Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

Draft Comprehensive Study Scoping Document for an Environmental Assessment of the Proposal by Ontario Power Generation for a Deep Geologic Repository For Low- and Intermediate-Level Radioactive Waste

June 2006

Canada

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Published by the Canadian Nuclear Safety Commission

Ce document est également disponible en français sous le titre
Ébauche du document sur la portée de l'étude approfondie concernant une évaluation environnementale de la proposition d'Ontario Power Generation relative à un dépôt en formations géologiques profondes des déchets radioactifs de faible et de moyenne activité

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TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Purpose of the Draft Scoping Document

The purpose of this document is to provide guidance on the scope of project, the factors and the scope of the factors for the environmental assessment (EA) to be conducted as a result of the proposal by Ontario Power Generation (OPG) for a Deep Geologic Repository (DGR) at the Bruce Nuclear Site, located within the Municipality of Kincardine, Ontario.

A federal EA of the proposed project is required under the provisions of the *Canadian Environmental Assessment Act* (CEAA). Under the CEAA, the scope of the project, the factors and the scope of the factors included in the assessment are to be determined by the Responsible Authority (RA) which, in this case, is the Canadian Nuclear Safety Commission (CNSC).

This draft scoping document describes the basis for the conduct of the EA, and focuses the assessment on relevant issues and concerns. The document also provides specific direction to the proponent, OPG, on how to document the technical EA study, which will be delegated to it by the CNSC pursuant to subsection 17(1) of the CEAA. The document indicates the necessary information to be submitted by OPG to the CNSC to facilitate the development of the EA Comprehensive Study Report. In addition, this document provides a means of communicating the EA process to stakeholders.

1.2 Environmental Assessment Process

The following points indicate the key steps likely to be followed by the CNSC during the EA process:

- determination of the application of the CEAA to the project, including application of the Federal Coordination Regulation; establishment of a Public Registry; and stakeholder notification;

- preparation of a draft scoping document and distribution to the proponent, federal authorities and the public; receipt of comments from federal authorities and the public;

- CNSC review and disposition of comments received; and

- revision of the draft scoping document, and submission of final scoping document to the Canadian Environmental Assessment Agency (CEA Agency) and the federal Minister of the Environment.

Following the public consultation associated with this document as described in Section 5 of this document and pursuant to Subsection 21(2) of the CEAA, the CNSC must provide a report to the federal Minister of the Environment (Minister). The report from the responsible authority to the Minister must include:

- the scope of the project, the factors to be considered in the EA and the scope of those factors;
- public concerns in relation to the project;
- the project's potential to cause adverse environmental effects; and
- the ability of the Comprehensive Study to address issues relating to the project.

The CNSC must also recommend to the Minister whether the EA should be continued by means of a Comprehensive Study, or whether the project should be referred to a mediator or review panel. After considering the responsible authority's report and recommendation, the Minister would decide whether to refer the project back to the responsible authority so that they may continue the Comprehensive Study process, or refer the project to a mediator or review panel. If the Minister refers the project to a mediator or review panel, the project will no longer be subject to the Comprehensive Study process under the CEAA. The Minister, after consulting the responsible authority and other appropriate parties, will set the terms of reference for the review, and appoint the mediator or review panel members.

If the Minister does not refer the project to a mediator or review panel, the project would go back to the responsible authority to continue the Comprehensive Study process. As a result, the project cannot be referred to a mediator or review panel in the future.

If the Minister refers the project back to the CNSC to continue the Comprehensive Study, the following steps to be taken are:

- issuance of the scoping document by the CNSC and delegation of both public consultation and technical studies to OPG;
- receipt of draft EA study report (technical studies) from OPG;
- distribution of the draft EA study report to the review team (CNSC, federal authorities) for comment; revision and resubmission by the proponent of the EA study report, as appropriate;
- preparation of a draft Comprehensive Study Report by the CNSC;
- public review and comment on the draft Comprehensive Study Report;
- review and dispositioning of public comments by the CNSC, and completion of the final Comprehensive Study Report;
- submission of the final Comprehensive Study Report to the Canadian Environmental Assessment Agency and to the Minister by the CNSC; and
- decision on the Comprehensive Study Report by the Minister.

The Comprehensive Study Report will present a conclusion by the CNSC as to whether the project is likely to cause significant adverse environmental effects, taking into account the appropriate mitigation measures. The CNSC will make recommendations to the Minister on a proposed EA decision, consistent with section 23 of the CEAA. The Minister will then render a decision on the Comprehensive Study Report. If the Minister concludes that the project is not likely to cause significant adverse environmental effects, taking into account the appropriate mitigation measures, then the CNSC may proceed with licensing hearings and decisions on licensing applications by OPG to excavate, construct and operate the DGR.

