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June 27, 2005

UMA Project No.: 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: Toxicity Tests of Groundwater Entering the Red River Report

UMA Engineering Ltd. (UMA) is pleased to provide you with three (3) copies of this letter report documenting the results of the preliminary groundwater toxicity tests at the Sutherland Avenue former Manufactured Gas Plant (MGP) site.

Background

It was earlier estimated by UMA, based on the currently available contaminant hydrogeological data for the Sutherland former MGP site, that about 370 g of naphthalene may be entering the Red River annually as dissolved phase transport in the shallow groundwater system. We noted earlier that on a total mass basis, this is very small relative to the mass of PAHs currently resident in riverbed sediments adjacent to the site, which is best explained by the historical direct deposition of coal tar to the river via land drainage sewers and surface runn-off.

UMA's 2004 ecological risk assessment of the contaminated sediments, based on sediment-dwelling invertebrate community composition, showed that the benthos are not appreciably impacted in comparison with other urbanized riverbed areas of the Red and Assiniboine Rivers. However, Manitoba Hydro requested UMA to undertake groundwater toxicity tests at the former Sutherland Avenue MGP as part of the on-going groundwater monitoring program.

UMA initially provided a proposed sampling and analytical plan to directly test the toxicity to aquatic life at the former MGP from areas of the groundwater plume immediately upgradient from the point of entry into the Red River. 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 (west of Rover Ave.), monitoring wells MW-29, MW-23, MW-24 and MW-42 are inferred to occur within the zone of groundwater contamination (Figure 01). 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 includes 3 to 4 nested 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.

We noted our concern that some of the piezometers – especially at sites MW-23 and MW-24 – might have been installed in intimate contact with soils containing free-phase hydrocarbons, and therefore might represent a highly localized condition vis-à-vis groundwater PAH concentrations, relative to those conditions that might prevail over a distance of metres to tens of metres laterally.

PLAN

0 20 40 m SCALE 1:2000

UMA | AECOM

This proposed plan also included the installation of drive-point piezometers across the plume trajectory within 1-2 m of the high water mark. This was in light of the above-mentioned concerns. The intent was specifically to capture groundwater samples representative of conditions at the discharge interface into the river, in the absence of highly localized influences in areas farther removed from the river.

The initial proposal included estimates associated with the testing of each sample of groundwater recovered based on mortality over 96-h of rainbow trout fry , as well as longer exposure durations [i.e. a 7-day exposure of embryos (E-test), a 28 d exposure of embryos/alevins (E-A test), and a 90 day exposure of embryos/alevins/fry (EAF-test)]. The 96-h trout fry assay is considered to be a sensitive aquatic toxicity test, even though it is for a short exposure duration, since the test utilizes a highly sensitive life station. Longer term sub-adult tests (28-d and 90-d) are used infrequently in effluent monitoring programs, but are considered highly sensitive.

This proposed level of effort was revised to reflect a phased approach to the Sutherland site toxicity testing of the groundwater entering the Red River as described below.

Scope of Work

The scope of work for the first stage of groundwater toxicity testing inlcuded:

- The collection of groundwater samples from the following existing wells along the Red River;

• MW-41C (Reference)	• MW-23C
• MW-29B	• MW-23D
• MW-29C	• MW-24D
	• MW-42C

- Conducting 96-hour trout fry toxicity tests for a range of concentrations, at Vizon SciTec, Vancouver, BC;
- Collecting separate groundwater samples for the analysis of PAHs and BTEX; and
- Providing a report assessing the results and recommending the next phase of monitoring.

Methodology

Prior to groundwater sampling, the above listed monitoring wells were monitored for water levels and purged to remove any accumulated sediment. Approximately 15 to 20 L of water was purged from each well, after which five days were allowed to pass before sampling.

Groundwater sampling was conducted on April 25, 2005. Two 20 L water samples were obtained from each well for toxicity testing. Sample containers consisted of new 20 L flexible plastic water containers which were rinsed with de-ionized water, then sample water prior to sampling. Between the filling of the two 20 L containers, samples were collected for chemical analysis. This included one 1 L amber glass bottle for PAH analysis and three 40 mL vials for BTEX analysis. All of the samples were obtained using low flow sampling techniques with a peristaltic pump. Care was taken not to introduce any sediment or bubbles into the samples. Conductivity and pH

measurements were taken at the beginning, middle and end of sampling each well to ensure consistent sample quality. A blind duplicate sample was also collected from monitoring well MW-29B for PAH analysis and labeled as MW-29D.

Samples for toxicity testing were immediately placed in coolers with ice packs and shipped to Vizon SciTec in Vancouver, along with the appropriately completed Chain of Custody forms. Toxicity tests were conducted according to Environment Canada methodology (2000: Reference Method for Determining Acute Lethality of Effluent to Rainbow Trout, EPS 1/RM/13,Second Edition, December 2000).

The groundwater sample from MW-23C exhibited the presence of a Light Non-aqueous Phase Liquid (LNAPL) floating on the surface of the groundwater sample. The sample from MW-24D exhibited the presence of a Dense Non-aqueous Phase Liquid (DNAPL) at the bottom of the sample container. The NAPL in the above monitoring wells was observed during purging of the wells. Accurate measurements of product thickness could not be obtained due to suspected interference of sediment in the case of the DNAPL and product sticking to the probe in the case of the LNAPL. As noted in the Background section, monitoring wells MW-23 and MW-24 might have been installed in intimate contact with soils containing free-phase hydrocarbons, and therefore might represent a highly localized condition vis-à-vis groundwater PAH concentrations, relative to those conditions that might prevail over a distance of metres to tens of metres laterally.

Results

Prior to obtaining the groundwater samples, a brief review was undertaken of the expected sensitivity of freshwater fish species to some of the more water soluble PAH constituents of coal tar. The USEPA "ECOTOX" database was accessed on line. The papers that form the basis of the excerpted data were not reviewed. A summary of the aquatic life toxicity data is provided in Appendix A.

Naphthalenes are the primary PAH of concern in groundwater beneath the Sutherland Site, owing to their abundance in the coal tar historically deposited there as well as the greater solubility of naphthalenes in comparison with higher molecular weight PAHs. The most sensitive response from Appendix A was a 27-d LC50 estimate of 110 µg/L for rainbow trout exposed in flow-through to naphthalene (Black et al., 1983).

Groundwater Toxicity Data

Table 1 provides a summary of the toxicity of the Sutherland Site groundwater samples to rainbow trout fry based on 96-h (4 d) exposures in static test systems. The detailed laboratory groundwater toxicity reports are provided as Appendix B.

The groundwater samples were tested at 100% strength, and at diluted strength (56%, 32%, 18%, 10%) along a roughly geometric series, using as a diluent, Vancouver Tapwater hardened and dechlorinated (EDTA Hardness: 18 mg $CaCO_3$/L)

Table 1: Summary of Sutherland Site Groundwater Toxicity Results

Well/ Sample ID	41C	42C	29B	29C	24D	23D	23C
Sample Concentration (%v/v)							
0%	0	0	0	0	0	0	0
10%	0	0	0	0	0	0	0
18%	0	0	0	0	0	0	0
32%	0	0	0	0	0	0	**90**
56%	0	0	0	0	**90**	**100**	**100**
100%	0	**70**	**30**	0	**100**	**100**	**100**
96-h Estimated LC50: %v/v (95% lower and upper CL)					**44.9% (32, 56)**	**42.3% (32, 56)**	**25.5% (18, 32)**

No fry mortality was observed at 100% or lower groundwater concentrations in samples from MW-41C or MW-29C. Mortality was observed only in the undiluted (100% v:v) samples for the remaining wells. For samples from MW-42C and MW-29B no fry mortality was noted at a sample concentration of 56%. For samples from MW-23D and MW-24D, no mortality was observed over the 96-h at a sample concentration of 32% v:v (equivalent to a dilution ratio of about 1:3). In the sample from MW-23C, no fry mortality was observed at a sample concentration of 18% v:v (equivalent to a dilution ratio of about 1:6). For the latter three samples, an estimated LC50 concentration is estimated at a dilution between the groundwater and uncontaminated reference water of about 25% to 45%. In other words, a dilution between the groundwater and uncontaminated reference water of 1:4 or greater dilution would result in a response based on 96-h fry exposure that is less severe than 50% mortality (LC50).

Groundwater Chemistry Data

Groundwater samples were collected from the study monitoring wells and sent to EnviroTest Laboratories in Winnipeg for chemical analysis. Field testing for pH and conductivity were conducted during sample collection and a summary of the results are provided in Table 2. A summary of the test results of the groundwater for PAH and Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) is provided in Table 3. The detailed laboratory chemistry groundwater test reports are provided as Appendix C.

