Guidance Document
for the
Management of Impacted Sites

December 2004

Version 1.0

GOVERNMENT OF
NEWFOUNDLAND
AND LABRADOR

Environment and Conservation

Preface

The purpose of this guidance document is to provide a clear process for the management of impacted sites in the Province of Newfoundland and Labrador that results in the satisfactory resolution of environmental contamination, which may present an unacceptable risk to human and ecological health.

The guidance document incorporates recent scientific and regulatory advances in this area that have resulted from work at the international, national and regional levels. Specifically, recent work by the Canadian Council of Ministers of the Environment (CCME), the Canada Wide Standards (CWS) for Petroleum Hydrocarbons (PHC) Committee and the Atlantic Partners in RBCA (Risk Based Corrective Action) Implementation (PIRI) Committee have provided additional technical and management tools that will contribute to viable solutions to provincial impacted sites.

The technical approaches in this guidance document are considered to be harmonized with the CCME CWS for PHC and with RBCA approaches taken in other Atlantic Provinces. This approach benefits from national and regional expertise and provides a high degree of uniformity in a complex area.

The guidance document is based on the tiered approach to site management. Within this tiered approach, three tiers of increasing technical complexity (Tier I, II and III) are available for the management of impacted sites, all of which provide protection of human health and the environment. The person responsible for each impacted site has the option to use the Tier that they consider most appropriate for the site, as long as they maintain compliance with the guidance document process administered by the Province. Tier I and II will be sufficient to manage most impacted sites within the province but large and complicated sites may require a Tier III analysis, which may include extensive study and multiple technical approaches. The Province accepts the use of CCME Protocols and the Atlantic RBCA model as safe and cost-effective preferred tools at Tier I and II but does not restrict the use of other equivalent methodologies at Tier III, as approved by the Department on a site-specific basis.

The guidance document is intended to apply to all impacted sites and types of contaminants in soil and groundwater and provides general direction on the appropriate scientific methodologies

for managing sites impacted by various groups of contaminants. Technical details, methodologies, and criteria are found in other documents cited in Appendix A.

This document replaces Department Policy Document PPD-97-01 “Cleanup of Contaminated Sites Criteria, “December 1997 (as amended August, 1998).

Amendments to this guidance document are anticipated as opportunities for improvement arise. Those responsible for the management of impacted sites should ensure that they are using the most recent version. The Department reserves the right to re-evaluate sites should new information come to light, or should site activities or circumstances change which may result in an increase in contamination or contaminant migration or which may cause changes in site conditions that may otherwise pose a risk to the environment.

For the disposal of impacted soil into a landfill, the concentrations of total petroleum hydrocarbons should be less than 1,000 ppm and the acceptance of the soil at a landfill is at the landfill operator’s discretion.

An added degree of flexibility for impacted sites provided in this Guidance Document for Management of Impacted Sites is the “Limited Remedial Action” option. This can be used when the Province determines that complexity and risk are low (e.g., vehicle accidents, oil/gas spills) and a Site Professional is not required. The Limited Remedial Action (LRA) approach puts responsibility on the Province for deciding what is acceptable. Use Form MIS01 to decide if LRA is appropriate with advice, as required, from PPD.

Using a nationally recognized “phased approach” for environmental site assessment, contaminants of concern are identified. Basic and defensible steps are provided for in each phase of a site assessment.

Additional information is available at:

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Jacques Whitford, MGI Limited, and officials of the Pollution Prevention Division, Department of Environment and Conservation have dedicated years of diligent effort in the development of this impacted sites management document. It is harmonized with national and strategic objectives and provides a balanced approach to stakeholders, individuals, groups, and organizations.

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Definitions

Adverse effect
An effect that impairs or damages the environment and includes an adverse effect to the health of humans.

Affected third party
A third party property owner, or occupier that is directly affected by contaminant(s) originating on the source property at concentrations exceeding the applicable criteria (e.g., CEQG, Atlantic RBCA Tier I screening levels).

Atlantic RBCA toolkit
The current version of a software model, endorsed by the environment departments of the four Atlantic Provinces, used to assess human health risk and develop site-specific remedial criteria for environmental contaminants.

Audit
A review of all or any part of the activities related to an impacted site by the province or its designate.

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

CCME
Canadian Council of Ministers of the Environment

CEQG
Canadian Environmental Quality Guidelines. Published in 1999 by CCME and updated as required.

Closure Report
A final report prepared by the Site Professional following successful completion of the steps necessary to satisfy the Impacted Site Management Process and which includes a completed Record of Site Condition form.

Conditional Closure
An interim point in the Impacted Site Management Process where all necessary work has been completed to achieve closure with the exception of a period of monitoring to confirm site conditions are stable. Conditional Closure requires completion of a Closure Report, a Record of Site Condition and a monitoring plan.

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

Designated Contaminated Site
A site 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*.

Ecological Habitat
A place where flora and fauna exist, often characterized by a dominant plant form and physical characteristics. The place where a population lives and its surroundings, both living and non-living, is its habitat.

Emergency Remedial Action
Remedial action required following identification of contamination in order to eliminate or prevent unacceptable human or ecological risk. Action could include partial contaminant removal, provision of drinking water, building ventilation, diversion and treatment of water as deemed necessary by the province or the person responsible.

Engineered Controls
Designed and installed measures to limit the extent of risk posed by an impacted site to human or ecological receptors that require on-going monitoring or maintenance to be effective. This may include ground covers, ventilation systems, water treatment systems and others.

Environmental Protection Officer (EPO)
An agent of the Department of Environment and Conservation.

Environmental Site Assessment
An assessment of the historical use and environmental condition of a site conducted in accordance with the applicable guidance from CCME and Canadian Standards Association. Minimum Site Assessments Requirements for use with the Atlantic RBCA process are published by the Atlantic PIRI Committee (www.atlanticrbca.com).

Environmental Sites Database
A electronic file of information on sites or properties that have been impacted by an environmental contaminant or sites that have been/are the subject of investigation (for the presence of environmental contaminants). A site will have an entry in the database whether contamination was discovered or not or whether any confirmed contaminants have been cleaned up or not.

GSC
Government Service Centre, Department of Government Services and Lands (Province of Newfoundland and Labrador).

Inspector
An Inspector appointed pursuant to the Newfoundland *Environmental Protection Act* or otherwise appointed by the provincial Minister responsible for environmental protection in Newfoundland and Labrador.

Impacted Site
A designated or non-designated contaminated site

Limited Remedial Action (LRA)
A less rigorous process for obtaining site closure in cases where the GSC Inspector has determined that risk to human health or the environment is sufficiently low. The person responsible for the site must receive written notification by a GSC inspector that this process is acceptable for use before proceeding in this manner.

Management Process
A series of steps laid out in the Guidance Document for the Management of Impacted Sites.

Monitoring
The collection of environmental quality and operational data related to impacted site conditions.

Non-Designated Contaminated Site
A site on which the Department has knowledge that there has been a release of a substance (which includes a spill or leak of gasoline or an associated product including heating oil), which causes or may cause an adverse effect **and** which has not been designated as a contaminated site by the Minister of Environment and Conservation.

Peer Review
A technical review of any part of the Site Professional's performance completed throughout the Impacted Site Management Process by a person acceptable to the province.

Person Responsible
The person(s), association of persons, corporate entity, or municipality determined, by the Province, to be responsible for the remediation of an impacted site.

PIRI
Partners in RBCA (Risk-Based Corrective Action) Implementation. Implementation of RBCA in Atlantic Canada is through the Atlantic PIRI Committee.

Receptor
The person or organism, including plants, subjected to contaminant exposure.

Record of Site Condition
A document completed by the Site Professional using the form found in Appendix C of this document summarizing the work and conclusions of the Site Professional.

