Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

Regulatory Document

RD–346

Site Evaluation for New Nuclear Power Plants

November 2008

Canada

CNSC REGULATORY DOCUMENTS

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PREFACE

This regulatory document sets out the expectations of the Canadian Nuclear Safety Commission (CNSC) with respect to the evaluation of sites for new nuclear power plants (NPPs) before application is made for a *Licence to Prepare Site*, and before an environmental assessment (EA) determination is initiated.

This regulatory document does not address siting for other Class IA or IB facilities. Regulatory expectations pertaining to site preparation are also outside the scope of this document.

RD-346 represents the CNSC staff's adoption, or where applicable, adaptation of the principles set forth by the International Atomic Energy Agency (IAEA) in NS-R-3, *Site Evaluation for Nuclear Installations*. The scope of RD-346 goes beyond NS-R-3 in several aspects such as the protection of the environment, security of the site, and protection of prescribed information and equipment, which are not addressed in IAEA's NS-R-3.

Site evaluation is a process that should precede the submission of an application to prepare a site for the construction of a new NPP. RD-346 is written to serve the broader licensing needs under the *Nuclear Safety and Control Act* and the *Canadian Environmental Assessment Act*, and will facilitate a more effective and efficient regulatory review.

Similar to NS-R-3, RD-346 considers all licensing phases, because information from the site evaluation process feeds into the environmental assessment (EA), and the processes for reviewing an application for a *Licence to Prepare Site*, and other licence applications.

Nothing contained in this document is to be construed as relieving any applicant or licensee from requirements associated with conventional codes and standards. In particular, while RD-346 may assist a proponent in making a licence application, it is the licensee's responsibility to identify and comply with all applicable regulations and licence conditions.

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SITE EVALUATION FOR NEW NUCLEAR POWER PLANTS

1.0 PURPOSE

The purpose of this regulatory document is to set out the expectations of the Canadian Nuclear Safety Commission (CNSC) with respect to the evaluation of sites for new nuclear power plants (NPPs or plants) before application is made for a *Licence to Prepare Site*, and before an environmental assessment (EA) determination is initiated.

2.0 SCOPE

This document provides high level guidance pertaining to site evaluation activities.

Site selection is not regulated under the *Nuclear Safety and Control Act* (NSCA), and is therefore not addressed in this document.

This regulatory document does not address siting for other Class IA or IB facilities.

The regulatory expectations pertaining to site preparation are outside the scope of this document. The information gathered during site evaluation may be used in the EA process, and may also feed into the NPP design process.

RD-346 represents the CNSC's adoption of the tenets set forth by the International Atomic Energy Agency (IAEA) in safety requirements document NS-R-3, *Site Evaluation for Nuclear Installations*, and the adaptation of those tenets to align with Canadian expectations. Some Canadian expectations, such as protection of the environment, security of the site, and protection of prescribed information and equipment, are not addressed in NS-R-3.

The IAEA guides that support NS-R-3 have also been adopted to support this document. These guides are included in the publications listed in the "Additional Information" section of this document.

3.0 RELEVANT REGULATIONS

The provisions of the NSCA and the associated regulations that are relevant to this regulatory document can be separated into stipulations that relate to determination of site suitability and evaluation of licence applications.

3.1 NSCA and Associated Regulations

Data and analysis results from site evaluation may be used to satisfy the following aspects of the NSCA and associated regulations once the proponent decides to submit an application for a licence:

1. Paragraph 44(1)(*e*) of the NSCA provides that the Commission may make regulations respecting the location, design, construction, installation, operation, maintenance, modification, decommissioning, abandonment and disposal of a nuclear facility or part of a nuclear facility;
2. Paragraph 44(1)(*o*) of the NSCA provides that the Commission may establish requirements to be complied with by any person who locates, designs, constructs, installs, operates, maintains, modifies, decommissions or abandons a nuclear facility;
3. Paragraphs 3(*a*) through 3(*k*) of the *Class I Nuclear Facilities Regulations* provides that an application for a licence in respect of a Class I nuclear facility, other than a licence to abandon, shall contain the following information in addition to the information required by paragraphs 3(*a*) through 3(*n*) of the *General Nuclear Safety and Control Regulations*:

   (*a*) a description of the site of the activity to be licensed, including the location of any exclusion zone and any structures within that zone;

   (*b*) plans showing the location, perimeter, areas, structures and systems of the nuclear facility;

   (*c*) 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;

   (d) the proposed quality assurance program for the activity to be licensed;

   (e) the name, form, characteristics and quantity of any hazardous substances that may be on the site while the activity to be licensed is carried on;

   (f) the proposed worker health and safety policies and procedures;

   (g) the proposed environmental protection policies and procedures;

   (h) the proposed effluent and environmental monitoring programs;

   (i) if the application is in respect of a nuclear facility referred to in paragraph 2(b) of the *Nuclear Security Regulations*, the information required by section 3 of those Regulations;

(j) the proposed program to inform persons living in the vicinity of the site of the general nature and characteristics of the anticipated effects on the environment and the health and safety of persons that may result from the activity to be licensed; and

(k) the proposed plan for the decommissioning of the nuclear facility or of the site;

4. Paragraphs 4(*a*) through 4(*e*) of the *Class I Nuclear Facilities Regulations* provide that an application for a licence to prepare a site for a Class I nuclear facility shall contain the following information in addition to the information required by Section 3:

(*a*) a description of the site evaluation process and of the investigations and preparatory work that have been and will be done on the site and in the surrounding area;

(*b*) a description of the site's susceptibility to human activity and natural phenomena, including seismic events, tornadoes and floods;

(*c*) the proposed program to determine the environmental baseline characteristics of the site and the surrounding area;

(*d*) the proposed quality assurance program for the design of the nuclear facility; and

(*e*) the effects on the environment and the health and safety of persons that may result from the activity to be licensed, and the measures that will be taken to prevent or mitigate those effects.

3.2 Additional Regulations

Once a site has been selected and a project description has been submitted to the CNSC, an environmental assessment (EA) determination is performed as per Section 5 of the *Canadian Environmental Assessment Act* (CEAA). A complete project description is required to perform the EA determination.

The EA is triggered if the EA determination confirms that there is a project and a trigger, as identified, respectively, in Sections 2 and 5 of the CEAA. A trigger exists for the Commission if a licence will be issued under Section 24(2) of the NSCA, as per the *Law List Regulations* of the CEAA.

CEAA requirements should therefore be considered during the site evaluation process, because the EA will look at all proposed undertakings to be considered. As per Section 14(3) of the CEAA, these include the preparation of the site.

