Guidance on the Application of Risk-Based Corrective Action (RBCA) in Municipal Wellfields and Watersheds

In Accordance with the Guideline
for the Management of Contaminated Sites (Version 2.0)

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New Nouveau Brunswick

Department of the Environment and Local Government

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1.0 INTRODUCTION

This document provides guidance on the application of Risk-Based Corrective Action (RBCA) in municipal wellfields or watersheds in New Brunswick. As with all contaminated sites in New Brunswick, the management approach to be used in municipal wellfields and watersheds incorporates the principles of RBCA.

It should be noted that the muncipal wellfield and watershed protection programs are proactive approaches to drinking water protection. In both instances, controls on chemical storage and land use are necessary to achieve this proactive approach. It is anticipated that occurrences of chemical spills in municipal wellfields and watersheds will decrease over time as a result of this approach. However, not all spills can be prevented and contaminated sites in wellfields and watersheds do exist and will continue to occur, although less frequently.

The RBCA process is used as a reactive approach to protect groundwater and surface water and human health once contamination is found in the environment. The RBCA process ensures that what residual contamination may remain does not pose an unacceptable risk to human health and the environment. In municipal wellfields and watersheds, emphasis is placed upon ensuring that there are no unacceptable health or aesthetic impacts to drinking water.

The three programs are co-operative in nature and are intended to protect groundwater and surface water resources, and ultimately, the consumers of these resources. The RBCA approach is therefore not to be used by Responsible Parties to dispute the principles of wellfield and watershed protection, in particular, the controls placed upon chemical storage and land use.

In the next sections, the three regulatory programs of interest to those involved in with contaminated sites management in wellfields and watersheds are introduced, and the objectives of this guidance document are presented.

2.0 REGULATORY PROGRAMS

*2.*1 Wellfield Protection

Twenty percent of the population of New Brunswick relies on municipal groundwater supplies for its potable water. The DELG has been working towards protecting the Province's key groundwater resources by implementing a Wellfield Protection Program. The associated ***Wellfield Protected Area Designation Order (WfPADO***) was enacted on October 1, 2000.

For each evaluated wellfield, a map has been generated showing the overall area to be protected, and within this broader area, three zones of varying sensitivities, identified as A, B and C. Zone A is the most sensitive of the protection zones and is typically defined as that area within which groundwater travel times from any point to a production well are less than 100 days (in a porous media aquifer) or 250 days (in a bedrock aquifer). The rationale is that potentially harmful bacteria are not likely to survive longer than 100 days in the groundwater system. Land uses and activities likely to produce such bacteria are therefore to be prohibited from or regulated within Zone A.

Zone B extends outwards from the production wells from Zone A to points corresponding to groundwater travel times of 5 years, a period considered to be long enough to adequately react to a release in Zone B of contaminants such as petroleum hydrocarbons.

Finally, beyond Zone B, is Zone C for which travel times are likely to be in the range 5 to 25 years. It is reasoned that although most groundwater contaminants will naturally degrade within this time period, persistent and mobile ones present within Zone C should be controlled, in order to reduce the risk of future impacts to the water supply.

Within the established zones, restrictions on land uses, activities, and particularly on the storage and use of potentially contaminating chemicals, are proposed. The latter are documented in a schedule of chemical quantities (Schedule C of the WfPADO), which identifies the maximum quantities of chemicals permitted to be stored in each zone.

2.2 Watershed Protection

In recognition of the fact that about 40 percent of the Province's population obtain their potable water supply directly from lakes, streams, and rivers, DELG has also instituted a Watershed Protection Program. The program was initiated in 1990, and the governing ***Watershed Protected Area Designation Order (W_sPADO),*** was enacted on November 1, 2001. The program and the Regulation address potentially contaminating land development activities taking place within the water supply watershed including residential, commercial and industrial development, agriculture and forestry.

