



**PROTOCOL FOR THE CONTAMINATED SITES REGULATION
UNDER THE ENVIRONMENT ACT**

**PROTOCOL No. 13:
Adaptive Management**

Prepared pursuant to Part 6 – Administration, Section 21,
Contaminated Sites Regulation, OIC 2002/171

ADAPTIVE MANAGEMENT

1.0 Introduction

Adaptive management is the process of planning a response to circumstances or events that may not be fully predictable or expected. Adaptive management identifies, in advance, actions that must be taken to gather information and respond appropriately in the event of an unanticipated or unpredictable circumstance.

Section 21(1) of the *Contaminated Sites Regulation*, O.I.C. 2002/171 (CSR), authorizes the Minister or his/her delegate to approve or adopt protocols. In accordance with Section 21(1), this protocol has been designed to ensure a consistent approach to identify and respond to impacts from activities that may adversely impact water quality, including operation of a land treatment facility or a solid waste disposal facility.

2.0 Water quality monitoring requirements

All landfill waste disposal facilities and some modified transfer station waste disposal facilities, as well as all land treatment facilities that accept highly contaminated material or have a capacity of 3000 m³ or greater, are required to conduct a hydrogeological assessment and ongoing groundwater monitoring as per permits issued pursuant to the *Environment Act*. Other permitted activities may be required to conduct a hydrogeological assessment and ongoing groundwater monitoring in accordance with their permit. The hydrogeological assessment and water quality monitoring must be conducted in accordance with the permit issued to the facility and all applicable protocols pursuant to the CSR.

Collecting and analyzing samples of groundwater and surface water near the facility is important to detect potential impacts to water quality from the permitted activity. Analytical results are compared to the generic numerical water standards specified in Schedule 3 of the CSR, which identify acceptable limits for contaminant concentrations in groundwater and surface water, depending on the applicable water use(s) of the site, in accordance with CSR Protocol 6: Application of Water Quality Standards.

3.0 Adaptive management triggers for land treatment facilities

Land treatment facility permit holders must develop an adaptive management plan if hydrocarbons are detected in any monitoring well at their facility in two consecutive sampling events. Detection of hydrocarbons may indicate a breach in the liner system designed to contain contaminants within the land treatment facility.

4.0 Adaptive management triggers for solid waste disposal facilities

Solid waste disposal facility permit holders must develop an adaptive management plan if there is evidence of any contaminant at a concentration equal to or greater than the appropriate generic numerical water standards specified in the CSR for a sustained period of time as outlined below.

Environmental Programs Branch recognizes that a one-time exceedance of standards may not indicate long-term deterioration of water quality. Thus, an adaptive management plan will be required if one of the following triggers is met in any groundwater monitoring well or surface water

body potentially impacted by the facility, based on the permit requirement for water quality sampling:

- Exceedances of a parameter in four consecutive bi-annual sampling events;
- Exceedances of a parameter in five out of six bi-annual sampling events; or
- Three seasonally-consecutive exceedances (e.g. three spring exceedances in a three year period or three fall exceedances in three year period).

5.0 Triggers for plans for other activities

Permit holders for other activities where water quality is monitored may be required to develop an adaptive management plan in accordance with the permit issued for their activity.

6.0 Preparation of Adaptive Management Plan

When one of the triggers described above or in the permit issued for the facility is met, the permittee must prepare an adaptive management plan for approval or attempt to demonstrate that adaptive management is not required.

An argument that adaptive management is not required may be based on one of the following premises:

- 1) The contamination observed is caused by a source other than the permitted activity; or
- 2) For solid waste disposal facilities, the contamination observed is consistent with local, natural background water quality.

This rationale must be submitted to an environmental protection analyst for review who will determine whether an adaptive management plan is required.

If an adaptive management plan is required, the plan must describe the current water quality at the site and predict a number of possible future scenarios regarding water quality. The permit holder is responsible for actions to assess, reduce, contain and mitigate contamination on the site to ensure that off-site migration of contaminants and associated off-site impacts are minimized.

Each scenario in the adaptive management plan shall be associated with a series of specific actions that will be taken if that scenario becomes true. Initial actions associated with any scenario may be simple, such as increasing the frequency of water quality monitoring or establishing additional water quality monitoring locations, while later actions may be more complex, such as delineating, containing, reducing, or assessing the risk of the contamination observed.

