



Health
Canada

Santé
Canada

*Your health and
safety... our priority.*

*Votre santé et votre
sécurité... notre priorité.*

Guidance for Evaluating
Human Health Impacts
in Environmental Assessment:

DRINKING AND RECREATIONAL WATER QUALITY



Health Canada is the federal department responsible for helping the people of Canada maintain and improve their health. We assess the safety of drugs and many consumer products, help improve the safety of food, and provide information to Canadians to help them make healthy decisions. We provide health services to First Nations people and to Inuit communities. We work with the provinces to ensure our health care system serves the needs of Canadians.

Également disponible en français sous le titre :

*Conseils pour l'évaluation des impacts sur la santé humaine dans le cadre des évaluations environnementales :
La qualité de l'eau potable et de l'eau utilisée à des fins récréatives*

To obtain additional information, please contact:

Health Canada
Address Locator 0900C2
Ottawa, ON K1A 0K9
Tel.: 613-957-2991
Toll free: 1-866-225-0709
Fax: 613-941-5366
TTY: 1-800-465-7735
Email: publications@hc-sc.gc.ca

This publication can be made available in alternative formats upon request.

© Her Majesty the Queen in Right of Canada, as represented by the Minister of Health, 2016

Publication date: December 2016

This publication may be reproduced for personal or internal use only without permission provided the source is fully acknowledged.

Cat.: H129-54/2-2017E-PDF
ISBN: 978-1-100-19259-8
Pub.: 160329

TABLE OF CONTENTS

1. ACRONYMS	1
2. PURPOSE OF THIS DOCUMENT	2
3. INTRODUCTION AND CONTEXT	3
4. HEALTH CANADA’S ROLE WITH RESPECT TO DRINKING AND RECREATIONAL WATER QUALITY	4
5. HEALTH CANADA’S APPROACH TO HUMAN HEALTH RISK ASSESSMENT	5
6. ADDRESSING THE POTENTIAL CONTAMINATION OF DRINKING AND RECREATIONAL WATER IN ENVIRONMENTAL ASSESSMENTS	6
6.1 ASSESSING POTENTIAL IMPACTS ON DRINKING WATER QUALITY	7
6.1.1 IDENTIFICATION OF SOURCES USED FOR DRINKING WATER	7
6.1.2 DETERMINATION OF POTENTIAL CHANGES TO SOURCE AND WELL WATER QUALITY	8
6.1.3 DETERMINATION OF IMPACTS OF CHANGES IN WATER QUALITY	8
6.1.4 MONITORING AND MITIGATION	9
6.1.5 ASSESSMENT OF RESIDUAL RISK	10
6.2 ASSESSING POTENTIAL IMPACTS ON RECREATIONAL WATER QUALITY	11
7. ASSESSMENT OF CUMULATIVE EFFECTS	12
8. FOLLOW-UP PROGRAMS	13
9. REFERENCES	14
9.1 CANADIAN WATER QUALITY GUIDELINES	14
9.2 ENVIRONMENTAL ASSESSMENTS	14
9.3 WORLD HEALTH ORGANIZATION GUIDELINES	14
9.4 HUMAN HEALTH RISK ASSESSMENT GUIDANCE	14
APPENDIX	
APPENDIX A1 WATER QUALITY IN EA CHECKLIST	15



This document may be cited as follows:

Health Canada. 2016. *Guidance for Evaluating Human Health Impacts in Environmental Assessment: Drinking and Recreational Water Quality*. Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.

Any questions or comments on this document may be directed to:
Environmental Assessment Program, Ottawa, Ontario K1A 0K9
Email: ead@hc-sc.gc.ca



1

ACRONYMS

ACRONYM	MEANING
CEAA 2012	<i>Canadian Environmental Assessment Act, 2012</i>
DOC	dissolved organic carbon
DWTP	drinking water treatment plant
EA	environmental assessment
<i>E. coli</i>	<i>Escherichia coli</i>
EIS	environmental impact statement
GCDWQ	<i>Guidelines for Canadian Drinking Water Quality</i>
GCRWQ	<i>Guidelines for Canadian Recreational Water Quality</i>
HHRA	human health risk assessment
TDS	total dissolved solids
TOC	total organic carbon
VOCs	volatile organic compounds
RA	responsible authority

2

PURPOSE OF THIS DOCUMENT

This document provides generic guidance on predicting health risks of water quality in federal environmental assessments (EAs) of proposed major resource and infrastructure projects (such as mines, dams, pipelines and other projects). It presents the principles, current practices and basic information Health Canada looks for when it reviews environmental impact statement (EIS) or other reports submitted by project proponents as part of the EA process.

