H INHIBITION			
	TOPSMELT 7D SURVIVAL AND GROWTH			
	ECHINODERM FERTILIZATION TEST (SEA URHCINS/SAND DOLLARS)			
	CHAMPIA PARVULA REPRODUCTION			
OTHER				

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: MARK RODDY — RECEIVED BY:

NAME	DATE	TIME	NAME	DATE	TIME
	10/31/06	14:30			

BC Research Inc.
3650 Wesbrook Mall
Vancouver, BC
Canada V6S 2L2
Canada
Tel: (604) 224-4331
Fax: (604) 224-0540
USA
Tel: (360) 738-0958
Fax: (360) 733-3590

Revised March 12, 2002

BC RESEARCH Inc.

TOXICITY TEST REQUEST SHEET

FOR LAB USE ONLY	PROJECT NUMBER	DATE
	CLIENT	SAMPLE NUMBER

REPORTING AND BILLING INFORMATION

RESULTS TO:		INVOICE TO (IF DIFFERENT):	
NAME	DR. ALEX MAN	NAME	
COMPANY	UMA ENGINEERING	COMPANY	
ADDRESS	1479 BUFFALO PLACE	ADDRESS	
CITY	WINNIPEG	PROVINCE MB	CITY	PROVINCE
COUNTRY		POSTAL CODE R3T 1L7	COUNTRY	POSTAL CODE
TELEPHONE	204-284-0580	FAX	TELEPHONE	FAX

SAMPLE INFORMATION

SAMPLE NAME	MW 48 A&B
SAMPLING METHOD	PERISTALTIC PUMP
SAMPLED BY	MARK ROODT
DATE	OCT. 31/06 TIME 10:30 - 12:30
CONTAINER TYPE AND NUMBER	2 - 20L CONTAINERS
SPECIAL INSTRUCTIONS	

TOXICITY TESTS REQUIRED

PROTOCOL		100% SCREEN	LC_X/EC_X	COMMENTS
ACUTE	DAPHNIA MAGNA 48H STATIC ACUTE			
	RAINBOW TROUT 96H STATIC ACUTE	✓		AS - PER-MAN
	FATHEAD MINNOW 96H ACUTE			
	MICROTOX			
CHRONIC	SALMONID 7D EMBRYO VIABILITY			
	FATHEAD MINNOW 7D SURVIVAL AND GROWTH			
	CERIODAPHNIA DUBIA 7D SURVIVAL AND REPRODUCTION			
	SELENASTRUM GROWTH 72H INHIBITION			
	TOPSMELT 7D SURVIVAL AND GROWTH			
	ECHINODERM FERTILIZATION TEST (SEA URHCINS/SAND DOLLARS)			
	CHAMPIA PARVULA REPRODUCTION			
OTHER				

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: MARK ROODT — RECEIVED BY:

NAME	DATE	TIME	NAME	DATE	TIME
	10/31/06	14:30			

BC Research Inc.
3650 Wesbrook Mall
Vancouver, BC
Canada V6S 2L2
Canada
Tel: (604) 224-4331
Fax: (604) 224-0540
USA
Tel: (360) 738-0958
Fax: (360) 733-3590

Revised March 12, 2002