Remedial Action Plan (RAP)
A report describing the rationale for the selection of remedial criteria, the remedial criteria, the methodology of the remedial action to achieve the remedial criteria and / or the method of risk management, which may include engineered controls. Monitoring, if required to demonstrate successful completion, is a part of the RAP.

Remediation
The actions necessary at an impacted site to prevent, minimize, or mitigate unacceptable risk to exposed human and ecological receptors.

Risk Assessment
The scientific determination of the nature and magnitude of risk presented to humans or ecological receptors due to their exposure to contaminants from an impacted site.

Risk-Based Screening Level (RBSL)
RBSLs, sometimes referred to as "applicable criteria" in this document, are contaminant concentrations found in prepared tables endorsed by the province, such as the Tier I Look Up Tables (www.atlanticrbca.com) or published CCME guidelines (www.ccme.ca).

Risk Management
The implementation of a strategy or measures to control or reduce the level of risk estimated by a risk assessment.

SCC
Standards Council of Canada

Screening Levels
See Risk – Based Screening Level (RBSL) definition.

Significant Risk
Human or ecological risk due to contaminants at levels greater than considered acceptable by provincial environmental authorities.

Site
Area of the environment that has been impacted by contaminants. For convenience, the site is often identified by the civic address of the property on which the site is located.

Site Professional
A person or corporate entity completing remedial tasks, including signing of a Record of Site Condition, and meeting the provincial requirements listed in Appendix B.

Site-Specific Target Levels (SSTL)
Risk-based remedial criteria for a specific site that are derived using site-specific conditions and accepted risk assessment / risk management methods at Tier II or III.

Source Property
The property where the contaminant(s) of concern was released into the environment.

Substance
Matter, energy, odour, organism, or combination thereof that may become dispersed in the environment.

Unconditional Closure
A closure at a site that does not require on-going site management or engineered controls. Compliance with the land use (agricultural, residential, commercial, or industrial) assumed in the Record of Site Condition is a requirement of unconditional closure.

Valued Environmental Component (VEC)
VECs are the ecological resources (flora or fauna) that are to be protected in an ecological risk assessment. VECs are resources or environmental features that are important to human populations, have economic and/or social value, have intrinsic ecological significance, or serve as a baseline from which the significance of impacts can be evaluated.

SECTION 1.0 INTRODUCTION

The guidance document specifies the Site Management Process to be followed during the assessment and remediation of impacted sites in the Province. The document provides a process for environmental site assessment, remediation and clean-up which may also be used when reviewing federally owned or controlled properties, especially those that are subject to divestiture to provincial agencies directly or to those governed by provincial departments and agencies.

1.1 Guiding Principles

The guidance document is based on the following guiding principles:

- Human health and the environment must be protected through the timely and proper management of impacted sites;
- Site assessment and remediation is based on the Polluter Pays principle.
- The person responsible for an impacted site must ensure that the Site Management Process is taken to completion to provide protection of human health and the environment;
- The Site Professional providing the technical expertise and final documentation is responsible for the results of their work;
- The public may require final documentation of the Site Professional's opinion stating the condition and safe uses of the site and the Province's confirmation of satisfactory completion of the Site Management Process; and
- The management process should be applicable to all impacted sites and provide a flexible, cost-effective approach to achieving closure on identified impacts.

1.2 Regulatory Rationale

Provincial legislation sets out two parallel paths; one for designated contaminated sites and one for non-designated sites, for identifying and cleaning up contamination. A single Management Process, as defined in this document, will detail the steps to be followed for both designated and non-designated sites. This document defines a process which will result in the resolution of identified contamination whether the sites are designated or not.

The Management Process is considered mandatory for designated sites. The person responsible is required to conduct an Environmental Site Assessment and to submit a Remedial Action Plan to the Department for review. Although the process is considered voluntary for non-designated sites, following the management process greatly facilitates closure of identified impacts.

The Minister's responsibility and authority for the management of impacted sites is contained in the *Environmental Protection Act* and associated regulations. Where action by the person responsible is inappropriate or untimely, the Minister has the authority to order specific actions or prosecute.

1.3 Responsibilities

The three key parties in impacted site management include the person responsible, the Site Professional and the Province. If environmental impacts are expected to cause direct and adverse effects to a third party (i.e., there is expected to be an exceedance of applicable criteria at the property line) then the person responsible is required to inform the third party as soon as they know or ought to have known of the release. In this case, third parties constitute an important additional party.

The guidance document redefines the responsibilities of the three key parties by assigning primary responsibility for technical judgement and problem resolution to the Site Professional. The Site Professional is ultimately responsible for stating when a site has been sufficiently remediated or how it is to be managed to provide satisfactory protection to human health and the environment. The Province has specified the Site Management Process to be used in the text of the guidance document and has a duty to ensure the process is followed and for technical verification of the work of the Site Professional. The person responsible retains the same historical responsibilities of financing the remediation and due diligence but now has more options available to reach closure.

It is important to note that the person responsible is not necessarily the polluter. The Minister of the Environment and Conservation does not determine or apportion liability. Any issues between the polluter and the responsible party, if they are not the same person, are not dealt with through the Site Management Process as between the persons responsible defined in this

document. The advantage for all parties is that the Site Management Process provides defined sequential steps to be followed and a documented end to the process.

1.3.1 The Person Responsible

The Person Responsible has a duty to:

- Immediately notify third party property owners that they may be adversely and directly affected by impacts on the source property (i.e., when impacts at the property line are in exceedance of applicable criteria);
- Immediately notify the Department of Environment and Conservation of the presence of impacts on the subject or third party properties;
- Take action necessary to ensure human health and the environment are protected during and after the completion of the Site Management Process;
- Proceed through the Site Management Process in a timely manner;
- Remain informed and involved during the steps of the Site Management Process;
- Forward Site Professional reports to the Department of the Environment and Conservation for processing; and
- Demonstrate to the Province that the site has been managed in compliance with the Site Management Process and is safe for the intended use.

1.3.2 The Site Professional

The Site Professional has a duty to:

- Provide the necessary level of professional competence to resolve all technical issues in the Site Management Process (Appendix B);
- Advise the person responsible of any necessary interim remedial action to mitigate immediate threats to human health or the environment;
- Advise the Province when, in his/her opinion, the person responsible fails to act in a manner necessary to mitigate an immediate threat to the safety or health of the public;
- Provide a completed Record of Site Condition upon completion of the work specified in the Site Management Process to the Department on behalf of the client; and
- Ensure the appropriate level of characterization and contaminant delineation is achieved.

1.3.3 The Province

The Province has a duty to:

- Protect human health and to protect and enhance the natural environment.
- Designate that area of the environment as a “contaminated site”;
- Give written notice to the Person Responsible after designating of a contaminated site;
- Establish standards, criteria or guidelines before designating of an area as a contaminated site;
- Identify the person responsible for management of each impacted site;
- Ensure the Site Management Process is followed properly and in a timely manner;
- Enforce compliance if the person responsible is delinquent or negligent, including ensuring that any necessary emergency action is taken and to provide for tracking a satisfactory rate of progress;
- Provide acknowledgement when satisfied that the Site Management Process is complete (Closure);
- Designate an area of the environment as a impacted site when appropriate; and
- Identify remediated sites within the provincial Environmental Sites Database system.
- Province to revise/review and update the guidance document on an annual basis or deemed necessary from time to time
- Provide lead directions and guidance to the GSC agents on criteria based on LRA cleanup projects and activities.

SECTION 2.0 MANAGEMENT PROCESS

2.1 General Application

The guidance document provides flexibility by using a tiered choice of technical approaches to achieve the same result of safe site closure. The person responsible, with the assistance of the Site Professional, is able to choose Tier I, II or III depending on the specifics of the site, the contamination, the affected parties and the intended property use after Closure. Tier I and II methods result in the selection of contaminant concentrations (clean-up criteria) that are protective of human health and the environment. Tier III may either result in the selection of clean-up criteria or in the implementation of risk management techniques to reduce or eliminate exposure to the identified contaminants.