3.3 Aboriginal Consultation

Canada has statutory, contractual, and common law obligations to consult with Aboriginal groups on the effects of proposed projects on established or potential Aboriginal rights. The common law duty to consult is based on judicial interpretation of the obligations of the Crown in the context of existing Aboriginal and treaty rights of the Aboriginal peoples of Canada, recognized and affirmed in Section 35 of the *Constitution Act* (1982).

The duty to consult by the CNSC arises when it has knowledge, real or constructive, of the potential existence of an Aboriginal right or title, and the CNSC contemplates conduct that might adversely affect the right or title.

Although this legal obligation does not extend to third parties such as industry proponents, early engagement with Aboriginal groups by the proponent can enhance relationships, promote trust, improve understanding of the project by the affected Aboriginal groups, and help the proponent to understand the interests of those in the affected region.

Aboriginal consultation is discussed in further detail in Section 12.0 of this document.

4.0 OVERVIEW

Information gathered during the site evaluation process may be used during the environmental assessment process, and will be reviewed by the CNSC during evaluation of all licence applications. The EA and licensing processes are outlined in CNSC information document INFO-0756, *Licensing Process for New Nuclear Power Plants in* Canada.

Site evaluation information may also feed into the NPP design process.

As the first step in establishing a new NPP, site evaluation takes into account all phases of the NPP life cycle, from site preparation to abandonment. In order to ensure that a thorough site evaluation is carried out, the proponent is expected to look at the NSCA, the CEAA, and this document.

Figure 4.1 describes where site evaluation fits within the initial stages of new NPP development.

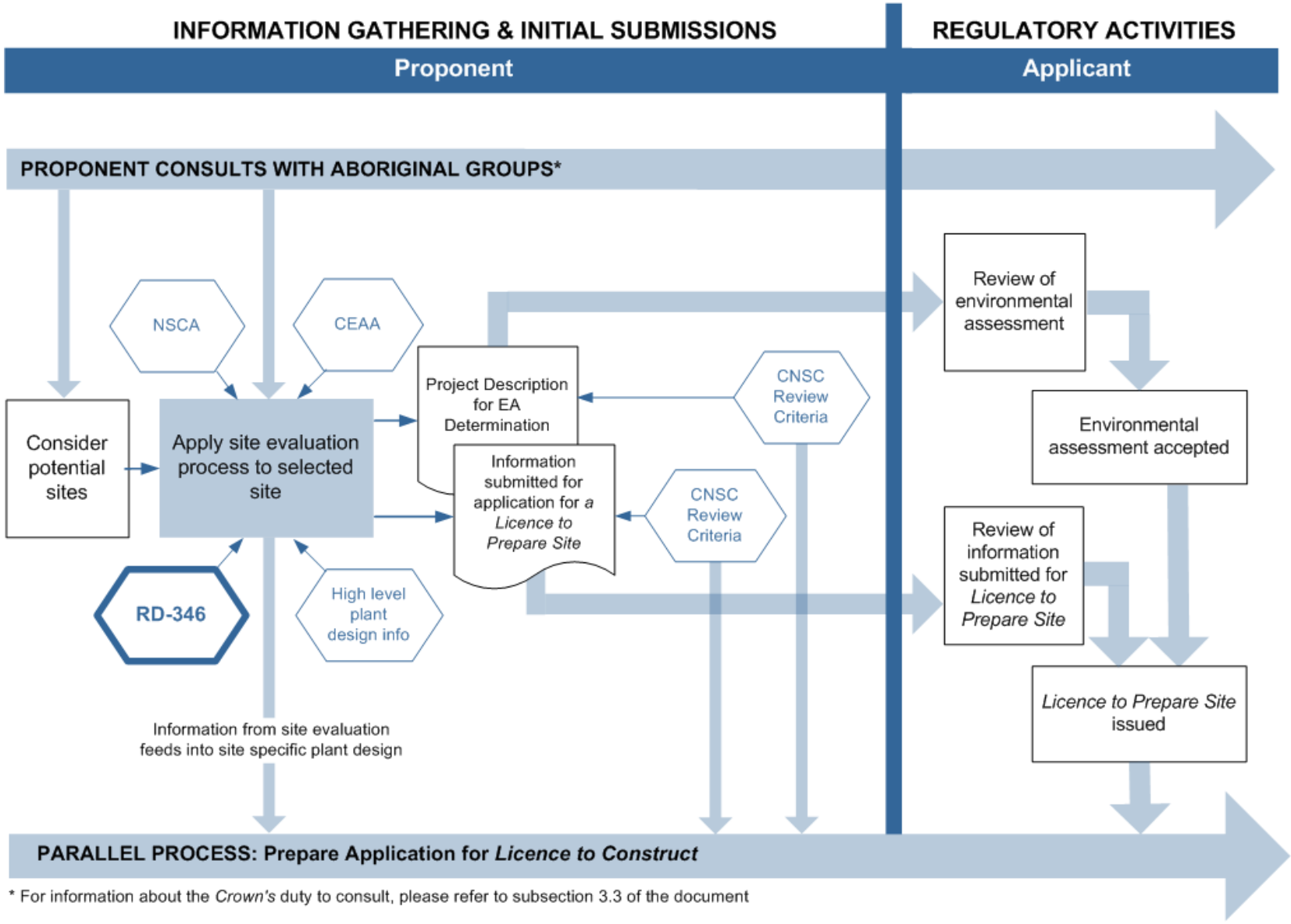

Figure 4.1: Site evaluation within the initial stages of NPP development

The process of evaluating the site involves conducting a site survey to identify one or more candidate sites, and then performing a detailed evaluation of those preferred sites to:

1. Minimize the effects of the proposed NPP on the environment;
2. Minimize the effects of the environment on the ability of the NPP to operate within the defined safe operating envelope; and
3. Identify mitigation strategies that may be needed to reduce risk to national security, the health and safety of persons, and the environment if the site is later selected for the proposed NPP.

One of the goals of the site evaluation process is to anticipate satisfying the requirements of the NSCA and associated regulations by yielding technical data that will be used in processes related to the design, construction, operation, and eventual decommissioning and abandonment of the NPP.

Site characteristics and the effects of external events are integral considerations in the site evaluation process for the following reasons:

1. They may be used in assessing the risks to both the plant and the environment, and in determining the mitigation strategies required to minimize those risks and their consequences;
2. Mitigation strategies feed into NPP site preparation and design through various safety assessment processes;
3. Site characteristics and associated risks feed into the Aboriginal and public consultation processes; and
4. Emergency preparedness and security needs can be anticipated to ensure adequate measures can be implemented at the appropriate licensing stages.

