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May 21, 2015
File: 1505-004.06

Ministry of Technology Innovation Citizens' Services
Suite 209 – 4000 Seymour Place
Victoria, BC V8V 1X4

Attn: Michael Masson, Environmental Lead

Dear Mr. Masson,

Re: Performance Verification Plan for Certificate of Compliance at South Block Lot 2, 537 Superior Street, Victoria, BC

Hemmera Envirochem Inc. (Hemmera) has prepared this Performance Verification Plan (PVP) in support of an application for a Certificate of Compliance (CofC) for the property located at South Block – Lot 2, 537 Superior Street, Victoria, BC (the "Site"). The PVP presents the principle risk management measures that apply at the Site so that risk-based standards are and continue to be met, and the actions that must be taken so that these risk controls are implemented and maintained. This PVP was prepared in accordance with BC Ministry of Environment (MOE) *Procedure 12: Procedures for Preparing and Issuing Contaminated Site Legal Instruments,* effective February 1, 2014 (BC MOE 2014a) and BC MOE Administrative Guidance on Contaminated Sites #14: *Performance Verification Plans, Contingency Plans, and Operations and Maintenance Plans, Version 1.0,* dated February 2014 (BC MOE 2014b).

A detailed human health and ecological risk assessment (DHHERA) was conducted for the Site in May 2015. The DHHERA relied on the Stage 1 and 2 Preliminary Site Investigation and Detailed Site Investigation (Hemmera 2015).

1.0 RISK CONTROL TYPE

Based on the risk management measures for the Site (i.e., the use of institutional controls to mitigate/eliminate risks at the Site and lack of imminent risks in the event that controls were either not implemented or were implemented but were rendered ineffective), the Type applicable at the Site is considered to be **Type 2**.

Under a **Type 2** scenario, the BC MOE (2014a; 2014b) indicates that a PVP is required, while an operations and maintenance plan may be required.

2.0 PERFORMANCE VERIFICATION PLAN

A PVP is required to maintain the principle risk management measures upon which the DHHERA is based. This includes the maintenance of up-to-date records of performance verification actions and results for the Site being maintained by the responsible person (or their agents). If requested by the Director, the responsible person (or their agents) must provide these records to the BC MOE. As well, if requested by the Director, responsible person(s) must provide a signed statement on whether conditions set out in Schedule B of the CofC are being met.

2.1 REQUIRED RISK CONTROLS

a) Groundwater must not be used for domestic purposes (i.e. drinking water).

b) If future buildings are constructed at the Site, measures must be in place so that groundwater is not in contact with the building foundation and groundwater sumps, if required, must be sealed.

c) Soil at the Site must not be redistributed as surface soils and used to grow vegetation.

2.2 SUMMARY OF RATIONALE FOR SELECTING REQUIRED PVP ELEMENTS

Groundwater must not be used for domestic purposes (i.e., drinking water).

Nitrate remains in groundwater at concentrations greater than the BC Contaminated Sites Regulation (CSR) Schedule 6 drinking water (DW) standards. The DHHERA concluded that drinking water wells are unlikely to be installed at the Site in the future given that the current on-site buildings are connected to the municipal water system. Communication by the Site owner to future users and operators that groundwater water should not be used as a potable water supply is considered to be a suitable risk measure. Decommissioning of the existing monitoring wells would further mitigate this as a possibility.

If future buildings are constructed at the Site, measures must be in place so that groundwater is not in contact with the building foundation and groundwater sumps, if required, must be sealed.

The DHHERA applied a sub-slab attenuation factor of 0.02 to measured soil vapour concentrations to evaluate indoor air exposures to human receptors. The DHHERA assumed that future buildings (buildings with underground parkades, with basements, or slab-on-grade) would have measures in place that would limit the potential for sustained groundwater contact with the building foundation. Based on a preliminary geotechnical report (DGI 2013), these measures could include a perimeter drainage system, free draining backfill, and/or groundwater sumps. Future buildings with foundations in contact with contaminated groundwater may result in higher volatile concentrations in indoor air then those indoor air concentrations assessed in the DHHERA. As such, measures must be in place such that contaminated groundwater is not in contact with the future building foundations.

Groundwater sumps may act as preferential pathways of vapour intrusion to future buildings particularly if groundwater contamination enters the sump and volatile contaminants enter the breathing zone. Toluene, xylenes, benzene, naphthalene, and chloroform are detected in groundwater at a few monitoring well locations. Health risks to future residents related to sump air exposures were evaluated by comparing non-attenuated measured soil vapour concentrations to BC CSR Schedule 11 soil vapour standards for residential land use. Potential risks to future residents and commercial receptors from exposures to multiple contaminants may exist. Non-attenuated measured soil vapour concentrations greater than BC CSR Schedule 11 standards for residential land use have been reported throughout the Site:

- n-hexane (at locations SV13-14, -43),
- benzene (at locations SV13-1, -2, -3,-4,-13,-14.-15, 21,-22,-43),
- xylenes (at location SV13-14),
- VPHv (C6-C13) (at locations SV13-2, -3,-4,-13,-14,-15,-21,-22,-43),
- naphthalene (at locations SV13-15, -22),
- 1,2,4-trimethylbenzene (at locations SV13-2,-3,-4,-14,-15,-21,-22),
- 1,3,5-trimethylbenzene (at locations SV13-14),
- bromodichloromethane (BDCM) (at locations SV13-22),
- trichloromethane (chloroform) (at locations -1,-2,-3,-4,-22,-43),
- tetrachloromethane (carbon tetrachloride) (at locations -2,-3,-4,-22,-43), and
- trichloroethylene (TCE) (at locations SV13-2).