The process is flexible in that it deals with impacted areas regardless of property boundaries. For all properties, closure documents address only the identified impacts on a property. Thus, for some larger properties, closure documents may only address a particular parcel of the property. This can be limited to the impacted area of the property as long as a proper description of the area being managed under the process is described in the text and site plans of Site Professional reports. For larger impacted areas that extend across property boundaries, a separate closure document will be required for each civic address.

An added degree of flexibility is provided by the “Limited Remedial Action” option. This can be used when the Province determines that complexity and risk are low (e.g., vehicle accidents) and a Site Professional is not required. For instance, residential heating oil contamination is a unique issue that can have major impact on the health and finances of individuals. The guidance document takes a balanced approach to this by providing the option of “Limited Remedial Action” and where the Province can be assured that human and environmental health is not placed at risk. Sites that can be addressed under this option will reach Closure quickly and at lower cost. Protection of indoor air quality, adjacent receptors and potable groundwater must be considered prior to choosing this option.

2.1.1 Tier I

The Tier I method minimizes the technical complexity of selecting remedial criteria by providing cleanup criteria from tables (Tier I Look Up Tables) published by the CCME and the Atlantic

PIRI Committee. The latest versions of the Tier I tables are available on-line at www.atlanticrbca.com and www.ccme.ca. The site must meet mandatory conditions listed in the Preamble to the Tier I Look Up Tables before the tables are used. The Tier I Look Up Tables offer criteria for different exposure scenarios such as land use, soil type and groundwater use. These criteria are sufficiently protective that they can be applied to a wide variety of sites with safety but do not require as much technical expertise or time. This Tier is most applicable for sites with lesser amounts of contamination.

2.1.2 Tier II

The Tier II method uses accepted risk assessment models, established protocols and modified Tier I assumptions to develop Site-Specific Target Levels (SSTLs) that may be used instead of screening levels from the Tier I Look Up Tables. The use of models to develop SSTLs requires a higher level of Site Professional expertise and additional site-specific information with subsequent increases in time and cost.

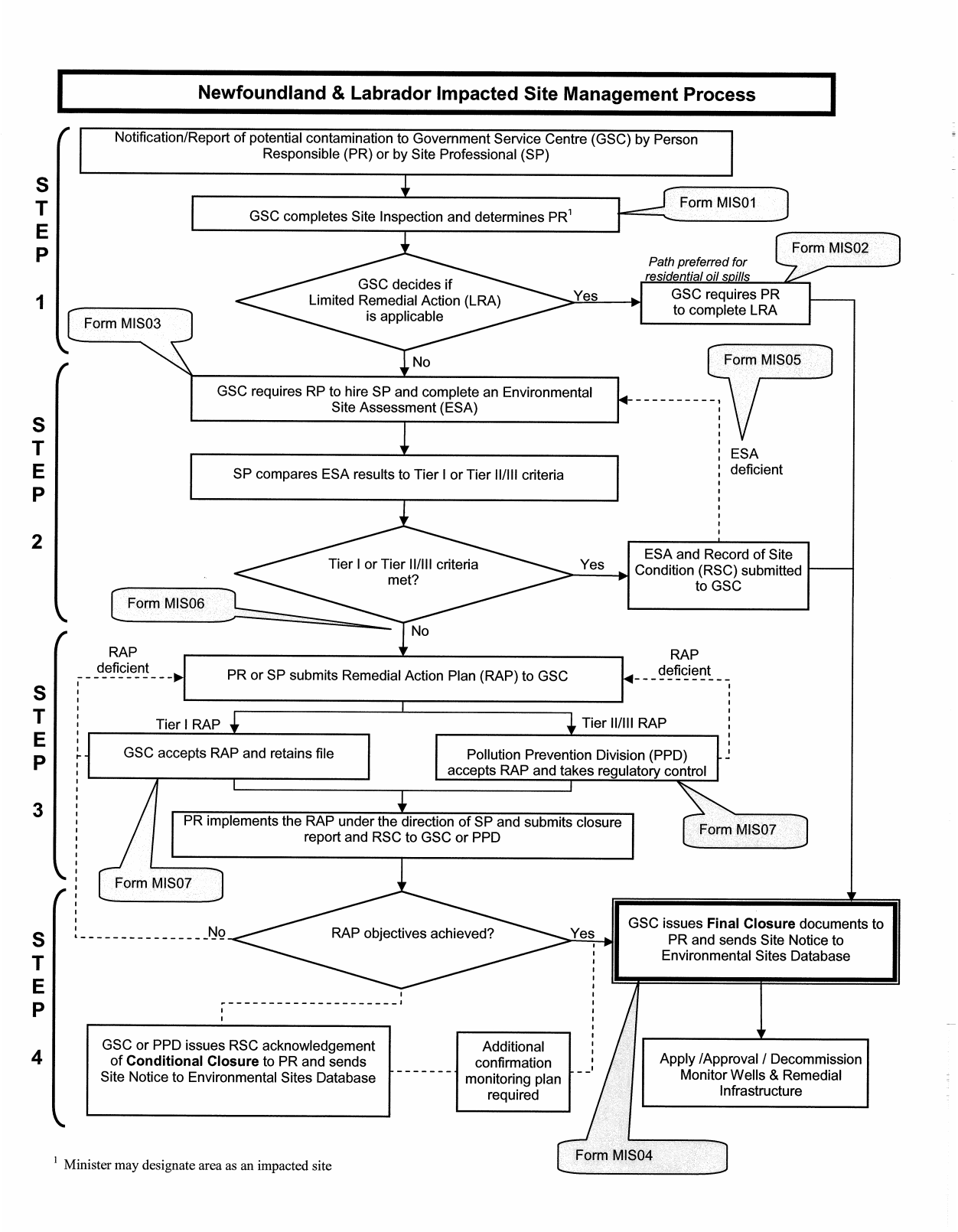
The province has endorsed the use of CCME Protocols and the Atlantic RBCA risk assessment model through participation with CCME and the Atlantic PIRI Committee. Reference documentation for these technical approaches is cited in Appendix A.

2.1.3 Tier III

The Tier III method uses other accepted risk assessment models and scientific approaches to derive SSTLs for sites where Tier II is not applicable or does not fully address the range of issues present at the site. Tier III may be required to address issues or routes of exposure that are not adequately handled at Tier II such as contamination in bedrock, significant ecological impacts or lack of toxicological or other data. Due to the complexity of Tier III risk assessments, they may require independent validation or Peer Review at the expense of the person responsible.

2.2 Process Steps

The Site Management Process has been divided into four sequential steps (Figure 1). Figure 1 shows the pathways by which the process may be completed to achieve Closure.


Newfoundland & Labrador Impacted Site Management Process
STEP 1
STEP 2
STEP 3
STEP 4
Notification/Report of potential contamination to Government Service Centre (GSC) by Person Responsible (PR) or by Site Professional (SP)
GSC completes Site Inspection and determines PR[1]
Form MIS01
GSC decides if Limited Remedial Action (LRA) is applicable
Yes
Path preferred for residential oil spills
Form MIS02
GSC requires PR to complete LRA
Form MIS03
No
Form MIS05
GSC requires RP to hire SP and complete an Environmental Site Assessment (ESA)
ESA deficient
SP compares ESA results to Tier I or Tier II/III criteria
Tier I or Tier II/III criteria met?
Yes
ESA and Record of Site Condition (RSC) submitted to GSC
Form MIS06
No
RAP deficient
PR or SP submits Remedial Action Plan (RAP) to GSC
RAP deficient
Tier I RAP
Tier II/III RAP
GSC accepts RAP and retains file
Pollution Prevention Division (PPD) accepts RAP and takes regulatory control
PR implements the RAP under the direction of SP and submits closure report and RSC to GSC or PPD
Form MIS07
Form MIS07
No
RAP objectives achieved?
Yes
GSC issues Final Closure documents to PR and sends Site Notice to Environmental Sites Database
GSC or PPD issues RSC acknowledgement of Conditional Closure to PR and sends Site Notice to Environmental Sites Database
Additional confirmation monitoring plan required
Apply /Approval / Decommission Monitor Wells & Remedial Infrastructure
Form MIS04
[1] Minister may designate area as an impacted site

The four steps are:

1. Initial Actions;
2. Site Assessment;
3. Remedial Action Planning; and
4. Remediation and Closure.

2.2.1 Step 1 – Initial Actions

Upon notification of contamination on a site, a Government Service Centre (GSC) Inspector will normally conduct an inspection to assess the type and extent of contamination and the receptors at possible risk. Based on the results of the investigation the GSC Inspector will:

- Determine and order any immediate, emergency remedial action that is required to protect human health or the environment;
- Determine who is the person responsible for emergency and remedial action; and
- Determine if the expertise of a Site Professional is required or if the necessary clean up can be completed as Limited Remedial Action without a Site Professional.