The degree of focus given to site characteristics and external events is dependent on their probability and severity. The amount of focus given to site characteristics is contingent on their ability to influence postulated events and contribute to an increased risk of adverse impact on the environment or on the health and safety of people, or to adversely affect the execution of emergency measures.

Detailed and methodical site evaluation is essential in preparing site mitigation strategies—including emergency response plans—that will adequately protect NPP personnel, the public, and the environment, from the effects of ionizing radiation and hazardous substances arising from licensed activities. Allowing for ongoing advances in technology and scientific knowledge with respect to nuclear safety, this document reflects the present IAEA consensus on what is expected in the site evaluation process.

It is expected that any inappropriate site will be rejected by the proponent prior to applying for a *Licence to Prepare Site*, without requiring CNSC involvement. Submission of site evaluation information on rejected sites is not expected either in future environmental assessments, or in future licensing phases under the NSCA.

Site evaluation takes the following considerations into account:

1. The population density, population distribution, and other characteristics of the protective zone, in so far as they may affect the implementation of emergency measures and the need to evaluate the risks to individuals and to the general population;
2. The technical basis for the safety and security analysis issues that will be included in the application for the *Licence to Prepare Site*;
3. Technical information for the *Project Description* and the *Description of the Existing Environment*, which will be included in the *Environmental Impact Statement* for the NPP (as per CEAA requirements for the EA);
4. Categorization and assessment of the characteristics of the natural and human environment in the region that may be affected by potential radiological or conventional impact associated with site preparation and construction, operational states, and accident conditions;
5. Predictions about the evolution of the natural and human environment in the region, particularly population growth and distribution, that may have a bearing on safety and security throughout the projected lifetime of the NPP;
6. Site suitability with respect to the storage and transport of input and output materials such as fresh and spent fuel and radioactive waste;
7. Information about non-radiological impact 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;
8. 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;
9. Predictions about the impact of the NPP 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 impact of any other releases of radioactive material in the region, etc.); and
10. The hazards associated with natural and human-induced external events.

5.0 GENERAL CRITERIA FOR SITE EVALUATION

The main objective of site evaluation is to ensure that an NPP constructed at the site will not create an unreasonable risk to the public or to the environment. A systematic process for prioritizing the risks associated with site characteristics and external events is documented by the proponent and includes consideration of the synergy of multiple events and multiple effects of different activities on the site.

Evaluation of site suitability includes consideration of:

1. Site characteristics that could have an impact on the public or on the environment;
2. Population density, distribution, and other characteristics of the protective zone that may have an impact on the implementation of emergency measures or on the evaluation of risk to individuals, the general population, and the environment; and
3. The effects of natural or human-induced external events occurring in the environment of the site.

If the site evaluation indicates deficiencies for which design features, site protection measures, or administrative procedures cannot compensate, the site is deemed unacceptable by the proponent.

The site evaluation includes:

1. Evaluation against safety goals;
2. Consideration of evolving natural and human-induced factors;
3. Evaluation of the hazards associated with external events;
4. Determination of the potential effects of the NPP on the environment; and
5. Consideration of projected population growth in the vicinity of the site, and emergency planning that takes those projections into account.

The evaluation also takes into account the combined radiological and conventional effects of the site and the NPP on each other during normal and abnormal situations, based on both temporal (life cycle) and spatial (regional, local, and site) considerations.

5.1 Evaluation against Safety Goals

Proposed NPP designs are evaluated against applicable safety goals, taking into account the characteristics of the site, the risks associated with external hazards, and the potential impact of the NPP on the environment.

5.2 Consideration of the Evolution of Natural and Human-induced Factors

The evolution of natural and human-induced factors in the environment that may have a bearing on safety and security are evaluated across a time period that encompasses the projected lifetime of the NPP, with the understanding that different levels of evaluation and monitoring apply to the various phases of the plant lifetime.

5.3 Evaluation of Hazards Associated with External Events

The proposed site is examined with regard to the frequency and severity of external natural and human-induced events that could affect the safety and security of the proposed NPP.

A systematic approach for identifying and assessing the hazards associated with external events, including underlying rationale, is developed, documented, and implemented in an auditable fashion.

Each external natural and human-induced event is identified and assessed with the following considerations:

1. The potential direct and indirect effects of the event on the proposed NPP structures, systems, and components (SSCs), including those that could effect the safe operation of the NPP in both normal and abnormal operating states.

   Examples include:

   a) direct effect—an earthquake resulting in a main steam line break, and

   b) indirect effect—a corrosive gas release from a nearby chemical plant degrading NPP safety system trip circuits via ventilation intakes;

2. The potential combined effects of external and human-induced events with normal and accidental releases from the proposed NPP that would exceed environmental limits or cause a significant adverse effect to occur; and

3. Effects that would influence the ability to successfully implement emergency plans.

Derivation of the hazards associated with external events includes consideration of the combined effects of these hazards with the ambient conditions (e.g., simultaneous aircraft crash and heavy snowstorm). Combined effects of external hazards can have significant impact on such facets of the proposed NPP as the implementation of emergency plans, accident mitigation, and contaminant pathway models.

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

The evaluation considers foreseeable changes in land use for the projected lifetime of the NPP to assess and plan for mitigation of new external hazards introduced by change in land use.

Site-specific data is 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.

Prehistoric, historic, and instrumentally recorded information, and records of the identified external events and their severity, is collected for the region and analyzed for reliability, accuracy, and completeness.

5.4 Determining the Potential Impact of the Site on the Environment

A number of considerations are taken into account in the early stages of site evaluation to minimize the potential impact of the site's interaction with the environment (i.e., moving, destroying, or substantially altering rare or sensitive habitats, biota, or areas of high economic value, etc.), including the structural, compositional, and functional components of its biodiversity.

Table 5.1 describes these considerations with respect to specific areas and activities that may be particularly sensitive to such interaction.

Table 5.1: Potential Impact—Considerations for Special Areas or Activities

Areas or Activities	Considerations
Habitats essential to maintaining the viability of valued ecosystem components (VECs), and designated protected habitats (national or provincial parks, preserves, etc.)	1) Assess and minimize any potential interaction with critical habitats or with individuals or species of conservation status; 2) Assess and minimize any potential for destruction or substantial alteration of breeding, nesting, or spawning habitats; and 3) Assess and minimize any potential for destruction or substantial alteration of other critical habitats to VECs, such as over-wintering, feeding, or nursery habitats.
Areas containing migratory routes of important species	1) Assess and minimize any potential for blockage or impairment of migration or movement corridors; this includes land areas, streams, creeks, rivers, and near shore areas of lakes and ponds that are used for breeding, spawning, or dispersion of reproductive products.
Areas of high biological production and their connecting links or buffer zones Certain habitats are extremely biologically productive, and therefore serve as important staging, feeding, and rearing grounds for numerous VECs	1) Assess and minimize any potential for compromising these natural heritage features, which may be site or region-specific, and may include woodlands, wetlands, meadows, valley lands, estuaries, and the shorelines of streams and lakes; and 2) Take into consideration that wetlands, salt marshes, mud flats, aquatic littoral zones, and offshore shoals may need buffer zones to protect areas of critical biodiversity functions from adverse effects such as contaminants and intrusions.