Table 2 – Groundwater Sampling and Field Results

	Initial		Interm ediate		Final					
Well #	pH	Cond (mmho/cm)	pH	Cond (mmho/cm)	pH	Cond (mmho/cm)	Depth to Product (m)	Depth to Water (m)	Depth to Bottom (m)	Comments
23C	6.7	1550	6.9	1520	6.7	1530	3.37	4.87	10.18	Product visible, odour
23D	6.7	2890	6.7	2580	6.7	2600	4.97	3.27	8.25	Product tone but not visible, odour
24D	7.1	1720	6.7	1640	6.7	1890	6.05	3.52	8.98	Product on sample bottom, odour
29B	6.7	1820	6.9	1930	6.8	1660		3.52		
29C	6.8	1950	6.7	2350	7.1	2350		3.55		
41C	6.9	1870	6.7	1760	6.9	1840		2.84	7.37	
42C	6.5	2350	6.9	2360	6.8	2370	5.01	2.86	7.47	Product tone but not visible, odour

Table 3: Groundwater PAH and BTEX Concentrations (µg/L)

Well/Sample ID	23C	23D	24D	29B	29D[1]	29C	41C	42C	Guideline[2]
1-Methyl Naphhalene	170	240	150	<0.05	<0.05	7.7	<0.05	130	
2-Methyl Naphthalene	260	340	230	<0.05	<0.05	9.2	<0.05	130	
Acenaphthene	170	470	42	<0.05	<0.05	0.12	<0.05	14	5.8
Acenaphthylene	<0.05	74	60	<0.05	<0.05	0.86	<0.05	80	
Anthracene	2.7	6.8	5.0	<0.01	<0.01	0.02	<0.01	2.1	0.012
Benzo(a)anthracene	0.07	0.59	1.7	0.01	<0.01	<0.01	<0.01	<0.01	0.018
Benzo(a)pyrene	<0.01	0.54	1.7	<0.01	<0.01	<0.01	<0.01	<0.01	0.015
Benzo(b)fluoranthene	<0.01	0.21	0.66	<0.01	<0.01	<0.01	<0.01	<0.01	
Beno(ghi)perylene	<0.01	0.24	0.86	<0.01	<0.01	<0.01	<0.01	<0.01	
Benzo(k)fluoranthene	<0.01	0.30	0.88	<0.01	<0.01	<0.01	<0.01	<0.01	
Chrysene	0.08	0.69	1.9	<0.05	<0.01	<0.05	<0.05	<0.05	
Dibenzo(ah)anthracene	<0.01	0.09	0.34	<0.01	<0.01	<0.01	<0.01	<0.01	
Fluoranthene	0.57	3.8	5.1	0.02	<0.01	0.01	<0.01	0.56	0.04
Fluorene	17	28	16	<0.05	<0.05	0.15	<0.05	12	3
Indeno(1,2,3cd)pyrene	<0.01	0.19	0.66	<0.01	<0.01	<0.01	<0.01	<0.01	
Naphthalene	5400	6000	4100	37	7.4	1000	0.50	2400	1.1
Phenanthrene	15	35	23	0.02	<0.01	0.14	<0.01	12	0.4
Pyrene	0.57	4.4	6.4	0.03	0.11	<0.01	<0.01	0.50	0.025
Quinoline	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	3.4
Acridine	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	4.4
Benzene	25000	19000	22000	8200	6500	790	<0.5	4100	370
Toluene	3800	640	280	9.2	6.1	21	<0.5	61	2
Ethylbenzene	2600	910	1700	620	630	730	<0.5	730	90
Xylenes	2900	2200	1400	330	94	220	<0.5	840	

1 - Sample 29D is a duplicate sample of monitoring well 29B
2 – CCME Freshwater Aquatic Life Guideline

Discussion

Groundwater samples from MW-23C and D, and MW-24D, in their undiluted form, were observed to be 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 fry were exposed to groundwater samples from MW-23D and MW-24D, but with less severity.

In the other samples, "At test initiation the fish in the 56 and 100% concentrations were swimming near the surface and gulping. All other fish appeared and behaved normally during the test." This behaviour response, observed in all undiluted groundwater samples might have resulted from groundwater constituents other than associated with coal tar or metal contamination, since it was not correlated with 96-h mortality rates. The electrical conductivity in the sample from MW-41C (beyond the zone of contamination) was 1,730 µmho/cm, and in all seven samples ranged from 1,560 to 2,400 µmho/cm, without any apparent correlation to degree of PAH or metal contamination.

While acute (96-h) toxicity to rainbow trout fry was observed in 5 of 7 undiluted groundwater samples from the site, it is important to note that no mortalities were recorded at groundwater: reference water dilution ratios of 1:6 or greater dilution. We have not yet estimated the minimum dilution factors that may occur seasonally at the point where the contaminated groundwater plume enters the Red River, but expect dilution factors of 1:1,000 or greater, in light of the range of previously documented saturated zone hydraulic conductivities.

Figures 02 and 03 show the relationships between percent dilution of the groundwater sample corresponding to an interpolated LC50 response and the concentration of naphthalene, benzene, or phenanthrene. It is apparent that the relationship between groundwater chemistry and toxicity is better for more soluble constituents than less soluble PAHs such as fluoranthene. Five- and six-ring PAHs such as benzo[k]fluoranthene were detected in very few of the seven samples (MW-23D and -24D) in spite of their relatively high concentrations in coal tar from the site. MW-24D was noted during the field visit to have DNAPL accumulation at the bottom of the piezometer.

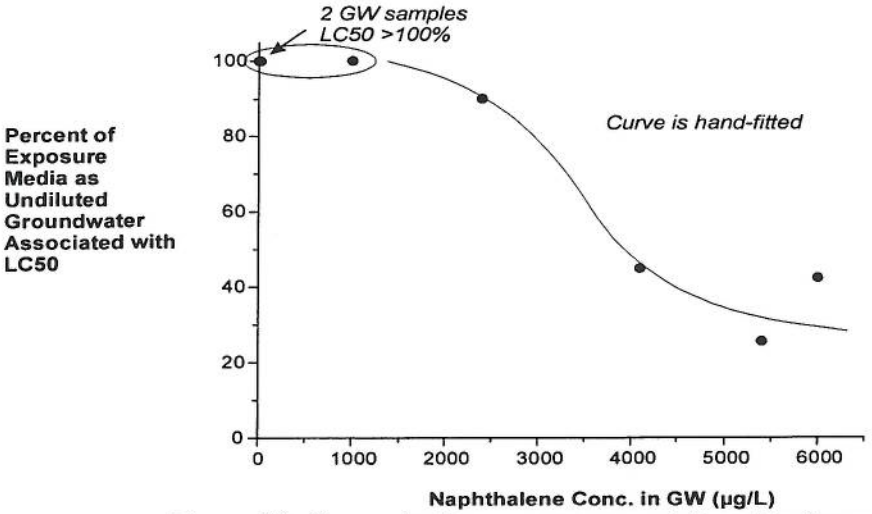
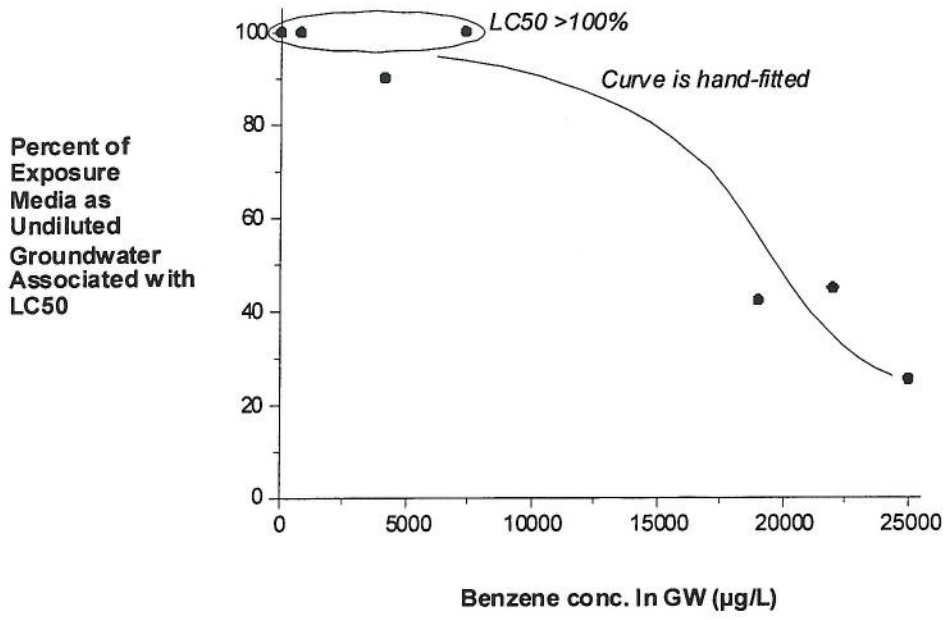


Figure 02: Concentration – response relationship for naphthalene.



