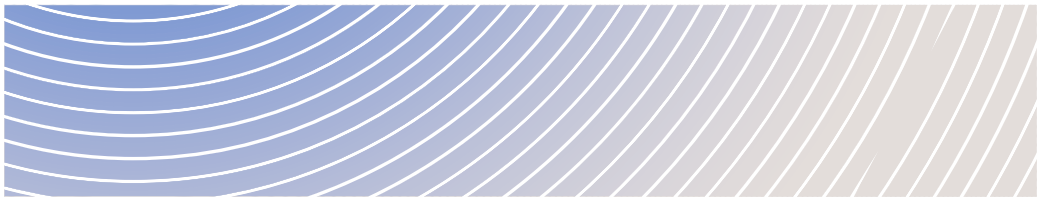
Integrated Tailored Impact Statement Guidelines



PEACE RIVER NUCLEAR POWER PROJECT

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DRAFT VERSION

Impact Assessment Agency of Canada | Agence d'évaluation d'impact du Canada

Canada

Contents

Abbreviations and Short Forms

Term	Definition
ALARA	As Low As Reasonably Achievable
IAA	Impact Assessment Act
IAAC	Impact Assessment Agency of Canada
BAT/BEP	Best Available Technologies / Best Environmental Practices
BCRs	Bird Conservation Regions
CSA	Canadian Standards Association
CCME	Canadian Council of Ministers of the Environment
CNSC	Canadian Nuclear Safety Commission
COPC	Contaminant of Potential Concern
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
ECCC	Environment and Climate Change Canada
GBA Plus	Gender Based Analysis Plus
Integrated Guidelines	Integrated Tailored Impact Statement Guidelines
GHG	Greenhouse gas
HHRA	Human Health Risk Assessment
IEPP	Indigenous Engagement and Partnership Plan

LSA	Local Study Area
LTPS	Licence to Prepare Site
Minister	Minister of Environment and Climate Change
NSCA	Nuclear Safety Control Act
PA	Project Area
PAD	Peace Athabasca Delta
PAH	Polycyclic aromatic hydrocarbons
REGDOC	Regulatory Document created by the Canadian Nuclear Safety Commission, in relation to the *Nuclear Safety and Control Act*.
The Registry	Canadian Impact Assessment Registry
RSA	Regional Study Area
SARA	Species at Risk Act
SACC	Strategic Assessment of Climate Change
SSC	Structures, Systems, and Components
the Template	Tailored Impact Statement Guidelines Template
VC	Valued component

1 Introduction

The federal impact assessment process is intended to prevent or mitigate significant adverse effects within federal jurisdiction – and significant direct or incidental adverse effects – by anticipating, identifying and assessing the potential effects of designated projects to inform decision making. Under the *Impact Assessment Act* (the IAA), designated projects that include physical activities regulated by the Canadian Nuclear Safety Commission (CNSC) must be assessed by a review panel. The review panel will conduct an integrated assessment that addresses the requirements of the IAA and the applicable requirements for an initial licence(s) under the *Nuclear Safety and Control Act* (NSCA).

A key element for the integrated assessment process of the Peace River Nuclear Power Project (the project) proposed by Energy Alberta (the proponent) is the preparation of integrated Tailored Impact Statement Guidelines (the Integrated Guidelines). The Integrated Guidelines provide the proponent with directions and requirements for the preparation of an integrated Impact Statement. This includes all the information necessary to make a decision in accordance with the IAA and to make a decision on whether to issue a Licence to Prepare Site (LTPS) in accordance with the NSCA

To support the Government of Canada's objective of "one project, one assessment", CNSC have collaborated with IAAC to ensure this document reflects both IAA requirements and guidance as well as many of the LTPS requirements for site evaluation in Regulatory Document[1] (REGDOC) 1.1.1 on Site Evaluation and Site Preparation for New Reactor Facilities, Version 1.2. CNSC have provided a concordance table in Appendix 1 – REGDOC 1.1.1. to TISG Concordance Table that identifies where these broadly overlapping information requirements are found. Not all REGDOC 1.1.1 criteria are fully detailed in the Integrated Guidelines, the proponent remains responsible for ensuring all applicable criteria to make a decision under the NSCA for an LTPS are addressed. The proponent's Impact Statement must also demonstrate, via a concordance table, where in the submission the information necessary to make a decision under the NSCA for an LTPS is found. The proponent should refer to the requirements in REGDOC 1.1.1 and other applicable regulatory and guidance documents to assist them in preparing their submission.

The Integrated Guidelines are focused on adverse effects within federal jurisdiction and direct or incidental adverse effects (adverse federal effects). The following effects are within the legislative authority of the federal government and, where they occur, are always considered adverse federal effects:

- non-negligible adverse changes to:
  - fish and fish habitat;

[1] REGDOCs are approved by the Commission following *public consultation.*

- aquatic species;
- migratory birds;
- the environment that would occur on federal lands;
- transboundary waters and the marine environment caused by pollution; and
- the health, social or economic conditions of the Indigenous Peoples of Canada;

- with respect to the Indigenous Peoples of Canada, a non-negligible adverse impact on:
  - physical and cultural heritage;
  - the current use of lands and resources for traditional purposes; or
  - any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

As the production of nuclear energy is declared to be to the general advantage of Canada in the *Nuclear Energy Act of 2000*, this project is considered to be a federal work or undertaking as defined under the *Canadian Environmental Protection Act 1999.* Therefore, adverse federal effects within federal jurisdiction, as defined under the IAA also include changes to the environment or to health, social and economic conditions and the positive and negative consequences of those changes that are likely to be caused by the carrying out of the project.

It is the intention that the requirements in the final Integrated Guidelines will be focused to key issues anticipated to be material to decision-making. This draft version of the Integrated Guidelines offers a broad and comprehensive list of requirements that need to be refined and focused to address the specific context and key issues of the project.

The Integrated Guidelines will be finalized following a comment period on this draft version.

1.1 Site Evaluation and Site Preparation for New Nuclear Reactor Facilities

The CNSC's regulatory framework for new nuclear reactors requires a description of the site evaluation process to inform the application for a LTPS. Applicable requirements are from REGDOC-1.1.1, Site Evaluation and Site Preparation for New Reactor Facilities, Version 1.2. This section provides an overview of site evaluation and site preparation, and how these intersect with the requirements of an impact assessment conducted under the IAA. More information on site evaluation methodology is located in section 7.9. General Criteria for Site Evaluation

1.1.1 Site Evaluation

Site evaluation is the process of evaluating sites for a new nuclear reactor. It is done before the proponent submits a licence application and continues throughout the lifecycle of the proposed project, to ensure that

the facility's design basis and safety case remains current with changing environmental conditions or modifications to the facility itself. Site evaluation information is also a key input into reactor facility design and subsequent lifecycle phases. The proponent should reject any unacceptable or inappropriate site before applying for a LTPS.

Site evaluation is not a licensed activity under the NSCA. Information gathered through the site evaluation process should be used during the impact assessment process and will be reviewed by the CNSC during the assessment of the LTPS and may be used to satisfy information needed for subsequent licensing phases. Therefore, many of the site evaluation requirements of REGDOC-1.1.1- Section 3 have been consolidated into these Integrated Guidelines.

The site evaluation process overlaps substantially with the requirements of an impact assessment conducted under the IAA. The site evaluation and impact assessment determine, for the entire lifecycle of the project, whether:

- siting option choices were made to avoid or minimize environmental effects;
- the proposed facility and site infrastructure designs to be established are adequate (including the exclusion zone boundary, where appropriate);
- the proponent will ensure adequate provision for the protection of the environment, the health and safety of persons and maintaining national security
- the effects are likely to be, to some extent, significant, and the extent to which they are significant, taking into consideration mitigation measures

The site evaluation process should satisfy the criteria contained in the following documents that apply to the facility being considered:

- applicable federal environmental legislation;
- REGDOC 2.5.2, Design of Reactor Facilities: Nuclear Power Plants, versions 2.1
- EPS1/PG/2 Environmental codes of practice for steam electric power generation: siting phase;
- Canadian Standard Association (CSA) N288.6, Environmental risk assessments at nuclear facilities and uranium mines and mills; and
- REGDOC. 3.5.1Licensing Process for Class I Nuclear Facilities and Uranium Mines and Mills, Version 2.1

In accordance with CSA N288.6, the site evaluation is periodically re-evaluated. The re-evaluation focuses on confirmation of the site characteristics (in particular, external events) and assessing the effects of the updated information. Design modifications, updates to operations, or both may be needed.

1.1.2 Site Preparation

Site preparation is a licensed activity under the NSCA. The proponent is required to hold an LTPS before any work is done on the site. The potential LTPS will be based on information gathered for the integrated assessment, and thus should demonstrate that the proponent is taking into account future steps in the

lifecycle of the proposed facility (construction, operation, decommissioning, and abandonment). The proponent should refer to the requirements of Section 4 of REGDOC-1.1.1, *Site Evaluation and Site Preparation for New Reactor Facilities, Version 1.2.* as well as other applicable documents and guidance to address the information criteria needed for an LTPS under the NSCA.

The proponent for the proposed project is applying for a LTPS for a new reactor facility.

1.2 Factors to be considered in the integrated assessment

The Integrated Guidelines correspond to factors to be considered in the integrated assessment (IA). These factors are listed in subsection 22(1) of the IAA and prescribe what the IA of a designated project must take into account:

a) the changes to the environment or to health, social or economic conditions and the positive and negative consequences of these changes that are likely to be caused by the carrying out of the designated project, including:
    i. the effects of malfunctions or accidents that may occur in connection with the designated project,
    ii. 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, and
    iii. the result of any interaction between those effects;
b) mitigation measures that are technically and economically feasible and that would mitigate any adverse effects of the designated project;
c) the impact that the designated project may have on any Indigenous Nation and community and any adverse impact that the designated project may have on the rights of the Indigenous Peoples of Canada recognized and affirmed by section 35 of the *Constitution Act, 1982*;
d) the purpose of and need for the designated project;
e) alternative means of carrying out the designated project that are technically and economically feasible, including through the use of best available technologies, and the effects of those means;
f) any alternatives to the designated project that are technically and economically feasible and are directly related to the designated project;
g) Indigenous Knowledge provided with respect to the designated project;
h) the extent to which the designated project contributes to sustainability;
i) the extent to which the effects of the designated project hinder or contribute to the Government of Canada's ability to meet its environmental obligations and its commitments in respect of climate change;
j) any change to the designated project that may be caused by the environment;
k) the requirements of the follow-up program in respect of the designated project;
l) considerations related to Indigenous cultures with respect to the designated project;
m) community knowledge provided with respect to the designated project;

n) comments received from the public;
o) comments from a jurisdiction that are received in the course of consultations conducted under section 21 of the IAA;
p) any relevant assessment referred to in sections 92, 93 or 95 of the IAA;
q) any assessment of the effects of the designated project that is conducted by or on behalf of an Indigenous governing body and that is provided with respect to the designated project;
r) any study or plan that is conducted or prepared by a jurisdiction—or an Indigenous governing body not referred to in paragraph (f) or (g) of the definition "jurisdiction" in section 2 of the IAA—that is in respect of a region related to the designated project and that has been provided with respect to the project;
s) the intersection of sex and gender with other identity factors; and
t) any other matter relevant to the impact assessment that IAAC requires to be taken into account.

IAAC took these factors into account in determining what information and studies are required in the proponent's Impact Statement, as set out in these draft Integrated Guidelines.

1.3 Gender-Based Analysis Plus (GBA Plus)

The Integrated Guidelines will refer to Gender-Based Analysis Plus (GBA Plus) with respect to requirements related to the consideration of intersection of sex and gender with other identity factors in the integrated assessment. This approach considers how people's identities intersect with context, lived experience, and structural barriers to impact how people may be affected by the project. These Integrated Guidelines refer to "diverse population groups" in the context of GBA Plus, accounting for various identity factors (e.g., sex, gender, age, disability, education, race, ethnicity, geography, language, religion, Indigenous identity, socio-economic status, health status) and their intersections (e.g., Indigenous women and racialization, young men recently immigrated to a rural area).

IAAC's Guidance: Gender-Based Analysis Plus in Impact Assessment provides guiding principles and tools to apply GBA Plus.

To support GBA Plus, the information provided in the Impact Statement must:

- be sufficiently disaggregated to support the analysis of disproportionate effects as per GBA Plus' intersectional approach. As much as possible, the data must be disaggregated by identity and cross-identify factors (e.g., by sex, gender, age, ethnicity, Indigenous identity, ability, and any other community-relevant identity factors) and presented distinctly for each population group;
- describe how community and Indigenous Knowledge from affected populations, including community-developed indicators and locally collected data, was used in establishing baseline conditions and informing effects assessments;
- describe how community members differ in access to resources, opportunities and services;

- describe the circumstances in which diverse population groups could suffer more adverse effects or receive fewer benefits related to the project than others, and how they may respond differently to effects; and
- describe mitigation or enhancement measures to address these differential effects.

Quantitative information, including equality, diversity and inclusion sensitive data, should be complemented by qualitative insights from studies or consultations, and other sources. The description of effects should be based on both data collected and concerns expressed through engaging with the affected Indigenous Nations and community members and local community members.

1.4 Preparing the Impact Statement

In the preparation of the Impact Statement, the proponent must:

- adhere to relevant ethical guidelines and cultural protocols governing research, data collection and confidentiality. This is particularly important in the case of information gathered and studies conducted with diverse population groups; and
- respect the obligation of protecting personal information and adopt the established standards for the management of Indigenous data (e.g., the First Nations principles of Ownership, Control, Access and Possession or standards adopted by an Indigenous Nation and community) and disaggregated data from small or unique populations.

The proponent may present the information in the Impact Statement in the manner it deems most appropriate. IAAC and the CNSC recommend the Impact Statement follow a structure similar to the Integrated Guidelines in order to facilitate its review and participation in the process. To facilitate the review of the Impact Statement, the proponent must provide a table of concordance that indicates where each requirement of the Integrated Guidelines is addressed.

The Impact Statement must address all requirements outlined in the Integrated Guidelines. Where the proponent is of the opinion that the information is not required or can be achieved in an alternative manner, it should contact IAAC and the CNSC to confirm the rationale prior to submitting the Impact Statement. The rationale for not including the information must also be provided in the Impact Statement. The proponent should also notify IAAC and the CNSC of any changes made to the project as proposed in the Initial Project Description that may result in a different set of effects and may require a reconsideration of information requirements.

Where relevant, the Impact Statement must consider:

- any relevant regional or strategic assessment;
- any study or plan that is conducted or prepared by a jurisdiction—or an Indigenous governing body—in respect to the region related to the project and that is provided to the proponent with respect to the project;

- any relevant assessment of the effects of the project that is conducted by or on behalf of an Indigenous governing body and that is provided to the proponent with respect to the project;
- Indigenous Knowledge, community knowledge, comments received by the public, comments received from a jurisdiction; and
- other studies or assessments realized by the proponent or other proponents.

IAAC and the CNSC are available to support the proponent during the preparation of the Impact Statement and may establish technical advisory groups, consisting of federal authorities and others, as appropriate. The proponent is encouraged to engage IAAC and the CNSC early in the process to clarify requirements and expectations as presented in the Integrated Guidelines. The proponent should, in consultation with IAAC and the CNSC, consider submitting documents for review (e.g., proposed study plans, draft sections of the Impact Statement) prior to submitting the formal Impact Statement. Active engagement will support early identification and resolution of issues. The proponent is expected to provide IAAC and the CNSC a work plan for the Impact Statement phase of the project, within three months of the Notice of Commencement.

IAAC and the CNSC will conduct an initial verification review of the submitted Impact Statement to confirm that the document contains sufficient information to proceed to a technical review, as well as a public comment period on the Summary of the Impact Statement. If so, IAAC and the CNSC will engage with Indigenous Nations and communities, federal authorities, jurisdictions, and participants to undertake a technical review of the Impact Statement and commence a public comment period. If warranted, IAAC and the CNSC will require that the proponent respond to identified deficiencies. When IAAC and the CNSC are satisfied that the proponent has provided it with all of the required information or studies, IAAC will post a notice on the Canadian Impact Assessment Registry (the Registry).

The proponent must provide IAAC with the information or studies required in the Integrated Guidelines within three years after the day on which a copy of the Notice of Commencement is posted on the Registry. The three-year time limit includes the time required for the review of the Impact Statement and for the proponent to address any deficiencies. At the proponent's request, IAAC may, considering the proponent's progress, work plan and other relevant factors, extend the time limit by any period that is necessary for the proponent to provide IAAC with the information or studies. If the proponent does not provide IAAC with the information or studies required by the Integrated Guidelines within the three-year time limit, or within any extension of that time limit, the impact assessment is terminated.

1.5 Format and accessibility

The impact assessment must be based on information that is publicly accessible, within the limitations of confidentiality and ethical constraints, such as in relation to Indigenous Knowledge and community knowledge, business confidential information, and intellectual property.

The Impact Statement must include:

- a summary for the documents that served as key references and are not otherwise publicly accessible, and, where possible, appending them to the Impact Statement; and
- all information in a machine-readable, accessible format.

Where information is provided as a map in the Impact Statement, the proponent must provide corresponding electronic geospatial data file(s). IAAC will make the geospatial data files available to the public under the terms of the Open Government Licence – Canada. Geospatial data files must include metadata that are compliant with the ISO 19115 standard and, at a minimum, provide:

- title;
- abstract or summary of what is contained in the data file;
- source of the data;
- date of creation for the data;
- the point of contact and originator; and
- confirmation that there are no restrictions or limitations on sharing the data.

The proponent should review IAAC's Guidance on submitting geospatial data for more information.

The proponent should be prepared to provide data, including surveys, analyses, methods, modelling, and results in well-documented data files, including geoenabled format where available, if requested by IAAC, the CNSC, or the review panel to support the integrated assessment process.These requirements support the Government of Canada's commitment to Open Science and Data and facilitate the sharing of information with the public through the Registry and the Government of Canada's Open Science and Data Platform.

All information submitted is subject to the provisions of the *Access to Information Act* and the *Privacy Act*. It is the proponent's responsibility to identify and justify any material that is not suitable for disclosure (that is, subject to confidentiality requirements).

As required by section 27 of the General Nuclear Safety and Control Regulations, (SOR/2000-202), the proponent must keep a record of all information relating to the licence that is submitted by the proponent to the Integrated Review Panel.

Note that prescribed information, such as details of the security program, may be transmitted only by secure means, such as letter mail or encrypted secure memory devices. It is prohibited to submit prescribed information via unencrypted email. Guidance for the protection and transmission of prescribed information can be found in REGDOC.-2.12.3, Security of Nuclear Substances: Sealed Sources and Category I, II and III Nuclear Material, Version 2.1

2 Proponent Information

2.1 The proponent

The Impact Statement must:

- include contact information for proponent representatives for the project (e.g., name, position, business address, phone, email), including;
  - name of the persons or organizations submitting the Impact Statement and applying of the licence under the NSCA, as it appears on the proof of legal status documentation.
    - first-time proponents must provide proof of legal status by appending proof of incorporation, corporation number or charter.
    - include the corporation's legal name, corporation number, date of incorporation, registered office address (if different from head office address).
    - If the mailing address is different from the head office address, the proponent should provide the mailing address. The proponent should notify IAAC and the CNSC within 15 days of any changes to this information.
    - persons who have authority to act for them in their dealings with IAAC and the CNSC or the Integrated Review Panel;
    - name, title and contact information of the individual who is signing the application as the proponent authority;
  - name, position, contact information, mailing address of the person responsible for licence fee payments;
  - organizational management structure insofar as it may bear on the proponent's compliance with the NSCA and the regulations made under it, including the internal allocation of functions, responsibilities and authority, and the roles and responsibilities of key personnel; and,
- names and position titles of the persons who are responsible for the management and control of the licenced activity and the nuclear substance, nuclear facility, prescribed equipment or prescribed information encompassed by the licence;
- evidence that the proponent is the owner of the site or has the authority from the owner of the site to carry on the activity to be licensed;
- specify the mechanism used to ensure that corporate policies will be implemented and respected for the project; and
- identify key personnel, contractors and sub-contractors responsible for preparing the Impact Statement.

2.2 Qualifications of individuals preparing the Impact Statement

In support of transparency, the Impact Statement must:

- provide information on the individuals who prepared the sections within the Impact Statement; and
- demonstrate that qualified individuals have prepared the information or studies, as demonstrated by formal education training or certification, experience, or credibility or standing as knowledge holders. Where possible, the proponent should use experts who are members of a professional body or recognized association, or holders of Indigenous Knowledge.

IAAC and the CNSC also expect proponents to demonstrate scientific integrity in their preparation and delivery of Impact Statements by:

- following existing standards and best practices for the responsible conduct of scientific research;
- declaring and managing any real or perceived conflict of interest for individuals involved in preparing the Impact Statement;
- eliminating, controlling for, or appropriately managing potential biases; and
- characterizing all potential sources and types of scientific uncertainty, including their magnitude and any differences in the interpretation of scientific results.

The proponent is expected to demonstrate their adherence to these methods and processes within their Impact Statement.

2.3 Management System for Site Evaluation

As the CNSC's regulatory framework for new nuclear reactors require a description of the management system to be applied to the site evaluation process, this section lists the information requirements for the management system. The management system may be graded in accordance with the importance to safety of the individual evaluation activity under consideration.

For information requirements on the management system to be implemented for the management and control of all licensed activities for a LTPS,

The Impact Statement must:

- describe the management system the proponent has established to govern the conduct of site evaluation activities;
  - the process of establishing site evaluation-related management system parameters should involve technical and engineering analyses, along with judgments that require extensive experience and knowledge. Evaluations should be reviewed and verified by individuals or groups that are independent of those who did the work;
- demonstrate that the management system will include:
  - procedures to control the effectiveness of assessments and engineering activities performed in the different stages of the site evaluation process;
  - appropriate organization, planning, work control, personnel qualification and training, and activity verification and documentation, to ensure that the management system is carried out as effectively as possible;

  - records of all work carried out in the site evaluation process;
  - documentation of the results of studies (including models and simulations) and investigations in sufficient detail to permit independent review; and
  - a report that documents the results of all site evaluation work, laboratory tests, and geotechnical analyses and evaluations.
- describe the components of the management system. Content should include (but not limited):
  - data control, verification and validation;
  - data format,
  - traceability of data,
  - configuration control (including data, environmental, meteorological, geological, geophysical, survey, hydrological, biological),
  - measuring and test equipment,
  - use and control of computer modelling,
  - field and laboratory work,
  - calculations and analyses, and
  - measures to ensure that the results of the site characterization are accurate, complete, reproducible, traceable and verifiable.

For additional guidance, please refer to:

- CSA N286:12 (R2022), Management system requirements for nuclear facilities
- IAEA GSR Part 2, Leadership and Management for Safety: General Safety Requirements
- IAEA GS-G-3.1, Application of the Management System for Facilities and Activities
- IAEA GS-G-3.5, The Management System for Nuclear Installations
- CNSC REGDOC-2.1.1, Management System, and
- CNSC REGDOC-2.9.1, Environmental Protection: Environmental Principles, Assessments and Protection Measures, Version 2

3 Project Description

3.1 Project overview

The Impact Statement must:

- describe the project, key project components and ancillary activities (both nuclear and non-nuclear), scheduling details, the timing of each phase of the project[2], the total lifespan of the project and other key features. If the project is part of a larger sequence of projects, the Impact Statement must outline the larger context:
- describe the purpose of the facility, such as for electrical power;
- provide the total facility's capacity in Megawatts thermal (MWth) and Megawatts electric (MWe);
- provide the total number of nuclear units and the projected in-service dates for each unit.

If site preparation activities involve construction of non-nuclear facility structures, systems and components (SSCs), the Impact Statement must demonstrate that the SSCs are appropriate for any reactor technology proposed for the site, such as water treatment plants, excavation (that is, earthen structures) and condenser cooling structures.

The proponent should clearly itemize all high-level activities proposed to be conducted under the LTPS. An application considering several technologies should clearly identify those site activities proposed to be undertaken under a LTPS that are not affected by the technology choice, as well as those that are.

3.2 Project location

The Impact Statement must describe the project's location, the geographical setting and the socio-ecological context in which the project is to take place. The description should focus on aspects of the project and its setting that are important to understand the potential effects of the project. If a decision on the preferred project site has not been made, the following information for both sites must be included and, where appropriate, located on map(s):

- geographic coordinates (i.e., longitude/latitude using international standard representation in degrees, minutes, seconds) for the centre of the main project site;
- project footprint, including the extent of the tenure;
- key project components, boundaries of the proposed site with geographic coordinates, major existing infrastructure;
- proponent lands, and leased properties or lands, adjacent resource lease boundaries;

[2] The *Information and Management of Time Limits Regulations*, established under the IAA, list construction, operation, decommissioning and abandonment as project phases. The CNSC's regulatory framework includes site preparation as a distinct phase requiring a licence. For the purposes of the integrated assessment, project phases for site preparation, construction and commissioning, operation, decommissioning, and abandonment are used in the Integrated Guidelines as defined in REGDOC-3.6, *Glossary of CNSC Terminology*.

- description of the site of the activity to be licensed, including the location of exclusion zone and any structures within that zone;
- plans showing the location, perimeter, areas, structures and systems of the nuclear facility;
  - satellite or aerial photographs of the site and surrounding region, with a resolution scale of 1:1,440 or better, including the proposed exclusion zone and site boundary; and
  - topographical map(s) for each site layout in 1:50,000 to no smaller than 1:250,000 scale for all structures and associated infrastructure (all drawings are to scale and include a legend);
- proposed layouts of labelled structures, including:
  - reactor building;
  - turbine-generator block;
  - auxiliary power buildings (for example, diesel generators) and related fuel storage;
  - switchyard;
  - cooling tower structures, water intakes and outlets;
  - large structures (for example, machine shops or storage buildings for parts inventory) in the immediate vicinity to the proposed nuclear facility;
- proposed conventional and radiological waste transfer and storage areas
- layouts of all site roads and proposed transmission corridors;
- distance of the project components to any federal lands and the location of any federal lands within the regional study area (RSA)(see section 7.4.1 for additional study area guidelines);
- services and infrastructure and current land and aquatic uses in the area, including:
  - transportation corridors (e.g., roads, rail lines, shipping lanes, airports)
  - municipalities and administrative regions,
  - resource development projects already underway in the study area (e.g., mines and forestry operations), and
  - local businesses and industries such as fisheries and outfitters, and any other relevant uses;
- primary, secondary and tertiary watersheds;
- all waterbodies and watercourses, including intermittent and ephemeral streams, and their location on a map, as well as flow direction;
- navigable waterways;
- landcover in the area, including any critical habitat;
- ecozones, ecoregions, and ecodistricts as per the province's or Canada's Ecological Landscape Classification (see Introduction to the Ecological Land Classification (ELC) 2017);
- environmentally sensitive areas, such as national, provincial, and regional parks, Indigenous Protected and Conserved Areas, UNESCO World Heritage Sites, ecological reserves, ecologically and biologically sensitive or significant areas, wetlands, estuaries, and habitats of federally or provincially listed species at risk and other sensitive areas;
- lands subject to conservation agreements;

- description and locations of all potable drinking water sources (i.e., municipal or private);
- distance to provincial and territorial borders (e.g., British Columbia, Northwest Territories, Saskatchewan);
- location, description and maps of Indigenous traditional territories and consultation areas, Treaty lands, Title lands, Reserve lands, Indigenous harvesting regions (with permission of Indigenous Nations or communities), Métis settlements; and
- culturally important features of the landscape.

3.3 Regulatory framework and the role of government

The Impact Statement must identify:

- any federal power, duty or function that may be exercised that would permit the carrying out (in whole or in part) of the project or associated activities, and any financial support that federal authorities are, or may be, providing to the project;
- legislative or regulatory requirements such as permits or authorizations that are applicable to the project at the federal, provincial, regional and municipal levels or from any body, including a co-management body, established under a land claim agreement referred to in section 35 of the *Constitution Act, 1982*, or from an Indigenous governing body that has powers, duties or functions in relation to the environmental effects of a project;
- federal or provincial greenhouse gas (GHG) legislation, policies or regulations that will apply to the project, in accordance with the Strategic Assessment of Climate Change (SACC);
- government policies, resource management plans, planning or study initiatives relevant to the project or the integrated assessment and their implications, including relevant regional studies, regional assessments and strategic assessments;
- any treaty, self-government, land claims or other agreements between federal or provincial governments and Indigenous Nations and communities that are pertinent to the project or the integrated assessment;
- any relevant land use plans, land zoning, or community plans;
- information on land lease agreement or land tenure, when applicable;
- municipal, regional, provincial and national objectives, standards or guidelines, by-laws or ordinances that have been used by the proponent to assist in the evaluation of any predicted environmental, health, social or economic effects or impacts; and
- Government of Canada's environmental obligations and commitments in respect of climate change which the effects of the project may hinder or contribute to (see section 14 Canada's Ability to Meet its Environmental Obligations).

3.4 Project components and activities

This section outlines the project components and activities that should be considered in the project description.

The Impact Statement must:

- describe the project components, associated and ancillary works, and other characteristics to assist in understanding the project and potential environmental, health, social and economic effects, and potential impacts on Indigenous Peoples and their rights;
- describe project activities to be carried out during each project phase, including life extension plans with a focus on activities with the greatest potential to have environmental, health, social and economic effects, or impacts on Indigenous Peoples and their rights;
  - describe the location, methods used, schedule (including expected start date, time of year, duration and frequency), magnitude and scale of each project activity; and,
  - highlight activities that involve periods of increased disturbance to environmental, health, social and economic conditions or impacts on Indigenous Nations and communities.
- describe nuclear facilities-related activities and components (e.g., reactor design, cooling water system, water intake and discharge structures, waste management strategies for low, intermediate, and high-level radioactive waste (e.g., spent fuel) for the facility's lifecycle, etc.);
- provide a summary of any change made to the project as proposed in the Initial Project Description, and the reasons for these changes, including rationale for final project site decision, if applicable;
- provide sufficient detail to support analysis regarding the project's impacts in the context of potential interaction between valued components (VCs);
- detail how input from diverse population groups was used to identify potential components or activities of concern; and,
- include maps of key project components, boundaries of the proposed site with geographic coordinates, major existing infrastructure, proponent lands, and leased properties or lands, adjacent resource lease boundaries, adjacent land uses and any important environmental features.
- At a minimum, the Impact Statement must describe the components and activities, for each project phase outlined below. The list is based on components and activities outlined in the Initial Project Description for the project, as well as components and activities IAAC and the CNSC consider to be relevant to this type of project.

Project components:

- Non-nuclear components, including temporary or permanent:
  - water management infrastructure, to divert, control, collect or discharge any surface or groundwater, including pipeline systems, underground infrastructure to support servicing the site (e.g., water, sanitary), and water storage facilities for fire protection and other purposes;

- infrastructure for electricity production, including turbine generators, switchyard, connections to power plant generator, as well as any other interconnection infrastructure required to connect to the provincial power transmission network;
- security infrastructure, including fencing and lighting;
- infrastructure for administration and personnel amenities, including onsite training facilities and worker's accommodations;
- waste management systems including facilities for the management and storage of conventional waste and hazardous materials;
- infrastructure for plant building and installation, including equipment assembly, laydown areas, as well as concrete batch and crusher plants;
- infrastructure for plant maintenance and operation including hot and cold shops, warehouse facilities, inspection facilities, laboratories and testing facilities, standby and emergency power supply generators, administration buildings, and structures and logistics infrastructure to support life extension (refurbishment and retube) activities;
- emergency response facilities;
- other infrastructure and ancillary facilities including access roads, road upgrades, parking lots, weigh scales and weather station.

- Nuclear components, including:
  - piles and foundations for reactor buildings and other structures;
  - main plant structures including the reactor and reactor auxiliary buildings;
  - nuclear reactor systems, including the electrical systems, cooling systems, safety systems, instrumentation and control, and connection with the cooling water supply infrastructure;
  - permanent control room and remaining support buildings;
  - permanent and temporary facilities for the management and storage of low, intermediate and high-level radioactive waste; and
  - any other infrastructure relevant to the project.

Project Activities

- Site Preparation Phase:
  - site earthworks, including land clearing, drilling, excavation, tunnelling and blasting
  - relocation and removal of existing structures and below grade utilities activities;
  - transportation of materials and equipment;
  - operation of equipment, including heavy equipment and diesel generators;
  - preparation of temporary material laydown areas;
  - construction of water management facilities, including water runoff management, flood protection and erosion control facilities, water storage, and
  - construction of waste treatment facilities and management of conventional, construction, and hazardous waste.

- construction of other temporary and permanent onsite facilities, including fabrication facilities, facilities for equipment assembly, warehouses, administration and worker amenities

- Construction Phase:
  - construction and installation of plant buildings and supporting nuclear infrastructure
  - construction and installation of all non-nuclear infrastructure and facilities, including communication infrastructure and systems, power supply and distribution, natural gas pipeline and potable and sewer water management facilities;
  - road construction and improvements.
- Operations Phase:
  - nuclear (active) commissioning, including removal of guaranteed shutdown state, fuel loading, and reactor startup;
  - operation of heat transport systems and cooling system infrastructure, including intakes, pumping systems, storage pond management, pipelines, draft cooling infrastructure, and water treatment and release;
  - operation of energy production (e.g., turbines for electrical generation, electrical power systems, including transformers, diesel generators, and emergency power);
  - operation of services and utilities including sewage, stormwater, and domestic water services;
  - operation of radiological laboratories and safety and security systems (e.g., emergency response systems, first aid stations, etc.);
  - management and storage of operational conventional, hazardous and radioactive waste, including on-site facilities for used fuel waste and packaging for off-site long-term disposal; and
  - road construction and improvements.
- Decommissioning Phase:
  - decommissioning activities, including clean out of radioactive inventory, demolition, dismantling and decontamination of reactors, structures, components, and shutdown of support systems;
  - used fuel handling and transfer to dry storage on-site in preparation for shipment to off-site disposal;
  - transportation and safe storage of all radioactive and non-radioactive waste to temporary and permanent off-site facilities;
  - reclamation and removal activities, including removal of surface contamination; and
  - other restoration and remediation activities of the site to a condition suitable for alternative land use
- Abandonment Phase:
  - restoring and reclaiming the site to desired outcomes, approach, and follow-up or adaptive management to achieve desired outcomes; and
  - long term caring, monitoring, and maintaining the integrity of the site.

3.4.1 Incidental activities

Under the IAA, a designated project includes one or more physical activities that are listed in the *Physical Activities Regulations,* as well as any physical activity incidental to those listed activities. All aspects of the designated project, including its incidental activities, are considered in the federal decision-making phase, including the federal public interest determination. If a project is allowed to proceed, incidental activities can be subject to conditions in a Decision Statement.

IAAC will continue to analyze which activities may be incidental to the project based on the Proponent's Initial Project Description, Response to the Summary of Issues, as well as information provided in the public comment period on these draft Integrated Guidelines. The result of this analysis will be reflected in the final version of these Integrated Guidelines.

3.5 Workforce requirements

The Impact Statement must:

- describe the anticipated labour requirements, employee programs and policies, and workforce development opportunities for the project, including:
  - opportunities for employment outlining the anticipated number of full-time and part-time positions to be created, and timeline for when they will be created. Positions should be presented using the National Occupational Classification system;
  - anticipated workforce region of origin (i.e., local, regional, out-of-province or international employees);
  - the skill and education levels required for the positions;
  - anticipated hiring policies and programs;
  - investment in training opportunities;
  - working conditions and anticipated work scheduling for construction and operation (e.g., hours of work, rotational schedules);
  - the anticipated transportation options for employees to commute to and from the project site during each project phase;
  - accommodation and lodging requirements for the workforce during each project phase;
  - workplace policies and programs for Indigenous employment, and employment of other underrepresented groups;
  - workplace policies and programs, including codes of conduct, workplace safety programs and cultural training programs; and
  - employee assistance programs and benefits programs; and
- consider GBA Plus and present the information in sufficient detail to analyze how historically excluded or underrepresented groups will be taken into account, including Indigenous Nations and communities and diverse population groups.

4 Project Purpose, Need and Alternatives Considered

The proponent must identify the purpose of and need for the project. The proponent must also analyze alternatives to the project and alternative means of carrying it out. The proponent should consult IAAC guidance documents Guidance: "Need for," "Purpose of," "Alternatives to" and "Alternative Means" and Policy Context: "Need for," "Purpose of," "Alternatives" and "Alternative Means".

4.1 Purpose of the project

The Impact Statement must outline what is to be achieved by carrying out the project. The Impact Statement should broadly classify the project (e.g., new nuclear energy) and indicate the target market (e.g., international, domestic, local), where applicable. The "purpose of" statement should include any objectives the proponent has in carrying out the project, and the proponent is encouraged to consider the perspectives of participants (i.e., Indigenous Nations and communities, public, governments) in establishing its objectives.

4.2 Need for the project

The Impact Statement must:

- describe need for the project as the underlying opportunity or issue that the project intends to seize or solve and should be described from the perspective of the proponent. In many cases, the need for the project can be described in terms of the demand for a resource. The information provided should make it possible to reasonably conclude that there is an opportunity or issue that warrants a response and that the proposed project is an appropriate approach;
- include supporting information that demonstrates the need for a project;
- present any comments or views of Indigenous Peoples, the public and other participants on the proponent's need description;
- describe whether and how the project would support any federal or provincial government objectives;

4.3 Alternatives to the project

An assessment of energy mandates established through federal and provincial legislation or policy may not be within the scope of the integrated assessment. As a result, the alternatives to the project presented by the proponent need not include alternatives that are inconsistent with federally mandated initiatives or a

province's formal plans or directives. However, the proponent should explain where this rationale has been applied to exclude consideration of possible alternatives to the project

4.4 Alternative means of carrying out the project

The Impact Statement must:

- identify and consider the alternative means of carrying out the project that are technically and economically feasible;
- for the selection of the alternative means of carrying out the project, describe:
  - the criteria to determine technical and economic feasibility of possible alternative means;
  - the best available technologies considered and applied in determining alternative means;
  - those alternative means that are technically and economically feasible presented in sufficient and appropriate detail; and
  - the particularities for each alternative mean and their potential adverse and positive environmental, health, social and economic effects, and their potential impacts on Indigenous Peoples and their rights, as identified by Indigenous Nations and communities.
  - potential adverse and positive effects from different combinations of alternative means to account for potential synergies;
- describe the methodology and criteria that were used to compare the alternative means, to determine the preferred means of carrying out the project, and to justify the exclusions of other solutions, based on the trade-offs associated with the preferred and other alternative means including:
  - consideration of environmental, health, social and economic effects, the impacts on the rights of Indigenous Peoples, technical and economic feasibility, risk from accidents and malfunctions, and the use of best available technologies, and consideration of the sustainability principles;
  - environmental criteria should include effects to air quality, surface water quality, groundwater quality, soil, sediment, all wildlife and associated habitat (including wetlands);
  - consideration of potential effects to species at risk as per the *Species at Risk Act* (SARA), including any critical habitat, including a description of how avoidance of effects was considered and how it may be achieved through alternative means of carrying out the project; and
  - potential effects to fish and fish habitat as per the *Fisheries Act*, including a description of how avoidance of effects was considered and how it may be achieved through alternative means of carrying out the project;
  - potential effects to migratory birds and their habitat as per the *Migratory Birds Convention Act*, including any critical habitat, including a description of how avoidance of effects was considered and how it may be achieved through alternative means of carrying out the project;
  - application of GBA Plus to the analysis of alternative means of carrying out the project to inform how effects may vary for diverse population groups; and

- how concerns, views and information provided by Indigenous Peoples, the public and other participants were taken into account in establishing criteria and conducting the analysis;

- provide a high-level overview of alternative sites considered prior to selecting the proposed site, including a brief description of the degree and depth of site evaluation used to narrow down the final choice (see REGDOC 1.1.1, section 3.3 for guidance);
  - describe how the potential release of contaminants related to historical land use, and the potential for those releases to interact cumulatively with effects of the project, was considered in the site options analysis;
- address key project elements in the alternative means analysis, including, but not limited to, the following:
  - project site and component locations, including temporary components used for construction;
  - timing options for components and phases of the project;
  - access to the project site;
  - facility design;
  - switchyard design;
  - workforce accommodations
  - nuclear facilities-related activities/components:
    - reactor design;
    - cooling water systems for nuclear reactors, including water intake and cooling structures;
    - energy sources to power the project site and other stationary sources to provide heat or steam to the project;
  - water and wastewater management including:
    - location of effluent discharge points, and
    - treatment technologies and techniques to control effluent quality.
  - waste management strategies, including;
    - non-radioactive waste
    - low, intermediate, and high-level radioactive waste.
    - description of the life-cycle of generated waste;
  - construction alternatives methods and materials;
  - location, construction and crossing methods for waterbodies, watercourses, wetlands and other obstacles;
  - management of excavated materials, including those that are potentially acid generating or leachable; and
  - suspension, abandonment or decommissioning options.

5 Description of Public Participation and Views

The proponent must engage with the public and interested parties, including local communities. Engagement activities should be inclusive and ensure that interested members of the public have an opportunity to share their views. They should also consider the language needs, with regards to official languages, of the people being engaged. Particular attention must be paid to the engagement of individuals and communities that have interests in the lands affected by the project.

The proponent should consult IAAC guidance documents on this topic, particularly: Framework: Public Participation Under the *Impact Assessment Act*, Guidance: Public Participation under the *Impact Assessment Act*.

The proponent must also comply with CNSC REGDOC 3.2.1. Public Information and Disclosure.

5.1 Summary of public engagement activities

The Impact Statement must:

- describe the proponent's public engagement activities regarding the project, including:
  - efforts made to distribute project information and the information and materials that were distributed during the consultation process;
  - methods used, where consultations were held, the persons, organizations and diverse population groups consulted;
  - efforts made to involve the public in the development of the Impact Statement, including collection and incorporation of community knowledge; and
  - efforts to engage diverse population groups of the community to support the collection of information needed to complete the GBA Plus (see section 1.3 Gender-Based Analysis Plus (GBA Plus)).

5.2 Analysis and response to questions, comments and issues raised

The Impact Statement must:

- provide a summary of key issues related to the project, including the potential environmental, health, social and economic conditions and potential for disproportionate effects for diverse population groups, which were raised through engagement with the public, or how they were incorporated into the Impact Statement;

- describe any questions and comments raised by the public and how they influenced the design of the project;
- describe the alternative means, mitigation measures or the follow-up and monitoring programs identified to address public concerns;
- identify public concerns that have not been addressed, if any, and provide the reasons why they have not been; and
- provide details and commitments regarding the public information program should the project proceed, including a public disclosure protocol, in compliance with REGDOC 3.2.1. Public Information and Disclosure.

6 Description of Engagement with Indigenous Nations and Communities

The proponent must engage with Indigenous Nations and communities as early as reasonably possible, in order to identify and understand the potential impacts on Indigenous rights and interests, and to incorporate Indigenous Knowledge into the integrated assessment.

For the purposes of this integrated assessment, the term Indigenous rights and interests will be used throughout these Integrated Guidelines. The term Indigenous rights and interests includes the following requirements from the IAA:

- with respect to the Indigenous Peoples of Canada, a non-negligible adverse impact – occurring Canada and resulting from any change to the environment - on physical and cultural heritage, the current use of lands and resources for traditional purposes, or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance;
- a non-negligible adverse change occurring in Canada to the health, social or economic conditions of Indigenous Peoples;
- considerations related to Indigenous cultures raised with respect to the designated project; and
- the impact that the designated project may have on Indigenous Nations and communities and the adverse impact that the designated project may have on the rights of the Indigenous Peoples of Canada recognized and affirmed by section 35 of the *Constitution Act, 1982*.
- The proponent must engage with Indigenous Nations and communities in their preferred manner, such as site visits and in-community meetings.

Engagement with Indigenous Nations and communities is required to inform the integrated assessment and identify measures to avoid, minimize, offset or otherwise accommodate for potential adverse impacts on Indigenous Peoples and their rights. This engagement may also identify potential positive outcomes from the project. The project should be designed to minimize its negative effects, and to maximize its

positive impact on Indigenous Peoples and their rights. The assessment process will be conducted in a manner consistent with the Indigenous Engagement and Partnership Plan (IEPP).

The proponent must apply IAAC and CNSC's guidance documents on engaging with Indigenous Nations and communities throughout the development of the Impact Statement, including in the collection and analysis of biophysical, health, social, and economic information. The proponent must follow appropriate methodologies for assessing potential effects and impacts on Indigenous Peoples and their rights throughout the assessment. The guidance documents are listed in the Tailored Impact Statement Guidelines Template Appendix 2 – Resources and Guidance Indigenous participation and engagement and include the following documents:

Table 1. Guidance Documents Required for Indigenous Consultation and Engagement

IAAC Guidance	
Indigenous Knowledge under the Impact Assessment Act: Procedures for Working with Indigenous Communities.	*Policy Context: Assessment of Potential Impacts on the Rights of Indigenous Peoples.*
Indigenous Knowledge Policy Framework for Project Reviews and Regulatory Decisions.	*https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/practitioners-guide-impact-assessment-act/protecting-confidential-indigenous-knowledge-under-the-impact-assessment-act.html*
Guidance: Assessment of Potential Impacts on the Rights of Indigenous Peoples.	*Technical Guidance for assessing the Current Use of Lands and Resources for Traditional Purposes under the Canadian Environmental Assessment Act, 2012.*
Guidance: Collaboration with Indigenous Peoples in Impact Assessments.	*Technical Guidance for Assessing Physical and Cultural Heritage or any Structure, Site or Thing under the Canadian Environmental Assessment Act, 2012*.
Guidance: Indigenous Participation in Impact Assessment.	*Policy Context: Indigenous Participation in Impact Assessment.*

CNSC Guidance	
Indigenous Knowledge Policy Framework	*REGDOC-3.2.2, Indigenous Engagement, Version 1.2*

The proponent's engagement with Indigenous Nations and communities must:

- be consistent with the Government of Canada's commitment to implement the United Nations Declaration on the Rights of Indigenous Peoples as a comprehensive international human rights instrument and Canada's roadmap for reconciliation, including working together to achieve consensus as detailed in IAAC's guidance document Implementing the United Nations Declaration on the Rights of Indigenous Peoples; and
- be consistent with jurisprudence and best practices in respect of implementing the common law duty to consult. IAAC and the CNSC have obligations and commitments to consult and engage with Indigenous Nations and communities participating in the integrated assessment process and proponent engagement with Indigenous Nations and communities will inform IAAC and the CNSC's consultations.