The future selection of the area of land allocated to the site will be balanced between the needs associated with facility construction, operation, and security, and those of the commercial and recreational uses of the land surrounding the site.

The site is also examined with respect to the risk from radiological and hazardous substances to the public and the environment, with the risks being kept as low as reasonably achievable. This includes the effects of thermal pollution on surrounding bodies of water, and the effects of long-term on-site radiological waste management.

The synergy of multiple events and multiple effects of several different activities, such as simultaneous oil spill and fire, is considered.

Contaminant (radiological and hazardous substances) pathway modeling incorporates 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 include site-specific, local, and regional topographic features and characteristics of the NPP, and take into account natural and human-induced events that may influence contaminant behaviour.

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

To determine the potential contaminant impact on the environment, assessments of all releases are made under normal and abnormal conditions for all phases of the NPP life cycle.

Bounding scenarios involving modeling of potential effects from maximum possible releases are completed to establish the outer boundaries or worst case scenarios for the NPP. These bounding scenarios also contribute to the scenarios used for emergency planning.

Assessments of releases or disturbances associated with normal or routine operations are 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 (AOOs).

The proponent will be expected to conduct risk modeling when developing the *Environmental Impact Statement* during the environmental assessment. The estimates of releases and disturbances used in risk modeling will be confirmed during assessment of the construction licence application when the design and safety features of the NPP have been confirmed. The licensee re-evaluates risk modeling as operating experience is gained over the facility lifetime. CNSC staff then reviews re-evaluated risk models as necessary.

The locations of the NPP and of the subsidiary structures on the site are examined at a high level with the assistance of environmental modeling, and are situated in a manner that minimizes potential impact on the public and on the environment. This includes emission or effluent release points, and air or water intake structures.

5.5 Population and Emergency Planning Considerations

5.5.1 Exclusion Zone

The exclusion zone is defined in Section 1 of the *Class I Nuclear Facilities Regulations* as, "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."

5.5.2 Protective Zone

The protective zone is the area beyond the exclusion zone that needs to be considered with respect to implementing emergency measures. This includes consideration of such matters as population distribution and density, land and water usage, roadways, evacuation planning, and consequence analysis.

5.5.3 Planning Considerations

The evaluation takes the following population and emergency planning considerations into account to support achievement of the safety goals:

1. Population density and distribution within the protective zone, with particular focus on existing and projected population densities and distributions in the region including resident populations and transient populations—this data is kept up to date over the lifetime of the NPP;
2. Present and future use of land and resources;
3. Physical site characteristics that could impede the development and implementation of emergency plans;
4. Populations in the vicinity of the NPP that are difficult to evacuate or shelter (for example, schools, prisons, hospitals); and
5. Ability to maintain population and land-use activities in the protective zone at levels that will not impede implementation of the emergency plans.

5.5.4 Confirming Unimpeded Implementation of Emergency Plans

Prior to construction, the proponent confirms with the surrounding municipalities and the affected provinces, territories, foreign states, and neighbouring countries, that implementation of their respective emergency plans and related protective actions will not be compromised for the life cycle of the proposed site.

For example, if a hospital expansion is anticipated as part of a long term emergency plan, then discussions between the proponent and the municipality should begin at the site evaluation stage so that appropriate agreements are in place prior to construction.

Due to the time involved for this task, it is important that these discussions be initiated during the site evaluation phase. The CNSC will expect these agreements to be in place before a *Licence to Construct* will be granted.

5.6 Consideration of Future Life Extension Activities

A life extension project involves the replacement or refurbishment of major components, or substantial modifications to the plant, or both.

Anticipated power uprate projects are early plans to seek to use NPP design margins, and future operating efficiencies and experience, to increase NPP output capacity by some degree.

Power uprate projects may also require plant modernization activities in order to maintain compliance with the NSCA and associated regulations.

Where possible, the site evaluation considers the following potential effects of life extension and power uprate activities:

1. Increased NPP service life;
2. Additional conventional and radiological waste generated, as well as estimated resulting impact on handling, transport, and storage of waste;
3. Impact of external and human induced events on the life extension and power uprate project activities; and
4. Impact on security and emergency planning.

6.0 GATHERING BASELINE DATA

A systematic process for gathering baseline data is documented and demonstrated by the proponent, and includes analyses of uncertainties.

Where possible, baseline data takes into account archeological, paleontological, and prehistoric data (including the oral history of aboriginal peoples), as well as historic and instrumentally recorded sources.

Baseline data is expected to be of sufficient sample size and duration to conduct hypothesis testing against post-commissioning (follow-up) monitoring data, with sufficient power to detect relevant effect sizes.

Baseline data is captured within auditable quality assurance programs.

6.1 Meteorological Data

A comprehensive site evaluation relies on understanding how meteorological phenomena may affect the site.

The evaluation therefore takes into account prehistoric, historic, and instrumentally recorded climate data sources that reflect the regional conditions, such as *Canadian Climate Normals*, published by the Canadian Weather Office.

Descriptions of basic meteorological variables include:

1. Regional topography;
2. Wind speed and direction;
3. Air temperature;
4. Precipitation;
5. Humidity;
6. Atmospheric pressure; and
7. Temperature inversions.

A program for meteorological measurements is typically prepared and carried out at or near the site with the use of instrumentation capable of measuring and recording the main meteorological variables at appropriate elevations, locations, and durations. This program initially provides data for site evaluation, and then provides ongoing data for use in revisions to basis documents in response to safety analysis results during future phases of the NPP life cycle.

6.2 Geological Data

Site evaluation includes a description of the structural geology in regional, local, and site scales.

The geotechnical properties of the overburden, including shear strength and liquefaction potential, are provided. The geotechnical properties support the assessment of slope stability and the bearing capacity of foundations under both static and dynamic conditions.

6.3 Geophysical Data

Seismotectonic data includes, without being limited to, information on prehistoric, historic, and instrumentally-recorded seismic activity in the region.

Information on geophysical hazards includes the influence of surface faults on seismic activity in the region.

6.4 Surface Water Data

The site evaluation describes 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.