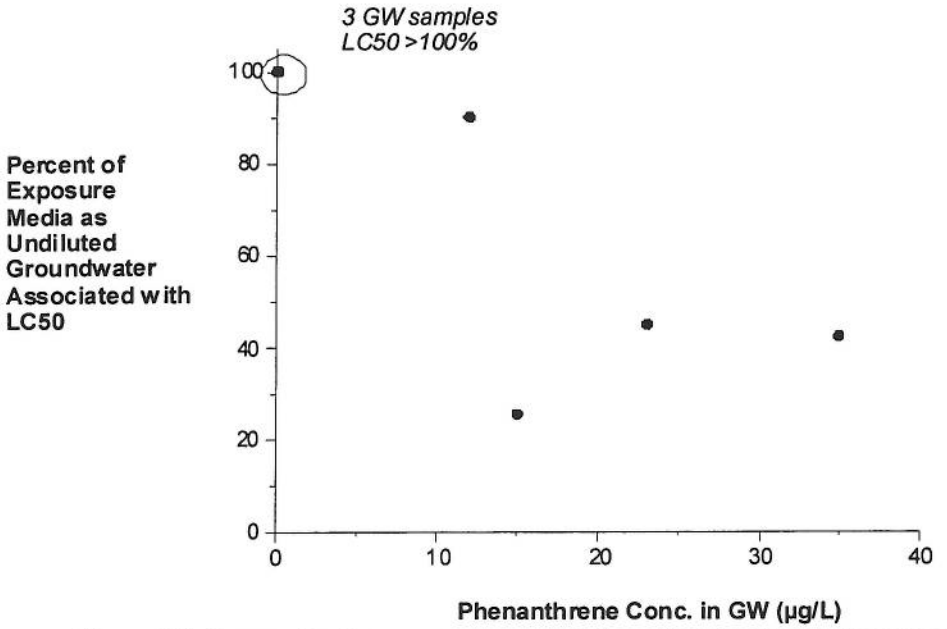


Figure 03: Concentration – response relationships for benzene and phenanthrene.

There are two caveats on the interpretation of this first stage of groundwater toxicity evaluation:

1. MW-23 and MW-24 may be unduly influenced by localized deposits of soils with coal tar contamination, such that the groundwater samples from them may reflect a localized condition that may not be representative of groundwater quality 3 to 10 m away or farther. In particular, these wells may be strongly influenced by local NAPL masses, that would tend to have a limited rate of dissolved-phased transport in groundwater over longer lateral distances, owing to the non-polar nature of many of the constituents (as reflected by very high K_{OC}s) as well as the strong affinity of the contaminants for local soil-bound non-polar organic constituents. **In light of this, it is recommended that the toxicity data for samples from piezometers installed closer to the river bank be gathered at these two locations for comparative purposes.**

2. The 96-h trout fry test may not adequately predict risks to sensitive life stages of fish (eggs, fry, alevins) based on exposure conditions experienced in the receiving environment. There does not appear to be viable spawning or juvenile nursery habitat in the section of the Red River immediately adjacent to the Sutherland Site; therefore, exposures in the groundwater entry zone are likely to be of a transient nature. We have not yet ruled out, however, that a cumulative exposure duration may exceed 96-h, or that potentially more sensitive, sub-lethal responses not examined (e.g. reduced locomotory activity and increased risks of being consumed by a predator) might play a role in the fitness of localized fish sub-populations. A 28-d egg/fry test, on the other hand, would be in excess of expected maximum exposure durations within the Red River adjacent to the site**. It is recommended that the acute 96-hour trout fry toxicity tests for a range of concentrations be conducted for samples from piezometers installed closer to the river bank.**

The groundwater chemistry results are relatively consistent with the 2003 monitoring data for the selected monitoring wells. Naphthalene concentrations were for the most part lower than the 2003 monitoring data with the exception of MW-24D and MW-29C where the concentrations of Naphthalene were higher. The results for the other PAH's were either consistent with or slightly lower than the 2003 data. The naphthalene result for the duplicate sample for monitoring well MW-29B was lower than the result for MW-29B and the 2003 monitoring data. However, all of the other PAH values were consistent. The BTEX results for the selected wells were lower than the 2003 BTEX concentrations. BTEX was not detected in MW-41C. The BTEX results for the duplicate sample for MW-29B were lower, but consistent with the results from the MW-29B sample. Quality Assurance and Quality Control shows the laboratory surrogates ranged from 74% to 84% within the acceptable range. The results of the PAH and BTEX Calibration Verification Standards fall within the 99% Confidence Interval.

The consistent groundwater chemisty results were reflected by similar values of calculated napthalene and benzene flux for the 2003 and 2005 data. Napthalene flux was calculated to be 300 g/year using the April 2005 data which is comparable to the flux of 370 g/year calculated using the 2003 data. The calculated benzene flux was 1.2 kg/year using the April 2005 data which is consistent with the flux of 2.3 kg/year calculated using the 2003 data. The flux values were updated using the same calculation procedure as presented in the Supplemental Site Investigation Report. For monitoring wells that were not sampled in 2005, the 2003 results were assumed. The flux calculation tables are included in Appendix D.

The groundwater chemistry results indicate groundwater from MW-23C, MW-23D and MW-24D has been significantly impacted by PAH and BTEX contamination. Monitoring wells MW-29B and MW-42C have also been impacted to a lesser extent. The groundwater chemistry results of the study monitoring wells with the exception of MW-41C, exceed the CCME Freshwater Aquatic Life guidelines for benzene, toluene and ethylbenzene. The groundwater chemistry results for the selected wells support the findings of the toxicity test.

Recommendations

We would recommend that Manitoba Hydro install a set of piezometers closer to the groundwater outflow face at the Red River in particular down gradient from MW-23 and MW-24, and obtain representative groundwater samples from these for use in the acute 96-hour trout fry laboratory-based toxicity tests for a range of concentrations.

Sincerely,

UMA Engineering Ltd.