If the GSC Inspector believes any of the following conditions exist or are probable on a non-designated site, Limited Remedial Action is not appropriate and a Site Professional will be required:

- Potable surface or groundwater supplies (public or private) are impacted or at significant risk;
- Contaminant odours are detected inside residential or commercial structures;
- Ecological habitat is at significant risk; or
- Contaminants are likely to migrate to off-site properties.

After contamination has been confirmed, the GSC Inspector will inform the person responsible, in writing, of their responsibility to conduct remediation by either Limited Remedial Action or to hire a Site Professional and conduct an Environmental Site Assessment. If a Site Professional is required, the person responsible moves to Step 2 of the process.

If Limited Remedial Action is used, the GSC Inspector or Site Professional will work with the person responsible to select the correct Tier I screening levels. After the remedial work is completed by the person responsible and the Tier I screening levels are met, the GSC Inspector will issue a Closure document ending the process within Step 1. Residential oil spills and vehicle accidents are the most common type of contamination that will be managed under Limited Remedial Action. The only accepted remedial approach under Limited Remedial Action is source removal.

2.2.2 Step 2 – Site Assessment

If the GSC Inspector determined that a Site Professional is required, the person responsible must employ one meeting the requirements in Appendix B. The Site Professional is required to complete an Environmental Site Assessment (ESA) that meets the Minimum Requirements set out in the most recent version of the Atlantic RBCA Reference Documentation for Petroleum Impacted Sites (www.atlanticrbca.com). The Site Professional is responsible for determining what chemicals of concern require investigation during the ESA based on all available information. If there are any issues related to assessment of non-petroleum compounds, it is the responsibility of the Site Professional to apply good judgement to meet the intent of the Minimum Requirements.

Part of the Minimum Requirements is to conduct an ecological receptor screening using the Atlantic PIRI screening form. If the ecological screening identifies potential for ecological exposure, additional ecological assessment is required. The Site Professional should assess the site and surrounding properties for their value as ecological habitats based on current and reasonable future land use. If they are unlikely to serve as habitats due to societal use of the land such as asphalt and gravel covers or heavily manipulated vegetative cover, they should not be considered further. If all ecological receptors are screened out, the Site Professional should identify the nearest ecological receptor and state why it is not at risk.

For petroleum impacts, the applicable Atlantic PIRI Tier I screening levels should be used to assess the impact. Published CCME Tier I screening levels may be used to supplement the Look Up Tables for other chemicals of concern (e.g., metals), as appropriate. In addition, regulated criteria may be used to supplement the Look Up Tables for bacterial impacts (e.g., sewer regulations, health regulations, ecological regulations).

If site concentrations exceed Tier I criteria, the Atlantic RBCA or CCME Tier II methodologies may be used to derive Tier II values based on site-specific conditions. If site concentrations exceed Tier II values, remediation or a Tier III site-specific human health and/or ecological risk assessment is required.

If Tier I screening levels are selected, the Site Professional must demonstrate that the requirements given using Tier I (see Tier I Look Up Tables preamble) are met and explain the reasons for land use choices as per CCME Canadian Environmental Quality Guidelines land use classification. If Tier II or III SSTLs are calculated, the Site Professional must provide supporting details to allow a peer reviewer or the Province to duplicate all steps of the risk assessment process. Justifications for selection of risk calculation parameters must be provided. Where reasonable, default input values should be replaced by site-specific data.

Remediation or site management is required to mitigate any impacts where there is an exceedance of the selected criteria, whether Tier I, II or III. Site management may include cutting off the pathway of the contaminant to the receptor.

The Person Responsible submits the completed ESA to GSC identifying if any site conditions exceed the selected Tier I, II, or III criteria. If no conditions exceed the Tier I, II, or III criteria, the Site Professional submits a completed Record of Site Condition requesting Closure and Provincial acknowledgement. GSC issues a Record of Site Condition acknowledgement if they are satisfied with the ESA and the selection of clean-up criteria.

The Province will review the ESA for conformance with the Minimum Site Assessment Requirements and return it for correction if it is deficient. This may include a site visit to confirm reported site conditions. If the ESA is satisfactory and the selected clean-up criteria (Tier I, II, or III) are exceeded, GSC will instruct the person responsible to move to Step 3 of the process and prepare a Remedial Action Plan (RAP).

The person responsible is required to notify third parties that may be adversely and directly affected by contamination originating on the source property (i.e., if concentrations exceed the applicable criteria at the property line) and retain proof of written notification.

2.2.3 Step 3 – Remedial Action Planning

The person responsible must determine if they wish to use Tier I, Tier II or Tier III criteria to direct necessary remedial action and provide the Province with a Remedial Action Plan (RAP) to achieve the selected criteria. The RAP must mitigate unacceptable risk to both human health and the environment. Any impacted soil or groundwater not treated on site under the RAP must be sent to a provincially approved treatment or disposal site.

If Tier I screening levels are proposed for the RAP and it is found to be satisfactory, the GSC Inspector will instruct the person responsible when required, in writing, to implement it and retain the file to completion of the process.

If Tier II or III SSTL are proposed for the RAP, the GSC Inspector will forward the file to the Pollution Prevention Division (PPD) for the balance of the process. Prior to written approval of a Tier II or III RAP, the PPD may determine that a peer review by an independent Site Professional is required. Any peer review required will be at the expense of the person responsible. Typical reasons why the Province may require a peer review are:

- Site is within a municipal wellfield zone;
- Multiple or non-petroleum hydrocarbon chemicals of concern are involved;
- Multiple third parties are impacted;
- Sensitive third parties are impacted (e.g. schools);
- A methodology other than CCME Protocols or Atlantic RBCA have been used; and
- A higher than normal degree of technical complexity is involved.

When a Tier II or III RAP is found to be satisfactory, when required, the PPD will instruct the person responsible, in writing, to implement it.

The Site Professional must determine, through the work completed in Steps 2 and 3, if a monitoring program is required. In cases where a monitoring program is required to demonstrate the success of the RAP, details on the program should be included in the RAP. Typical components of a monitoring program include:

- A clear definition of the monitoring objectives;
- Identification of the parameters to be monitored and measured;
- Description of when, where, and how data is to be collected, analyzed and reported;
- Description of how satisfactory RAP or site management performance will be confirmed; and
- Detailed interpretation of monitoring results.

Remedial Action Plans are required for all impacted sites. Approval of the RAP by the Province is required for designated contaminated sites. Only acknowledgement of the RAP is required by the Province for non-designated sites.

2.2.4 Step 4 – Remediation and Closure

The person responsible and the Site Professional implement remediation and any proposed monitoring. The period of implementation and extent of monitoring will depend on the method of remediation selected. If deviation in method or schedule from the RAP occurs or is planned, the person responsible must inform the Province in writing.