A program of hydrological investigations is carried out using both deterministic and probabilistic approaches 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. This program includes predictions of changes to site surface water hydrology (flows and chemistry) that are expected from foreseeable changes in upstream land use.

Baseline surface water quality data is gathered and provided.

6.5 Groundwater Data

The site evaluation describes the groundwater hydrology of the environment, including the physical and geochemical properties of water-bearing formations (hydrogeological units) and their interactions with surface waters.

A program of hydrogeological investigations is carried out to permit the assessment of groundwater as well as radionuclide and other contaminant movement in the hydrogeological units. This program includes predictions of changes to site groundwater hydrology (flows and chemistry) that are expected to result from foreseeable changes in upstream land use or migration of existing contaminant plumes.

Baseline groundwater quality data is gathered and provided.

6.6 Biological Data

The biotic characteristics of the proposed site are identified and documented, taking into account the environmental considerations set out in Table 5.1, “Potential Impact—Considerations for Special Areas or Activities.” Documentation of the biota utilizing the habitat at the proposed site is documented, and includes descriptions of vegetation communities, birds, mammals, reptiles, fish, and invertebrate communities. This information is then used to:

1. Identify likely interactions between the project and the biota in the area;
2. Predict potential environmental effects;
3. Identify mitigation measures; and
4. Evaluate the significance of the residual effects once the mitigation measures are applied.

Biological data plays an important role in identifying VECs, which are used as the final receptors in pathways modeling.

6.7 Baseline Ambient Radioactivity and Pre-existing Hazardous Substances

The overburden and any bedrock to be removed are characterized with respect to both natural and anthropogenic sources to assess any conventional and radiological risks to health, safety, and the environment. Where an area on the site has received substantial contamination from previous nuclear or non-nuclear industrial activities, baseline characterization considers radionuclide and hazardous substance levels within biota of interest. The presence of contamination may result in the need for special measures to manage the removed overburden.

Prior to active commissioning of the nuclear installation under a *Licence to Operate*, the ambient radioactivity of the atmosphere, hydrosphere, lithosphere, and biota in the region will need to be assessed, including an assessment of ambient radionuclide activity levels in ingested water and food used in the human pathways modeling.

7.0 EVALUATION OF NATURAL EXTERNAL EVENTS

The proponent is expected to develop, document, and implement a systematic approach for identifying all natural external events. The hazards described below are indicative of the types of natural external events to be considered:

1. Climate change;
2. Meteorological factors;
3. Surface water hazards;
4. Groundwater hazards;
5. Geotechnical hazards;
6. Geophysical hazards;
7. Biological hazards; and
8. Natural fire hazards.

7.1 Climate Change

The evaluation of natural external events considers potential climate change across the projected lifetime of the NPP.

Climate change can potentially influence all of the other natural external events. With respect to those indicated above, some examples of this influence are provided in Table 7.1.

Table 7.1: Potential Influence of Climate Change on Other Natural External Events

Natural External Event	Examples of Potential Influence of Climate Change
Meteorological factors	Averages and extremes of temperature, humidity, evaporation, high winds, abrasive dust and sand storms, precipitation, lightning
Surface water hazards	Water supply—magnitude and frequency of floods and droughts
Groundwater hazards	Groundwater levels, flow pattern and velocity change resulting from changes in surface water recharge and evaporation
Geotechnical hazards	Stabilities related to changes in permafrost, surface water, and groundwater flow systems
Geophysical hazards	Magnitude and frequency of earthquakes and landslides, etc., due to changing sea and lake levels and melting glaciers
Biological hazards	Biota population and distribution changes due to temperature and humidity changes
Natural fire hazards	Changes in temperature and vegetation cover

7.2 Meteorological Factors

7.2.1 Temperature and Humidity

The following potential factors are included in the assessment of temperature and humidity:

1. Effects of sudden or prolonged extreme temperatures on future plant SSCs that will be important to safety (e.g., cooling air intakes);
2. Effects of condensation and evaporation on future plant SSCs that will be important to safety (e.g., electronic components); and
3. Potential for temperature and humidity to affect releases from the NPP into the environment.

7.2.2 High Winds

The frequency and intensity of strong winds, including tornadoes and hurricanes, is assessed on the basis of historic and recorded data for the region.

The following potential factors are included in the assessment:

1. Wind and pressure-loading effects;
2. Wind-propelled missiles that could have an impact on SSCs, or that could render off-site power supplies unavailable;
3. Effects on emergency plan execution; and
4. Possibility of affecting releases from the NPP into the environment.

7.2.3 Abrasive Dust and Sand Storms

Assessment of the risk of dust and sand storms is made on the basis of historic and recorded data, and includes consideration of the following potential factors:

1. Abrasion or erosion of SSCs;
2. Impact on air or water intakes;
3. Effect of static electricity generation on electrical or electronic SSCs;
4. Impact on off-site power supplies to the site;
5. Effect on emergency plan execution; and
6. Possibility of affecting releases from the NPP into the environment.

7.2.4 Precipitation

All types of precipitation are assessed on the basis of historic and recorded data for the region. The assessment takes into account the potential effects on:

1. Structural loading, including acute impact from heavy precipitation such as hail;
2. Cooling air or water intakes;
3. Off-site power supplies to the site;
4. Dispersion of releases from the NPP through surface or groundwater;
5. Emergency plan execution; and
6. Possibility of affecting releases from the NPP into the environment.

7.2.5 Lightning

The frequency and severity of lightning is evaluated to determine potential impact on the NPP, including the influence of lightning events on the risks of natural fire hazards (as discussed in subsection 7.8).

7.3 Surface Water Hazards

7.3.1 Floods

The region is assessed to determine the potential for flooding due to natural causes that may affect the safety of the NPP (e.g., runoff from precipitation or snow melt, high tide, storm surge, seiche or wind waves, etc.). Prehistoric, historic, and instrumentally recorded data, both meteorological and hydrological, is collected and analyzed.

A suitable meteorological, seismic, and hydrological model is developed, taking the following factors into account:

1. Limits on data accuracy and quantity;
2. The length of the period over which the data was accumulated;
3. Possible combination of effects; and
4. All known past changes in relevant characteristics of the region.

The potential for tsunamis (known as seiche waves in inland lakes) is investigated, as is the potential for instability of a coastal area or river channel due to erosion or sedimentation. The potential for water accumulation resulting from temporary blockage of rivers upstream or downstream to cause flooding and associated phenomena at the proposed site is also examined.

Information relating to upstream water control structures is analyzed to determine whether the NPP will be able to withstand the effects of failure of one or more upstream structures.