It was prepared for the benefit of proponents and their consultants and to support an efficient and transparent project review process. The foundational information described here should be supplemented appropriately with additional information relevant to specific projects.

The guidance was also prepared for responsible authorities and stakeholders to the EA process to communicate our normal areas of engagement and our priorities within these areas to help ensure that sufficient evidence is available to support sound decisions. As part of its review, Health Canada may suggest that a responsible authority (RA), review panel or others collect information not specifically described here in order to assess the health effects of specific projects. As the guidance provided here is generic and designed to support EA under multiple jurisdictions, the scope of our review will also necessarily be amended according to specific jurisdictional requirements.

Health Canada updates guidance documents periodically and, in the interest of continuous improvement, accepts comments and corrections at the following address: ead@hc-sc.gc.ca

Please verify that you are reading the most recent version available by consulting: www.healthycanadians.gc.ca/publications/department-ministere/hc-sc/environmental-assessment-evaluation-environnementale/index-eng.php

3

INTRODUCTION AND CONTEXT

Health Canada provides expertise to assist RAs, review panels and/or other jurisdictions leading environmental assessments to determine whether there are potential health risks associated with proposed projects and how to prevent, reduce or mitigate them.

Health Canada brings to bear its expertise in health risks associated with air quality, water quality, radiation, noise and country foods when it reviews and provides comments on information submitted by proponents in support of proposed projects. Health Canada also provides guidance to help stakeholders, including responsible authorities, review panels and affected communities, better understand how to conduct health assessments for proposed major resource projects.

This document concerns the assessment of health risks associated with water quality. It contains information on Health Canada's role with respect to drinking and recreational water quality; steps in Health Canada's preferred approach to human health risk assessment (HHRA) and assessing water quality-related health effects; and assessing cumulative effects.

Appendix A contains a checklist that can be used to verify that the main components of a water quality assessment are complete and to show where this information can be found within an EA document.



4

HEALTH CANADA'S ROLE WITH RESPECT TO DRINKING AND RECREATIONAL WATER QUALITY

In Canada, the responsibility for the safety and quality of drinking and recreational waters is shared between federal and provincial/territorial levels of government. The primary responsibility, including for regulations, generally rests with the provinces and territories. Health Canada provides scientific leadership by developing the *Guidelines for Canadian Drinking Water Quality* (GCDWQ) and the *Guidelines for Canadian Recreational Water Quality* (GCRWQ), in partnership with the provinces and territories. These guidelines are used as the basis for provincial/territorial drinking and recreational water quality requirements. For the most recent listing of these guidelines, refer to Health Canada's publication at: www.healthcanada.gc.ca/waterquality

Provincial and territorial standards may differ from the GCDWQ, depending on local considerations and needs. Upon request, Health Canada may provide scientific and technical advice to a federal department. This advice may be in the context of an environmental assessment (in this case, advice may also be provided to a province for projects substituted under *Canadian Environmental Assessment Act, 2012* [CEAA, 2012], or to a territory) or general advice on emergency response to a spill—and could include the development of drinking water guidance values.

Drinking water guidance values are developed upon request to provide a level that is considered to be safe for exposure to a specific chemical contaminant in drinking water, under specific conditions. They are generally developed for contaminants for which no GCDWQ are available. These guidance values are developed for use within the department or government that has made the request, and are based on the limited scientific information available at the time of the request, and not on a thorough research of all existing studies. They are not subject to a review at the level of the GCDWQ, which undergo internal/external peer review and public consultation before being approved by the Federal-Provincial-Territorial Committees on Drinking Water and on Health and the Environment. Drinking water guidance values apply to water intended for human consumption, and do not replace or supersede existing guidelines or regulations.

For more information, refer to Health Canada's publication entitled *Water Talk—Drinking Water Quality in Canada* at: www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/water-eau/drink-potab-eng.pdf



5

HEALTH CANADA'S APPROACH TO HUMAN HEALTH RISK ASSESSMENT

One of the key tools that Health Canada promotes for evaluating the potential health impacts of project-related exposure to contaminants is called a “human health risk assessment” (HHRA). An HHRA can help identify whether there are potential human health risks associated with a proposed project.