The watershed protection program initially focused on those activities taking place within a 75 metre setback of a protected watercourse. With the enactment of the WsPADO, standards were placed on those activities taking place within the entire watershed, in addition to the setback zone, and including the watercourses themselves. For each designated watershed, three protection zones have been identified (Zones A, B and C). Zone A represents the watercourses. Zone B is the 75-metre setback area, and Zone C is the balance of the watershed. As with the wellfield protection program, regulatory standards vary for each zone of protection.

2.3 Management of Contaminated Sites

The New Brunswick Department of the Environment and Local Government (DELG) has adopted a risk-based approach to the management of contaminated sites. The process is described in the DELG publication: ***"Guideline for the Management of Contaminated Sites – Version 2"*** dated November, 2003. This document is intended to assist those involved with contaminated properties in understanding the responsibilities of the various parties, the expectations of DELG, and the options that are available to achieve satisfactory closure at contaminated sites in New Brunswick.

The technical requirements for contaminated sites management are presented in the publication ***"Atlantic RBCA (Risk-Based Corrective Action) for Petroleum Impacted Sites, User Guidance Version 2.0"***, dated September, 2003." This has been adopted for use by all four Atlantic Provinces and provides a common, risk-based technical approach to site assessment and remediation of contaminated sites. This technical approach was developed by the Atlantic **P**artners **I**n **R**BCA **I**mplementation (PIRI), based upon the American Society of Testing and Materials' (ASTM) Risk-Based Corrective Action tool, which includes a computer model.

This risk-based approach involves the development of clean-up criteria for a property using successively more complex levels of site evaluation and corrective action. While this technical tool deals specifically with application to petroleum-impacted sites, similar approaches such as those of the Canadian Council of Ministers of the Environment (CCME) can be used for risk assessment of non-petroleum contaminants. These are three "Tiers" in the risk assessment model:

- Tier I (or "screening level") criteria for petroleum hydrocarbons are presented in "Look Up" tables that were derived using the Atlantic RBCA software and conservative default assumptions about Atlantic site conditions. The resulting remedial criteria may be applicable and this is verified by the Site Professional in their submission to DELG;

- Tier II (or "Site-specific") criteria for petroleum hydrocarbons are derived by the Site Professional using an increasing amount of site specific information in the Atlantic RBCA computer model, in place of default, Tier I default information and/or by determining which pathways from the source to the receptor of contamination are active;

- Tier III remedial criteria are derived using a large amount of site-specific data and methodologies that replace or supplement Atlantic RBCA. These include application of extensive groundwater monitoring or indoor air quality data for petroleum hydrocarbons, application of other risk assessment models for non-petroleum contaminants, use of other groundwater flow and transport models, or ecological risk assessment.

The risk-based approach to the management of contaminated sites allows resources and emphasis to be directed at the remediation of those sites that present an unacceptable threat to human health or the environment.

*3.*0 RBCA IN MUNICIPAL WELLFIELDS AND WATERSHEDS

3.1 Background

This guidance document addresses the steps that might reasonably be introduced into the contaminated sites management process in those cases where the affected site is located in a municipal wellfield or watershed. The objective of this document is to provide guidance to those involved with the process and to ensure that risk based corrective action is applied uniformly and sensibly in the interests of protecting the water resource. The technical approach is discussed in Section 3.0. and the administrative approach is discussed in Section 4.0. Appendices A and B contain technical details on the application of RBCA within wellfields and watersheds.

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3.2 Evaluation of Exposure Pathways

The (DELG) Guideline for the Management of Contaminated Sites and the Atlantic RBCA Reference Documentation both emphasize the importance of properly identifying, at the initial site evaluation stage: (a) the contaminant sources (i.e. the extent of soil and groundwater contamination in three dimensions); (b) the potential migration pathways (the route whereby contaminants might travel towards a receptor); and (c) the receptors (in this case a municipal well or surface water intake).

An exposure pathway is the route that a contaminant takes in migrating from the source zone to the receptor. Four of these pathways are identified in the Atlantic RBCA methodology: outdoor air, indoor air, soil and groundwater. When evaluating contaminated sites in watersheds, the surface water pathway should be also be considered to account for the following situations:

- Contaminants present in the upper part of a watercourse would likely be rapidly transported downstream in the surface water system towards surface water intake. Nearby municipal wells could also be affected if the aquifer is locally recharged from the (impacted) contributing stream or river.