Tom Wingrove, P.Eng.
Senior Vice President
EY/dh

PROVINCE OF MANITOBA
T. R. WINGROVE
27/06/05
REGISTERED ENGINEER

APPENDIX A

EXISTING ECOTOXICITY DATA

Appendix A: Existing Ecotoxicity Data

Chemical Name	Scientific Name	Endpoint	Test Duration	Exposure Concentration (µg/L)	Reference
Naphthalene	*Oncorhynchus mykiss* (Rainbow trout,donaldson trout)	LC50	27 D	110	Black, J.A., W.J. Birge, A.G. Westerman, and P.C. Francis, 1983.Comparative Aquatic Toxicology of Aromatic Hydrocarbons. Fundam.Appl.Toxicol. 3(9/10):353-358.
Naphthalene		LC50	23 D	120	As above.
Naphthalene		LC50	27 D	120	Millemann, R.E., W.J. Birge, J.A. Black, R.M. Cushman, K.L. Daniels, P.J. Franco, and J.M. Giddings, 1984. Comparative Acute Toxicity to Aquatic Organisms of Components of Coal-Derived Synthetic Fuels. Trans.Am.Fish.Soc. 113(1):74-85.
2-Methylnaphthalene		LC50	96 H	1456	Kennedy, C.J., 1990. Toxicokinetic Studies of Chlorinated Phenols and Polycyclic Aromatic Hydrocarbons in Rainbow Trout (Oncorhynchus mykiss). Ph.D.Thesis, Simon Fraser University, Canada:188 p.; Diss.Abstr.Int.B Sci.Eng.53(1):18 (1992)
Naphthalene		NR-ZERO	96 H	1500	Bergman, H.L., and A.D. Anderson, 1977. Effects of Aqueous Effluents from In Situ Fossil Fuel Processing Technologies on Aquatic Systems. Contract No.EY-77-C-04-3913, Univ.of Wyoming, Laramie, WY
Naphthalene		LC50	96 H	1600	DeGraeve, G.M., R.G. Elder, D.C. Woods, and H.L. Bergman, 1982. Effects of Naphthalene and Benzene on Fathead Minnows and Rainbow Trout. Arch.Environ.Contam.Toxicol. 11(4):487-490.
2-Methylnaphthalene		LC50	72 H	1694	Kennedy, C.J., 1990. Toxicokinetic Studies of Chlorinated Phenols and Polycyclic Aromatic Hydrocarbons in Rainbow Trout (Oncorhynchus mykiss). Ph.D.Thesis, Simon Fraser University, Canada:188 p.; Diss.Abstr.Int.B Sci.Eng.53(1):18 (1992)
1,3-Dimethylnaphthalene		LC50	96 H	1700	Edsall, C.C., 1991. Acute Toxicities to Larval Rainbow Trout of Representative Compounds Detected in Great Lakes Fish. Bull.Environ.Contam.Toxicol. 46(2):173-178.
Naphthalene		LC50	96 H	1800	As above.
2-Methylnaphthalene		LC50	48 H	2080	Kennedy, C.J., 1990. Toxicokinetic Studies of Chlorinated Phenols and Polycyclic Aromatic Hydrocarbons in Rainbow Trout (Oncorhynchus mykiss). Ph.D.Thesis, Simon Fraser University, Canada:188 p.; Diss.Abstr.Int.B Sci.Eng.53(1):18 (1992)
Naphthalene		LC50	96 H	2250	Bergman, H.L., and A.D. Anderson, 1977. Effects of Aqueous Effluents from In Situ Fossil Fuel Processing Technologies on Aquatic Systems. Contract No.EY-77-C-04-3913, Univ.of Wyoming, Laramie, WY
2-Methylnaphthalene		LC50	24 H	2443	Kennedy, C.J., 1990. Toxicokinetic Studies of Chlorinated Phenols and Polycyclic Aromatic Hydrocarbons in Rainbow Trout (Oncorhynchus mykiss). Ph.D.Thesis, Simon Fraser University, Canada:188 p.; Diss.Abstr.Int.B Sci.Eng.53(1):18 (1992)
Naphthalene		LC50	96 H	2600	Edsall, C.C., 1991. Acute Toxicities to Larval Rainbow Trout of Representative Compounds Detected in Great Lakes Fish. Bull.Environ.Contam.Toxicol. 46(2):173-178.
Naphthalene		LC50	96 H	4400	As above.
Naphthalene		LC50	96 H	4500	As above.
Naphthalene		LC50	96 H	5500	As above.
Naphthalene		NR-LETH	96 H	5600	Bergman, H.L., and A.D. Anderson, 1977. Effects of Aqueous Effluents from In Situ Fossil Fuel

Appendix A: Existing Ecotoxicity Data

Chemical Name	Scientific Name	Endpoint	Test Duration	Exposure Concentration (µg/L)	Reference
Naphthalene		LC50	96 H	6100	Processing Technologies on Aquatic Systems. Contract No.EY-77-C-04-3913, Univ.of Wyoming, Laramie, WY
Methylnaphthalene	*Salmo trutta* (Brown trout)	LC50	48 H	8400	Edsall, C.C., 1991. Acute Toxicities to Larval Rainbow Trout of Representative Compounds Detected in Great Lakes Fish. Bull.Environ.Contam.Toxicol. 46(2):173-178. Woodiwiss, F.S., and G. Fretwell, 1974. The Toxicities of Sewage Effluents, Industrial Discharges and Some Chemical Substances to Brown Trout (Salmo trutta) in the Trent River Authority Area. Water Pollut.Control 73:396-405.

APPENDIX B

LABORATORY GROUNDWATER TOXICITY TEST REPORTS

UMA Engineering Ltd.
Victoria
Hydro 41C

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

Vizon SciTec Inc.
3650 Wesbrook Mall
Vancouver, BC
Canada V6S 2L2
tel: (604) 224-4331
fax: (604) 224-0540
web: http://vizonscitec.com

Vizon Sample # : 050427B-03 Report # : 2-11-200-114-05-007

Sample Taken:	Apr. 26, 2005 12:00 PM	Sample pH:	7.4
Sample Collected By:	R. Stark	Sample Dissolved Oxygen:	6.2 mg/L
Sample Received:	Apr. 27, 2005	Sample Temperature:	15.8 °C
Start Date/Time:	Apr. 28, 2005 3:18 PM	Sample Conductance:	1728 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	54	15.3	14.5	7.3	7.3	9.6	9.6	0	0	0	0	0
10	251	14.6	14.3	7.5	8.0	9.9	9.0	0	0	0	0	0
18	405	14.6	14.1	7.4	8.2	9.5	9.4	0	0	0	0	0
32	645	14.6	14.2	7.4	8.4	9.3	9.4	0	0	0	0	0
56	1033	14.7	14.2	7.4	8.4	8.8	9.7	0	0	0	0	0
100	1730	15.5	14.3	7.4	8.4	7.4	9.8	0	0	0	0	0

Comments:
At test initiation the fish in the 100% concentration had rapid gill movement and several fish were swimming at the surface. All other fish appeared and behaved normally during the test.

Test Conditions:

Organisms per Replicate:	10	Preaeration Time:	30 min.
Test Volume:	15 L	Rate of aeration:	6.5 ml/min/L
Loading Density:	0.30 g/L		

Test Organism: Rainbow Trout (*Oncorhynchus mykiss*)

Weight (Mean + SD):	0.45 ± 0.09 g	Length (Mean + SD):	3.8 ± 0.2 cm
Weight (Range):	0.32– 0.73 g	Length (Range):	3.5– 4.3 cm

Reference Toxicant: Phenol
Test was conducted on: 04/15/2005
Test gave a 96-h LC50 of 11.41 (10.02, 13.09) 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**

UMA Engineering Ltd.
Victoria
Hydro 42C

Rainbow Trout Bioassay
96-h LC50 %v/v: 87.6 (56, 100)

Vizon SciTec Inc.
3650 Wesbrook Mall
Vancouver, BC
Canada V6S 2L2
tel: (604) 224-4331
fax: (604) 224-0540
web: http://vizonscitec.com

Vizon Sample # : 050426B-04 Report # : 2-11-200-114-05-004

Sample Taken:	Apr. 25, 2005 12:00 PM	Sample pH:	7.1
Sample Collected By:	Russ Stark	Sample Dissolved Oxygen:	8.1 mg/L
Sample Received:	Apr. 26, 2005	Sample Temperature:	15.1 °C
Start Date/Time:	Apr. 27, 2005 2:45 PM	Sample Conductance:	2300 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	57	15.7	14.1	7.4	7.4	9.5	9.9	0	0	0	0	0
10	324	15.4	13.6	7.4	8.2	9.3	9.9	0	0	0	0	0
18	529	15.3	13.6	7.4	8.3	9.4	10.0	0	0	0	0	0
32	864	15.3	13.7	7.3	8.5	9.3	10.0	0	0	0	0	0
56	1407	15.2	13.4	7.3	8.3	9.3	10.0	0	0	0	0	0
100	2300	15.2	13.5	7.3	8.5	9.5	10.4	40	70	70	70	7

Comments:
At test initiation the fish in the sample were stressed i.e., in the 56 & 100% concentrations the fish were gulping at the surface. After 2.5 hours the fish 100% still had rapid gill movement and were at the surface. All other fish appeared and behaved normally during the remainder of the test. The binomial method was used to determine the LC50 value. Some of the final temperatures were below recommended (14 to 16°C).

Test Conditions:

Organisms per Replicate:	10	Preaeration Time:	30 min.
Test Volume:	15 L	Rate of aeration:	6.5 ml/min/L
Loading Density:	0.42 g/L		

Test Organism: Rainbow Trout (*Oncorhynchus mykiss*)

Weight (Mean + SD):	0.63 ± 0.14 g	Length (Mean + SD):	4.1 ± 0.3 cm
Weight (Range):	0.35– 0.92 g	Length (Range):	3.5– 4.6 cm

Reference Toxicant: Phenol
Test was conducted on: 04/15/2005
Test gave a 96-h LC50 of 11.41 (10.02, 13.09) 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**

UMA Engineering Ltd.
Victoria
Hydro 29B

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

Vizon SciTec Inc.
3650 Wesbrook Mall
Vancouver, BC
Canada V6S 2L2
tel: (604) 224-4331
fax: (604) 224-0540
web: http://vizonscitec.com

Vizon Sample # : 050427B-01 Report # : 2-11-200-114-05-005

Sample Taken:	Apr. 26, 2005 6:00 PM	Sample pH:	7.4
Sample Collected By:	D. Schmidt	Sample Dissolved Oxygen:	6.9 mg/L
Sample Received:	Apr. 27, 2005	Sample Temperature:	15.7 °C
Start Date/Time:	Apr. 28, 2005 2:35 PM	Sample Conductance:	1677 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	54	15.3	15.0	7.3	7.3	9.6	7.8	0	0	0	0	0
10	281	15.5	15.0	7.3	7.8	9.4	7.7	0	0	0	0	0
18	367	15.4	15.0	7.3	8.2	9.4	9.6	0	0	0	0	0
32	594	15.3	14.9	7.3	8.4	9.1	9.6	0	0	0	0	0
56	994	15.5	14.9	7.4	8.3	8.6	9.7	0	0	0	0	0
100	1685	15.7	14.9	7.4	8.2	7.1	9.6	0	10	30	30	3

Comments:
At test initiation the fish in the 56 & 100% concentrations were biting at the surface and swimming erratically. All other fish appeared and behaved normally during the test.