Three components must be present for a “risk” to exist: 1. a hazard (for example, a chemical or a radionuclide) 2. a receptor (individuals or communities) and 3. an exposure pathway (a means by which people are exposed to the contaminant).

Within an environmental assessment, an HHRA is defined as the process used to estimate the probability of adverse health effects for people who may be exposed to contaminants through different routes/pathways (ingestion, inhalation and/or dermal contact) in specific environmental media (air, foods, soil, water and/or sediment).

An HHRA provides qualitative and/or quantitative estimates of the likelihood of adverse effects to human health, depending on the available information. These estimates are based on the inherent characteristics of the contaminants, as well as factors specific to the project being assessed—such as the characteristics of the exposed population and the media through which the exposure would take place.

Although conducting an HHRA is not always a requirement of an EA and is dependent on the potential effects of particular project, it can provide increased support for the conclusions of an EA. The findings of an HHRA are particularly useful for determining the significance of a potential effect, and for establishing appropriate mitigation measures, follow-up programs, and plans for monitoring, remediation and/or risk management.

With respect to water quality, an HHRA can be used to assess the risk of potential contamination of drinking or recreational water by taking into consideration the levels of contaminants in the water sources and the exposure of humans to these contaminants. By combining these two factors, one can estimate the potential effects of the intake of contaminants on human health. However, a complete HHRA may not always be necessary in an EA focused solely on water quality—for example, when the project's predicted impacts meet applicable guidelines and standards (such as the GCDWQ, GCRWQ or provincial standards)—given that extensive HHRA's have been already performed to establish these guidelines and standards.

In other cases where multiple pathways of exposure are being evaluated, exposure to contaminants in drinking and recreational water should be included in a multi-media HHRA.



6

ADDRESSING THE POTENTIAL CONTAMINATION OF DRINKING AND RECREATIONAL WATER IN ENVIRONMENTAL ASSESSMENTS

A water quality assessment is typically performed as part of an EA. If the EA demonstrates that a project will not result in any exceedances of applicable water quality guidelines or standards at the point of human consumption or exposure, it is reasonable to conclude that negative impacts on human health are not expected from exposure to drinking or recreational water.

If groundwater is consumed directly without treatment, then its water quality parameters could be compared to applicable drinking water limits. When water is treated before consumption, the water quality assessment for the project should examine whether the technology and capacity of the existing drinking water treatment plant (DWTP) are sufficient to ensure that the treated water will be of adequate quality.

It is not necessary for source water to meet guidelines or standards before treatment; however, this does NOT mean that source water can be contaminated up to the limits set by the guideline or standard. Health Canada holds the view that the assessment should demonstrate the steps to be taken to minimize the impacts of contamination on the quality of source water.

Water quality assessments should consider water quality parameters that are specific to the project, as well as common parameters that could have an impact on drinking water treatment. These common parameters include the following: total dissolved solids (TDS), turbidity, pH, temperature, ammonia, total organic carbon (TOC) and dissolved organic carbon (DOC). Surface water should never be consumed without treatment; this also applies to groundwater under the direct influence of surface water (in cases such as seepage of surface water through well casing or fractured rock)—which should be considered to be surface water for water quality purposes.

If a facility may be affected by a project and rendered unable to treat water to meet the applicable drinking water guidelines or standards, this fact should be considered in the water quality assessment, particularly because upgrading an existing DWTP may take several years.



6.1 ASSESSING POTENTIAL IMPACTS ON DRINKING WATER QUALITY

Assessing the potential impacts of projects on drinking water quality often involves simply comparing predicted concentrations of substances and parameters to the most recent version of the *Guidelines for Canadian Drinking Water Quality* (GCDWQ), published by Health Canada on behalf of the Federal-Provincial-Territorial Committee on Drinking Water. However, when the predicted concentrations approach or exceed the values suggested in the GCDWQ, it is advisable to include drinking water as a pathway in the HHRA conducted for the project.

