



Guidance for Evaluating
Human Health Effects
in Impact Assessment:

DRINKING AND RECREATIONAL WATER QUALITY



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Health Canada is the federal department responsible for helping the people of Canada maintain and improve their health. Health Canada is committed to improving the lives of all of Canada's people and to making this country's population among the healthiest in the world as measured by longevity, lifestyle and effective use of the public health care system.

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ACRONYMS

ACRONYM	MEANING
Agency	Impact Assessment Agency of Canada (also known as IAAC)
DWTP	drinking water treatment plant
<i>E. coli</i>	<i>Escherichia coli</i>
GBA Plus	gender-based analysis plus
GCDWQ	<i>Guidelines for Canadian Drinking Water Quality</i>
GCRWQ	<i>Guidelines for Canadian Recreational Water Quality</i>
HHRA	human health risk assessment
HIA	health impact assessment
IA	impact assessment
IAA	<i>Impact Assessment Act</i>
IAAC	Impact Assessment Agency of Canada (also known as “the Agency”)
IS	impact statement
TISG	tailored impact statement guidelines

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PURPOSE OF THIS DOCUMENT

This document provides generic guidance on assessing potential human health risks associated with contaminants affecting drinking water and recreational water quality in federal impact assessments (IAs) of proposed major resource and infrastructure projects in Canada. It presents the principles, current practices and basic information Health Canada looks for when reviewing impact statements (IS) or other documentation submitted by project proponents as part of the IA process.

This document was prepared to support an efficient and transparent project review process. The foundational information described here should be supplemented appropriately with additional information relevant to proposed projects. The guidance was prepared for the Impact Assessment Agency of Canada (the Agency) and stakeholders involved in the IA process to communicate Health Canada's standard areas of engagement and priorities to help ensure that sufficient evidence is available to support sound decisions. As part of its review, Health Canada may suggest that the Agency, review panels or others collect information not specifically described in this document to assess the health effects of proposed projects. As the guidance provided here is generic and designed to support the IA process, the scope of Health Canada's review may also be amended to reflect project-specific circumstances.

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

In the same series, the following guidance documents are available:

- *Guidance for Evaluating Human Health Effects in Impact Assessment: AIR QUALITY*
- *Guidance for Evaluating Human Health Effects in Impact Assessment: COUNTRY FOODS*
- *Guidance for Evaluating Human Health Effects in Impact Assessment: HUMAN HEALTH RISK ASSESSMENT*
- *Guidance for Evaluating Human Health Effects in Impact Assessment: NOISE*
- *Guidance for Evaluating Human Health Effects in Impact Assessment: RADIOLOGICAL IMPACTS*

Please verify that you are reading the most recent version available by consulting the Government of Canada Publications: <https://www.publications.gc.ca/site/eng/home.html>.



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INTRODUCTION AND CONTEXT

The key objectives of Health Canada’s IA program are to inform and improve understanding of the potential risks to human health associated with proposed projects, to help prevent, reduce, and mitigate negative impacts and foster positive impacts. Health Canada’s expert information and knowledge are available to assist the Agency, review panels and others in assessing the potential project-related health effects.

As a federal authority, Health Canada provides specialist or expert information or knowledge in the Department’s possession (expertise) to support the assessment of impacts on human health from projects considered individually and cumulatively under the *Impact Assessment Act* (IAA). This complement of expertise may change or evolve over time. The Department provides scientific expertise; it does not play a regulatory role. The use of expertise provided by Health Canada in the IA process will ultimately be determined by the reviewing body(ies).

In comparison to the *Canadian Environmental Assessment Act 2012*, the IAA expands the assessment of health to promote a broader understanding of the biophysical environment and supports assessment of the social and economic effects of projects. Among other things, the IAA includes specific requirements to consider positive and negative effects on the health, social and economic conditions of the public, including Indigenous peoples. In addition, the IAA includes the requirement for potentially affected Indigenous groups to be consulted during the planning phase of the project and incorporate Indigenous traditional knowledge, if provided, alongside other evidence. The IAA also requires consideration of the intersection of sex and gender with other identity factors.

Gender-Based Analysis Plus

Gender-based analysis plus (GBA Plus) identifies and analyzes the differential impacts of designated projects on diverse population groups. The “plus” in GBA Plus acknowledges that GBA goes beyond biological (sex¹) and socio-cultural (gender²) differences. It highlights the pathways on which those differences develop and how they intersect with other determinants to shape health and well-being. It guides how we consider sex and gender when we frame, plan for, and implement the impact assessment of designated projects. Gender-based analysis plus includes other individual and social identity factors such as race, religion, social position, income, age, ability, and education; this is called intersectionality³. The basic steps to applying GBA Plus include gathering appropriate data, understanding context, and asking analytical questions to determine whether the project is expected to have disproportionate effects on diverse populations. By working through a GBA Plus analysis, experts can better understand the possible differential effects of a project on distinct groups of people, including on disproportionately affected or impacted populations identified by sex and gender. Considering how a program, policy, plan, or product might impact groups differently provides an opportunity for all those involved to help address potential pitfalls before they become a problem or to identify opportunities that would not have been otherwise considered.