Test Conditions:

Organisms per Replicate:	10	Preaeration Time:	30 min.
Test Volume:	15 L	Rate of aeration:	6.5 ml/min/L
Loading Density:	0.30 g/L		

Test Organism: Rainbow Trout (*Oncorhynchus mykiss*)

Weight (Mean + SD):	0.45 ± 0.09 g	Length (Mean + SD):	3.8 ± 0.2 cm
Weight (Range):	0.32– 0.73 g	Length (Range):	3.5– 4.3 cm

Reference Toxicant: Phenol
Test was conducted on: 04/15/2005
Test gave a 96-h LC50 of 11.41 (10.02, 13.09) 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**

UMA Engineering Ltd.
Victoria
Hydro 29C

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

Vizon SciTec Inc.
3650 Wesbrook Mall
Vancouver, BC
Canada V6S 2L2
tel: (604) 224-4331
fax: (604) 224-0540
web: http://vizonscitec.com

Vizon Sample # : 050427B-02 Report # : 2-11-200-114-05-006

Sample Taken:	Apr. 26, 2005 6:00 PM	Sample pH:	7.2
Sample Collected By:	R. Stark	Sample Dissolved Oxygen:	7.8 mg/L
Sample Received:	Apr. 27, 2005	Sample Temperature:	15.6 °C
Start Date/Time:	Apr. 28, 2005 2:55 PM	Sample Conductance:	2360 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	54	15.3	15.0	7.3	7.3	9.6	7.8	0	0	0	0	0
10	399	15.3	14.9	7.5	7.9	9.4	8.5	0	0	0	0	0
18	585	15.3	14.8	7.4	8.3	9.5	9.4	0	0	0	0	0
32	969	15.4	14.8	7.3	8.5	9.5	9.5	0	0	0	0	0
56	1534	15.4	14.8	7.3	8.3	9.1	9.5	0	0	0	0	0
100	2370	15.6	14.9	7.3	8.3	8.6	9.6	0	0	0	0	0

Comments:
At test initiation the fish in the 56 & 100% concentrations were swimming near the surface and gulping. All other fish appeared and behaved normally during the test.

Test Conditions:

Organisms per Replicate:	10	Preaeration Time:	30 min.
Test Volume:	15 L	Rate of aeration:	6.5 ml/min/L
Loading Density:	0.30 g/L		

Test Organism: Rainbow Trout (*Oncorhynchus mykiss*)

Weight (Mean + SD):	0.45 ± 0.09 g	Length (Mean + SD):	3.8 ± 0.2 cm
Weight (Range):	0.32– 0.73 g	Length (Range):	3.5– 4.3 cm

Reference Toxicant: Phenol
Test was conducted on: 04/15/2005
Test gave a 96-h LC50 of 11.41 (10.02, 13.09) 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**

UMA Engineering Ltd.
Victoria
Hydro 24D

Rainbow Trout Bioassay
96-h LC50 %v/v: 44.91 (32, 56)

Vizon SciTec Inc.
3650 Wesbrook Mall
Vancouver, BC
Canada V6S 2L2
tel: (604) 224-4331
fax: (604) 224-0540
web: http://vizonscitec.com

Vizon Sample # : 050426B-03 Report # : 2-11-200-114-05-003

Sample Taken:	Apr. 25, 2005 12:00 PM	Sample pH:	7.0
Sample Collected By:	Darryl Schmidt	Sample Dissolved Oxygen:	7.8 mg/L
Sample Received:	Apr. 26, 2005	Sample Temperature:	15.3 °C
Start Date/Time:	Apr. 27, 2005 2:45 PM	Sample Conductance:	1820 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	57	15.7	14.1	7.4	7.4	9.5	9.9	0	0	0	0	0
10	253	15.8	14.0	7.3	8.0	9.6	9.6	0	0	0	0	0
18	411	16.0	13.8	7.2	8.3	9.6	10.0	0	0	0	0	0
32	655	16.0	13.8	7.1	8.5	9.4	9.9	0	0	0	0	0
56	1091	15.7	13.8	7.1	8.4	9.3	10.3	90	90	90	90	9
100	1820	15.9	15.0	7.3	8.2	9.2	9.2	100	100	100	100	10

Comments:
After 1/2 hour the fish in the sample were stressed i.e., in the 56% concentration the fish were lying on the bottom and were gulping. It was difficult to see the fish in the 100% but at least one was dead after 1/2 hour. After 2.5 hours most fish in the 56 & 100% concentrations were lying on the bottom and several appeared dead and the fish in the 32% concentration were swimming at the surface and had rapid gill movement. The fish in 32% had rapid gill movement at 24 and 96 hours. All other fish appeared and behaved normally during the remainder of the test. The binomial method was used to determine the LC50 value. Some of the final temperatures were below recommended (14 to 16°C).

Test Conditions:

Organisms per Replicate:	10	Preaeration Time:	30 min.
Test Volume:	15 L	Rate of aeration:	6.5 ml/min/L
Loading Density:	0.42 g/L		

Test Organism: Rainbow Trout (*Oncorhynchus mykiss*)

Weight (Mean + SD):	0.63 ± 0.14 g	Length (Mean + SD):	4.1 ± 0.3 cm
Weight (Range):	0.35– 0.92 g	Length (Range):	3.5– 4.6 cm

Reference Toxicant: Phenol
Test was conducted on: 04/15/2005
Test gave a 96-h LC50 of 11.41 (10.02, 13.09) 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**

UMA Engineering Ltd.
Victoria
Hydro 23D

Rainbow Trout Bioassay
96-h LC50 %v/v: 42.33 (32, 56)

Vizon SciTec Inc.
3650 Wesbrook Mall
Vancouver, BC
Canada V6S 2L2
tel: (604) 224-4331
fax: (604) 224-0540
web: http://vizonscitec.com

Vizon Sample # : 050426B-02 Report # : 2-11-200-114-05-002

Sample Taken:	Apr. 25, 2005 4:00 PM	Sample pH:	7.2
Sample Collected By:	R. Stark	Sample Dissolved Oxygen:	9.2 mg/L
Sample Received:	Apr. 26, 2005	Sample Temperature:	15.1 °C
Start Date/Time:	Apr. 27, 2005 1:44 PM	Sample Conductance:	2390 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	57	14.8	14.2	7.4	7.3	10.1	9.8	0	0	0	0	0
10	360	15.3	13.5	7.5	8.2	10.0	10.3	0	0	0	0	0
18	585	15.2	13.4	7.5	8.4	9.9	10.1	0	0	0	0	0
32	963	15.2	13.4	7.5	8.5	9.7	10.3	0	0	0	0	0
56	1648	15.3	14.8	7.4	8.3	9.6	8.5	100	100	100	100	10
100	2400	15.3	14.9	7.4	8.1	9.4	8.9	100	100	100	100	10

Comments:
At test initiation the fish in the sample were stressed i.e., rapid gill movement in all concentrations. In the top 2 concentration there was loss of equilibrium and swimming on the surface. After 3.5 hours the fish in the 56 & 100% concentrations were lying on the bottom and the 100% appeared dead. All other fish appeared and behaved normally during the remainder of the test. The binomial method was used to determine the LC50 value. Some of the final temperatures were below recommended (14 to 16°C).