- Contaminants in surface water or shallow groundwater might find access to leaky storm drains that cross a wellfield, and such drains may represent an important component of the exposure pathway system.

Given that contaminated sites located in wellfields or watersheds automatically involve both a contaminant source and a potential groundwater or surface water receptor, it follows that in addition to the evaluation of other plausible exposure-pathway scenarios, ***assessment efforts should include the close examination of the potential groundwater and surface water pathways whereby contaminants might migrate from the source to that part of the system tapped by the municipal supply.***

The fact that there would not usually be a water supply well or surface water intake within the limits of the individual property upon which the contamination has been found (unless the release has occurred on the property housing the municipal well(s) or intake infrastructure themselves) does not relieve the Responsible Party from conducting this line of enquiry. ***Within a wellfield or watershed, sufficient data and analysis must be obtained at the assessment stage to permit proper evaluation of the potential exposure pathways from source to the potable water supply.***

Groundwater supplies

In the case of a groundwater supply, such evaluation requires consideration of both the stratigraphic conditions and the potentiometric (i.e. water level) data.

The exposure pathway would be considered <u>inactive or incomplete</u> if:

- it can be demonstrated that low permeability soil or rock units are located between the source zone and the aquifer and serve to effectively separate the two systems; or

- no stratigraphic separation is evident but it can be demonstrated from the water level and geochemical data that there are no flow paths from the source area to the aquifer;

The exposure pathway would be considered active or complete if:

- the conditions are such that groundwater in the source area might reasonably be expected to follow one or more flow paths towards a municipal well; or

- doubt remains as to the prevailing stratigraphic or potentiometric conditions, and it is considered possible that the contamination at the source could migrate towards that part of the aquifer tapped by the water supply.

Surface water supplies

In the case of surface water supplies, the exposure pathway would be considered active or complete if:

- contaminants released into surface water upstream of the water supply intake could reasonably affect the water quality in the contributing stream; or

- contaminants released into the groundwater could discharge into the surface water upstream of the supply intake and affect the water quality in the stream.

It should be noted that more than one groundwater/surface water exposure pathway might be involved and that each plausible one will require assessment.

3.3 Information review prior to site assessment

A number of lines of enquiry are available for site assessment and for the associated evaluation of groundwater/surface water flow paths. This is particularly important within a wellfield because such information may include stratigraphic data that should be taken into account in designing the field program. Great care should be taken, for example, to ensure that the exploration process does not result in the introduction of new pathways to the aquifer by the inappropriate drilling of deep exploratory holes through a protective (confining, aquitard) layer. The location of such a layer may have been identified from prior work.

The sources of such information should include but not necessarily be limited to the following:

- Wellfield or watershed protection studies provide information about the stratigraphy, the hydraulic characteristics of the aquifer, and the protection area zones. It should be noted that the modeling undertaken for wellfield or watershed protection purposes will likely have been carried out on a larger scale and that the results may not be directly applicable to the site-specific scale of a contaminated property.

- Other relevant geo-environmental information. Such data would include, for example, the New Brunswick Department of Natural Resources geologic and topographic mapping and air photos, the DELG remediation database, geotechncial reports, and information from the municipality as to the location and nature of service lines and trenches (that might themselves influence contaminant migration).

3.4 Environmental site assessment

Once the available data have been reviewed, the field program will be designed and implemented by the Site Professional. To enhance the regulatory acceptance of the assessment reports, consultation with DELG is recommended. It is likely that exploration would be undertaken in stages: firstly to address the immediate issues of on-site contaminant presence, containment and removal; secondly to evaluate the hydrogeological setting and to identify potential exposure pathways whereby potential receptors including the municipal well(s) and surface water intakes might be affected; and thirdly as required to fully determine the status of the identified pathways. Monitoring of both horizontal and vertical components of groundwater flow may be required in this effort, including the installation of monitoring wells at several different (vertical) locations within the flow system, and water samples may need to be recovered from intermediate points between the source zone and the municipal well(s) or water intakes along the suspected flow path lines.