Sealing of groundwater sumps would mitigate potential health risks to future receptors from indoor air exposures to the volatile contaminants.

Soil at the Site must not be redistributed as surface soils and used to grow vegetation.

Barium, chloride, and zinc are greater than the BC CSR residential land use soil standard for toxicity to soil invertebrates and plants. Given the possibility of future gardening on the Site, the DHHERA considered potential risks to human health from ingestion of edible plants growing in contaminated soils. Certain plants may accumulate contaminants which when harvested and consumed by people may result in adverse health effects. The DHHERA assumed that all plants (edible and non-edible) would be grown in clean soils.

Instituting a prohibition on the use establishment of soils from the site as media to grow vegetation and use of planter boxes would limit the potential for accumulation of contaminants by root uptake were considered to be appropriate risk management actions.

3.0 CLOSURE

We have appreciated the opportunity of working with you on this project and trust that this report is satisfactory to your requirements. Please feel free to contact the undersigned regarding any questions or further information that you may require.

Report prepared by:
Hemmera Envirochem Inc.

ORIGINAL SIGNED AND STAMPED

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Report peer reviewed by:
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This document represents an electronic version of the original hard copy document, sealed, signed and dated by Adam J. Radlowski, M.Sc., R.P.Bio.and Diane Zorn, P.Eng., CSAP and retained on file. The content of the electronically transmitted document can be confirmed by referring to the original hard copy and file. This document is provided in electronic format for convenience only. Hemmera Envirochem Inc. shall not be liable in any way for errors or omissions in any electronic version of its report document.

4.0 STATEMENT OF LIMITATIONS

This report was prepared by Hemmera Envirochem Inc. (“Hemmera”), based on previous investigations reports, for the sole benefit and exclusive use of the Ministry of Technology, Innovation and Citizens' Services (Client). For the purpose of the work product herein, Hemmera extends reliance on the report to the BC Ministry of the Environment (MOE), provided that the MOE is bound to the same terms and conditions as the Client. The material in it reflects Hemmera’s best judgment in light of the information available to it at the time of preparing this report. Any use that a third party makes of this report, or any reliance on or decision made based on it, is the responsibility of such third parties. Hemmera accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

Hemmera has performed the work as described above and made the findings and conclusions set out in this report in a manner consistent with the level of care and skill normally exercised by members of the environmental science profession practicing under similar conditions at the time the work was performed.

This report represents a reasonable review of the information available to Hemmera within the established scope, work schedule and budgetary constraints. It is possible that the levels of contamination or hazardous materials may vary across the Site, and hence currently unrecognised contamination or potentially hazardous materials may exist at the Site. No warranty, expressed or implied, is given concerning the presence or level of contamination on the Site, except as specifically noted in this report. The conclusions and recommendations contained in this report are based upon applicable legislation existing at the time the report was drafted. Any changes in the legislation may alter the conclusions and/or recommendations contained in the report. Regulatory implications discussed in this report were based on the applicable legislation existing at the time this report was written.

In preparing this report, Hemmera has relied in good faith on information provided by others as noted in this report, and has assumed that the information provided by those individuals is both factual and accurate. Hemmera accepts no responsibility for any deficiency, mis-statement or inaccuracy in this report resulting from the information provided by those individuals.

The liability of Hemmera to Ministry of Technology, Innovation and Citizens' Services shall be limited to injury or loss caused by the negligent acts of Hemmera. The total aggregate liability of Hemmera related to this agreement shall not exceed the lesser of the actual damages incurred, or the total fee of Hemmera for services rendered on this project.

5.0 REFERENCES

BC MOE 2014a. BC Ministry of Environment (BC MOE) Procedure 12: Procedures for Preparing and Issuing Contaminated Site Legal Instruments dated January 14, 2014. Effective February 1, 2014.

BC MOE 2014b. BC MOE Administrative Guidance on Contaminated Sites: Performance Verification Plans, Contingency Plans, and Operations and Maintenance Plans, Version 1.0 dated February 2014.

BC MOE (2010). BC Ministry of Environment. CSR Technical Guidance 4 Vapour Investigation and Remediation, Version 1, September 2010.

DGI (2013) Davies Geotechnical Inc. Preliminary Geotechnical Report South Block, Victoria, BC. Dated August 20, 2013.

Hemmera (2015). Stage 1 and 2 Preliminary and Detailed Site Investigation South Block, Superior Street, Victoria, British Columbia. Dated May 2015.