Test Conditions:

Organisms per Replicate:	10	Preaeration Time:	30 min.
Test Volume:	15 L	Rate of aeration:	6.5 ml/min/L
Loading Density:	0.42 g/L		

Test Organism: Rainbow Trout (*Oncorhynchus mykiss*)

Weight (Mean + SD):	0.63 ± 0.14 g	Length (Mean + SD):	4.1 ± 0.3 cm
Weight (Range):	0.35– 0.92 g	Length (Range):	3.5– 4.6 cm

Reference Toxicant: Phenol
Test was conducted on: 04/15/2005
Test gave a 96-h LC50 of 11.41 (10.02, 13.09) 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**

UMA Engineering Ltd.
Victoria
Hydro 23C

Rainbow Trout Bioassay
96-h LC50 %v/v: 25.5 (18, 32)

Vizon SciTec Inc.
3650 Wesbrook Mall
Vancouver, BC
Canada V6S 2L2
tel: (604) 224-4331
fax: (604) 224-0540
web: http://vizonscitec.com

Vizon Sample # : 050426B-01 Report # : 2-11-200-114-05-001

Sample Taken:	Apr. 25, 2005 4:00 PM	Sample pH:	7.1
Sample Collected By:	D. Schmidt	Sample Dissolved Oxygen:	8.5 mg/L
Sample Received:	Apr. 26, 2005	Sample Temperature:	15.3 °C
Start Date/Time:	Apr. 27, 2005 1:44 PM	Sample Conductance:	1548 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	57	14.8	14.2	7.4	7.3	10.1	9.8	0	0	0	0	0
10	217	15.7	13.8	7.4	8.0	9.5	9.7	0	0	0	0	0
18	349	15.7	13.7	7.4	8.2	9.5	10.0	0	0	0	0	0
32	568	15.7	13.8	7.3	8.6	9.5	10.2	80	90	90	90	9
56	937	15.8	15.6	7.3	8.3	9.4	8.0	100	100	100	100	10
100	1559	15.9	15.6	7.3	8.1	9.1	6.6	100	100	100	100	10

Comments:
At test initiation the fish in the sample were stressed i.e., rapid gill movement in all concentrations. In the top 3 concentration there was loss of equilibrium, some were lying on the bottom and in the 100% they appeared dead. All control fish appeared and behaved normally during the test. The binomial method was used to determine the LC50 value. Some of the final temperatures were below recommended (14 to 16°C).

Test Conditions:

Organisms per Replicate:	10	Preaeration Time:	30 min.
Test Volume:	15 L	Rate of aeration:	6.5 ml/min/L
Loading Density:	0.42 g/L		

Test Organism: Rainbow Trout (*Oncorhynchus mykiss*)

Weight (Mean + SD):	0.63 ± 0.14 g	Length (Mean + SD):	4.1 ± 0.3 cm
Weight (Range):	0.35– 0.92 g	Length (Range):	3.5– 4.6 cm

Reference Toxicant: Phenol
Test was conducted on: 04/15/2005
Test gave a 96-h LC50 of 11.41 (10.02, 13.09) 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**

APPENDIX C

LABORATORY GROUNDWATER CHEMISTRY TEST REPORTS

ETL Enviro-Test LABORATORIES Manitoba Technology Centre Ltd. MTC

745 Logan Avenue
Winnipeg, Manitoba R3E 3L5
Tel: (204) 945-3705 Fax: (204) 945-0763
G.S.T. Reg.#895929230RT

ANALYTICAL REPORT

UMA ENGINEERING
ATTN: ALEX MAN
1479 BUFFALO PLACE
WINNIPEG MB R3T 1L7

DATE: 06-MAY-05

Lab Work Order #: L262481 **Sampled By:** R STARK/D SCHMIDT **Date Received:** 27-APR-05
Project P.O. #: MAN HYDRO SUTHERLAND
Project Reference: 0217-158-02

Comments:

RECEIVED
MAY 12 2005
UMA ENGINEERING LTD.

APPROVED BY:

GERRY VERA
Project Manager

ENVIRO-TEST ANALYTICAL REPORT

L262481-1 MW 23C								
Sample Date: 25-APR-05								
Matrix: WATER								
PAH								
1-Methyl Naphthalene	0.17		0.00005	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
2-Methyl Naphthalene	0.26		0.00005	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Acenaphthene	0.17		0.00005	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Acenaphthylene	<0.00005		0.00005	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Anthracene	0.0027		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Benzo(a)anthracene	0.00007		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Benzo(a)pyrene	<0.00001		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Benzo(b)fluoranthene	<0.00001		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Benzo(ghi)perylene	<0.00001		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Benzo(k)fluoranthene	<0.00001		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Chrysene	0.00008		0.00005	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Dibenzo(ah)anthracene	<0.00001		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Fluoranthene	0.00057		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Fluorene	0.017		0.00005	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Indeno(1,2,3 cd)pyrene	<0.00001		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Naphthalene	5.4		0.00005	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Phenanthrene	0.015		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Pyrene	0.00057		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Quinoline	<0.00005		0.00005	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Acridine	<0.00001		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Surr: 2-Fluorobiphenyl Surr	84		50-150	%	03-MAY-05	03-MAY-05	JAP	R280952
Surr: Terphenyl Surr	71		50-150	%	03-MAY-05	03-MAY-05	JAP	R280952
BTEX								
Benzene	25		0.0005	mg/L		05-MAY-05	DVH	R280420
Toluene	3.8		0.0005	mg/L		05-MAY-05	DVH	R280420
Ethylbenzene	2.6		0.0005	mg/L		05-MAY-05	DVH	R280420
m+p-Xylenes	1.9		0.0005	mg/L		05-MAY-05	DVH	R280420
o-Xylene	1.0		0.0005	mg/L		05-MAY-05	DVH	R280420
Xylenes	2.9		0.0005	mg/L		05-MAY-05	DVH	R280420
L262481-2 MW 23D								
Sample Date: 25-APR-05								
Matrix: WATER								
PAH								
1-Methyl Naphthalene	0.24		0.00005	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
2-Methyl Naphthalene	0.34		0.00005	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Acenaphthene	0.047		0.00005	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Acenaphthylene	0.074		0.00005	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Anthracene	0.0068		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Benzo(a)anthracene	0.00059		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Benzo(a)pyrene	0.00054		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Benzo(b)fluoranthene	0.00021		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Benzo(ghi)perylene	0.00024		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Benzo(k)fluoranthene	0.00030		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Chrysene	0.00069		0.00005	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Dibenzo(ah)anthracene	0.00009		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Fluoranthene	0.0038		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Fluorene	0.028		0.00005	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Indeno(1,2,3 cd)pyrene	0.00019		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Naphthalene	6.0		0.00005	mg/L	03-MAY-05	03-MAY-05	JAP	R280952

ENVIRO-TEST ANALYTICAL REPORT

L262481-2	MW 23D								
Sample Date:	25-APR-05								
Matrix:	WATER								
	PAH								
	Phenanthrene	0.035		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
	Pyrene	0.0044		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
	Quinoline	<0.00005		0.00005	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
	Acridine	<0.00001		0.00001	mg/L	03-MAY-05	03-MAY-05	JAP	R280952
Surr:	2-Fluorobiphenyl Surr	73		50-150	%	03-MAY-05	03-MAY-05	JAP	R280952
Surr:	Terphenyl Surr	76		50-150	%	03-MAY-05	03-MAY-05	JAP	R280952
	BTEX								
	Benzene	19		0.0005	mg/L		05-MAY-05	DVH	R280420
	Toluene	0.64		0.0005	mg/L		05-MAY-05	DVH	R280420
	Ethylbenzene	0.91		0.0005	mg/L		05-MAY-05	DVH	R280420
	m+p-Xylenes	1.3		0.0005	mg/L		05-MAY-05	DVH	R280420
	o-Xylene	0.86		0.0005	mg/L		05-MAY-05	DVH	R280420
	Xylenes	2.2		0.0005	mg/L		05-MAY-05	DVH	R280420
L262481-3	MW 24D								
Sample Date:	25-APR-05								
Matrix:	WATER								
	PAH								
	1-Methyl Naphthalene	0.15		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	2-Methyl Naphthalene	0.23		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Acenaphthene	0.042		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Acenaphthylene	0.060		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Anthracene	0.0050		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Benzo(a)anthracene	0.0017		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Benzo(a)pyrene	0.0017		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Benzo(b)fluoranthene	0.00066		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Benzo(ghi)perylene	0.00086		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Benzo(k)fluoranthene	0.00088		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Chrysene	0.0019		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Dibenzo(ah)anthracene	0.00034		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Fluoranthene	0.0051		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Fluorene	0.016		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Indeno(1,2,3 cd)pyrene	0.00066		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Naphthalene	4.1		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Phenanthrene	0.023		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Pyrene	0.0064		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Quinoline	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Acridine	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Surr:	2-Fluorobiphenyl Surr	75		50-150	%	03-MAY-05	04-MAY-05	JAP	R280952
Surr:	Terphenyl Surr	84		50-150	%	03-MAY-05	04-MAY-05	JAP	R280952
	BTEX								
	Benzene	22		0.0005	mg/L		05-MAY-05	DVH	R280420
	Toluene	0.28		0.0005	mg/L		05-MAY-05	DVH	R280420
	Ethylbenzene	1.7		0.0005	mg/L		05-MAY-05	DVH	R280420
	m+p-Xylenes	0.79		0.0005	mg/L		05-MAY-05	DVH	R280420
	o-Xylene	0.57		0.0005	mg/L		05-MAY-05	DVH	R280420
	Xylenes	1.4		0.0005	mg/L		05-MAY-05	DVH	R280420