Upon completion of active remediation, the person responsible or Site Professional submits a Closure Report to the Province demonstrating that all the work in the RAP has been completed and that the site meets remedial criteria. The two options for Closure available to the person responsible are Conditional Closure and Final Closure. A completed Record of Site Condition (Appendix C) and a site plan must be filed with the Province for either option. The Record of Site Condition is valid only for the land use and conditions stated by the Site Professional. The risk to receptors must be reassessed and the process restarted if changes in land use or site conditions would increase risk (e.g. commercial to residential land use and removal of an asphalt cover).

Conditional Closure may be used when all active remediation is complete and only passive confirmation monitoring is required to verify that the Tier I, II or III remedial criteria have been achieved and site conditions are stable. Once monitoring demonstrates stable site conditions to the satisfaction of the Province, the person responsible can submit a second Record of Site Condition for Final Closure.

Final Closure may be used without Conditional Closure if monitoring is not required to demonstrate that site conditions are stable following remedial action.

There are two types of Final Closure noted in the Record of Site Condition depending on the methodology selected in the Remedial Action Plan (RAP). Unconditional Closure can be achieved by demonstrating (by means of an ESA, risk assessment, closure report, or confirmatory sampling or monitoring) that applicable Tier I, II, or III criteria have been met. Unconditional closure usually permits unrestricted future development or use within the particular land use designation (e.g., agricultural, residential, commercial, industrial).

Conditional Closure requires on-going site management using engineered controls, institutional controls, or periodic monitoring to ensure adequate protection of human and environmental health for the land uses specified in Part 5 of the Record of Site Condition.

Examples of Conditional on-going site management controls include:

- engineered controls such as slurry walls, asphalt covers, imported soil covers, forced or passive air ventilation systems, groundwater pumping systems and long-term treatment equipment; and
- institutional controls such as building location limitations, building construction limitations (i.e. slab on grade), and potable groundwater well location and/or construction.

When land use management or engineered controls are part of the risk management selected for the site, the Closure Report and Record of Site Condition must disclose those specific limitations and requirements. Conditional Closure requires someone to have long-term responsibility for the site management controls. This may be through assignment of responsibility to subsequent property owners, bonding or other financial guarantors. On sites where institutional controls or area zoning restrictions are required, the Person Responsible would normally be required to consult with any affected stakeholders (e.g., Regulator, Municipality). Prior to Closure, the Province must be convinced that the necessary site management will be carried out in the near and distant future.

The Province will acknowledge receipt of the Record of Site Condition for both options but the process is not complete until Final Closure is acknowledged. The GSC or PPD must send Part 7 of 7 of the Record of Site Condition to the person responsible to acknowledge acceptance.

The Province will send a Site Notice to the Environmental Sites Database identifying that the site has been subject to assessment and remediation following:

- Limited Remedial Action;
- ESA showing Tier I, II, or III criteria are not exceeded;
- Conditional Closure; and
- Final Closure.

The last step after site Final Closure is completed is the decommissioning of monitor wells and remedial infrastructure (Appendix D). Application for decommissioning must be made to GSC or PPD and approval received before decommissioning work is done.

The guidance document uses a sequence of documents through the various steps in the Site Management Process, culminating in the Record of Site Condition signed by the Site Professional and the province's acknowledgement of the Record of Site Condition, which is the final step in Closure. This documentation provides a high level of certainty to the province, owners, lenders, and buyers or sellers of real property that safety and environmental risks have been satisfactorily addressed.

2.3 Technical Considerations

2.3.1 Application of Tier I Look-Up Tables

The screening levels in the Tier I Look Up Tables can only be applied if:

- The site conditions are compatible with the default site conditions assumed in the development of the Tier I criteria;
- The Mandatory Criteria in the preamble to the Tier I Look Up Tables have been satisfied; and
- The appropriate land uses are selected based on reasonable current and future receptors on and adjacent to the site (i.e., If a commercial site has a residential neighbour, screening levels on site can be commercial but at the property line should meet residential).

Selection of screening levels should be done in consultation with the Province if a Site Professional is not used. If Limited Remedial Action is used, the GSC Inspector will be the prime party deciding what Tier I criteria apply to the site.

2.3.2 Land Use and Receptors

Identification of the human and ecological receptors that will be exposed to residual contaminants is critical to the selection of Tier I criteria or SSTLs that provide for protection of human and ecological health. The Province considers the following to be the appropriate human receptors for the four land use categories listed below.

Agricultural	Toddlers	(A Tier II or III approach is required to evaluate risk to farm animals and human consumption of farm produce)
Residential/Parkland	Toddlers	
Commercial	Toddlers	
Industrial	Adults	

The Site Professional is responsible for identifying the reasonable future land use prior to the selection of remedial criteria unless Limited Remedial Action is applicable.

The Tier I ecological screening levels provide protection to specific receptors, based on the availability of toxicological data for specific contaminants. The receptors used to derive Tier I screening levels may or may not be present on a given site; therefore a more detailed receptor identification may be warranted by Tier II/III assessments.

2.3.3 Ecological Assessment

The guidance document provides flexibility in the assessment of ecological impacts and determination of remedial requirements. Increasing levels of assessment are applied in sequence until no risk is apparent or a decision to clean up is made, as follows:

- Use of the Atlantic PIRI Ecological Receptor Screening form;
- Tier I Look Up Tables ecological criteria adapted from the CCME Canada Wide Standards and Canadian Environmental Quality Guidance documents;

- Tier II site-specific ecological criteria modified according to the CCME Protocol; and
- Tier III - Ecological Risk Assessment.

General guidance on the process for ecological assessment is provided in Appendix E. Reference documentation for detailed technical approaches is cited in Appendix A.

2.3.4 Chemicals of Concern

This guidance document is intended to apply to all chemicals of concern present in the natural environment due to spillage or release that require remediation or management to provide protection of human health and the environment. The Province has grouped the more common Chemicals of Concern into seven groups. The listings are not necessarily complete but provide a method of grouping unlisted chemicals in the future. A complete list is available by consulting the latest version of CEQG (www.ccme.ca).

GROUP 1 – PETROLEUM HYDROCARBONS	
Benzene	Gasoline
Toluene	#2 Fuel oil (furnace & diesel)
Ethylbenzene	Heavy oil (Bunker & waste oil)
Xylenes	TPH fractions (C6-10, C11-16, C17-34)
GROUP 2 – POLYCYCLIC AROMATIC HYDROCARBONS (PAH)	
Benzo(a)pyrene	Fluoranthene
Naphthalene	Pyrene
2-methylnaphthalene	Benz(a)anthracene
1-methylnaphthalene	Chrysene
Acenaphthyene	Benzo(a)fluoranthene
Acenaphthene	Benzo(k)fluoranthene
Fluoranthene	Perlene
Phenanthrene	Indeno(1,2,3-cd)pyrene
Anthracene	Dibenz(a,h)anthracene
	Benzo(ghi)perylene
GROUP 3 – HEAVY METALS (inorganic forms only)	
Antimony	Lead
Arsenic	Mercury
Barium	Nickel
Beryllium	Selenium
Cadmium	Thallium
Chromium (total)	Uranium
Chromium (hexavalent)	Vanadium
Copper	Zinc

GROUP 4 – NON-CHLORINATED ORGANIC COMPOUNDS	
MTBE	Ethylene glycol
Phenol	Cyanide (free)
GROUP 5 – CHLORINATED ORGANIC COMPOUNDS	
Polychlorinated Biphenyls (PCB)	Trichloroethane
Tetrachloroethylene (PCE)	Methylene chloride
Trichloroethylene (TCE)	1,1,1-trichloroethane
Chlorophenols (Penta and daughters)	
GROUP 6 – PESTICIDES	
DDT insecticide and daughters	Phenoxy Acid Herbicides
Organochlorine insecticides (excl DDT)	Carbamate insecticides
Organophosphate insecticides	Fungicides
GROUP 7 – MICROBIOLOGICAL	
e-coli	Cryptosporidium
total coliform	Giardia

Although the process in the guidance document is applicable to all environmental contaminants, the technical methods commonly used, such as Atlantic RBCA, are not applicable to all chemicals of concern or to all exposure pathways. Specifically, the Atlantic RBCA Toolkit is only approved for use with Group 1 contaminants – Petroleum Hydrocarbons. Contaminants in Groups 2 to 6 should be assessed using other technical tools, primarily the protocols provided by CCME (1996) and Health Canada (2003) or other technical approaches that may be appropriate on a case by case basis.