1.3 Project Background

In a letter dated December 2, 2005 (Reference 1), OPG indicated its intent to prepare a site and construct a Deep Geologic Repository (DGR) on the Bruce Nuclear Site within the Municipality of Kincardine, Ontario.

The letter included a project description for the proposal, which indicated that the DGR would receive low- and intermediate-level radioactive waste currently stored on the Bruce Site, as well as waste produced from the continued operation of OPG-owned generating stations at Bruce, Pickering and Darlington, Ontario. Much of the waste is currently stored in interim facilities at the Western Waste Management Facility (WWMF) on the Bruce Site, and the remainder will be produced over the remaining lives of the OPG-owned nuclear generating stations.

The DGR project includes the site preparation, construction, operation and long-term performance of above-ground and below-ground facilities. The surface facilities would consist of components such as the underground access and ventilation buildings, associated temporary or permanent buildings and related infrastructure. The underground facilities would comprise components such as shafts, ramps and tunnels, emplacement rooms, and various service areas and installations. Surface and underground facilities are expected to be located within the boundaries of the Bruce Site. Operations would involve those activities required to operate and maintain the DGR facility, remove waste from the WWMF, receive waste from the WWMF and nuclear generating stations, emplacement of the waste into the repository, as well as closure activities and monitoring of the repository.

1.4 Application of the *Canadian Environmental Assessment Act*

CNSC staff have determined, pursuant to section 5(1)(*d*) of the CEAA, that a federal EA is required before the CNSC can authorize OPG to proceed with activities involved with the DGR project.

The proposal involves the preparation, construction and operation of the DGR. This is an undertaking in relation to a physical work and, as such, is a "project" as defined under Section 2 of the CEAA.

The CNSC is a federal authority as defined in the CEAA. Paragraph 5(1)(*d*) of the CEAA requires that an EA be conducted before a federal authority exercises a regulatory power or duty prescribed in the *Law List Regulations* under the CEAA. The CNSC issues licences for activities

involved in OPG's proposal under the authority of Section 24(2) of the *Nuclear Safety and Control* Act (NSCA), which is prescribed on the *Law List Regulations*. Therefore there is a "trigger" for an EA.

There are no identified exclusions from the EA for this project, pursuant to Section 7 of the CEAA and the *Exclusion List Regulations* of the CEAA.

Accordingly, CNSC authorization of the proposed project would require that a federal EA be conducted in accordance with the provisions of the CEAA. The CNSC is a Responsible Authority for the project as defined under the CEAA.

Furthermore, the proposed installation is a new Class 1B facility on a site not within the boundaries of an existing licensed nuclear facility, and would be used for the disposal of radioactive nuclear substances. As such, under Part VI, Section 19(*g*)(iii) of the *Comprehensive Study Regulations* of the CEAA, and pursuant to Section 21 of the CEAA, the CNSC must ensure that a Comprehensive Study of the project is initiated, and that a report must be provided to the federal Minister of the Environment.

At this time, CNSC staff have not identified any issues associated with this project which would suggest a need for it to be referred to a mediator or review panel pursuant to section 25 of the CEAA.

1.5 Federal and Provincial Coordination

The CNSC is the only Responsible Authority under the CEAA identified for this Comprehensive Study.

Through application of the CEAA *Federal Coordination Regulations*, Natural Resources Canada, Environment Canada and Health Canada have been identified as Federal Authorities for the purpose of providing expert assistance to the CNSC during the EA.

CNSC staff have confirmed with the Ontario Ministry of the Environment that there are no provincial EA requirements under the Ontario *Environmental Assessment Act* that are applicable to this proposal.

The Canadian Environmental Assessment Agency is the Federal Environmental Assessment Coordinator (FEAC) for this project because is described on the Comprehensive Study List. The role of the FEAC is to coordinate the participation of federal authorities in the EA process and to facilitate communication and cooperation among them.

1.6 Delegation of Assessment Studies to Ontario Power Generation

Based on authority given to a responsible authority in subsection 17(1) of the CEAA, the CNSC will delegate to OPG the conduct of technical support studies for the EA, the development and implementation of a public consultation program, and the preparation of an EA study report (EASR).

