



MILLENNIUM
EMS Solutions Ltd.

#148, 2257 Premier Way
Sherwood Park, AB T8H 2M8
tel: 780.496.9048
fax: 780.496.9049

Suite 202, 701 - 64 Avenue SE
Calgary, AB T2H 2C3
tel: 403.592.6180
fax: 403.283.2647

#102, 11312 98 Avenue
Grande Prairie, AB T8V 8H4
tel: 780.357.5500
fax: 780.357.5501

toll free: 888.722.2563
www.mems.ca

Regulatory Approval of Risk Tools 2019 Update and Next Steps

Prepared for:
Petroleum Technology Alliance Canada

Prepared by:
Millennium EMS Solutions Ltd.
Suite 202, 701 - 64 Avenue SE
Calgary, Alberta
T2H 2C3

February 2020
File #17-00394

Table of Contents

	Page
Table of Contents.....	i
1.0 INTRODUCTION.....	1
2.0 MULTI-LAYER EXTENSION OF TIER 2 GROUNDWATER MODEL	1
2.1 Overview.....	1
2.2 Regulator Meeting Outcomes	2
2.3 Next Steps	2
3.0 SCREENING GROUNDWATER GUIDELINE APPROACH FOR INORGANICS	3
3.1 Overview.....	3
3.2 Regulatory Meeting Outcomes	3
3.3 Next Steps	3
4.0 ELIMINATION OF WILDLIFE SOIL INGESTION	3
4.1 Overview.....	3
4.2 Regulatory Meeting Outcomes	4
4.3 Next Steps	4
5.0 TIER 2 PARAMETERS FOR PEAT	4
5.1 Overview.....	4
5.2 Regulatory Meeting Outcomes	5
5.3 Next Steps	5
6.0 LIMITATIONS OF LIABILITY AND CLOSURE.....	5
7.0 REFERENCES	7

1.0 INTRODUCTION

One of the key challenges in getting site-specific risk assessments quickly approved by regulators is the lack of formally approved tools, resources and methods. This limits the review of risk assessments to a small number of technical experts with limited available time. However, there are a variety of tools already developed that are broadly applicable to large numbers of sites and have been shown to effectively reduce remediation requirements/cost; formal vetting and approval of these tools would streamline the review and approval of risk assessments using them.

The intent of the current project is to work with regulators to get select existing risk assessment tools vetted by Alberta Environment and Parks (AEP) and the Alberta Energy Regulator (AER) and endorsed for use for their intended purposes. A secondary purpose is to compile information on available tools in a single location.

The 2018 report for this project documented 6 potential tools. Four (4) of these were presented to Alberta Environment and Parks (AEP) and the Alberta Energy Regulator (AER) on September 27, 2019:

- Multi-layer extension of Tier 2 groundwater model;
- Screening groundwater guideline approach for inorganics;
- Elimination of wildlife soil ingestion at depth at remote green area sites; and
- Tier 2 model parameters for peat.

The meeting was attended by AEP (Norman Sawatsky and Gordon Dinwoodie), AER (Dan Pollard), CNRL (Sonia Glubish), Husky (Shawn Glessing), the Orphan Well Association (Wanda Sakura) and Millennium EMS Solutions Ltd. (Ian Mitchell, Miles Tindal, Trevor Burgers). The current report summarizes the outcomes of the presentation to regulators and next steps.

2.0 MULTI-LAYER EXTENSION OF TIER 2 GROUNDWATER MODEL

2.1 Overview

The Tier 1 groundwater model has a built-in assumption that shallow groundwater is a domestic use aquifer (DUA). However, in many cases shallow groundwater is not a DUA. The proposed tool is intended for use when DUA is a critical pathway, shallow groundwater is not a DUA, but the pathway cannot be unconditionally eliminated (*i.e.*, insufficient data to demonstrate adequate isolating unit, isolating unit doesn't meet elimination requirements, or substance not eligible for elimination).

The proposed tool is a simple modification of the existing Tier 1 groundwater model, adjusted to account for vertical transport through clean saturated (instead of unsaturated) soils and dilution within a deeper DUA.

2.2 Regulator Meeting Outcomes

This tool was the primary focus of the September 2019 meeting with AEP and AER. Key outcomes from the meeting included:

- The conditions for applying the approach need to be clearly defined. This includes plume stability, low concentrations, not a conservative solute.
- AEP suggested that a guidance document framed out adjustment factors (e.g. 10x, 100x) based on certain conditions would be of more interest to them for general application than a modelling approach; the model would be used as part of the basis for justifying the adjustment factors and the minimum information requirements.
- The approach needs to be protective rather than predictive; AEP envisions an implementation document and a scientific rationale.
- The approach needs to account for complexities that are not accounted for in the model. For example, in the unsaturated zone fingered flow occurs but is fairly stable and movement is a bit faster than predicted, but when appropriately bounded AEP allows its use.
- Clear weight of evidence requirements for demonstrating separation thicknesses less than 5 m would be required (e.g. consistent description of geological units).
- The approach needs to be broader than petroleum hydrocarbons at upstream sites. Criteria for application may include an exclusion for dense non-aqueous phase liquids (DNAPL) such as creosote or chlorinated solvents.

2.3 Next Steps

To meet regulator requirements, a guidance document will need to be prepared. This guidance document would use the model as part of the underlying technical support, but the guidance itself would be framed as conditions under which guidelines for the protection of domestic use aquifers could be multiplied by an adjustment factor, similar to approaches used for vapour inhalation. The guidance document would need to include:

- A conceptual model for application;
- Results of vertical transport modelling for a range of conditions including a sensitivity analysis;
- An assessment of alternative approaches to evaluate vertical transport to ensure conservatism;

- A set of guideline adjustment factors with criteria for application supported by the model results; and
- Conditions under which the guidance could and could not be applied.