The site assessment should be carried out in sufficient detail to support the Site Professionals' determination as to whether or not a pathway exists between the source zone and the water resource. In those cases where it cannot be determined with any degree of certainty that

a pathway to the water resource does not exist, the pathway shall be considered complete, and *further detailed studies may be required, and/or a comprehensive monitoring program may be mandated.* The scope of such study would be determined by the Site Professional in consultation with DELG, and may involve the drilling of additional exploratory holes, the installation of more monitoring wells, hydraulic testing, computer flow path modeling, and/or the long term monitoring of water levels and quality at strategic locations.

3.5 Development of Remediation Criteria within the Tiered RBCA Process

In the Atlantic RBCA process, a contaminated site is classified as being in either a "potable" or "non potable" setting, depending on whether or not an on-site water supply well is present. In a potable setting, the remediation criteria are selected so as to be protective of those consuming water from an on site well and being exposed to the contamination via other pathways. The word "potable", as used in the RBCA documentation, means acceptable from a health risk viewpoint, not from an aesthetic one. It should be noted that the Tier I potable numbers for benzene, toluene, ethylbenzene and xylene (BTEX) are duplicated from the CCME Canadian Drinking Water Quality Guidelines and would therefore be acceptable throughout the wellfield in situations where the groundwater consumption pathway is complete.

However, in close proximity to the wellhead (i.e. in Zone A), the permitted "potable" concentrations of total petroleum hydrocarbon components in groundwater, although much less than those for the "non-potable" situation, may still not be compatible with the presence of a nearby municipal well and require evaluation as described in Appendix A. ***The criteria for TPH shall be developed so as to result in "non-detect" concentrations at the municipal well or intake.***

See Appendix A for the appropriate Atlantic RBCA methods for non-petroleum contaminants.

In the case of watersheds, potable criteria for BTEX and TPH for soils and groundwater may not be appropriate since ecological receptors as well as human receptors must be considered. The appropriate RBCA methods for petroleum and non-petroleum contaminants are described in Appendix B.

If the assessment reveals that the surface water/groundwater pathway is incomplete, the site can be managed in a traditional way, utilizing the “non-potable” criteria at Tier I, or evaluating the site at Tier II or III with the groundwater consumption pathway inactivated.

4.0 ADMINISTRATIVE REQUIREMENTS

4.1 Communication process

The legislated reporting requirements for the release, assessment and remediation of contaminants are discussed in the ***Guideline for the Management of Contaminated Sites***. The duties of the Responsible Party, Site Professional, and the DELG Regional Inspector and staff of the Remediation Branch will be unchanged from those outlined in the ***Guideline.*** When contaminated sites occur in municipal wellfields and watersheds, involvement of the DELG Regional Water Planning Officer (RWPO) and in some situations the Water Supply Operator (WSO) and New Brunswick Department of Health and Wellness (DHW) will result. The following are the communication steps:

1. Following notification of contamination, the DELG Regional Inspector, assisted as required by staff from the DELG Remediation Branch, will determine a Responsible Party and advise that party as to whether the services of a Site Professional will be required.

2. The DELG Regional Inspector will notify the RWPO of the presence of a contaminated site within the wellfield or watershed and consult with the RWPO to determine in which zone the site is located. This information will be recorded on the DELG Remediation Site Registration/Inspection form.

3. Upon creation of a remediation file for a site within a wellfield or water supply watershed, the Regional Inspector, Remediation Engineer, Site Professional and RWPO will receive file identification information via e-mail from the Remediation Program Administrator. This will include a notice to the Site Professional that the requirements of this guidance document must be followed.

4. The RWPO or DELG Regional Inspector may request from the WSO information about the water supply system so that DELG can ensure that proper emergency measures or assessment of the contaminated site are carried out.