The IEPP identifies Indigenous Nations and communities that the Crown will consult to understand the concerns and potential impacts of the project on their exercise of potential or established Aboriginal or Treaty rights and, where appropriate, make accommodations. The degree of consultation or engagement will vary and will be proportionate to the information provided by Indigenous Nations and communities regarding potential pathways of impact from the project on Indigenous or Treaty rights and interests. Engagement is also conducted to understand other potential project effects not directly related to the exercise of Indigenous or Treaty rights such as impacts on the interests of an Indigenous Nation or community from the project. The proponent must:

- work with the Indigenous Nations and communities identified in sections 3.1 and 3.2 of the IEPP in the development of the Impact Statement. As described in the IEPP, the degree of engagement with each community will be contextualized based on the information provided by Indigenous Nations and communities regarding potential pathways of impact from the project on Indigenous or Treaty rights and interests;
- conduct the work required in the Integrated Guidelines with integrity and transparency, without conflicts of interest, in good faith, and in a manner that is attentive to the concerns of Indigenous Nations and communities and committed to producing mutually beneficial outcomes;
- share information and collaborate with Indigenous Nations and communities to contribute to the development and validation of conclusions and assessment findings related to potential impacts and pathways of effects to Indigenous Peoples and their rights and interests. The results of any engagement with each Indigenous Nation and community must be presented in the Impact Statement, and, as best as possible, convey the perspective of the Indigenous Nations and communities being engaged;

- consider how GBA Plus and relevant approaches to engagement would create safe spaces for meaningful dialogue to enable full and free participation of community members, including different sub-populations (e.g., Elders, women, off reserve community members, youth, gender diverse and two-spirit peoples), in the engagement process;
- use consistent terminology for the valued components as identified by the Indigenous Nations and communities;
- provide occasions for Indigenous Nations and communities to review and provide comments on information prior to submission of the Impact Statement, and incorporate the comments;

The proponent must collaborate with all Indigenous Nations and communities identified in the IEPP, in completing its Impact Statement and apply this approach to all subsequent sections of these Integrated Guidelines:

- share project information, including plans for baseline studies in support of the Impact Statement, frequently and transparently with Indigenous Nations and communities;
- present information in a format requested by the Indigenous Nations and communities;
- work with Indigenous Nations and communities to understand and discuss perspectives in order to seek agreement on the nature of potential impacts on Indigenous Peoples and their interests as well as appropriate ways to address those impacts for inclusion in the Impact Statement;
- make best efforts at collaboration and provide IAAC and CNSC with an explanation regarding circumstances where collaboration was not possible. Where Indigenous Nations and communities identified in the IEPP do not wish to participate or have not responded to engagement requests, the proponent should continue sharing information and analyses with the Indigenous Nations and communities on the potential effects of the project (unless the Indigenous Nations and communities request otherwise), document its efforts in that respect, and use available public sources of information to support the assessment;
- collaborate with Indigenous Nations and communities identified in section 3.1 of the IEPP, in completing its Impact Statement and apply this approach to all subsequent sections of these Integrated Guidelines;
- support the participation of Indigenous Nations and communities in the completion of the Impact Statement, which could include funding studies conducted by potentially affected Indigenous Nations and communities who will have demonstrated interest in this regard; and
- cooperate with Indigenous Nations and communities to identify preferred measures to avoid, minimize, offset or otherwise accommodate for adverse impacts on Indigenous Peoples or their rights, as well as to optimize the project's benefits for their communities.

6.1 Indigenous Knowledge considerations

Indigenous Knowledge[3] is holistic and, when integrated in integrated assessment, informs the assessment on areas including the biophysical environment, as well as social, cultural, economic and health aspects, Indigenous governance, resource use, and mitigation. Indigenous Knowledge should be brought together on equitable footing with scientific or technical information to inform all aspects of the integrated assessment including the environmental, health, social, economic and rights assessments. Indigenous Knowledge should be conveyed in a culturally appropriate manner which captures the context in which it was provided. The proponent must apply IAAC and CNSC guidance on Indigenous Knowledge listed in the Tailored Impact Statement Guidelines Template Appendix 2 – Resources and Guidance – Indigenous participation and engagement.

The Impact Statement for all sections must:

- reflect that community-specific engagement protocols and procedures around Indigenous Knowledge in assessment processes are understood, respected and implemented;
- indicate where input from Indigenous Nations and communities, including Indigenous Knowledge, has been incorporated and how it was considered. Information should be specific to the individual Indigenous Nation(s) and communities involved in the assessment and describe contextual information about the members within an Indigenous Nation and community (e.g., women, men, Two-Spirit peoples, Elders and youth); and
- indicate where Indigenous Knowledge that was provided was not included in the assessment and provide a rationale. Where findings differ between Indigenous Knowledge and scientific or technical studies, the proponent should clearly present how both were considered in the Impact Statement.

Indigenous Knowledge, whether publicly available or directly shared with the proponent, should not be included without written consent and validation from the Indigenous Nation or community, regardless of the source of the Indigenous Knowledge. The proponent must refer to IAAC and CNSC guidance, and follow appropriate and culturally based Indigenous methodology.

6.2 Record of engagement

The Impact Statement must:

- provide a record of engagement that describes all efforts taken to seek the views of each potentially affected Indigenous Nation and community with respect to the project, including:

[3] The Government of Canada recognizes that Indigenous Peoples refer to their knowledge in different ways, characteristic of their unique languages. Within the context of these Integrated Guidelines, the term Indigenous Knowledge is used to refer to all Indigenous ways of knowing. The proponent is encouraged to respect the terminology preferences of the Indigenous Nations and communities involved in the assessment.

- the proponent's Indigenous engagement policy, as well as established policies and stated principles related to the collection of Indigenous Knowledge and traditional land use information; and
- the list of Indigenous Nations and communities engaged by the proponent, including those that the proponent was unsuccessful in engaging, and those not engaged by the proponent and the reasons for not engaging.

- provide a record of engagement, seeking permission of the Indigenous Nation or community for the content of the record, that describes all efforts taken to seek the views of each potentially affected Indigenous Nation and community with respect to the project, including:
  - where applicable, a copy of each community-specific engagement plan developed collaboratively by the Indigenous Nations and communities and the proponent. If only one engagement plan was developed for engagement with all Indigenous Nations and communities, provide a rationale for this approach;
  - a description of key engagement and consultation activities undertaken with each Indigenous Nation and community;
  - the results of key engagement and the perspectives of the Indigenous Nations and communities involved;
  - the list of the consultation or engagement protocols adopted by each Indigenous Nation and community, if applicable. A written copy of the protocols must be included when available;
  - a description of how project information was frequently and transparently shared with Indigenous Nations and communities;
  - a description of how Indigenous Nations and communities were provided with reasonable opportunities to review draft sections of the Impact Statement prior to them being filed, where disagreements occurred, and how disagreements were considered;
  - a description of efforts to engage diverse segments of each Indigenous Nation and community in culturally appropriate ways, including groups identified by gender, age or other community-relevant factors (e.g., youth, women, off reserve community members, gender diverse, two-spirited people, individuals with disabilities, Elders, hunters, trappers, and fishers) to support the collection of information needed to integrate GBA Plus requirements throughout the impact statement;
  - a description of how engagement activities by the proponent were intended to ensure Indigenous Nations and communities were provided the occasion to evaluate the project's potential positive and negative effects and impacts on their members, communities, activities and rights, as identified by the Indigenous Nation(s);
    - append any specific studies or Indigenous-led assessments and a summary of the scope, objective and timelines of the assessment, provided by Indigenous Nations and communities, and describe how they were taken into account;
  - a description of how the proponent sought to build consensus and obtained the agreement from Indigenous Nations and communities regarding information specifically pertaining to those Indigenous Nations and communities, including Indigenous Knowledge, that is presented in the Impact Statement;

- a description of the proponent's progress in seeking free, prior and informed consent from Indigenous Nations and communities, as identified by the Indigenous Nations and communities themselves, where Indigenous Nations and communities have agreed to including this information in the Impact Statement;
- any agreements pertaining to engagement that are finalized or in progress, with anticipated timelines to complete;
- a demonstration that the capacity needs of Indigenous Nations and communities were taken into account, including a description of how they were taken into account, and that timelines were adequately communicated and flexible enough to ensure Indigenous Nations and communities had the ability to review and gain understanding of, and contribute to, information in the Impact Statement; and,
- provide the views of Indigenous Nations and communities on whether the proponent provided reasonable funding support for their engagement efforts.

6.3 Issues identification and resolution

The proponent must collaborate with Indigenous Nations and communities, in completing its Impact Statement and while working through all sections of the Integrated Guidelines. The proponent must:

- where requested by Indigenous Nations and communities, collaborate and work with Nations and communities to incorporate information from each Nation into topic-specific parts of the Impact Statement, such as the biophysical environment or alternative sections;
- for each Indigenous-specific assessment required in section 10, present a summary of context and conclusions of key biophysical, health, social and economic pathways relevant to the effects to that specific Indigenous Nation and community;
- detail the main issues, questions and comments raised by each Indigenous Nation and community during engagement activities and the proponent's responses, including how matters have been addressed in the Impact Statement or will be addressed in the future;
- indicate where and how Indigenous Nations and communities' knowledge, perspectives and input were integrated into or contributed to decisions regarding the project or its integrated assessment, including:
  - the construction, operation, decommissioning, closure and reclamation plans;
  - the evaluation of alternatives to the project and of alternative means of carrying out the project;
  - developing the assessment, including setting spatial and temporal boundaries, identifying and selecting VCs and collection of baseline information;
  - characterization of potential environmental, health, social and economic effects of the project for each Indigenous Nation and community;
  - measures to mitigate effects or to enhance or optimize potential project benefits;
  - follow-up and monitoring activities should the project proceed; and
  - characterization of the extent to which adverse federal effects are significant; and

- describe how the information gathered during the Pre-planning and Planning phase of the integrated assessment was included, including the documents submitted to the Registry by Indigenous Nations and communities.

6.4 Collaboration with Indigenous Peoples following the submission of the Impact Statement

The Impact Statement must describe how the proponent plans to continue to work with Indigenous Peoples throughout the lifecycle of the project, should the project proceed, including:

- any proponent commitments for engaging affected Indigenous Nations and communities;
- involvement of and ongoing engagement with Indigenous Nations and communities throughout the project lifecycle, including how the proponent will report to the CNSC on engagement efforts;
- how the proponent will provide sufficient information to Indigenous Nations and communities on the potential selected technologies throughout the integrated assessment process, how the proponent will continue to follow-up with Indigenous Nations and communities once the technology is selected, and how the proponent will develop appropriate mitigation or accommodation measures with Indigenous Nations and communities for any of the potential technologies being considered; and
- how Indigenous Knowledge and expertise would be considered.

7 Assessment Methodology

The Assessment Methodology requirements below must be applied to all subsequent sections of the Integrated Guidelines.

7.1 Uncertainty and bias

While developing the Impact Statement, the proponent may use information or modelling that inherently contains a bias, uncertainties and which require assumptions to be made in order to meet the requirements of these Integrated Guidelines. The Impact Statement must provide a description of uncertainty and bias

for major claims[4] and how they were addressed where uncertainty and bias may meaningfully impact conclusions. The Impact Statement must:

- describe the major sources of uncertainty, including uncertainty arising from:
  - limitations on data accuracy, precision, completeness and reliability,
  - environmental variability, including spatiotemporal variability,
  - extrapolations from other contexts (e.g., baseline conditions are extrapolated from other locations, time periods, populations or communities),
  - extrapolations from proxy measures or indicators to VCs themselves,
  - model limitations arising from incomplete or imperfect knowledge of the structure or function of the system being modelled, and
- provide a quantitative (where possible) or qualitative estimate of the magnitude of major sources of uncertainty and provide an explicit justification or rationale for these estimates or why no estimate was possible;
- describe the potential sources of bias in the design, execution or interpretation of studies or analysis, including:
  - selection bias resulting in non-representative sample populations,
  - confounding bias arising from inadequate control of factors that may influence project effects,
  - measurement bias associated with the methods used to establish baseline conditions,
  - detection bias in monitoring or surveillance data,
  - outcome reporting or publication bias when relying on external studies or scientific publications, and
  - observer, confirmation, performance, or interpretation bias by those conducting or interpreting studies;
- provide a quantitative (where possible) or qualitative estimate of the direction and magnitude of each major source of scientific bias, and provide an explicit justification or rationale for these estimates or why no estimate was possible;
- describe the potential implications of the estimated cumulative uncertainty and bias (i.e., the total uncertainty and bias arising from all identified sources), including:
  - providing a quantitative range [lower bound, upper bound] (where possible) or qualitative estimate, for residual effects, and, where relevant, on the extent of significance, in light of the estimated cumulative uncertainty and bias, and

[4] Major claims may include the descriptions of baseline conditions, assessment of effects, effectiveness of mitigation (for adverse effects) or enhancements (for beneficial effects), residual effects, cumulative effects and the extent of significance of residual effects.

- describing the difference in consequences to any associated VCs if realized ("actual") residual effects were of a magnitude equal to the lower versus upper bound of the range;

- describe any approaches that were used or could be used to reduce sources of uncertainty or bias associated with the conclusion (e.g., additional data collection or research); and
- describe how the precautionary principle was applied and any precautionary approaches that have been used in the effects assessment or in the development of mitigation.

7.2 Baseline methodology

For all baseline conditions of VC's, the Impact Statement must:

- describe the baseline for the environmental, health, social and economic conditions related to the project and the interrelations and interactions among them. Meaningful, two-way dialogue with Indigenous Nations and communities and local communities should support the description of how environmental, health, social, and economic conditions are interrelated;
- describe changes in the baseline conditions that are likely to occur in the future, if the project was not carried out, including changes due to future climate change;
- include baseline data collected in a way that makes reliable analyses, extrapolations and predictions possible, and are suitable to estimate pre-project baseline conditions, to predict effects from the project throughout the project lifecycle, and to evaluate changes in the conditions within and across the study areas;
  - where sampling is used to gather field data, standard sampling techniques and approaches should be from recognized government agencies and peer-reviewed published scientific literature for the appropriate technical discipline (e.g., groundwater monitoring, fish monitoring);
  - when reference sites/areas are used, a minimum of two should be identified in order to characterize natural spatial variability in measured parameters.
- Identify facility characteristics and activities that may interact with the environment during the relevant phase of the facility lifecycle (e.g., site preparation, construction, operation and decommissioning) to identify the potential interactions between the facility or activity and the surrounding environment in sufficient detail to assess the potential for effects arising from the proposed maximum quantities and anticipated volumes and flow rates for releases associated with the facility or activity, including:
  - physical disturbances (for example, footprint for surface structures, below-grade structures, diversions or flow alterations of surface or groundwater including short-duration fluctuations);
  - emissions released to the environment; and
  - effluents released to the environment.
- ensure baseline data is captured within auditable management systems, quality management or quality assurance programs, additional information can be found in section 2.3 Management System for site evaluation ;

- ensure adequacy of baseline data collection for those elements of the environment to be carried forward into future licensing phases with the objective of monitoring for a specified level of change in some environmental parameter or analyte;
- provide detailed descriptions of data sources and data collection methods, including sampling, survey and research protocols, modelling methods and any assumptions;
  - identify measurement end points, as appropriate.
- describe modelling methods and include software used, assumptions, estimations of margins of error, validation with field or other appropriate data, model performance and other relevant statistical information;
- show that the data sources used are relevant to and representative of conditions within the established spatial and temporal boundaries and account for natural variability, especially if surrogate data from representative sites are used rather than specific measurements at the project site;
- discuss the degree of confidence in the baseline data as detailed in section 7.1 Uncertainty and bias; and
- describe where and how community or Indigenous Knowledge and input were collected and considered in determining baseline conditions.

The proponent is encouraged to consult with IAAC and the CNSC during the development and planning of baseline studies and may use relevant sources of existing baseline information., including those listed in Appendix 1 – Additional Guidance: Sources of baseline information of the Tailored Impact Statement Guidelines Template.

7.2.1 Existing baseline information

The proponent may leverage existing baseline information, including ongoing monitoring and previous technical studies, to meet the requirements for baseline conditions in these Integrated Guidelines.

In order to rely on existing baseline information, the Impact Statement must:

- demonstrate that existing baseline information meet the requirements outlined in the baseline methodology section 7.2;
- provide a summary of the existing baseline information, including:
  - how it relates to the potential effects from the project;
  - how this data is representative of the current conditions in the assessment study areas; and
  - how Indigenous Nations and communities, the CNSC, government agencies, and other participants in the integrated assessment were engaged in the development or validation of the information and any relevant conclusions or outstanding issues;
- describe how Indigenous Knowledge was integrated, or supplemented, to the existing baseline information; and

- identify whether the existing baseline information is publicly available and explain how it can be accessed.

IAAC possesses information gathered during previous impact assessments and environmental assessments in the northern Alberta region. The proponent is encouraged to contact IAAC to request available information and determine to what degree this existing information could be leveraged to support the development of the Impact Statement.

7.3 Selection of valued components

The impact assessment is focused on the Valued Components (VCs), the analysis of which is anticipated to be material for decision-making. The VCs serve as the focal points for the impact assessment and will inform conclusions in the Impact Assessment Report. VCs consists of components that are of particular concern or value to participants and that may be affected by the project's components and activities. The value of a component not only relates to its role, but also to the value people place on it.

Each VC must be assessed following the assessment methodology outlined in section 7 above, as well as VC-specific requirements presented in the VC-specific subsection of these Integrated Guidelines. The assessment of effects on VCs includes the assessment of effect pathways that are cause-effect linkages between a project component or activity and the VC. The generic Assessment Methodology assessment methodology outlines the steps that must be applied to the assessment of each VC, namely establishing spatial and temporal boundaries, describing baseline conditions, and assessing effects as well as uncertainty and bias. Where there are adverse federal effects in relation to a VC, additional steps of the Assessment Methodology include identifying mitigation measures, assessing residual and cumulative effects, characterizing the extent of significance and describing the follow-up program.

The Integrated Guidelines, in sections 8, 9, and 10, provide information requirements organized in categories that may be considered as VCs, or may be considered as intermediate components to inform the assessment of VCs, depending on the project. The VCs will help to organize the description of the effects of the project required by the Integrated Guidelines.

The VCs included in the Impact Statement must include, at minimum, those listed in Table 2. The table includes in-text citations and rationales for inclusion, referencing the proponent's Initial Project Description or Summary of Issues. Based on information to date, it is anticipated that the following VCs will be material for decision-making, and these will be further informed through public engagement and Indigenous consultation activities in the planning phase.

Table 2: Valued Components to include in the Impact Statement

Valued Component	Rationale for inclusion
• Aquatic environment	• Changes to water quality and quantity (including water levels, flow rates, variation throughout the year, drought scenarios, release of contaminants and effects from any water discharge) could affect

Valued Component	Rationale for inclusion
	the aquatic environment and have potential downstream effects including any possible effects to the PAD and Wood Buffalo National Park (IPD table 7.1-1)
• Atmospheric environment, including: ◦ Air quality; ◦ Noise and vibrations; ◦ Visual environment, including light	• Changes to air quality (e.g., dust, chemical/radiological contaminants), light, noise and vibrations due to project development could affect the atmospheric environment and other valued components, such as fish, migratory birds, species at risk, human health, etc.
• Terrestrial, riparian, and wetland environment, including: ◦ Dry Mixedwood Natural Subregion of the Boreal Forest Natural Region of Alberta (IPD section 5.2.4.2 Vegetation)	• Changes to water quality and quantity from project activities (including thermal effects from operation of the nuclear facility, site water run-off, and release of contaminants) and location of physical work and placement of infrastructure could affect terrestrial, riparian and wetland environment. • Changes to radiological conditions could affect vegetation, riparian and wetland environments.
• Birds, breeding birds, migratory birds, and their habitats, including: ◦ migratory birds protected under the Migratory Birds Convention Act and Migratory Birds Regulation;	• Changes to habitat due to: ◦ clearing; ◦ air, noise or light pollution; ◦ changes to radiological condition; ◦ potential impacts from hazardous waste (IPD Table 7.2-2); ◦ changes in water quality or quantity, site water run-off and erosion (IPD Table 7.2-2). • Potential impacts on mortality to migratory birds due to: ◦ site traffic and transportation (IPD Table 7.2-2); ◦ potential impacts from hazardous waste (IPD Table 7.2-2).
• Fish and Fish habitat	• Changes to water quality and quantity from project activities (including thermal effects from any water discharge and release of contaminants including radionuclides) and location of physical work and placement of infrastructure could affect fish and fish habitat (IPD Table 7.1-1); • Changes to radiological conditions could affect fish and fish habitat; • Increased vibrations due to blasting could affect fish spawning activities and fish mortality • Construction and operation of cooling water intake and operational water discharge could affect fish and fish habitat (e.g., impingement and entrainment)
• Indigenous physical and cultural heritage, and structures, sites or things of significance, including:	• Changes to terrestrial and aquatic environments and associated environmental valued components may adversely affect Indigenous rights and interests, including ability to catch fish

Valued Component	Rationale for inclusion
○ sacred sites and culturally significant locations; and ○ stewardship responsibilities • Current use of lands and resources for traditional purposes by Indigenous Peoples, including fishing and harvesting. • Health, social and economic conditions of Indigenous Peoples, including: ○ economic and health inequity for Indigenous Peoples; • Indigenous rights, including: ○ Indigenous governance; ○ fishing; ○ harvesting; and ○ cultural Practices.	species for food, commerce, and ceremony by their preferred means. • Potential impacts on health inequalities between Indigenous Nations and communities and the general population. • Potential impacts on economic inequity for Indigenous Peoples and Indigenous rights. • Changes to the exercise of Indigenous rights due to the project • Consideration and integration of Indigenous rights including Indigenous decision-making, Indigenous Knowledge and values, including consideration of free, prior and informed consent, in this project-specific decision making.
• Terrestrial wildlife and wildlife habitat: ○ Hibernacula habitat (IPD section 5.3.4) ○ Grizzly bear Support Zone5 (IPD section 5.3.4)	• Changes to water quality from project activities (including effects from any water discharge, release of contaminants) and location of physical work and placement of infrastructure could affect wildlife and wildlife habitat • Potential impacts on mortality, due to new infrastructure and increased traffic. • Changes to radiological conditions could affect terrestrial wildlife and wildlife habitat.
• Health, social, and economic conditions, including: ○ human health and well-being; ○ housing and infrastructure; ○ social and community services; ○ labour; ○ labour and workforce availability; and ○ education and training.	• Changes to water quality, air quality, and radiological conditions from project activities could affect human health. • Changes to: ○ the local and regional economy (e.g., job creation, education and training, youth retention in the area, and indirect effects on local businesses). ○ the availability of workforce for non-nuclear companies in the region (e.g., construction industry) and lower wage jobs (e.g., hospitality, service, tourism, healthcare, childcare, manufacturing, agriculture).

[5] Support zones are designed to support the grizzly bear population in the Recovery Zone by creating a priority area for managing bear attractants and other sources of human-wildlife conflict adjacent to the Recovery Zone. This will improve females and females with cubs that are moving between the Recovery and the Support Zone.

Valued Component	Rationale for inclusion
	◦ local demand for housing and increased housing and rental prices. ◦ demand on healthcare services, childcare services and education, as well as community, recreational and emergency services. • Potential impacts on: ◦ county and municipal infrastructure due to increased road traffic, transportation infrastructure (e.g., air and rail), public transit, sewer and water infrastructure, and waste management. ◦ housing, transportation and other infrastructure from an influx of temporary workers
• Species at risk and their habitat listed under the *Species at Risk Act*, including: ◦ Bull Trout listed as Special Concern by SARA (IPD Section 5.3.1) ◦ Rainbow Trout listed as Endangered by SARA (IPD Section 5.3.21) ◦ little brown bat (Myotis lucifugus) listed as Endangered under SARA (IPD section 5.3.4) ◦ Northern Long-eared bat (Myotis septentrionalis) listed as Endangered under SARA (IPD section 5.3.4)	• Changes to vegetative communities could affect species at risk critical habitat. • Changes to radiological conditions could affect species at risk and their critical habitat; • Changes to water quality, quantity and functions of wetlands could affect species at risk and their critical habitat. • Changes to atmospheric environment could affect avian species at risk.

As noted in section 1, given the production of nuclear energy is a federal work or undertaking, adverse federal effects considered for this project include environmental, health, social and economic effects where an adverse, non-negligible change is likely to result from the project.

As further detailed in section 10, the proponent may identify additional VCs beyond those included in the Integrated Guidelines, in consultation with Indigenous Nations and communities and other participants. Indigenous Nations and communities may identify holistic VCs that encompass multiple environmental, health, social, or economic components. Where identified, the proponent should structure the analysis and presentation of individual components into an assessment of the holistic Indigenous VC. The proponent is encouraged to work with Indigenous Nations and communities to identify holistic VCs, which may increase the efficiency of the assessment and clarity of presentation.

The Impact Statement must:

- describe the VCs and provide a rationale for the selection of VCs in sufficient detail to allow the reviewer to understand their relevance to the assessment;
- describe the ecological significance of VCs;
- indicate the source and reasons of the concerns or interests considered in the selection of VCs, including from Indigenous Nations and communities, the public, provincial or federal authorities, and other participants;
- in the event that a VC is suggested by Indigenous Nations and communities but is excluded from the Impact Statement, provide a justification for its exclusion; and
- describe how community and Indigenous Knowledge and the perspectives were considered in selecting VCs.

7.4 Spatial and temporal boundaries

The Impact Statement must establish appropriate spatial and temporal boundaries to describe the baseline conditions for, and to guide the assessment of, each VC. The proponent must engage with Indigenous Nations and communities when defining spatial and temporal boundaries for VCs that are identified by, or related directly to, Indigenous Peoples.

The proponent should consider additional guidance for assigning appropriate study areas or boundaries provided in Appendix 1 - Establishing spatial and temporal boundaries of the Tailored Impact Statement Guidelines Template.

7.4.1 Spatial boundaries

The proponent should generally establish three spatial boundaries of study areas to assess the impacts on each VC:

- Project Area (PA): defined as the project footprint including all temporary and permanent areas associated with the project, and alternatives considered;
- Local Study Area (LSA): defined as the area beyond the project footprint where project effects may extend; and
- Regional Study Area (RSA): defined as the larger area around the LSA (delineated by ecological, social, economic or other appropriate boundaries), including the region where cumulative effects may extend.

The Impact Statement must:

- describe the spatial boundaries for each VC and provide a rationale for each boundary. Spatial boundaries must be shown on maps;
- define spatial boundaries by taking into account:

- scale and spatial extent of potential effects and impacts of the project,
- the physical location of potential receptors, including, where applicable, the movement patterns of potential receptors,
- relationships between VCs (e.g., interaction between wildlife and vegetation),
- community knowledge and Indigenous Knowledge,
- current or traditional land and resource use by Indigenous Nations and communities,
- rights of Indigenous Peoples, including treaty lands, traditional territories and areas or sites used for cultural and spiritual practices,
- physical, technical, ecological, social, health, economic and cultural considerations,
- size, nature, location and known effects of past, present and foreseeable projects and activities, particularly for the RSA, and
- information received from Indigenous Nations and communities.

- identify where spatial boundaries may extend to areas that are (i) on federal lands, (ii) in a province other than the one where the project is being carried out, or (iii) outside Canada.

7.4.2 Temporal boundaries

The Impact Statement must:

- describe the temporal boundaries for each VC and provide a rationale for each boundary; and
- define temporal boundaries by taking into account:
  - the project's lifecycle (i.e., site evaluation, site preparation, construction, operation, decommissioning and abandonment);
  - schedule of phases of the project,
  - past conditions and historical context,
  - community knowledge and Indigenous Knowledge,
  - current or traditional land and resource use by Indigenous Nations and communities,
  - rights of Indigenous Peoples, including treaty lands, traditional territories and areas or sites used for cultural and spiritual practices,
  - relevant physical, technical, ecological, social, health, economic and cultural considerations,
  - timing of past, present and foreseeable projects and activities, and
  - information received from Indigenous Nations and communities.

7.5 Effects assessment methodology

The Impact Statement must:

- describe the project's positive effects and adverse federal effects (referred to collectively as "effects") for each phase of the project;
- identify and describe measures that are technically and economically feasible and that would mitigate the project's adverse federal effects or enhancements to increase positive effects (see section 7.6 Mitigation and enhancement measures for more details);
- describe any residual[6] effects of the project taking into account interactions between residual effects of the project and those of past, existing and reasonably foreseeable projects or physical activities, as described in section 7.7 Cumulative effects assessment;
- describe the project's potential impacts on the exercise of rights of the Indigenous Peoples of Canada as detailed in section 10 Indigenous Peoples The description must include the information requirements detailed in section 8 Biophysical environment.
- describe how baseline data were used to inform this analysis;
- describe effects in a qualitative or quantitative manner, taking into account any important contextual factors, as appropriate;
- the scope of information should be scaled to the scope of anticipated adverse federal effects;
- describe the analytical methods selected to assess effects, including clearly stated assumptions for all predictions and how each assumption has been tested and criteria or descriptors used;
- describe the probability or likelihood of that effect occurring, using methods that are statistically and scientifically defensible;
- for quantitative predictions based on models, describe detail model assumptions, parameters, the quality of the data and the degree of certainty of the predictions obtained, including an explanation of model calibration, validation and model performance metrics used;
- discuss the degree of confidence in the predictions and conclusions of the effect assessment;
- if a detailed description of effects cannot be provided, provide a rationale for the absence of details and a general description of the potential effects and related project activities (e.g., activities and effects related to closure and reclamation). The proponent should confirm the rationale with IAAC and the CNSC before submitting the Impact Statement;
- for predictions that may be affected by climate change, discuss how the range of potential climates informed the assessment, including predicted changes in climate extremes;
- consider and describe the interactions among the environmental, health, social and economic effects and impacts on Indigenous Peoples and their rights;

[6] Residual effects are changes to the environment or to the health, social or economic conditions, and the positive and negative consequences of these changes, of the project that remain, or are predicted to remain, even after mitigation have been implemented.

- consider and describe the perspectives, concerns and tolerance levels of Indigenous Nations and communities and other participants;
- describe where and how Indigenous Knowledge and community knowledge and input were considered and incorporated into effects assessment; and
- describe how GBA Plus was applied to examine differences in effects among diverse population groups and provide disaggregated data where necessary.

7.6 Mitigation and enhancement measures

The Impact Statement must identify mitigation measures that are technically and economically feasible and that would eliminate, reduce, control or offset adverse effects within federal jurisdiction, and direct or incidental adverse effects, including restitution for any damage caused by effects through replacement, restoration, compensation, or any other measures. The Integrated Guidelines, in Sections 8 Biophysical Environment, 9 Health, Social and Economic Conditions, and 10 Indigenous Peoples, provide additional requirements specific to mitigating environmental, health, social and economic effects which may be considered for the development of mitigation measures of adverse effects within federal jurisdiction, or direct or incidental adverse effects. The proponent may also identify enhancement measures to increase positive effects, such as local and regional training efforts, investment in infrastructure and services, and projects to rehabilitate degraded environments. For more guidance on developing mitigation and enhancement measures see Appendix 1 - Developing mitigation measures and enhancements of the Tailored Impact Statement Guidelines Template.

The Impact Statement must:

- describe mitigation that are specific to each environmental, health, social or economic effect identified in the effects assessment including:
  - mitigation practices, policies and commitments that are part of the project design and that are required to achieve the predicted effects (e.g., project design elements that were accounted for in the effects assessment),
  - standard mitigation practices, policies and commitments that constitute proven technically and economically feasible mitigation measures and that are to be applied as part of standard practice, and
  - any new or innovative mitigation measures being proposed;
- propose differentiated mitigation, if applicable, so that adverse effects do not fall disproportionately on diverse population groups, or so they are not disadvantaged in sharing any development benefits and opportunities resulting from the project. Mitigation measures should be developed in collaboration with those who are vulnerable or disadvantaged;
- write mitigation as specific commitments that clearly describe how the proponent intends to implement them and the desired outcomes. Measures are to be specific, achievable, measurable and verifiable, and described in a manner that avoids ambiguity in intent, interpretation and implementation;

- identify and describe the use and application of best available technology and best environmental practice in identifying, assessing and implementing mitigation measures;
- describe any environmental protection plan(s) for the project and, if applicable, the environmental management system through which the proponent will deliver this plan. The plan(s) must provide an overall perspective on how adverse effects would be minimized and managed over time;
- identify the party responsible for the implementation of mitigation measures and the system of accountability;
- discuss the mechanisms the proponent would use to require its contractors and sub-contractors to comply with any commitments;
- describe the approach that would be taken if a mitigation measure is no longer feasible while the project is carried out;
- describe how, throughout the project's duration, the lessons learned through the follow-up program will be used to continually improve mitigation measures;
- where components are to be decommissioned and abandoned, include planned activities to do so. Project components that may be abandoned and decommissioned during the construction or operation phases may include access roads, temporary laydown areas, aggregate extraction sites and other temporary sites;
- where appropriate, provide details regarding financial liability and compensation in place as required by regulation or company commitment in relation to decommissioning or abandonment;
- document specific suggestions raised by Indigenous Nations and communities for avoiding, mitigating or otherwise accommodating the project's environmental, health, social and economic effects, including potential effects and impacts on Indigenous Peoples and describe whether and how these measures will be incorporated in the project design;
- identify opportunities for enhancing positive effects, such as creation of local employment and infrastructure improvements;
- identify other technically and economically feasible mitigation measures that were considered but are not proposed for implementation and explain why they were rejected. Justify any trade-offs between cost savings and effectiveness of the various forms of mitigation measures;
- in cases where proposed mitigation differ from any specifically suggested in the Integrated Guidelines, provide a rationale; and
- describe any relevant federal, provincial, regional or municipal legislative or regulatory frameworks (such as regulations, approvals, and programs) that will contribute to the management of effects; and how they will contribute to the management of effects (see section 3.3 Regulatory framework and the role of government).

For each mitigation identified, the Impact Statement must:

- provide an assessment of the anticipated effectiveness and resulting residual effects, including available information that was relied on such as technical information from other projects, peer-reviewed studies, as well as Indigenous Knowledge and community knowledge;

- if there is little experience or uncertainty as to the effectiveness of any measures, describe the potential risks and effects should those measures not be effective or malfunction;
- for those mitigation intended to address impacts on Indigenous Peoples and their rights, provide a description of the consultation with Indigenous Nations and communities regarding the residual impacts;
- assess any potentially adverse environmental effects associated with the mitigation method itself; and
- describe how disproportionate effects that were identified in the GBA Plus results were used to inform mitigation and enhancement measures.

7.7 Cumulative effects assessment

The proponent must assess the project's cumulative effects using the approach described in IAAC's guidance document Policy Framework for Assessing Cumulative Effects under the *Impact Assessment Act*.

Cumulative effects are changes to the environment, health, social, cultural and economic conditions, as a result of the project's residual effects combined with the effects of other past, existing and reasonably foreseeable projects and physical activities. Cumulative effects may result if:

- the implementation of the project may cause residual adverse effects to the VC, and
- the same VC has been or can be affected by other past, existing or future projects or physical activities.

A cumulative effect on an environmental, health, social or economic component or on Indigenous Peoples and their rights may be important even if the project's incremental effects to these components by themselves are minor. Project components and activities should be considered in the cumulative effects analysis to understand synergistic, compensatory, masking or additive effects.

The Impact Statement must:

- identify the VCs that will be subject to the cumulative effects assessment, including: all VCs for which the proponent or an Indigenous Nation and community anticipates residual effects or impacts on Indigenous Peoples and their rights from the project and those identified as a concern in the Planning phase (refer to Table 2);
- include a rationale, with prior consultation with IAAC and the CNSC, if VCs are excluded from the cumulative effects assessment;
- identify and justify the spatial and temporal boundaries for the cumulative effect assessment for each VC, taking into account:
  - boundaries may differ for each VC and will generally be larger than the boundaries for the project effects alone,
  - boundaries should not be constrained by jurisdictional boundaries and may extend beyond Canada's jurisdiction,

  - temporal boundaries should account for potential effects throughout the lifecycle of the project, including decommissioning and abandonment, and
  - spatial and temporal boundaries for VCs related to effects and impacts on Indigenous Peoples defined in collaboration with the Indigenous Nations and communities concerned;
- identify the sources of potential cumulative effects. Specify which other projects or activities that have been or will be carried out that could have resulted or could result in effects on the VCs within the defined boundaries and whether those effects could interact with the residual effects of the project. Clearly explain and justify the rationale for selecting other past, existing or future projects or activities to include in the cumulative effects assessment. Project activities to be considered include, but are not limited to:
  - transmission lines
  - on-site storage of nuclear waste
  - potential component replacement projects and site upgrades
  - manufacturing and production plants
  - natural gas pipeline
  - other existing or planned energy sector projects
- consider the results of any relevant regional studies or regional assessments;
- describe how the selection of boundaries and other past, existing or future projects or activities for cumulative effects assessment were informed by consultations with the public, Indigenous Peoples, provincial ministries, federal authorities and other participants;
- assess the cumulative effects for each selected VC:
  - the analysis must include the effects of past, existing and future projects and physical activities in combination with the residual effects of the project, taking into account how the effects may interact (additive, synergistic, compensatory, and masking effects;
  - the analysis of the effects of future projects and physical activities must include a comparison of possible future scenarios with and without the project, and must reflect the full range of cumulative effects and not just the project's contribution;
  - the effects of past and existing projects and physical activities can be used to put the current state of the VC into context, but must be included in the cumulative effects analysis;
  - cumulative effects for the same VC may need to be assessed using a hierarchy, e.g., effects on local populations of certain species and on the larger populations; and
  - the potential for disproportionate cumulative effects for diverse population groups as per GBA Plus.
- describe technically and economically feasible mitigation proposed for cumulative environmental, health, social and economic effects, as well as potential impacts on Indigenous Peoples and their rights, including:
  - an assessment of the effectiveness of the measures proposed to mitigate the cumulative effects, and

- in cases where measures to mitigate these effects are beyond the control of the proponent, identify any parties that have the authority to act on these measures. In such cases, the Impact Statement must summarize any commitments by the other parties regarding implementation of the necessary measures and any associated communication plans;
  - assess the regional implications of applying project-specific mitigation and enhancement measures, taking into account any reasonably foreseeable development in the area;
  - develop a follow-up program to verify the accuracy of the assessment and the effectiveness of mitigation measures for cumulative effects (see section 16 Follow-up programs);

The cumulative effects assessment must include consideration of cumulative effects in relation to the ability of Indigenous Peoples to exercise their rights and culture and must take into account the views and preferences of each Indigenous Nation and community in carrying out and presenting the assessment. Both the content and means of presenting this information is to be developed in consultation with each potentially impacted Indigenous Nations and communities. Where provided with information, the proponent must also document the lived and told experience of the changes in relation to the ability of Indigenous Peoples to exercise their rights and culture through time in collaboration with Indigenous Nations and communities. If Indigenous Nations and communities do not wish to participate in the cumulative effects assessment, the proponent should continue sharing information and analyses with the Indigenous Nations and communities, to use publicly available sources of information to support the assessment, and to document their efforts in that respect.

The Government of Canada has developed the Open Science and Data Platform as a means to access science, data, publications and information about development activities to better understand cumulative effects. Proponents are encouraged to make use of this resource in their cumulative effects analysis.

7.8 Extent to which adverse federal effects are significant

For adverse effects within federal jurisdiction and direct or incidental adverse effects, the Impact Statement must:

- characterize adverse residual effects and cumulative effects, using criteria and language most appropriate for the effect;
- consider using the following criteria, as appropriate:
  - magnitude,
  - geographic extent,
  - timing,
  - duration,
  - frequency,
  - reversibility, and
  - uncertainty;

- the environmental, health, social and economic context within which likely effects may occur should be described and applied as part of the key criteria above, for example:
  - the sensitivity and importance of affected aquatic and terrestrial species, including species at risk and species of importance for Indigenous Peoples,
  - the sensitivity and importance of affected habitats and their functions for wildlife,
  - the existence of standards, guidelines, tolerance levels and other sources of information to assess effects, and
  - the potential for disproportionate residual effects for diverse population groups as per GBA Plus;
- characterize the extent to which the residual adverse effects within federal jurisdiction and the residual direct or incidental adverse effects are significant;
- characterize the extent to which the cumulative adverse effects within federal jurisdiction, and cumulative direct or incidental adverse effects, are significant;
- describe how the probability or likelihood of that effect occurring and the degree of scientific uncertainty related to the data and methods used in the effect assessment, where considered in characterizing the extent of significance;
- indicate, among the residual and cumulative adverse effects within federal jurisdiction and direct or incidental adverse effects, those that are likely to be, to some extent, significant;
- justify the methodology and choice of quantitative or qualitative criteria used to determine the extent to which the residual and cumulative effects are significant; and
- identify and explain relevant sources of information that were used to characterize the extent to which residual and cumulative effects are significant, including how the perspectives, concerns and tolerance levels of Indigenous Nations and communities and other participants were considered.

The information provided must be clear and sufficient to enable IAAC, the CNSC and the review panel, Indigenous Nations and communities, and participants to evaluate the proponent's characterization of the extent of significance of adverse residual effects within federal jurisdiction and of direct and incidental adverse effects.

Criteria and relevant benchmarks should be defined and applied with Indigenous Nations and communities, including but not limited to the description of effects on Indigenous Peoples. Criteria may include those identified in Guidance: Assessment of Potential Impacts on the Rights of Indigenous Peoples and other relevant criteria proposed by an Indigenous Nation or community. These criteria should be applied to determine the extent to which adverse effects on Indigenous Peoples are significant.

The best practices described in IAAC's technical guidance document for Describing effects and characterizing extent of significance may be considered for the characterization of residual effects as applicable.

7.9 General Criteria for Site Evaluation

A detailed and methodical site evaluation, using a graded approach commensurate with the risks posed by the proposed reactor facility, is essential in preparing site mitigation strategies (including emergency response plans) that will adequately protect the facility personnel, the public and the environment from the effects of nuclear and hazardous substances arising from licensed activities. The Impact Statement must be prepared in a manner to demonstrate the following requirements have been met, which has further been integrated in the requirements of section 11 Security Considerations and 13 Effects of the Environment on the Project.

7.9.1 Requirements for site evaluation

Site evaluation must take into account all phases of the facility lifecycle, from site preparation to abandonment. The proponent must:

- use a documented, systematic process for site evaluation (including site characterization);
- consider the synergy of multiple simultaneous events (e.g., combinations of external hazards, reactor facility events including beyond-design-basis events and severe accidents, and multiple effects of different activities on the site);
- ensure that the site is evaluated at a level sufficient to confirm the suitability of the site for the activity;
- document the methodology used to determine the suitability of the site over the full lifecycle of the proposed facility;
  - demonstrate how facility decommissioning at the end of the project is being considered in the overall lifecycle of the nuclear facility;
  - consider the ease with which the proposed facility can be decommissioned; that is, the facility is designed to be readily dismantled and disposed of in a fashion that minimizes environmental effects;
  - take into account proximity and transport considerations to recycling, waste storage and disposal infrastructure; and
- document the processes used to manage the quality of work during site evaluation and the activities that verify compliance.

For analysis of external hazards, the proponent must consider both design-basis events and beyond-design-basis events. In particular, the proponent must consider the concept of potential cliff-edge effects when analyzing external hazards, where a small change of conditions may lead to a catastrophic increase in the severity of consequences.

For reactor facilities, the proponent must analyze external hazards at the site evaluation stage, to confirm that the reactor facility will withstand such events.

Evaluation of the suitability of a site for the construction and operation of a nuclear facility must address the following considerations:

- population density, population distribution and other characteristics of the emergency planning zone that may have an effect on the implementation of emergency response measures and the need to evaluate the risks to individuals and the general population;
- the technical basis for the safety and security analysis issues that will be included in the licence application (particularly important for the LTPS), including the range of technologies being considered and the estimated total power for the reactor facility;
- categorization and assessment of the characteristics of the natural and human environment in the region that may be affected by potential radiological or conventional effects associated with site preparation and construction, operational states, and accident conditions;
- predictions about the evolution of the natural and human environment in the region, particularly population growth and distribution, which may have a bearing on safety and security throughout the projected lifecycle of the reactor facility;
- storage and transport of input and output materials – such as fresh and spent fuel, and radioactive waste;
- information about non-radiological effects due to chemical or thermal releases, or other site activities such as damage to aquatic organisms from entrainment into cooling water intakes, or physical disruption of landscape and shoreline from site development, and the potential for explosion and the dispersion of chemical products;
- as far as practicable, information about the potential for interactions between nuclear and conventional effluents, such as the combination of heat or chemicals with radioactive material in liquid effluents;
- predictions about the reactor facility's effects on the population, including those that could lead to emergency conditions, with due consideration of relevant factors (e.g., population distribution, use of land and water, radiological effect of any other releases of radioactive material in the region);
- hazards associated with natural and human-induced external events, including future alterations of magnitude and frequency due to effects of climate change; and
- evaluation against safety goals.

In evaluating the site, the proponent must also take into account the combined radiological and conventional effects of the site and the reactor facility on each other during normal and abnormal situations, based on both temporal (lifecycle) and spatial (regional, local and site) considerations.

Guidance

The proponent should provide a high-level overview of alternate sites considered prior to selecting the proposed site, including a brief description of the degree and depth of site evaluation used to narrow down the final choice(s).

The proponent should describe how the characteristics of natural and human induced hazards, as well as the demographic, meteorological and hydrological conditions of relevance to the nuclear installation, will be monitored over the nuclear facility's lifecycle.

7.9.2 Evaluation against safety goals from a site perspective

The proponent must evaluate reactor facility designs against applicable safety goals, taking into account the characteristics of the site, the risks associated with external hazards (including any potential cliff-edge effects that may arise from small increases in the severity of external hazards), and the potential negative effect of the reactor facility on the environment. The evaluation must include the effects of multiple unit events and – where applicable – effects from events that may affect multiple units.

To support this evaluation, the proponent must provide a summary of the process by which the different nuclear reactor technologies being considered have been included in the site evaluation. Bounding approaches for site evaluation may be considered; however, bounding limits for a proposed facility must be based on credible information from designs being considered for that site.

For more information on safety goals related to quantitative and qualitative safety goals, see REGDOC-1.1.1, Appendix F – 2.1 Assessment of non-malevolent nuclear accidents and malfunctions and REGDOC. 2.5.2, Design of Reactor Facilities: Nuclear Power Plants[7].

7.9.3 Consideration of the evolution of natural and human-induced factors

The proponent must evaluate the evolution of natural and human-induced factors in the environment that may have a bearing on safety and security across a time period that encompasses the projected lifecycle of the reactor facility, with the understanding that different levels of evaluation and monitoring apply to the various phases of the reactor facility's lifecycle.

For more information, see sections 11 Security Considerations and 13 Effects of the Environment on the Project.

7.9.4 Evaluation of hazards associated with external events

The proponent must examine the site with regard to the frequency and severity of external natural and human-induced events that could affect the safety and security of the reactor facility. The analysis must

[7] CNSC, REGDOC-2.5.2, Design of Reactor Facilities: Nuclear Power Plants, Ottawa, Canada, 2014

include an examination of potential cliff-edge effects that may arise from small increases in the severity of events. This information provides a baseline for future assessments over the life of the facility.

The proponent must apply a systematic approach for identifying and assessing the hazards associated with external events. The approach (including the underlying rationale) must be developed, documented, and implemented in an auditable fashion.

The proponent must identify and assess each external natural and human-induced event with the following considerations:

- the potential direct and indirect effects of the event on the reactor facility structures, systems, and components (SSCs), including those that could affect the safe operation of the reactor facility in both normal and abnormal operating states:
  - direct effects (e.g., an earthquake resulting in a main steam line break), and
  - indirect effects (e.g., a corrosive gas release from a nearby chemical plant degrading reactor facility safety system trip circuits via ventilation intakes);
- the potential combined effects of external and human-induced events with normal and accidental releases from the reactor facility that would exceed environmental limits, or cause a significant adverse effect to occur; and
- effects of natural external and human-induced events – including consequential events (that is, events that arise as a consequence of an initiating event) or reasonable combinations of independent events – that could influence the ability to successfully implement emergency response plans.

Derivation of the hazards associated with external events must include consideration of the combined effects of these hazards with the ambient conditions (for example, simultaneous aircraft crash and heavy snowstorm). Combined effects of external hazards can have significant effects on such facets of the reactor facility as the implementation of emergency response plans, accident mitigation, and contaminant dispersion.