Should the project continue as a Comprehensive Study and not be referred to a mediator or review panel, OPG will submit its EASR and technical support studies to the CNSC. The CNSC, in conjunction with the Canadian Environmental Assessment Agency, will distribute the EASR and supporting documentation to Federal Authorities and the appropriate provincial authorities for review and comment. Based on comments received, the CNSC may request that the proponent revise its EASR. When the EASR is formally accepted as satisfactory by the CNSC, the FEAC and all Federal Authorities, the CNSC will use the information and analysis in the accepted EASR to prepare a draft EA Comprehensive Study Report. The draft Comprehensive Study Report will be made available for review and comment by the public and by Federal Authorities. The CNSC will then consider the comments received on the draft Comprehensive Study Report, make appropriate revisions and submit a revised Comprehensive Study Report to the Minister for consideration and decision.

2.0 SCOPE OF THE PROJECT

In establishing the scope of a project for a Comprehensive Study EA under the CEAA, the physical works that are involved in the proposal and any specific undertaking that will be carried out in relation to those physical works must be determined.

The physical works for this project would include both surface facilities and underground facilities. Surface facilities include two permanent buildings, plus buildings required for ancillary facilities. The principal structures of the surface facilities are:

- Receipt/Access Building: this building would contain facilities for underground access by ramp or shaft. If access is by shaft, this building would include a hoist/headframe/cage. If access is by ramp, this building would include ramp access. This building would also contain facilities for staff, as well as the heating ventilation air conditioning (HVAC) equipment. Low- and intermediate-level waste would be received at this building and staged for transfer to the DGR. This building would also be used for transfer and removal of excavated rock during construction activities.

- Ventilation Shaft Headframe Building: this building would provide cover for the ventilation shaft, exhaust fans, sampling/monitoring devices, a hoist and mechanical/electrical systems.

Underground facilities include the following:

- Ramp or Main Shaft: the main shaft would be excavated using drill and blast methods. The ramp would be tunneled into the rock. Either the ramp or the shaft would be used to bring materials and waste into the DGR.

- Ventilation Shaft: the ventilation shaft would be used to route air and provide emergency egress. This shaft would be excavated by drill and blast or raise bore methods.

- Underground Tunnels: these tunnels would provide access from the underground receipt area to the operational level.

- Emplacement Rooms: these rooms would provide approximately 160,000 m^3 capacity for low- and intermediate-level waste.

- Operational Level Office, amenities and maintenance areas: these would be constructed adjacent to the main shaft/ramp and used for servicing underground equipment, and serve as a distribution point for services.

The physical works also include site infrastructure such as power, a sanitary sewer system, a potable water system, a storm water system, a subsurface drainage system, a construction laydown area, access roadways, fencing, a rock pile and associated roads, security and a roadway for linking the DGR to the existing WWMF.

The undertakings in relation to the physical works comprise site preparation, construction and operation of the facility. These activities are:

- Site Preparation: clearing a portion of the proposed site (approximately 15 hectares are wooded) and development of roads to provide site access.

- Construction: construction of surface facilities, the shaft or ramp, the ventilation shaft, and the underground excavation of tunnels and an initial set of emplacement rooms. Construction would also result in storage of rock in a temporary pile on the Bruce site.

- Operation: operational activities include retrieving waste from the WWMF and transferring it to the DGR, followed by the emplacement of the low- and intermediate-level waste into the DGR. The operational phase may also include construction campaigns for additional emplacement rooms.

While decommissioning is not part of the project, the long-term performance of the facility will be assessed.

3.0 FACTORS TO BE CONSIDERED IN THE COMPREHENSIVE STUDY

The scope of the Comprehensive Study under the CEAA must include all the factors identified in paragraphs 16(1)(*a*) to (*d*) and 16(2)(*a*) to (*d*) of the CEAA and, as provided for under paragraph 16(1)(*e*), any other matter that the CNSC or the Minister requires to be considered.

Paragraphs 16(1)(*a*) to (*d*) require that the following factors be included:

- the environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project, and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out;

- the significance of the effects identified above;

- comments from the public that are received in accordance with the CEAA and its regulations;

- measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project;

- the purpose of the project;

- alternative means of carrying out the project that are technically and economically feasible and the environmental effects of any such alternative means;

- the need for and the requirements of the required follow-up program in respect of the project; and

- the capacity of renewable resources that are likely to be significantly affected by the project to meet the needs of the present and those of the future.

For the purpose of an EA under the CEAA, the "environment" means the components of the Earth, and includes:

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.) above.