5. Should there be an imminent threat to the water supply, DELG staff will consult with DHW personnel.

6. All Site Professional submissions for contaminated sites located within a wellfield or watershed will be reviewed by DELG personnel as per the DELG document ***"The Submission and Processing of Site Professional Documentation"*** dated October, 2004. For complex cases, Remediation Branch staff may seek assistance from other technical specialists within DELG.

4.2 Scheduling of Assessment, Remediation and Reporting Activities

As is the presently the case with all contaminated sites in New Brunswick, the Site Professional will establish reasonable time lines for each step of the assessment and remediation process, which must be acceptable to the Department. It is expected that emergency actions in wellfield and watershed protected areas will include the immediate removal of free petroleum product in surface water, groundwater and in soils. The more rapid the travel time to the municipal well/watershed, the more aggressive the remedial technique that will be expected of Responsible Parties.

No minimum reporting periods are identified specifically for cases where contaminated sites are located within wellfields or watersheds, but the Responsible Party should be aware that more stringent time lines will apply where the municipal water supply is considered to be at risk.

5.0 CLOSURE

In evaluating contaminated sites within municipal wellfields and watersheds, greater emphasis must be placed on the evaluation of exposure pathways in order to provide sufficient evidence that the water resource will not be affected by the contamination. To ensure that drinking water resources are protected throughout the Contaminated Sites Management Process, Site Professionals should become familiar with the factors that need to be considered when evaluating contaminated sites in wellfields and watersheds. Persons requiring further information on this initiative should contact the Remediation Branch at (506) 444-5955.

APPENDIX A – Technical Guidance on the Application of RBCA in New Brunswick Wellfields

Appendix A – Technical Guidance on the Application of RBCA in New Brunswick Wellfields

The Atlantic RBCA User Guidance, Version 2, outlines appropriate methodologies for site assessment and risk assessment for Contaminated Sites in Atlantic Canada. In the User Guidance, the reader is referred to the provincial regulator on matters dealing with the appropriate application of RBCA in wellfield protected areas. The purpose of this Appendix is to outline the types of risk-based corrective action that will be deemed to be appropriate in wellfield protected areas in New Brunswick, which are supplemental to the minimum requirements for all sites presented in the User Guidance. Key considerations in the acceptability of various approaches are the time available to complete remediation before a municipal well is impacted, and travel distance to the well

A Limited Remedial Action (LRA) approach may be appropriate in wellfield protected areas, provided that there are no impacts to groundwater, no long-term indoor air quality issues and no ecological exposure. Consultation with DELG is required to confirm that this approach is appropriate for a particular site. Limited Remedial Action is not appropriate on sites with multiple contaminants, historical contamination or on bulk plant/service station sites.

The risk assessment approaches that may be carried out by the Site Professional in each zone are described below:

Zone A (100 or 250 day travel time), no underlying aquitard

Application of Tier I:

- Application of potable criteria in groundwater for benzene, toluene, ethylbenzene and xylene (BTEX) within Zone A is acceptable as these numbers are duplicated from the CCME Canadian Drinking Water Quality Guidelines (CDWQG).

- Application of potable criteria in soils for BTEX is acceptable within Zone A as these numbers are derived to ensure that leaching from these soils does not increase the groundwater concentration above the CDWQG's for these contaminants.

- For non-petroleum contaminants in groundwater, the CDWQG may also be applied for groundwater within Zone A.

- For non-petroleum contaminants in soil, the CCME Recommended Soil Quality Guidelines may be applied for soils in Zone A using the Soil Quality Guideline to protect human health (SQG_{HH}), provided that the groundwater check was calculated by CCME. For contaminants where CCME screening criteria are not available, or the groundwater check has not been completed, site-specific

criteria, which consider the soil leaching to groundwater pathway, will need to be generated by the Site Professional.