3.0 SCREENING GROUNDWATER GUIDELINE APPROACH FOR INORGANICS

3.1 Overview

The Tier 1 groundwater model is designed for use with organic chemicals. Transport of inorganics is complicated by different factors affecting soil/water partitioning and background concentrations in groundwater. An approach is needed to derive site-specific groundwater guidelines for metals that are not in contact with the receptor/point of exposure – *i.e.*, when shallow groundwater is not a DUA and/or there is no surface water close to the site being assessed.

The tool involves the application of the Tier 1 groundwater model, with modifications to account for the differences between organic and inorganic chemicals. Specifically, the tool incorporates consideration of background concentrations at both the source and receptor, and replaces the organic carbon partition coefficient and soil organic carbon content with the application of a soil-water partitioning coefficient (K_d). The K_d is either a conservative screening value (values published by the British Columbia Ministry of Environment and Climate Change Strategy (2017) were recommended) or a measured site-specific value.

3.2 Regulatory Meeting Outcomes

This tool was only briefly discussed at the meeting with AEP and AER. The primary issue raised was that AEP would need confidence that K_d values applied for inorganics were conservative for Alberta conditions.

3.3 Next Steps

A scientific rationale report documenting the basis for the K_d values and the methodology for measuring a conservative site-specific K_d value is expected to address regulatory requirements for application of the screening model.

4.0 ELIMINATION OF WILDLIFE SOIL INGESTION

4.1 Overview

The wildlife soil & food ingestion pathway cannot be eliminated under current guidance. However, at remote sites where there is no likelihood of disturbance/regrading, there would be no exposure to contamination at sufficient depth. While most wildlife would only be exposed to contamination at surface (through soil ingestion) or within the rooting zone (through food ingestion), the presence of

burrowing animals which may be exposed at greater depths must also be considered. Elimination of this pathway is proposed when:

- The site is public land in a natural area.
- The site is in a remote location as defined by ESRD (2014).
- The site does not overlap a grazing lease where dugout construction is feasible.
- The site is stable as defined by ESRD (2014).
- Contamination is below 1.5 m (fine soil) or 3.0 m (coarse soil).
- Contamination is below the depth of the deepest burrowing mammal present in the area, supported by a comprehensive review of species present in the natural subregion of the site and information on burrow depths of those species.

The primary anticipated application of this tool would be on sites with deep barite impacts exceeding the wildlife soil ingestion guideline.

4.2 Regulatory Meeting Outcomes

AEP expressed a position that, if the wildlife soil and food ingestion pathway were eliminated, a management limit may be needed to ensure there are limits on residual concentrations. It was also noted that land manager input may be needed.

4.3 Next Steps

A protocol for the derivation of management limits for metals would likely be required to fully address the regulator concerns. While the primary application of the tool is expected to be for barite sites, a more general approach is expected to be better received and would also have broader application for metals in subsoil.

5.0 TIER 2 PARAMETERS FOR PEAT

5.1 Overview

Currently, AEP endorses the use of coarse soil guidelines for peat. However, the properties of peat are substantially different from coarse soils. Where transport needs to be assessed on a site-specific basis, parameters that are more representative of peat would be appropriate. Based on a literature review, conservative parameters specific to peat have been recommended.

5.2 Regulatory Meeting Outcomes

The view of AEP expressed at the September 2019 session was they did not want to look at specific parameters for peat transport without the context of a broader framework for assessing and closing peat sites.

5.3 Next Steps

To progress the closure of peat sites, a robust framework will be required. There have been several previous PTAC projects addressing aspects of peat sites which could form part of the underlying technical basis of such a framework. The framework would need to include:

- Clear definition of objectives (preservation of peatland, prevention of adverse effect);
- Requirements for assessing peat sites;
- Criteria for assessing peat health and function; and
- Endpoints for demonstrating closure (numerical and/or function-based).

6.0 LIMITATIONS OF LIABILITY AND CLOSURE

This report was prepared by Millennium EMS Solutions Ltd. (“MEMS”) for the Petroleum Technology Alliance of Canada (“PTAC”) and has been completed in accordance with the terms of reference in the Recipient Agreement dated April 26, 2019 for PTAC Project reference 19-RRRC-02. This report does not necessarily represent the views or opinions of PTAC or the PTAC members.

While we have made every attempt to ensure that the information contained in this report is complete and has been obtained from reliable sources, neither MEMS nor PTAC are responsible for any errors or omissions, or for the results obtained from the use of the information in this report.

Nothing in this report should be a substitute for independent site investigations and the sound technical and business judgment of the reader. In no event will MEMS, PTAC or their employees or agents, be liable to the reader or anyone else for any decision made or action taken in reliance on the information in this report.

Yours truly,

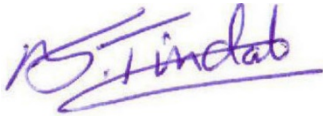
Millennium EMS Solutions Ltd.

Prepared by:



Ian Mitchell
VP Client & Business Services

Reviewed by:



Miles Tindal
Specialist, Risk Assessment

7.0 REFERENCES

Alberta Environment and Sustainable Resource Development (ESRD). 2014. Subsoil Petroleum Hydrocarbon Guidelines for Remote Forested Sites in the Green Area.

British Columbia Ministry of Environment and Climate Change Strategy. 2017. Technical Guidance on Contaminated Sites 13: Groundwater Protection Model.