The region assessed for each identified external event must encompass the environment that could be affected.

The evaluation must consider foreseeable changes in land use for the projected lifecycle of the reactor facility, in order to assess and plan for mitigation of new external hazards introduced by changes in land use.

For more information, refer to section 11 Security Considerations.

Guidance

Site-specific data should be used to determine hazards, unless such data is unobtainable. In this case, data from similar regions that is sufficiently relevant to the region of interest, or data derived from appropriate and acceptable simulation techniques, may be used. Data from similar regions and from simulated findings may also be used to augment site-specific data.

Historic and instrumentally recorded information, and records of the identified external events and their severity, should be collected for the region and analyzed for reliability, accuracy, and completeness.

7.9.5 Determining the potential effect of the site on the environment

In describing potential effects of the site on the environment, the proponent must consider the synergy of multiple events. Some examples of such events are:

- those that affect multiple units, including those leading to severe accidents;
- multiple effects of several different activities, such as simultaneous oil spill and fire; and
- spills of multiple chemicals and interactions thereof.

Contaminant (nuclear and hazardous substances) pathway modelling must incorporate atmospheric dispersion, surface water dispersion, and groundwater movement, as well as the associated abiotic and biotic environmental compartments.

Models used for dispersion and pathways analyses must include site-specific, local, and regional topographic features and characteristics of the reactor facility and take into account natural and human-induced events that may influence contaminant behaviour.

The pathways analyses must take specific environmental and site characteristics into account, with special attention paid to the function of the biosphere in the accumulation and transport of nuclear and hazardous substances.

To determine the potential contaminant effect on the environment, assessments of all releases must be made under normal and accident conditions for all phases of the reactor facility's lifecycle. This assessment must include an examination of potential releases from multiple unit events, or events affecting multiple units.

The proponent must complete bounding scenarios involving modelling of potential effects from maximum possible releases, in order to establish the outer boundaries or worst-case scenarios for the reactor facility. These bounding scenarios also contribute to the scenarios used for emergency planning.

Guidance

Assessments of releases or disturbances associated with normal or routine operations should be based on expected performance (e.g., average concentrations) and upper threshold bounding conditions, as well as possible pulse releases (high concentration with short exposure period) from anticipated operational occurrences.

The locations of the reactor facility and of the subsidiary structures on the site should be examined at a high level, with the assistance of environmental modelling. Such structures should be located so as to minimize potential effects on the public and on the environment (for example, emission or effluent release points, and air or water intake structures).

The proponent should identify reference areas that will be unexposed to project interactions but close enough to be similar to the special areas or activities. These reference areas are used to detect project effects relative to changes in background conditions. Reference areas should be sampled during baseline conditions to

establish the natural differences from exposure sites. The baseline should be characterized sufficiently to allow for a statistically significant assessment of project effects. Two or more reference areas should be identified, in order to characterize natural spatial variability in measured parameters as a "noise" factor to be accounted for when monitoring to detect project effects.

For more information, see IAEA Safety Standards Series No.NS-G-3.2, Dispersion of Radioactive Material in Air and Water and Consideration of Population Distribution in Site Evaluation for Nuclear Power Plants[8].

7.9.6 Population and emergency planning considerations

An exclusion zone is "a parcel of land within or surrounding a nuclear facility on which there is no permanent dwelling and over which a licensee has the legal authority to exercise control".

To support the achievement of safety objectives, the site evaluation must take the following population and emergency planning considerations into account:

- the planning basis as described in REGDOC-2.10.1, Nuclear Emergency Preparedness and Response, version 2;
- population density, characterization and distribution within the emergency planning zone, with particular focus on existing and projected population densities and distributions in the region including resident populations and transient populations (note: this data is to be kept up to date over the lifecycle of the reactor facility);
- present and future use of land and resources;
- physical site characteristics that could impede the development and implementation of emergency plans (e.g., the ability to deliver fuel in a timely manner to backup generators);
- populations, including vulnerable populations, in the vicinity of the reactor facility that are, or may become, difficult to evacuate or shelter (e.g., schools, prisons, hospitals); and
- ability to maintain population and land-use activities in the emergency planning zone at levels that will not impede implementation of the emergency response plans.

Before submitting the application for a LTPS, the proponent must confirm with the surrounding municipalities and the affected provinces, territories, foreign states, and neighbouring countries that the implementation of

[8] IAEA, Safety Standards Series No.NS-G-3.2, Dispersion of Radioactive Material in Air and Water and Consideration of Population Distribution in Site Evaluation for Nuclear Power Plants, Vienna, Austria, 2002

their respective emergency plans and related protective actions will accommodate the lifecycle of the proposed project. Discussions around early plans must include consideration of the following:

- onsite response, including the capacity to bring offsite equipment onsite;
- ability of offsite licensee staff to communicate with and access the site during a catastrophic event;
- offsite response, and how it is coordinated between the licensee and federal, provincial and municipal government agencies playing a role in emergency preparedness and response;
- how the licensee will coordinate with regulatory bodies;
- how the licensee will respond and coordinate with emergency service providers (fire department, ambulance, hospital, fuel, food, and so on);

The proponent must document the strategy and process for effective two-way ongoing consultation with emergency management agencies affected by site operations throughout the project's lifecycle. Emergency management agencies include security agencies involved in the development of the site selection threat risk assessment report.

Guidance

Because of the time required for this task, the proponent should initiate these discussions during the early stages of site evaluation. The CNSC expects these agreements to be in place before granting a LTPS.

The emergency planning zones are established by the province or territory and are under control of the region or municipality. These zones cover the area beyond the exclusion zone that should be considered with respect to implementing emergency measures.

7.9.7 Consideration of future life-extension activities

Where appropriate, the proponent must consider the potential effects of longer service life[9], power uprate[10] activities, and modifications to accommodate additional or modified uses, including:

- any proposed longer period of service life for the reactor facility;

[9] Life extension involves the replacement or refurbishment of major components, or substantial modifications to the plant, or both.

[10] Anticipated power uprate projects aim to increase the reactor facility's output capacity by using design margins and future operating efficiencies and experience. Power uprate projects may also require plant modernization activities, in order to maintain compliance with the NSCA and associated regulations.

- additional conventional and nuclear waste generated, as well as estimated resulting effects on handling, transport, and storage of waste;
- effects of external and human induced events on the life extension, power uprate or modification activities; and
- effects on security and emergency planning;

8 Biophysical Environment

8.1 Meteorological environment

The Impact Statement must:

- describe the local and regional climate, in sufficient detail to highlight weather variations and characteristics of the regions affected by project activities and components, including historical records of relevant meteorological information.
  - five years of meteorological data should be used. Site-specific meteorological data may be used if it covers the most recent five-year period. The proponent should verify that the data covering the most recent one-year period is representative of the conditions at the site. If the data is not representative, then the five-year average data should be used;
  - the regional and local meteorological data should be appropriate as bases for:
    - evaluation of potential changes in normal and extreme values;
    - severe weather phenomena;
    - assessing effects on air quality from the project, from site preparation to abandonment; and
    - assessing the effects on design and siting of the reactor facility and its heat dissipation system.
- provide summary data and the reference to underlying data source, including unique weather station identifiers for:
  - monthly mean, maximum and minimum temperatures,
  - monthly mean, maximum and minimum precipitation,
  - typical wind speed and direction; and
  - standard and reliable meteorological measurement to provide estimates of evaporation (e.g., using the Penman, Morton or Meyer Methods) or of evapotranspiration;
- identify the locations of all meteorological and air quality data collection stations on an appropriately sized topographical map and include a justification of their locations;
- describe the location of onsite meteorological stations and other local sources of meteorological data with respect to local topographic characteristics that could affect:
  - local airflow patterns (for example, local circulation conditions, such as “drainage flow”), and

  - if the site is located close to a lake, information about land-lake interactions;
  - provide reference to sources (and unique weather station identifiers) for hourly meteorological data (wind speed and direction, air temperature, dew point temperature or humidity, air pressure, precipitation data, and solar radiation) from a minimum of one year to support dispersion modelling that captures the normal variability of meteorological conditions;
- include information about climatic parameters as compared against references, including for air masses, general airflow, pressure patterns, and frontal systems;
- describe the influence of climate change on the local and regional climate and on the risks of extreme weather events.

The baseline information should address the criteria contained in the following documents:

- NS-G-3.2, Dispersion of Radioactive Material in Air and Water and Consideration of Population Distribution in Site Evaluation for Nuclear Power Plants; and
- SSG-18, Meteorological and Hydrological Hazards in Site Evaluation for Nuclear Installations;

8.2 Geology, geochemistry and geological hazards

8.2.1 Baseline conditions

The Impact Statement must:

- describe the geomorphology, topography and geotechnical characteristics of areas proposed for construction of major project components, including the presence, distribution and classification (e.g., discontinuous, sporadic, isolated) of, if applicable;
- describe the stability of the foundation material under dynamic, static, and seismic loading, with a detailed description of surface and subsurface conditions (including hydrogeochemical effects) to be incorporated into a geotechnical investigation program for the purposes of hazard determination and mitigation;
- analyze underground instability (rock falls and underground collapses) and groundwater inflow using site-specific geotechnical and hydrogeological data to assess the potential risks;
- describe any potential site instability, such as collapse, subsidence, surface uplift, and liquefaction of the subsurface materials and the backfill materials;
- present a 3-dimensional numerical geological model developed for the site, local, and regional study areas based on the conceptual model of the geological environment;
  - include cross sections through the 3-dimensional models showing the geological units, unit thicknesses, and structural information;
  - state limitations and assumptions in the modelling approach, including calibration methods, model validation and accuracy;

  - calibrate the numerical model to baseline geological conditions using groundwater level and stream flow monitoring data and provide metrics and graphs describing the quality of the calibration that was achieved and discuss how spatial variability is considered in model calibration;
  - analyse the sensitivity of key model outputs to hydraulic properties and climatic parameters such as recharge;
- describe the geology of the surface, bedrock and unconsolidated sediments for the project, including a table of geological descriptions, geological maps and cross-sections at appropriate local and regional scale(s).
- describe the geological history of the site, local, and regional study areas including information on bedrock lithology and stratigraphy;
- include relative and absolute age information, where available, based on published government reports or journal articles;
- describe the geotechnical and mechanical properties of the rocks and overburden, including shear strength and liquefaction potential;
- identify and describe any geological hazards that exist in the areas planned for the project facilities and infrastructure, including:
  - history of natural or induced seismic activity in the area, and secondary effects such as the risk of seismic generated landslides and liquefaction;
  - evidence of active faults;
  - structural geology and tectonic setting;
  - an assessment of whether a fault or any part of a fault is capable, on the basis of geological, geophysical, geodetic, or seismological data (including paleoseismological, geomorphological data, etc.);
  - isostatic rise or subsidence; and
  - history of landslides, slope erosion and the potential for ground and rock instability/landslides, and subsidence during and following project activities;
- for structures such as faults, lineaments and arches, assess their seismogenic potential and their potential to constitute preferential groundwater flow paths, with a description of their tectonic setting;
- describe the seismotectonics for the region, using geophysical data and information on geotechnical hazards;
- prepare a site-specific seismic hazard assessment, including a paleoseismic investigation and probabilistic seismic hazard analysis to develop ground motion response spectra, for the final selected site to be referenced in the LTPS application;
  - conduct the assessment in accordance with CSA N289.2, Ground motion determination for seismic qualification of nuclear power plants;
- identify on geological maps the location of areas of bedrock outcrops that will require blasting;
- map both active and inactive structural geological features using 2-dimensional and 3-dimensional models;

- include data from in-situ investigations, including maps of borehole locations and their positions relative to the project;
- for data obtained with in-situ investigations, indicate the location of the boreholes on maps and cross-sections with their positions relative to the planned facility shown;
- include all available information (both recorded and those available from geoscientific studies and historical accounts) on volcanic activity that has occurred in the region;
  - include characteristics of potential volcanic events, such as tectonic setting, type of volcanism and nature of material produced during eruption including volatile gas emissions;
- provide a characterization of instabilities caused by historic industrial activities, including any ongoing mining, hydrocarbon extraction, and wastewater disposal activities; and
- provide a characterization of the geochemical composition of materials to be excavated.

The baseline information should address the criteria contained in the following documents:

- REGDOC. 1.1.1 – sections 3.5.5, 3.5.6, appendices C.3.4 and C.3.5
- REGDOC.-2.9.1, Environmental Protection: Environmental Principles, Assessments and Protection Measures, Version 2 – section B.4.1 Geology
- NRC Regulations (10 CFR), Appendix A to Part 100 – Seismic and Geologic Siting Criteria for Nuclear Power Plants
- CSA N289.2, Ground motion determination for seismic qualification of nuclear power plants
- CSA N289.3, Design procedures for seismic qualification of nuclear power plants
- IAEA NS-G-3.6, Geotechnical Aspects of Site Evaluation and Foundations for Nuclear Power Plants; and
- IAEA NS-R-3(Rev1), Site Evaluation for Nuclear Installations;

8.2.2 Effects to geology, geochemistry and geological hazards

The Impact Statement must:

- describe the effects of the project on geology, geochemistry and geological hazards;
- assess settlements (magnitude and rate) of foundations and foundation soils caused by large surface loadings and underground water drainage, using project-specific data;
- analyze differential settlement and soil distortion as required to assess their potential effects on the nuclear facility;

8.3 Topography, soil and sediment

8.3.1 Baseline conditions

The Impact Statement must:

- describe the terrain, soils and sediments within the LSAs and RSAs, including sediment soil types and stratigraphy. Provide surficial geology maps and cross-sections of appropriate scale;
- describe soil characteristics that are most likely to influence future assessments and which are required for modelling purposes, including pH, soil bulk density, soil moisture content;
- provide the geotechnical properties of the soil units, such as index properties, shear strength, deformation characteristics, and liquefaction potential;
- provide dynamic properties (such as shear wave velocities, damping ratio, shear modulus) to be used in soil response and soil-structure interaction analyses;
- describe and map landforms associated with important wildlife habitat features including elevated land forms, eskers, ridges, cliffs, rock outcrops, exposed bedrock, talus and other karst topography caves;
- provide a description and location of any erosion-sensitive soils, predicted rates of erosion, and areas of ground instability;
- identify possible mechanisms for erosion in the vicinity of the proposed facility and include both natural (such as high river levels) and human-induced (engineering structures along the shore, dams on contributing rivers, and so on);
- provide estimates of the rate(s) of erosion of shores or riverbanks on or near the site;
- estimates should be conducted for the average long term and also for the historical occurrence of unusual events for example, high river levels;
- provide maps depicting soil depth by horizon and soil order within the project area to support soil salvage and reclamation efforts, and to outline potential for soil erosion;
- describe the suitability of topsoil and overburden for use in the reclamation of disturbed areas including an assessment of the acid generating potential of overburden to be used;
- for agricultural lands or forested lands with agricultural capability, describe:
  - the soil classification, including the order, group, family, series and type of soil prior to construction, and quantify the soil classification,
  - the productivity of land and the type of agricultural resource,
  - the soil types in the study areas highly susceptible to wind and erosion, soil compaction and loss of structure and tilth,
  - any other soil types needing specific management, and
  - soil conservation and protection measures;
- describe the historical land use and the potential for contamination of soils and sediments;
- describe any known or suspected soil or sediment contamination with the study areas that could be re-suspended, released or otherwise disturbed as a result of the project;

- describe erosion mechanisms and predicted rates;
- describe baseline concentrations for relevant contaminants in relation to applicable guidelines for soil quality; and
- identify areas or ecosystems that are sensitive or vulnerable to acidification resulting from the deposition of atmospheric contaminants, including radionuclides.
- describe permafrost conditions including distribution of frozen and unfrozen ground, thermal conditions (ground temperatures), ground ice, thaw sensitivity and active layer thickness, if applicable;
- describe the interactions between permafrost, surface water and groundwater, and topography, as well as rock fractures and talik zones between different surface-groundwaters, if applicable; and
- describe the potential for thaw settlement and terrain instability associated with ground thawing in permafrost areas, if applicable.

The baseline information should address the criteria contained in the following documents:

- CSA N288.4, Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills;
- Soil Quality Criteria Relative to Disturbance and Reclamation (Revised 2004) prepared by the Soil Quality Criteria Working Group, Soil Reclamation Subcommittee (Alberta Agriculture);
- A Soil Mapping System for Canada: Revised prepared by the Mapping System Working Group (Agriculture Canada); and,
- additional federal and provincial guidelines, for example, the Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health.

8.3.2 Effects to topography, soil and sediment

The Impact Statement must describe all effects of the project on topography, soil and sediment including:

- potential and likelihood of problematic erosion from movement or redistribution of soil and overburden, vegetation clearing, and watercourse diversions;
- potential and likelihood of re-suspended, releasing or otherwise disturbing known or suspected soil or sediment contamination; and
- effects of the project on erosion.

8.4 Ambient radioactivity

8.4.1 Baseline conditions

The Impact Statement must:

- describe the ambient radiological conditions at the project site and within the LSA and RSA by providing information on existing conditions including an inventory of sources, activity levels and origin for all environmental components including air, soil, food, water, aquatic sediments, plant and animal tissue (see section 7.2 Baseline methodology).
- describe human and non-human biota exposed to ambient radioactivity, including information on radiation levels to which workers and members of the public are exposed;
- describe current radiological monitoring, management programs and any special studies, including detailed results from these programs.

8.4.2 Changes to radiological conditions

For all phases of the project and all applicable VCs the Impact Statement must:

- describe changes to radiation and radioactivity present in the terrestrial and aquatic environment, the atmosphere, and to workers or nearby communities; and
- document plans and strategies for characterizing effects of the project related to the release of radionuclides to the environment, including:
  - details pertaining to sampling media and indicator species, measured parameters, sampling methodologies, locations, and frequencies; and
  - the use of detailed maps to present this information with sampling locations.

Additional guidance that should be referenced to support the effects assessment and associated follow up include:

- Priority Substances List Assessment Report. Releases of radionuclides from nuclear facilities (impact on non-human biota).

The proponent should refer to Health Canada's Guidance for Evaluation Human Health Impacts in Impact Assessment: Radiological Impacts to ensure that it provides the information and analysis considered necessary to assess the project's impact on human health. The proponent should complete the checklists provided in these guides (Appendix A) to assist participants in verifying that the main elements have been completed and in identifying the location of this information in the Impact Statement.

8.5 Electromagnetism and corona discharge

The Impact Statement must:

- describe the levels of noise;
- describe ozone concentrations;

- describe electric field gradient and magnetic field strength expected at the edge of any transmission line right-of-way and maximum loading;
- describe predicted electromagnetic field levels;
- provide any relevant standards;
- identify the potential for electromagnetic interference with radio, television or other telecommunication signals and reception at maximum loading and describe the area potentially affected, the frequency and duration of occurrence and any applicable standards;
- describe potential induction effects to other infrastructure operators, and where applicable, describe any authorizations required and consultations with potentially affected infrastructure operators; and
- evaluate electromagnetic emitters in the region during operations, with respect to their potential to affect the safe operation of the reactor facility.

8.6 Atmospheric, acoustic and visual environment

8.6.1 Baseline conditions

The Impact Statement must:

- characterize the ambient air quality in the project area, LSAs and RSAs and identify existing emissions and contaminant sources;
  - include a description of the methods used to identify nuclear and hazardous substances that will be included in the baseline air quality characterization;
- provide baseline ambient air concentrations for contaminants, in particular near key receptors (e.g., communities, traditional land users, wildlife) and quantify emission sources for the following:
  - total particulate matter,
  - particulate matter less than 2.5 microns ($PM_{2.5}$),
  - particulate matter less than 10 microns (PM_{10}),
  - carbon monoxide (CO),
  - carbon dioxide (CO_2) (IPD Section 7.9.1 Atmospheric Emissions);
  - sulphur dioxide (SO_2),
  - nitrogen dioxide (NO_2) and nitrogen oxides (NOx),
  - ozone (O_3),
  - volatile organic compounds, individual or an appropriate subset,
  - polycyclic aromatic compounds, including polycyclic aromatic hydrocarbons (PAHs), alkylated PAHs, PAH transformation products, including nitro and oxy-PAHs, and dibenzothiophenes (DBTs),
  - diesel particulate matter;

- nuclear emissions including tritium oxide and tritium gas, carbon 14, noble gases, iodine-131, and particulates;
- hydrazine;
- morpholine;
- ammonia;

- compare ambient air quality results with applicable regional, provincial and federal standards. For air pollutants with standards, the comparison must use the same averaging period and the statistical format associated with each numerical value
  - standards include: Canadian Ambient Air Quality Standards, National Ambient Air Quality Objectives and relevant provincial standards. The proponent must refer to the new Canadian Ambient Air Quality Standards established by the Canadian Council of Ministers of the Environment (CCME) for $PM_{2.5}$, O_3, SO_2 and NO_2 for 2020 and 2025;
  - for complete hazardous substance analysis, volatile organic compounds (VOCs) are compared to ozone; to particulate matter related to total suspended particulates (TSP); to particulate matter<10µm (PM_{10}); and to particulate matter<2.5µm ($PM_{2.5}$). Sulphur dioxide (SO_2), nitrogen oxides (Nox) and carbon monoxide (CO) are included in the analysis;
- describe dust and acid deposition through either existing long-term or new monitoring data for a duration of a minimum of one year;
- describe the data collection methods and data source(s), including data validation and quality control methods;
- identify and address issues related to the quality of the monitoring data and seasonal variability in the baseline survey and determine ambient contaminant concentrations using complete, exhaustive and representative monitoring data, collected over an appropriate duration and geographic scope;
- if modelling is undertaken to understand baseline ambient air quality, then describe direct and indirect sources of baseline air emissions, including mobile, stationary and fugitive;
- describe existing radon gas conditions;
- provide current ambient noise levels at key receptor points (e.g., communities, traditional land users, sensitive human receptors and wildlife), including the results of a baseline ambient noise survey and permissible noise levels for each receptor. The information on usual noise sources (natural or anthropogenic), their geographic extent and temporal variations must be included. At the time of collecting baseline data for the study on ambient noise where there are human receptors, it is recommended that the following aspects be considered:
  - natural sounds,
  - soundscapes (see ISO 12913-1:2014. Acoustics — Soundscape — Part 1: Definition and conceptual framework),
  - expectations regarding quiet conditions in specific places or at specific times,
  - usual sleeping hours (the default assumption is 10 p.m. to 7 a.m.), and
  - degree of baseline annoyance attributable to existing noise sources (e.g., vehicle traffic, aircraft, other industrial noise);

- justify the selection of and provide information on all noise sensitive receptors in the study areas, including any foreseeable potential receptor and the distance between the receptors and the project;
- provide current underwater soundscape and vibration sources, including those offshore in the study areas and at the project site, based on acoustic measurements. Provide information on vibration and sound sources, geographic extent and spatial and temporal variations within the water column and at the seafloor;
- describe existing ambient night-time light levels at the project site and at any other areas where project activities could have an effect on light levels;
- describe night-time illumination levels during different weather conditions and seasons; and
- describe landscapes of interest, visual screens and other components of the visual environment, and locate them on maps.

For additional guidance, see Appendix 1 – Guidance for biophysical components of the Tailored Impact Statement Guidelines Template..

8.6.2 Effects to the atmospheric, acoustic, and visual environment

The Impact Statement must describe the effects of the project on the atmospheric, acoustic and visual environment, including:

- provide a detailed description of emission sources of air pollutants from the project listed under section 8.6.1 Baseline conditions:
- provide detailed methodology and assumptions used to estimate emissions of air pollutants released, including:
  - provide and reference all relevant emission factors,
  - for all applicable emission sources, include the assumed tier of emission standard for each emission factor applied, and
  - provide details of the achievement of emission standards for all mobile and stationary engines used in the project;
- use atmospheric dispersion modelling to predict the fate of emissions resulting from project-related sources and provide appropriately scaled contour map(s) plotting the predicted emissions (see Appendix 1 Guidance for biophysical components of the Tailored Impact Statement Guidelines Template for guidance on dispersion modelling):
  - determine whether the formation of secondary pollutants (pollutants which are not directly emitted but form when other primary pollutants react in the atmosphere) resulting from the project under assessment has the potential to raise concentrations above baseline levels – if so, identify and characterize these pollutants;

- provide the rationale for the choice of air quality model, including the type and magnitude of emissions, the complexity of sources, terrain and meteorology, or for why modelling is not being used to predict fate of air emissions.
    - If used, models for dispersion and pathways analyses must include site-specific, local, and regional topographic features and characteristics of the reactor facility, and take into account natural and human-induced events that may influence contaminant behaviour;
- provide justification for all control efficiencies used to reduce emission rates of sources within the model, including details of all assumptions associated with the related mitigation, and their achievability;
- assess the uncertainty in the modeled air pollutant concentrations using relevant range of model inputs. All sources of uncertainty should be taken into account, including:
    - model uncertainty, including a consideration for how uncertainty in modeled predictions may vary spatially and temporally, and
    - uncertainty in baseline concentration estimates, in the estimates of meteorological inputs, and in estimates of source emissions (from sources attributable to the project, and externally);
- conduct a source contribution analysis to assess the relative contributions of project and non-project emission sources on pollutant concentrations at key receptors. The source contribution analysis should be conducted for all pollutants that exceed 10% of the relevant guidance or standard value. Emission sources should be grouped into appropriate categories;
- assess effects to receiving environment through:
    - comparison with ambient standards, including the Canadian Ambient Air Quality Standards . The assessment should be based on the principles of “keeping clean areas clean” and continuous improvement, and in the context of air sheds and air zones with the Air Quality Management System,
    - comparison with critical thresholds (consider current, historical loadings, buffering capacity, including Acid Deposition Critical Loads),
    - comparison with sensitive ecological receptors or VCs in the aquatic and terrestrial environment (consider effects thresholds of species in question), and
    - comparison to other appropriate existing guidelines, objectives or standards, where relevant. This includes regional and community-based air quality guidelines;
- describe changes in ambient vibration and sound levels, including frequency and timing, resulting from the project at potential receptor locations, including changes in the perception of non-anthropogenic sounds and the predicted area of influence of project acoustic effects including from:
    - blasting;
    - increased road transportation;
    - rail transportation, if applicable; and
    - operation of various engines, motors, and equipment, if applicable;
- provide a vibration and sound impact assessment for the construction phase, including an overview of the expressed concerns;

- for project activities that result or may result in an increase in sounds emissions during any phase of the project:
  - quantify sound levels at appropriate distances from any project facility and activities and describe the timing, frequency, duration and character of sound,
  - provide the hourly distribution of baseline night-time sound events compared to the individual nighttime sound events expected at each receptor location;
  - describe the locations and characteristics of sensitive receptors, including species at risk;
  - describe consultation with Indigenous Nations and communities, the public, federal authorities, and interested parties including landowners about potential effects to the acoustic environment, and
  - identify and justify the approach to determine the extent to which sound effects resulting from the project are adverse;
- provide a description of any changes in nighttime light levels resulting from the project:
  - quantify light levels at appropriate distances from any project facilities, including the timing (e.g., night hours), frequency, duration, distribution and character of light emissions,
  - describe the locations and characteristics of the most sensitive receptors, including species at risk and areas favoured by Indigenous Peoples for the practice of traditional activities, and
  - describe engagement activities and, where appropriate, provide a record of engagement with Indigenous Nations and communities, the public, federal authorities, and interested parties including landowners regarding potential effects on the visual environment; and
- describe any positive changes.

The proponent should refer to Health Canada's Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise and Guidance for Evaluating Human Health Impacts in Environmental Assessment: Air Quality to ensure that it provides the information and analysis considered necessary to assess the project's impacts on human health in relation to changes to the sound environment and air quality. It is requested that the proponent complete the checklists provided in these guides (Appendix B in the noise guide and Appendix A in the air quality guide) to assist participants in verifying that the main elements of a noise or air quality impact assessment have been completed and in identifying the location of this information in the Impact Statement. These checklists will facilitate the review of the Impact Statement and will be particularly useful if analyses on these aspects are found in several sections of the Impact Statement.

The proponent should consult with the Alberta Ambient Air Quality Objectives and Guidelines (2024) and Air Monitoring Directive (revised 2016) prepared by the Alberta Ministry of Environment and Protected Areas, at a minimum to support the development of a monitoring plan but ultimately the most conservative source should be used.

8.6.3 Mitigation and enhancement measures

The Impact Statement must:

- describe all methods and practices to be deployed to reduce and control emissions. If the best available technologies are not included in the project design, the proponent should provide a rationale for the technologies selected;
- document and justify how the contaminant emission reduction efficiencies were applied in the calculation of emission rates, including details of all assumptions associated with these mitigation and their feasibility;
- document the evaluation of the proposed methodology for environmental effects monitoring, including projected minimum detectable critical effect size (spatial area where air concentrations may surpass background concentrations or the applicable provincial or federal air quality guidelines), and the confidence associated with the design of the monitoring and baseline data;
- provide a description of existing and planned measures to reduce odours and dust, including a description of improvements to existing infrastructure, as applicable;
- provide a description of participation in national or regional air emission tracking and reporting programs (e.g., National Pollutant Release Inventory) or provide rationale why participation is not required;
- describe the implementation of strategies compliant with regional and national commitments, such as the CCME's commitment regarding pollution prevention;
- provide a description of any ambient air quality monitoring to be implemented to verify the predictions of the modelling results and to confirm the effectiveness of the mitigation;
- provide a noise management plan, including identification of the noise sources, noise mitigation, the performance efficiency of the noise control devices, the best practices programs and the continuous improvement programs, and establish the need for follow-up monitoring for the purposes of validation of the model or due to any concern raised by participants; and
- provide a lighting management plan, including the planning and management of lighting and of the ambient light for every activity site and the consideration of measures for the reduction of excessive light during construction and operation. Consider the following options of measures for lighting management:
  - avoid or minimize the use of artificial light,
  - select low-intensity lighting,
  - use lighting fixtures that limit or concentrate the lighting to targeted areas and avoid light spilling out of the spaces to be illuminated,
  - limit the projection of light toward the sky by using fixtures that produce dark, uniform lighting that meets actual lighting needs,
  - avoid the emission of light at more than 90 degrees from the nadir; and,
  - avoid lights that emit blue/green/white/ultraviolet wavelengths.

8.7 Groundwater and surface water

8.7.1 Baseline conditions

The Impact Statement must:

- describe the hydrographic and hydro-climatic context of the project site (e.g., climate patterns);
- identify the hydrologic network, including but not limited to the watershed delineation, stream courses identification and mapping;
- provide a characterization of groundwater resources potentially affected by the project;
- describe the local monitoring program and hydrologic data collection;
- quantify the existing surface water conditions, including the full range of seasonal and inter-annual variations, (including variations in inflows, outflows, water surface elevations, net loss, including evaporation and seepage and storage volumes and retention time), ice cover and snow regime. This may be based on data from on-site gauging stations or from reference regional gauging stations;
- identify and describe the waterbodies and water resources potentially affected by the project;
  - for each major stream, the following information should be included in the description: flood frequency distributions including dam failures and flood control measures, historical drought stages and discharges by month, and the seven-day once-in-10 years low flow;
  - If the project is on a river, the description should include the size, location, and elevation of outlets, and elevation-area-capacity curves;
- annual yield and dependability;
- identify surface-water bodies that could affect the project's water supply and effluent;
- describe the water requirements for project construction, operation, decommissioning and closure, including estimate of quantities needed for the safe operation of the project;
- describe the adequacy of water supply to the site, include consideration of:
  - surface and groundwater resources;
  - quantity and quality of water supply;
  - reliability and availability of supply;
  - effects of debris and fouling;
  - additional water requirements for emergency cooling or process needs;
  - effects on contaminant transportation;
  - effects of fluctuations in water temperature that could affect heatsinks;
  - effects on firefighting capability;
- for any water body that could affect the facility's water supply and effluent discharge used by the project, provide information about maximum, average maximum, average, average minimum, and minimum monthly temperature and monthly flow of the water bodies;
- describe the design-basis flood (DBF) elevation, derivation, and discharge, if applicable

- screen baseline surface water quality data against recognized water quality guidelines such as the Canadian Environmental Quality Guidelines;
  - contaminants associated with historical, current, or proposed site activities should from the basis for the baseline monitoring program.
  - if federal or provincial standards or guidelines are not available or where natural background as documented in an appropriate baseline study demonstrates the water quality standards or guidelines are not applicable, benchmarks from the peer-reviewed scientific literature may be used with appropriate rationale. Site-specific water quality objectives may be developed with the support of the scientific literature and the application of the procedures for deriving numerical water quality objectives as documented in the Canadian Environmental Quality Guidelines;
- provide complete hydrometeorological information (temperature, precipitation, evapotranspiration), based on data from nearby weather stations or from a weather station on site
- describe and illustrate on one or more topographic maps, at appropriate scales, the drainage basins in relation to key project components. On the map(s), identify all waterbodies and watercourses, including intermittent streams, flood risk areas, wetlands, watershed and sub-watershed boundaries, and direction of flow;
  - show types of land use in drainage areas;
  - if applicable, indicate the intended locations of water crossing and watercourse diversions;
- provide a list of all waterbodies and watercourses (permanent, intermittent and ephemeral) that may be directly or indirectly affected by the project. Provide a table that groups waterbodies and watercourses by sub-watershed and provides the following information about each:
  - type of watercourse impacted (e.g., lotic or lentic system, lake, river, pond, temporary or permanent stream), and
  - size of the waterbodies and watercourses, as applicable (e.g., width at the ordinary high water mark, length or area);
- provide flow hydrographs and corresponding water levels for nearby streams and rivers showing the full range of seasonal and inter-annual variations; as well as seasonal baseflow:
  - hydrographs may be based on data from nearby gauging stations or from gauging stations on site, and
  - approach used should take into account the need to provide information for use in fish habitat characterization and effects assessment as guided by the Canadian Science Advisory Secretariat's Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada;
  - approach used should take into account the need to provide information for use in aquatic dispersion modelling for both groundwater and surface water;
- describe where river water level can affect the safe operation of the facility, the design basis maximum and minimum water levels, including how those levels were derived;
- provide stage hydrographs for waterbodies expected to be affected by the project, including the Peace River, showing the full range of seasonal and inter-annual water level variations, taking into consideration the upstream water management structures;

- describe waves (statistics of wave heights, run-up, and so on), if applicable, including:
  - where waves can affect the safe operation of the facility, information about the design basis wave conditions (including how those conditions were derived);
- provide information about current patterns:
  - including frequency distributions of current speed, direction, and persistence;
  - at the local and regional spatial scale; and
  - at the whole-water body spatial scale within a reasonable distance from the site;
- for each waterbody and watercourse potentially affected by the project, provide a description of ice cover, thickness and conditions and the timing of freeze-thaw cycles;
- provide for each waterbody potentially affected by the project, bathymetry, maximum and mean depths, vertical profile information, information on stratification and turnover, and sediment composition (e.g., particle size analysis and sediment quality);
- using traditional field and mapping techniques, provide a delineation and characterization of groundwater–surface water interactions, including an identification of groundwater-dependent ecosystems, wetlands, discharge and recharge areas that are potentially affected by the project
  - use this information to calibrate and verify numerical flow modelling;
- if applicable, describe permafrost conditions and taliks and their influence on groundwater–surface water interactions with consideration to potential for effects on surface water quality;
- develop a quantitative surface water balance for watersheds potentially affected by the project, for all phases of the project detailing water intake and outflow to the environment, including upstream and downstream of the zones of influence;
- describe the surface water, ground water and sediment quality baseline characterization program, including sampling site selection and locations, upstream, within the zone of influence of the project, and downstream monitoring duration and frequency, sampling methodology, and analytical protocol, including quality assurance and quality control measures
  - describe the incorporation of any applicable historical data or existing information, and
  - characterization program should include sampling locations within the project area, the LSAs and RSAs, and should include reference locations that are unlikely to be impacted by the project. Provide a detailed map that indicate the sampling locations;
- provide baseline data for relevant physicochemical parameters and chemical constituents for surface water, groundwater and sediment quality that are expected to change throughout the project lifecycle;
  - physicochemical parameters may include temperature, pH, electrical conductivity, dissolved oxygen, turbidity, total suspended solids, total hardness, total dissolved solids,
  - relevant chemical constituents may include major and minor ions, total and dissolved trace metals, radionuclides including radionuclide plumes, total mercury, methylmercury, polycyclic aromatic compounds, nutrients, organic and inorganic compounds, or other compounds of potential concern, and

    - water sample collection and analysis should use appropriately sensitive detection limits and the data should illustrate the seasonal and inter-annual variability in baseline surface water quality with sufficient years of baseline data to fully characterize natural variability, including possible variabilities due to groundwater–surface water interactions; and
    - screen baseline sediment quality data against Federal Sediment Quality Guidelines;
        - if an appropriate baseline study demonstrates that natural background exceeds the available standards or guidelines (or that none exist for the contaminants of potential concern (COPC) of interest), sediment quality benchmarks from the peer-reviewed scientific literature should be used with appropriate rationale;
- identify springs and any other potable surface water resources within the local and regional project areas and describe their current use, potential for future use;
- Identify other sources of water withdrawal (e.g., other projects or activities that have been or will be carried out) for the Peace River and tributaries, Wood Buffalo National Park and the Peace Athabasca Delta (PAD).
- identify domestic, communal or municipal water wells within the local and regional areas, and provide information on their depth, distance from the project, stratigraphy, screened hydrostratigraphic unit and piezometric level and capacity, and describe their current use, potential for future use;
- identify groundwater-producing strata (coarse-grained sediments and permeable bedrock) that may be affected by the project. Where current domestic, communal or municipal water wells access these strata, their distance from the project must also be marked and added to the map;
- provide a summary of key groundwater monitoring wells within the RSA used to inform the conceptual model, and identify their location, groundwater quality information and monitoring frequency. Provide representative hydrographs showing the range of seasonal and inter-annual water level variations and indicate any spatial variation in the RSA. Provide graphs illustrating historical analytical data for CPCs for selected wells. Trends in concentration should be interpreted and described;
- describe the hydrostratigraphic units (aquifers, aquitards, aquicludes) of the hydrogeological environment in both bedrock and overburden and provide a piezometric map showing heads and the direction of groundwater flow;
    - provide piezometric maps for each hydrostratisgraphic unit, and
    - include the thickness and area extent of each unit through appropriate tools such as isopach maps;
- describe the structural geology of the hydrogeological environment, including major faults, fracture density and orientation with respect to groundwater flow directions;
- describe the groundwater flow boundaries of the hydrogeological environment, including groundwater divides and boundaries with surface water;
- provide the method used and the hydraulic properties of the hydrostratigraphic units graphically, on maps, and in cross-sections in conjunction with water level and gradient information, including data on hydraulic conductivity, specific storage, transmissivity, storativity, saturated thickness, porosity,

estimated rates and directions of groundwater flow, the capture zones of wells and specific yield, as applicable;

- include any chemical or isotopic tracer data that provide constraints on fluid direction, flow velocity or mixing;
- provide hydrogeological maps and cross-sections, using the same scales and able to show important site features, of the study areas showing water table elevations, potentiometric contours, interpreted groundwater flow directions, groundwater divides and areas of recharge and discharge;
- provide lithological logs, cone penetrometer logs, borehole geophysical logs, surface geological mapping, surface geophysical surveys, and trench logs for hydrogeological cross-sections:
  - cross-sections must depict the interpretation of hydrostratigraphy and rationale for the interpretation must be provided. As additional monitoring or geological data are developed, cross-section interpretations should be updated, and the results of the data must be reported if they result in significant changes to conceptual models. Final drawings should be included with draft and ongoing remedial investigation reports
- provide site-specific structure contour maps that use the same scale(s) as groundwater. Contour intervals should be selected commensurate with the density and precision of the data; (REGDOC.. 1.1.1 - Appendix C5.4)
- present a conceptual model of the hydrogeological environment, including a discussion of geomorphic, hydrostratigraphic, hydrologic, climatic and anthropogenic controls on groundwater flow;
- amend maps (and include the amendment date) as additional monitoring or geological data are developed;
- present a conceptual model for the hydrological environment, as appropriate to describe baseline conditions for surface waters. The model should be developed to support the assessment of potential changes to water and sediment quantity and quality in rivers, streams, lakes, springs and wetlands, with input from regulators; and
- explain how baseline data were gathered, and modelling developed, at a scale and resolution that allows for the application of results about groundwater and surface water to the assessment of interrelated VCs, notably for fish, birds and other wildlife, their habitat and their health, human health as well as the current use of land and resources for traditional purposes.

8.7.2 Effects to groundwater and surface water

The Impact Statement must:

- describe the effects of the project on surface and ground water, including effects related to:
  - project use of surface water or groundwater resources,
  - changes to water flow or watercourse diversions, and
  - discharge of water, effluent, wastewaters or other substances to the environment;

  - potential downstream effects to water quality including in Wood Buffalo National Park, and the Peace-Athabasca Delta (PAD);
- describe how the effects of climate change are taken into account in the evaluation of the project effects;
- discuss changes to watersheds, including alignment and condition of waterbodies and watercourses (permanent, intermittent and ephemeral), including those created, removed or altered by the project;
- quantify the extent of hydrological changes that will result from disturbances to aquifers and surface water features, taking into account climate change. This includes changes to the quantity or timing of surface flow, water levels, ice thickness or extent, sediment input, and channel regime in watercourses, and water levels in affected waterbodies;
- present an integrated site water balance model incorporating surface and groundwater fluxes to or from all major project components, for all project phases. Include estimates of surface water runoff rates for major project components;
- indicate the groundwater and surface water withdrawal requirements during all phases and specify:
  - the timing, quantity and quality of water withdrawn from the environment (flow rates and annual volumes),
  - any treatment carried out on these waters (e.g., addition of a tracer), and
  - the conditions under which this water is released into the receiving environment;
- present key flow rates for all project components and water management structures, including inflow, outflow or surface run off from storage piles, dredge materials, and contaminated material storage;
- present a comprehensive site water management plan for the project's lifecycle, including for:
  - water inflows and outflows from project site;
  - water diversion;
  - process water management;
  - stormwater management;
  - water management within the project site; and
- describe the contaminants associated with the project, including radionuclides, their spatial and temporal locations and their potential flow paths (e.g., groundwater seepage pathways and how they relate to potential receptors such as drinking water sources. Characterize how they could affect surface and groundwater quality, including information on the source(s) of any contaminants, and their transport and fate in the hydraulic environment;
- demonstrate contaminant attenuation capacity empirically with field data and/or a numerical model (i.e., aquatic dispersion modelling. This model should also include a description of expected physical and geochemical reactions and transport mechanisms along flow paths (i.e., aqueous complexation, redox reactions, adsorption, ion exchange, colloidal transport, precipitation of solid phases, radioactive decay and ingrowth, advection, dispersion, diffusion) and how these were quantified or accounted for in the model.

- If used, models for dispersion and pathways analyses must include site-specific, local, and regional topographic features and characteristics of the reactor facility, and take into account natural and human-induced events that may influence contaminant behaviour

- describe the downgradient flow of groundwater affected by the project, with the use of figures showing groundwater piezometric contours, drawdown contours and particle tracking results;
- describe the contaminant attenuation capacity within the hydrogeological units in the project area. With this input, assess the potential for off-site groundwater and surface water contamination. Alternatively, the proponent may conservatively assume no attenuation capacity, but must still describe, in detail, potential degradation products that may result from attenuation and other processes during groundwater flow;
- describe the potential changes to surface water, groundwater or sediment quality related to the project including:
  - potential changes to surface water quality due to surface erosion and sedimentation, from the removal of vegetation and changes to riparian, wetland and terrestrial environments,
  - potential changes to surface water quality due to the generation and deposition of dust and particulate matter and any contaminants they contain (such as metals, mercury, methylmercury),
  - changes to surface water, groundwater and sediment quality due to all discharges and effluents from the project, including changes to physicochemical parameters (temperature, pH, salinity, dissolved oxygen), and relevant chemical constituents (major and minor ions, trace metals, radionuclides, nutrients, organic compounds),
  - changes to surface water from thermal plumes associated with nuclear power generating activities, including:
    - areas of influence (temperature, discharge jet) relative to intakes and known/suspected areas of VC-focused habitat use (spawning, rearing, nursery, feeding, wintering areas) and features (substrates, bathymetry, wetlands, aquatic plants);
    - descriptions of models (physical, mathematical, conceptual) used to predict temperature effects and thermal discharge jet effects, and to account for long-term effects of climate warming relative to incremental effects of the project;
    - descriptions of zones of influence of thermal plume temperature effect (greater than 1ºC above ambient) and physical discharge jet effect with maps and plots;
    - descriptions of how alongshore currents are changed by discharge plumes, including direction, speed and sediment transport (deflection, distance and entrainment time for passively drifting biota, such as eggs, larvae);
    - temperature predictions (mean, median, maximum and minimum) during critical life stage periods for potential VCs and plots of hourly maxima showing duration at peak temperatures;
    - contaminants released in the thermal discharge, and
    - compare any changes to surface or groundwater quality to applicable guidelines, objectives or standards;

- describe the quantity and quality of all effluent streams released from the site to the receiving environment, including effluent from treatment facilities, dewatering activities, seepage and surface run off from project components:
  - compare the quality of all effluent streams to applicable guidelines, objectives or standards to better identify possible adverse effects on the receiving environment;
- using the integrated chemical mass balance model, describe predicted worst, base and sensitivity case changes caused by project activities to surface water, groundwater and sediment quality in the receiving environment, for both physicochemical parameters and chemical constituents, including but not limited to:
  - watercourse and waterbody crossings, blasting, diversions, dewatering, water withdrawal, wastewater return, overflows from excavation, and surface runoff volumes and quality;
- compare the predicted worst, base and sensitivity case scenario changes to groundwater, surface and sediment quality to baseline and applicable guidelines, objectives or standards;
- provide an assessment for off-site migration pathways for impacted groundwater, and an analysis of contaminant attenuation capacities within the hydrogeological units of the project study area;
- describe locations at which potential changes to water or sediment quality will be assessed, including:
  - all point and diffuse sources of discharges,
  - immediate receiving environment for any point of diffuse sources of discharges from the project,
  - at outer boundary of mixing zone,
  - where the water quality from the immediate receiving environment begins to meet Water Quality Guidelines, or background levels for that contaminant,
  - at project boundary,
  - at LSA boundary, and
  - at RSA boundary;
- analyze and describe changes to surface and groundwater at a scale and resolution that allows for the application of results to the assessment of interrelated VCs, notably for fish and fish habitat and human health. Carry forward the assessment of potential changes in water quality, as required in the following sections of the Integrated Guidelines.

The proponent should refer to Health Canada's Guidance for Evaluating Human Health Impacts in Environmental Assessment: Drinking and Recreational Water Quality to ensure that it provides the information and analysis considered necessary to assess the project's effects on human health in relation to changes to water quality. It is requested that the proponent complete the checklist provided in this guide (Appendix A) to assist participants in verifying that the main elements of a water quality impact assessment have been completed and in identifying the location of this information in the Impact Statement. This checklist will facilitate the review of the Impact Statement and will be particularly useful if analyses on this aspect are found in several sections of the Impact Statement.

The proponent should consult with Alberta Environment and Protected Areas where an Environmental Assessment report is required under Alberta's *Environmental Protection and Enhancement Act* and a license under the *Water Act* is required to divert and use surface or groundwater in Alberta for a specified purpose such as irrigation, a municipal water system or energy production .