- For total petroleum hydrocarbons (TPH)in groundwater, the Tier I concentrations are protective of human health but not of the aesthetic quality of drinking water. The acceptable concentration of TPH at the contaminated site is one that will not produce concentrations above the DELG laboratory limits of quantitation for TPH in groundwater at the municipal well. The DELG laboratory limits of quantitation for TPH are currently 0.005 mg/L for C_6–C_{10}, 0.010 mg/L for C_{10}-C_{21} and 0.020 mg/L for C_{21}-C_{32}. This will require an additional screening of the TPH concentration at the municipal well, for sites within the normal range of a hydrocarbon contaminant plume (150 m).

  $$\mathbf{TPH_{(allowable\ site)} = TPH_{(municipal\ well)} / (WD/2\pi LT)}$$

  where: $TPH_{(municipal\ well)}$ = TPH limit of quantitation in municipal well (mg/L)
  $TPH_{(allowable\ site)}$= TPH concentration leaving the site (mg/L)
  W= width of contaminant plume at site perpendicular to flow direction (m)
  D = depth of contaminant at source (m)
  L = distance of municipal well from source (m)
  T = thickness of aquifer supplying the municipal well (m)

  The above equation should not be applied when W>L or D>T, rather a Tier III approach should be used in close proximity to the wellhead. Also, the above equation is not applicable for bedrock that does not behave as a porous medium. The Site Professional is responsible to make this determination and develop an appropriate Tier III approach should a porous medium approach not be applicable. This determination should include a review of the parameters used in the model to generate the wellfield protection zones.

  For typical sites located greater than 150 meters from the municipal well, potable criteria can be applied for TPH. If the Site Professional determines that site conditions are not typical (i.e. preferential pathways are present, etc.), then the above mathematical check should be applied.

- For sites within 150 m of the municipal well, the acceptable concentration of TPH in on-site soils will be generated by the RBCA model using the acceptable maximum on-site groundwater TPH concentration calculated above using $TPH_{(allowable\ site)}$ as the end-point for an on-site soil leaching pathway. This will involve a trial-and error process of entering soil data to generate a groundwater concentration less than $TPH_{(allowable\ site)}$.

Application of Tier II: Application of Tier II for the is not appropriate in close proximity to municipal-sized pumping wells and will not be accepted in Zone A for evaluation of the groundwater pathway. Tier II may still be appropriate for evaluation of other pathways (i.e. indoor air).

Application of Tier III: Application of Tier III methods are acceptable in consultation with DELG.

Zone B (100 or 250 days to 5 years), no underlying aquitard

Application of Tier I: Potable criteria for BTEX and CCME CDWQG for non-petroleum contaminants are acceptable. For TPH, if the site is located more than 150 m away from the municipal well, potable criteria may or may not be applied as discussed for Zone A.

Application of Tier II: Application of Tier II is possible, provided that a gradient between the site groundwater table and the pumping level in the municipal wells is used for the groundwater consumption and soil leaching pathways and that no lateral or vertical offsets are used. If the pumping well is in a bedrock aquifer that can be considered to be a porous medium, a low porosity to simulate flow in fractured bedrock should be used. In types of bedrock that do not behave as a porous medium, a Tier II approach should not be used. Alternatively, modeling can be carried out at Tier II to achieve acceptable concentrations at a point of compliance (i.e. potable criteria 150 m away from the well).

Application of Tier III: Application of Tier III methods are acceptable in consultation with DELG.

Zone C (5 years to 25 years), no underlying aquitard

Application of Tier I: Application of potable criteria is acceptable but may be over-conservative.

Application of Tier II: Same as for Zone B, above.

Application of Tier III: Application of Tier III methods are acceptable in consultation with DELG.

Zones A-C with an underlying aquitard

Application of Tier I: Where the Site professional has determined, and DELG concurs, that a continuous aquitard exists between the shallow impacted aquifer and the deeper supply aquifer, non-potable criteria may be applied. Where windows in the aquitard exist, the Site Professional must confirm that the site is sufficiently distant from the window that the groundwater pathway is incomplete, before applying non-potable criteria.

Application of Tier II: In the presence of an aquitard, groundwater consumption and the soil leaching to groundwater pathways are incomplete. Tier II modeling can be carried out for the remaining pathways.

Application of Tier III: Application of Tier III methods are acceptable in consultation with DELG.