Health Canada does not establish rules under the CEAA 2012 concerning the format and presentation of data and results when assessing potential impacts on drinking water quality. However, inclusion of the following components is suggested:

1. Identification of sources used for drinking water (locations and proximities to the proposed project);
2. Determination of potential changes to source and well water quality;
3. Determination of impacts of changes in water quality;
4. Mitigation;
5. Assessment of residual risk;
6. Monitoring (if required); and
7. References.

It is Health Canada's preference that only qualified professionals with suitable experience assess potential effects on drinking water quality.

6.1.1 Identification of sources used for drinking water

The water quality assessment should identify and describe all sources of drinking water in the area that may experience a change as a result of the project. Such sources may include source water intakes for DWTPs; sources that are consumed directly (for example, private wells). It is useful to include a statement indicating that all drinking water sources have been listed in the assessment.

The potential spread of contamination through the local watershed should be taken into consideration, when deciding which drinking water sources may experience a change as a result of the project. If a DWTP is present in the project's area of influence, Health Canada suggests that the water quality assessment identify the treatment technologies used in the facility (for example, chlorination, filtration, ozonation) and provide information from the facility (if available) on intake and treated water monitoring. If no sources of drinking water exist in the project area, either public or private, then no assessment with respect to drinking water would be suggested.



6.1.2 Determination of potential changes to source and well water quality

Any potential project-related changes in the quality of drinking water sources should be determined (including the risk of spills or accidents) and quantified to the greatest extent possible in the assessment. Health Canada also suggests provision of basic information on the local watershed; the geographical/hydrological influence of the project on drinking water supplies; and potential human exposure pathways.

Modelling may be used to estimate contaminant levels in water after the project proceeds—through the phases of construction, operation and/or decommissioning, as appropriate. Ideally, the estimates should be based on models recommended by Environment Canada, Natural Resources Canada and/or the United States Environmental Protection Agency, and the water quality assessment should document the models used.

If a potential impact on water quality has been identified, Health Canada would prefer that the water quality assessment include a comprehensive list of potential contaminants and their physicochemical properties. To properly identify these contaminants, the assessment should consider the following types of factors: the nature of the project; the effluents, materials and chemicals present; excavation and construction methods; potential flooding; rerouting of waterways; landscape changes; and waste management.

Health Canada would also prefer that the assessment take into account naturally occurring sources of contamination in the project area (for example, substances found in soils and/or water), as well as contamination from previous industrial activities, which could be mobilized by the project activities. Examples of potential contaminants are metals, pesticides, pathogens, hydrocarbons and volatile organic compounds (VOCs).

A change in physical characteristics, as well as in levels of ammonia or bromide, can affect water treatment. If no water quality changes are expected to occur in the source water of nearby DWTPs or in untreated well water, a statement with proper justification indicating this fact should be included.

6.1.3 Determination of impacts of changes in water quality

If any changes to source or well water quality are predicted, Health Canada prefers that the water quality assessment include discussion of the potential impacts of these changes. In the case of untreated well water or any other untreated drinking water source, the predicted water quality should be compared to the GCDWQ or to the applicable provincial or territorial standards.

The potential risk to human health caused by contaminants for which no Canadian human-health-based guidelines or standards exist needs to be assessed on a case-by-case basis. If there are potential guidelines or standard exceedances, Health Canada suggests that the assessment discuss monitoring and mitigation.

If source water is to be treated, Health Canada prefers that the assessment include discussion of the type of treatment used and/or the capacity of the facility, and whether the facility will be able to address the predicted or possible changes in water quality. If the facility is provincially or territorially regulated, it is advisable to consult with the appropriate authorities and/or facility operators to confirm the expected adequacy of the facility.

6.1.4 Monitoring and mitigation

If the assessment determines that a project poses a risk of a change to the environment or an effect of a change to the environment on a drinking water source—and where that effect cannot be eliminated by existing treatment plants—the assessment should describe the measures to be taken to manage this risk. In addition, Health Canada encourages development of plans for mitigation measures that further reduce small impacts. It is suggested that all recommendations, including any projected mitigation and monitoring plans, be listed and described.

Monitoring

The periodic monitoring of drinking water parameters can be used to verify water quality predictions. If there is uncertainty as to whether water quality will meet applicable guidelines or standards—either due to predicted concentrations being near guideline or standard concentrations or high uncertainty in predicted values—Health Canada suggests that a commitment be made to undertake a monitoring program.