8.7.3 Mitigation, monitoring and enhancement measures

The Impact Statement must:

- describe the mitigation for the possible effects on the quantity and quality of surface water, groundwater and sediment, including water supply wells and provide a rationale with quantitative and qualitative evidence that explains the effectiveness of proposed measures;
- describe any applicable water quality treatment measures and provide evidence supporting the effectiveness of these measures (refer to MEND report 3.50.1), including predicted inflow and outflow rates and concentrations for relevant water quality parameters;
- provide the details of mitigation comprised in water management plans proposed for waterbodies and watercourses likely to be affected during all phases of the project, including measures applicable to water use minimization;
- describe and justify water use for the project and the measures that will be taken to eliminate or reduce the adverse effects, including the supply and discharge of water, potential exchanges between watersheds and, if applicable, consider other water sources or the possibility of reusing the water;
- describe groundwater and surface water monitoring programs during the operations and post-closure periods, including:
  - the proposed monitoring points to assess changes to surface water quality, which should include monitoring at all point and diffuse sources of discharge and in the immediate receiving environment and at the boundaries for the outer mixing zone, the project, the LSAs and RSAs,
  - the proposed monitoring points to assess changes to groundwater quality, which should include well locations and depths, and
  - the parameters that will be measured, the duration and frequency of monitoring, the sampling protocol and analysis protocol and the quality assurance and quality control measures. Include the description of the measures that will be implemented if the criteria are exceeded; and
- describe any specific monitoring program planned during construction, including assessment of effects before and after construction activities in order to optimize or adapt mitigation at the time of their application.

8.8 Terrestrial, riparian and wetland environments

8.8.1 Baseline conditions

The Impact Statement must:

- Provide a description of the biodiversity[11], relative abundance and distribution of vegetation species and communities of ecological importance and of importance for human uses (e.g., recreational and economic uses), within the LSAs and RSAs of the project, including:
  - the geographical settings, as described in section 3.2 Project location along with the presence of endangered ecosystems, rare, limited, or significant habitat (e.g., federal provincial or Indigenous protected areas, wildlife sensitivity maps, RAMSAR sites, identified or proposed critical habitat in recovery strategies or action plans);
  - rare plant communities and communities of limited distribution,
  - old growth forests,
  - species at risk, including those listed in Schedule 1 of the SARA, provincially listed or assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) to be 'at risk,' including species of concern,
  - critical habitat as described in final or draft recovery strategies or action plans for species at risk,
  - species that have harvest level records maintained by provincial, local conservation agencies or organizations;
- describe the biodiversity metrics, biotic and abiotic indicators that are used to characterize the baseline vegetation biodiversity and discuss the rationale for their selection such as cover and standing biomass for aquatic plants as a basis to predict and detect changes;
- provide maps, at an appropriate scale, of the vegetation species and communities of importance within the LSA, and where available, the RSA;
- describe the current level of both anthropogenic and natural (e.g., fire, flood, drought) disturbance associated with vegetation, including a description of level of habitat fragmentation and loss, historical and current disturbance, any proximate activities that have resulted in changes to fire regimes (e.g., fire suppression, flooding, insect infestations);
  - describe any weed species, other invasive species and introduced species of concern;
  - describe past site clearing and shoreline development, if applicable (this information determines the succession trajectory of the site habitat);

[11] Biodiversity can include the species or communities found, abundance, density, species richness and evenness, species distribution within the study areas; their ecological role, trophic level, their ecological or population health (e.g., breeding status, population trends, movement, habitat availability or connectivity, reproductive status or health, food availability or limitations).

- describe the use of local vegetation for medicinal purposes, or as a source of country foods[12];
- describe the shoreline, banks, current and future flood risk areas, and wetland catchment boundaries;
- quantify, describe and map riparian areas within the LSA and RSA potentially affected by the project;
- quantify, describe and map wetlands (e.g., fens, marshes, peat lands, bogs) and floodplains within the LSA and RSA potentially affected by the project, in the context of:
  - wetland class, ecological community type and conservation status;
  - biodiversity;
  - wetland habitat that provides important functions for species at risk, migratory birds;
  - abundance at local, regional and provincial scales;
  - distribution;
  - current level of disturbance; and
  - seasonal characteristics
- determine whether these wetlands are within a geographic area of Canada where wetland loss or degradation has reached critical levels, or considered ecologically, socially or economically important to a region;
- identify and map wetlands on federal lands potentially affected by the project and within the scope of federal permits, authorizations or other approvals. Provide information adequate to determine if the Federal Policy on Wetland Conservation applies;
- identify and describe wetland capacities to perform hydrological and water quality functions, provide for wildlife and wildlife habitat or other ecological functions;
- provide a wetland functions assessment in accordance with the guiding principles of Wetland Ecological Functions Assessment: An Overview of Approaches or any subsequent approved guidelines by which to determine the most appropriate functions assessment methodology to use (see Appendix 1 Guidance for biophysical components of the Tailored Impact Statement Guidelines Template for more guidance on conducting a wetland function assessment);
  - provide a rationale for the wetland functions assessment method chosen and submit complete data sets from any survey sites, including geospatial data files;

[12] country foods refer to all foods that do not come from commercial systems. It includes all food that is trapped, fished, hunted, harvested or grown for subsistence or medicinal purposes for Indigenous Nations and communities as well as local communities. For Indigenous Peoples these foods can also have Indigenous cultural value;

- determine if other wetland conservation policies, regulations or wetland compensation guidelines apply (contact provincial and local government authorities); and
- identify a RSA of sufficient size to capture effects to wetlands within the larger drainage area and include wetlands located outside of the LSA that may be affected by hydrological changes as a result of cumulative effects.

8.8.2 Effects to terrestrial, riparian and wetland environments

The Impact Statement must describe the effects of the project on vegetation and the riparian and wetland environments, including:

- describe all potential effects due to the project, for all phases, to vegetation and to the riparian and wetland environments;
- describe the key indicators used to assess project effects and the sensitivity of vegetation communities, wetlands, and riparian and terrestrial environments to disturbance;
- describe changes related to landscape disturbance, including loss and fragmentation of habitats, alteration of riparian areas, including buffers or setbacks and project effects on areas of soil or ground instability;
- quantify the area of vegetation communities, riparian, wetland, aquatic and terrestrial environments, that may be cleared or otherwise disturbed within the study areas during all phases of the project, including a description of the disturbance and changes to:
  - habitat ratios between the interior and periphery,
  - availability of rare habitat, and
  - function within the remaining vegetation or wetland complex;
- describe the amount, merchantability and location of any timber to be removed during project construction;
- describe effects onto the biodiversity of riparian, wetland and terrestrial environments, including effects from fragmentation and changes to regional biodiversity;
- describe effects related to potential introduction of weed species or invasive species or due to the increase in the spread and prevalence of diseases or pests;
- describe any hydrological or water flow changes, either permanent or temporary, that could alter moisture regimes or drainage conditions, and describe the effects on vegetation and wetlands;
- describe any changes to or loss of wetland function, including consideration of ecological (e.g., hydrological, biogeochemical cycling, habitat and climate functions) and socioeconomic functions of wetlands. Describe and justify the methodology used to assess the effects;

- describe potential effects from project emissions that may result in contamination and acidification of nearby land and waterbodies, including consideration of the sensitivity of vegetation communities, wetlands, and riparian and terrestrial environments to disturbance;
- describe potential changes to riparian, wetland and terrestrial environments due to activities that may affect topography, soil erosion, compaction and productivity, contamination, bank slopes and suspension of sediment, or due to any contaminants of concern potentially associated with the project that may affect vegetation, soil, sediment or water;
- describe potential changes to riparian, wetland and terrestrial environments as a result of any known or suspected soil contamination within the study areas that could be re-suspended, released or otherwise disturbed as a result of the project;
- present the explicit calculation of radiation doses to vegetation with recognized approaches and software tools;
    - provide a high-level discussion of the relative merits of alternative approaches to put the presented approach in a current national and international context,
    - document details of transfer parameters and their validation for site conditions. Site-specific data, and authoritative data sources, should support model structure and parameter choices,
    - note the choice of food chain transfer factors for VCs, which can vary by orders of magnitude in different environments for different species, and
    - if the approach is different from CSA N288.6 is used, describe the model structure and implementation. Regardless of the approach taken, document a few representative samples of dose calculations starting with media and food concentrations;
- quantify and interpret doses for the effects of controlled releases on life history parameters (morbidity, mortality, reproduction);
- if numerical benchmarks for chronic radiation effects are exceeded, interpret effects at multiple levels of organization in an ecological context relative to the potential for effects on individual biota, populations, communities and ecosystems; and
- describe any positive changes.

The proponent should consult Alberta's Wetland Policy for strategic direction and tools for wetland management.

8.8.3 Mitigation and enhancement measures

The Impact Statement must describe the proposed mitigation for the effects on vegetation and on riparian and wetland environments.

In particular, the Impact Statement must:

- describe and justify the construction methods used to cross wetlands and other sensitive habitats, and the criteria for determination of techniques proposed for each crossing, including the locations where trenchless crossing methods will be employed;

- describe and justify the ways of avoiding or reducing the temporary or permanent adverse effects on wetlands and riparian habitats;
- describe and justify the necessity of temporary construction sites, and the considerations taken for minimizing the adverse effects, namely the location choice and management measures;
- describe and justify the proposed measures to mitigate bank erosion, including measures to eliminate the potential for erosion, such as bank stabilization using vegetation;
- describe the vegetation standards and controls that will be deployed during construction and operation of the project
    - describe the measures allowing identification of invasive species or other undesirable introduced species, avoid their propagation and control their spread during all phases of the project, including the necessity of preconstruction surveys to identify any high-density areas,
    - identify the criteria and circumstances of application of chemical, biological or mechanical control methods (e.g., biocides) as well as the relevant regulations and determine the adverse effects associated with control methods to human and non-human biota, and
    - describe the selection of plant species to be conserved and planted in order to promote vegetation communities with low natural growth;
- concerning wetlands:
    - explain how avoidance of wetlands was considered, namely by considering other locations for project components and activities,
        - this is to be substantiated by the assessment of the alternative options for project location and cooling technology;
    - explain how proposed mitigation consider the natural succession and the variability of the environment over time, and
    - describe proposed compensation measures (see Appendix 1 – Guidance for biophysical components of the Tailored Impact Statement Guidelines Template for relevant guidance on compensation and offset plans);
- describe any reclamation and revegetation procedures proposed, including:
    - revegetation techniques and the locations where they would be implemented,
    - selection of plant species to be maintained and planted to promote return to a natural ecosystem,
    - seeding and planting plans, which include a description of the species to be replanted, the replanting locations and the criteria for determining these specifications,
    - the expected timelines, from an ecological perspective, for establishment and recovery of vegetation communities and the expected differences in community composition and structure. Identify the information sources on which the predictions rely, such as evidence from peer-reviewed scientific literature, and
    - reclamation standards to be used to evaluate ecological equivalency of post-operation reclaimed landscapes,
- describe and justify the soil treatment methods to eliminate or reduce the adverse effects on the soils and materials in the root area, including recovery techniques (e.g., soil stripping, including the

proposed width, stump removal and other soil treatment techniques), soil separation maintenance measures, control measures for wind and water erosion, work shutdown procedures in case of wet conditions, and soil settlement prevention measures; and

- describe how to locate pre-existing soil or sediment contamination, the mitigation and monitoring measures that will be undertaken in this regard, and the applicable regulatory restoration measures.

8.9 Terrestrial wildlife and wildlife habitat

The proponent should consult the additional guidance for requirements pertaining to wildlife provided in Appendix 1 – Guidance for biophysical components of the Tailored Impact Statement Guidelines Template.

8.9.1 Baseline conditions

The Impact Statement must:

- describe and map the biodiversity of terrestrial wildlife species (amphibians, reptiles, mammals) and wildlife habitats that are found or are likely to be found in the study areas;
- identify wildlife species of ecological importance and of importance for human uses (e.g., recreational and economic uses), other than birds, that are likely to be directly or indirectly affected in the study areas. Include species with harvest level records maintained by provincial, local conservation agencies or organizations. For each species:
  - describe their distribution and location, abundance and population status, lifecycle, known residences, seasonal ranges, migration and movements, wildlife corridors and physical barriers to movement, habitat requirements, and sensitive periods (e.g., seasonal, diurnal and nocturnal), and
  - provide a map showing the highest concentrations or areas of use by species, differentiating between federal and non-federal lands;
- identify the metrics and biotic and abiotic indicators that are used to characterize the baseline conditions (e.g., population size, recruitment rates, spatial distribution, density) and provide a rationale for their selection, including how the selection of indicators for baseline conditions will support adequate population monitoring;
- describe the use of wildlife as a source of country foods
- describe the use and harvesting of fur-bearing species
- describe any locations within the study areas that might constitute sensitive areas for terrestrial wildlife, and show on maps, such as:
  - protected areas or sensitive habitats as described in sections 3.2 Project location and 8.10 Species at risk and their habitat;
  - species at risk critical habitat that has been designated or is under consideration,

  - ecological reserves; wildlife management areas, established or proposed sanctuaries and protected areas, in proximity to the project location or that could be affected by routine project operations,
  - any lands in the study areas that might constitute sensitive areas and habitat for wildlife, and
  - nearby environmentally significant areas such as; National Parks, areas of natural or scientific interest, National Wildlife Areas, World Biosphere Reserves or UNESCO Natural World Heritage Sites; and areas under consideration or study for such designation;
  - travel corridors and alternate routes for travel corridors that could potentially be affected by the project;
- describe the levels of disturbance currently affecting wildlife and wildlife habitat, such as habitat fragmentation and the extent of human access and use;
- describe the natural disturbance regimes and their sources (e.g., fire, floods, droughts, diseases, insects and other pests);
- describe and provide the location of any recent or currently in progress ecological or biological studies of the site or the surrounding area; and
- describe the source of the baseline data, data collection methods, and provide a rationale for any modelling approaches chosen, and describe how community and Indigenous Knowledge was incorporated.

8.9.2 Effects to terrestrial wildlife and their habitat

The Impact Statement must:

- describe the potential effects of the project on wildlife and wildlife habitat, including population level, regional or local sub-population effects, including, but not limited to:
  - site preparation, vegetation removal, particularly of habitats important for breeding, overwintering or that act as movement corridors,
  - noise, light and sensory disturbances,
  - water and air emissions or dust,
  - bioaccumulation of contaminants in wildlife,
  - habitat loss and fragmentation,
  - introduction of invasive species, including the rapid growth of pathogens such as those in the ultimate heat sink or other elements of the cooling system, and other biohazards,
  - altered predator-prey relations, such as increased wildlife predation,
  - increase in the spread and prevalence of diseases and other health concerns;
- provide an evaluation of the effect of the project, including any new road or rail access, pipeline, transmission line or other rights of way on wildlife mortality risk and movement patterns;
- describe effects to wildlife biodiversity, considering biodiversity metrics and the biotic and abiotic indicators selected, including changes to regional biodiversity and local and regional ecosystems;

- describe and quantify, where possible, the potential effects to wildlife, including acute and chronic effects to wildlife health, of changes to air and water quality (e.g., from radiation exposure, contaminants, effluents, atmospheric emissions, dust deposition, and bioaccumulation);
- describe how predicted effects to wildlife compare to the expected reference conditions for unexposed wildlife on a biological population basis, taking into account natural variation
- present the explicit calculation of radiation doses to terrestrial wildlife with recognized approaches and software tools (example of acceptable approach in CSA N288.6);
  - provide a high-level discussion of the relative merits of alternative approaches to put the presented approach in a current national and international context,
  - document details of transfer parameters and their validation for site conditions. Site-specific data, and/or authoritative data sources, should support model structure and parameter choices,
  - note the choice of food chain transfer factors for VCs, which can vary by orders of magnitude in different environments for different species, and
  - if an approach different from CSA N288.6 is used, describe the model structure and implementation. Regardless of the approach taken, document a few representative samples of dose calculations starting with media and/or food concentrations;
- quantify and interpret doses for the effects of controlled releases on life history parameters (morbidity, mortality, reproduction);
  - if numerical benchmarks for chronic radiation effects are exceeded, interpret effects at multiple levels of organization in an ecological context relative to the potential for effects on individual biota, populations, communities and ecosystems;
- describe and assess the resilience and recovery capabilities of wildlife populations and habitats to disturbance, including the anticipated potential for the project area to be returned to its existing state with respect to wildlife populations and their habitat following operations;
- describe the potential adverse effects of the project on species noted as important to local communities, and their habitat;

Appropriate methodologies to predict effects to wildlife should be used.

The assessment of effects on the terrestrial environment must be consistent with CSA N288.6, Environmental risk assessments at nuclear facilities and uranium mines and mills.

8.9.3 Mitigation and enhancement measures

The Impact Statement must describe the measures for mitigating effects on terrestrial wildlife and wildlife habitat, including:

- describe all feasible measures to avoid or lessen adverse effects on wildlife and their habitat, including residences and critical habitat. Include a description of the measures in terms of the effectiveness of each measure in avoiding negative effects;

- provide the best technically and economically feasible approaches for mitigating effects on habitat, aligned with the mitigation hierarchy, and justify moving from one mitigation option to another;
- describe and explain the condition in which the temporary construction areas and right-of-way will be restored or maintained following construction, and explain the mitigation considered including possible revegetation, obstruction of the sightline, restoration of wildlife corridors and habitat connectivity, reduction of fragmentation and reduction of long-term cumulative effects;
- describe and explain the measures to control the use of new access roads to access areas that were previously difficult to reach, including by wildlife predators as well as by hunters, recreational uses, and other users;
- describe the deterrent systems that will be used to mitigate impacts to wildlife and species at risk due to, for instance, attraction to the project site and components and activities associated with the project;
- describe measures to prevent the release of harmful substances into waters or areas frequented or occupied by wildlife;
- describe measures to address sensory disturbance and the resulting functional loss of wildlife habitat;
- provide details of any compensation or offsetting plans proposed following guidance in Appendix 1 – Guidance for biophysical components of the Tailored Impact Statement Guidelines Template , if effects cannot be otherwise avoided or mitigated; and
- describe mitigation applicable to wildlife habitat and other biodiversity metrics that will be implemented through reclamation, including timelines and targets that will be used to assess effectiveness.

8.10 Species at risk and their habitat

The proponent should consult the additional guidance for requirements pertaining to Species at Risk provided in Appendix 1 – Guidance for biophysical components of the Tailored Impact Statement Guidelines Template. With respect to effects on bird species at risk, the information required is presented in section 8.12 Birds and their habitat.

8.10.1 Baseline conditions

The Impact Statement must:

- provide a list of all species at risk that are likely to be in the project area, including:
  - species listed in Schedule 1 of SARA, and
  - species assessed by COSEWIC as extirpated, endangered, threatened or of special concern. It is recommended to refer to the most recent COSEWIC annual report for the list of assessed wildlife species posted on its website;

- for each species at risk identified in the list above:
  - describe abundance (including relative abundance in each habitat type), population status, and distribution,
  - provide a map showing survey sites, species sighting records, the areas of highest concentration or areas of use,
  - provide information and mapping at an appropriate scale for residences, seasonal movements, movement corridors, habitat requirements, key habitat areas, identified or proposed critical habitat or recovery habitat (where applicable), differentiated by federal and non-federal lands,
  - describe the general life history (e.g., breeding, foraging) that may occur in the project area, or be affected by the project, and
  - identify critical periods (e.g., denning, rutting, spawning, calving, breeding, roosting), setback distances, or other restrictions related to these species;
- provide any published studies that describe the regional importance (including economic), abundance and distribution of species at risk, including recovery strategies or plans; and
- describe the source of the Species at Risk data, including survey design, sampling protocols and data handling:
  - when using recognized standards, provide details of any modifications to the recommended methods and rationale for these modifications; and
  - indicate who was consulted in the development of the baseline surveys (e.g., federal/provincial wildlife experts, specialists), and describe how community and Indigenous Knowledge was incorporated.

The proponent should contact provincial or local government authorities to determine additional data sources and survey methods. A permit under SARA must be obtained prior to conducting surveys on federal lands that are likely to harm, harass, capture or kill species at risk other than migratory birds.

8.10.2 Effects to species at risk and their habitat

The Impact Statement must:

- describe the potential effects of the project on species at risk listed under Schedule 1 of SARA as listed under section 7.3 Selection valued components, and their critical habitat (including its extent, availability and presence of biophysical attributes). The analysis of potential effects should be provided separately for each species at risk, including separate analyses for each activity, component and phase of the project;
- present the explicit calculation of radiation doses to species at risk assessed by COSEWIC with recognized approaches and software tools (example of acceptable approach in CSA N288.6-22 clause 7.3.4 Dose calculation methods, and clause 7.3.7 Models);
  - provide a high-level discussion of the relative merits of alternative approaches to put the presented approach in a current national and international context,

  - document details of transfer parameters and their validation for site conditions. Site-specific data, or authoritative data sources, should support model structure and parameter choices,
  - note the choice of food chain transfer factors for VCs, which can vary by orders of magnitude in different environments for different species, and
  - if approach different from CSA N288.6 is used, describe the model structure and implementation. Regardless of the approach taken, document a few representative samples of dose calculations starting with media and food concentrations;
- describe the potential effects of the project on species assessed by the COSEWIC as extirpated, endangered, threatened or of special concern (flora and fauna), as well as on the potential habitat of these species that are not currently listed under SARA;
- describe the area, biophysical attributes and location of habitat including critical habitat affected (e.g., destroyed, permanently altered, disrupted), including direct and indirect effects due to vibration and artificial light in the project area on usage patterns and migratory behaviour of species at risk;
- describe the residual effects that are likely to result from the project after avoidance and minimization measures have been applied, including the extent, duration and magnitude of the effects on:
  - number of individuals killed, harmed, harassed, and
  - number of residences damaged or destroyed;

If a permit under Section 73 of the SARA is anticipated, additional information on the SARA permitting process is available in the Project's Permitting Plan on the Registry

The Alberta government should be considered a source of information on appropriate methodologies to predict impacts to wildlife species at risk.

8.10.3 Mitigation and enhancement measures

The Impact Statement must describe measures for mitigating effects on species at risk and their habitat, including:

- describe the proposed mitigation for adverse effects on species at risk and critical habitat, include the justification, based on scientific data, for the proposed measures;
- provide an account of how the project and proposed mitigation are consistent with the recovery strategy, action plan, or management plan for the species and be described in terms of the effectiveness of each measure in avoiding negative effects;
- describe mitigation to reduce the risk of harmful, destructive or disruptive activities in sensitive times and places of importance to species at risk;
- describe measures to prevent the release of harmful substances into waters or areas frequented or occupied by species at risk; and

- provide mitigation for effects on habitat, aligned with the mitigation hierarchy and justify moving from one mitigation option to another.

With respect to bats:

- describe the effectiveness of the mitigation, taking into account the configuration of the resources in the environment and how local bat populations use these resources;
- describe how bat behaviour (differentiated by species) has been taken into account, based on the geographical location and time period; and
- at minimum, the following mitigation should be implemented:
  - spatial avoidance:
    - a buffer zone of 120 m is recommended,
    - for resting areas and nurseries in trees, apply a buffer zone to the entire complex of roosts and nurseries, and
    - for hibernacula, apply the buffer zone to the entire underground cave and mine system;
  - temporal avoidance (timing of disruption, destruction of resting areas or exclusion):
    - avoid disruption, destruction and exclusion between April 30 and September 1;
  - lighting:
    - avoid or minimize the use of artificial light in bat habitats,
    - select low-intensity lighting,
    - use lighting fixtures that restrict or focus illumination to target areas, and
    - avoid lights that emit blue/green/white/UV wavelengths.
  - follow the Canadian National White-nose Syndrome Decontamination Protocol for entering bat hibernacula (Canadian Wildlife Health Cooperative); and
  - other compensation.

8.11 Fish and fish habitat

The proponent should consult Appendix 1 – Guidance for biophysical components of the Tailored Impact Statement Guidelines Template for guidance pertaining to fish and fish habitat.

8.11.1 Baseline conditions

The Impact Statement must:

- prepare a list of all waterbodies and watercourses (permanent and intermittent) that may be directly or indirectly affected by the project and provide:
  - type of waterbody or watercourse,

  - size and depths of the waterbody or watercourse,
  - streamflow types and characteristics,
  - substrate type, vegetation and anthropogenic barriers to fish,
  - description of any proposed water work, and
  - for crossings, describe the anticipated method of crossing (trenched or trenchless);
- describe primary and secondary productivity in affected waterbodies with a characterization of trophic levels, biodiversity, key functional interactions and processes (e.g., food web and nutrient cycling), seasonal and year-to-year variability, ranges and sensitive periods and include the rationale for the selection of biodiversity metrics and indicators;
- provide information of the stability or variability of biodiversity metrics and indicators;
- provide conceptual models of existing baseline aquatic biota endpoints (for example, survival, growth, reproduction, age/size distributions) including linkages with abiotic environmental media and other biota (feeding); the conceptual model must:
  - describe the baseline sources and distribution of stressors along transport and exposure pathways resulting in baseline hazard quotients for contaminants to aquatic organisms through diet and direct exposure; and
  - include potential receptor from each trophic level (for example, piscivore, benthic prey feeder, zooplankton feeder, herbivore, primary producers);
- characterize reference locations that would not be exposed to project effects;
- for each potentially affected waterbody or watercourse frequented by fish, provide the location and area of potential and confirmed fish habitat and a detailed assessment of physical and biological habitat characteristics. Present information as maps using satellite imagery overlaid with relevant information and text description, with associated summary tables. Relevant physical and biological habitat characteristics for fish habitat include:
  - surface and ground water characteristics requested in Section 8.7.1 Baseline Conditions;
  - overlap of areas of project activities with aquatic VC habitat in time and space (including VC home range and migration and dispersal estimates);
    - seasonal variation of species; and
    - seasonal variation of water quality;
  - baseline extent of habitat disturbance (e.g., fragmentation);
  - habitat use or suitability for fish and aquatic species present, including critical habitat and residences for species at risk, and habitat function (e.g., spawning, calving, nursery, growth, prey, invertebrate population, food availability, foraging, migration, cover habitat, thermal and overwintering habitat) and sensitive times for these activities, and
  - substrate type, aquatic vegetation, riparian vegetation, bank stability, light penetration, presence of woody debris, presence of beaver dams, stream segment type (riffle, run, pool), natural or anthropogenic barriers to fish passage, and geomorphological features and processes;
- present fish habitat mapping that includes existing operations thermal discharge areas of elevated temperatures and physical disruption of lake currents (depth and area) identification of habitats

exposed to existing facility stressors and those potentially exposed through data review and field reconnaissance, including:

- contaminant and thermal effluents and plumes;
- storm water release points;
- present and projected radiological and conventional groundwater contaminant plumes;
- hydrological characteristics associated with any identified critical fish habitat ;
- nuclear and conventional accidents and spills;

- for each potentially affected waterbody or watercourse, provide a detailed description of potentially affected fish[13] species and populations (as defined in subsection 2(1) of the *Fisheries Act*) within the aquatic environment;
  - where data are used to generate biodiversity metrics (e.g., abundance, richness, diversity, density), provide rationale on the choice of metrics based on their applicability for use in the effects assessment and associated follow-up, if applicable;
  - provide information on the stability or variability of biodiversity metrics and indicators;
- provide information on the benthic invertebrate community in representative habitats, such as exposed rocky inshore areas or embayment wetlands;
- describe parameters and ecological processes relevant to predicted effects on fish and aquatic species listed above. For example, it may be necessary to establish a broader ecological baseline if the project affects a spawning area for a migratory species but does not affect the larger area they depend on for life processes. Relevant parameters and ecological process may include: migratory patterns, food webs and trophic levels, structural and functional linkages (e.g., predator-prey interactions), life history and population dynamics, sensitive habitats and periods, behaviour or other relevant ecological processes that fish depend on to carry out their life history
  - use either a qualitative or a quantitative approach to characterize ecological processes, as appropriate, and include a rationale to support the selected approach;
- describe existing physically altered or contaminated habitats that were changed by past operations;
- identify and describe the data sources used, including information on data collection (e.g., gear and catch methods, location of sampling stations, date of catches, date of surveys, species surveyed, size and lifecycle stage, catch per unit effort). It is recommended that the information be presented in the form of detailed maps and tables;

[13] fish includes: parts of fish, shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals, and the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals.

- provide baseline measurements (typical values and variability) of contaminants in fish and aquatic species (including benthic invertebrates) including radionuclides and chemicals for study areas and reference sites;
- describe the use of fish and aquatic plants as country foods, including a description of the particular species of importance. Where possible, sites used in the study areas or historically important sites for the collection of country foods must be identified and mapped, such as important fishing sites;
- provide a summary of existing studies and research on potential effects of noise and vibrations on potentially affected aquatic species, including behavioural impacts, the freshwater environment; and
- identify and describe sensitive habitat areas (e.g., Ecologically and Biologically Sensitive Marine Areas) within the LSA and RSAs and include maps that demonstrate proximity of these areas.

Certain intermittent and ephemeral watercourses or waterbodies may constitute fish habitat or contribute indirectly to fish habitat during a certain period. The absence of fish or water at the time of the survey does not irrefutably indicate an absence of fish and fish habitat (e.g., migratory corridor). Similarly, beaver dams and accumulations of woody debris are not considered impassable barriers to fish.

8.11.2 Effects to fish and fish habitat

The Impact Statement must describe the potential effects of the project on fish and fish habitat, as defined in subsection 2(1) of the *Fisheries Act.* Consider any effects whether they are adverse or positive, direct or indirect, and temporary or permanent, for all phases of the project, including from the release of effluent or the deposit of a deleterious substance to water frequented by fish, for all developmental stages of fish, and other aquatic species. Refer to Section 8.7 Groundwater and surface water for related water quality requirements to inform the assessment.

The Impact Statement must:

- use of a Pathways of Effects approach to determine potential effects to fish and fish habitat;
- for each waterbody and watercourse affected by the project, the following must be documented and considered in the determination of effects:
  - geomorphological changes and their effects on hydrodynamic conditions and aquatic habitats (e.g., modification of substrates, dynamic imbalance, long-term bank instability, silting of spawning grounds), including direct and indirect effects from habitat fragmentation;
  - changes in hydrological and hydrometric conditions and their effects on aquatic habitat and lifecycle activities (e.g., reproduction rearing, feeding, movements, migrations, winter refuge) and any changes to aquatic invertebrate communities;
  - changes to riparian areas that could affect fish and fish habitat, aquatic species at risk and productivity;
  - any alteration to accessibility or use of habitat, including residence and critical habitat of aquatic species at risk;
  - changes to the primary and secondary productivity, food sources, potential imbalances in the food web and trophic levels;

- risk of fish mortality, including that associated with:
  - noise and vibrations, or other disruptions caused by project activities in or near the aquatic environment [(e.g., blasting, excavating)],
  - describe the magnitude, temporal and spatial extent of blasting activities;
  - predict numbers of fish killed or injured per blast for the lifecycle of the project;
  - describe effects of project activities, including blasting, thermal effects, and impingement on aquatic species;
  - if applicable, effects of thermal plume(s) on thermally sensitive fish species, and
  - entrapment, impingement or entrainment in cooling water intakes;
- potential introduction and/or spread of aquatic invasive species, including pathogens such as those in the ultimate heat sink or other elements of the cooling system, through project activities, including discussion of the frequency of those activities;
- changes to water quality and quantity, including:
  - potential introduction of deleterious substances (e.g., sediment, project-related contaminants) including contaminants that have been re-suspended or re-released from soils or sediments as a result of the project);
  - potential discharges to the aquatic environment of waters used for hydrostatic testing;
  - effluent at the discharge point and in the receiving environment (referencing the assessment of water quality in Section 8.7 Groundwater and surface water;
- compare predicted water quality for all project phases and at all key locations in the receiving environment to:
  - applicable water quality guidelines;
  - site-specific objectives or benchmarks;
  - relevant toxicity test results (either site-specific or published);
  - changes in potential contaminant levels in harvested species and their prey,
  - changes in access to the area and increased access to fishing; and
  - for linear project components: describe and justify watercourse-crossing techniques to be used and the criteria for determining the techniques proposed for each watercourse crossing; and
  - any other changes resulting from the project that may affect fish and fish habitat,

- delineate anticipated habitat alteration, disruption or destruction (temporary or permanent) in terms of area, habitat type, sensitivity of habitat and impact (e.g., magnitude, intensity and persistence). Habitat losses must be clearly located and presented on a map at appropriate scales and in a table, including;
  - timing of effects throughout the project lifecycle;
  - duration of effects; and
  - spatial scale of effects over time;

- describe potential effects to fish and fish habitat, based on specific life history processes, population status, resilience in the face of change, dependence on specific habitat features, or limiting ecological processes or variables;
- include an examination of the correlation between construction periods and sensitive periods for fish (e.g., reproduction), key fisheries windows for freshwater and anadromous/catadromous species, and any potential effects due to overlapping periods;
- describe potential effects to fish from contaminants, including from bioaccumulation downstream of the project. Include a comparison of predicted water quality for all project phases at all key locations in the receiving environment to applicable water quality guidelines, site-specific objectives or benchmarks, and relevant toxicity test results (either site-specific or published), or other applicable methods. Describe potential effects from contamination on fish and other aquatic species' behaviour, distribution, abundance, and migration patterns:
  - effects should include direct exposure effects (for example, on survival, growth, reproduction, age, species distribution of community), and indirect effects (for example, altered predators, prey, competition, exposure via the food chain);
  - effects should be predicted or modeled using baseline measurements of contaminants in the complete food web (including water, sediment, benthic invertebrates and prey fish), and by carbon and nitrogen stable isotope measurements in fish and the complete fish food web;
  - describe how predicted effects to fish compare to the expected reference conditions for unexposed fish on a biological population basis, taking into account natural variation (ERAD-48);
- if applicable, describe effects from thermal plumes associated with nuclear power generating activities, including:
  - consideration of risk to aquatic biota from "pulse" temperature increases and decreases relative to ambient changes such as thermal shock from ongoing operations, outages and anticipated operational occurrences;
  - effects of contaminants released in the thermal discharge, including the combined effects of temperature and contaminants, as well as the potential for gas-bubble disease;
  - effects on fish, including:
    - physical displacement of life stages exposed to discharge jets;
    - lethal and sub-lethal effects;
    - behavioural responses (attraction and avoidance) for all life stages;
    - direct effects (survival, growth, reproduction, diet, condition) and indirect effects (for example, discharge angling mortality, increased larval mortality from predation due to physical transfer out of discharge channel to open water body, disease prevalence) analysis and evaluation of the incremental effects from the project, and the cumulative effects of combined discharges;
- present the explicit calculation of radiation doses to fish with recognized approaches and software tools (example of acceptable approach in CSA N288.6);
  - provide a high-level discussion of the relative merits of alternative approaches to put the presented approach in a current national and international context,

  - document details of transfer parameters and their validation for site conditions. Site-specific data, and/or authoritative data sources, should support model structure and parameter choices,
  - note the choice of food chain transfer factors for VCs, which can vary by orders of magnitude in different environments for different species, and
  - if approach different from CSA N288.6 is used, describe the model structure and implementation. Regardless of the approach taken, document a few representative samples of dose calculations starting with media and/or food concentrations;
- quantify and interpret doses for the effects of controlled releases on life history parameters (morbidity, mortality, reproduction);
- if numerical benchmarks for chronic radiation effects are exceeded, interpret effects at multiple levels of organization in an ecological context relative to the potential for effects on individual biota, populations, communities and ecosystems;
- describe how the project's effects on aquatic biodiversity may contribute to changes in regional biodiversity and effects on local and regional ecosystems;
- describe potential effects on fish behaviour, distribution, abundance, and migration patterns;
- describe any need for a *Fisheries Act* authorization or a SARA permit and describe any consideration of Fisheries and Oceans Canada guidance documents; and
- describe any positive changes, such as habitat creation and, where applicable, provide information on re-stocking (including the number of fish) or creation of new fish habitat (including the new area created).
- for effects to fish and other aquatic biota from impingement and entrainment, the estimates of intake losses (cropping rates) for all life stages of aquatic biota in numbers and biomass should be extrapolated to the whole year, with confidence intervals based upon industry-accepted methods of sampling and analysis. This extrapolation includes the conversion of immature stages to age-1 adult equivalents for estimates of losses of population-level importance. Standard modelling and statistical approaches and contextual methods from government agencies and peer-reviewed published scientific literature should be used to project the effects on individual biota to those of the year-class or population. Mortality is assumed to be 100 percent from impingement, unless a fish handling and return system is included. The effectiveness predictions also vary by species and life stage.

Additional guidance that should be referenced to support the effects assessment and associated follow up include:

- A framework for assessing fisheries productivity for the Fisheries Protection Program.
- A framework for ecological risk assessment at contaminated sites in Canada: review and recommendations;
- A Science-Based Framework for Assessing the Response of Fisheries Productivity to State of Species or Habitats.
- Criteria contained in Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters.
- Environment and Climate Change Canada's total suspended solids and turbidity criteria.

- Defining and Assessing Adverse Environmental Impact from Power Plant Impingement and Entrainments of Aquatic Organisms

If an authorization is required under Section 34 or 35 of the *Fisheries Act*, further information on authorization requirements under the *Fisheries Act* is available here: Applicants Guide Supporting the Authorizations Concerning Fish and Fish Habitat Regulations.

8.11.3 Mitigation and enhancement measures

The Impact Statement must describe the mitigation measures for the effects on fish and fish habitat including:

- all standard measures, policies and commitments regarding mitigation that constitute technical and economically feasible proven mitigation measures and that will be applied in common practice, regardless of the location, as well as any new or innovative mitigation measure proposed;
- measures to prevent or mitigate the risk of harmful alteration, disruption or destruction of fish, fish habitat, or death of fish caused by any project activity, including during the sensitive periods and in the sensitive locations (e.g., spawning and migration) for fish and other aquatic species;
- measures applicable to all water crossings, intakes, and outflows including how they would be maintained following construction of the project;
- describe the conditions under which crossings of watercourses and riparian areas would be restored and maintained after construction of the project;
- measures to mitigate sensory disturbance and functional fish habitat loss that it may cause
- measures recommended to avoid fish mortality, for example, during use of explosives or from thermal plumes in the aquatic environment, or by fish impingement and entrainment during pumping and water withdrawal operations (e.g., during the construction of temporary structures and of hydrostatic tests);
- measures to prevent the deposit of substances harmful to fish in the aquatic environment;
- measures for impacted riparian or aquatic environments;
- criteria for assessment of the successful restoration of fish-bearing watercourses, as well as the mode and timing and the conditions of documentation of this assessment;
- mitigation measures to be applied during hydrostatic tests, including for water withdrawal and discharge activities;
- measures to prevent the introduction and intrusion of invasive aquatic species during work in or near the aquatic environment;
- measures and plans to offset or compensate for any loss in productivity of fish populations and fish habitat as a result of the project;
- descriptions on how environmental protection plans will address any applicable federal and provincial policies with respect to fish habitat; and

- description on how the mitigation measures are consistent with any applicable recovery strategy, action plan or management plan.

The proponent must refer to Fisheries and Oceans Canada guidance and explain how it was applied to the assessment, including the references provided in Appendix 1 – Guidance for biophysical components of the Tailored Impact Statement Guidelines Template under Compensation and offset plans and Fish and fish habitat.

8.12 Birds and their habitat

For the purpose of the Integrated Guidelines, birds refers to all birds, with emphases on migratory birds as defined under the *Migratory Birds Convention Act, 1994*. The proponent should consult the additional guidance for requirements pertaining to birds provided in Appendix 1 – Guidance for biophysical components of the Tailored Impact Statement Guidelines Template.

8.12.1 Baseline conditions

The Impact Statement must:

- identify species or groups that may be affected differently by the project and may require different mitigation measures and consider them as unique VCs, including those identified in section 7.3 Selection of valued components;
- identify any applicable Bird Conservation Regions (BCRs) and BCR strategies;
- describe the biodiversity of bird species and their habitats that are found or are likely to be found in the LSAs and RSAs;
- identify the biodiversity metrics, biotic and abiotic indicators that are used to characterize the baseline avifauna biodiversity and discuss the rationale for their selection;
- for birds that use the study areas at any time of the year that are likely to be directly or indirectly affected and describe their:
  - abundance and population status,
  - distribution,
  - lifecycle,
  - seasonal ranges, migration, movements,
  - frequency and timing of occurrence,
  - habitat association(s) and requirements for all relevant lifecycle stages, and
  - sensitive periods (e.g., seasonal, time of day);
- provide an estimate of year-round bird use of the study areas (e.g., winter, spring migration, breeding season, fall migration) based on data from existing sources and surveys to provide current field data if required to generate reliable estimates. In each portion of the year, survey effort must

account for differences in species movements including: winter usage of highly habitat reliant species and highly mobile species that will accurately characterize the use of a site;

- identify, and show on maps, areas of concentration of birds, including sites used for breeding, feeding, wintering, resting, staging and migrating;
- describe the habitat and habitat features found in the study areas that are associated with the presence of those bird species that are likely to be affected, based on the best available existing information (e.g., land cover types, vegetation). Provide maps showing the location of identified habitat and habitat features associated with the presence of those bird species that are likely to be affected
    - should there be anticipated displacement of nesting birds, baseline habitat data should provide evidence that there is enough equivalent habitat for birds to be displaced to and that the habitat being removed is not unique to the project study area or region;
- describe food webs and trophic linkages to summarize biotic interactions;
- for avian species at risk, locate on an appropriately scaled map the potential habitats, survey locations, records of the species, residences and critical habitat, except where locations and records are considered sensitive information
    - identify any and all federal species at risk and critical habitat in the study areas,
    - identify any sites that are likely to be sensitive locations and habitat for birds or environmentally significant areas. These include parks (national and provincial), areas of natural or scientific interest, migratory bird sanctuaries or other priority areas or sanctuaries for birds, national wildlife areas or world biosphere reserves, and
- illustrate on the map the project's footprint, identifying temporary and permanent infrastructure;
- describe the use of (magnitude, timing) birds as a source of country foods;
- describe the source of the data, data collection methods, and provide a rationale for any modelling approaches chosen; and
- where predictive modelling is required, provide the explanatory data (e.g., covariables such as associated land cover) required to predict effects on birds (e.g., changes in abundance, distribution or other relevant effects) collected in such a way as to represent the following sources of variation where applicable: spatial variation in land cover composition, soil type, geomorphology, hydrological processes, and inter-annual and intra-annual climate variability.

8.12.2 Effects to birds and their habitat

The Impact Statement must:

- describe the interaction between the project and birds and their habitat, for all phases, including from:
    - site preparation, vegetation removal, particularly of habitats important for nesting, foraging, staging, overwintering or that act as movement corridors,
    - deposit of harmful substances in waters that are frequented by birds and changes to water quality,

- evaluate the risk posed from the potential introduction of aquatic invasive species, including the rapid growth of pathogens such as those in the ultimate heat sink or other elements of the cooling system, and other biohazards;
- changes to the aquatic flow regime and sediment load,
- construction and operation of structures including power transmission and distribution lines,
- changes to the atmospheric, acoustic and visual environment (e.g., noise, vibration, lighting, air emissions and dust),
- site reclamation, and
- any project activities that may occur during critical periods or restricted activity periods birds, including species at risk;
- consider important habitats, including: forests, riparian zones, grasslands, wetlands, eskers and other similar geological formations, and open waters;

- describe the potential effects of the project on birds, their nest and eggs, including, but not limited to, from:
  - short and long-term changes to habitats important for nesting, foraging, staging, overwintering, rearing and moulting and to movement corridors between habitat, and from habitat loss, fragmentation and structural change. Any assumptions regarding temporary or permanent relocation should be justified using scientific evidence that there is available habitat to allow relocation under a variety of population scenarios. For example, it should be clear that a growing population will not be limited by habitat loss in the study areas;
  - changes in food sources in terms of types, quality, quantity, availability, distribution and function, including short-term and long-term changes;
  - changes in biodiversity, abundance, and density of the avian community that utilise the various habitat types or ecosystems;
  - changes to mortality risk, including as a result of collision of birds with project infrastructure, buildings, overhead lines, vessels and vehicles, as a result of light attraction and from indirect effects, such as increased movement of predators or access to hunting;
  - increased disturbance (e.g., sound, artificial light, presence of workers) considering the critical periods for the birds, including breeding, migration and overwintering;
  - describe the activities most likely to result in disturbance, injury or take of birds, their nests and eggs, such as vegetation clearing, increased noise from industrial machinery, and whether or not those activities would be permanent or non-permanent in the environment; and
  - contaminants and bioaccumulation of contaminants; and
- present the explicit calculation of radiation doses to birds with recognized approaches and software tools;
  - provide a high-level discussion of the relative merits of alternative approaches to put the presented approach in a current national and international context,
  - document details of transfer parameters and their validation for site conditions. Site-specific data, and/or authoritative data sources, should support model structure and parameter choices,

  - note the choice of food chain transfer factors for VCs, which can vary by orders of magnitude in different environments for different species, and
  - if approach different from CSA N288.6 is used, describe the model structure and implementation. Regardless of the approach taken, document a few representative samples of dose calculations starting with media and/or food concentrations;
- quantify and interpret doses for the effects of controlled releases on life history parameters (morbidity, mortality, reproduction);
- if numerical benchmarks for chronic radiation effects are exceeded, interpret effects at multiple levels of organization in an ecological context relative to the potential for effects on individual biota, populations, communities and ecosystems;
- describe, with evidence, available habitat for the relocation of displaced birds; and
- describe how predicted effects to birds compare to the expected reference conditions for unexposed birds on a biological population basis, taking into account natural variation.
- The proponent should refer to the Government of Canada's guidance on this topic, including:
  - Avoiding harm to migratory birds.
  - A framework for the scientific assessment of potential project impacts on bird
  - Migratory birds environmental assessment guideline

8.12.3 Mitigations and enhancement measures

The Impact Statement must:

- describe the measures to mitigate adverse effects to birds and their habitat, including their eggs and nests;
- describe the measures to prevent and mitigate the risk of harmful, destructive or disruptive activities during sensitive periods and in sensitive locations (e.g., breeding bird season, migration and nesting) for birds, their nests and their eggs, or areas frequented by birds, such as avoiding lights at night during key migration peaks, avoiding excessive loud noises, vibration or blasting during breeding season;
- consider the timing of vegetation removal and construction to be outside the main breeding season;
- describe measures to mitigate sensory disturbance and the functional habitat loss it may cause;
- describe measures for preventing the deposit of substances harmful to birds; and
- describe how mitigation measures for effects on eskers serve as mitigation measures for birds, since this type of geological formation presents a type of land cover that is not widespread and is of great value to forest birds during migration and reproduction.

The proponent should refer to the Guidelines to reduce risk to migratory birds and to the General nesting periods for migratory birds, which covers the main nesting periods of migratory birds and reduces the risk of

taking their nests or eggs. This recommendation does not authorize the disruption, destruction or taking of a migratory bird, its nest or its eggs outside these periods

9 Health, Social and Economic Conditions

The IAA requires the consideration of changes to health, social or economic conditions and the positive and negative consequences of these changes that are likely to be assessed. The IAA also requires the assessment of adverse effects within federal jurisdiction, including non-negligible adverse changes occurring in Canada to the health, social or economic conditions of the Indigenous Peoples of Canada.

Section 9 of the Integrated Guidelines presents a holistic approach to the requirements for health, social, and economic conditions of both the broad population living in the project study area (referred to as local communities) as well as the impacted Indigenous Nations and communities. For the Impact Statement, the goal of Section 9 is to collect relevant baseline information, conduct effects analysis and provide potential mitigation measures as a result of local community and Indigenous engagement efforts in the project study area. Section 10.3.2 Effects to Health, Social, and Economic Conditions of Indigenous Peoples presents a targeted approach by building on the information in Section 9 and providing Nation or community specific detailed requirements based on input from each impacted Indigenous Nation or community listed in the Indigenous Engagement and Partnership Plan. The proponent may provide information in response to sections 9 and 10 together, if and when appropriate.