1 Sex refers to physical and physiological features including chromosomes, gene expression, hormone levels and function, and reproductive/sexual anatomy. <https://cihr-irsc.gc.ca/e/48642.html>

2 Gender refers to the socially constructed roles, behaviors, expressions and identities of girls, women, boys, men, and gender diverse people. <https://cihr-irsc.gc.ca/e/48642.html>

3 Government of Canada’s Approach Gender Based Analysis Plus. <https://women-gender-equality.canada.ca/en/gender-based-analysis-plus/government-approach.html>

Key GBA Plus considerations in IA of designated projects:

- Does the proposal identify the diverse communities of women, men and children who will be directly and indirectly affected by the proposed project's activities?
- Are the data about potential impacts disaggregated by sex, age, language and other social identities relevant to the local communities?
- Have the views of the affected women, men, Indigenous peoples and other disproportionately impacted groups been included in the proposed project's design?
- What are the implications of the proposed project's health and socio-economic effects on the well-being of women, men, Indigenous peoples and disproportionately impacted populations?
- What types of measures are needed to ensure equitable representation during consultation processes and subsequent stages of the IA?
- What measures are needed to enhance the positive effects or mitigate any adverse effects of the designated project on women, men, children and other disproportionately impacted groups?

Identifying the range of concerns and interests of, and impacts on, diverse groups based on social characteristics like gender, age, ethnicity, occupation, and length of residency, for example, can help foster the development of more comprehensive mitigation and enhancement strategies.

A health impact assessment (HIA) is a systematic, objective and yet flexible and practical way of assessing the potential positive and negative impacts of a proposal on health and well-being. In the context of designated projects under the IAA, an HIA aims to characterize the anticipated health effects, both adverse and positive, and the distribution of those effects within the population. The Agency determines the scope of the factors taken into account, including their relevance to the IA, as outlined in the tailored impact assessment guidelines (TISG). The steps of an HIA include screening, scoping, assessment, recommendations, reporting, monitoring and evaluation of the effectiveness of the HIA process, and the impact on decision-making.

Health Canada has been working with key partners and rights holders, which include Indigenous organizations, federal partners, provinces/territories, and other key stakeholders, to develop HIA guidance and tools for a more comprehensive assessment of potential health effects of proposed projects. The document provides guidance to scope and address the broader social and economic conditions underlying the health of potentially affected communities and Indigenous peoples. Health Canada has developed an interim HIA Guidance Document to bridge the gap between the IAA coming into force in August 28, 2019, and the planned publication by the Department of the guidance document and complementary material on HIA. The interim guidance document is available upon request at the following address: ia-ei@hc-sc.gc.ca.

Health Canada provides its expertise in human health risks associated with air quality, drinking and recreational water quality, radiation, electromagnetic fields, noise and country foods when it reviews and provides comments on information submitted by proponents in support of proposed projects. Health Canada also provides general information on the subject of health assessments in relation to proposed projects subject to the federal IA process.

This document concerns the assessment of human 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 and assessing water quality-related health effects; and assessing cumulative effects.

APPENDIX A provides a checklist for verifying that the key elements of a water quality risk assessment have been completed and where this information appears in the assessment document.

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ROLES AND RESPONSIBILITIES

In Canada, the responsibility for the safety and quality of drinking and recreational waters is shared between both the federal and the 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 and territorial drinking and recreational water quality requirements. For the most recent listing of these guidelines, refer to Health Canada's publication list at: www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/water-quality.html.

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 IA (in this case, advice may also be provided to a province for projects substituted under the IAA, or for different environmental assessment regimes (e.g., "North of the 60th parallel") or for general advice on emergency response to a spill—and could include the development of drinking water screening values.

Drinking water screening 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 screening 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 screening 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.

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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 (e.g., 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 IA, 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 IA and is dependent on the potential effects of a particular project, it can provide increased support for the conclusions of an IA. 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 IA focused solely on water quality—for example, when the project's predicted impacts meet applicable guidelines and standards (such as the GCDWQ, GCRWQ, provincial or territorial standards)—given that extensive HHRAs have been already performed to establish these guidelines and standards.

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

Detailed information on HHRA methodologies in the context of IA can be found in the *Guidance for Evaluating Human Health Effects in Impact Assessment: HUMAN HEALTH RISK ASSESSMENT* (Health Canada, 2023).

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

A water quality assessment is typically performed as part of an IA. If the assessment 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, turbidity, pH, temperature, ammonia, total organic carbon and dissolved organic carbon. 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 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 IAA 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 current and potential future 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 and/or sources that are consumed directly (e.g., 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 (e.g., 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 and Climate Change 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 (e.g., 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.