ENVIRO-TEST ANALYTICAL REPORT

L262481-4 MW 29B								
Sample Date: 26-APR-05								
Matrix: WATER								
PAH								
1-Methyl Naphthalene	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
2-Methyl Naphthalene	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Acenaphthene	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Acenaphthylene	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Anthracene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Benzo(a)anthracene	0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Benzo(a)pyrene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Benzo(b)fluoranthene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Benzo(ghi)perylene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Benzo(k)fluoranthene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Chrysene	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Dibenzo(ah)anthracene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Fluoranthene	0.00002		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Fluorene	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Indeno(1,2,3 cd)pyrene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Naphthalene	0.037		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Phenanthrene	0.00002		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Pyrene	0.00003		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Quinoline	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Acridine	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Surr: 2-Fluorobiphenyl Surr	84		50-150	%	03-MAY-05	04-MAY-05	JAP	R280952
Surr: Terphenyl Surr	82		50-150	%	03-MAY-05	04-MAY-05	JAP	R280952
BTEX								
Benzene	8.2		0.0005	mg/L		05-MAY-05	DVH	R280420
Toluene	0.0092		0.0005	mg/L		05-MAY-05	DVH	R280420
Ethylbenzene	0.62		0.0005	mg/L		05-MAY-05	DVH	R280420
m+p-Xylenes	0.22		0.0005	mg/L		05-MAY-05	DVH	R280420
o-Xylene	0.11		0.0005	mg/L		05-MAY-05	DVH	R280420
Xylenes	0.33		0.0005	mg/L		05-MAY-05	DVH	R280420
L262481-5 MW 29C								
Sample Date: 26-APR-05								
Matrix: WATER								
PAH								
1-Methyl Naphthalene	0.0077		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
2-Methyl Naphthalene	0.0092		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Acenaphthene	0.00012		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Acenaphthylene	0.00086		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Anthracene	0.00002		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Benzo(a)anthracene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Benzo(a)pyrene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Benzo(b)fluoranthene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Benzo(ghi)perylene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Benzo(k)fluoranthene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Chrysene	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Dibenzo(ah)anthracene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Fluoranthene	0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Fluorene	0.00015		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Indeno(1,2,3 cd)pyrene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Naphthalene	1.0		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952

ENVIRO-TEST ANALYTICAL REPORT

L262481-5	MW 29C								
Sample Date:	26-APR-05								
Matrix:	WATER								
PAH									
	Phenanthrene	0.00014		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Pyrene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Quinoline	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Acridine	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Surr:	2-Fluorobiphenyl Surr	75		50-150	%	03-MAY-05	04-MAY-05	JAP	R280952
Surr:	Terphenyl Surr	82		50-150	%	03-MAY-05	04-MAY-05	JAP	R280952
BTEX									
	Benzene	0.79		0.0005	mg/L		05-MAY-05	DVH	R280420
	Toluene	0.021		0.0005	mg/L		05-MAY-05	DVH	R280420
	Ethylbenzene	0.73		0.0005	mg/L		05-MAY-05	DVH	R280420
	m+p-Xylenes	0.15		0.0005	mg/L		05-MAY-05	DVH	R280420
	o-Xylene	0.066		0.0005	mg/L		05-MAY-05	DVH	R280420
	Xylenes	0.22		0.0005	mg/L		05-MAY-05	DVH	R280420
L262481-6	MW 41C								
Sample Date:	26-APR-05								
Matrix:	WATER								
PAH									
	1-Methyl Naphthalene	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	2-Methyl Naphthalene	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Acenaphthene	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Acenaphthylene	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Anthracene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Benzo(a)anthracene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Benzo(a)pyrene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Benzo(b)fluoranthene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Benzo(ghi)perylene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Benzo(k)fluoranthene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Chrysene	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Dibenzo(ah)anthracene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Fluoranthene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Fluorene	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Indeno(1,2,3 cd)pyrene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Naphthalene	0.00050		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Phenanthrene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Pyrene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Quinoline	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Acridine	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Surr:	2-Fluorobiphenyl Surr	73		50-150	%	03-MAY-05	04-MAY-05	JAP	R280952
Surr:	Terphenyl Surr	83		50-150	%	03-MAY-05	04-MAY-05	JAP	R280952
BTEX									
	Benzene	<0.0005		0.0005	mg/L		05-MAY-05	DVH	R280420
	Toluene	<0.0005		0.0005	mg/L		05-MAY-05	DVH	R280420
	Ethylbenzene	<0.0005		0.0005	mg/L		05-MAY-05	DVH	R280420
	m+p-Xylenes	<0.0005		0.0005	mg/L		05-MAY-05	DVH	R280420
	o-Xylene	<0.0005		0.0005	mg/L		05-MAY-05	DVH	R280420
	Xylenes	<0.0005		0.0005	mg/L		05-MAY-05	DVH	R280420

ENVIRO-TEST ANALYTICAL REPORT

L262481-7	MW 42C								
Sample Date:	25-APR-05								
Matrix:	WATER								
PAH									
	1-Methyl Naphthalene	0.13		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	2-Methyl Naphthalene	0.13		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Acenaphthene	0.014		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Acenaphthylene	0.080		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Anthracene	0.0021		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Benzo(a)anthracene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Benzo(a)pyrene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Benzo(b)fluoranthene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Benzo(ghi)perylene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Benzo(k)fluoranthene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Chrysene	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Dibenzo(ah)anthracene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Fluoranthene	0.00056		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Fluorene	0.012		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Indeno(1,2,3 cd)pyrene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Naphthalene	2.4		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Phenanthrene	0.012		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Pyrene	0.00050		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Quinoline	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Acridine	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Surr:	2-Fluorobiphenyl Surr	78		50-150	%	03-MAY-05	04-MAY-05	JAP	R280952
Surr:	Terphenyl Surr	78		50-150	%	03-MAY-05	04-MAY-05	JAP	R280952
BTEX									
	Benzene	4.1		0.0005	mg/L		05-MAY-05	DVH	R280420
	Toluene	0.061		0.0005	mg/L		05-MAY-05	DVH	R280420
	Ethylbenzene	0.73		0.0005	mg/L		05-MAY-05	DVH	R280420
	m+p-Xylenes	0.49		0.0005	mg/L		05-MAY-05	DVH	R280420
	o-Xylene	0.35		0.0005	mg/L		05-MAY-05	DVH	R280420
	Xylenes	0.84		0.0005	mg/L		05-MAY-05	DVH	R280420
L262481-8	MW 29D								
Sample Date:	26-APR-05								
Matrix:	WATER								
PAH									
	1-Methyl Naphthalene	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	2-Methyl Naphthalene	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Acenaphthene	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Acenaphthylene	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Anthracene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Benzo(a)anthracene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Benzo(a)pyrene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Benzo(b)fluoranthene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Benzo(ghi)perylene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Benzo(k)fluoranthene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Chrysene	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Dibenzo(ah)anthracene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Fluoranthene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Fluorene	<0.00005		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Indeno(1,2,3 cd)pyrene	<0.00001		0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Naphthalene	0.0074		0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952

ENVIRO-TEST ANALYTICAL REPORT

L262481-8 MW 29D Sample Date: 26-APR-05 Matrix: WATER								
PAH								
	Phenanthrene	<0.00001	0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Pyrene	0.00011	0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Quinoline	<0.00005	0.00005	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
	Acridine	<0.00001	0.00001	mg/L	03-MAY-05	04-MAY-05	JAP	R280952
Surr:	2-Fluorobiphenyl Surr	64	50-150	%	03-MAY-05	04-MAY-05	JAP	R280952
Surr:	Terphenyl Surr	70	50-150	%	03-MAY-05	04-MAY-05	JAP	R280952
BTEX								
	Benzene	6.5	0.0005	mg/L		05-MAY-05	DVH	R280420
	Toluene	0.0061	0.0005	mg/L		05-MAY-05	DVH	R280420
	Ethylbenzene	0.63	0.0005	mg/L		05-MAY-05	DVH	R280420
	m+p-Xylenes	0.18	0.0005	mg/L		05-MAY-05	DVH	R280420
	o-Xylene	0.094	0.0005	mg/L		05-MAY-05	DVH	R280420
	Xylenes	0.28	0.0005	mg/L		05-MAY-05	DVH	R280420

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

Reference Information

Methods Listed (if applicable):

ETL 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).

PAH,PANH-WP	Water	PAH		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	Enviro-Test Laboratories - 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 enviromental 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 warning units 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. - Detection 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.