7.3.2 Adequacy of Water Supply

Evaluation of water supplies to the site includes the following components:

1. Surface and groundwater sources;
2. Quantity and quality of water; and
3. Reliability and availability of supply.

The evaluation also includes consideration of the potential impact of:

1. Debris and fouling;
2. Additional water requirements for emergency cooling or process needs;
3. Effects on contamination transport;
4. Fluctuations in water temperature that could affect heat sinks; and
5. Effects on firefighting capability.

7.4 Groundwater Hazards

A program of hydrogeological investigations, based on groundwater probing, monitoring data, and numerical modeling, assesses the potential impact of the groundwater flow system on the NPP, such as:

1. Effects on the stability of the NPP's foundations; and
2. Effects on the integrity of the NPP's below-grade structures, such as fuel bays.

7.5 Geotechnical Hazards

Geological maps and other appropriate reference sources for the region are examined to determine the existence of natural features that could affect the surface and subsurface stability of the site.

The stability of the foundation material under dynamic, static, and seismic loading is assessed, with a detailed description of surface and subsurface conditions (including hydrogeochemical effects) being incorporated into a geotechnical investigation program for the purposes of hazard determination and mitigation. The investigation describes any potential site instability, such as collapse, subsidence, surface uplift, and liquefaction of the subsurface materials.

7.6 Geophysical Hazards

7.6.1 Seismic and Surface-faulting Hazards

A fault is considered capable if, on the basis of geological, geophysical, geodetic, or seismological data, one or more of the following conditions applies:

1. The fault shows evidence of past movement or movements of a recurring nature (significant deformations or dislocations) within such a period that is reasonable to infer that further movements at or near the surface could occur;
2. A structural relationship with a known capable fault has been demonstrated such that movement of one may cause movement of the other at or near the surface; and
3. The maximum potential seismic event associated with the seismogenic structure is sufficiently large and at such a depth that it is reasonable to infer that, in the geodynamic setting of the site, movement at or near the surface could occur.

The time-span for the assessment of capable faults is proportional to recurrence intervals of seismic events.

Seismotectonic evaluation is conducted for the region using geophysical data and information on geotechnical hazards. The effects of seismic events and capable faults on sub-surface contamination transport are also evaluated for the region.

7.6.2 Volcanism

An evaluation of all active volcanism in the region that could affect the safe operation of the NPP includes information on prehistoric, historic, and instrumentally recorded volcanic activity in the region. The evaluation also considers:

1. Characteristics of the volcanic source, such as seismic triggers, ash, and volatile gases;
2. Potential effects on ventilation systems;
3. Missiles that could have an impact on SSCs;
4. Potential abrasion or chemical impact on SSCs;
5. Effects on air and water intakes;
6. Effects of static electricity generation on electrical or electronic SSCs;
7. Effects on off-site power supplies to the site; and
8. Effects on emergency plan execution.

7.7 Biological Hazards

Site evaluation includes consideration of the biological phenomena that may pose a risk to the safe operation of the NPP.

Particular attention should be paid to biological phenomena that may pose a risk to cooling water systems. 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, are therefore considered.

The evaluation also considers 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 that will foul the intake structures.

The potential for the rapid growth of pathogens in the ultimate heat sink and other elements of the cooling system poses a risk to both humans and non-humans, and is therefore considered in the evaluation.

The potential risk to human and non-human biota from biocides and other means of managing these biohazards is also evaluated.

7.8 Natural Fire Hazards

Natural fire hazards are assessed with respect to their potential risk to NPP safety.

8.0 EVALUATION OF EXTERNAL, NON-MALEVOLENT, HUMAN-INDUCED EVENTS

The proponent is expected to develop, document, and implement a systematic approach to identifying all external, non-malevolent, human-induced events. Such events include, without being limited to:

1. Aircraft crashes;
2. Other transportation hazards;
3. Fires and explosions;
4. Chemical and radiological hazards; and
5. Electromagnetic interference hazards.

8.1 Aircraft Crashes

The potential for aircraft crashes on the site is assessed, taking into account the probable characteristics of future air traffic and aircraft. 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, is conducted. The potential effects on emergency plan execution, including effects on evacuation routes, are also considered.

8.2 Other Transportation Hazards

Present and proposed land and water transportation routes in the region are evaluated with respect to potential collisions with SSCs, generation of explosions, chemical and radiological hazards, and fires. The potential effects on emergency plan execution, including effects on evacuation routes, are also considered.

8.3 Fires and Explosions

All potential fire and explosion events in the region that could affect the safe operation of the NPP are evaluated, including:

1. Direction and force of pressure waves and their effects on SSCs and unprotected personnel;
2. Temperature effects on SSCs and unprotected personnel;
3. Potential secondary fires and explosions generated by the primary explosion or fire;
4. Release of volatile gases, asphyxiants, or chemicals that could affect safe function of SSCs or harm unprotected personnel;
5. Missiles that could have an impact on SSCs;
6. Effects that could render off-site power supplies unavailable; and
7. Potential effects on emergency plan execution.

8.4 Chemical and Radiological Hazards

All chemical and radiological hazards in the region that could affect the safe operation of the NPP are evaluated, with particular focus on:

1. 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;
2. Effects of the above on SSCs and unprotected personnel, including estimates of overpressure, toxicity, and transport characteristics in air;
3. Secondary chemical interactions on SSCs; and
4. Potential effects on emergency plan execution.

8.5 Electromagnetic Interference Hazards

Electromagnetic emitters in the region are evaluated during normal and abnormal operations with respect to their potential to affects on the safe operation of the NPP.

Emitters include the following:

1. Telecommunications facilities, including military and civilian radar installations;
2. Particle accelerators or other research facilities utilizing large electromagnetic fields; and
3. High-voltage transmission lines, including the effects of solar storms on transmission.

8.6 Consideration of Future Connections to the Grid

The proponent is expected to confirm with the grid owner(s) that, with appropriate grid and plant mitigation measures in place, the location of the plant will not adversely affect the grid.

9.0 SECURITY CONSIDERATIONS

Development of security-related physical protection objectives for new NPPs includes gathering information about the NPP'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 findings from this study are compiled by the proponent in a *Site Selection Threat and Risk Assessment* (SSTRA) report—this applies to new sites, and to new plants on existing sites.

At a very early stage, the SSTRA report provides the basis for identifying physical protection requirements and proposed mitigation strategies 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.

The SSTRA includes comprehensive consideration of both physical protection concerns and transportation routes, as discussed in the following subsections.

The SSTRA report is classified as prescribed information and protected from release under Access to Information/Freedom of Information requests on the basis of national security.

9.1 Physical Protection

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

Physical protection design requirements are influenced by the site location. For example, NPPs located in a remote area bordered by a small population density may require different physical protection considerations than those that apply to NPPs located in a large urban area.