An "environmental effect" means, with respect to a project:

- any change that the project may cause in the environment, including any change it may cause to a listed wildlife species, its critical habitat or the residences of individuals of that species, as those terms are defined in subsection 2(1) of the *Species at Risk Act*;

- any effect of any environmental effect on:
  - health and socio-economic conditions;
  - physical and cultural heritage;
  - the current use of lands and resources for traditional purposes by Aboriginal persons; or
  - any structure, site or thing that is of historical, archaeological, paleontological or architectural significance;

- any change to the project that may be caused by the environment.

With the discretion allowed for in paragraph 16(1)(*e*) of the CEAA, the CNSC also requires consideration of:

- the need for the project and the benefits of the project; and

- consideration of traditional aboriginal and local knowledge, where relevant.

Additional or more specific factors or issues to address in the EA may be identified during the conduct of the EA following consultation with the Minister, expert Federal Authorities and other stakeholders.

4.0 SCOPE OF THE FACTORS TO BE CONSIDERED IN THE COMPREHENSIVE STUDY

The scope of factors assessment includes a determination of the environmental effects to be addressed, the scope of the environmental effects to be assessed, and the effects to be considered in making decisions regarding the project. The scope of the factors is described in this section. This section also provides guidance on how the scope of the factors should be documented in a Comprehensive Study Report.

4.1 Structure of the Comprehensive Study Report

Should the Minister direct the CNSC to continue the Comprehensive Study process, the CNSC will prepare a Comprehensive Study Report under the following section headings. The CNSC asks that the proponent's EA study report use a similar structure.

Comprehensive Study Report

Executive Summary
1) Introduction
2) Project Description
3) Alternative Means of Carrying Out the Project
4) Scope of the Assessment
5) Public Consultation Program
6) Description of the Existing Environment
7) Predicted Environmental Effects of the Project
    - Description of assessment methodology
    - Spatial and Temporal Boundaries of Assessment
    - Criteria of Assessment
    - Effects of the Project on the Environment
    - Demonstration of Long-Term Safety
    - Effects of the Environment on the Project
    - Effects of the Project on the Capacity of Renewable and Non-Renewable Resources
    - Cumulative Environmental Effects
8) Determination of Significance
9) Follow-up Program
10) Conclusions and Recommendations
11) References

The recommended structure serves as a framework for explaining how the assessment factors required by Section 16(1) and 16(2) of the CEAA are to be considered systematically in the Comprehensive Study Report. Information about the project and the existing environment is necessary to permit such a systematic consideration. The results of the EA study report consideration will be documented in the Comprehensive Study Report to be prepared by the CNSC.

The parts of the assessment that are to be delegated to OPG, in accordance with subsection 17(1) of the CEAA, are to be documented in the form of a technical EASR in a manner consistent with this structure. The EASR will be appended to the Comprehensive Study Report as a support document.

4.2 Project-Specific Information Requirements

4.2.1 Executive summary

This section should briefly describe the project, indicating the main predicted environmental effects. The key aspects of the project and of the environment affected by the project should be highlighted, and the proposed mitigation measures that will render effects insignificant should be tied to the predicted effects. Any public concerns and uncertainties should also be noted.

4.2.2 Introduction

The introduction should include an overview of the project, including location, project components, associated activities, scheduling details and other key features. This section should also identify the project proponent. The intent of this overview is to provide context rather than description.

The proposed project will be designed to achieve certain specific objectives. These objectives should be adequately described as the "purpose of the project".

The "need for the project" should be established from OPG's perspective and describe the problem or opportunity the project is intending to solve or satisfy.

The introduction should also identify the CNSC's application of the CEAA, describing why the assessment is being carried out, including which triggers have led to the assessment. This information will provide reviewers with an understanding of the context of the EA and the issues that have been addressed in it.

4.2.3 Project Description

The main objective of the project description is to identify and characterize those specific components and activities that have the potential to interact with, and thus result in a likely change or disruption to, the surrounding environment under both normal operations and malfunctions and accidents during the life cycle of the project (site preparation and construction, operations, decommissioning and long-term performance).

The description of the project will refer to, and elaborate on, the items identified in the project scope, supported with appropriate maps and diagrams. It will include a proposed schedule for the different phases of the project as well as a detailed description of OPG, including its ownership, organization, structure and technical capabilities.