In general, Health Canada prefers that monitoring of drinking water quality be done in accordance with provincial and territorial regulations. The following factors may be of assistance in planning monitoring studies:

- Information on contaminants typically of concern related to similar development projects and similar sites;
- Discussion with local residents;
- Consultation with local health and/or environmental health officials; and
- Previous studies conducted in the project area.

Health Canada does not have specific expertise in development of site-specific sampling plans; however, if it receives a request under Section 20 of CEAA 2012, it may make available information and knowledge to guide the conducting of human health risk assessments (HHRAs) after monitoring data is obtained.

Health Canada prefers that historic drinking water quality data (baseline conditions prior to any project activities in the affected watershed) be collected before the project begins. These data can then be compared to predicted changes in water quality due to project activities, as well as to water quality data collected after the project is underway. Baseline data may be obtained from DWTPs and from nearby wells that may be influenced by the project.

If no monitoring is to be undertaken, Health Canada prefers that the water quality assessment include a justification for this decision.

Mitigation

If an environmental effect on drinking water sources is either predicted or possible, the water quality assessment should include a mitigation plan. Possible mitigation measures include the following:

- Measures to reduce predicted changes in water quality;
- Improved treatment technology or capacity in DWTPs;
- Implementation of water treatment where it was previously absent; and
- Provision of an alternative drinking water source.

If a DWTP's source water quality could be affected by a project, Health Canada prefers that the owners/operators of the facility be notified, and that the assessment include information on this notification and how it will be done. Health Canada also prefers that private well owners affected by a project be notified of potential changes in their water quality.

Health Canada prefers clarifying whether any monitoring, mitigation or other risk management measures will be undertaken conditionally or unconditionally. If the measures are conditional, Health Canada prefers that the water quality assessment clearly describe the conditions under which the measures will be implemented.

6.1.5 Assessment of residual risk

A water quality assessment should discuss potential impacts on drinking water quality after all proposed mitigation and management measures have been applied. This discussion should include human health risks in cases of accidents or spills and in cases where water quality at any stage of the project is found to be different than predicted. If there is a possibility of exposure to contamination in drinking water that is above applicable guidelines or standards, Health Canada prefers that the risk to the health of nearby residents be estimated using methods appropriate for the contaminant in question.

It is very important that the GCDWQ related to *Escherichia coli* (*E. coli*) not be exceeded. *E. coli* is used as an indicator of faecal contamination, which means that disease-causing microorganisms may also be present. People may become sick very soon after being exposed to faecally contaminated water. Other guidelines, many of them for chemicals, are based on the best available science and give a good indication of human health effects that might be seen if levels exceed the GCDWQ over the lifetime of a project.

Some guidelines are aesthetic and exceeding them would not present a human health risk. In other cases, guidelines are risk-managed (due to limitations in analytical methods or treatment technologies) and some risks to human health may be present even below GCDWQ levels. An example is the case of arsenic where the concentration in drinking water representing an “essentially negligible” risk of internal organ cancers is 0.3 µg/L, however, current residential scale drinking water treatment technologies are only certified to reduce arsenic levels to 10 µg/L (the current GCDWQ); the guideline also recommends that every effort should be made to reduce arsenic levels in drinking water to as low as reasonably achievable. More information on the assessment of risk associated with short-term guideline exceedances can be found in the GCDWQ technical documents at: www.healthcanada.gc.ca/waterquality

Health Canada prefers that a rationale be provided in the water quality assessment as to why certain expected risks are found to be acceptable.

6.2 ASSESSING POTENTIAL IMPACTS ON RECREATIONAL WATER QUALITY

For the purposes of this guidance document, recreational waters are any natural fresh, marine or estuarine bodies of water, including artificial lakes and quarries, used by people for leisure. As described in The GCRWQ, a recreational water activity can be considered as any activity involving intentional or incidental immersion in natural waters and can be further categorized as:

- *Primary contact:* Activities in which the whole body or the face and trunk are frequently immersed or the face is frequently wetted by spray, and where it is likely that some water will be swallowed (such as swimming, surfing, waterskiing, white-water canoeing/rafting/kayaking, windsurfing and subsurface diving); or
- *Secondary contact:* Activities in which only the limbs are regularly wetted and in which greater contact (including swallowing water) is unusual (for example, rowing, sailing, canoe touring and fishing).