Site evaluation therefore addresses the physical dimensions of the NPP and its surrounding environment, including:

1. The topology of the area that can be considered a component of the overall security barrier design (such as line-of-sight view);
2. 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;
3. Site boundaries;
4. Weather that could factor as a potential impediment to the operability of physical protection systems; and
5. 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.

9.1.1 Remote Areas

Remote sites are evaluated with respect to the anticipated time required to implement essential response services, including how long it will take off-site armed responders to reach the NPP. This aspect of the SSTRA supports early identification of the need for establishing an on-site 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 NPP.

9.2 Transportation Routes

The transportation routes in the vicinity of the site are considered as part of the site evaluation 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 discussed below.

9.2.1 Waterways

The site evaluation includes assessment of all waterways in the vicinity of the site from the perspective of physical protection. For example, there may be a potential for a waterborne vehicle or its personnel or contents to be used in a manner that may pose a threat to the NPP (e.g., being laden with explosives) to disable operations, equipment, or systems in an act of sabotage that could have radiological implications.

9.2.2 Land Routes

All vehicular access land routes in proximity to the site, including rail lines, are assessed to determine the security threat they may pose to potential locations of future vital areas.

Where possible, the surrounding terrain may be considered as a natural barrier in reducing the risk from vehicle borne explosives. Where this is not possible, consideration is given to delineate areas from which land vehicles must be restricted.

9.2.3 Airspace

The SSTRA considers the threats and risks associated with private and commercial airports, including associated flight pathways. This involves discussions with municipal, provincial, and federal governments to establish measures for deterring entry into airspace identified as being of “high risk” to the site.

10.0 DECOMMISSIONING

Site evaluation includes consideration of the effects and requirements of site decommissioning and abandonment activities, including:

1. Decommissioning of site preparation or construction activities;
2. Execution of a site restoration plan should the project be discontinued; and
3. Consideration of guidance contained in CNSC regulatory guide G-219, *Decommissioning Planning for Licensed Activities*.

11.0 QUALITY ASSURANCE

Quality assurance (QA) for the site evaluation process is part of the overall management arrangements for the NPP. Site evaluation activities are initiated long before the NPP is established; however, it is expected that a QA program will be established at such a time that it can be applied to the site evaluation process.

The process of establishing site evaluation-related QA parameters involves technical and engineering analyses, along with judgments that require extensive experience and knowledge. In many cases, the parameters and analyses may not lend themselves to direct verification by inspections, tests, or other techniques that can be precisely defined and controlled. In these cases, evaluations are reviewed and verified by individuals or groups that are independent of those who did the work.

Feedback associated with experienced engineering judgment and expertise in geotechnical engineering is an important aspect of assuring the quality of the site evaluation process. For example, in the assessment of matters such as liquefaction potential and slope stability, the accuracy of the evaluation results depends heavily on insight into failures that have occurred in comparable situations. The information gathered from these assessments is documented and analyzed to provide evidence that similar failures will not occur.

A complete site evaluation QA program includes:

1. Procedures to control the effectiveness of assessments and engineering activities performed in the different stages of the site evaluation process;
2. Appropriate organization, planning, work control, personnel qualification and training, and activity verification and documentation, to ensure that the QA program is carried out as effectively as possible;
3. Records of all work carried out in the site evaluation process;
4. Documentation of the results of studies (including models and simulations) and investigations in sufficient detail to permit independent review; and
5. A report that documents the results of all site evaluation work, laboratory tests, and geotechnical analyses and evaluations.

These expectations apply to all activities that may influence safety, or that may contribute to the derivation of parameters that will ultimately contribute to the design basis for the site.

In addition, the QA program may be graded in accordance with the importance to safety of the individual evaluation activity under consideration.

12.0 CONSULTATION

Early consultation is an important part of good governance, sound policy development, and decision-making. The proponent is therefore expected to demonstrate that consultation with the appropriate parties has been integrated into site evaluation activities.

Because of the constitutional obligations discussed in subsection 3.3, early consultation with Aboriginal groups is conducted separately from consultation with the general public.

However, in both cases, the proponent is expected to work with all stakeholders to establish:

1. The most appropriate methods by which to consult;
2. The objectives and expectations of the consultation process;
3. The means by which interested parties will be able to participate in the formulation and implementation of decisions; and
4. A dispute resolution mechanism that documents disputes and records efforts taken in their resolution.

Proponents are encouraged to thoroughly document the consultation process, and to include a summary of that process when submitting a project description to the CNSC. The summary is expected to include such information as:

1. A list of the stakeholders that were engaged and how they were identified;
2. The project information provided to the stakeholders;
3. A summary of issues raised; and
4. A description of how the proponent has already responded, or plans to respond, to any concerns raised.

12.1 Aboriginal Consultation

Aboriginal groups include communities of Indian, Inuit, and Métis peoples that hold or may hold Aboriginal or treaty rights under section 35 of the *Constitution Act, 1982*. Consultation with Aboriginal groups during site evaluation assists in the early identification of the potential impact that a new NPP would have on treaty and other Aboriginal rights if built on the site being evaluated. Proactive discussion of Aboriginal issues and concerns at the early stages of new NPP development (i.e., during site evaluation) before a project description is submitted to the CNSC can also facilitate a more effective and efficient regulatory review process, including environmental assessment and licensing. Proponents are therefore encouraged to engage Aboriginal groups as an integral part of the site evaluation process, before filing a project description for a new NPP with the CNSC.

There are many sources available to help identify Aboriginal groups in the region associated with the site that is under evaluation, and proponents are encouraged to contact regional or local Aboriginal organizations, as well as federal and provincial government sources, to identify the groups that could be expected to have an interest in the proposed project.

In addition, Natural Resources Canada possesses maps of treaties, comprehensive land claims, and Canada lands that may be useful, and Indian and Northern Affairs Canada maintains a database of all Aboriginal communities within Canada, including contact information.

12.2 Public Consultation

In keeping with best industry practices, the proponent is also expected to consult with stakeholders and the general public early in the site evaluation process, and before any substantive decisions are made.

The consultation process associated with site evaluation demonstrates involvement of stakeholders in good faith, openness, respect, and fairness, with a genuine desire to utilize the input received.

GLOSSARY

Abbreviations

AOO	anticipated operational occurrence
CEAA	*Canadian Environmental Assessment Act*
CNSC	Canadian Nuclear Safety Commission
DBA	design basis accident
EA	environmental assessment
IAEA	International Atomic Energy Agency
NPP	Nuclear power plant
NSCA	*Nuclear Safety and Control Act*
SSCs	Systems, structures, and components
SSTRA	site selection threat and risk assessment
VEC	valued ecosystem component

Terminology

Abiotic
Refers to the non-living parts of the environment such as air, rock, soil, and water.