For the Peace River Nuclear Power Project, the proponent should consider the Indigenous Nations and communities outlined in the IEPP when fulfilling the requirements in Section 9 and Section 10.3.2. For local communities, the proponent should work with, at minimum, the County of Northern Lights, Municipal District of Peace, Northern Sunrise County, Town of Grimshaw, the Town of Peace River, Dixonville, Deadwood, St. Isidore and other self-identifying local communities, as well as local residents, when fulfilling the requirements of Section 9.

The proponent is encouraged to refer to:

- the Resources and Guidance for Human Health section of the Guidelines Template,
- Analyzing Health, Social and Economic Effects under the *Impact Assessment Act*,
- as well as Gender-based Analysis Plus in Impact Assessment, Indigenous Mental Wellness and Major Project Development: Guidance for Impact Assessment Professionals and Indigenous Communities;
- National Collaborating Centre for Healthy Public Policy publication: Tools and approaches for assessing and supporting public health action on the social determinants of health and health equity;
- More-than-mental health: Indigenous identity, culture, community and relationship with land are integral to Indigenous wellbeing (training manual);

- Final report on Missing and Murdered Indigenous Women and Girls, in particular the Calls for Justice for Extractive and Development Industries (Calls for Justice 13.1 to 13.5); and,
- Health Canada's Interim Guidance: Health Impact Assessment of Designated Projects under the Impact Assessment Act.
- Guidance from Health Canada for Evaluating Human Health Impacts;
- the CSA N288.6, Environmental risk assessments at nuclear facilities and uranium mines and mills; and
- the resources provided in Appendix 2 - Human health of the Tailored Impact Statement Guidelines Template.

9.1 Health, social and economic conditions

9.1.1 Baseline conditions for health, social and economic conditions

The Impact Statement must:

- describe current health conditions in the context of physical, mental and social well-being and incorporate a determinants of health approach that extends beyond biophysical health considerations. The proponent must work with Indigenous Nations and communities and local communities on the collection of baseline information for non-negligible adverse changes occurring in Canada to health, social or economic conditions. The selection of determinants should be guided by the references listed in Appendix 2 - Human health of the Tailored Impact Statement Guidelines template.
  - develop community health profiles that describe the overall biophysical, social and economic health of each Indigenous Nation and community and local community including baseline information. Health profiles should be co-developed, where possible.
  - provide a demographic profile, and describe other community-relevant health information; and;
  - use, where known, secondary information sources (e.g., Public Health Agency of Canada, Statistics Canada, Indigenous Services Canada, Indigenous health authorities, provincial health authorities, municipalities;
- describe any context-specific definitions of health and well-being, including from the perspective of the impacted Indigenous Nations and communities and local communities;
- describe the relevant protection factors that contribute to community well-being and resilience;
- describe relevant community history or context, including historical impacts on health;
- be sufficiently detailed to provide a comprehensive understanding of the health, social and economic conditions, including relevant trends;

- be sufficiently detailed to describe the pathways by which the project's influence on the determinants of health may affect health outcomes;
- provide a comparison of data at the provincial, regional or national level, if possible, to better interpret baseline conditions;
- identify the social area of influence of the project;
- describe baseline conditions using disaggregated data for diverse population groups and their different access to resources, opportunities and services within the community to support GBA Plus; and
- describe the relevant protection factors that contribute to community well-being and resilience (e.g., sense of belonging, cultural continuity, language, family supports).

Guidance for developing the appropriate baseline information relevant to human health is identified in the section 9 preamble (above). The proponent should refer to the Health Canada guides to ensure that best practices are followed in collecting baseline information for assessment of the project's impacts on human health caused by changes in air quality, noise levels, the quality of drinking water and water used for recreational purposes, traditional foods and the multiple contaminant exposure routes. Receptor exposure characteristics (for example, inhalation or ingestion rates), when used, should be referenced from accepted Canadian or international sources, for example:

- the most up-to-date International Commission on Radiological Protection (ICRP) references; and
- the U.S. Environmental Protection Agency's Agency for Toxic Substances and Disease Registry

The proponent must justify any omission or deviation from the recommended baseline characterization approaches and methods, including the Health Canada guidelines.

9.1.2 Effects to human health, social, and economic conditions

The Impact Statement must:

- describe potential effects of the project on human health, including the health of Indigenous Peoples:
  - apply a Health Impact Assessment approach or Human Health Risk Assessment (HHRA) approach;
  - apply a determinants of health lens and describe any potential health effects resulting from changes on biophysical, social and economic determinants of health, including relevant interconnections and interactions;
  - estimate radiological doses to workers from routine and non-routine work practices, including the maximum annual effective and equivalent doses to categories of workers;
  - evaluate the potential risk to human and non-human biota from biocides and other means used to used to manage biohazards and invasive species;

- describe any potential project effects on community health profiles;
- assess the adverse and positive effects of the project on social and economic conditions;
- assess potential positive and adverse effects to the local, Indigenous, regional, provincial and national economies;
- describe how the differential effects identified in the GBA Plus results affect diverse population groups (e.g., Indigenous women, girls, gender-diverse and Two-Spirit peoples);
- describe potential effects from the influx of transient workers on health, social, and economic conditions, including local housing, services and infrastructure; and
- describe the interconnections between social, health and economic conditions and other VCs and interactions between effects.

As applicable to the assessment, the analysis should describe the goals of local or regional land use plans or local or regional development plans and the extent to which the project is aligned with such plans to avoid or enhance effects. The effects assessment should explore and discuss opportunities by which benefits to local communities can be enhanced. The assessment of economic effects should take into consideration the temporal scale for construction, operation and beyond and the potential for boom-and-bust cycles associated with the project.

9.1.3 Mitigation and enhancement measures

The Impact Statement must:

- describe the proposed mitigation and enhancement measures for effects on human health, including:
  - effects identified related to Indigenous Nations and communities' or local municipalities communities' and their health profiles;
  - any additional mitigation that will be considered if the level of emissions from a particular project or effluent discharge is below or at the applicable limits. If the change may be substantial (even within established limits) as a result of local or regional circumstances or the extent of the change, the proponent must provide additional mitigation to minimize pollution and risks to human health;
  - when potential effects on human health exist due to exposure to a non-threshold contaminant (e.g., certain air pollutants such as fine particulate matter and nitrogen dioxide, describe mitigation aimed at reducing residual effects to as low a level as reasonably possible;
  - how radiation protection measures maintain doses to the public at the environment to a level that is As Low As Reasonably Achievable (ALARA) through the application of Best Available Technology and Techniques Economically Achievable (BATEA);
  - for more information, the proponent should consult additional guidance:
    - in section 2.1 of REGDOC-2.9.1,in section 2.1 of CNSC REGDOC.-2.9.1, Environmental Protection: Environmental Principles, Assessments and Protection Measures, Version 1.2;
    - on environmental control measures in section 3 of REGDOC-2.9.2,section 3 of REGDOC-2.9.2: Controlling Releases to the Environment

    - on how to conduct a BATEA assessment in section 4 of REGDOC-2.9.2, Controlling Releases to the Environment;

- describe how radiation protection measures maintain doses to the public at the environment to a level that is As Low As Reasonably Achievable (ALARA) through the application of Best Available Technology and Techniques Economically Achievable (BATEA);
- document radiation doses on and offsite at similar existing facilities (when they exist) that use the best available technology economically achievable (BATEA);
    - Calculated doses to persons, both on and offsite, should be traceable to the input data (for example, receptor exposure characteristics, relevant radiological data). Sample dose calculations should be included that demonstrate the link from input data (such as concentrations of radionuclides in air) to doses to persons, with all relevant assumptions provided;
- identify mitigation and preventative measures to eliminate or minimize radiological hazards through design and engineering controls;
    - ensure that engineered controls demonstrate that the controls reduce the magnitude of each radiation source and keep radiological exposures of workers as low as reasonably achievable (ALARA) during routine and non-routine work practices (for example, operating and maintenance activities;
    - specify radiological design objectives for engineered controls;
    - Identify the administrative controls that will be used to minimize doses to workers (e.g., personal protective equipment, training and procedures);
    - describe contingency responses in the events of failed engineered and administrative controls;
    - describe the mitigation that will be taken in the event radiological hazards are identified during the site preparation or construction phases;
- identify mitigation and enhancement measures for health and well-being effects;
- describe the proposed mitigation and enhancement measures that will be implemented for all social effects, taking into account local, Indigenous and regional land use and development plans, including:
    - opportunities to enhance positive impacts;
    - effects on infrastructure and services;
    - mitigation considered for heritage and structures, sites, and things of significance, as well as contingency plans and communications plans in the event of such discoveries during construction; and,
    - where applicable, provide documented confirmation from the grid owner(s) that, with appropriate grid and plant mitigation measures in place, the location of the reactor facility will not adversely affect the grid;
- describe the proposed mitigation and enhancement measures that will be implemented for all economic effects, including:
    - mitigation measures to address potential shortage of skillsets (such as training programs), in order to adequately assess potential economic impacts and support the population;

- opportunities for enhancing positive effects, such as:
  - education, training and hiring practices that encourage employment of local people;
  - actions taken to increase access to education and training opportunities for different groups (e.g., provision of transportation, flexible hours);
  - a summary of commitments made with respect to employment, training and trade; and
  - training, education, and scholarship programs that the proponent plans to support in order to improve employment opportunities, including participation in and contribution to local training networks. Specify the types of employment targeted by these programs, as well as the targeted clientele, such as local residents, Indigenous Peoples, and diverse population groups (e.g., Indigenous women);
- describe plans, programs and policies to encourage contracting and procurement opportunities for local and regional businesses and Indigenous Peoples:
  - describe supplier network development initiatives, including the identification of potential local suppliers, and plans to provide them with information on technical, commercial and other requirements, and to debrief unsuccessful bidders;
  - describe any procurement policies that facilitate the opportunities for local companies, and
  - describe technology transfer and research and development programs that will facilitate the use of local suppliers of goods and services and local employees, and that will develop new capabilities related to project requirements; and
- where appropriate, provide details regarding financial liability and compensation in place as required by regulation or the proponent's commitments in relation to decommissioning or abandonment.

9.2 Biophysical determinants of health

9.2.1 Baseline conditions for biophysical determinants of health

The Impact Statement must:

- provide the approximate location on a map and distance of likely human receptors, including foreseeable future receptors, which could be affected by changes in air, water, country food quality, and noise and light levels. Include communities' gathering, hunting, trapping and fishing areas. Include a description for Indigenous Peoples permanent residences, temporary residences (e.g., Indigenous cottages and camps identified in collaboration with Indigenous Peoples) and sensitive

receptors (e.g., schools, hospitals, community centres, retirement complexes, health care centres) near the project;

- describe and characterize the existing health services and programs, including health care provider capacity and emergency services;
- describe drinking water sources, both surface and groundwater (permanent, seasonal, periodic or temporary), including flow rates, approximate wellhead capture zones, and the distance from project activities;
- describe the consumption of country foods (traditional foods) as a health-related behaviour, including what species are used, quantities, frequency, harvesting locations and how the data were collected;
- provide baseline contaminant concentrations in ambient air, drinking water and tissues of country foods consumed by Indigenous Nations and communities and local communities. The proponent should work with local Indigenous Nations and communities to collect tissue samples where appropriate and to ensure samples collected are representative of the population; and
- describe the level of food security and food sovereignty within Indigenous Nations and communities and local communities. Refer to the Public Health Agency of Canada's website on food security and to the First Nations Food, Nutrition & Environment Study for more information;

9.2.2 Effects on biophysical determinants of Health

The Impact Statement must:

- provide an assessment of the potential effects on human health in consideration of, but not limited to, potential changes in:
  - air quality;
  - noise exposure and effects of vibration;
  - light levels;
  - drinking water quality and quantity including flow rates, as applicable;
  - current and future availability and quality of country foods, and
  - current and future availability and quality of water for drinking, recreational and cultural uses;
- describe and document the method used to estimate effective and equivalent doses (see methodology guidance in REGDOC-. 1.1.1 appendix, section G.7.1);
- consider statistical interpretation of acute exposures;
- reference and describe alternative interpretations of radiation risk;
  - address the effects of using radiation weighting factors suggested in CSA N288.6, for calculating a "biota effective dose" from absorbed dose (i.e., weighting factors of 40 for alpha particles, and 3 for tritium beta particles); and,
  - use a probabilistic modelling approach if there is ambiguity in the validity of dose estimates for site-specific conditions and/or VCs (i.e., a probabilistic approach is appropriate when it is

necessary to grossly extrapolate information for other areas or species, or when there is ambiguity in the protection of any threatened or endangered species, or species of concern;

- determine the anticipated effects of the project on the quality and quantity of groundwater or surface water used for domestic purposes based on the strictest guideline values for the following criteria: Guidelines for Canadian Drinking Water Quality (GCDWQ), or any relevant provincial water quality standards or guidelines, and compliance with existing provincial regulatory mechanisms
- describe the fate and estimated travel times of COPCs from contaminant source areas to drinking water sources;
- describe how the project-related contaminants (as identified in sections 8.3 Topography, soil and sediment, 8.6 , and 8.7 Groundwater and surface water) can potentially end up in the water, air or soil, can be absorbed in country foods (i.e., foods that are trapped, fished, hunted, harvested or grown for subsistence, cultural or medicinal purposes);
- provide the rationale if a determination is made that an assessment of the potential for contamination of country foods (traditional foods or other exposure pathways) is not required or if some contaminants are excluded from the assessment;
- identify other potential routes of exposure to contaminants;
- provide a detailed justification for every contaminant of potential concern (COPC[14]) or exposure route that would be excluded or eliminated from the assessment of the human health risks;
- conduct a problem formulation exercise and/or preliminary model predictions to determine whether a complete HHRA is required. The proponent must provide a rationale if the problem formulation and/or preliminary model predictions indicate that a HHRA complete is not warranted. The problem formulation exercise and, if a HHRA is conducted, must use best practices in health risk assessments methods (see Health Canada, 2023. Guidance for Evaluating Human Health Impacts Effects in Environmental Assessments Impact Assessment: Human Health Risk Assessment);
- provide an assessment of the carcinogenicity of diesel exhaust gases when diesel engines are a source of air pollutant emissions for the project.
- describe and quantify specific thresholds used for HHRA and document if different thresholds were considered for vulnerable populations, including by sex and age. Provide a justification if any applicable threshold was not used;
- document and take into account tolerance thresholds for potential adverse effects on health identified by Indigenous Nations and communities and local communities;

[14] COPC: Any chemical substance, radiological or non-radiological contaminant for which the concentration in an environmental medium is likely to be high due to the Project's activities may first be considered as a COPC. However, if it is established that the sum of the modeled concentrations and the background concentrations is below the guidelines, standards or criteria - based on health protection - for the affected area, the statement of the problem stage of the risk assessment may conclude that it is unnecessary to treat this chemical substance as a COPC in a quantitative risk assessment.

- in situations where project-related air, water or noise emissions meet local, provincial or federal guidelines, and yet public concerns were raised regarding human health effects, provide a description of the public concerns and how they were or are to be addressed;
- with regard to potential effects on food security:
  - describe changes in terms of availability, use, consumption and quality of country foods (traditional foods), and the potential effects related to these changes on physical and mental health of communities; and
  - identify possibilities of avoidance of certain country food sources or drinking or recreational water sources due to the perception of contamination; and
- describe any project-related changes that could result in a positive health effect (e.g., remediation projects).

9.3 Social determinants of health and community well-being

9.3.1 Baseline conditions for social determinants of health and community well-being

The Impact Statement must describe:

- the existing social conditions for Indigenous Nations and communities and local communities:
  - community cohesion, including level of support and engagement in community or neighbourhood, social networks and social activities;
  - the psychosocial environment and its influence on community well-being;
  - demographic characteristics and major socio-cultural values and concerns;
  - capacity of municipal governments to collaborate with provincial authorities and to secure funding and support required to upgrade the current regional infrastructure and services;
  - relevant historical community background; and
  - applicable history with previous developers;
- baseline conditions for land and resource use, including:
  - a brief history of human occupancy and of land resource use in the study area based on selected spatial and temporal boundaries (include maps, if possible), including information on major industries in the vicinity of the project site;
  - a consideration of relevant current and future land use from local, regional, or provincial land use or resource development plans;

- sites or areas that are used by local people either as a permanent residence or as a seasonal/temporary location, and the number of people using each identified site or area (include a map, if possible);
- identify remote, rural and urban residential areas (including seasonally and year-round occupied establishments);
- identify parks and primary recreation areas (including local and provincial/territorial parks, recognized scenic areas, and recreational water bodies;
- identify monitored or administered forest areas (including forests under agreement and areas designated for timber sales);
- identify registered or recognized hunting, trapping or guiding areas, recreational and commercial fishing areas, preferred harvesting areas; and
- identify water supplies and water lots, as well as water sources and intakes for farms, industries, residents and municipalities; and

- describe the natural and cultural heritage, and provide maps for buildings, sites and things of historical, archaeological, paleontological or architectural significance in the study area, including land, natural features and resources considered to be heritage.

9.3.2 Effects on social and economic determinants of health

The Impact Statement must:

- describe the potential health effects arising from changes to social and economic conditions that are determinants of health, and their respective indicators, reflecting the input of the affected communities;
- identify and describe anticipated changes to determinants of health that may be related to the project, including:
  - housing availability, housing affordability, home ownership and home value;
  - demographic information on the region, including available descriptive statistics (e.g., age, ethnicity, sex and gender, language);
  - access to health and social services;
  - access to green spaces, parks and recreational facilities;
  - community cohesion;
  - average income and wage inequality;
  - education level;
  - factors supporting mental health and community well-being (including perceived stress, concern for future generations), and
  - safety of Indigenous women, girls and 2SLGBTQIA+ People;

- identify any emotional or social stress factor that may result from the project, particularly concerns regarding perceived public safety risks due to the project or due to potential accidents or malfunctions
- describe potential effects on access to social and health services, including the increased use of health services and related social services in local communities;
- indicate the potential health effects, short-term or long-term, resulting from changes on community cohesion and perception of well-being during the construction phase, and determine whether and how those effects would change again during the operation phase;
- describe how potential avoidance of land near project components by Indigenous Peoples due to perceived changes in safety, environmental quality and tranquillity was considered in assessing potential effects on the diet and health of Indigenous Peoples;
- document and take into account tolerance thresholds for potential adverse effects identified by Indigenous Peoples; and
- describe any positive health effects (e.g., resulting from improved economic opportunities, increased access to services).

9.3.3 Effects on community well-being

The Impact Statement must:

- describe potential adverse and positive effects, at the community level, of changes to community well-being including, but not limited to:
  - safety and security;
  - food security;
  - income inequity;
  - housing prices and availability;
  - cost of living;
  - non-commercial/trade economy; and
  - those conditions considered for analysis of determinants of health in section 9.2 Effects to human health, social and economic conditions;
- consider potential effects related to greater propagation of infectious diseases and gender-based violence;
- describe, at the community level, the expected interactions between the project's construction, operation and maintenance workforce and local communities, businesses and residents;
- describe in-and out-migration effects, related to construction and operation activities, including changes in population;
- evaluate effects on access, ownership and use of resources (e.g., land tenure, food, water, social infrastructure);

- document and take into account tolerance thresholds for potential adverse effects identified by Indigenous Peoples; and
- describe any positive effects on well-being (e.g., resulting from improved economic opportunities, increased access to services).

9.4 Services and infrastructure

9.4.1 Baseline conditions for services and infrastructure

The Impact Statement must:

- describe the existing local and regional infrastructure and services in the study areas, including:
  - road infrastructure and traffic safety,
  - active transportation (e.g., cycle and pedestrian routes);
  - railways;
  - barges/docks
  - airports;
  - information related to existing traffic;
  - pipelines, water mains and sewer lines;
  - power lines;
  - utilities;
  - housing, accommodation and lodging (e.g., affordability including rental prices, availability, suitability), including camping facilities and recreational dwellings;
  - public transportation;
  - recreation and parks;
  - waste management;
  - educational services, facilities, and childcare;
  - elder care and services;
  - existing health services and programs, including health providers capacity;
  - emergency services, including ambulance services;
  - police and fire departments;
  - social services; and
  - all other potentially affected infrastructure and services.

9.4.2 Effects on services and infrastructure

The Impact Statement must:

- describe the adverse and positive effects to the local and regional services and infrastructure anticipating and considering increased demand on these services including those identified under section 9.1.3 Baseline for services and infrastructure;
- take into account potential effects arising from a higher risk of accidents for each phase of the project, (e.g., a higher risk of impact on the road system and emergency services during the construction phase due to an increased use of roads); and
- describe any need for government or proponent expenditures for new or expanded services, facilities or infrastructure, arising out of project-related effects.

9.5 Employment and economics

9.5.1 Baseline conditions for employment and economics

The Impact Statement must:

- describe the local and regional economic conditions for Indigenous Nations and communities and local communities, including:
  - demographic features of the local and regional population, including educational attainment and income;
  - prevalent economic concerns and economic aspirations of residents, families and workers in the study area;
  - any local, Indigenous, provincial, or federal economic development and land use plans for the study areas;
  - existing employment rates and economic well-being in the study area and impacted communities;
  - labour force indicators, including participation rates, unemployment rates, employment by industry and by occupation, the availability of skilled and unskilled workers, existing working conditions, wages and average salary range, full-time and part-time employment, and an assessment of any existing gaps in employment equity using tools such as Equi'Vision;
  - training opportunities to examine gender and Indigenous inequities such as for skilled trades and in wages and qualifications;
  - local and regional workforce development and training plans, including those specific for Indigenous Peoples;
  - main economic activities in the study areas;

- an overview of the businesses that may provide supplies and services required for the project;
- current use of land and waterbodies for economic activities in the study areas including a description of hunting, recreational and commercial fishing (including catch rates, visitation rates, and angling days), trapping, outdoor recreation, use of seasonal cabins, outfitters, and forestry;
- local organizations, user groups and Indigenous Peoples interested in local land uses and resources for previous projects in the regional study area; and

- describe agricultural activities, including the major crops, commercial livestock held, the growing season, and the size of local farms.

9.5.2 Effects on employment

The Impact Statement must:

- describe the potential changes in employment including the following aspects:
  - an estimate of the direct, indirect and induced employment at each phase of the project (including an estimate of the full-time equivalent (FTE) employment for each phase of the project, and an estimate of full- and part-time employment);
  - an estimate of direct, indirect or induced income or wages;
  - a description of the types and duration of employment anticipated to be created at each phase of the project;
  - an estimate of the ability of the local and regional labour market to meet the demand;
  - an analysis of the potential for labour shortages in certain sectors as a result of the project;
  - a description of the plans and the justification for hiring of temporary workers to make up for any local shortage of labour and skills;
  - situations where the project may cause the displacement of local workers, and
  - any potential short, medium and long-term changes to the local and regional labour markets as a result of the project;
- describe the potential changes in training including:
  - training programs to improve employment opportunities for local and Indigenous residents, and
  - potential employment effects from training related to the project; and
- the project's diversity and inclusion workforce plans, policies and practices, including to increase the employment of Indigenous Peoples, women and diverse population groups.

9.5.3 Effects on business environment and local economy

The Impact Statement must:

- discuss the economics of the project, including:

  - an estimate of capital costs for each phase of the project and total investment
  - a detailed forecast of project revenues, capital and operating costs for the operating phase of the project
  - an analysis of the economics of the project and sensitivity analyses based on qualitative (e.g., a discussion of risks related to the project, such as capital cost overruns and anticipated electricity rates or quantitative analyses (e.g., discounted cash-flow analysis or levelized cost of electricity).
- describe, if applicable, any actions to increase procurement from local or regional businesses, and from businesses owned by Indigenous Peoples, women, or diverse population groups;
- describe any economic benefit agreements under consideration or concluded with local communities provide an estimate of the anticipated levels of local and regional economic participation in the project in comparison to the total project requirements (e.g., total dollar value of contracts);
- describe positive effects on the local and regional economy (e.g., job creation, youth retention in the area, and indirect effects on local businesses total dollar value of contracts);
- describe situations when the project may directly or indirectly create economic hardships for, or the displacement of, businesses such as non-nuclear companies in the region (e.g., construction industry) and low wage jobs (e.g., hospitality, service, tourism, healthcare, childcare, manufacturing and agriculture);
- estimate the potential effects of the project on the traditional economy, including the potential loss of related jobs;
- describe the potential effects of changes to economic conditions for specific sectors, for example:
  - fishing, hunting and trapping,
  - commercial outfitters;
  - commercial recreation and tourism; and
  - agriculture, including predicted effects to crops and livestock health and productivity;
- describe the potential effects of changes to land and resources used in local economic activity, including:
  - potential effects of the project on the availability, value and quality of commercial land and real estate; and
  - potential effects of the project on the quality and quantity of groundwater or surface water used for agricultural and commercial purposes;
- evaluate the net economic benefits to the economy as a whole, including:
  - a quantitative evaluation of effects on local, regional, provincial federal government or Indigenous Peoples revenues from tax levies, royalties, revenue sharing and other means for each phase of the project;
  - discuss how the project would affect the gross domestic product at the local, regional, provincial and federal levels;
  - a quantitative or qualitative evaluation of positive (revenues) and adverse (expenditures) fiscal effects of the project on local, regional, provincial and federal government or Indigenous Peoples

    - sources and methodologies used for developing multipliers and estimates and, where a generic multiplier may not accurately reflect the specific situation of the project, provide evidence of specific economic activity that will result from the project going ahead;
- provide information on the economic viability of the project, to support the net benefits assessment, including:
    - cash-flow modelling results for the project with a focus on net-present value, internal rate of return, and break-even commodity prices for the project;
    - forecasts of relevant commodity prices for the project and descriptions for where these were acquired and, if available, how they were forecasted;
    - the project's position on the global cost curve and any potential impact on local and global commodity markets;
    - sensitivity analysis pertaining to key aspects of the project, including, but not limited to, discount rates, prices, capital and operating costs;
    - details on the financial securities relating to the proponent's commitments for the decommissioning or abandonment of the project; and
    - discussion of environmental, social and governance risks to project economics, including the cost of capital.

The economic information provided will be made publicly available and should not contain confidential business information.

9.6 Navigation

9.6.1 Baseline conditions for effects on navigation

Describe baseline conditions for navigation, including:

- existing navigable waterways, including the Peace River, and all their uses; and
- potentially affected waterway users and existing concerns regarding navigable water use and access, including on the Peace River.

9.6.2 Effects on navigation

The Impact Statement must describe effects on navigation and navigation safety, including:

- navigable waterways that could be impacted by the project, and specify the proposed crossing method;
- ancillary project components that will be constructed in, on, under, over, through or across navigable waterways to support the project, and specify the proposed crossing method;

- potentially affected waterway users and describe consultation with waterway users such as Indigenous Nations and communities regarding navigational use, issues raised and how issues were addressed.

10 Indigenous Peoples

Indigenous Nations and communities are best placed to understand and assess how a project may impact Indigenous Peoples and their rights.

The proponent should work with Indigenous Nations and communities and respect each Nation's preference regarding the assessment of impacts on Indigenous rights and interests, including residual impacts and cumulative impacts.

As outlined in section 7.3 Selection of valued components, Indigenous Nations and communities may identify holistic VCs that encompass multiple environmental, health, social or economic components. Where holistic VCs are identified, the proponent must combine the analysis of individual components into an assessment of the holistic VCs and note it in the Impact Statement.

Where requested by Indigenous Nations and communities, parts or all of the assessments of effects on Indigenous Peoples and impacts on Indigenous Peoples and their rights can be combined. This supports Indigenous Nations and communities to assess the impacts in a meaningful way and ensures methods and conclusions are consistent. For example, effects on the current use of lands and resources for traditional purposes and impacts on Indigenous rights to hunt, fish and trap are often the same because they both involve changes to the same activities on the land and water. Undertaking these assessments together, when requested, will support consistent conclusions that apply both to impacts on Indigenous Peoples and their rights and effects on Indigenous Peoples under the IAA. However, if this approach is used, it is important to demonstrate that all of the specific requirements of the IAA have been met. The proponent must collaborate with Indigenous Nations and communities to the extent possible to identify proposed measures to avoid, minimize, offset, or otherwise accommodate for potential adverse impacts on Indigenous Peoples and their rights.

The Impact Statement must contain an assessment for each Indigenous Nation and community potentially affected by the project, and summarize any past, present and anticipated future use of, and practices within, the project areas. The Indigenous Nation and community-specific assessments should include Indigenous Nation and community-specific methodological considerations, analyses and conclusions based on feedback or submissions from Indigenous Nations and communities. To the extent possible, each group-specific assessment should be done in a way that works best for each Indigenous Nation and community.

10.1 Indigenous physical and cultural heritage, and structures, sites or things of significance

The Impact Statement must include information on Indigenous physical and cultural heritage, and structures, sites or things of significance. The proponent must follow the Technical Guidance for Assessing Physical and Cultural Heritage or any Structure, Site or Thing, or subsequent revisions made prior to submission of the Impact Statement to ensure that the relevant provisions of the IAA are met.

10.1.1 Baseline conditions

The description of the baseline conditions associated with physical and cultural heritage and structure, site or thing of significance for Indigenous Peoples should consider historical conditions associated with the ability to transmit culture (e.g., through language, ceremonies, harvesting, teaching of sacred laws, traditional laws, stewardship laws, Indigenous Knowledge). Protocols and participation in any assessment of physical and cultural heritage, including but not limited to archaeological investigations, must be developed in collaboration with Indigenous Nations and communities and must abide by provincial standards and standards set by applicable Indigenous Nations and communities.

The Impact Statement must:

- describe the interconnections and impact pathways between heritage and cultural structures, sites, places, and things and other Indigenous rights and interests for each potentially impacted Indigenous Nation and community, including intergenerational impacts over the lifetime of the project;
- describe how historical and current cumulative effects to environmental and socio-cultural conditions, including changes to those conditions, have already impacted physical and cultural heritage; and
- include valued components identified by Indigenous Nations and communities.

10.1.2 Effects to Indigenous physical and cultural heritage

The Impact Statement must:

- assess effects to physical and cultural heritage, and structures, sites or things of historical, archaeological, paleontological or architectural significance based on a comparison with baseline conditions, and taking into consideration cumulative effects, including: [*add any relevant structures, sites or things of significance, and potential effects, identified by Indigenous groups during the Planning phase:*
  - effects on structures, sites or things of significance including:
  - burial sites;
  - spiritual sites, including rivers and watercourses;
  - cultural landscapes;

- teaching areas used to transfer knowledge between generations;
- sacred, ceremonial or culturally important places, plants, animals, objects, beings or things;
- places with archaeological potential or artefacts;
- historically occupied sites; and
- components of the environment identified by Indigenous groups as having heritage value.
- loss or destruction of physical and cultural heritage, including
- oral histories;
- cultural values and experiences on the land;
- Indigenous governance systems and Indigenous laws tied to the landscape;
- place names, language and other components that make up a culture;
- changes to access to and/or experience with physical and cultural heritage,
- changes to the cultural value, spirituality, or importance associated with physical and cultural heritage,
- changes to sacred, ceremonial or culturally important places, objects or things,
- changes to visual aesthetics over the life of the project and post-project abandonment or decommissioning,
- changes to components of the environment identified by Indigenous Peoples as having heritage value, and
- any other effects identified by Indigenous groups];

- describe how impacts on Indigenous Peoples and their rights will also impact the ability of Indigenous Peoples to transmit their culture, language or Indigenous Knowledge intergenerationally, for example, through ceremonies, harvesting, teaching of stewardship laws, or a community tradition of sharing;
- describe contingency plans and field interventions that will be applied should heritage resources be discovered during construction and operation, or cultural heritage training programs for workers; assess effects identified by Indigenous Nations and communities.

10.2 Current use of lands and resources for traditional purposes

The Impact Statement must include information on the current use of lands and resources for traditional purposes. The proponent must follow the Technical Guidance for Assessing the Current Use of Lands and Resources for Traditional Purposes under CEAA, 2012 or subsequent revisions made prior to submission of the Impact Statement to ensure that the relevant provisions of the IAA are met.

10.2.1 Baseline Conditions

Where information is provided or validated by Indigenous Nations and communities, the Impact Statement must describe baseline conditions, including:

- Indigenous governance systems and Indigenous laws associated with the current use of lands and resources for traditional purposes;
- traditional activities presently or historically practised (e.g., hunting, fishing, trapping, gathering of plants or medicines, access or travel routes); and any Indigenous-led research or monitoring activities pertaining to the Indigenous Nations and communities' current use of lands and resources.
- studies from Indigenous Nations and communities conducted to quantify use of land for hunting, fishing, trapping, medicinal plant gathering, habitation, spiritual, ceremonial, burial, or any other traditional pursuits; (REGDOC. 1.1.1 - Appendix C9);
- valued components identified by Indigenous Nations and communities

10.2.2 Effects to current use of lands and resources for traditional purposes

The Impact Statement must:

- assess the effects on current use of lands and resources for traditional purposes, based on a comparison with baseline conditions which consider cumulative effects, including changes to:
  - the quantity, distribution, and quality (including perceived quality) of resources available for harvesting and consumption of country foods (traditional foods), specifying the species and resources used or important for traditional and cultural purposes;
  - the locations, frequency, duration or timing of traditional practices, including any avoidance of resources due to perceived quality;
  - access to:
    - culturally important harvesting areas or resources and travel routes for conducting traditional practices (e.g., physical access to harvest-specific species, culturally important locations),
    - traditional territories, communities and reserves,
    - locations of importance for traditional use, including camps, cabins and gathering, staging, or teaching grounds,
  - economic burdens of, and increased time for, travelling further to hunting, fishing, trapping, and gathering opportunities;
  - efforts by Indigenous Nations and communities to restore traditional practices;
  - experiences of being on the land (e.g., changes in air quality, noise and sensory disturbance, artificial light, fragmentation of traditional territory, visual aesthetics/landscape and any corollary wellness impacts as a result of sensory changes, including perceived contamination);
  - the use of riverbanks, travel ways, navigable waterways and waterbodies, including for social and ceremonial purposes, travel or recreation; and

    - sites of interest to communities including for commercial and non-commercial fishing, hunting, trapping and gathering and cultural or ceremonial activities and practices, and other current uses identified by Indigenous Nations and communities.
- describe potential effects on the transmission of Indigenous Knowledge, including intergenerational transfer of knowledge, language, community tradition of sharing and community cohesion linked to activities potentially affected by the project;
- take into account expectations pertaining to the preservation of landscapes, including nighttime landscapes and, if applicable, regulatory requirements and best practices in place concerning light pollution (the proponent needs to work with communities to ensure that any standards that are applied are protective of traditional uses and purposes and human health);
- describe all reasonable alternatives considered that would avoid impacts on current use of lands and resources for traditional purposes considered during project development;
- assess other potential project effects requested by Indigenous Nations and communities.

10.3 Health, social and economic conditions of Indigenous Peoples

10.3.1 Baseline conditions

The baseline conditions established for Indigenous Nations and communities must meet the requirements set out in section 9 Health, Social and Economic Conditions, and take into account GBA Plus specific to Indigenous Peoples as well as Indigenous governance regimes and Indigenous laws. A health baseline study, where applicable based on potential project effects, should be tailored to each of the impacted Indigenous Nations and communities. Indigenous Nations and communities should be offered the opportunity to carry out their own study.

The Impact Statement must identify and describe the following components identified by Indigenous Nations and communities:

- valued components or health, social or economic concerns relevant to the project identified by each Indigenous Nation or community.

10.3.2 Effects to health, social and economic conditions of Indigenous Peoples

In addition to the requirements set out in Section 9 Health, Social and Economic Conditions, the Impact Statement must include a health impact assessment tailored to each of the impacted Indigenous Nations

and communities who should be offered the opportunity and the means to carry out their own study or co-draft the assessment of project impacts on their health and well-being.

The Impact Statement must:

- describe the health, social and economic effects that the project may have on Indigenous Peoples including:
  - from changes to radiological conditions;
  - Indigenous economic participation in the project (e.g., number of workers, revenue sharing, ownership, equity and other related measures);
  - effects on Indigenous Nations and communities' ability to manage or improve social and economic conditions including in relation to engaging in traditional and other economic activities;
  - effects to commercial fisheries, including species fished (along with catch rates and fishing days), number of licences, value of fisheries and breakdown between domestic vs. international fisheries, where applicable;
  - Indigenous Nation and community-specific benefit plans, including economic development, whether through an agreement or otherwise;
  - how positive impacts on one or more Nation or community may result in adverse impacts on one or more other Nation(s) or community;
  - other potential project effects identified by Indigenous Nations and communities.

10.4 Rights of Indigenous Peoples

The Impact Statement must include information on the potential impacts on the rights of Indigenous Peoples. The proponent must apply the following IAAC guidance on this topic: the Policy Context: Assessment of Potential Impacts on the Rights of Indigenous Peoples and the Guidance on Assessing Potential Impacts on the Rights of Indigenous Peoples or subsequent revisions made prior to submission of the Impact Statement to ensure that the relevant provisions of the IAA are met.

10.4.1 Baseline Conditions

The Impact Statement must:

- describe how historical and current cumulative effects to environmental and socio-cultural conditions, including changes to those conditions, have already impacted Indigenous rights; and
- document the nature and extent of the exercise of rights of Indigenous Peoples, potentially impacted by the project, as identified by the Indigenous Nations and communities.

Indigenous Nations and communities may also provide their perspective through consultations with IAAC, the CNSC, and the review panel.

The Impact Statement must include a description of how historic, existing and reasonably foreseeable future activities have cumulatively affected or could affect the conditions that support or limit the Indigenous Nation or community's meaningful exercise of their rights.

Indigenous Nations and communities must be involved in the baseline characterization of conditions supporting the exercise of rights, as well as the scoping and assessment of the nature and extent of the exercise of rights of Indigenous Peoples.

10.4.2 Impacts on Rights of Indigenous Peoples

The proponent must share studies and information about the project and its potential impacts with Indigenous Nations and communities prior to assessing the impact of the project on their rights.

The Impact Statement must:

- document and assess the project's potential impacts on the exercise or practice of the rights or the rights arising from treaties in the project area, including the severity of impact, considering links between resources, access and experience, as expressed by potentially impacted Indigenous Nations and communities;
- describe solutions to concerns raised about impacts on the exercise of rights, as agreed to by Indigenous Nations and communities;
- describe how the assessment of other Indigenous rights and interests were integrated into the assessment of Indigenous rights and considered in the determining residual impacts and the severity of impacts;
- document the level of engagement with Indigenous Nations and communities and the approach taken to support Indigenous Nations and communities in identifying the potential impacts of the project on their rights; and
- where an Indigenous Nation and community has not provided its views on the impact of the project on their rights to the proponent, or where the proponent and an Indigenous Nation and community, in consultation with IAAC and the CNSC, agree that the Indigenous Nation and community will provide information on impacts on their rights and interests directly to IAAC or the review panel instead of through the Impact Statement, the proponent must provide this rationale in the Impact Statement.

The proponent, in collaboration with Indigenous Nations and communities, must consider the following factors, as relevant:

- impacts on fishing including impacts on economics, food, culture, and ceremony;
- impacts on Indigenous governance;
- impacts on harvesting;
- impacts on navigation;
- impacts on cultural practices including sharing Indigenous Knowledge; and

- Indigenous Nations and communities' approach to managing changing climate.

10.5 Mitigation and enhancement measures

The Impact Statement must include information on the potential impacts on Indigenous rights and interests. The proponent must apply the following IAAC guidance in section 12 – Indigenous Peoples of the Tailored Impact Statement Guidelines Template: the Policy Context: Assessment of Potential Impacts on the Rights of Indigenous Peoples, Guidance on Assessing Potential Impacts on the Rights of Indigenous Peoples, Technical Guidance for Assessing the Current Use of Lands and Resources for Traditional Purposes under CEAA, 2012, Technical Guidance for Assessing Physical and Cultural Heritage or any Structure, Site or Thing or subsequent revisions made prior to submission of the Impact Statement to ensure that the relevant provisions of the IAA are met.

The Impact Statement must:

- describe the proposed mitigation and enhancement measures for all adverse impacts to Indigenous rights and interests, identify if these are measures for which the proponent or other parties would be responsible and how these measures vary for each Indigenous Nation and community;
- describe if and how mitigation and enhancement measures will be integrated into the project design;
- include perspectives of the potentially impacted Indigenous Nations and communities, on the effectiveness of particular mitigation measures;
- describe collaboration undertaken with Indigenous Nations and communities to identify preferred mitigation, as well as to optimize the project's benefits for their communities and include outcomes of that collaboration;
- demonstrate how the timing of Indigenous Nations and communities' activities on the land was considered when establishing the schedule for project activities;
- describe the measures that will be implemented by the proponent for the impacts of the project on the exercise of rights, including how the measures directly address the possible impacts of the project on the exercise of rights and the scope of the measures;
- describe any differentiated mitigation and enhancement measures for Indigenous Nations and communities and various vulnerable population groups, and how they were developed in collaboration with the potentially affected communities and diverse population groups;
- describe how GBA Plus results have been used to inform mitigation and enhancement measures;
- describe predicted climate change considerations for VCs and incorporate climate change adaptation into reclamation planning;
- describe existing and proposed measures for the protection of culturally significant areas;
- provide available information of the effectiveness for all proposed mitigation related to Indigenous rights and interests. Where no information exists, describe plans to monitor the effectiveness of mitigation. The proponent is encouraged to share the information available with Indigenous Nations

and communities and to monitor the effectiveness of mitigation in cooperation with Indigenous Nations and communities;

- where no mitigation is proposed or mitigation is not possible, describe the potential adverse impacts on Indigenous rights and interests, as identified by the Indigenous Nations and communities;
- note if any impacts on Indigenous rights and interests are addressed through an impact benefit agreement with an Indigenous Nation or community. and
- describe and consider mitigation measures identified by Indigenous Nations and communities.

10.6 Characterization of residual impacts on Indigenous rights and interests

The proponent should either provide conclusions on the extent of significance or potential impacts on Indigenous rights and interests for each of the Indigenous Nations and communities affected by the project or, have conclusions provided by the Indigenous Nations and communities conducting the assessment.

The proponent should discuss with each Indigenous Nation and community whether it is appropriate for the proponent to provide their views on the conclusions regarding Indigenous rights and interests. The proponent is not required to provide a conclusion about impacts on an Indigenous Nation and community if an Indigenous Nation and community has provided their own conclusion.

11 Security Considerations

The following guidance and requirements on security considerations are included in the Integrated Guidelines as they apply to the entire project lifecycle.

For new nuclear sites and new reactor facilities on existing sites, the proponent must develop security-related physical protection objectives for reactor facilities. To do so, the proponent must include the gathering of information about the reactor facility's proposed siting location, in order to study threats or issues presented by the geographical location and characteristics of the proposed site, including potential acts of terrorism. The proponent must compile the findings from this study in a site selection threat and risk assessment (SSTRA) report. Should the project be allowed to proceed, the contents of the SSTRA report may be merged into the licensee's overall security program after the LTPS has been granted.

A site selection threat and risk assessment (SSTRA) must be conducted prior to the submission of an application for a LTPS. The resulting report contains an analysis of physical barriers to security presented by the location of the site over the proposed lifecycle of the project. It includes an assessment of the consequences of successful threat events, proposed mitigation measure and the resulting risk levels associated with these threat events. The intent of the SSTRA is to aid the proponent in determining the suitability of the site from a security perspective. The information from the SSTRA feeds into the development of appropriate security mitigation measures for activities to be encompassed by a licence

under the NSCA, to ensure that all security-related regulatory requirements are met. The SSTRA also identifies security concerns that may render the site undesirable from a security perspective and must not be restricted to those threats defined by the Design basis Threat (DBT).

Should the project be allowed to proceed, the SSTRA report and its basis information must be maintained as security baseline characterization data for the lifecycle of the facility. The SSTRA must include comprehensive consideration of both physical protection concerns and transportation routes, as described in the following subsections.

The SSTRA report must be classified as prescribed information, and protected from release under access to information / freedom of information requests, on the basis of national security.

The Impact Statement must: provide a commitment that the SSTRA and basis information will be maintained as security baseline characterization data for the lifecycle of the facility.

11.1 Physical protection

The proposed physical protection requirements must ensure that the appropriate detection, delay, and response considerations are taken into account.

Physical protection design requirements are influenced by the site location. Site evaluation must, therefore, address the physical dimensions of the reactor facility and its surrounding environment, including:

- the topology of the area that can be considered a component of the overall security barrier design (such as line-of-sight view);
- the proximity of various infrastructure elements that could adversely affect physical protection, such as a chemical plant that could release a noxious substance, an upstream hydroelectric dam on the Peace River or its tributaries that could be accidentally or deliberately breached (resulting in flood), or an airport that provides significant flight traffic in the vicinity of the site;
- site boundaries;
- weather that could factor as a potential impediment to the operability of physical protection systems (that is, systems that monitor the operation of a reactor and which, on sensing an abnormal condition, automatically initiate actions to prevent an unsafe or potentially unsafe condition); and
- details pertaining to the establishment of a construction site, such as the positioning of perimeter fences, access and egress points, and storage of construction drawings.

Guidance

Reactor facilities located in a remote area bordered by a small population density may require different physical protection considerations than those that apply to reactor facilities located in a large urban area.

11.1.1 Remote areas

The proponent must evaluate remote sites with respect to the anticipated time required to implement essential response services, including how long it will take offsite armed responders to reach the reactor facility.

Guidance

This aspect of the SSTRA should support early identification of the need for establishing an onsite nuclear response force capability, to ensure that a trained response group is in position during the construction phase of possible target sets (such as vital areas) that are part of the reactor facility.

11.2 Transportation routes

The proponent must consider the transportation routes in the vicinity of the site, to ensure that they are adequately taken into account during future site development activities. The routes to be considered include waterways, land routes and airspace, as described in the following text.

11.2.1 Waterways

The site evaluation must include assessment of all waterways in the vicinity of the site, from the perspective of physical protection. For example, a waterborne vehicle – or its personnel or contents – may be used in a manner that may pose a threat to the reactor facility (for example, being an explosive risk) to disable operations, equipment, or systems, in an act of sabotage that could have radiological implications.

11.2.2 Land routes

The proponent must assess all vehicular access land routes in proximity to the site, including rail lines, to determine the security threat they may pose to potential locations of future vital areas.

Guidance

Where possible, the surrounding terrain may be considered as a natural barrier in reducing vehicle-borne explosive risk. Where this is not possible, the proponent should consider delineating areas from which land vehicles must be restricted.

11.2.3 Airspaces

The SSTRA must consider the threats and risks associated with private and commercial airports, including associated flight pathways. This requirement involves discussions with municipal, provincial or territorial, and federal governments to confirm interdiction capabilities and coordinating points of contact.