If project activities could affect recreational waters such that waters might not meet the recreational water quality guidelines of the appropriate jurisdictional authority (provincial/territorial or federal), Health Canada prefers that a water quality assessment be undertaken. Such an assessment would be similar to what is described in this document for drinking water and it is advisable to include information from consultations with the authorities responsible for the recreational water in question.

The GCRWQ do not include guidelines for specific chemical parameters. In the case of chemical contamination, Health Canada prefers that the potential risk to human health be assessed on a case-by-case basis.

Considerations specific to the risk assessment of recreational water quality include the following:

- Potential human exposure pathways include ingestion, inhalation and direct contact with the skin and mucous membranes. Health Canada prefers that the water quality assessments include a description of the types of activities practiced on or in the waters, to identify potential exposure pathways.
- Natural recreational waters are not subject to treatment. Similar to the case of untreated source water quality, mitigation of the impact of a project on recreational water quality and related predicted changes (including possible spills and accidents) would involve developing plans to implement measures to reduce this impact and monitor recovery in the water quality.

If recreational water quality could be subjected to an environmental effect due to a project, Health Canada prefers that the appropriate authorities be notified and recreational users be informed.

7

ASSESSMENT OF CUMULATIVE EFFECTS

Under CEAA 2012, subsection 19(1), an environmental assessment must consider “the environmental effects ... and any cumulative environmental effects that are likely to result from the ... designated project in combination with other physical activities that have been or will be carried out.”

In the case of drinking and recreational water quality, Health Canada suggests that an assessment of cumulative effects, if required, include the following:

- Changes in levels of contaminants in drinking and recreational water resulting from all past, present or known future projects and activities (in other words, changes in exposure); and
- Whether future projects could result in new access to recreational and drinking water sources that may be contaminated and that were previously inaccessible (for example, a new road or bridge providing access to water, or modified water flow as a result of a project making previously un-navigable watercourses navigable).

If the cumulative effects assessment identifies water quality effects that exceed project-only effects, Health Canada suggests that further monitoring and/or mitigation measures be considered.

For guidance on assessing cumulative effects, consult the Canadian Environmental Assessment Agency’s website for up-to-date guidance materials: www.ceaa.gc.ca



8

FOLLOW-UP PROGRAMS

Under CEAA 2012, a “follow-up program” means a program for:

- a) verifying the accuracy of the environmental assessment of a designated project; and
- b) determining the effectiveness of any mitigation measures.

It may be appropriate to consider a follow-up program for water quality (drinking and recreational) if one of the following applies (note: this is not a comprehensive list):

- There is uncertainty about the modelling of contaminant emission, release, mobilization, deposition or modification in the environment, and uptake into groundwater or surface water sources;
- There is uncertainty about the capacity of the DWTP to respond adequately to changes in source water quality;
- There is a possibility that a novel substance may be introduced into water bodies as a result of project activities;
- There is uncertainty whether proposed mitigation measures will be effective (e.g. the use of novel technologies or complex systems); or
- There is a possibility that water sources may be contaminated unexpectedly (for example, by a sudden release of untreated effluent).

For more information on follow-up programs, contact the Canadian Environmental Assessment Agency, Canadian Nuclear Safety Commission, or National Energy Board, as appropriate.



9

REFERENCES

9.1 CANADIAN WATER QUALITY GUIDELINES

Health Canada. 2012a. *Guidelines for Canadian Drinking Water Quality—Summary Table*. Ottawa, Ontario. Health Canada. Available online at: www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/sum_guides_recom/index-eng.php

Health Canada. 2012b. *Guidelines for Canadian Recreational Water Quality*. Ottawa, Ontario. Health Canada.

Health Canada reports and publications on water quality in relation to radiological, chemical/physical, bacteriological and microbiological parameters can be found at the following link: www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/index-eng.php

9.2 ENVIRONMENTAL ASSESSMENTS

Canadian Environmental Assessment Act. S.C. 2012, c. 19, s. 52. 2012. Available online at: laws-lois.justice.gc.ca/eng/acts/C-15.21/index.html

9.3 WORLD HEALTH ORGANIZATION GUIDELINES

WHO. 2011. *Guidelines for Drinking-water Quality. Fourth Edition. Volume 1, Recommendations*. Geneva, Switzerland.

WHO. 2003. *Guidelines for Safe Recreational Water Environments. Volume 1, Coastal and Fresh Waters*. Geneva, Switzerland.