The project description should include the following information, provided in summary form

with references made to more detailed information where applicable:

- the location of the project;
- the DGR concept, its components and supporting infrastructure (includes the basic configuration, layout, shape, size, and key design features);
- the proposed construction method(s), process and scheduling for the construction of all components of the DGR;
- the description of the characteristics of the waste containment system and the way its components will function to contain and isolate the waste from humans and the environment in the long-term;
- the type of waste streams to be emplaced in the DGR (includes the inventories and characteristics of nuclear substances and other hazardous materials to be stored at the facility);
- the waste handling, packaging, transport and final emplacement processes;
- the sources, types and quantities of radioactive, hazardous and non-hazardous waste predicted to be generated by the project;
- the processes for the collection, handling, transport, storage and disposal of radioactive, hazardous and non-hazardous waste to be generated by the project;
- the sources and characteristics of any fire hazards;
- the sources and characteristics of any noise, odour, dust and other likely nuisance effects from the project;
- the sources and characteristics of any potential risks (including radiological risks) to workers, the public or the environment from the project;
- the predicted doses to workers involved with the associated operations and activities that are within the scope of this project;
- the key operational procedures relevant to protection of workers, the public and the environment relating to the project;
- the identification and description of engineered and administrative controls, including the use of an approved margin of subcriticality for safety, which would assure that the entire process will be subcritical;
- the description of any specific criticality events and demonstration of how the consequences of the events do not violate criteria established by Health Canada and the International

Atomic Energy Agency as a trigger for a public evacuation;

- the key components of the facility and its physical security systems (excluding prescribed information) that are relevant to management of malfunctions and accidents that may occur during the siting and construction activities, and during the subsequent operations; and

- the predicted sources, quantities and points of release from the project of emissions and effluents containing nuclear substances and hazardous materials.

Malfunctions and Accidents

Information on potential malfunctions and accidents is also necessary to permit consideration of relevant environmental effects in the assessment. Early in the conduct of the EA studies, the potential malfunctions and accidents to be considered in the EA will be reviewed and must be accepted by CNSC staff.

- a description of specific malfunction and accident events that have a reasonable probability of occurring during the life of the project, including an explanation of how these events were identified for the purpose of this environmental assessment;

- a description of the source, quantity, mechanism, rate, form and characteristics of contaminants and other materials (physical, chemical and radiological) likely to be released to the surrounding environment during the postulated malfunctions and accidents;

- a description of specific criticality events and a demonstration that consequences of the events do not violate criteria established by international standards (Ref. 2) and national guidance (Ref. 3) as a trigger for a temporary public evacuation; and

- a description of any contingency, clean-up or restoration work in the surrounding environment that would be required during, or immediately following, the postulated malfunction and accident scenarios.

Preliminary Decommissioning Plan

A preliminary decommissioning plan (PDP) for the facility will be included in the assessment. The preliminary plan will document the preferred decommissioning strategy, including a justification of why this is the preferred strategy. The PDP will also include end-state objectives; the major decontamination, disassembly and remediation of surface and underground facilities; the nature and approximate quantities and types of waste generated during decommissioning; and an overview of the principal hazards and protection strategies envisioned for decommissioning.

4.2.4 Alternative Means of Carrying Out the Project

The Comprehensive Study Report must describe the process taken to select the most appropriate option for the DGR project. Under the CEAA, the consideration of these alternatives and the selection criteria used to identify the preferred alternatives must include environmental factors.

The information being used to make that decision and the decision-making process must be documented in the Comprehensive Study Report.

The alternatives must be identified, information must be collected on each alternative and a selection criterion must be applied to determine a preferred alternative. The selection criteria may include economic, technical, social and environmental factors.

4.2.5 Scope of the Assessment

The scope of the assessment includes the scope of the project, the factors to be considered in the environmental assessment and the scope of those factors. Therefore, the scope of the assessment is a summary of this draft scoping document. No additional contribution is required of OPG.

4.2.6 Public Consultation Program

The assessment will include notification of, and consultation with potentially affected stakeholders, including the local public and First Nations, as well as the municipal governments in the project area. Various media will be used to inform and engage individuals, interest groups, local governments and other stakeholders in the assessment. OPG will be expected to hold appropriate public consultation meetings, and OPG's stakeholder consultation program will be monitored by CNSC staff throughout the EA process.

Various stakeholders, including the following, will be invited to participate in the consultation process:

- federal government;
- provincial government;
- local government;
- established committees;
- general public;
- neighbouring residents;
- local businesses; and
- non-governmental organizations and interest groups.

First Nations and Aboriginal communities will also be consulted.