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—it is important that the assessment 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 23 of the IAA, it may make available information and knowledge to guide the undertaking of 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.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/water-quality.html.

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 (e.g., 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 (e.g., 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 (federal or provincial and territorial), 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.

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ASSESSMENT OF CUMULATIVE EFFECTS

Under subsection 22(1)(a)(ii) of the IAA, an IA must take into account “any cumulative effects that are likely to result from the designated project in combination with other physical activities that have been or will be carried out.”

Assessing the cumulative effects of projects is a central element of the IA. The cumulative effects scenario represents the potential environmental effects of the existing baseline plus project scenario in combination with effects from reasonably foreseeable future projects within the same area of influence. Reasonably foreseeable future projects include those that are approved but not yet operating, and/or other proposed or likely developments within the potentially impacted area. The cumulative effect scenario provides an estimate of human health risks in the future when other facilities are also in operation.

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 (e.g., 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 Agency’s website for up-to-date guidance materials at Canada.ca/iaac.

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FOLLOW-UP PROGRAMS

Under Section 2 of the IAA, a follow-up program is defined as a program for:

- a) Verifying the accuracy of the IA 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 that this is not a comprehensive list and is not a substitute for professional judgment):

- 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 (e.g., by a sudden release of untreated effluent).

Health Canada may make available expert health-related information or knowledge regarding a follow-up program upon request by the Agency, a review panel or others conducting the IA.

For further and up-to-date information on the need or requirements of follow-up programs, contact the Agency.

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REFERENCES

9.1 CANADIAN WATER QUALITY GUIDELINES

Health Canada. (2022). *Guidelines for Canadian Drinking Water Quality—Summary Table*. Ottawa, Ontario. Health Canada. Available online at: <https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/water-quality/guidelines-canadian-drinking-water-quality-summary-table.html>.

Health Canada. (2012). *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 IMPACT ASSESSMENTS

Impact Assessment Act. S.C. 2019, c. 28, s.1. (2019). Available online at: <https://laws-lois.justice.gc.ca/PDF/1-2.75.pdf>.

9.3 WORLD HEALTH ORGANIZATION GUIDELINES

World Health Organization (WHO). (2017). *Guidelines for drinking-water quality: fourth edition incorporating the first addendum*. World Health Organization. <https://www.who.int/publications/i/item/9789241549950>.

WHO. (2003). *Guidelines for safe recreational water environments. Volume 1, Coastal and fresh waters*. World Health Organization. <https://apps.who.int/iris/handle/10665/42591>.

9.4 HUMAN HEALTH RISK ASSESSMENT GUIDELINES

Health Canada. (2023). *Guidance for Evaluating Human Health Effects in Impact Assessment: HUMAN HEALTH RISK ASSESSMENT*. Healthy Environments and Consumer Safety Branch, Ottawa, Ontario.

Health Canada. (2021). *Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA), Version 3.0*. Contaminated Sites Division, Safe Environments Directorate, Ottawa.

APPENDIX A | WATER QUALITY ASSESSMENT 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 IS (or equivalent document) 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	
✓	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. All potential human receptors, with particular attention, if applicable, to Indigenous peoples who use the land, are clearly identified and their potentially increased exposure to sources of water contamination is characterized
	4. Assumptions are clearly stated and justified (modelling of worst-case scenarios, etc.).
	5. 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.
	6. Cumulative scenarios and effects are considered
	7. The water quality section (as required) of the follow-up program is described.

DRINKING WATER SOURCES

✓	Item	Section in IA
	<p>8. All sources used for drinking water are identified in the IA study areas (project, local and regional) including:</p> <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 IA study area (municipal/provincial/territorial/federal). 	
	<p>9. 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).</p> <p>If yes, the following is included:</p>	
	<p>a. A comprehensive list (including quantitative information) of potential organic, inorganic and microbial contaminants, as well as their physical characteristics.</p>	
	<p>b. A comparison of predicted or measured changes in individual parameters to appropriate guidelines or standards.</p>	
	<p>c. A conclusion with respect to the ability of DWTP(s) to address the predicted or measured changes in water quality.</p>	
	<p>d. Information on how managers of DWTP(s) will be informed of any predicted or measured changes in source water quality.</p>	
	<p>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.</p>	



PRIVATE WELLS

✓	Item	Section in IA
	<p>10. Information is included on whether there are any private wells in the IA study area.</p> <p>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).</p>	
	<p>11. If changes to well water quality are predicted or measured as a result of project activities, the following is included:</p>	
	<p>a. A comprehensive list (including quantitative information) of predicted organic, inorganic and microbial contaminants, as well as their physical characteristics.</p>	
	<p>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).</p>	
	<p>c. Details on how well owners will be notified of potential changes in water quality.</p>	

RECREATIONAL WATER QUALITY

✓	Item	Section in IA
	12. 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.	
	13. 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 or 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 IA
	14. 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.	