9.4 HUMAN HEALTH RISK ASSESSMENT GUIDANCE

Health Canada. 2010. *Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA)*, Version 2.0 (revised 2012). Contaminated Sites Division, Safe Environments Directorate, Ottawa.

APPENDIX A1 WATER QUALITY IN EA CHECKLIST

This checklist can be used to verify that the main components of a water assessment have been completed. It is helpful to include this checklist with the EIS or application, to show where the components of the water quality assessment are located in the document. This is especially helpful if the components are located in more than one section of the document.

OVERALL (throughout the EA)	
✓	Item
	1. Worked examples are included for calculations, if a quantitative risk assessment was completed.
	2. Units are clearly stated and consistent (or conversion calculations are included as appropriate).
	3. Assumptions are clearly stated and justified (modelling of worst-case scenarios, etc.).
	4. Principles of minimizing impacts are considered (e.g. not polluting up to guidelines). This concept includes identifying mitigation measures to minimize increases in concentrations of contaminants as a result of project activities.
	5. All Indigenous receptors are clearly identified and their potentially increased exposure to sources of water contamination is characterized

DRINKING WATER SOURCES		
✓	Item	Section in EA
	6. All sources used for drinking water are identified in the EA study areas (project, local and regional) including: <ul style="list-style-type: none"> • Source water intakes for DWTP(s) and/or sources from which water is consumed directly (e.g. wells) and their distance from the project; • Whether all sources of drinking water have been identified; • The responsibility/jurisdiction for DWTP(s) in the EA study area (municipal/provincial/territorial/federal). 	
	7. Information is included on whether there are predicted or measured changes to source water quality due to project activities (includes spills and accidents, where relevant). If yes, the following is included:	
	a. A comprehensive list (including quantitative information) of potential organic, inorganic and microbial contaminants, as well as their physical characteristics.	
	b. A comparison of predicted or measured changes in individual parameters to appropriate guidelines or standards.	
	c. A conclusion with respect to the ability of DWTP(s) to address the predicted or measured changes in water quality.	
	d. Information on how managers of DWTP(s) will be informed of any predicted or measured changes in source water quality.	
	e. If the province or territory is responsible for managing the DWTP(s), confirmation from the appropriate authority of changes to the drinking water treatment protocol associated with predicted or measured changes to source water parameters.	



PRIVATE WELLS		
✓	Item	Section in EA
	8. Information is included on whether there are any private wells in the EA study area. If so, a discussion is included on whether any changes to the quality of the well water are likely due to project activities (including spills and accidents).	
	9. If changes to well water quality are predicted or measured as a result of project activities, the following is included:	
	a. A comprehensive list (including quantitative information) of predicted organic, inorganic and microbial contaminants, as well as their physical characteristics.	
	b. A comparison of individual parameters to appropriate guidelines or standards—for both the baseline case and predicted future concentrations during project construction, operation and decommissioning, and in the event of accidents/malfunctions (as applicable).	
	c. Details on how well owners will be notified of potential changes in water quality.	

RECREATIONAL WATER QUALITY		
✓	Item	Section in EA
	10. All water bodies that are currently being used or may be used in the future for recreational purposes—and which may be affected by project activities—are identified, and a characterization of recreational activities in affected water bodies (swimming, canoeing, fishing, etc.) is included.	
	11. Information is included on whether there are predicted or measured changes to recreational water quality due to project activities (includes spills and accidents, where relevant). If so, the following is included:	
	a. A comprehensive list (including quantitative information) of predicted or measured microbial, organic, and inorganic contaminants, as well as their physical characteristics.	
	b. A comparison of predicted or measured changes in individual parameters to appropriate guidelines or standards (provincial/territorial standards or the GCRWQ, which also apply on federal lands and First Nation reserves south of the 60 th parallel).	
	c. As the GCRWQ do not include guidelines for specific chemical parameters, in the case of chemical contamination, a comparison of predicted changes in individual parameters to appropriate guidelines or standards, as determined in consultation with the responsible authorities.	

NEED FOR AN HHRA		
✓	Item	Section in EA
	12. Are there predicted exceedances of any provincial or territorial standards or federal guidelines after the application of mitigation measures? If so, it is suggested that an HHRA for the drinking or recreational water pathway be completed for contaminants.	