Group 7 - Microbiological contaminants are listed above but no screening level guidelines are provided in the Tier I Look Up Tables and the technical tools discussed are not suitable for assessing risk from this Group. The Province should be contacted for site-specific guidance on methods of assessing microbiological contamination as regulated criteria may be used to supplement the Look Up Tables for bacterial impacts (e.g., sewer regulations, health regulations, ecological regulations). Testing for the presence of microbiological contaminants should be conducted when microbiological contaminants are identified as likely or known as contaminants of concern.

2.3.5 Laboratory Analytical Methods

The accepted laboratory method for analyzing petroleum hydrocarbons under the Atlantic RBCA process is the Alberta MUST methodology. The samples must be analyzed for TPH, comprised of both purgeable and extractable hydrocarbons (gas/diesel/lube oil ranges - C6 to C32), and

BTEX by the Atlantic PIRI protocol. Samples are to be collected using defensible methods, kept cool until delivery to the laboratory and must respect storage and handling requirements of the laboratory. Laboratories analyzing samples for all contaminants of concern, including TPH, should be Standards Council of Canada (SCC) accredited for those parameters.

2.3.6 Scientific Advancements

Site Professionals are responsible for maintaining current technical and policy knowledge in contaminated sites management. There will be times when changes in criteria or protocols, laboratory methods, risk assessment software and other directly related issues occur prior to changes to the Province's guidance document. Site Professionals must incorporate these types of changes in their work once they become generally accepted and consult with the Province if they are in doubt about application.

APPENDIX A

REFERENCES

American Society for Testing and Materials (ASTM), 1995. Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites. Standard E-1739-95.

Atlantic PIRI Committee, 2003. Atlantic RBCA (Risk-Based Corrective Action) Reference Documentation for Petroleum Impacted Sites, Version 2.0, October 2004.

Canadian Council of Ministers of the Environment, 1999, revised and updated December 2003. Canadian Environmental Quality Guidance documents, CCME, Winnipeg,MB, ISBN 1-896997-34-1, Publication # 1299.

Canadian Council of Ministers of the Environment (CCME). 1997. A framework for ecological risk assessment: technical appendices. The National Contaminated Sites Remediation Program. March 1997.

Canadian Council of Ministers of the Environment (CCME). 1996. A framework for ecological risk assessment: general guidance. The National Contaminated Sites Remediation Program. March 1996.

Canadian Council of Ministers of the Environment (CCME). 1996. Guidance Manual for Developing Site-specific Soil Quality Remediation Objectives for Contaminated Sites in Canada. The National Contaminated Sites Remediation Program. March 1996.

Canadian Council of Ministers of the Environment (CCME). 1996. A protocol for the derivation of environmental and human health soil quality guidelines. CCME sub-committee on environmental quality criteria for contaminated sites. CCME-EPC-101E. ISBN 0-662-24344-7.

Environment Canada. 1994. A Framework for Ecological Risk Assessment at Contaminated Sites in Canada: Review and Recommendations. Ecosystem Conservation Directorate. Scientific Series No. 199.

Health Canada 2003. Federal Contaminated Site Risk Assessment in Canada. Part I: Guidance on Human Health Screening Level Risk Assessment (SLRA), Version 1.1.

Nevin, J.P. and McHugh, T.E., 1999. Guidance Manual for the RBCA Tool Kit for Atlantic Canada, Groundwater Services Inc., ISBN: 1-882713-11-7.

United States Environmental Protection Agency. 1992. Framework for Ecological Risk Assessment. Risk Assessment Forum. February 1992, Washington, DC. EPA/630/R-92/001.

U.S. Environmental Protection Agency (U.S. EPA). 1998. Guidance documents for ecological risk assessment. Risk Assessment Forum. EA/630/R-95/002F.

APPENDIX B

SITE PROFESSIONAL QUALIFICATIONS

GENERAL QUALIFICATIONS OF SITE PROFESSIONALS

The work on which the Record of Site Condition is based must be reviewed, overseen or conducted by the person signing the completed form. The person signing the Record of Site Condition must meet the qualifications of Site Professionals noted below:

1. Be a Member in Good Standing of the Professional Engineers and Geoscientists of Newfoundland and Labrador (PEGNL); and
2. Hold professional errors and omissions liability insurance coverage for environmental work of at least $1,000,000 individually or through a registered company employer.

The Province will not accept a Record of Site Condition signed by an unqualified person. The Person responsible is advised to ensure that the Site Professional they hire at the beginning of the process meets these requirements to avoid unnecessary expense and delay. A permit to practice is required by the individual or the company that the individual represents. A permit to practice may be provided by PEGNL.

APPENDIX C

RECORD OF SITE CONDITION

Part 1 of 7: Source Property Information

Civic Address:

Person Responsible (name and address):

GSC / Provincial File Number:

Part 2 of 7: List of Reports

- **Prepared by Others:** The following reports pertaining to the source property cited in Part 1 and/or any other related impacted properties have been prepared by others and reviewed under the supervision of the Site Professional. (expand the table as required)

Report Title	Prepared by	Date

- **Prepared by and/or overseen by the Site Professional:** The following reports pertaining to the source property cited in Part 1 and/or any other related impacted properties have been prepared by and/or overseen by the Site Professional. (expand the table as required)

Report Title	Date

Part 3 of 7: Remedial Action

- List the Chemicals of Concern (COC) identified on or originating from the source property:

- Describe the elements of the Remedial Action Plan(s) with time periods, employed for the site:

- Was a risk assessment completed as part of the Remedial Action Plan? ____ Yes ____ No

  If yes, identify the risk assessment methodology and the resulting site-specific remedial criteria: (expand the table as required)

Risk Assessment Methodology Used		(Atlantic RBCA Tier II, Tier III, etc)			
Media	**(units)**	(insert COC #1)	(insert COC #2)	(insert COC #3)	(insert COC #4)
Surface Soil					
Sub-surface Soil					
Groundwater					

  If no, list the selected Tier I criteria: (expand the table as required)

Media	**(units)**	(insert COC #1)	(insert COC #2)	(insert COC #3)	(insert COC #4)
Surface Soil					
Sub-surface Soil					
Groundwater					

- If a peer review of the Remedial Action Plan and/or the Risk Assessment/Closure Report was requested by GSC or NLDEC, provide the following information:

Consultant Name:

Consultant Address:

Date & Title of Risk Assessment/Closure Report:

Part 4 of 7: Off-Site Impacts

- Precautionary duty of the Person Responsible; Based on the work completed, the following third party properties (identified by civic address) were identified by the Person Responsible, in accordance with section 5.8(1)d of the Environmental Protection Act, as being affected or threatened by the contamination originating from the source property. Where appropriate, indicate the type of impact and the corrective action taken: (expand the table as required)

Civic Address	Type of Impact	Corrective Action

Part 5 of 7: Site Activities

- Based on the work completed, the source property cited in Part 1 is suitable for the following site activity(s). Check appropriate box and provide comments if necessary.

IF LAND USE CHANGES – LEVEL OF RISK MUST BE RE-EVALUATED

☐ Agricultural ☐ Residential/Parkland ☐ Commercial ☐ Industrial

Comments (special considerations, site management issues, etc.):

Part 6 of 7: Summary Statement of Site Professional

The Minister considers the pre-checked statements below to be mandatory for submission of the Record of Site Condition. The signature of the Site Professional on this form indicates the fulfillment of these mandatory requirements as well as the requirements of all other checked statements.