The Comprehensive Study Report will contain a summary review of the comments received during the EA process. The report will indicate how issues identified have been considered in the completion of the assessment, or where relevant, how they may be addressed in any subsequent CNSC licensing and compliance process.

The program will also include opportunities for the public to review and comment on the draft and final Comprehensive Study Report prior to its submission to the Minister.

4.2.7 Description of the Existing Environment

A description of the existing environment is needed to determine the likely interactions between the project and the surrounding environment and, conversely, between the environment and the project, during the life cycle of the project. The description must include both the biophysical environment (such as ecological, geological, hydrological, geochemical, geomechanical and climatic conditions) and the socio-economic environment (human, cultural). The description of the existing environment should include sufficient information on the baseline conditions to allow the environmental impacts of the licensed activities to be assessed.

The subsurface environment will play a dominant role in containing and isolating the waste from humans and the environment in the long term. It is therefore expected that the information on the subsurface site characterization data will be sufficient to allow the development of site-specific assessment models that will predict with reasonable confidence the long-term performance of the proposed repository. It is expected that OPG will consult with CNSC staff with regards to the adequacy of the subsurface characterization data to support the EA.

An initial screening of likely project-environment interactions will be used in identifying the relevant components of the environment that need to be described. In general, the environmental components that are typically described in the various study areas include, but are not necessarily limited to:

- meteorology and climate;
- air quality;
- noise;
- geomorphology and topography;
- soil quality;
- geology;
- seismicity;
- hydrogeology;
- geochemistry;
- geomechanics;
- groundwater quality (physical and chemical);
- surface hydrology;
- surface water quality (physical and chemical);
- aquatic ecology; and
- terrestrial ecology.

The description of the human components of the above environment should include, but should not necessarily be limited to:

- population (including relevant demographic characteristics);
- economic base;
- community infrastructure and services;
- renewable and non-renewable resource use;
- existing and planned land use;
- human health;
- heritage, cultural and archaeological sites;
- recreation areas; and
- use of lands and resources for traditional purposes by Aboriginal persons.

Valued Ecosystem Components (VECs) are environmental attributes or components identified as having a legal, scientific, cultural, economic or aesthetic value. Where relevant, VECs in the existing environment will be identified and used as specific assessment end-points. VECs should be identified following consultations with the public, First Nations, federal and provincial government departments and other relevant stakeholders. The VECs proposed in the EA methodology for this project must be reviewed and accepted by CNSC staff in the early phases of the EA study.

The required level of detail in the description of the existing environment will be less where the potential interactions between the project and various components of the environment are weak or remote in time and/or space.

Relevant existing information, including traditional knowledge, may be used to describe the environment. Where that information is significantly lacking, additional research and field studies may be required. CNSC staff will review any work done by OPG to fill identified gaps in information as progress is being made.

4.2.8 Prediction of Environmental Effects of the Project

4.2.8.1 Description of the Assessment Methodology

The consideration of environmental effects in the Comprehensive Study should be done in a systematic and traceable manner, and the assessment methodology should be summarized. The results of the assessment process should be clearly documented using summary matrices and tabular summaries where appropriate.

4.2.8.2 Spatial and Temporal Boundaries of Assessment

The consideration of the environmental effects in the Comprehensive Study needs to be conceptually bounded in both time and space. This is more commonly known as defining the *study areas* and *time frames*, or spatial and temporal boundaries, of the Comprehensive Study assessment.

Study Areas

The geographic study areas for this Comprehensive Study must encompass the areas of the environment that can reasonably be expected to be affected by the project, or which may be relevant to the assessment of cumulative environmental effects. Study areas will encompass all relevant components of the environment, including the people; non-human biota; land; water; air and other aspects of the natural and human environment. Study boundaries will be defined taking into account ecological, technical and social/political considerations.

The following geographic study areas are suggested:

- *Site Study Area*: the Site Study Area includes the facilities, buildings and infrastructure at the Bruce Nuclear Site, including the existing licensed exclusion zone for the site on land and within Lake Huron, and particularly the property where the Deep Geologic Repository is proposed.

- *Local Study Area*: the Local Study Area is defined as that area existing outside the site study area boundary, where there is a reasonable potential for immediate impacts due to either construction activities, ongoing normal activities, or to possible abnormal operating conditions. The Local Study Area includes all of the Bruce Nuclear Site and the lands within the Municipality of Kincardine closest to it, as well as the area of Lake Huron abutting the facility. The boundaries may change as appropriate following a preliminary assessment of the spatial extent of potential impact.