12 Effects of Potential Accidents or Malfunctions

12.1 Risk assessment

The Impact Statement must:

- identify hazards for each project phase that could lead to accidents and malfunctions related to the project.
- describe the methods used to identify hazards and potential accidents and malfunctions, such as the use of existing information sources, recognized risk assessment methodology, the site selection threat and risk assessments (see section 11 Security Considerations), analysis of natural hazards (see section 13 Effects of the Environment on the Project), professional expertise, experience from similar projects, input from participants.
- explain how the lifespan and design of different project components has been taken into account in the identification of hazards, and accidents and malfunctions.
- include consideration of:
  - natural events such as flooding, earthquake (natural and induced), forest fires, high winds, tornadoes, landslides, blizzards, drought, ice storms, hail and lightning;
  - malevolent acts, including the potential for vandalism or sabotage;
  - vehicle accidents and collisions;
  - malfunction or failure of upstream hydroelectric facilities;
  - other human-induced external events, such as at other facilities; and
  - potential climate change over the project lifecycle;
- conduct an analysis of the risk of each hazard and adverse events based on consideration of likelihood and consequences for these events;
- describe the potential consequences of accidents and malfunctions in terms of environmental, health, social and economic effects, and effects to Indigenous peoples;
- characterize the risk to health and safety of workers and the public over the lifecycle of the project, in as much detail as possible;
- evaluate the risk of:
  - collisions with structures;
  - systems and components;
  - generation of explosions;
  - chemical and radiological hazards;
  - fires on present and proposed land; and
  - water transportation routes in the region;

- describe the plausible worst-case scenarios, and the more-likely but lower-consequence alternative scenarios, including;
  - the magnitude, duration and extent of effects;
  - the quantity, mechanism, rate, form and characteristic of contaminants, greenhouse gas emissions and other materials released or discharged into the environment;
  - influence of local and regional terrain, topography and weather conditions (e.g., difficult access for interventions);
  - modelling for any contaminants spilled or released indirectly into water or air;
  - potential adverse environmental effects of any event sequence that may result in hazardous substance releases or large releases of energy (such as steam or electrical arcs);
  - potential environmental, health, social and economic effects, as well as impacts on Indigenous rights and interests.
    - With respect to human health specifically, consideration should be given to potential pathways of effects associated with surface water, air, country foods, and other relevant media, including short-term and long-term risks to human health,
  - relative locations of sensitive receptors (e.g., humans, fish or wildlife and their habitat, waterways, private drinking water wells);
  - timing related to sensitive receptors (e.g., migration and nesting periods of migratory birds, spawning periods for fish, hunting season, tourist season); and
  - critical infrastructure, such as local drinking water treatment plants or facilities that can treat water sources affected by the project, as well as the ability and capacity of the drinking water treatment plants or facilities to treat water sources affected by accidental releases from the project during all project phases;
- identify and justify the spatial and temporal boundaries for the effect assessment associated with accidents and malfunctions. The spatial boundaries identified for effects from potential accidents and malfunctions will generally be larger than the boundaries for the project effects alone, and may extend beyond Canada's jurisdiction;
- describe long-term consequences of accidental releases (i.e., as shown from studies of major nuclear accidents such as "Differences in effects of radiation on abundance of animals in Fukushima and Chernobyl", published in Ecological Indicators;
- use the notional range of 1–10 Gy to describe the effects of acute exposure; and
- provide environmental sensitivity mapping that identifies site-specific conditions and sensitive receptors adjacent to project activities, including shores, streams and wetlands frequented by fish or migratory birds, and likely routes to them. Shoreline classification surveys and mapping must be conducted along major waterways where large spills or other accidents and malfunctions may occur, and must identify the route of the effects to the sensitive receptors. The characterization criteria established by Environment and Climate Change Canada contained in the Field Guide for Intervention in the Event of an Oil Spill on Maritime Shores constitutes a useful guide in this regard.

The risk assessment must also:

- meet the requirements and comply with relevant guidance provided in section 7.9 General criteria for site evaluation, including the consideration of potential cliff-edge effects that may arise from small increases in the severity of events;
- address severe accident sequences, which include, where applicable, simultaneous multiple-unit events, with loss of grid / station blackout events, and events with a simultaneous loss of offsite power with loss of normal access to the ultimate heat sink for an extended period of time. Considerations must also include radioactive sources such as the wet storage bay (also called irradiated fuel bay or spent fuel pool);
- explain how the potential for cascading or cumulative events was taken into account as part of the risk assessment and identification of worst-case scenarios, such as the potential for a tsunami generated by an earthquake as experienced during the Fukushima nuclear accident); and
- describe the risks that geohazards pose to the project, which should be described and evaluated through numerical or physical modelling.

Guidance that should be consulted to support the assessment of accidents and malfunctions on a nuclear facility include:

- IAEA Safety Standards Series No.NS-G-3.1, External Human Induced Events in Site Evaluation for Nuclear Power Plants;
- IAEA Safety Standards Series, Specific Safety Guide No. SSG-18, Meteorological and Hydrological Hazards in Site Evaluation for Nuclear Installations;
- NUREG/CR-7046, PNNL-20091, Design Basis Flood Estimation for Site Characterization at Nuclear Power Plants in the United States of America;
- NUREG/CR-7005, Technical Basis for Regulatory Guidance on Design-Basis Hurricane Wind Speeds for Nuclear Power Plants (CNSC-86-90).

12.2 Mitigation and enhancement measures

The Impact Statement must:

- describe the measures that would be in place to prevent accidents and malfunctions;
- describe security measures to reduce the potential for malevolent acts that could lead to accidents or malfunctions, including:
  - protection of prescribed information;
  - site security program;
  - site access clearance;
  - security arrangements with offsite response forces;
  - physical security;
  - cyber security; and
  - security program officer

- describe mitigation measures for the adverse environmental, health, social and economic effects, as well as impacts on Indigenous rights and interests, in the event of an accident or malfunction, such as emergency response and repair procedures that would be put in place;
- describe long-term monitoring and recovery measures that would be implemented to manage effects to the environment and health, social and environmental conditions, as well as impacts on Indigenous rights and interests, from accidents and malfunctions, including measures to remediate affected lands and waters;
- provide details of financial liability and compensation measures in place pursuant to regulations or the proponent's commitment in case of potential accidents or malfunctions associated with the project;
- describe mutual aid arrangements or memorandums of understanding with off-site response organizations in the event that the incident exceeds proponent resources and how to access these resources;
- describe the expected effectiveness of the mitigation for the prevention of accidents and malfunctions and mitigation of their consequences, as well as other applicable response measures; and
- outline the strategy that will be taken upon the potential discovery of additional risks to the health and safety of the public and environment that were not anticipated in the Impact Statement, including the development of additional mitigation measures.

12.3 Emergency management

The Impact Statement must describe an emergency response plan and as part of this plan must:

- address the safety and control area regarding emergency response captured in REGDOC 1.1.1. Section 4.6 Physical design and 4.10 Emergency management and fire protection for the activities that would be conducted under the licence to prepare a site, such as requirements for exclusion zones, emergency planning, preparedness, management and response, and fire protection;
- identify the types of accidents and malfunctions scenarios that would require emergency response, beyond those related to activities that would be conducted under the LTPS;
- identify emergency planning zones and emergency response for accident and malfunction scenarios, taking into account population density and population projections for the life cycle of the project;
- present preliminary emergency response measures, including identifying associated response systems and capabilities;
- take into account evacuation areas in the planning of emergency measures as well as the particularities linked to these areas (e.g., population density, number of residents varying with the seasons, possible high number of individuals unfamiliar with the region, limited communication means in remote areas and with temporary residents);

- describe the potential effects of accidents and malfunctions on the emergency plan execution, including on evacuation routes;
- describe existing emergency preparedness and response systems and existing arrangements and coordination with the responsible response organizations in the spatial boundaries associated with the project;
- describe emergency response training and exercise programs, including a description of the participation and training agreements with Indigenous Nations and communities that could be impacted by accidents or malfunctions;
- describe any plans for delivering training and exercise programs in local Indigenous languages for potentially affected Indigenous Nations and communities;
- document spill response strategies for each type of spill scenario including strategic locations of spill response equipment relative to likely accident and malfunction sites and likely pathways to sensitive environmental receptors;
- describe emergency communication and public notification plans, community awareness plans and public reporting;
- describe emergency communication plans that would provide emergency instructions to surrounding communities, including Indigenous Nations and communities, and how these will be informed by the public and Indigenous Nations and communities. The proponent should consider including:
  - immediate urgent actions, such as notifying the public of security and safety concerns, instructions for on-site shelter or shelter-in-place, procedures and evacuation routes;
  - longer-term actions, such as a general website and telephone helplines, updates on the status of incidents, injured animal reports; and
  - translation to local Indigenous languages
- describe liaison and continuous education plans linked to emergency preparedness for surrounding communities that may be affected by the consequences of a significant incident, including for Indigenous Nations and communities;
- describe past, ongoing and planned outreach efforts to ensure the public and Indigenous Nations and communities understanding the risks associated with this type of project (e.g., providing non-technical information, providing information in local languages if requested); and
- describe any waste management plan as it pertains to waste generated during an emergency response.

13 Effects of the Environment on the Project

The Impact Statement must:

- describe how environmental conditions, including natural hazards such as severe or extreme weather conditions and external events, could adversely affect the project and how this in turn could result in effects to the environment, health, social and economic conditions.
  - Natural hazards to take into account include: earthquakes (natural and induced), landslides, avalanches, biophysical or biological hazards (such as algae, moulds, pathogens, wildlife); extreme weather events such as tornadoes, blizzards, dust and sand storms, floods (including from extreme rainfall or snowmelt events upstream), forest fires, drought, ice storms, hail and lightning;
  - These events are to be considered in different probability patterns (e.g., 5-year flood versus 100-year flood) taking into account how these could change under a range of potential future climate scenarios.
  - The focus should be on credible external events that have a reasonable probability of occurrence and for which the resulting environmental effects could be major without careful management.
  - Site specific data should be used to determine natural hazards, unless such data is unobtainable;
- describe the project's climate resilience and how the impacts of climate change have been integrated into the project design and planning throughout the life of the project, following ECCC's technical guide on assessing climate change resilience;
- identify the project's sensitivities and vulnerabilities to changes in climate (both in mean conditions and extremes such as short-duration heavy precipitation events);
- provide details of planning, design and construction strategies intended to minimize the potential adverse effects of the environment on the project;
- describe mitigation that can be implemented in anticipation or in preparation for effects of the environment on the project;
- describe possible mitigation to address adverse environmental, health, social and economic effects resulting from effects of the environment on the project; and
- describe measures to enhance positive environmental, health, social and economic effects resulting from effects of the environment on the project.

The Impact Statement must specify, where applicable, the best practice codes and guides used to assess effects of the environment on the project, including:

- guidance related to conducting climate change resilience assessments in the Strategic Assessment of Climate Change;
- the National Building Code of Canada (for seismic effects);
- IAEA Safety Standards Series No.SSG9, Seismic Hazards in Site Evaluation for Nuclear Installations
- IAEA Safety Standards Series No.NSG1.5, External Events Excluding Earthquakes in the Design of Nuclear Power Plants
- CSA N289.2, Ground motion determination for seismic qualification of nuclear power plants
- CSA N289.3, Design procedures for seismic qualification of nuclear power plants

- IAEA Safety Standards, Series No.NS G3.6, Geotechnical Aspects of Site Evaluation and Foundations for Nuclear Power Plants
- IAEA Safety Standards Series, Specific Safety Guide No. SSG18, Meteorological and Hydrological Hazards in Site Evaluation for Nuclear Installations
- Dam Safety Guidelines 2007 (2013 Edition)
- NUREG/CR-7046, PNNL-20091, Design Basis Flood Estimation for Site Characterization at Nuclear Power Plants in the United States of America
- NUREG/CR-7005, Technical Basis for Regulatory Guidance on Design-Basis Hurricane Wind Speeds for Nuclear Power Plants
- IAEA SSG-21, Volcanic Hazards in Site Evaluation for Nuclear Installations (CNSC-76).
- CSA N293, Fire protection for nuclear power plants
- NFPA 1141, Standard for Fire Protection Infrastructure for Land Development in Wildland, Rural, and Suburban Areas
- NFPA 1142, Standard on Water Supplies for Suburban and Rural Fire Fighting
- NFPA 1143, Standard for Wildland Fire Management
- NFPA 1144, Standard for Reducing Structure Ignition Hazards from Wildland Fire

13.1 Meteorological hazards

The Impact Statement must:

- document a systematic approach for identifying meteorological events for the site and surrounding region (natural external events), including steps for continued data collection for meteorological events over the project's lifecycle.
    - provide information to show that the representative data series is complete, of adequate quality, and identify all sources for verification. Document limitations and rationale of the statistical distributions for the data sets;
- describe all known and relevant trends in meteorological events, weather patterns or physical changes in the environment that are expected to result from climate change and incorporate this information into a risk assessment as contributing or complicating factors for accidents and malfunctions (e.g., increased risk of forest fires).
    - provide mitigation (both passive and active) that the proponent is prepared to take to minimize the frequency, severity and consequences of these projected effects;
- assess effects related to changes in temperature and humidity, including:
    - effects of sudden or prolonged extreme temperatures on future reactor facility SSCs that will be important to safety (for example, cooling air intakes);
    - effects of condensation and evaporation on future reactor facility SSCs that will be important to safety (for example, electronic components); and

  - potential for temperature and humidity to affect releases from the reactor facility into the environment and to affect the temperature of the condenser cooling water;
- assess the frequency and intensity of strong winds, including tornadoes on the basis of historic and recorded data for the region. Include in the assessment:
  - wind and pressure-loading effects;
  - wind-propelled missiles that could affect SSCs, or that could render offsite power supplies unavailable;
  - effects on emergency plan execution; and
  - possibility of affecting releases from the reactor facility into the environment;
- assess the risk of dust and sand storms on the basis of historic and recorded data for the region, including consideration of the following potential factors:
  - abrasion or erosion of SSCs;
  - effects on air or water intakes;
  - effect of static electricity generation on electrical or electronic SSCs;
  - effects on offsite power supplies to the site;
  - effects on emergency plan execution; and
  - possibility of affecting releases from the reactor facility into the environment.
- assess all types of precipitation on the basis of historic and recorded data for the region, and take into account potential effects on:
  - structural loading, including acute effects from heavy precipitation, such as hail;
  - cooling air or water intakes;
  - offsite power supplies to the site;
  - dispersion of releases from the reactor facility through surface or groundwater;
  - emergency plan execution; and
  - possibility of affecting releases from the reactor facility into the environment
- evaluate the frequency and severity of lightning to determine potential effects on the reactor facility, including the influence of lightning events on the risks of natural fire.

13.2 Surface water hazards

The Impact Statement must:

- describe the potential for flooding in the project area and conduct flood hazard assessments from all sources of flooding (e.g., local intense precipitation, riverine flooding, ice damming, extreme rainfall or snowmelt events upstream, failure of infrastructure, etc.);

- describe the approach for identifying water supply adequacy for the site and surrounding region, including steps for continued data collection over the project's lifecycle. Water supply adequacy studies should consider:
  - reliability and availability of water supply (considering existing water-taking projects in the region, and the potential for additional water-taking projects that could exist in the region);
  - water supply changes from naturally induced failures of offsite structures, such as dams, flood control dykes; and
  - if groundwater is used as the water supply: groundwater levels, flow patterns, pumping rates, water quality and the effects on water quality during flooding or drought events (for example, excess minerals released into groundwater during flood events)

13.3 Groundwater, geotechnical, geological and seismic hazards

The Impact Statement must:

- document the investigation and evaluation of the site's and surrounding areas' susceptibility to the following events over the project's lifecycle, including how they will be addressed groundwater-related events (groundwater flow and contaminant transport), geotechnical events, and seismic and surface faulting events. Describe effects related to:
  - groundwater conditions, including:
    - groundwater flow patterns, rates and groundwater level influence the risk of seismic events, and the stability of slopes and foundations;
    - effects on the integrity of the reactor facility's below-grade structures, such as wet storage bays; and,
    - the adverse effects of groundwater conditions on site preparation should be evaluated by combining the groundwater conditions with the geotechnical analysis.
  - geotechnical events, including slope instability, underground collapse and rock fall, subsidence or uplift of the site surface, and instability of the soil foundation due to static or dynamic loads;
  - geotechnical events on future site activities by combining qualitative explanations with the results of quantitative analyses;
  - seismic events and surface faulting events, including:
    - surface faults and lineaments in the regional, local and site scales are identified;
    - the potential for these faults to be seismogenic and seismotectonic should be evaluated;
    - their effects on future site activities should be assessed;
    - industry-induced seismic events, where applicable, and their effects on the structures, systems and components (SSCs); and
    - liquefiable soil units should be identified, and their effects on structures and site preparation should be assessed;

- assess the potential effects of seismic events on facilities and specify the ground movement parameters that will be used with the probability of occurrence (e.g., 2% in 50 years);
- evaluate the potential effects that seismic events may have on sub-surface contaminant transport for the region;
- specify the best practice codes and guides that are or will be used in the geotechnical effects analysis (e.g., NS-G-3.6, Geotechnical Aspects of Site Evaluation and Foundations for Nuclear Power Plants); and
- evaluate the potential for a volcanic event to occur that could affect the safe operation of the reactor facility, include:
  - potential effects on ventilation systems;
  - volcanic missiles that could affect SSCs;
  - potential abrasion or chemical effects on SSCs;
  - effects on air and water intakes;
  - effects of static electricity generation on electrical or electronic SSCs;
  - effects on offsite power supplies to the site; and
  - effects on emergency plan execution.

13.4 Biological hazards

The Impact Statement must:

- describe the potential for unusual weather events to increase the risk of ventilation and cooling intake systems being clogged by biota (for example, flooding or large storm events can dislodge large biomasses of aquatic macrophytes, and those biomasses could foul the intake structures);
- characterize potential biological phenomena that could affect facility SSCs over the project's lifecycle, with emphasis on the facility's operational phase, such as;
  - plant matter, mussels or fish impingement events (for example, smelt runs) that could block water intakes;
  - the potential for the colonization and excessive growth of algae, mussels, or clams within cooling water systems, and the clogging of intake structures by large quantities of biological material (such as aquatic plants, fishes, or jellyfish);
  - bird species, insects or other fauna that may nest near or in air intakes (which could result in blockages of air intakes and pathogens or chemically reactive agents from nesting areas entering air systems);
  - moulds, organisms or pathogens, either naturally present or generated by site activities (for example, cooling tower mist or algae in cooling water ponds), which could chemically react with SSCs and may result in reduced reliability of systems if not mitigated in design (for example, lichens chemically attacking concrete), and affect human health, either on- or offsite;

- algae or micro-organisms in thermal plume of the facility outlet that could degrade the quality of water entering intakes for drinking and personal hygiene or affect plant intake water quality; and
- wildlife that could potentially reside within the facility structures and systems and cause damage or long-term degradation;

- discuss how the biological baseline information has been collected and documented to allow the prediction of the effects of biological hazards for the project (episodic events and ongoing hazards), and to test mitigation performance;
- select and describe mitigation strategies to counter postulated biological events, and explain effects on the environment and the health and safety of workers and the public will be minimized. If any credible biological events are postulated, provide a description of a follow-up monitoring plan, including methods to test the performance of mitigation of those biological hazards.

13.5 Fire and explosion hazards

The Impact Statement must:

- describe the effects of external fire and explosion events for each phase of site development, and provide applicable mitigation strategies, including providing information on:
  - environmental effects resulting from external fire and explosion events;
  - site security program;
  - site and regional emergency plans for the project;
  - history of significant non-malevolent external fire and explosion events in the region surrounding the site;
  - fire and explosion risks that may develop from changes in land use around the site (for example, industrial growth);
  - the effects of climate change that may increase the risks or effects of postulated fire events (for example, increased wind speed, drier weather conditions, increased lightning);
  - effects on the ability to maintain effective site security during and following these events;
  - effects on the health and safety of workers and the public, where these events interact with activities performed under the licence (for example, if the event causes a secondary fire in a chemical storage area, which causes an explosion or release of combustion products); and
  - emergency response requirements posed by these types of events (e.g., fire response, medical response, chemical spill-control and response).
- address criteria contained in the following documents:
  - external fire criteria contained NS-G-1.5, External Events Excluding Earthquakes in the Design of Nuclear Power Plants;
  - CSA N293, Fire protection for nuclear power plants;
  - NFPA1141, Standard for Fire Protection Infrastructure for Land Development in Wildland, Rural, and Suburban Areas;

- NFPA1142, Standard on Water Supplies for Suburban and Rural Fire Fighting;
- NFPA1143, Standard for Wildland Fire Management; and
- NFPA1144, Standard for Reducing Structure Ignition Hazards from Wildland Fire

14 Canada's Ability to Meet its Environmental Obligations

The Government of Canada recognizes that impact assessments contribute to Canada's understanding and ability to meet its environmental obligations and its commitments in respect of climate change.

14.1 Environmental Obligations

The Impact Statement must describe the likely effects of the project in the context of environmental obligations.

Federal environmental obligations relevant to this project include:

- the Convention on Biological Diversity including:
- the Kunming-Montreal Global Biodiversity Framework and Canada's supporting national framework (e.g., the 2030 Nature strategy, Canada's Biodiversity Outcomes Framework and the current biodiversity goals and objectives in Canada); and
- legislation that supports the implementation of Canada's biodiversity commitments, including SARA and the *Canadian Wildlife Act* (1985), as well as supporting policies and guidance documents;
- recovery strategies and action plans developed under SARA for all species at risk potentially affected by the project;
- The *Convention for the Protection of Migratory Birds in the United States and Canada*, as implemented in part under the *Migratory Birds Convention Act (1994),* and supporting guidance documents on conservation objectives and strategies specific to Bird Conservation Regions;
- The *Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar),* as implemented in part under the Federal Policy on Wetland Conservation and supporting guidance documents such as the North American Waterfowl Management Plan

The Government of Canada through collaborative effort with the Government of Alberta, the Government of British Columbia, the Government of the Northwest Territories, and Indigenous partners have developed an Action Plan to ensure the ongoing protection and maintenance of the Wood Buffalo National Park World Heritage Site. The proponent must ensure the project will not hinder achievement of the Action Plan goals and any associated monitoring or management actions implemented by the Federal-Provincial-Territorial-Indigenous Action Plan Committee.

The Impact Statement must:

- describe the extent to which the likely effects of the project could hinder or contribute to Canada's ability to meet its environmental obligations, including:
  - the proponent's plans and commitments to ensure that positive contributions are respected; and
  - the mitigation or follow-up program related to those effects.

With respect to biodiversity, the proponent is encouraged to describe whether the project's likely effects will hinder or contribute to the targets identified in Canada's 2030 Nature Strategy. Based on the information scoped into the assessment, consider potential impacts on achieving Target 2 (ecosystem restoration), Target 3 (protected and conserved areas (30x30)), Target 4 (species recovery), Target 6 (invasive alien species), Target 7 (pollution and biodiversity, focusing on chemicals and air pollutants), and Target 11 (ecosystem services and functions).

The proponent should refer to IAAC's guidance documents on this topic, including the document Policy Context: Considering Environmental Obligations and Commitments in Respect of Climate Change under the Impact Assessment Act.

14.2 Climate Change Commitments

With respect to climate change commitments, Sections 14.1 and 14.2 of these Integrated Guidelines outline the information requested as part of the Impact Statement. IAAC, with the support of federal authorities, will provide a supplementary analysis on the project's GHG emissions in the context of Canada's emissions targets and forecasts. The proponent must provide its views in the Impact Statement on the extent to which the likely effects of the project would hinder or contribute to the Government of Canada's ability to meet its commitments in respect of climate change in order to inform the integrated assessment.

14.2.1 Effects on Canada's ability to meet its climate change commitments

As part of its decision, should the Governor in Council determine that the adverse federal effects are, to some extent significant, the Governor in Council must consider only whether the extent to which the effects that are likely to be caused by the carrying out of the project, contribute to the Government of Canada's ability to meet its commitment in respect of climate change, when considering whether the effects are justified in the public interest.

The proponent must follow the directions and guidance contained in the Strategic Assessment of Climate Change (SACC) developed by ECCC, and the Draft Technical Guide Related to the Strategic Assessment of Climate Change: Guidance on quantification of the net GHG emissions, impacts on carbon sinks, mitigation measures, and net-zero and upstream GHG assessment ('the technical guide').

The proponent should keep apprised of updates to the SACC and related technical guides published by ECCC. The Impact Statement must:

- assess the project's GHG emissions and emissions intensity as described in sections 3 and 5 of the SACC and section 2.1 and 2.5 of the technical guide;
- provide an explanation of how the project may impact Canada's efforts to reduce GHG emissions, in Canada and globally as described in section 5.1.3 of the SACC and in the technical guide.

14.2.2 Mitigation and enhancement measures

The Impact Statement must include a determination of Best Available Technologies and Best Environmental Practices (BAT/BEP) as described in section 3.2 of the technical guide. This BAT/BEP determination process will evaluate potential measures throughout all phases of the project with an emphasis on reducing net GHG emissions as early as possible in the life of the project, as described in section 5.1.4 of the SACC. Additional guidance is provided in sections 3.4.1 and 3.4.2 of the technical guide.

Given that there will be Project activities beyond 2050, the proponent must also provide a credible plan to achieve net-zero emissions, describing the measures that will be taken to minimize GHG emissions during all project phases and achieve net-zero emissions by 2050, as described in section 5.3 of the SACC. The plan to achieve net-zero emissions should follow the principles and include the required information that is described in sections 3.4.1, 3.4.3, 3.5.1, and 3.5.2 respectively of the current version of the technical guide, or the latest version that may become available prior to submission of the Impact Statement.

15 Sustainability

Sustainability is the ability to protect the environment, contribute to the social and economic well-being of the people of Canada and preserve their health in a manner that benefits present and future generations.

The Impact Statement must provide an analysis of the extent to which the project's likely positive effects and adverse federal effects contribute to sustainability as outlined in the Guidance: Considering the Extent to which a Project's Likely Effects Contribute to Sustainability according to the following steps:

- identify the four to six key VCs from section 7.3 Selection of valued components that are of relevance to long-term well-being for consideration in the sustainability analysis and informed by Indigenous Knowledge and the project context;
- establish temporal boundaries, considering how long-term effects on the identified VCs could affect future generations and whether they will extend beyond the project lifecycle; and

- apply the four sustainability principles to determine the extent to which the project's likely positive and adverse federal effects result in a net positive contribution to sustainability (based on the criteria of no contribution, to low, moderate or high contribution).

16 Follow-up Program

A follow-up program is a program to verify the accuracy of the impact assessment and evaluate the effectiveness of mitigation measures. Should the project proceed, the proponent would be required to develop and implement a follow-up program in consultation with relevant authorities and Indigenous Nations and Communities and to submit to IAAC and the CNSC the results of the program. A follow-up program also provides an opportunity to continue engaging with impacted Indigenous Nations and communities during project implementation and, when undertaken collaboratively, can contribute to the incorporation of Indigenous Knowledge to support solution-oriented approaches for identifying and managing issues.

Monitoring is a key component of a follow-up program which entails collecting the information necessary to verify the accuracy of the effects predicted in an impact assessment and determine the effectiveness of mitigation measures, to decide whether new or modified action(s) are required to protect VCs.

The proponent must establish expected outcomes for their follow-up program, in consultation with relevant authorities and Indigenous Nations and Groups. Expected outcomes refer to the desired environmental, health, social or economic conditions that the proponent can reasonably anticipate achieving during all phases of the project with mitigation measures in place. Expected outcomes may be qualitative or quantitative and should be expressed in a manner to support a determination of whether mitigation measures are working effectively to eliminate, reduce, control, or offset adverse effects within federal jurisdiction. Should the project proceed, the proponent will be expected to provide information to IAAC and the CNSC annually on the extent to which the expected outcomes have been achieved.

If the follow-up program indicates that mitigation measures are not working effectively, additional measures may be required and implemented. If, through a follow-up program, it is identified that the predictions of the impact assessment were not accurate, corrective action or additional measures may be required to be put in place by the proponent.

The proponent should consider the use of adaptive management to address uncertainties associated with the effectiveness of mitigation measures or predicted effects and to help ensure expected outcomes are achieved. Adaptive management does not eliminate the need to provide sufficient information on the baseline conditions or effects attributed to the project, nor does it eliminate the need to characterize effects and identify appropriate mitigation measures to eliminate, reduce or control those effects.

In developing the follow-up program framework for environmental, health, social or economic valued components, as applicable, the Impact Statement should take into account the considerations outlined in the Agency guidance on Follow-up Programs under the Canadian Environmental Assessment Act

(guidance to be updated) and section 4 Environmental Protection Measures of REGDOC-2.9.1, Environmental Protection: Environmental Principles, Assessments and Protection Measures, Version 1.2.

16.1 Follow-up program framework

The duration of the follow-up program must be as long as required to verify the accuracy of effects, as well as impacts on Indigenous rights and interests, predicted during the impact assessment and to evaluate the effectiveness of the mitigation measures.

The Impact Statement must:

- identify VCs subject to the follow-up program and rationale;
- describe the effects predictions and mitigation measures that would be evaluated for each VC included in the follow-up program;
- identify expected outcomes, targets and indicators associated with each VC included in the follow-up program and describe how the proponent expects to achieve them;
- identify thresholds[15] associated with each VC included in the follow-up program and, the technically and economically feasible new or modified measures that may be implemented if the thresholds are met or exceeded, as indicated by the monitoring results;
- identify mechanism to disseminate follow-up results to Indigenous Nations and communities, relevant authorities, and other interested parties;
- consider accessibility of data for the general population;
- describe how the disproportionate effects identified in the GBA Plus results would be addressed in the follow-up program; and
- describe opportunities for the involvement of Indigenous Nations and communities, local communities, stakeholders, local and regional Indigenous organizations in the follow-up program design and implementation, as well as communication mechanisms between these parties and the proponent.

16.2 Follow-up program monitoring

The Impact Statement must present the preliminary monitoring program for each VC included in the follow-up program, including:

[15] Thresholds are the levels of environmental, health, social or economic changes relative to baseline conditions that would trigger the implementation of new or modified mitigation measures.

- identification of regulatory instruments that include a monitoring requirement for the VC;
- description of the methodology for monitoring and how it was informed by Indigenous Knowledge, community knowledge and input provided by various impacted population groups;
  - monitoring programs should be based on peer-reviewed published standards, where applicable
- description of how monitoring would be conducted (e.g., planned protocols, list of measured parameters and locations, analytical methods employed, schedule, data management, human and financial resources required).
  - Include detailed maps showing the location of sampling and monitoring stations, including stations relevant to the characterisation of baseline conditions, prediction of effects, and future stations that may be required monitoring potential effects;
- identification of the monitoring activities that could pose a risk to the VCs, and to Indigenous rights and interests, and the measures planned to protect them;
- identification of opportunities for participation of representatives from Indigenous Nations and communities identified in the Indigenous Engagement and Partnership Plan in monitoring programs;
- outlines of the monitoring reports (number, content, frequency, format and duration of the reports) that would be provided to the authorities involved and other interested parties; and
- plans, including funding options, to involve Indigenous Nations and communities, local communities, stakeholders, and Indigenous organizations in monitoring, where appropriate.

If the proponent considers that monitoring activities required through other regulatory instruments are suitable to provide the data necessary to achieve the objectives of the follow-up program, the Impact Statement must include a justification for the use of data from existing or other planned monitoring activities.

16.3 Compliance Monitoring

The proponent is responsible for verifying whether the required mitigation measures were implemented. The Impact Statement must present a framework by which it will undertake compliance monitoring for follow-up programs. This should include, but not be limited to:

- identification of those positions accountable and responsible for monitoring and ensuring compliance;
- description of the proponent's intervention mechanisms in the event of the observation of non-compliance with the legal and environmental requirements or with the obligations imposed on contractors by the provisions of their contracts; and
- quality assurance and quality control measures to be applied to monitoring programs.

16.4 Adaptive Management Framework

The proponent should consider adaptive management as a means to address high uncertainties associated with the effectiveness of mitigation measures or predicted effects and to help ensure expected outcomes are achieved. Adaptive Management Plans establish a systematic process following six iterative steps: assess, design, implement, monitor, evaluate, and adjust. An Adaptive Management Plan may be warranted in addition to a follow-up program if it meets each of the following criteria:

- there is high uncertainty around the effectiveness of mitigation measures or predicted effects.
- there is a need for, or benefit to, reducing uncertainties through an Adaptive Management Plan.
- adaptive management is technically feasible.

Adaptive management does not eliminate the need to provide sufficient information on the baseline conditions or effects attributed to the project. Nor does it eliminate the need to characterize effects and identify appropriate mitigation measures to eliminate, reduce or control those effects.

Please refer to IAAC guidance on Adaptive Management Measures under the Canadian Environmental Assessment Act 1992 (guidance to be updated).

17 Assessment Summary

The proponent must prepare a stand-alone plain language summary of the Impact Statement in both of Canada's official languages (French and English). The Summary must contain sufficient details for the reader to understand the project, potential environmental, health, social and economic effects, potential adverse impacts on Indigenous rights and interests, proposed mitigation measures, residual effects, cumulative effects and associated mitigation measures, the extent to which adverse effects are significant based on characterization of residual effects, the extent to which the effects that are likely to be caused by the carrying out of the project contribute to sustainability and to the Government of Canada's ability to meet its environmental obligations and the follow-up program.

The Summary provides an opportunity for the proponent to demonstrate issues raised, notably by Indigenous Nations and communities and the public, were addressed. The Summary must include commitments made by the proponent or recommendations made by the proponent to other parties. The Summary should be presented by VC, which allows the proponent to demonstrate the completeness of the assessment and provide the results of the analysis. The Summary must include key maps or figures illustrating the project location and key project components and may summarize information through a series of tables.

Appendix 1 – REGDOC 1.1.1. to the Integrated Tailored Impact Statement Guidelines Concordance Table

REGDOC 1.1.1 Heading	Shall/Should Clause	Applicable TISG Section
2 Background	The applicant shall conduct a review to consider whether the activity described in their licence application requesting authorization from the Commission: • could affect the environment • could adversely affect an Aboriginal group's potential or established Aboriginal and/or treaty rights, such as the ability to hunt, trap, fish, gather or conduct cultural ceremonies	1.2 Factors to be considered in the integrated assessment
2.1 Environmental assessments	information gathered during the site evaluation process should be used during the EA process.	1.1.1 Site evaluation
2.2.1 Public information and disclosure	The applicant shall develop and implement a public information and disclosure program and, as part of the application for a licence to prepare the site, submit the program to the CNSC.	5. Description of Public Participation and Views
2.2.2 Aboriginal engagement	The applicant shall identify and engage with potentially affected Aboriginal groups	6. Description of Engagement with Indigenous Nations and Communities 6.2 Record of engagement 6.4 Collaboration with Indigenous Peoples following the submission of the Impact Statement 10. Indigenous Peoples
	The applicant shall submit an Aboriginal engagement report	
	The applicant shall submit material change updates to the Aboriginal engagement report	
	The applicant shall include a summary of Aboriginal engagement activities in their licence application and any submissions to the Commission	
2.3 Overview of the site evaluation	Information from the site evaluation should be continually considered throughout the lifecycle of the proposed facility (including construction and operation), to ensure that the facility's design basis and safety case remain current with changing environmental conditions or modifications to the facility itself. Appendices B through G contain working-level requirements and Guidance for site evaluation.	1.1.1 Site evaluation
2.4 Overview of site preparation	Significant site evaluation work should be completed before initiating the application for a licence to prepare site.	1.1.1 Site evaluation
3 Site Evaluation for New Reactor Facilities	Information gathered through the site evaluation process should be used during the EA process, and will be reviewed by the CNSC during the assessment of all licence applications in the facility's lifecycle, in particular for the licence to prepare site.	1.1.1 Site Evaluation 7.9.1 Site evaluation
	Site evaluation should begin before the submission of an application to prepare a site for the construction of a reactor facility.	
	The applicant should ensure that the site is evaluated at a level sufficient to confirm the suitability of the site for the activity.	
	The applicant should reject any unacceptable or inappropriate site before applying for a licence to prepare site, without requiring CNSC involvement. Submission of site evaluation information on rejected sites is not required.	
3.3 General criteria for site evaluation	The applicant shall use a documented, systematic process for site evaluation (including site characterization)	1.1.1 Site Evaluation 4.4 Alternative Means of Carrying out the Project 7.9.1 Requirements for Site Evaluation
	The applicant shall consider the synergy of multiple simultaneous events (for example, combinations of external hazards, reactor facility events including beyond-design-basis events and severe accidents, and multiple effects of different activities on the site)	
	The applicant should provide a high-level overview of alternate sites considered prior to selecting the proposed site, including a brief description of the degree and depth of site evaluation used to narrow down the final choice(s).	
	The applicant shall consider the concept of potential cliff-edge effects when analyzing external hazards, where a small change of conditions may lead to a catastrophic increase in the severity of consequences.	
	If the site evaluation indicates deficiencies for which design features, site protection measures, or administrative procedures cannot compensate, the site should be deemed unacceptable or inappropriate.	
	The applicant shall analyze external hazards at the site evaluation stage, to confirm that the reactor facility will withstand such events.	
	The applicant shall also take into account the combined radiological and conventional effects of the site and the reactor facility on each other during normal and abnormal situations, based on both temporal (lifecycle) and spatial (regional, local and site) considerations.	
	the applicant should: reject any unacceptable or inappropriate site before applying for a licence to prepare a site. Submission of site evaluation information on rejected sites is not required.)	
	The applicant shall periodically review site-specific hazards using updated knowledge.	
	Describe how the characteristics of the natural and human induced hazards, as well as the demographic, meteorological and hydrological conditions of relevance to the nuclear installation, will be monitored over the nuclear facility's lifecycle.	

REGDOC 1.1.1 Heading	Shall/Should Clause	Applicable TISG Section
	Site evaluation shall take into account all phases of the facility lifecycle, from site preparation to abandonment.	
	Evaluation of the suitability of a site for the construction and operation of a nuclear facility shall address the following considerations: • population density, population distribution and other characteristics of the emergency planning zone that may have an effect on the implementation of emergency response measures and the need to evaluate the risks to individuals and the general population • the technical basis for the safety and security analysis issues that will be included in the licence application (particularly important for the licence to prepare site), including the range of technologies being considered and the estimated total power for the reactor facility • categorization and assessment of the characteristics of the natural and human environment in the region that may be affected by potential radiological or conventional effects associated with site preparation and construction, operational states, and accident conditions • predictions about the evolution of the natural and human environment in the region, particularly population growth and distribution, which may have a bearing on safety and security throughout the projected lifecycle of the reactor facility • storage and transport of input and output materials – such as fresh and spent fuel, and radioactive waste • information about non-radiological effects due to chemical or thermal releases, or other site activities such as damage to aquatic organisms from entrainment into cooling water intakes, or physical disruption of landscape and shoreline from site development, and the potential for explosion and the dispersion of chemical products • as far as practicable, information about the potential for interactions between nuclear and conventional effluents, such as the combination of heat or chemicals with radioactive material in liquid effluents • predictions about the reactor facility's effects on the population, including those that could lead to emergency conditions, with due consideration of relevant factors (for example, population distribution, use of land and water, radiological effect of any other releases of radioactive material in the region) • hazards associated with natural and human-induced external events, including future alterations of magnitude and frequency due to effects of climate change • evaluation against safety goals	
3.3.1 Evaluation against safety goals from a site perspective	The applicant shall evaluate reactor facility designs against applicable safety goals, taking into account the characteristics of the site, the risks associated with external hazards (including any potential cliff-edge effects that may arise from small increases in the severity of external hazards), and the potential negative effect of the reactor facility on the environment.	7.9.2 Evaluation against safety goals from a site perspective 12.1 Risk Assessment
	The applicant shall provide a summary of the process by which the different nuclear power plant or small reactor technologies being considered have been included in the site evaluation.	
	The evaluation shall include the effects of multiple unit events and – where applicable – effects from events that may affect multiple units.	
3.3.2 Consideration of the evolution of natural and human-induced factors	The applicant shall evaluate the evolution of natural and human-induced factors in the environment that may have a bearing on safety and security across a time period that encompasses the projected lifecycle of the reactor facility, with the understanding that different levels of evaluation and monitoring apply to the various phases of the reactor facility's lifecycle.	7.9.3 Consideration of the evolution of natural and human-induced factors
3.3.3 Evaluation of hazards associated with external events	The applicant shall examine the site with regard to the frequency and severity of external natural and human-induced events that could affect the safety and security of the reactor facility.	7.9.4 Evaluation of hazards associated with external events 13. Effects of the Environment on the Project
	Site-specific data should be used to determine hazards, unless such data is unobtainable.	
	The applicant shall apply a systematic approach for identifying and assessing the hazards associated with external events.	
	Prehistoric, historic, and instrumentally recorded information, and records of the identified external events and their severity, should be collected for the region and analyzed for reliability, accuracy, and completeness.	
	The applicant shall identify and assess each external natural and human-induced event with the following considerations: • the potential direct and indirect effects of the event on the reactor facility structures, systems, and components (SSCs), including those that could affect the safe operation of the reactor facility in both normal and abnormal operating states: • direct effects (for example, an earthquake resulting in a main steam line break) • indirect effects (for example, a corrosive gas release from a nearby chemical plant degrading reactor facility safety system trip circuits via ventilation intakes)	
	The analysis shall include an examination of potential cliff-edge effects that may arise from small increases in the severity of events.	
	The approach (including the underlying rationale) shall be developed, documented, and implemented in an auditable fashion.	
	Derivation of the hazards associated with external events shall include consideration of the combined effects of these hazards with the ambient conditions (for example, simultaneous aircraft crash and heavy snowstorm).	
	The region assessed for each identified external event shall encompass the environment that could be affected.	
	The evaluation shall consider foreseeable changes in land use for the projected lifecycle of the reactor facility, in order to assess and plan for mitigation of new external hazards introduced by changes in land use.	
3.3.4 Determining the potential effect of the site on the environment	The applicant shall take into account considerations such as those listed in table A to minimize the potential effect of the site's interaction with the environment (such as moving, destroying or substantially altering rare or sensitive habitats, biota, or areas of socio- economic importance), including the structural, compositional, and functional components of its biodiversity.	1.1.1 Site evaluation 7.2 Baseline Methodology

REGDOC 1.1.1 Heading	Shall/Should Clause	Applicable TISG Section
	The applicant should complete bounding scenarios involving modelling of potential effects from maximum possible releases, in order to establish the outer boundaries or worst-case scenarios for the reactor facility.	7.3 Selection of valued components 7.9.1 Requirements for Site Evaluation 7.9.4 Evaluation of hazards associated with external events 7.9.5 Determining the potential effect of the site on the environment 8.6.2 Effects to the atmospheric, acoustic, and visual environment 8.7.2 Effects to Groundwater and Surface Water
	The applicant shall examine the site with respect to the risk from nuclear and hazardous substances to the public and the environment.	
	Assessments of releases or disturbances associated with normal or routine operations should be based on expected performance (for example, average concentrations) and upper threshold bounding conditions, as well as possible pulse releases (high concentration with short exposure period) from anticipated operational occurrences.	
	The applicant shall consider the synergy of multiple events.	
	The locations of the reactor facility and of the subsidiary structures on the site should be examined at a high level, with the assistance of environmental modelling.	
	Contaminant (nuclear and hazardous substances) pathway modelling shall incorporate atmospheric dispersion, surface water dispersion, and groundwater movement, as well as the associated abiotic and biotic environmental compartments.	
	Such structures should be located so as to minimize potential effects on the public and on the environment (for example, emission or effluent release points, and air or water intake structures).	
	Models used for dispersion and pathways analyses shall include site-specific, local, and regional topographic features and characteristics of the reactor facility, and take into account natural and human-induced events that may influence contaminant behaviour.	
	The pathways analyses shall take specific environmental and site characteristics into account, with special attention paid to the function of the biosphere in the accumulation and transport of nuclear and hazardous substances.	
	The applicant should re-evaluate risk modelling continually, as operating experience is gained over the reactor facility's lifecycle.	
	assessments of all releases shall be made under normal and accident conditions for all phases of the reactor facility's lifecycle.	
	The applicant should identify reference areas that will be unexposed to project interactions but close enough to be similar to the special areas or activities (see table A).	
	assessments of all releases shall include an examination of potential releases from multiple unit events, or events affecting multiple units.	
	Reference areas should be sampled during baseline conditions to establish the natural differences from exposure sites.	
	The baseline should be characterized sufficiently to allow for a statistically significant assessment of project effects.	
	Two or more reference areas should be identified, in order to characterize natural spatial variability in measured parameters as a "noise" factor to be accounted for when monitoring to detect project effects.	
3.3.5 Population and emergency planning considerations	The applicant shall confirm with the surrounding municipalities and the affected provinces, territories, foreign states, and neighbouring countries that the implementation of their respective emergency plans and related protective actions will accommodate the lifecycle of the proposed project.	7.9.6 Population and emergency planning considerations
	the applicant should initiate these discussions during the early stages of site evaluation.	
	The applicant shall document the strategy and process for effective two-way ongoing consultation with emergency management agencies affected by site operations throughout the project's lifecycle.	
	The emergency planning zones are established by the province or territory and are under control of the region or municipality. These zones cover the area beyond the exclusion zone that should be considered with respect to implementing emergency measures.	
	the site evaluation shall take the following population and emergency planning considerations into account the planning basis as described in REGDOC-2.10.1, Nuclear Emergency Preparedness and Response, version 2 [10]	
	the site evaluation shall take the following population and emergency planning considerations into account: • population density, characterization and distribution within the emergency planning zone, with particular focus on existing and projected population densities and distributions in the region including resident populations and transient populations (note: this data is to be kept up to date over the lifecycle of the reactor facility) • present and future use of land and resources • physical site characteristics that could impede the development and implementation of emergency plans (for example, the ability to deliver fuel in a timely manner to backup generators) • populations, including vulnerable populations, in the vicinity of the reactor facility that are, or may become, difficult to evacuate or shelter (for example, schools, prisons, hospitals) • ability to maintain population and land-use activities in the emergency planning zone at levels that will not impede implementation of the emergency response plans	
	Discussions around early plans shall include plans and consideration of the following onsite response, including the capacity to bring offsite equipment onsite	
	Discussions around early plans shall include plans and consideration of the following ability of offsite licensee staff to communicate with and access the site during a catastrophic event	
	Discussions around early plans shall include plans and consideration of the following offsite response, and how it is coordinated between the licensee and federal, provincial and municipal government agencies playing a role in emergency preparedness and response	
	Discussions around early plans shall include plans and consideration of the following how the licensee will coordinate with regulatory bodies	