Please check appropriate statements:

✓ This Record of Site Condition form is identical to the one provided in the Province of Newfoundland & Labrador Guidance Document for the Management of Impacted Sites and the content of the form has not been altered.

✓ All work on which this Record of Site Condition is based was prepared, overseen and/or reviewed by the Site Professional.

✓ The site was managed in accordance with the current version of the Province of Newfoundland & Labrador Guidance Document for the Management of Impacted Sites.

✓ The applicable quality criteria (Tier I, II or III) for the site as defined by the Site Professional and as cited in Part 3 have been achieved for the current or reasonably foreseeable future site activities as cited in Part 5.

✓ A site plan with scale indicated, identifying the referenced properties is attached to this Record of Site Condition.

___ All reports cited in Part 2 and other related documents that have been prepared by the Site Professional have been delivered to the Person Responsible.

___ The Remedial Action Plan, Risk Assessment or Closure Report was peer reviewed by a qualified, independent Site Professional.

___ If peer reviewed, the results of the Peer Review were appropriately incorporated into the final Remedial Action Plan and/or Closure Report.

___ Based on the results of the site evaluation, the applicable quality criteria (Tier I, II or III) were not exceeded on the source property and therefore, remedial action and/or on-going site management is not required for the current or reasonably foreseeable future site activities.

___ Based on results of the site evaluation, the applicable quality criteria (Tier I, II or III) were not exceeded on the third party properties and therefore, remedial action and/or on-going site management is not required for the current or reasonably foreseeable future site activities.

___ The source property has been remediated to an acceptable level for the current or reasonably foreseeable future site activities as cited in Part 5.

___ The source property requires on-going site management to satisfy the current or reasonably foreseeable future site activities as cited in Part 5.

___ Third party properties affected by the contamination of the source property have been addressed and remediated to an acceptable level for the current or reasonably foreseeable future site activities as cited in Part 5.

___ Third party properties affected by the contamination of the source property have been addressed and require on-going site management to satisfy the current or reasonably foreseeable future site activities as cited in Part 5.

___ With respect to notification, the requirements of section 8(d) of the *Environmental Protection Act* have been fulfilled.

___ The source property is recommended for **Conditional Closure** and is subject to monitoring requirements specified in documents listed in Part 2.

___ The source property is recommended for **Final Closure**

Signature _____

Name (Print) Date

Professional Affiliation Membership No.

Company

Address Tel.

Part 7 of 7: (Conditional) Closure Letter

GOVERNMENT OF NEWFOUNDLAND AND LABRADOR

Department of Environment and Conservation
Pollution Prevention Division

Date File: ***xxx.xxxx.xxx***

Responsible Party

Attention: ***Responsible Party's Contact***

Dear ***Responsible Party's Contact***:

Re: (Conditional) Closure of identified impacts in accordance with section 18(5) of the *Heating Oil Storage Tank System Regulations* / 25 of the *Storage and Handling of Gasoline and Associated Products Regulations* / 9(c) of the *Environmental Protection Act)* at *Civic Address*

This letter is in response to your request for closure of the identified impacts at ***Civic Address*** as detailed in the documentation listed below.

We have reviewed the following documentation that was submitted with respect to this request:

- ***Document 1***
- ***Document 2***

With respect to the classification of the site, the site sensitivity classification as a (Commercial/Residential/Agricultural/Industrial) site is considered appropriate for this property.

Based *solely* on the information contained in the documentation listed above, the Department is satisfied, at this point in time, that the stated level of contamination remaining on the subject property*,* in the area addressed by this reports, does not pose an unacceptable risk to human health and the environment. Notwithstanding this opinion, the Department reserves the right to re-evaluate this decision should new information come to light, or should site activities, site uses or circumstances change which may result in an increase in contamination or contaminant migration or which may cause changes in site conditions or site classification that may otherwise pose a risk to human health and the environment.

In addition, we require that the following stipulations be followed:

- A copy of this letter be provided to any future purchaser or potential purchaser of the property.

- Workers engaged in future sub-surface excavations on site must be made aware of the potential risks of exposure to the remaining contamination.

The Department has not directly supervised the work undertaken at the site and does not assume any responsibility or liability for this work, or for notifying future owners, or present or future occupants of the property, of the work completed. In no way does this letter make any representation with respect to any environmental damage or liability that may have occurred at the above mentioned property due to contamination that was not discovered, reported, or investigated. Any persons intending to purchase or occupy the property should make their own independent determination of the environmental condition of the property and the extent of responsibility and liability, if any, that may arise from taking ownership or occupancy.

Regards,

_____

Derrick Maddocks, P.Eng.
Director

cc.

APPENDIX D

GUIDELINES FOR DECOMMISSIONING OF MONITOR WELLS BOREHOLES
GUIDANCE DOCUMENT GD-PPD-024 rev. 1

GOVERNMENT OF
NEWFOUNDLAND AND LABRADOR

Department of
Environment and Conservation
Pollution Prevention Division

Guidance Document

Title: **Guidelines for Decommissioning of Monitor Wells and Boreholes**

Submitted By: **Brian Drover, P.Eng., Pollution Prevention Division**

Prepared By: **Craig Bugden, P.Eng., Pollution Prevention Division**
Keith Guzzwell, P.Geo., Water Resources Division
Jim Slade, P.Eng., Jacques Whitford Environment Ltd.

Issue Date: **February 13, 2003**

Approved By: _____
Derrick Maddocks, Director

Monitor Well and Borehole Decommissioning
GD-PPD - 024 rev.1

OBJECTIVE

The guidance document will establish minimum acceptable standards for the decommissioning of monitor wells and boreholes, and accompanying documentation. The objectives of the decommissioning procedure are to:

1) eliminate the vertical migration of fluids down the borehole;
2) eliminate physical hazards;
3) eliminate improper use; and,
4) conserve groundwater resources.

EXCLUSIONS

This policy does not apply to:

a. seismic shot holes and mineral exploration holes*;
b. piezometers, and monitor wells where active long term monitoring is required (eg. dams, service stations, landfills);
c. boreholes advanced above an aquifer for the purpose of characterizing local geology;
d. water wells, oil and gas wells; and,
e. special cases with prior approval of the Department.

INTRODUCTION/BACKGROUND

Monitor wells are specifically designed and used for aquifer assessment purposes including groundwater flow and water quality observations. Monitor wells and other types of boreholes such as remediation wells that penetrate into the water table depth provide potential pathways for contaminants to impact local groundwater resources. These types of monitor wells and boreholes should be sealed to prevent both vertical movement of water within the well bore and infiltration of surface water into the well.

LEGISLATION:

General provisions of the *Environmental Protection Act* SNL 2002 cE-14.2 and the *Water Resources Act* SNL 2002 cW-4.01 apply to this policy.

GUIDANCE:

A monitor well or borehole must be decommissioned in accordance with this guidance document within 1 year after abandonment.

IMPLEMENTATION:

Monitor wells and boreholes shall be decommissioned in accordance with the following protocols.