- *Regional Study Area*: the Regional Study Area is defined as the area within which there is the potential for cumulative and socio-economic effects. This area includes lands, communities and portions of Lake Huron around the Bruce Nuclear Site that may be relevant to the assessment of any wider-spread effects of the project.

Assessment Time Frames

The assessment should provide a rationale for the assessment time frame used. As a minimum, the assessment is expected to include the period of time during which the maximum impact is predicted to occur. The approach taken to determine the temporal boundary of assessment should take into account the following elements:

- the hazardous lifetime of the contaminants associated with the waste;

- the duration of the operational period (before the facility reaches its end state);

- the design life of engineered barriers;

- the duration of both active and passive institutional controls; and

- the frequency and duration of natural events and human-induced environmental changes (e.g., seismic occurrence, flood, drought, glaciation, climate change, etc).

Both the study areas and time frames will remain flexible during the assessment to allow the full extent of a likely environmental effect to be considered in the Comprehensive Study. For instance, should the results of modelling demonstrate that there is dispersion of a contaminant that is likely to cause an environmental effect beyond the boundaries identified above, it will be taken into account in the assessment.

4.2.8.3 Assessment of Effects Caused by the Project on the Environment during Operations

The assessment will be conducted in a manner consistent with the following general method:

1) ***Identify the potential interactions between the project activities and the existing environment during site preparation and construction, normal operations, decommissioning and in the long term, and during identified relevant malfunctions and accidents.***

Specific attention will be given to interactions between the project and the identified VECs. In this step, the standard design and operational aspects from the project description that prevent or significantly reduce the likelihood of interactions occurring with the environment should be reviewed. Opportunities for additional impact mitigation measures are addressed in step 3 below.

2) ***Describe the resulting changes that likely would occur to the components of the environment and VECs as a result of the identified interactions with the project.***

Each environmental change must be described in terms of whether it is direct or indirect, and positive or adverse.

Identified changes in socio-economic conditions and various aspects of culture, health, heritage, archaeology and traditional land and resource use may be limited to those that are likely to result from the predicted changes that the project is likely to cause to the environment. The consideration of public views, including any perceived changes attributed to the project, should be recognized and addressed in the assessment methodology.

Quantitative as well as qualitative methods may be used to identify and describe the likely adverse environmental effects. Professional expertise and judgment may be used in interpreting the results of the analyses. The basis of predictions and interpretation of results, as well as the importance of remaining uncertainties, will be clearly documented in the EA study report.

3) Identify and describe mitigation measures that may be applied to each likely adverse effect (or sequence of effects), and that are technically and economically feasible.

Mitigation strategies should reflect avoidance, precautionary and preventive principles; that is, emphasis should be placed on tempering or preventing the cause or source of an effect, or sequence of effects, before addressing how to reverse or compensate for an effect once it occurs.

Where the prevention of effects cannot be assured, or the effectiveness of preventive mitigation measures is uncertain, further mitigation measures in the form of contingency responses, including emergency response plans, will be described.

Where cost/benefit analyses are used to determine economic feasibility of mitigation measures, the details of those analyses will be included or referenced.

4) Describe the significance of the environmental effects that likely will occur as a result of the project, having taken into account the implementation of the proposed mitigation measures.

The criteria for judging and describing the significance of the residual (post-mitigation) effects will include: magnitude, duration, frequency, timing, probability of occurrence, ecological and social context, geographic extent, and degree of reversibility. Specific assessment criteria proposed in the EA methodology for this project will be submitted to CNSC staff in the early phases of the EA study for review and acceptance. Existing regulatory and industry standards and guidelines are relevant as points of reference for judging significance. However, professional expertise and judgement should also be applied in judging the significance of any effect. All applicable federal and provincial laws must be respected.

The analysis must be documented in a manner that readily enables conclusions on the significance of the environmental effects to be drawn. The CNSC, as the responsible authority for the EA project, must document in the Comprehensive Study Report a conclusion, taking into account the mitigation measures, as to whether the project is likely to cause significant adverse environmental effects.

4.2.8.4 Demonstrating the Long term Safety of the Deep Geological Repository

Detailed regulatory guidance on how to assess the long-term safety of the deep geological repository is provided in the CNSC draft regulatory guide G-320.

Demonstrating long-term safety consists of providing reasonable assurance that the proposed DGR will perform in a manner that protects human health and the environment. This demonstration is achieved through the development of a safety case. The safety case includes a safety assessment complemented by additional arguments and evidence in order to provide confidence in the long-term safety of the facility.

