



GOVERNMENT OF
NEWFOUNDLAND AND LABRADOR

Department of Environment and Conservation

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GUIDANCE DOCUMENT

Title: Determination of Petroleum Product Resemblance for
use of Atlantic PIRI Guidelines

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PETROLEUM PRODUCT
RESEMBLANCE FOR USE OF
ATLANTIC PIRI GUIDELINES
GD-PPD-044.1

1.0 SUBJECT:

The determination of petroleum product resemblance for selection of applicable Tier I guidelines for the management of petroleum impacted sites.

2.0 OBJECTIVE:

To clarify the procedures for characterizing petroleum hydrocarbon contamination in order to select the appropriate Modified TPH cleanup guidelines, when following the Tier I method described in the Department's "Guidance Document for the Management of Impacted Sites" (latest version).

3.0 DEFINITIONS:

Atlantic PIRI: Partnership in RBCA (Risk-Based Corrective Action) Implementation.

Atlantic RBCA toolkit: The latest version of the Atlantic Risk-Based Corrective Action software model, developed by Atlantic PIRI, and used to assess potential of risk to human health and develop site-specific screening levels (guidelines). This model is currently endorsed by the four Atlantic Provinces for petroleum hydrocarbon contamination only, although other parameters are being considered.

BTEX: An acronym for the hydrocarbon compounds benzene, toluene, ethylbenzene and xylene(s).

CCME: Canadian Council of Ministers of the Environment

Contaminant: A substance that causes or may cause an adverse effect.

Department: Department of Environment and Conservation

Designated Contaminated Site: A site formally designated as a contaminated site by the Minister of Environment and Conservation under Section 26 of the *Environmental Protection Act* SNL 2002 cE-14.2.

Impacted Site: A site that contains a contaminant, above or below guidelines.

Person Responsible: The person(s), association of persons, corporate entity, or municipality determined, by the Department or an agent acting on behalf of the Department, to be responsible for the remediation of an impacted site, as defined in Section 2(x) or Section 2(y) of the Newfoundland and Labrador *Environmental Protection Act*.

Petroleum Hydrocarbon: A hydrocarbon is a molecule consisting primarily of carbon and hydrogen. Hydrocarbon groups present in petroleum products include: alkanes, alkenes, alkynes, aromatics, polynuclear aromatics, and complex hydrocarbon compounds containing oxygen, nitrogen, and sulfur. These compounds are found in or derived from geological sources such as oil, coal and bitumen. In this document, petroleum hydrocarbons refer to BTEX and Modified Total Petroleum Hydrocarbons (TPH), which is TPH minus BTEX.

4.0 BACKGROUND:

It is the Department's policy that impacted sites are to be managed in accordance with the *"Guidance Document for the Management of Impacted Sites."* As outlined in that document, the Department has adopted a tiered approach to the management of impacted sites, whereby three tiers (Tier I, Tier II and Tier III) of increasing technical complexity are available for use. Tier I, II or III can be applied, depending on the specifics of the site and various other factors.

The Tier I method streamlines the management process by providing published cleanup guidelines in tables (Tier I Risk-Based Screening Levels or RBSLs) found in the *"Atlantic PIRI User Guidance for Petroleum Impacted Sites in Atlantic Canada"*.

The Tier I guidelines are generic risk-based values, that have been established by Atlantic PIRI using the Atlantic RBCA model. The default parameters used in the model are typical of many sites in Atlantic Canada and are considered to be conservative and applicable for most locations. These guidelines can only be used if the site meets the defaults and mandatory conditions listed in the Preamble to the Tier I RBSL tables. This is outlined in the *"Guidance Document for the Management of Impacted Sites"*, with additional information in the *"Atlantic PIRI User Guidance for Petroleum Impacted Sites in Atlantic Canada"*.

Modified TPH Tier I RBSLs are provided in these tables for three types of fresh petroleum products (gasoline, diesel/#2 oil and #6 oil (lube oil)). These are typical products used in Atlantic Canada. When using the Tier I method to evaluate a site containing petroleum hydrocarbon contamination, it is necessary to determine which of the three petroleum product types the contamination resembles in order to select the appropriate guideline. This guidance document outlines the process to be followed in making this determination.

5.0 LEGISLATION:

- Environmental Protection Act, Sections 26(2), 29(a) and 29(b)

6.0 PROCEDURE:

The following procedure is based on guidance established and provided by Atlantic PIRI.

- 6.1 The applicable Modified TPH Tier I RBSL should be selected for each petroleum hydrocarbon impacted area on the site.
- 6.2 No more than one Modified TPH Tier I RBSL shall be selected for each actual or potential contaminant source. Where two or more samples are collected and analysed for a single source, the procedure outlined in the following sections shall be performed. If the laboratory results for the samples differ to the extent that more than one hydrocarbon product type is identified for a single source, the most stringent guideline is selected.
- 6.3 Analytical laboratories report Modified TPH in four carbon ranges (C_6-C_{10} {excluding BTEX}, $>C_{10}-C_{16}$, $>C_{16}-C_{21}$ and $>C_{21}-C_{32}$). These ranges are not the same as the petroleum product types specified in the Tier I Tables, and must not be individually compared to the Modified TPH criteria for the specified product types (e.g., the laboratory results for $>C_6-C_{10}$ must not be compared directly to the gasoline RBSL). Rather, the laboratory results for the four carbon ranges must be added together and the total then compared to the applicable Modified TPH RBSL.
- 6.4 The applicable Modified TPH RBSL for a given site should be selected based on a clear indication of a single product type by the laboratory, when such information is provided in their product resemblance comments. If a single product type is not clearly identified by the laboratory, the Modified TPH guideline must be selected upon consideration of the following information:
 - review of historical information for the site (petroleum usage, storage and/or spillage); and
 - comparison of the carbon fraction distribution obtained from laboratory results to the values provided in Table 1 (these percent distributions, published by Atlantic PIRI, are those used in the derivation of the Tier I RBSLs).

Table 1: Distribution of Carbon Fractions in Fresh Hydrocarbon Products (%)

	C6 – C10	>C10 – C16	>C16 – C21	>C21 – C32	TOTAL
Gasoline	76	24	0	0	100
Diesel / #2 Oil	6	63	26	5	100
#6 Oil (Lube/Heavy Oil)	1	26	33	40	100

Note: BTEX is excluded from C6-C10 (i.e., modified).

- 6.5 When considering historical records for product determination, it is important to reconcile the information with laboratory results to ensure the Modified TPH RBSL selected is applicable to the existing state of the product. In some circumstances, weathering of a petroleum product may result in the loss of the more volatile fractions, such that it more closely resembles a 'heavier' product. For example, if gasoline weathers to the extent that the C₆-C₁₀ fraction forms 6% or less of the total TPH in the sample, as shown as Table 1, the product may have similar chemical and toxicological properties as diesel. In such a situation, the Modified TPH Tier I RBSL for diesel should be selected.
- 6.6 In certain situations, weathering of petroleum products or mixing of different product types on a site can make it difficult, if not impossible, to provide a definitive identification of a petroleum product type. When laboratory results for a given source provide resemblance comments or a carbon fraction distribution that could be indicative of more than one hydrocarbon product type, the most stringent RBSL should be selected.

7.0 REFERENCES:

1. Government of Newfoundland and Labrador, Department of Environment and Conservation, *Guidance Document for the Management of Impacted Sites*, Version 2, January 29, 2014.
2. Atlantic PIRI Committee, *Atlantic RBCA (Risk-Based Corrective Action) User Guidance for Petroleum Impacted Sites in Atlantic Canada*, Version 3.0, July 2012.