Monitor/Recovery Wells

1. Wells that have not been monitored for 1 year shall be considered abandoned unless written permission is obtained from the Pollution Prevention Division of the Department of Environment and Conservation to continue usage of the well. This permission is contingent upon inspection and verification that the well is in good condition.
2. Monitor wells shall be checked to ensure they are free from obstructions prior to sealing. In all cases, the casing must be cut below the natural ground level so as not to interfere with future land use. In no case should the casing be cut less that 1 m below ground level.
3. Decommissioned monitor wells and boreholes must be filled with material of equal or lower permeability than the original geologic formation.
4. Monitor wells up to and including 50 mm in diameter shall be completely filled with a sealant such as bentonite pellets or chips sized no more than 1/4 of the minimum well diameter. The rate of pouring the pellets/chips into the well shall be at a rate to prevent bridging. Where pellets/chips are poured above the water level, the addition of water is required to properly hydrate the bentonite.
5. Monitor wells and other vertical structures greater than 50 mm and less than or equal to 300 mm diameter are to be filled with alternating layers of 3.0 m sand and 0.3 m bentonite to the bottom of the well, starting with a minimum of 0.3 m of bentonite.
6. Vertical infrastructures with a diameter greater than 300 mm are to be removed and the void filled with material having a permeability lower than the native, on site material.
7. Where the abandonment will be completed below grade, the area of the well boring shall be covered with a layer of bentonite, grout, or other sealant before back filling.
8. Acceptable sealants are bentonite grout, pellets, and chips.

9. A monitor well abandonment record is required for each well that is decommissioned. This log is to be sent to the Department of Environment and Conservation, Pollution Prevention Division, P.O. Box 8700, St. John's, NL, A1B 4J6.

Boreholes

1. Boreholes that are advanced into an aquifer for the purpose of characterizing local geology and are not developed into a monitor well are to be backfilled with material of equal or lower permeability.
2. The back filling material must be compacted and a mound placed over the hole to allow for future settling.
3. Boreholes in which a monitor well is not installed shall be decommissioned immediately upon completion of the relevant site investigation activities.

Documentation

The attached form must be completed. In any case the following minimum information is required.

Client Name	List of Materials Used
Project Title	Well Abandonment Method
Site ID #	Name of Site Professional
Borehole Designation	Total Well Depth

Borehole Log showing zone(s) of grout placement

DEFINITIONS

Aquifer means a water bearing formation that transmits water in sufficient quantities to supply a well for a beneficial use.
Borehole means an open or cased subsurface hole created by drilling.
Casing means the pipe installed to maintain integrity of the borehole.
Department means the Department of Environment and Conservation.
Grout means approved cement, concrete or bentonite sealing material used to fill in the annual spacing of a well or to abandon a well.

Monitor Well means an artificial excavation constructed to measure or monitor the quality and/or quantity or movement of substances, elements, chemicals, or fluids, beneath the surface of the ground.

Permeability means the ability to transmit fluid.
Recovery Well means a sub surface infrastructure installed for the purpose of bulk recovery of free phase contaminant fluids.

* Addressed by Department of Natural Resources Regulations.

Government of Newfoundland and Labrador
Department of Environment and Conservation

Monitor Well Abandonment Log

Date: _____

Project Number: _____ ProjectName:_____

Location: _____ Form Completed By:_____

Sub-Contractor:	Well:
Date Completed:	Lithology:

MONITOR WELL SPECIFICATIONS	**MATERIALS REMOVED**
Well Depth: (m)	Well Protector: Type:
Casing Stick-up: (m)	Casing: (m) Screen: (m)
Borehole/Pack Diameter: (mm)	Other:
Screen Length: (m)	
Sand Pack Length (m)	
Static Water Level: (m)	

ABANDONMENT PROCEDURE

Grout Pumping Method:

Grout Type:

Volume Grout Used:

SUMMARY OF MATERIALS USED

Item	Specifications	Volume Used
Grout		
Sand		
Bentonite		
Cement		

ABANDONED BOREHOLE LOG

Description of Material Emplaced	Strata Plot	Emplaced Material Depth *From:* *To:*

APPENDIX E

ECOLOGICAL ASSESSMENT GUIDANCE

General Guidance on Ecological Assessments

The approach to Ecological Risk Assessment (ERA) is based on the Canadian Council of Ministers of the Environment (CCME), *A Framework for Ecological Risk Assessment at Contaminated Sites: General Guidance* (1996). ERA is the formal process that has been developed for assessing and quantifying risk to ecological receptors from exposure to one or more stressors. The framework within which ERA is performed was largely developed in the United States, under the United States Environmental Protection Agency (EPA 1992). In Canada, CCME has developed a similar protocol and variants of these protocols are presently in use in several Provinces.

ERA is defined (EPA 1992) as the process that evaluates the likelihood that adverse ecological effects may occur or are occurring as a result of exposure to one or more stressors. It is a process for organizing and analyzing data, information, assumptions, and uncertainties to evaluate the likelihood of adverse ecological effects. It provides risk managers with an approach for considering available scientific information along with other factors (*e.g.,* social, legal, political, economic) they need to consider in selecting a course of action, in order to safely manage the environment.

The ERA process is inherently iterative and tiered. A relatively simple process may be all that is required to achieve an adequate foundation for a management decision. Alternatively, remaining uncertainties may require that the process be repeated at increasing levels of detail before decision-making can occur. Initial tiers in an ERA are typically based on environmentally protective assumptions such as maximum exposure or ecological sensitivity. When an early tier cannot sufficiently define risk to support a management decision, a higher assessment tier may be pursued that will require either additional data or a more refined analysis technique. Higher tiers provide more ecologically realistic assessments that are more site-specific and make fewer assumptions about exposure and effects.

A three-tier framework is typically followed and is composed of sequentially more sophisticated and complex evaluations. Tiers in the framework include:

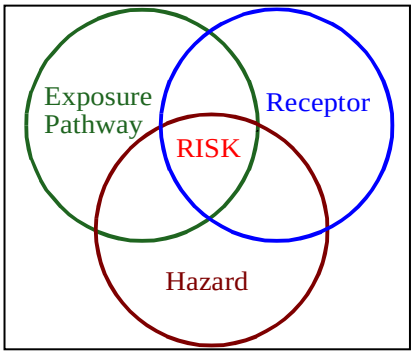
- Tier I: Screening Assessment,
- Tier II: Preliminary Quantitative ERA, and
- Tier III: Detailed Quantitative ERA.

Each tier has the same structure and builds upon data, information, knowledge, and decisions from the preceding tier. At the same time, each tier becomes more focused on specific issues or concerns as the available information is reviewed and data gaps are addressed. The ERA process does not necessarily involve all three tiers; rather, the process stops at a point when sufficient information has been amassed to support the decision-making or management process (CCME 1996). When an early tier cannot sufficiently define risk to support a

management decision, a higher assessment tier that may require either additional data, or applying a more refined analysis technique, may be needed. Higher tiers provide more ecologically realistic assessments while making less conservative assumptions about exposure and effects.

At the screening level, ERA is essentially a desk-top exercise based primarily on data from the literature, previous or preliminary studies of the impacted site, monitoring studies, historical data for the site, and a reconnaissance visit to evaluate the receptors, exposure, hazards, and potential risk at the study area.

Risk can be defined as the product of the level of hazard and the level of exposure for a given receptor. Therefore, risk does not exist unless the hazard (*e.g.,* a high concentration of contaminant) co-exists with a receptor (*e.g.,* an organism that has inherent value to society), and there are active pathways that cause the receptor to be exposed to the hazard. Risk occurs only where hazard, receptor and exposure coincide in space and time, as illustrated.



Receptor identification involves the identification of organisms that may be exposed to the potential hazards. Typically this involves selecting key indicator organisms or Valued Environmental Components (VECs) to represent the variety of possible receptors at the site. Initial receptor characterization should identify VECs and other environmental components that may be affected by contaminants from the site. VECs are resources or environmental features that are:

- important to human populations;
- have economic and/or social value;
- have intrinsic ecological significance; or
- serve as a baseline from which the impacts of development can be evaluated, including changes in management or regulatory policies (CCME 1996).

Hazard identification involves the identification of environmental hazards (*e.g.,* contaminants) that may pose a risk to organisms and relates the known VECs to toxicity information obtained from the literature for the contaminants. Exposure assessment involves the evaluation of the likelihood or degree to which receptors will be exposed to the hazard, and the pathway(s) by which exposure may occur. Finally, risk characterization involves the assessment of risk of each hazard to each receptor, based on degree of exposure.