REGDOC 1.1.1 Heading	Shall/Should Clause	Applicable TISG Section
	Discussions around early plans shall include plans and consideration of the following how the licensee will respond and coordinate with emergency service providers (fire department, ambulance, hospital, fuel, food, and so on)	
3.3.6 Consideration of future life-extension activities	The applicant shall consider the potential effects of longer service life, power uprate activities and modifications to accommodate additional or modified uses: • any proposed longer period of service life for the reactor facility • additional conventional and nuclear waste generated, as well as estimated resulting effects on handling, transport, and storage of waste • effects of external and human induced events on the life extension, power uprate and/or modification activities • effects on security and emergency planning	7.9.7 Consideration of future life-extension activities
3.4 Gathering Baseline Data	The applicant shall document and demonstrate a systematic process for gathering baseline data,	7.1 Uncertainty and Bias 7.2 Baseline methodology 7.3 Selection of valued components 8.7.1 Baseline Conditions 8.9.1 Baseline conditions 9.1.1 Baseline for social determinants of health and community well-being 9.2.2 Effects on Biophysical Determinants of Health
	baseline data should take into account archeological, paleontological, and prehistoric data (including the oral history of Indigenous peoples), as well as historic and instrumentally recorded sources.	
	The applicant shall include analysis of variability and uncertainties.	
	baseline data should be of sufficient sample size and duration to obtain a basic understanding of within-year and between-year variation.	
	The applicant shall describe the general criteria used to identify VCs that may be affected by the project.	
	All provincially or federally listed wildlife species occurring or reasonably expected to occur, within the spatial boundaries should be identified as VCs.	
	The applicant shall identify VCs in the existing environment and use them as specific assessment end-points.	
	The applicant shall identify measurement end-points, as appropriate.	
	The applicant shall verify the baseline data collected in the initial assessment in subsequent periodic assessments carried out over the life of the facility.	
	The baseline data shall be captured within auditable management systems, quality management or quality assurance programs.	
	The baseline data shall consider valued components (VCs) [9].	
	The baseline data shall also consider contaminants of potential concern (COPCs) associated with historical, present or proposed future use of the site.	
3.4.1 Atmospheric and meteorological data	The applicant shall provide a description of the ambient air quality in the study areas, with emphasis on those parameters for which there will be radiological and non-radiological emissions resulting from the project.	7.9.4 Evaluation of hazards associated with external events (GUIDANCE) 8.1 Meteorological environment 8.6.1 Baseline conditions
	The evaluation should also take into account prehistoric and historic climate data sources that reflect the regional conditions.	
	The applicant shall prepare and carry out a program for meteorological measurements at – or near – the site, with the use of instrumentation capable of measuring and recording the main meteorological variables at appropriate elevations, locations, durations and time intervals.	
	The evaluation shall take into account instrumentally recorded climate data sources that reflect the regional conditions, such as the “Canadian climate normals” webpage [18].	
	Descriptions of basic meteorological variables shall include wind speed and direction, air temperature, precipitation, humidity, atmospheric pressure	
3.4.2 Geological data	The applicant shall include a description of the regional, local and site geology and a description of important geological structures.	7.4.1 Spatial boundaries 8.2.1 Baseline Conditions
	The applicant shall investigate the geotechnical properties of the overburden, including shear strength and liquefaction potential. The geotechnical properties support the assessment of slope stability and the bearing capacity of foundations under both static and dynamic conditions.	
3..Typo4.3 Geophysical data	The applicant’s site evaluation shall describe the site’s seismotectonic data, including (but not limited to) information on prehistoric, historic and instrumentally recorded seismic activity in the region.	8.2.1 Baseline conditions
	The applicant’s site evaluation shall include the influence of surface faults on seismic activity in the region.	
3.4.4 Hydrological data	The applicant shall carry out a program of hydrological investigations using both deterministic and probabilistic approaches as appropriate, so as to permit the assessment of normal flow, flooding, and drought properties of water bodies, as well as the interactions between surface water and groundwater flow systems.	8.7.1 Baseline conditions 8.7.2 Effects to groundwater and surface water
	The applicant shall include predictions of changes to site surface water hydrology (flows and chemistry) that are expected from foreseeable changes in upstream land use	
	The applicant shall gather baseline surface water and sediment quality data and provide that data as part of the site evaluation.	
	The site evaluation shall describe surface water hydrology, including delineation of the drainage basins and available prehistoric, historic, and instrumentally recorded hydrological data, such as water levels and flow rates.	
3.4.5 Hydrogeological data	The applicant shall carry out a program of hydrogeological investigations to permit the assessment of groundwater distribution and flow, as well as radionuclide and other contaminant movement in the hydrogeological environment.	8.7.1 Baseline conditions 8.7.2 Effects to groundwater and surface water
	The applicant shall include predictions of the interaction between the Project and the hydrogeology, including changes to the site hydrogeology (groundwater distribution, groundwater flows and chemistry, and migration of COPCs) that are expected to result from foreseeable changes in upstream land use the Project or migration of existing contaminant plumes.	
	The applicant shall gather baseline groundwater quality data and provide that data as part of the site evaluation.	
	The site evaluation shall describe the hydrogeology of the local environment, including the groundwater distribution, groundwater quality, and physical and geochemical properties of water- bearing formations (hydrogeological units) and their interactions with surface waters.	
	The applicant shall characterize the overburden and any bedrock to be removed with respect to both natural and anthropogenic sources, so as to assess any conventional and radiological risks to health, safety, and the environment.	8.2.1 Baseline Conditions

REGDOC 1.1.1 Heading	Shall/Should Clause	Applicable TISG Section
3.4.7 Baseline ambient radioactivity and pre-existing hazardous substances	The applicant shall assess the ambient radioactivity of the atmosphere, hydrosphere, lithosphere, and biota in the region, including an assessment of ambient radionuclide activity levels in ingested water and food used in the human pathways modelling.	8.3.1 Baseline Conditions 8.3.2 Effects to Topography, soil and sedeiment 8.4.1 Baseline conditions 8.7.1 Baseline Conditions
	The baseline characterization shall consider nuclear and hazardous substance levels within biota and relevant environmental media of interest.	
3.5 Evaluation of Natural External Events	The applicant shall develop, document and implement a systematic approach for identifying all natural external events.	7.9.4 Evaluation of hazards associated with external events
3.5.1 Climate change	The applicant shall consider potential climate change over the projected lifecycle of the reactor facility.	12.1 Risk Assessment
3.5.2 Meteorological hazards	The applicant shall include the following potential factors in the assessment of temperature and humidity: • effects of sudden or prolonged extreme temperatures on future reactor facility SSCs that will be important to safety (for example, cooling air intakes) • effects of condensation and evaporation on future reactor facility SSCs that will be important to safety (for example, electronic components) • potential for temperature and humidity to affect releases from the reactor facility into the environment and to affect the temperature of the condenser cooling water	13.1 Meteorological hazards
	The applicant should include the following potential factors in the assessment: • wind and pressure-loading effects • wind-propelled missiles that could affect SSCs, or that could render offsite power supplies unavailable • effects on emergency plan execution • possibility of affecting releases from the reactor facility into the environment	
	The Applicant shall assess the frequency and intensity of strong winds, including tornadoes and hurricanes, on the basis of historic and recorded data for the region.	
	should include: • consideration of the following potential factors: • abrasion or erosion of SSCs • effects on air or water intakes • effect of static electricity generation on electrical or electronic SSCs • effects on offsite power supplies to the site • effects on emergency plan execution • possibility of affecting releases from the reactor facility into the environment	
	The applicant shall assess the risk of dust and sand storms on the basis of historic and recorded data for the region,	
	The assessment should take into account the potential effects on: • structural loading, including acute effects from heavy precipitation, such as hail • cooling air or water intakes • offsite power supplies to the site • dispersion of releases from the reactor facility through surface or groundwater • emergency plan execution • possibility of affecting releases from the reactor facility into the environment	
	The applicant shall assess all types of precipitation on the basis of historic and recorded data for the region.	
	The applicant shall evaluate the frequency and severity of lightning to determine potential effects on the reactor facility, including the influence of lightning events on the risks of natural fire.	
3.5.3 Surface water hazards	Evaluation of water supplies to the site shall include the following components: • surface and groundwater sources • quantity and quality of water • reliability and availability of supply	8.7.1 Baseline Conditions
	The evaluation shall also include consideration of the potential effects of: • debris and fouling • additional water requirements for emergency cooling or process needs • effects on contaminant transportation • fluctuations in water temperature that could affect heat sinks • effects on firefighting capability	
3.5.4 Groundwater hazards	The applicant shall use a program of hydrogeological investigations, based on groundwater probing, monitoring data, and numerical modelling, to assess the potential effects of the groundwater flow system (groundwater level and quality) on the reactor facility, such as: • effects on the stability of the reactor facility's foundations • effects on the integrity of the reactor facility's below-grade structures, such as wet storage bays	13.3 Groundwater, geotechnical, geological and seismic hazards

REGDOC 1.1.1 Heading	Shall/Should Clause	Applicable TISG Section
3.5.5 Geotechnical hazards	The applicant shall examine geological maps and other appropriate reference sources for the region to determine the existence of natural features that could affect the surface and subsurface stability of the site.	8.2.1 Baseline Conditions 8.2.2 Effects to Geology, Geochemistry and Geological Hazards
	The applicant shall assess the stability of the foundation material under dynamic, static, and seismic loading, with a detailed description of surface and subsurface conditions (includinghydrogeochemical effects) being incorporated into a geotechnical investigation program for the purposes of hazard determination and mitigation.	
	The applicant shall analyze the stability of natural slopes and human made features such as mines, cut slopes, dams and embankments, and waste stockpiles under static, dynamic, and seismic loading, using site-specific data to assess their potential effects on the nuclear facility.	
	The applicant shall assess settlements (magnitude and rate) of foundations and/or foundation soils caused by large surface loadings and/or underground water drainage, using project-specific data.	
	The applicant shall also analyze differential settlement and soil distortion as required to assess their potential effects on the nuclear facility.	
	The applicant shall analyze underground instability (rock falls and underground collapses) and groundwater inflow using site-specific geotechnical and hydrogeological data to assess the potential risks to worker safety.	
	The investigation shall describe any potential site instability, such as collapse, subsidence, surface uplift, and liquefaction of the subsurface materials and the backfill materials.	
3.5.6 Seismic and geological hazards	The applicant shall conduct a seismotectonic evaluation for the region, using geophysical data and information on geotechnical hazards.	8.2.1 Baseline Conditions 13.3 Groundwater, geotechnical, geological and seismic hazards
	The applicant shall evaluate the potential effects that seismic events and faults may have on sub-surface contaminant transport for the region.	
	The applicant shall prepare a site-specific seismic hazard assessment, including a paleoseismic investigation and probabilistic seismic hazard analysis to develop ground motion response spectra.	
	The applicant shall conduct the assessment in accordance with the latest approved version of CSA N289.2, Ground motion determination for seismic qualification of nuclear power plants [19].	
	The applicant shall include an assessment of whether a fault or any part of a fault is capable, on the basis of geological, geophysical, geodetic, or seismological data (including paleoseismological, geomorphological data, etc.).	
	The applicant shall evaluate the tsunami risk from earthquakes and/or landslides.	
	The applicant shall provide an evaluation of the potential for a volcanic event to occur that could affect the safe operation of the reactor facility.	
	The evaluation shall include all available information (both recorded and those available from geoscientific studies and historical accounts) on volcanic activity that has occurred in the region	
	The evaluation shall include characteristics of potential volcanic event, such as tectonic setting, type of volcanism and nature of material produced during eruption including volatile gas emissions	
	The evaluation shall include potential effects on ventilation systems	
	The evaluation shall include volcanic missiles that could affect SSCs	
	The evlauation shall include potential abrasion or chemical effects on SSCs	
	The evaluation shall include effects on air and water intakes	
	The evaluation shall include effects of static electricity generation on electrical or electronic SSCs	
	The evaluation shall include effects on offsite power supplies to the site	
	The evaluation shall include effects on emergency plan execution	
3.5.7 Biological hazards	The applicant shall evaluate the potential risk to human and non-human biota from biocides and other means of managing these biohazards.	8.9.2 Effects to terrestrial wildlife and their habitat 8.12.2 Effects to birds and their habitats 9.1.2 Effects to Human Health, Social and Economic Conditions 13.4 Biological hazards
	The applicant should pay particular attention to biological phenomena that may pose a risk to cooling water systems.	
	Site evalution shall include consideration of the biological phenomena that may pose a risk to the safe operation of the reactor facility.	
	The potential for the colonization and excessive growth of algae, mussels, or clams within these systems, and the clogging of intake structures by large quantities of biological material (such as aquatic plants, fishes, or jellyfish) should be considered.	
	Site evaluation shall also consider the potential for unusual weather events to increase the risk of ventilation and cooling intake systems being clogged by biota (for example, flooding or large storm events can dislodge large biomasses of aquatic macrophytes, and those biomasses could foul the intake structures).	
	Site evaluation shall consider the potential for the rapid growth of pathogens in the ultimate heat sink and other elements of the cooling system (as it poses a potential risk to both human and non- human biota).	
3.5.8 Natural fire hazards	The applicant shall assess natural fire hazards with respect to their potential risk to reactor facility safety.	13. Effects of the environment on the project
3.6.1 Aircraft crashes	The applicant shall assess the potential for aircraft crashes on the site, taking into account the probable characteristics of future air traffic and aircraft.	7.9.4 Evaluation of hazards associated with external events 12.3 Emergency Management
	If the assessment reveals an unreasonable risk of an aircraft crash on the site, then an assessment of the associated hazards, including impact, fire, and explosion, shall be conducted.	
	The site evaluation shall consider the potential effects on emergency plan execution, including effects on evacuation routes.	
3.6.2 Other transportation hazards	The applicant shall evaluate present and proposed land and water transportation routes in the region with respect to potential collisions with SSCs, generation of explosions, chemical and	12.1 Risk Assessment 12.3 Emergency management
	The site evaluation shall consider the potential effects on emergency plan execution, including effects on evacuation routes.	

REGDOC 1.1.1 Heading	Shall/Should Clause	Applicable TISG Section
3.6.3 Fires and explosions	The applicant shall evaluate all potential fire and explosion events in the region that could affect the safe operation of the reactor facility, including: • direction and force of pressure waves and their effects on SSCs and unprotected personnel • temperature effects on SSCs and unprotected personnel • potential secondary fires and explosions generated by the primary explosion or fire • release of volatile gases, asphyxiants, or chemicals that could affect safe function of SSCs or harm unprotected personnel • missiles that could affect SSCs • effects that could render offsite power supplies unavailable • potential effects on emergency plan execution	7.9.4 Evaluation of hazards associated with external events
3.6.4 Chemical and radiological hazards	The applicant shall evaluate all chemical and radiological hazards in the region that could affect the safe operation of the reactor facility, with particular focus on: • activities that involve the handling, processing, transport, and storage of materials with the potential for explosions, or the production of radioactive materials, volatile and reactive gases, or asphyxiants • effects of the above on SSCs and unprotected personnel, including estimates of overpressure, toxicity, and transport characteristics in air • secondary chemical interactions on SSCs • potential effects on emergency plan execution	7.9.4 Evaluation of hazards associated with external events
3.6.5 Electromagnetic interference hazards	The applicant shall evaluate electromagnetic emitters in the region during normal and abnormal operations, with respect to their potential to affect the safe operation of the reactor facility.	8.5 Electromagnetism and corona discharge
3.6.6 Consideration of future connections to the grid	The applicant shall confirm with the grid owner(s) that, with appropriate grid and plant mitigation measures in place, the location of the reactor facility will not adversely affect the grid.	9.1.3 Mitigation and enhancement measures
	The applicant shall document this confirmation and provide it in the application.	
	the applicant should consider delineating areas from which land vehicles must be restricted.	
	The applicant shall include assessment of all waterways in the vicinity of the site, from the perspective of physical protection.	
	The applicant shall assess all vehicular access land routes in proximity to the site, including rail lines, to determine the security threat they may pose to potential locations of future vital areas.	
	The SSTRA shall consider the threats and risks associated with private and commercial airports, including associated flight pathways.	
3.7 Security Considerations	The applicant shall include the gathering of information about the reactor facility's proposed siting location, in order to study threats or issues presented by the geographical location and characteristics of the proposed site, including potential acts of terrorism.	11. Security Considerations
	The applicant shall compile the findings from this study in a site selection threat and risk assessment (SSTRA) report (this requirement applies to new sites and to reactor facilities on existing sites).	11. Security Considerations
	The SSTRA shall include comprehensive consideration of both physical protection concerns and transportation routes, as described in the following subsections.	11. Security Considerations
	The SSTRA shall be classified as prescribed information, and protected from release under access to information / freedom of information requests, on the basis of national security.	11. Security Considerations
3.7.1 Physical Protection	The applicant shall evaluate remote sites with respect to the anticipated time required to implement essential response services, including how long it will take offsite armed responders to reach the reactor facility.	11.1.1 Remote Areas
	SSTRA should support early identification of the need for establishing an onsite nuclear response force capability, to ensure that a trained response group is in position during the construction phase of possible target sets (such as vital areas) that are part of the reactor facility.	11.1.1 Remote Areas
	Site evaluation shall therefore, address the physical dimensions of the reactor facility and its surrounding environment, including: • the topology of the area that can be considered a component of the overall security barrier design (such as line-of-sight view) • the proximity of various infrastructure elements that could adversely affect physical protection, such as a chemical plant that could release a noxious substance, a hydroelectric dam that could be accidentally or deliberately breached (resulting in flood), or an airport that provides significant flight traffic in the vicinity of the site • site boundaries • weather that could factor as a potential impediment to the operability of physical protection systems (that is, systems that monitor the operation of a reactor and which, on sensing an abnormal condition, automatically initiate actions to prevent an unsafe or potentially unsafe condition) • details pertaining to the establishment of a construction site, such as the positioning of perimeter fences, access and egress points, and storage of construction drawings	11.1 Physical Protection
	The proposed phsical protection requirements shall ensure that the appropriate detection, delay, and response considerations are taken into account.	11.1 Physical Protection
3.7.2 Transportation Routes	The applicant shall consider the transportation routes in the vicinity of the site, to ensure that they are adequately taken into account during future site development activities. The routes to be considered include waterways, land routes and airspace, as described in the following text.	11.2 Transportation Routes
	the applicant should consider delineating areas from which land vehicles must be restricted.	11.2.2 Land Routes
	The applicant shall include assessment of all waterways in the vicinity of the site, from the perspective of physical protection.	11.2.1 Waterways
	The applicant shall assess all vehicular access land routes in proximity to the site, including rail lines, to determine the security threat they may pose to potential locations of future vital areas.	11.2.2 Land Routes

REGDOC 1.1.1 Heading	Shall/Should Clause	Applicable TISG Section
	The SSTRA shall consider the threats and risks associated with private and commercial airports, including associated flight pathways.	11.2.3 Airspaces
3.8 Management system	The applicant shall establish a management system when it can be applied to the site evaluation process.	2.3 Management System for Site Evaluation 7.1 Uncertainty and Bias
	the applicant should have a management system in place that governs the conduct of site evaluation activities.	
	The process of establishing site evaluation-related management system parameters should involve technical and engineering analyses, along with judgments that require extensive experience and knowledge.	
	A management system shall include procedures to control the effectiveness of assessments and engineering activities performed in the different stages of the site evaluation process	
	In these cases, evaluations should be reviewed and verified by individuals or groups that are independent of those who did the work.	
	A management system shall include appropriate organization, planning, work control, personnel qualification and training, and activity verification and documentation, to ensure that the management system is carried out as effectively as possible	
	A management system shall include records of all work carried out in the site evaluation process documentation of the results of studies (including models and simulations) and investigations in sufficient detail to permit independent review	
	In addition to the requirements listed above, a management system should include: • data control, verification and validation • data format • traceability of data • configuration control (including data, environmental, meteorological, geological, geophysical, survey, hydrological, biological) • measuring and test equipment • use and control of computer modelling • field and laboratory work • calculations and analyses • measures to ensure that the results of the site characterization are accurate, complete, reproducible, traceable and verifiable	
	A management system shall include a report that documents the results of all site evaluation work, laboratory tests, and geotechnical analyses and evaluations	
	Uncertainties in the design basis hazard level shall be taken into account.	
3.9 Decommissioning	The site evaluation shall demonstrate how facility decommissioning at the end of the Project is being considered in the overall lifecycle of the nuclear facility.	7.9.1 Requirements for Site Evaluation
	the applicant should consider the ease with which the proposed facility can be decommissioned; that is, the facility is designed to be readily dismantled and disposed of in a fashion that minimizes environmental	
	proximity and transport considerations to recycling, waste storage and disposal infrastructure	
4.1 Role of site evaluation in an application for a licence to prepare site	The application for a licence to prepare the site builds on the information gathered from the site evaluation, and should demonstrate that the applicant is taking into account future steps in the lifecycle of the proposed facility (construction, operation, decommissioning, and abandonment).	1.1.2 Site Preparation
4.3 Management system	The applicant shall describe the management system that governed the conduct of site evaluation activities (see section 3.8, Management system for site evaluation).	2.3 Management System for Site Evaluation
	Management system arrangements shall demonstrate adherence to CSA N286, Management system requirements for nuclear facilities [26], or equivalent standard established in the licensing basis, as applicable to the relative project phase.	
4.3.2 Management system for design activities during site preparation	The process of establishing site evaluation-related management system parameters should involve technical and engineering analyses, along with judgments that require extensive experience and knowledge.	2.3 Management system for site evaluation
4.4 Operating performance	The applicant shall outline the strategy that the applicant will take (including development of mitigation measures) upon discovery of additional risks to the health and safety of the public that were not anticipated during the licence application process.	12.2 Mitigation and enhancement measures
4.6.3 Layout of areas, structures and systems	The applicant shall present the proposed layout of structures in the final layout state (to the extent practicable).	3.2 Project location
	The applicant shall provide: • satellite or aerial photographs of the site and surrounding region, with a resolution scale of 1:1,440 or better, including the proposed exclusion zone and site boundary • topographical map(s) for each site layout in 1:50,000 to no smaller than 1:250,000 scale for all structures and associated infrastructure (all drawings are to scale and include a legend) • proposed layouts of labelled structures, including: • reactor building • turbine-generator block • auxiliary power buildings (for example, diesel generators) and related fuel storage • switchyard • cooling tower structures, water intakes and outlets • large structures (for example, machine shops or storage buildings for parts inventory) in the immediate vicinity to the proposed nuclear facility • proposed conventional and radiological waste transfer and storage areas	

REGDOC 1.1.1 Heading	Shall/Should Clause	Applicable TISG Section
	• layouts of all site roads and proposed transmission corridors • locations of transportation corridors in the vicinity of the site (for example, rail lines, shipping lanes, roads, proximity to airports)	
4.12.1 General consideration for security	The security measures shall address the following elements: • prescribed information • site security program • site access clearance • security arrangements with offsite response forces • physical security • cyber security • security program officer	12.2 Mitigation and enhancement measures
Appendix A Licence Application Guide: Licence to Prepare Site	The licence application for a licence to prepare site shall include the following information to satisfy the requirements of the Nuclear Safety and Control Act (NSCA) and the regulations made under the NSCA.	1. Introduction
A.1 General considerations	The applicant shall keep a record of all information relating to the licence that is submitted by the applicant to the Commission.	1.4 Preparing the Impact Statement 1.5 Format and Accessibility
	The applicant should ensure that the application is complete, dated and signed by the appropriate authority, and that all supporting documents are clearly identified and cross-referenced.	
A.2 Structure and organization of the information in the licence application	the applicant should map the application to the CNSC's SCA framework.	1.4 Preparing the Impact Statement
A.3.1 Applicant's name and business address	The applicant shall provide the applicant's name and business address.	2.1 The Proponent
	The name should be that of the persons or organization applying for the licence, as it appears on the proof of legal status documentation (such as the proof of incorporation or sole proprietorship).	
	The applicant should name an individual only if that person is a sole proprietor or will be solely responsible for the licence.	
	The applicant should notify the Commission within 15 days of any changes to this information.	
A.3.2 Mailing address	the applicant should provide the mailing address, including the complete street name and number, rural route number if appropriate, city, province or territory, and postal code.	2.1 The Proponent
	The applicant should notify the Commission within 15 days of any changes to this information.	
A.3.3 All persons who have authority to interact for the applicant with the CNSC	The applicant shall notify the Commission of any change in the information, within 15 days after the change occurs.	2.1 The Proponent
	The applicant should provide a list of names, positions and contact information of all persons who are authorized by the applicant to interact with the CNSC.	
A.3.4 Proof of legal status	First-time applicants should provide proof of legal status by appending proof of incorporation, corporation number or charter.	2.1 The Proponent
	When submitting an application to renew a licence, proof of legal status should be provided if the applicant's original organization name has changed.	
	If the applicant is a corporation, the application should include the following information: • corporation's legal name • corporation number • date of incorporation • registered office address (if different from the head office address)	
A.3.5 Evidence that the applicant is the owner of the site or has authority from the owner of the site to carry on the activity to be licensed	The applicant shall provide evidence that the applicant is the owner of the site or has authority from the owner of the site to carry on the activity to be licensed.	2.1 The Proponent
A.3.6 Identification of persons responsible for management and control of the licensed activity	The applicant shall contain the applicant's organizational management structure insofar as it may bear on the applicant's compliance with the NSCA and the regulations made under it, including the internal allocation of functions, responsibilities and authority.	2.1 The Proponent
	To satisfy these requirements, the applicant should provide a summary list of all persons responsible for management and control of the licensed activity, including: • names • positions (job titles) • contact information (email, telephone, facsimile) • mailing addresses (if different from the business mailing address); include the complete street name and number, rural route number if appropriate, city, province or territory, and postal code	
	The applicant shall notify the Commission of any change in this information within 15 days after the change occurs	
A.3.7 Billing contact person	The applicant should provide the following information for the person responsible for licence fee payments: • name • position • contact information (email, telephone, fax)	2.1 The Proponent

REGDOC 1.1.1 Heading	Shall/Should Clause	Applicable TISG Section
	• mailing address (if different from the business mailing address); include the complete street name and number, rural route number if appropriate, city, province or territory, and postal code	
A.3.8 Legal signing authority	The applicant should provide the name, title and contact information (address, email address and telephone number) of the individual who is signing the application as the applicant authority.	2.1 The Proponent
A.4.2 Descriptive overview	The applicant shall describe the purpose of the facility (for example, for electrical power or to generate steam for industrial purposes)	3.1 Project Overview 4. Project Purpose, Need and Alternatives Considered
	The applicant should clearly itemize all high-level activities proposed to be conducted under the licence to prepare site.	
	The applicant shall describe the purpose of the facility (for example, for electrical power or to generate steam for industrial purposes)	
	The applicant shall provide total facility capacity, in Megawatts thermal (MWth), and/or Megawatts electric (MWe); for example, the total number of nuclear units and the projected in- service dates for each unit.	
	An application considering several technologies should clearly identify those site activities proposed to be undertaken under a licence to prepare site that are not affected by the technology choice, as well as those that are.	
	The applicant shall provide technical information that demonstrates that these SSCs are appropriate for any reactor technology proposed for the site.	
A.5 Location and site layout	The applicant shall provide an overview or summary of the location and site layout: • a labelled map or series of maps showing the project's location • a map of the site with the proposed or final layout locations (if possible) of the proposed structures determined for the site at the post-construction stage	3.2 Project Location
B.1 General considerations	The process used for the evaluation of the site shall document • the methodology used to determine the suitability of the site over the full lifecycle of the proposed facility • the processes used to manage the quality of work during site evaluation and the activities that verify compliance	1.1.1 Site Evaluation 7.9.1 Requirements for Site Evaluation
	The site evaluation process should satisfy the criteria contained in the following documents that apply to the facility being considered: • applicable federal environmental legislation • either: • REGDOC-2.5.2, Design of Reactor Facilities: Nuclear Power Plants [6] or • RD-367, Design of Small Reactor Facilities [33] • EPS 1/PG/2 Environmental codes of practice for steam electric power generation: siting phase [59] • CSA N288.6, Environmental risk assessments at class I nuclear facilities and uranium mines and mills [7]	
B.3 Process for gathering baseline data	The applicant should document the process for reviewing the credibility and quality of data collection and the analysis methods used by consulting companies.	7.1 Uncertainty and Bias 7.2 Baseline Methodology
	Limitations and data gaps in the quality and completeness of baseline information should be identified and addressed	
	Specific attention should be paid to the adequacy of baseline data collection for those elements of the environment to be carried forward into future licensing phases with the objective of monitoring for a specified level of change in some environmental parameter or analyte	
	Where sampling is used to gather field data, standard sampling techniques and approaches should be from recognized government agencies and peer-reviewed published scientific literature for the appropriate technical discipline (for example, groundwater monitoring, fish monitoring).	
B.4 Process to evaluate natural and human-induced factors that may affect safety and security	The process used to define and evaluate evolving natural and human-induced factors over the lifecycle of the proposed facility that may affect safety and security shall be documented.	7.9.3 Consideration of the evolution of natural and human-induced factors 7.9.6 Population and emergency planning considerations
	The process should include factors such as: • external events • major planned facility evolutions such as plant life extension activities • effects of the site on the environment • changes to population density and land use in the emergency planning zone, including future facilities that may be difficult to evacuate	
C.1 General considerations	The site baseline data shall be sufficiently robust to support site evaluation claims.	2.3 Management system for site evaluation 7.1 Uncertainty and Bias 7.2 Baseline methodology 7.4 Spatial and Temporal Boundaries 7.9.1 Requirements for Site Evaluation 8.9.2 Effects to terrestrial wildlife and their habitat
	For each site baseline data topic, the applicant should justify the size of the local and regional study areas used for that topic.	
	The applicant should describe uncertainties and types of uncertainties (for example, natural randomness, insufficient knowledge, and sampling or measurement error).	
	The applicant should demonstrate that the process used for each type of data collection is managed in a process consistent with the applicant's management system. The results of the site baseline characterization should be accurate, complete, reproducible, traceable and verifiable.	
	The applicant should identify and address limitations and data gaps in the quality and completeness of baseline information, including specifying the deviation from a reference condition that would be considered an adverse effect (taking into consideration the normal natural variation for that parameter). This analysis can be done through the implementation of statistical design into baseline studies.	
	The applicant should establish reference sites used to track changes that are not project-related, but that coincide with project activities (for example, bird nesting habits). This information is important to support site findings on baseline characterization of species occurrence. The applicant should specify the selection basis and planned use of reference sites.	
	Site baseline data submissions should, where appropriate, also provide details on the present human population distribution and land use and indicate how each of the topics described in appendix B has affected population distribution and land use (for example, seasonal floods may have rendered a particular area near the site unsuitable for industrial development).	

REGDOC 1.1.1 Heading	Shall/Should Clause	Applicable TISG Section
C.2 Baseline climate, meteorological data and air quality data	Information should include: prehistoric, historic, and instrumentally recorded climate data sources that reflect the regional conditions (for example, the “Canadian Climate Normals” webpage [18]) • five years of regional meteorological data to evaluate the potential environmental effects on the surrounding areas, or one year of site-specific meteorological data for the most recent one-year period: • this information should provide the atmospheric dispersion in the vicinity of the site and the surrounding areas • the assumptions used should be clearly identified under a separate header • conservatism should be addressed	8.1 Meteorologica environment 8.6.1 Baseline conditions 12.1 Risk Assessment
	Information should include: if available, information about climatic parameters as compared against references (if the information is not provided, an explanation should be included); for example: • air masses • general airflow • pressure patterns • frontal systems • temperature and humidity conditions	
	Information should include: information about the ambient air quality of the study areas prior to the initiation of the project	
	Information should include: topographic descriptions of the site area and information about local (site) meteorological parameters: • the information provided should establish that the data represents conditions at the site and its immediate vicinity • the location of onsite meteorological stations and other local sources of meteorological data should be described with respect to local topographic characteristics that could affect: • local airflow patterns (for example, local circulation conditions, such as “drainage flow”) • meteorological parameters (for example, temperature and humidity)	
	Information should include: if the site is located close to a lake, information about land-lake interactions	
	Information should include: extreme (minimum or maximum) and average values of meteorological variables for regional and onsite locations, including: • air temperature • relative humidity • precipitation • wind speed and direction • atmospheric pressure • solar radiation	
	Information should include: information about rare (infrequent) and other meteorological phenomena, owing to their possible effects on facility safety; for example, tornadoes, hurricanes (blizzards, dust and sand storms, drought, ice storms, hail and lightning	
	Five years of meteorological data should be used. Site-specific meteorological data may be used if it covers the most recent five-year period. The applicant should verify that the data covering the most recent one-year period is representative of the conditions at the site. If the data is not representative, then the five-year average data should be used.	
	The applicant should identify the locations of all meteorological and air quality data collection stations on an appropriately sized topographical map, and should include a justification of their locations.	
	The regional and local meteorological data should be appropriate as bases for: • evaluation of potential changes in normal and extreme values • severe weather phenomena • air quality conditions resulting from: • site preparation • facility construction	

REGDOC 1.1.1 Heading	Shall/Should Clause	Applicable TISG Section
	• facility operation • decommissioning • site abandonment	
	Data on regional climatological and local meteorological conditions and phenomena should be adequate as bases for assessing the: • effects on design and siting of the reactor facility and its heat dissipation system • effects on the atmospheric environment resulting from site preparation, station construction, operation, decommissioning, and abandonment	
	Baseline information should demonstrate consideration of criteria contained in the following IAEA safety guides: • NS-G-3.2, Dispersion of Radioactive Material in Air and Water and Consideration of Population Distribution in Site Evaluation for Nuclear Power Plants [8] • SSG-18, Meteorological and Hydrological Hazards in Site Evaluation for Nuclear Installations [15]	
	For baseline air quality data, air quality assessment results should be compared against applicable provincial and federal air quality criteria and objectives, such as annual, 24-hour and one-hour maximum acceptable concentrations. Precise guidance can be obtained from provincial regulations and standards.	
C.3 Baseline geological, geotechnical, and coastal geomorphological data and baseline information on geotechnical and seismic hazards	The applicant shall document the following baseline data and information within the site, local and regional areas: • geological history and physical, chemical, and mechanical characteristics of geological formations • structural geology and tectonic setting • geotechnical properties of overburden materials (within the site and local areas) • coastal geomorphology (for example, erosion mechanisms and characteristics) • natural or human-induced geotechnical hazards • natural or human-induced seismic hazards	8.2.1 Baseline Conditions
	The baseline information should address the criteria contained in the following documents: • CSA N289.2, Ground motion determination for seismic qualification of nuclear power plants [19] • CSA N289.3, Design procedures for seismic qualification of nuclear power plants [62] • IAEA NS-G-3.6, Geotechnical Aspects of Site Evaluation and Foundations for Nuclear Power Plants [14] • IAEA NS-R-3 (Rev 1), Site Evaluation for Nuclear Installations [1]	
C.3.1 Geology and structural geology	The application shall define the data sources (literature review, borehole information, geophysical investigation, and so on).	8.2.1 Baseline Conditions
	Data obtained from in-situ investigations will include borehole locations; their positions relative to the planned facility should be shown on maps	
	The application shall justify other applicable data (if no in-situ data exists in the footprint of the proposed facility)	
	The application shall present geological history of the area, including information on bedrock lithology and stratigraphy	
	The application shall Relative and absolute age information shall be included where available, based on published government reports or journal articles	
	The application shall document three-dimensional models of the geology and structural geology at three different scales (site, local and regional scales)	
	The application shall Cross sections through the three-dimensional models showing the geological units, unit thicknesses, and structural information shall be provided	
	The application shall describe the physical, chemical, hydrogeological and mechanical properties of rocks and overburden materials	
	The application shall assess their seismogenic potential and their potential to constitute preferential groundwater flow paths, with a description of their tectonic setting	
C.3.2 Geotechnical data	The application shall provide cross-sections showing the soil deposits (with a definition of the soil units) and the upper bedrock and the groundwater levels	8.2.1 Baseline Conditions 8.3.1 Baseline Conditions
	For data obtained with in-situ investigations, the location of the boreholes shall be indicated on maps and cross-sections with their positions relative to the planned facility shown	
	If no in-situ data exists in the footprint of the proposed facility and immediate vicinity, the applicant shall justify other applicable data	
	The application shall provide the geotechnical properties of the soil units, such as index properties, shear strength, deformation characteristics, and liquefaction potential	
	The application shall provide dynamic properties (such as shear wave velocities, damping ratio, shear modulus) to be used in soil response and soil-structure interaction analyses	
C.3.3 Coastal geomorphological data	The application should identify possible mechanisms for coastal erosion in the vicinity of the proposed facility, and should include both natural (such as high lake levels) and human-induced (engineering structures along the shore, dams on contributing rivers, and so on).	8.3.1 Baseline Conditions 13.2 Surface water hazards
	The application should provide estimates of the rate(s) of erosion of shores or riverbanks on or near the site. These estimates should be conducted for the average long term and also for the historical occurrence of unusual events (for example, unusually high lake or sea levels.)	
	The application should include assessments of how: • coastal erosion could affect site facilities • the activities to be licensed for each licensing stage of the site would affect coastal erosion	
	The application should include assessments of how: • coastal erosion could affect site facilities • the activities to be licensed for each licensing stage of the site would affect coastal erosion	
C.3.4 Characterization of potential geotechnical hazards	Assessment of geotechnical hazards shall include consideration of factors such as slope instability, underwater instability, collapse, subsidence or uplift of site surfaces and instability of soil foundations due to static or dynamic loads.	13.3 Groundwater, geotechnical, geological and seismic hazards

REGDOC 1.1.1 Heading	Shall/Should Clause	Applicable TISG Section
C.3.5 Characterization of potential seismic hazards	The applicant shall conduct a site-specific seismic hazard assessment, including a paleoseismic investigation and probabilistic seismic hazard analysis, to develop ground motion response spectra	8.2.1 Baseline conditions 13. Effects of the Environment on the Project
	The assessment should be developed using the most current knowledge, information, and standards, such as: • CSA N289.1, General requirements for seismic design and qualification of CANDU nuclear power plants [64] • CSA N289.2, Ground motion determination for seismic qualification of nuclear power plants [19] • CSA N289.3, Design procedures for seismic qualification of nuclear power plants [62]	
C.4 Baseline hydrology – normal flow, flood and drought	The applicant shall identify surface-water bodies that could affect the facility's water supply and effluent or that could be affected by facility construction, operation, decommissioning or abandonment of the proposed project (including transmission corridors)	8.7.1 Baseline Conditions
	The applicant shall provide site-specific and regional data on the hydrological characteristics of the above surface water bodies under normal, flood and drought conditions.	
C.4.1 General surface-water	The following information should be provided, where applicable: • maps (including digital databases such as a geographic information system (GIS)) showing the relationship of the site to major hydrological systems that could affect or be affected by plant construction, operation, decommissioning, or abandonment • for surface-water bodies used as a heat sink or process water source, information about maximum, average maximum, average, average minimum, and minimum monthly temperature of the water bodies • for surface-water bodies and wetlands, estimated erosion characteristics and sediment transport, including rate, bed, and suspended load fractions, and graduation analyses; a description of the floodplain and its relationship to the site • a description of wetlands and their relationship to the site • the design-basis flood (DBF) elevation and the DBF discharge, if applicable; the derivation of the DBF should be described	8.7.1 Baseline Conditions
C.4.2 Freshwater streams	Characterization information should include a list of major streams, size of drainage areas, stream order and gradient. For each of the major streams listed, the following information should be documented: • maximum, average maximum, average, average minimum, and minimum monthly flow • flood frequency distributions, including levee failures • flood control measures (reservoirs, levees, flood forecasting) • historical drought stages and discharges by month, and the seven-day once-in-10-years low flow • important short-duration flow fluctuations (for example, diurnal release variations from peaking operation of upstream hydroelectric project) • within the influence of the intake and discharge structures, velocity distribution (horizontal and vertical), bathymetry at and near the intake structure, bathymetry at and downstream of the discharge structure, and stream cross-sections • other hydrographic modifications (for example, diversion dams, channelization) • a list of wetlands and floodplains and their seasonal characteristics	8.7.1 Baseline Conditions
C.4.3 Lakes and impoundments	Characterization information should include a description of lakes or impoundments that could be affected by the project. For each of the lakes or major waterbodies described, the following information should be documented: • where influenced by the intake or discharge structures, size, location, and elevation of outlets • where influenced by the intake or discharge structures, elevation-area-capacity curves • a summary description of lake operating rules (for example, motorboat capacity) • annual yield and dependability • variations in inflows, outflows, water surface elevations, and storage volumes and retention time • waves (statistics of wave heights, run-up, and so on), including: • information about historic seiche activity • where waves can affect the safe operation of the facility, information about the design basis wave conditions (including how those conditions were derived) • net loss, including evaporation and seepage • information about current patterns: • including frequency distributions of current speed, direction, and persistence • at the local and regional spatial scale • at the whole-water body spatial scale within a reasonable distance from the site • temperature distribution (horizontal and vertical) and stratification and seasonal variations of density induced currents • detailed bathymetry in vicinity of planned station intake(s) and outfall(s) • where lake level can affect the safe operation of the facility, the design basis maximum and minimum lake levels, including how those levels were derived	8.7.1 Baseline Conditions
C.5 Baseline surface water, sediment and groundwater quality data	The applicant shall evaluate the baseline surface water quality, sediment quality and groundwater quality relative to established standards, criteria, guidelines and/or objectives, to ensure that changes due to a given project do not pose a present, imminent, or long-term risk to human health and the environment.	4.4 Alternative means of carrying out the project
C.5.2 Baseline surface water quality	The applicant shall report baseline surface water quality, including general water quality parameters (for example, pH, conductivity, temperature, and dissolved oxygen)	7.2 Baseline methodology
	The focus should be on those parameters expected to change as a result of project activities assessed throughout all licensing stages.	8.7.1 Baseline conditions

REGDOC 1.1.1 Heading	Shall/Should Clause	Applicable TISG Section
	The expected COPCs shall form the basis of the parameters to be analyzed in baseline surface water samples	
	Baseline surface water quality data should be initially screened against recognized water quality guidelines, such as the Canadian Environmental Quality Guidelines [65] . Where federal or provincial standards or guidelines are not available or where natural background as documented in an appropriate baseline study demonstrates the water quality standards or guidelines are not applicable, benchmarks from the peer-reviewed scientific literature may be used with appropriate rationale. Site-specific water quality objectives may be developed with the support of the scientific literature and the application of the procedures for deriving numerical water quality objectives as documented in the Canadian Environmental Quality Guidelines.	
	The application shall include sample station locations, along with the justification for their selection and statistical basis (number of samples and variability) by which “baseline” is defined	
C.5.3 Baseline sediment quality	The applicant shall report on baseline sediment quality, including sediment physical parameters (for example, pH, total organic carbon, and particle size analysis)	7.2 Baseline methodology 8.7.1 Baseline conditions
	The focus should be on those parameters expected to change as a result of project activities assessed throughout all licensing stages.	
	The expected COPCs shall form the basis of the parameters to be analyzed in baseline sediment samples.	
	Baseline sediment quality data should initially be screened against federal sediment quality guidelines, such as the Canadian Environmental Quality Guidelines [65]. Where an appropriate baseline study demonstrates that natural background exceeds the available standards or guidelines (or that none exist for the COPC of interest), sediment quality benchmarks from the peer-reviewed scientific literature should be used with appropriate rationale.	
	The application shall include sample station locations, justification for their selection and statistical basis (number of samples and variability) by which “baseline” is defined	
C.5.4 Baseline hydrogeology and groundwater quality	The applicant shall determine and report baseline groundwater quality, including pH, conductivity and turbidity	8.7.1 Baseline conditions 7.2 Baseline methodology
	The focus should be on those parameters expected to change as a result of project activities assessed throughout all licensing stages.	
	The expected COPCs shall form the basis of the parameters to be analyzed in baseline groundwater quality samples	
	Baseline groundwater quality data should be compared to federal water quality guidelines, such as the Canadian Environmental Quality Guidelines [65]. If federal or provincial standards and guidelines are not available, water quality benchmarks from the peer-reviewed scientific literature should be used with appropriate rationale.	
	The report shall include sample station locations, justification for their selection and statistical basis (number of samples and variability) by which “baseline” is defined	
	Groundwater elevations and hydraulic heads should be presented as contour maps. Seasonal variations should also be presented.	
	The applicant shall document site-specific hydrogeological cross-sections..	
	Cross-sections should incorporate available geological and hydrogeological information, including lithological logs, cone penetrometer logs, borehole geophysical logs, surface geological mapping, surface geophysical surveys and trench logs. Cross-sections should be drawn to scales that depict important site features. Cross-sections and accompanying maps should be maintained using the same scales.	
	The applicant shall document estimates of the hydraulic properties of hydrostratigraphic units	
	Cross-sections should depict the interpretation of hydrostratigraphy (that is, the mapping of surface and sub-surface water flow pathways for characterization and remediation activities). The rationale for the interpretation should also be documented. Cross-sections should be amended as additional monitoring or geological data are developed. If new data result in significant changes to the conceptual models, the results should be reported. Final drawings should accompany both draft and ongoing remedial investigation reports.	
	These estimates shall include hydraulic conductivity and porosity of aquifers and aquitards, and the transmissivity and storage coefficient of aquifers	
	The applicant should provide site-specific geological structure contour maps illustrating the interpreted elevation of geological contacts, thickness of geological units and the saturated thickness, extent, and overall geometry of hydrostratigraphic zones. If new data result in significant changes to the conceptual models, the changes should be reported. Final drawings do not need to be submitted until the draft remedial investigation report is due.	
	identify the method used to estimate hydraulic properties, whether from pumping tests, slug tests, or laboratory tests of core samples.	
	Site-specific structure contour maps should use the same scale(s) as groundwater. Contour intervals should be selected commensurate with the density and precision of the data.	
	use hydraulic properties, in conjunction with water level and gradient information, to estimate rates and directions of groundwater flow, the rate of transfer of water between aquifers, and the capture zones of wells.	
	Maps should be amended (and include the amendment date) as additional monitoring or geological data are developed.	
	Characterization information shall describe any potable groundwater supplies, their current and potential use near and around the proposed plant	
	The applicant should provide groundwater elevation contour maps for each water-bearing zone, to illustrate the extent of water-bearing zones, horizontal groundwater flow directions, and to support interpretation and illustration of the groundwater flow system.	
	Baseline water quality, including general water quality parameters, shall be documented	
	Site-specific groundwater elevation maps should be drawn to scales that depict important site features.	
	Groundwater elevation contour maps illustrate the horizontal distribution of hydraulic head. The vertical distribution of hydraulic head should be illustrated on cross-sections. All potentiometric data used to develop individual contour maps should be from the same hydrostratigraphic zone and possibly from the same relative position. Groundwater elevation contour maps should incorporate all potentiometric data from a single groundwater elevation survey for the hydrostratigraphic zone illustrated. Groundwater elevation data should be posted with the well identification on each map.	