Enviro-Test Laboratories 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, Enviro-Test Laboratories assumes no liability for the use or interpretation of the results.

Enviro-Test LABORATORIES

Enviro-Test Quality Control Report

Workorder: L262481

Client: UMA ENGINEERING
1479 BUFFALO PLACE
WINNIPEG MB R3T 1L7

Contact: ALEX MAN

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTX-WP	Water							
Batch R280420								
WG296085-2 CCV								
Benzene			96		%		87-113	02-MAY-05
Ethylbenzene			99		%		87-113	02-MAY-05
o-Xylene			106		%		87-113	02-MAY-05
Toluene			95		%		87-113	02-MAY-05
m+p-Xylenes			106		%		87-113	02-MAY-05
Xylenes			106		%		70-130	02-MAY-05
WG296085-1 CVS								
Benzene			82	H	%		87-113	02-MAY-05
Ethylbenzene			87		%		87-113	02-MAY-05
o-Xylene			91		%		87-113	02-MAY-05
Toluene			85	H	%		87-113	02-MAY-05
m+p-Xylenes			105		%		87-113	02-MAY-05
Xylenes			98		%		70-130	02-MAY-05
WG296084-1 DUP		L262481-7						
Benzene		4.1	3.9		mg/L	6.8	12	05-MAY-05
Ethylbenzene		0.73	0.73		mg/L	0.20	12	05-MAY-05
m+p-Xylenes		0.49	0.50		mg/L	1.6	12	05-MAY-05
o-Xylene		0.35	0.36		mg/L	2.2	12	05-MAY-05
Toluene		0.061	0.066		mg/L	8.6	12	05-MAY-05
Xylenes		0.84	0.86		mg/L	1.9	12	05-MAY-05
PAH,PANH-WP	Water							
Batch R280952								
WG296022-2 CCV								
Acenaphthene			99		%		87-113	04-MAY-05
Benzo(a)anthracene			101		%		87-113	04-MAY-05
Benzo(a)pyrene			102		%		87-113	04-MAY-05
Benzo(ghi)perylene			95		%		87-113	04-MAY-05
Phenanthrene			99		%		87-113	04-MAY-05
WG296022-1 CVS								
Acenaphthene			90		%		83-117	03-MAY-05
Benzo(a)anthracene			83	H	%		83-117	03-MAY-05
Benzo(a)pyrene			81	H	%		83-117	03-MAY-05
Benzo(ghi)perylene			84		%		83-117	03-MAY-05

Enviro-Test Quality Control Report

Workorder: L262481

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH,PANH-WP	Water							
Batch R280952								
WG296022-1 CVS								
Phenanthrene			80	H	%		83-117	03-MAY-05
WG296020-2 LCS								
Acenaphthene			86		%		80-120	03-MAY-05
Benzo(a)anthracene			85		%		80-120	03-MAY-05
Benzo(a)pyrene			86		%		80-120	03-MAY-05
Benzo(ghi)perylene			89		%		80-120	03-MAY-05
Phenanthrene			87		%		80-120	03-MAY-05
WG296020-1 MB								
1-Methyl Naphthalene			<0.00005		mg/L		0.00005	03-MAY-05
2-Methyl Naphthalene			<0.00005		mg/L		0.00005	03-MAY-05
Acenaphthene			<0.00005		mg/L		0.00005	03-MAY-05
Acenaphthylene			<0.00005		mg/L		0.00005	03-MAY-05
Acridine			<0.00001		mg/L		0.00001	03-MAY-05
Anthracene			<0.00001		mg/L		0.00001	03-MAY-05
Benzo(a)anthracene			<0.00001		mg/L		0.00001	03-MAY-05
Benzo(a)pyrene			<0.00001		mg/L		0.00001	03-MAY-05
Benzo(b)fluoranthene			<0.00001		mg/L		0.00001	03-MAY-05
Benzo(ghi)perylene			<0.00001		mg/L		0.00001	03-MAY-05
Benzo(k)fluoranthene			<0.00001		mg/L		0.00001	03-MAY-05
Chrysene			<0.00005		mg/L		0.00005	03-MAY-05
Dibenzo(ah)anthracene			<0.00001		mg/L		0.00001	03-MAY-05
Fluoranthene			<0.00001		mg/L		0.00001	03-MAY-05
Fluorene			<0.00005		mg/L		0.00005	03-MAY-05
Indeno(1,2,3 cd)pyrene			<0.00001		mg/L		0.00001	03-MAY-05
Naphthalene			<0.00005		mg/L		0.00005	03-MAY-05
Phenanthrene			<0.00001		mg/L		0.00001	03-MAY-05
Pyrene			<0.00001		mg/L		0.00001	03-MAY-05
Quinoline			<0.00005		mg/L		0.00005	03-MAY-05

ENVIRO-TEST QC REPORT

Workorder # L262481

Legend:

Limit	95% Confidence Interval (Laboratory Warning Limits)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Qualifier:

RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.
A	Method blank exceeds acceptance limit. Blank correction not applied, unless the qualifier "RAMB" (result adjusted for method blank) appears in the Analytical Report.
B	Method blank result exceeds acceptance limit, however, it is less than 5% of sample concentration. Blank correction not applied.
E	Matrix spike recovery may fall outside the acceptance limits due to high sample background.
F	Silver recovery low, likely due to elevated chloride levels in sample.
G	Outlier - No assignable cause for nonconformity has been determined.
H	Result falls within the 99% Confidence Interval (Laboratory Control Limits)
J	Duplicate results and limit(s) are expressed in terms of absolute difference.
K	The sample referenced above is of a non-standard matrix type; standard QC acceptance criteria may not be achievable.

APPENDIX D

NAPTHALENE AND BENZENE FLUX CALCUALTIONS

Weighted Average Napthalene Flux Calculation

Well Nest	Concentration (mg/L)	Thickness (m)	Width (m)	Area (m^2)	Concentration Weighted Average (mg/L)	Q (L/yr)	Mass Loading (mg/yr)	Mass Loading (kg/yr)
BD-01 B	0.01	6.90	42.00	289.80	0.01	2.51E+04	250.87	0.000
MW-29 A	0.00	4.70	45.00	211.50		1.83E+04		
B	0.04	0.40	45.00	18.00		1.56E+03		
C	1.00	2.00	45.00	90.00	0.28	7.79E+03	7849.70	0.008
MW-23 A	3.60	0.30	43.00	12.90		1.12E+03		
B	9.12	0.60	43.00	25.80		2.23E+03		
C	5.40	8.25	43.00	354.75		3.07E+04		
D	6.00	2.00	43.00	86.00	5.66	7.44E+03	234887.84	0.235
MW-24 B	0.01	5.30	34.00	180.20		1.56E+04		
C	0.01	1.10	34.00	37.40		3.24E+03		
D	4.10	2.80	34.00	95.20	1.26	8.24E+03	34008.13	0.034
MW-42 A	0.01	6.40	30.00	192.00		1.66E+04		
B	0.02	0.60	30.00	18.00		1.56E+03		
C	2.40	3.00	30.00	90.00	0.73	7.79E+03	18933.61	0.019
			Total Area	1701.55		1.47E+05	Total Mass	0.296

Notes: K= 4.50E-07
i = 0.0061

Weighted Average Benzene Flux Calculation

Well Nest	Concentration (mg/L)	Thickness (m)	Width (m)	Area (m2)	Concentration Weighted Average (mg/L)	Q (L/yr)	Mass Loading (mg/yr)	Mass Loading (kg/yr)
BD-01 B	1.30	6.90	42.00	289.80	0.01	2.51E+04	250.87	0.000
MW-29 A	0.11	4.70	45.00	211.50		1.83E+04		
B	8.20	0.40	45.00	18.00		1.56E+03		
C	0.79	2.00	45.00	90.00	0.76	7.79E+03	20946.02	0.021
MW-23 A	18.00	0.30	43.00	12.90		1.12E+03		
B	8.50	0.60	43.00	25.80		2.23E+03		
C	25.00	8.25	43.00	354.75		3.07E+04		
D	19.00	2.00	43.00	86.00	22.85	7.44E+03	948269.11	0.948
MW-24 B	0.40	5.30	34.00	180.20		1.56E+04		
C	7.00	1.10	34.00	37.40		3.24E+03		
D	22.00	2.80	34.00	95.20	7.76	8.24E+03	210207.26	0.210
MW-42 A	0.07	6.40	30.00	192.00		1.66E+04		
B	2.40	0.60	30.00	18.00		1.56E+03		
C	4.10	3.00	30.00	90.00	1.42	7.79E+03	36796.23	0.037
			Total Area	1701.55		1.47E+05	Total Mass	1.216

Notes: K= 4.50E-07
i = 0.0061