APPENDIX B – Technical Guidance on the Application of RBCA in New Brunswick Watersheds

APPENDIX B – Technical Guidance on the Application of RBCA in New Brunswick Drinking Watersheds

The Atlantic RBCA User Guidance, Version 2, outlines appropriate methodologies for site assessment and risk assessment for Contaminated Sites in Atlantic Canada. In the User Guidance, the reader is referred to the provincial regulator on matters dealing with the appropriate application of RBCA in watershed protected areas. The purpose of this Appendix is to outline the types of risk-based corrective action that will be deemed to be appropriate in watershed protected areas in New Brunswick, which are supplemental to the minimum requirements for all sites presented in the User Guidance. Key considerations in the acceptability of various approaches are the time available to complete remediation before a municipal water intake is impacted, and travel distance to the intake.

A Limited Remedial Action (LRA) approach may be appropriate in watershed protected areas, provided that there are no impacts to groundwater, no long-term indoor air quality issues, and no ecological exposure. Consultation with the Department is required to confirm that this approach is appropriate for a particular site. Limited Remedial Action is not appropriate on sites with multiple contaminants, historical contamination or on bulk plant/service station sites.

The risk assessment approaches that may be carried out by the Site Professional in each zone are described below:

Release into Zone A (the actual watercourse)

Direct release into a watercourse requires immediate notification of DELG and emergency action to contain and collect the contaminant. Depending upon the size and type of the spill and proximity to the intake, the water intake may need to be shut off. In many cases, there will be insufficient time to determine the expected concentration at the intake and a visual or professional-judgment decision to shut off the intake will need to be made by the regulatory authorities involved.

The acceptable concentration at the intake is a concentration less than the Canadian Drinking Water Quality Guidelines for the contaminant in question, or in the case of total petroleum hydrocarbons, less than the limit of quantitation of the DELG lab. The DELG laboratory limits of quantitation for TPH are currently 0.005 mg/L for C_6–C_{10}, 0.010 mg/L for C_{10}-C_{21} and 0.020 mg/L for C_{21}-C_{32}.It should be noted that CCME Aquatic Life Guidelines must also be satisfied in a watercourse as part of ecological risk assessment and that these criteria may be more stringent than those to protect the drinking water quality. Therefore, direct application of Tier I potable numbers in the watercourse may not be appropriate in most situations.

Release into Zone B (75 m setback from the watercourse)

A release to the ground surface may reach the watercourse through overland flow. This

requires immediate notification of DELG and emergency action to contain and collect the contaminant. If the contaminant enters the watercourse, the same procedures as those used for Zone A are appropriate.

It should be noted that sites located within 150 m of a watercourse or other ecological receptor require an exposure evaluation as per the Ecological Screening Document found in the Atlantic RBCA User Guidance, Version 2. Should there be a potential for exposure, then this must be further investigated through an ecological risk assessment at Tier III.

If the watercourse is not impacted through overland flow, but soils and or/groundwater are impacted, remediation criteria will need to be developed to protect the watercourse from the groundwater discharge to surface water pathway. The appropriate remediation criteria for the site will be the lowest of the ecological criteria and human health criteria for drinking water. Therefore, application of Tier I potable numbers in the watercourse may not be appropriate in most situations.

It should be noted that the groundwater discharge to surface water pathway in Version 2 of the Atlantic RBCA model has not been approved for use in Atlantic Canada by Atlantic PIRI. However, development of criteria for this pathway is a Tier III procedure and the Atlantic RBCA model, or other models, may be used with sufficient justification from the Site Professional and acceptance from DELG. Careful consideration should be given to develop criteria that will still be protective during low-flow conditions in the watercourse.

Once the acceptable criteria for groundwater is known, the Tier II Atlantic RBCA model can be used to determine the acceptable soil levels for the on site soil leaching to groundwater pathway, through a trial and error approach.

Release in Zone C (the remainder of the watershed)

Typical releases in this zone will not pose as much of an immediate threat to the environment as those in closer proximity to the watercourse. However, the same approach can be used in Zone C as for releases in Zone B, but the acceptable site concentrations developed will likely be higher than for Zone B.