REGDOC 1.1.1 Heading	Shall/Should Clause	Applicable TISG Section
	The applicant should document anisotropy of hydraulic properties. The range and spatial distribution of hydraulic conductivity and/or transmissivity should be depicted in graphical form, on maps and cross- sections.	
	The application should include any chemical or isotopic tracer data that provide constraints on fluid direction, flow velocity or mixing.	
	The rates and directions of groundwater flow in each hydrostratigraphic unit should be described using potentiometric data and hydraulic properties, t and depicted on maps and cross sections.	
	Characterization should include maps showing the locations of the groundwater supplies.	
	The sample locations and statistics used to define baseline water quality should be justified.	
	Well purge and recovery rates, well volume, purge volume, temperature, specific conductance and any other parameters measured in the field should be reported for each well sampled.	
	Graphs illustrating historical analytical data for COPCs should be provided for selected wells. Trends in concentrations should be interpreted and described.	
C.6 Baseline terrestrial flora, fauna and food chain data	Information about the terrestrial biotic environment to be obtained for the site and surrounding areas shall include: • maps that identify important terrestrial habitats on and in the vicinity of the site • descriptions and maps of the area occupied by each natural and human-made habitat type • descriptions and maps of major soil types in the site, local and regional study areas • a list and description of important floral and faunal species and their spatial and temporal distribution on and in the site's vicinity (including abundance, critical habitat, and life histories that include critical life stages, biologically significant activities, seasonal habitat requirements, trophic, and interspecific relationships) • characterization of the existing vegetation communities (ecological land classification) to assess the likely effects on potential valued component (VC) habitat suitability/availability and potential direct effects on plants identified as potential VCs • description of existing wildlife communities to evaluate likely acute and chronic toxicity or direct mortality effects on fauna (birds, mammals, amphibians, reptiles, and invertebrates) • identification of any conservation status species (that is, species designated at risk by a government agency, that are known to occur, or have the potential to occur within the zone of influence of project activities), and including an assessment of the importance of the habitat within that zone for these species • locations of travel corridors for important terrestrial species and alternate routes for those corridors that could potentially be affected by the site's use • description of wetlands and their relationship to the site • description of natural and human-induced pre-existing environmental stresses and the current ecological conditions that indicate such stresses • description and location of any recent or currently in progress ecological or biological studies of the site or its environs • description and map of boundaries of the proposed project in a regional context, showing existing and planned future land use, and existing infrastructure	8.3.1 Baseline Conditions 8.9.1 Baseline conditions
	Documentation of biota using habitat at the proposed site should include descriptions of communities of birds, mammals, and reptiles. This information helps to identify interactions between the Project and the biological components of the area, to predict potential environmental effects, to identify mitigation measures, and to evaluate the significance of the residual effects when the mitigation measures are applied. Biological data play an important role in the identification of potential VCs, which are used as the final receptors in pathways modelling.	8.12.1 Baseline conditions
	The biotic characteristics of the proposed site shall be identified and documented, while taking into account environmental considerations such as: habitats essential to maintaining the viability of potential VCs, designated protected habitats, areas containing migratory routes of important species, and areas of high biological production	
	documented for understanding the potential changes in, or effects on, the terrestrial environment and the adequacy of environmental monitoring programs to identify these potential changes. Consideration should be given to the need for and design of wildlife population monitoring (for example, spatial distribution, abundance, and density) to put residual adverse effects into proper context for those species at risk. Population monitoring is complex and requires estimates with minimum bias and maximum precision.	
	Characterization shall also contain a description of soil types at the site and within local and regional study areas and the quantitative baseline data of the soil characteristics that are most likely to influence future assessments and required for modelling purposes (e.g., pH, soil bulk density, soil moisture content).	
	For commercially or recreationally valuable species, the applicant should list the types of wildlife and plants that could be adversely affected by the proposed facility. The provincial, local conservation agencies or organizations that maintain harvest level records of these species should be identified.	
C.7.1 Baseline aquatic biota and habitat	Characterization information shall address the site and surrounding region potentially affected by the project, such as the following: • aquatic finfish, shellfish and their prey (for example, benthic and other aquatic invertebrates, phytoplankton, zooplankton) and aquatic plants	7.2 Baseline Methodology 7.3 Selection of valued components
	• for existing facilities on the same site, a description of the zone of influence of existing thermal plumes in horizontal and vertical space with maps and plots (for example, delta above ambient versus distance alongshore and offshore relative to maps of lake bottom depths and substrates); note that the zone of influence should be based on site-specific information	7.4.1 Spatial Boundaries
	Characterization information shall address the site and surrounding region potentially affected by the project, such as the following: • identification of any conservation status species designated as species at risk by a government agency that are known to occur or have the potential to occur within the zone of influence of project activities, including an assessment of the importance of the habitat within that zone for these species	7.5 Effects assessment methodology 8.7.1 Baseline conditions

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	• adequate characterization of the VC structural attributes (for example, population range and size, density, age/size distributions, and so on) and functional attributes (for example, food type, ingestion rates, activity, bioaccumulation, and so on) • including the specific attribute that is the focus in this assessment as important to protect and may be affected by the project • for example, for a specific fish species, this characterization would include whether the population geographic distribution of the species is likely local, regional or lakewide; whether it is a stream, wetland or lake spawner; and so on • this characterization should also include a statement on the level of confidence attached to the information for each species	8.8.1 Baseline conditions 8.10.1 Baseline conditions 8.11.1 Baseline conditions 8.11.2 Effects to fish and fish habitat
	Characterization information shall address the site and surrounding region potentially affected by the project, such as the following: • aquatic habitats of aquatic finfish, shellfish and their prey that are pelagic (open water), littoral (near- shore and shallow), benthic (bottom-associated), riparian (shoreline) and wetland, onsite ponds and streams that provide habitat for aquatic biota, and include: o parameters of habitat quality, quantity and frequency of use o all lentic (standing water) and lotic (flowing water) water bodies, wetlands located within the geographic study areas o fish habitat mapping, including spatial and temporal variation by life stage for spawning, nursery, rearing, feeding, refuge/cover, wintering and corridors for movement, considering that: § the spatial scale of mapping beyond this level is governed by interaction with the project § this mapping includes streams that contain fish for substrate type, cover and structure (run, riffle, pool) and stream channel morphology, according to published protocols from § government agencies or externally peer-reviewed references § the area of consideration may extend beyond the regional study area to include potential VC home ranges, critical habitats, natural corridors (for example, larval and adult fish migration corridors) § the boundaries in space and time take into account the home range, migration corridors and dispersal areas of potentially affected species § the VC information will be used to adjust the assessment boundaries; aquatic mammals, water birds, waterfowl, reptiles and wetlands as potential VC entities considered in section 3.4, Gathering Baseline Data • general criteria used to identify aquatic and wetland VCs that may be affected by the project, and consider that: o typically the list of VCs that result from stakeholder consultation is too long to be of practical use and selection criteria must be applied to reduce the list to a manageable size o the VC selection criteria must be clearly stated and the manner in which they were applied to come up with the final list of VCs o a supporting rationale statement is expected for each VC and must clearly describe how the preliminary list was changed in response to external input	
	Characterization information shall address the site and surrounding region potentially affected by the project, such as the following: • general criteria used to identify aquatic and wetland VCs that may be affected by the project, and consider that: o typically the list of VCs that result from stakeholder consultation is too long to be of practical use and selection criteria must be applied to reduce the list to a manageable size o the VC selection criteria must be clearly stated and the manner in which they were applied to come up with the final list of VCs o a supporting rationale statement is expected for each VC and must clearly describe how the preliminary list was changed in response to external input	
	Characterization information shall address the site and surrounding region potentially affected by the project, such as the following: • mapping of watersheds, sub-watersheds local, site, regional areas and size of drainage areas showing types of land use (for example, pasture cattle, cottage, housing, aggregate extraction former or active) tied into ecological land classification mapping done for terrestrial baseline work	
	Characterization information shall address the site and surrounding region potentially affected by the project, such as the following: • existing physically altered or contaminated habitats (for example, seasonal or annual concentrations above background) that were changed by past operations at sites where there is an existing facility (for example, thermal discharge channels, thermal plumes and past/present physical disruption/structures in near-shore uplands, shoreline/riparian and water bodies)	
	Characterization information shall address the site and surrounding region potentially affected by the project, such as the following: • for existing facilities on the same site, a description of the zone of influence of existing thermal plumes in horizontal and vertical space with maps and plots (for example, delta above ambient versus distance alongshore and offshore relative to maps of lake bottom depths and substrates); note that the zone of influence should be based on site-specific information	
	Characterization information shall address the site and surrounding region potentially affected by the project, such as the following: • fish habitat mapping that includes existing operations thermal discharge areas of elevated temperatures and physical disruption of lake currents (depth and area) identification of habitats exposed to existing facility stressors and those potentially exposed through data review and field reconnaissance, including:	

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	o contaminant and thermal effluents and plumes o storm water release points o present and projected radiological and conventional groundwater contaminant plumes o hydrological characteristics associated with any identified critical fish habitat (see appendix C.4) o nuclear and conventional accidents and spills	
	Characterization information shall address the site and surrounding region potentially affected by the project, such as the following: • the distribution, density and type of aquatic plants in shoreline and wetland areas • baseline habitat information for VCs, including data from reference sites as close as possible to the project site, but unlikely to be on an exposure pathway from the project; note that: o actual reference site sample data is preferred o if actual reference site sample data or filling gaps in sparse reference databases is not possible , calibrated and validated model estimates of baseline habitat condition are acceptable when linked to proposed VC responses, • baseline characterization field study of site reference areas that provide habitat for aquatic biota, providing typical values and variability for types of aquatic biota present and chemistry of water and sediment • the potential effects of climate change on habitat suitability and how that may alter spatial distributions of biota (for example, temperature and water level change effects on location and timing of use of spawning habitat by lake and round whitefish) • habitat criticality and frequency of use in space and time for VC, to determine overlap with stressor exposure distributions in space and time • review of past site clearing and shoreline development, if applicable (this information determines the succession trajectory of the site habitat) • background ranges for measured habitat characteristics, especially those that may be affected by the Project (for example, temperature, flow, turbidity, water and sediment chemistry, percent cover streams) • background information on the potential changes and effects on the aquatic environment and the adequacy of environmental monitoring programs including: o site background information (for example, history of past exposure) and biological life history information that affect population growth rates o the capability to recover from adverse effects (factors to consider include development and maturation time, longevity, generation time, body size, maximum population growth rate per generation, fecundity, likelihood of migration) • cover and standing biomass for aquatic plants as a basis to predict and detect changes • adequate characterization of the VC structural attributes (for example, population range and size, density, age/size distributions, and so on) and functional attributes (for example, food type, ingestion rates, activity, bioaccumulation, and so on) o including the specific attribute that is the focus in this assessment as important to protect and may be affected by the project o for example, for a specific fish species, this characterization would include whether the population geographic distribution of the species is likely local, regional or lakewide; whether it is a stream, wetland or lake spawner; and so on o this characterization should also include a statement on the level of confidence attached to the information for each species • information on the stability of VCs (variability in key biological attributes) and present levels of exposure to stressors o these aspects affect VC vulnerability or the capability to cope with additional project interactions o documentation of baseline values and ongoing trends (normal seasonal and year-to-year fluctuations) for standard biological attributes for the VCs (for example, density, biomass, richness, abundance, community indices, growth, size and age distributions) • information on the variation in spatial distribution (for example, depth) and seasonal distribution by life stage for each VC • an aquatic species inventory list based on field studies for the site and local study area and available published information for the regional study area, including: o the list of fish, benthic invertebrates and major macrophyte species, based on species collected in field studies on the site and local area and those species expected to be found in the area based on regional studies with some indication on their relative abundance and the presence of protected species	

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	o evidence that the information is representative, including identifying species from literature or atlases that are expected but were absent during past surveys	
C.7.2 Baseline food chain data	Characterization information shall include: • conceptual models of existing baseline aquatic biota endpoints (for example, survival, growth, reproduction, age/size distributions) including linkages with abiotic environmental media and other biota (feeding); the conceptual model shall: o describe the baseline sources and distribution of stressors along transport and exposure pathways resulting in baseline hazard quotients for contaminants to aquatic organisms through diet and direct exposure o include potential VCs from each trophic level (for example, piscivore, benthic prey feeder, zooplankton feeder, herbivore, primary producers) • baseline fish and fish prey (benthic invertebrate) tissue concentration levels (typical values and variability) for radionuclides and chemicals for existing exposure areas and reference sites • baseline information on the benthic invertebrate community for representative habitats (for example, exposed rocky inshore areas; embayment wetland) to allow the calculation of standard endpoints quality and quantity of information on benthic invertebrate community consistent with: o Environment and Climate Change Canada technical Guidance on environmental effects monitoring [68] and scientific literature protocols o data from collections in the site and local study area • reference locations that would not be exposed to project effects made over multiple years to understand natural year-to-year variability	8.11.1 Baseline Conditions
C.8 Baseline ambient radioactivity and ambient non-radioactive hazardous substances	For hazardous substances or hazardous waste [9], characterization information shall address characteristics of the ambient radioactivity and non-radioactive hazardous substances for the proposed site and the surrounding area	7.1 Uncertainty and bias 7.2 Baseline methodology 7.3 Selection of valued components 7.5 Effects assessment methodology 7.9.5 Determining the potential effect of the site on the environment 8.3.1 Baseline conditions 8.4.1 Baseline Conditions 8.4.2 Changes to Radiological Conditions
	Characterization information shall include: • baseline concentration of nuclear and hazardous substances in the environment; regional background and/or historical data should be provided where possible	
	Ambient radioactivity baseline information should consider: • CSA N288.4, Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills [11] • IAEA RS-G-1.8, Environmental and Source Monitoring for Purposes of Radiation Protection [69]	
	Ambient hazardous substances baseline information should consider: • CSA N288.4, Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills [11] • federal guidelines; for example, the Canadian Environmental Quality Guidelines [65], specifically the Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health • provincial guidelines and standards; for example, Operations Manual for Air Quality Monitoring in Ontario [70] • international and foreign guidelines and standards; for example, EPA QA/G-5S, Guidance on Choosing a Sampling Design for Environmental Data Collection for Use in Developing a Quality Assurance Project Plan [59]	

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	Characterization information shall include: • detailed maps to show the locations of sampling/monitoring stations for measurements of nuclear and hazardous environmental concentrations The typical, natural variation in nuclear and hazardous substances concentrations at reference sites should be described and documented by implementing a statistical design into the baseline studies. Uncertainties and types of uncertainties included in the data (for example, natural randomness, insufficient knowledge, and sampling or measurement error) should be specified. • an inventory of natural and anthropogenic sources for nuclear and hazardous substances at the site and within local and regional study areas • criteria/benchmarks used in the evaluation of effects associated with nuclear and hazardous substances in the aquatic and terrestrial environment • relevant pathways of exposure to nuclear and hazardous substances for aquatic and terrestrial biota • background radiation doses to aquatic and terrestrial receptors from all natural and anthropogenic sources • predicted/estimated concentrations of nuclear and hazardous substances as a result of the project, including comparisons to baseline conditions • selection of potential aquatic and terrestrial VCs for the Project based on concentrations of nuclear and hazardous substances in the aquatic and terrestrial environment • predicted/estimated radiation doses to aquatic and terrestrial VC receptors from the Project including comparisons to baseline conditions • parameter values used to predict/calculate the environmental concentrations of nuclear and hazardous substances or exposure to aquatic and terrestrial VC receptors • assessment of effects from potential changes in the aquatic and terrestrial environment from predicted nuclear and hazardous substance concentrations and predicted cumulative effects • identification of mitigation measures for project phases to minimize or eliminate the effects of the Project on potential aquatic and terrestrial VC receptors	8.6.1 Baseline conditions 8.6.2 Effects to the atmospheric, acoustic, and visual environment 8.4.2 Changes to Radiological Conditions 8.4.2 Changes to radiological conditions 8.7.3 Mitigation, monitoring and enhancement measures 8.8.3 Mitigation and enhancement measures 8.10.3 Mitigation and enhancement measures 8.11.3 Mitigation and enhancement measures 8.12.3 Mitigations and enhancement measures
C.9 Baseline land use data	Baseline land-use information is used to predict the effects on the proposed site operations, and of the site operations on the environment. In addition, future changes in land use shall be taken into account in the assessment.	9.3.1 Baseline for social determinants of health and community well-being 10.2.1 Baseline Conditions 3.2 Project Location 7.2 Baseline methodology
	Characterization information should: • provide a brief history of land use in the regional study area, including any information on major industries in the vicinity of the proposed site • identify local agencies, user groups and Indigenous peoples interested in local land uses and resources for previous projects in the regional study area; note that land use information from Indigenous peoples may require separate studies to quantify using land for hunting, fishing, trapping, medicinal plant gathering, habitation, spiritual, ceremonial, burial, or any other traditional pursuits • consider and identify information collected and analyzed by federal, provincial or municipal agencies responsible for land-use management • consider and identify information contained in provincial land use policies and regional/municipal official plans, relevant to the regional study area for current and planned land uses • provide a description of primary recreational land uses • describe existing and proposed modes and routes of transportation that will be used throughout the site preparation activities and subsequent phases of the project • provide natural resources data; for example: • commercial fishing, including catch and quota, for the previous 10-year period • timber harvesting • oil, gas and mineral extraction data	
	A detailed description of the baseline uses of land in the local and regional study areas shall be documented.	
	Considerations of future land use should include expected or credible changes to the current land use (for example, possible future municipal development on adjacent property, based on the uses permitted in the official plan).	
	For studies based on interviews with resource users, the methods used to conduct the study should be described, including interview questions that demonstrate how the process validates the studies' results (for example, on traditional use of lands).	
Appendix D - Security baseline data – security risks presented by the site's location	The SSTRA report and its basis information shall be maintained as security baseline characterization data for the lifecycle of the facility.	11. Security Considerations
E.2 Potential change of the climate and environment	The applicant shall document the detailed steps and procedures used for assessing the effects of climate change on the site.	7.5 Effects assessment methodology 8.1 Meteorological environment
	Effects predictions should include: • temperature, humidity, evaporation, high winds, abrasive dust and storms, precipitation, and lightning • water levels and temperature changes of open water bodies (lakes, bays, and oceans), river floods and droughts (flow rates)	

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	• groundwater level, flow pattern and velocity change resulting from changes of surface water recharge and evaporation • earthquakes and landslides, and so on, due to changing sea and lake levels and melting glaciers	8.7.1 Baseline Conditions 8.7.2 Effects to Groundwater and Surface Water 13. Effects of the Environment on the Project 13.1 Meteorological Hazards 13.4 Biological Hazards
	Effects predictions should pay additional attention to potential environmental effects on the water systems of the project, due to: • ice from water bodies (lake or river ice) or frazil ice in forebay • suspended silt • bio-fouling due to biofilms, attached algae, mussels, fish	
	Effects predictions should consider the effects of climate and environmental change on populations of non-human biota that could adversely alter predicted environmental effects due to site activities or introduce new potential environmental effects. The mitigation plans for prevention or reduction of plant intake fouling should take into account projected effects of climate change, including frazil ice and bio- fouling (mussels, algae, marine plants).	
	Future meteorological conditions (that is, accounting for climate change) and the extent of thermal plume from modelling should be used as a basis for extrapolating the long-term ice conditions / silt / fish / mussel / algae density observations for source water body and future potential for effects on the project. Experience with similar operating facilities, such as thermal and nuclear power plants using the same or a similar source water body, should also be considered.	
E.3 Prediction of meteorological events	The application should document a systematic approach for identifying meteorological events for the site and surrounding region (natural external events). This approach includes steps for continued data collection for meteorological events over the project's lifecycle, such as information that shows that the representative data series is complete, of adequate quality and all sources are identified for verification.	13.1 Meteorological hazards 7.5 Effects assessment methodology
	The application should document the verification of the appropriateness, limitations and rationale of the statistical distributions for the data sets.	
E.5 Water supply adequacy	The application should describe the approach for identifying water supply adequacy for the site and surrounding region. This approach should include the steps for continued data collection over the project's lifecycle.	13.2 Surface water hazards
	Water supply adequacy studies should consider: • reliability and availability of water supply (considering existing water-taking projects in the region, and the potential for additional water-taking projects that could exist in the region) • water supply changes from naturally induced failures of offsite structures, such as dams, flood control dykes • if groundwater is used as the water supply: groundwater levels, flow patterns, pumping rates, water quality and the effects on water quality during flooding or drought events (for example, excess minerals released into groundwater during flood events)	
E.6 Prediction of groundwater, geotechnical, seismic and surface faulting events	The application shall document the investigation and evaluation of the site's and surrounding areas' susceptibility to the following events over the project's lifecycle, and shall address: • groundwater related events (groundwater flow and contaminant transport) • geotechnical events • seismic and surface faulting events	13.3 Groundwater, geotechnical, geological and seismic hazards
	The application should provide information on the effects of: • groundwater conditions: • groundwater flow patterns, rates and groundwater level influence the risk of seismic events, and the stability of slopes and foundations • the adverse effects of groundwater conditions on site preparation should be evaluated by combining the groundwater conditions with the geotechnical analysis • geotechnical events: • slope instability • underground collapse and/or rock fall • subsidence or uplift of the site surface • instability of the soil foundation due to static or dynamic loads • geotechnical events on future site activities by combining qualitative explanations with the results of quantitative analyses • seismic events and surface faulting events: • surface faults and lineaments in the regional, local and site scales are identified • the potential for these faults to be seismogenic and seismotectonic should be evaluated • their effects on future site activities should be assessed • mine-induced seismic events, where applicable, and their effects on the structures, systems and components (SSCs) • liquefiable soil units should be identified, and their effects on structures and site preparation should be assessed	
E.7 Prediction of non-malevolent biological events	The applicant shall use a systematic process for characterizing and prioritizing risks of external biological events over the project's lifecycle, with emphasis on the facility's operational phase.	13.5 Fire and explosion hazards
	Mitigation strategies to counter postulated biological events should demonstrate an effort to minimize effects on the environment and the health and safety of workers and the public.	
	Analyses shall characterize potential biological phenomena that could affect facility SSCs, such as: • plant matter, mussels or fish impingement events (for example, smelt runs) that could block water intakes • bird species, insects or other fauna that may nest near or in air intakes (which could result in blockages of air intakes and pathogens or chemically reactive	

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	agents from nesting areas entering air systems) • moulds, organisms or pathogens, either naturally present or generated by site activities (for example, cooling tower mist or algae in cooling water ponds), which could chemically react with SSCs and may result in reduced reliability of systems if not mitigated in design (for example, lichens chemically attacking concrete), and affect human health, either on- or offsite • algae or micro-organisms in thermal plume of the facility outlet that could degrade the quality of water entering intakes for drinking and personal hygiene or affect plant intake water quality • wildlife that could potentially reside within the facility structures and systems and cause damage or long-term degradation	
	If any credible biological events are postulated, a description of a follow-up monitoring plan should be documented. The plans should include methods to test the performance of mitigation of those biological hazards.	
E.8 Prediction of non-malevolent external fire and explosion events	The examination of postulated accidents and malfunctions events and their mitigating strategies shall address • the effects of postulated non-malevolent external fire and explosion events for each phase of site development • environmental effects • site security program • site and regional emergency plans for the project • history of significant non-malevolent external fire and explosion events in the region surrounding the site • fire and explosion risks that may develop from changes in land use around the site (for example, industrial growth) • the effects of climate change that may increase the risks or effects of postulated fire events (for example, increased wind speed, drier weather conditions, increased lightning) • effects on the ability to maintain effective site security during and following these events • effects on the health and safety of workers and the public, where these events interact with activities performed under the licence (for example, if the event causes a secondary fire in a chemical storage area, which causes an explosion or release of combustion products • emergency response requirements posed by these types of events (for example, fire response, chemical spill-control and response) The examination should also address: • external fire criteria contained NS-G-1.5, External Events Excluding Earthquakes in the Design of Nuclear Power Plants [13] • where applicable, criteria contained in: • CSA N293, Fire protection for nuclear power plants [73] • NFPA 1141, Standard for Fire Protection Infrastructure for Land Development in Wildland, Rural, and Suburban Areas [74] • NFPA 1142, Standard on Water Supplies for Suburban and Rural Fire Fighting [75] • NFPA 1143, Standard for Wildland Fire Management [76] • NFPA 1144, Standard for Reducing Structure Ignition Hazards from Wildland Fire [77]	13.5 Fire and explosion hazards
F.1.3 Criteria for level of design detail for an application for a licence to prepare site	the applicant shall address severe accident sequences. Considerations shall also include radioactive sources such as the wet storage bay (also called irradiated fuel bay or spent fuel pool).	12.1 Risk Assessment
F.2 Considerations applicable to all licensing phases	The applicant shall address severe accident sequences. These sequences include, where applicable, simultaneous multiple-unit events, with loss of grid / station blackout events, and events with a simultaneous loss of offsite power with loss of normal access to the ultimate heat sink for an extended period of time. Considerations shall also include radioactive sources such as the wet storage bay (also called irradiated fuel bay or spent fuel pool).	12.1 Risk Assessment
G.1 General considerations	The applicant shall provide adequate and sufficient information on the environmental effects of the Project so that it can be determined, for the entire lifecycle of the project, whether: • siting option choices were made to avoid or reduce environmental effects • the facility design and site infrastructure designs are adequate to meet regulatory requirements (including the exclusion zone boundary, where appropriate) • the applicant will ensure adequate provision to protect health, safety, security and the environment Effects predictions and statistical approaches should be documented and used (for example, random sampling wherever feasible) for testing these effects predictions according to published protocols. Effects predictions for pulse exposures (for example spills, accidental or intended releases, silt and storm water runoff events) should be developed appropriately, because they have different requirements than predictions for continuous exposures. The applicant shall document the evaluation of the proposed approach for environmental effects monitoring for the current licensing phase, including projected minimum detectable critical effect size, and the confidence associated with the design of the monitoring and baseline data.	1.1.1 Site evaluation 7.1 Uncertainty and Bias 8.6.3 Mitigation and enhancement measures
G.2 Effects of the Project on air quality	The applicant shall document the evaluation of the proposed approach for environmental effects monitoring for the current licensing phase, including projected minimum detectable critical effect size, and the confidence associated with the design of the monitoring and baseline data. The applicant should: • characterize the effects of emissions of nuclear and hazardous substances from the Project to the atmosphere during normal operations and during postulated accident and malfunction scenarios • assess the potential effects of atmospheric nuclear and hazardous substance emission to air quality for each phase of the project, and the ability of the described mitigation measures in eliminating or minimizing any adverse effects	8.6.3 Mitigation and Enhancement Measures 8.6.2 Effects to the atmospheric, acoustic, and visual environment 7.9.5 Determining the potential effect of the site on the environment

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	Air quality assessments should include, as applicable: • information on project-related emission sources from stationary and mobile sources • information on point source emissions • information on proposed pollution-control technologies, including environmental effects; the information should be prepared with an awareness of pollution-control technologies available in the industry	
G.3 Effects of the Project on the terrestrial environment	The applicant shall examine and document the effects of the proposed project on the terrestrial environment, including flora and fauna, including effects on wildlife corridors, protected areas, and other valued components (VCs).	8.9.2 Effects to terrestrial wildlife and their habitat 8.10.2 Effects to species at risk and their habitat 8.12.2 Effects to birds and their habitat 7.9 General criteria for site evaluation
	The assessment of project effects on the terrestrial environment should include: • concentration of contaminants in soil • concentration of contaminants in the food chain • characterization of effects on potential terrestrial VCs • effects of loss of habitat and disturbance on flora and fauna • effects of physical barriers, including disruption of migration corridors, on wildlife • effects of disruption, blockage, impediment and sensory disturbance on wildlife • mortality, direct and indirect, of terrestrial wildlife • reduction in wildlife productivity and population attributes • effects prediction using quantitative ecological risk assessment modelling • effects on biodiversity • identification of potential credible mitigation measures for all project phases to minimize or eliminate the effects of the Project on the proposed terrestrial VCs	
	The degree of detail provided in the assessment of the effects should be commensurate with the magnitude of the potential effects.	
	The applicant shall assess the effects from the Project on the terrestrial environment in a manner consistent with CSA N288.6, Environmental risk assessments at class I nuclear facilities and uranium mines and mills [7].	
	Information and data on the terrestrial effects should be evaluated against reliable criteria and objectives, so as to ensure that the information can identify likely interactions between the Project and its effects on the terrestrial environment's biological components. Guidance on selecting appropriate toxicological benchmarks is provided in CSA N288.6, Environmental risk assessments at class I nuclear facilities and uranium mines and mills [7].	
G.4 Effects of nuclear and hazardous substances on the terrestrial environment	The applicant shall specify uncertainties included in the data (for example, natural randomness, insufficient knowledge, and sampling or measurement error).	7.1 Uncertainty and bias 8.9.2 Effects to terrestrial wildlife and their habitat
	The applicant should address relevant federal and provincial guidelines and include, for all cumulative project effects above baseline data: • detailed maps showing the proposed locations of sampling/monitoring stations for all measurements of nuclear and hazardous environmental concentrations • an inventory of natural and anthropogenic sources for nuclear and hazardous substances at the site and within local and regional study areas, including predicted/estimated concentrations of nuclear and hazardous substances from the project • relevant pathways of exposure to nuclear and hazardous substances for terrestrial biota, including parameter values used to predict/calculate the environmental concentrations of nuclear and hazardous substances or exposure for terrestrial VC receptors • predicted/estimated radiation doses and contaminant exposure to terrestrial VC receptors from the project, including the criteria and benchmarks used in the evaluation of effects associated with nuclear and hazardous substances in the terrestrial environment • assessment of possible effects from potential changes in the terrestrial environment, due to predicted concentrations of nuclear and hazardous substances and predicted cumulative effects • identification of potential credible mitigation measures for all project phases to minimize or eliminate the effects of the Project on the proposed terrestrial VC receptors	
G.5 Effects of the Project on the aquatic environment	The applicant shall address the effects from project activities on the aquatic environment, including aquatic habitat and associated aquatic biota.	8.8.2 Effects to vegetation, riparian and wetland environments 8.11.1 Baseline Conditions 8.11.2 Effects to fish and fish habitat
	The applicant should address the following general areas: • the following aquatic habitats (using the parameters of habitat quality, quantity and frequency of use): • pelagic (open water) • littoral (near-shore and shallow) • benthic (bottom-associated) • riparian (shoreline) • wetland • onsite pond and streams that provide habitat for aquatic biota • the existing physically altered or contaminated habitats that were changed by past operations where there is an existing facility (for example, thermal discharge channels, thermal plumes and past/present physical disruption/structures in near-shore uplands, shoreline/riparian and water bodies) • habitat of aquatic finfish, shellfish and aquatic plants, excluding aquatic mammals, water birds, waterfowl and reptiles (within the scope of effects of the Project on the terrestrial environment) • maps (including digital databases such as a geographic information system) that show the relationship of the site to major hydrological systems that could affect or be affected by plant construction or operation	

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	Pre-project or baseline aquatic habitat classification and mapping are precursors to any decisions associated with aquatic habitat loss. Assessing the potential for habitat loss should include: • numerical statements on the size, frequency, duration and magnitude of change of the affected area and/or volume of habitat, and an assessment of how critical and unique the affected habitat is to biota exploiting the habitat (quantity and quality) Note: This information should be supported by maps showing: • areas of project activities • overlap with aquatic VC habitat in time and space (including VC home range and migration and dispersal estimates) • descriptions of any project effects that are physical, biological, chemical or radiological in space and time on the habitat, and occurrence of interacting organisms • descriptions of disturbances of land, shoreline and water bodies from activities in project phases, with: • linkages to any expected change in aquatic habitat (for example, offshore placement of excavated material, placement of intake and discharge structures, cofferdams or shoreworks or shoreline protection) • an assessment of the water column volume and area affected by the intake water withdrawal • descriptions of past habitat loss and possible future habitat loss, to set the context for the evaluation of the importance of the possible future losses • justification if the benthic invertebrate community is not used as indicator of loss of fish habitat (because this is the food base for many fish species)	
	Submissions should address the Fisheries Act. The applicant should review the proposed activities against the requirements of the Fisheries Act, because an authorization may be required if an activity is likely to cause serious harm to fish. The applicant should consult the Fisheries and Oceans Canada (DFO) Projects Near Water website for further guidance on self-assessing serious harm to fish and the authorization application process. Depending on the location of the activity (within the proposed licence boundary or outside), the application would be submitted for review to the CNSC or DFO, respectively.	
	The applicant should evaluate information and data on the aquatic effects against credible criteria and objectives, to ensure that the information is sufficient to identify likely interactions between the Project and its effects on the biological components of the aquatic environment. For more information on determining the appropriate aquatic effects criteria and objectives, see: • CCME, A Framework for Ecological Risk Assessment: General Guidance [83] • CCME, A Framework for Ecological Risk Assessment: Technical Appendices [84] • A framework for ecological risk assessment at contaminated sites in Canada: review and recommendations [85] • Priority Substances List Assessment Report. Releases of radionuclides from nuclear facilities (impact on non-human biota) [86] • where applicable, provincial guidelines and the following CSA Group standards: • N288.4, Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills [11] • N288.6, Environmental risk assessments at class I nuclear facilities and uranium mines and mills [7] • N288.5, Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills [37]	
G.5.1 Effects of liquid effluent on the aquatic environment	The applicant shall address the following areas of concern: • identification of all plant-related structures or alterations of the natural topography that lead to aquatic contaminant inputs to receiving water bodies, floodplains or wetlands at the site • known (historical and present) aquatic contaminants found at the site and within the local and regional study areas, potentially affecting or affected by plant construction and operation • confirmation that the information contains sufficient linkage of hydrological mappings to known (historical and present) data and predicted future changes in aquatic contaminant concentrations	8.7.1 Baseline conditions 8.7.2 Effects to groundwater and surface water 8.8.2 Effects to vegetation, riparian and wetland environments 8.11.2 Effects to fish and fish habitat
	The applicant should provide sufficient data for the assessment of anticipated effects during the period of site preparation, facility construction, facility operations and decommissioning within, upstream and downstream of the zone of influence of the intake and discharge structures.	
	The approach should project the effects on individual biota to those of the population. Information should be supported by peer-reviewed published scientific literature, and be based on a combination of water and sediment chemistry, benthic invertebrate and fish field surveys (accounting for the most sensitive VCs), laboratory toxicity tests and computer modelling. The approach should confirm whether there are or will be significant adverse effects on the aquatic community.	
	Predicted changes to surface water and sediment quality from modelling data should be evaluated using criteria that ensure that surface water and/or sediment quality changes and liquid effluent input into water bodies do not pose risks to human health and the environment. When determining appropriate surface water quality criteria and objectives, the applicant should consider federal guidelines, such as the Canadian Environmental Quality Guidelines [65], as well as provincial guidelines and standards, and use water-quality benchmarks from reputable scientific literature.	
	Descriptions of effects should include direct exposure effects (for example, on survival, growth, reproduction, age, species distribution of community), and indirect effects (for example, altered predators, prey, competition, exposure via the food chain).	
G.5.2 Effects of blasting and excavating on aquatic biota	Information for this area should be commensurate with the level of blasting and excavating to be performed under each licence phase of the project.	8.11.2 Effects to fish and fish habitat 8.11.3 Mitigation and enhancement measures
	Activities should be planned to avoid critical fish habitat use times and locations within the zone of influence.	
	The site evaluation should address: • criteria contained in Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters [89] • Environment and Climate Change Canada's total suspended solids and turbidity criteria • control/effect testing for site preparation blasting effects on aquatic biota in nearby site ditches, streams or ponds within the zone of influence	

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	• habitat disruption (for example, through siltation or propagation of sound pressure waves) or physical disruption (for example, disrupting groundwater flows to streams during spawning periods) • estimates of individual losses of aquatic fauna provided in the context of population attributes (for example, spatial distribution, abundance or density)	
	The site evaluation should demonstrate that the site preparation and construction activity monitoring plan design is sufficient to define the magnitude, temporal and spatial extent of the source terms and effects (for example, spatial extent of lake bottom affected, numbers of fish killed or injured per blast extrapolated to whole period of activity, effects on benthic invertebrates)	
G.5.3 Effects of impingement and entrainment on aquatic biota	The applicant shall address the following, for each project phase: • site evaluation from the perspective of project-related intake impingement and entrainment effects on aquatic organisms (with an emphasis on VCs); however, total losses of all species should be considered, in order to ensure adequate provision for the protection of the environment • effects for all consumable and cooling water system options • defensible and testable predictions of residual adverse effects of water intakes (such as cooling water intakes) on aquatic biota, so that the significance of all effects of the project, and the cumulative effects of other projects, can be assessed • monitoring programs for entrainment and impingement should be based on peer-reviewed published standards, for example: • Impingement Abundance Monitoring Technical Support Document [90] • Entrainment Abundance Monitoring Technical Support Document [91] • screenings of VCs for susceptibility to intake withdrawal based on susceptibility factors • descriptions of conceptual model, linking source terms for entrainment and impingement to measures, and predictions of effect	8.11.2 Effects to fish and fish habitat
	The estimates of intake losses (cropping rates) for all life stages of aquatic biota in numbers and biomass should be extrapolated to the whole year, with confidence intervals based upon industry-accepted methods of sampling and analysis. This extrapolation includes the conversion of immature stages to age-1 adult equivalents for estimates of losses of population-level importance (for example, Defining and Assessing Adverse Environmental Impact from Power Plant Impingement and Entrainment of Aquatic Organisms [92]). Standard modelling and statistical approaches and contextual methods from government agencies and peer-reviewed published scientific literature should be used to project the effects on individual biota to those of the year-class or population. Mortality is assumed to be 100 percent from impingement, unless a fish handling and return system is included. The effectiveness predictions also vary by species and life stage. For example, alewife are fragile and easily killed, whereas sucker and eels are not; juveniles are easily injured and do not easily withstand mechanical handling systems	
G.5.4 Effects of thermal plume on the aquatic environment	The site evaluation shall address: • clear pictorial descriptions showing the locations of discharge structures and areas of influence (temperature, discharge jet) relative to intakes and known/suspected areas of VC-focused habitat use (spawning, rearing, nursery, feeding, wintering areas) and features (for example, substrates, bathymetry, wetlands, aquatic plants) • descriptions of models (physical, mathematical, conceptual) used to predict temperature effects and thermal discharge jet effects, and to account for long-term effects of climate warming relative to incremental effects of the project • a listing of aquatic fish and shellfish species, aquatic plants, and invertebrates, identifying which life stages are susceptible to exposure to the interaction, and which subset of species are most sensitive • descriptions of zones of influence of thermal plume temperature effect (greater than 1ºC above ambient) and physical discharge jet effect with maps and plots (for example, delta above ambient versus distance alongshore and offshore and incremental effect on existing thermal plumes) • descriptions of alongshore currents, including direction, speed and sediment transport and how these are changed by discharge plumes (deflection, distance and entrainment time for passively drifting biota, such as eggs, larvae) • direct consequences to the ecosystem (process, structure, function), fish and fish habitat, other aquatic VCs , and indirect effects (via food chain) to aquatic birds and mammals • descriptions of worst-case and average conditions of discharge water effects, including: o the effects of thermal plume on aquatic habitat temporal and spatial changes (for example, discharge jet interruption of ambient lake currents, scouring, temperature changes, sedimentation and particle size, algal cover) o consideration of risk to aquatic biota from “pulse” temperature increases and decreases relative to ambient changes such as thermal shock from ongoing operations, outages and anticipated operational occurrences • temperature predictions (mean, median, maximum and minimum) during critical life stage periods for potential VCs and plots of hourly maxima showing duration at peak temperatures • effects of contaminants released in the thermal discharge, including the combined effects of temperature and contaminants, as well as the potential for gas-bubble disease • effects on fish, including: o physical displacement of life stages exposed to discharge jets o lethal and sub-lethal effects o behavioural responses (attraction and avoidance) for all life stages o direct effects (survival, growth, reproduction, diet, condition) and indirect effects (for example, discharge angling mortality, increased larval mortality from predation due to physical transfer out of discharge channel to open water body, disease prevalence) analysis and evaluation of the incremental effects from	4.4 Alternative means of carrying out the Project 7.5 Effects Assessment Methodology 8.7.2 Effects to Groundwater and Surface Water 8.11.2 Effects to fish and fish habitat 13.4 Biological hazards

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	the project, and the cumulative effects of combined discharges • the monitoring and sampling methodologies that will be used onsite along with descriptions of sampling/monitoring points and equipment	
	The scope of information should be scaled to the scope of anticipated adverse effects. For example, a once-through cooling system (diffuser) would require complex analysis but cooling towers would not.	
	When considering the use of a nearby large body of water as the ultimate heat sink for heat rejection (for example, using once-through condenser cooling water), the applicant shall predict, monitor and document the effects of the resultant thermal plume and the physical effects of the discharge water flow on nearby bodies of water.	
	This analysis shall consider the potential effects of using cooling towers on air quality, terrestrial and aquatic environment.	
G.6 Effects of the Project on hydrogeology	The site evaluation shall address effects from project activities on hydrogeology.	7.8 Extent to which adverse federal effects are significant 7.9.5 Determining the potential effect of the site on the environment 8.7.1 Baseline conditions 8.7.2 Effects to groundwater and surface water 9.1.1 Baseline Conditions
	Information should: • address the prediction and monitoring of effects of activities on: • flow patterns and rates of groundwater flow • physical, chemical, and biological characteristics of the groundwater within the site, local and regional areas, during site preparation, construction, operation, decommissioning or abandonment of the facility • describe how the hydrogeological investigations program is being conducted to permit the assessment of the effects of features and processes from the baseline hydrogeology and groundwater quality information contained in the licensing submissions • include the physical, chemical, and biological water-quality parameters, rates, flow patterns of groundwater flow and movements of released contaminants through local and regional groundwater flow systems • provide sufficient information to enable the reader to become familiar with the physiographic, hydrologic, hydrogeological and groundwater uses at the site and in its vicinity	
	Investigations of groundwater, as well as the investigation and modelling of dispersion and retention of radionuclides in groundwater should demonstrate consideration of the criteria contained in NS-G-3.2, Dispersion of Radioactive Material in Air and Water and Consideration of Population Distribution in Site Evaluation for Nuclear Power Plants [8].	
	Well-supported effects predictions should be provided (for example, quantitative expression of change and a rationale provided for significance and mitigation follow-up). For more information, see Operational Policy Statement: Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012 [93].	
	The applicant should assess and document the potential radiological doses and exposures to hazardous substances to persons, including mitigation strategies, for each phase of the facility's lifecycle.	
G.7 Effects of the Project on human health	Receptor exposure characteristics (for example, inhalation or ingestion rates), when used, should be referenced from accepted Canadian or international sources, for example: • for hazardous substances, 2013 Canadian Exposure Factors Handbook [94] • the most up-to-date International Commission on Radiological Protection (ICRP) references • the U.S. Environmental Protection Agency's Agency for Toxic Substances and Disease Registry	9.1.1 Baseline Conditions 12. Effects of Potential Accidents or Malfunctions
	The effects documented for accidents and malfunctions should correlate with the postulated accidents and malfunctions scenarios.	
G.7.1 Radiological risks	The applicant shall describe and document the method used to estimate effective and equivalent doses.	9.1.2 Effects to Human Health, Social and Economic Conditions 9.1.3 Mitigation and enhancement measures
	Documentation should identify radiation doses received by persons on and offsite at similar existing facilities (when they exist) that use the best available technology economically achievable (BATEA). This benchmarking exercise should be used to develop a licensing basis that achieves similar or lower doses.	
	Calculated doses to persons, both on and offsite, should be traceable to the input data (for example, receptor exposure characteristics, relevant radiological data). Sample dose calculations should be included that demonstrate the link from input data (such as concentrations of radionuclides in air) to dose to persons, with all relevant assumptions provided.	
G.7.2 Mitigation strategies	The applicant shall ensure that mitigation strategies reflect preventive principles and are technically and economically feasible.	7.6 Mitigation and enhancement measures 9.1.2 Effects to human health, social and economic conditions 9.1.3 Mitigation and enhancement measures
	Emphasis shall be placed on eliminating or minimizing hazards through design and engineered controls.	
	Doses to workers from routine and non-routine work practices should be estimated, including the maximum annual effective and equivalent doses to categories of workers.	
	The applicant shall ensure that engineered controls demonstrate that the controls reduce the magnitude of each radiation source and keep radiological exposures of workers as low as reasonably achievable (ALARA) during routine and non-routine work practices (for example, operating and maintenance activities).	
	Where prevention of effects cannot be assured, the applicant should describe administrative mitigation controls such as personal protective equipment, training and procedures. Only mitigation measures that are technically and economically feasible (ALARA and BATEA) should be considered.	
	The radiological design objectives for these engineered controls shall be specified.	
	The applicant shall identify administrative controls that will be used to minimize doses to workers.	
	The applicant shall describe contingency responses in the event of failed engineered and administrative controls.	
	The applicant shall demonstrate that the assessment of the significance of effects resulting from the Project takes into account the implementation of the proposed mitigation measures.	

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	The assessment results shall demonstrate that the predicted effective and equivalent doses to workers and members of the public will be ALARA and below the applicable radiation dose limits specified in sections 13 and 14 of the Radiation Protection Regulations.	
G.7.3 Hazardous substances	The applicant should identify and describe: • the methods used to estimate exposure, via various pathways, of the various human receptors to hazardous substances • the engineering controls to be applied to reduce the magnitude of each source	9.2.2 Effects on biophysical determinants of health
	When estimating the significance of the effects resulting from the project, the applicant should account for the implementation of the proposed mitigation measures. The assessment results should demonstrate that the estimated exposure to hazardous substances of persons onsite during the normal operation will not exceed criteria specified by Health Canada, the CCME or other agencies acceptable to the CNSC.	
G.8 Prediction of non-human biota dose	The applicant shall address non-human biota radiation dose assessment methods used to quantify effects for releases of nuclear substances.	8.4.1 Baseline conditions 8.9.2 Effects to terrestrial wildlife and their habitat 8.11.2 Effects to fish and fish habitat 8.12.2 Effects to birds and their habitat
	The scope shall include analysis of both the effects of chronic and acute exposures on terrestrial and aquatic organisms.	
G.8.1 Exposure information	The applicant shall perform explicit calculation of radiation doses to non-human biota with recognized approaches and software tools.	1.4 Preparaing the Impact Statement 8.8.2 Effects to vegetation, riparian and wetland environments 8.10.2 Effects to species at risk and their habitat 8.11.2 Effects to fish and fish habitat 8.12.2 Effects to birds and their habitat
	The applicant should provide a high-level discussion of the relative merits of alternative approaches to put the presented approach in a current national and international context.	
	An example of an acceptable approach is available in CSA N288.6, Environmental risk assessments at class I nuclear facilities and uranium mines and mills [7]. The applicant should document the details of transfer parameters and their validation for site conditions. Site-specific data, and/or authoritative data sources, should support model structure and parameter choices. The applicant should note the choice of food chain transfer factors for VCs, which can vary by orders of magnitude in different environments for different species.	
	The applicant may use a software tool, if it addresses risks to VCs explicitly or by reasonable analogy. If an approach different from CSA N288.6 [7] is used, the applicant should describe the model structure and implementation. Regardless of the approach taken, the applicant should document a few representative samples of dose calculations starting with media and/or food concentrations.	
G.8.2 Selection of radiation benchmarks	For controlled releases, the applicant shall quantify and interpret doses for the effects on life history parameters (morbidity, mortality, reproduction).	8.8.2 Effects to vegetation, riparian and wetland environments 8.9.2 Effects to terrestrial wildlife and their habitat 8.11.2 Effects to fish and fish habitat 8.12.2 Effects to birds and their habitats 9.2.2 Effects on biophysical determinants of health 12.1 Risk Assessment
	For accidental releases, the applicant should use the notional range of 1–10 Gy to describe the effects of acute exposure. Comparisons may only be possible for analogous organisms. Consideration should also be given to statistical interpretation of acute exposures.	
	If numerical benchmarks for chronic radiation effects are exceeded, effects shall be interpreted at multiple levels of organization in an ecological context relative to the potential for effects on individual biota, populations, communities and ecosystems.	
	Because derivation of non-human biota dose benchmarks for generic use is still ongoing, the applicant should reference and describe alternative interpretations of radiation risk. A documented detailed description would be appropriate only if more restrictive criteria could lead to a conclusion of likely and significant adverse effects.	
	The applicant shall describe long-term consequences of accidental releases (for example, as shown from studies of major nuclear accidents such as “Differences in effects of radiation on abundance of animals in Fukushima and Chernobyl”, published in Ecological Indicators [98].	
G.8.3 Uncertainties	The applicant should address the effects of using radiation weighting factors suggested in CSA N288.6, Environmental risk assessments at class I nuclear facilities and uranium mines and mills [7] for calculating a “biota effective dose” from absorbed dose (for example, weighting factors of 40 for alpha particles, and 3 for tritium beta particles).	9.2.2 Effects on biophysical determinants of health
	The applicant should use a probabilistic modelling approach if there is ambiguity in the validity of dose estimates for site-specific conditions and/or VCs. For example, a probabilistic approach is appropriate when it is necessary to grossly extrapolate information for other areas or species, or when there is ambiguity in the protection of any threatened or endangered species, or species of concern.	