Anticipated operational occurrence (AOO)
An operational process deviating from normal operation that is expected to occur at least once during the operating lifetime of the nuclear power plant but which, in view of the appropriate design provisions, does not cause any significant damage to items important to safety nor lead to accident conditions.

Biotic
Refers to the living parts of the environment such as plants, animals and microorganisms.

Direct effect
An effect in which the cause-effect relationship has no intermediary effects.

Environment
The components of the earth, including:

(1) Land, water and air, including all layers of the atmosphere;
(2) All organic and inorganic matter and living organisms; and
(3) The interacting natural systems that include components referred to in (1) and (2)

Environmental effect

(1) any change that an activity, substance, equipment, or facility that is regulated by the CNSC may cause in the environment, including any effect of any such change: on health and socio-economic conditions; on physical and cultural heritage; on the current use of lands and resources for traditional purposes by aboriginal persons; or on any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance; and

(2) any change to any activity, substance, equipment, or facility that the environment causes, whether any such change occurs within or outside Canada.

External events

Events unconnected with the operation of a facility or activity that could have an effect on the safety of the facility or activity.

External hazards

An external hazard is an event that originates outside the site and whose effects on the nuclear power plant should be considered as potentially hazardous. Such events may be of natural or human-induced origin, and are identified and selected for design purposes during the site evaluation process. In some cases hazards originating on-site but outside the safety related buildings can be treated as external hazards, if the characteristics of the generated loads are similar to those caused by hazards originating outside the site.

Hazardous substance

A substance, other than a nuclear substance, that is used or produced in the course of carrying on a licensed activity and that may pose a risk to the environment or the health and safety of persons.

Indirect Effect

An effect in which the cause-effect relationship (e.g., between the project's impacts and the ultimate effect on a valued ecosystem components) has intermediary effects.

Malevolent act

An illegal action or an action that is committed with the intent of causing wrongful harm.

Management arrangements

The means by which an organization functions to achieve its objectives, including:

(1) Physical elements, such as people, buildings, work areas, equipment, tools, etc.;

(2) Intangible elements, such as roles and responsibilities, knowledge, skills and behaviour of the people, cultural norms, agreements, understandings, decision-making processes, etc.; and

(3) The documentation that is essential to meeting the organization’s objectives.

Nuclear power plant

Any fission reactor installation constructed to generate electricity on a commercial scale. A nuclear power plant is a Class IA nuclear facility, as defined in the *Class I Nuclear Facilities Regulations*.

Nuclear power plant lifetime
The time between the granting of the *Licence to Prepare Site* and the granting of a *Licence to Abandon*.

Overburden
Any loose material that overlies bedrock.

Protective zone
The area beyond the exclusion zone that needs to be considered with respect to implementing emergency measures. This includes consideration of such matters as population distribution and density, land and water usage, roadways, and consequence and evacuation planning.

Region
A specific area to be studied; the spatial characteristics of a 'region' will vary for each hazard being studied. For example, the region being investigated for groundwater effects of an NPP may be substantially different from the region being investigated for effects due to atmospheric releases.

Risk

The product derived from the multiplication of the probability of a particular event by a parameter corresponding to the consequences of this event.

Seiche
An oscillation of an enclosed or semi-enclosed body of water in response to an atmospheric, oceanographic or seismic disturbing force. In the Great Lakes area, a seiche could mean any sudden rise in the water of a harbor or a lake, whether or not it is oscillatory.

Site
The area within the exclusion zone where the NPP and all associated support structures and systems are located.

Site personnel
All persons working in the site area of an authorized facility, either permanently or temporarily.

Siting
The process of selecting a suitable site for a facility, including appropriate assessment and definition of the related design bases.

Storm surge
Abnormal rise in sea level accompanying a hurricane or other intense storm.

Uprate
The action of increasing existing nuclear power plant's output capacity

Valued Ecosystem Components

VECs are selected from the abiotic and biotic information collected as part of the baseline characterization. They are ecosystem components or elements of the ecosystem considered to have scientific, cultural, economic, historical or aesthetic importance. They may be surrogate organisms rather than actual plant or animal species (e.g. a theoretical benthic feeding fish species), communities (e.g., benthic macroinvertebrate community) or specific species (i.e., endangered species), but may also include significant ecological features of the environment, such as wetlands.

ADDITIONAL INFORMATION

1. *Class I Nuclear Facilities Regulations*, SOR/2000-204

2. *Decommissioning Planning for Licensed Activities*, CNSC G-219, Canadian Nuclear Safety Commission, 2000

3. *Ground Motion Determination for Seismic Qualification of CANDU Nuclear Power Plants*, CAN3-N289.2-M81, Standards Council of Canada, Canada (reaffirmed 2008)

4. *Licensing Process for New Nuclear Power Plants in Canada*, CNSC INFO-0756, Canadian Nuclear Safety Commission, 2006

5. *Life Extension of Nuclear Power Plants*, CNSC RD-360, Canadian Nuclear Safety Commission, 2008

6. *Nuclear Safety and Control Act*, S.C.,1997, c.9

The following IAEA publications provide guidance to aspects of this regulatory document:

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

2. *Evaluation of Seismic Hazards for Nuclear Power Plants*, IAEA Safety Standards Series No. NS-G-3.3, Vienna, 2002

3. *External Events Excluding Earthquakes in the Design of Nuclear Power Plants*, IAEA Safety Standards Series No. NS-G-1.5, Vienna, 2003

4. *External Human Induced Events in Site Evaluation for Nuclear Power Plants*, IAEA Safety Standards Series No. NS-G-3.1, Vienna, 2002

5. *Flood Hazard for Nuclear Power Plants on Coastal and River Sites*, IAEA Safety Standards Series No. NS-G-3.5, Vienna, 2007

6. *Geotechnical Aspects of Site Evaluation and Foundations for Nuclear Power Plants*, IAEA Safety Standards, Series No. NS-G-3.6, Vienna, 2005

7. *Meteorological Events in Site Evaluation for Nuclear Power Plants*, IAEA Safety Standards Series No. NS-G-3.4, Vienna, 2003

8. *Quality Assurance for Safety in Nuclear Power Plants and Other Nuclear Installations: Code and Safety Guides Q1–Q14*, IAEA Safety Series No. 50-C/SG-Q, Vienna, 1996

9. *Site Evaluation for Nuclear Installations*, IAEA Safety Standards Series No. NS-R-3, Vienna, 2003

10. *The Safety of Nuclear Installations*, IAEA Safety Series No. 110, Vienna, 1993