More advanced actions associated with adaptive management generally fall under the following categories:

- 1) Source Control – The purpose of source control is to reduce or eliminate the source of the observed contamination. Examples of source control include:
 - a. Banning certain types of material from the facility;
 - b. Repairing or installing liners;
 - c. For a solid waste disposal facility, ensuring that completed cells are properly capped and contoured; and
 - d. For a solid waste disposal facility, excavating the offending material.

- 2) Monitored Natural Attenuation – Natural attenuation refers to physical, chemical, or biological processes, occurring without human intervention, that act to reduce the concentration of contaminants in soil or groundwater. Monitored natural attenuation (MNA) is a controlled approach to site remediation in which natural attenuation processes are used to achieve compliance with the generic numerical water standards in the CSR within a reasonable timeframe. It is frequently combined with source control measures. MNA must be conducted in accordance with CSR Protocol 8. In particular, MNA shall only be used at sites where a quantitative risk assessment has been conducted unless otherwise authorized by the Standards & Approvals section of the Environmental Programs Branch, the CSR, or another Protocol approved under section 21(1) of the CSR.
- 3) Plume Containment – The aim of plume containment is to prevent contaminants from migrating and impacting potential receptors. Containment may be achieved with physical methods (e.g., caps, sheet piles, slurry walls, grouted barriers), hydraulic methods (e.g., extraction wells, injection wells, subsurface drains), or a combination thereof.
- 4) In-Situ Restoration – In-situ restoration involves taking action to reduce contamination without extracting the groundwater or surface water. Examples of in-situ restoration include:
 - a. Addition of microorganisms and/or nutrients to promote natural degradation of contaminants;
 - b. Permeable reactive barriers;
 - c. Thermal desorption;
 - d. Vapour extraction; and
 - e. pH control.
- 5) Ex-Situ Restoration – Ex-situ restoration (commonly referred to as “pump and treat”) involves removing the affected water and treating it. The treated water can potentially be injected to an aquifer or discharged to a surface water body or sewer system.

The actions proposed in an adaptive management plan must reflect site-specific considerations, including the concentration and types of contaminants observed, the known extent of contamination, the groundwater flow speed and direction, and the distance to receptors. If remedial options are proposed, the plan must compare the different remedial options considered and describe how the contaminants of concern are expected to respond to each proposed remedial option.

An adaptive management plan must also describe how progress will be measured, including water quality monitoring locations and sampling frequency and the statistical methods that will be used to analyse the data gathered.

Please be aware that some activities under an adaptive management plan may trigger an assessment under the *Yukon Environmental and Socio-economic Assessment Act*.

7.0 Adaptive Management Plan Approval

An adaptive management plan must be submitted to an environmental protection analyst for approval within 90 days of becoming aware that such a plan is required in accordance with sections 3.0, 4.0 and 5.0 of this protocol. The adaptive management plan must be prepared by a qualified professional.

The permit holder must incorporate any changes to the adaptive management plan as requested by an environmental protection analyst and implement the adaptive management plan as of the date it is approved. The permit holder must not undertake any of the actions described in the adaptive management plan prior to the plan being approved, with the exception of additional water quality monitoring. If some actions in the proposed adaptive management plan should be undertaken immediately, the proponent must obtain permission from an environmental protection analyst for that portion of the plan, prior to the entire plan being approved, in order to undertake those actions.

If an environmental protection analyst requests in writing and with reasons that an approved adaptive management plan be amended, the permit holder must prepare the required amendment and submit the revised adaptive management plan for approval to an environmental protection analyst within the period of time specified in the request.

8.0 Effective Date

The effective date of this protocol shall be February 7, 2018, and it shall remain in effect until replaced or rescinded by the Environmental Programs Branch.

9.0 Additional Information

For more information on contaminated sites, please contact:

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| Environmental Programs Branch (V-8) Department of Environment Government of Yukon Box 2703, Whitehorse, YT Y1A 2C6 | T: 867-667-5683 or 1-800-661-0408 ext. 5683 F: 867-393-6205 E: envprot@gov.yk.ca |
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Approved:



Date: February 7, 2018

Manager, Standards and Approvals Section
Environmental Programs Branch
Department of Environment