The safety assessment is central to the safety case. It involves an analysis to evaluate the performance of the overall waste disposal facility and its impact on human health and the environment. A long-term safety assessment is generally based on a pathways analysis of contaminant releases, contaminant transport, receptor exposure and potential effects based on a scenario of expected evolution of the disposal facility and the site.

Selection of Assessment Scenarios

The first step in conducting a safety assessment is the development of scenarios. A scenario is a postulated or assumed set of future conditions or events to be modeled in an assessment. Long-term assessment scenarios should be sufficiently comprehensive to account for all of the potential future states of the site and the environment. It is common for a safety assessment to include a central scenario of the normal (or expected) evolution of the site and facility with time, and additional scenarios that examine the impacts of disruptive events or modes of containment failure.

A normal evolution scenario should be based on reasonable extrapolation of present-day site features and receptors lifestyles. It should include expected evolution of the site and degradation of the waste disposal system (gradual or total loss of barrier function) as it ages. Disruptive events scenarios postulate the occurrence of low-probability events leading to the possible abnormal degradation and loss of containment

Scenarios should be developed in a systematic, transparent and traceable manner based on current and future conditions of site characteristics, waste properties and receptor characteristics and their lifestyles.

The safety assessment should demonstrate that the set of scenarios developed is credible and comprehensive. Some scenarios may be excluded from the assessment because there is an extremely low likelihood that they would occur or because they would result in a trivial consequence. The approach and screening criteria used to exclude or include scenarios should be justified and well-documented.

The anticipated evolution of the repository under different scenarios has to be supported by a combination of expert judgment, field data on the past evolution of the site, and also mathematical models that might need to couple chemical, thermal hydrologic, hydrogeologic and mechanical processes that play key roles in the repository evolution.

Additional arguments in the safety case

Due to increasing uncertainty as predictions are made far into the future, the long-term safety assessment should also be supported by additional arguments and multiple lines of reasoning such as:

- use of different safety assessment strategies: for example by using a combination of assessment approaches such as scoping and bounding calculations, deterministic and probabilistic approaches etc.;

- demonstration of the robustness of the waste disposal system: this entails demonstrating that the waste disposal system will maintain its safety function under extreme conditions, disruptive events or unexpected containment failure. The safety case should illustrate and explain the relative role of the different components of the disposal system that contribute to its overall robustness; and

- use of complementary safety indicators to doses and environmental concentrations that are usually calculated for comparison with regulatory limits. Other parameters that are illustrative of safety include: waste dissolution rates; groundwater age and travel time; fluxes of contaminants; concentrations of contaminants in specific environmental media (for example, concentration of radium in groundwater); or changes in toxicity of the waste.

Confidence in mathematical models

The proponent should provide adequate confidence in the mathematical models used to support the safety case. The equations of the mathematical models are usually solved numerically with computer codes. Proper verification of these codes has to be demonstrated, to ensure that the codes adequately solve the equations of the mathematical models. In addition, confidence in the mathematical models can be provided by performing any or all of the following activities:

- performing independent predictions using entirely different assessment strategies and computer tools;

- demonstrating consistency amongst the results of the long term assessment model and complementary scoping and bounding assessments;

- applying the assessment model to an analog of the waste management system to build confidence through a post audit of the real data available from an analog; and

- performing model intercomparison studies of benchmark problems.

In addition, scientific peer review by publication in open literature and widespread use by the scientific and technical community will add to the confidence in the assessment model.

Interpretation of Assessment Results and Comparison with Acceptance Criteria

Compliance with the acceptance criteria and with regulatory guidance must be evaluated, and the uncertainties associated with the assessment should be analyzed.

Acceptance criteria are the numerical values (regulatory limits) used to judge the results of assessment model calculations. These acceptance criteria ensure compliance with *the Nuclear Safety and Control Act* (NSCA) and its associated regulations, and by other applicable legislation. The principal regulatory limits are the radiological dose and environmental concentrations of hazardous substances, and it is expected that these parameters are calculated in long-term assessments as primary indicators of safety.

Acceptance criteria for a long-term assessment are current regulatory limits, standards, objectives and benchmarks. Adopting a fraction of these acceptance criteria (such as dose constraints or factors of safety) for a long-term assessment provides additional assurance that the uncertainty in the predictions and in future human actions would not result in unreasonable risk in the future. It is expected that OPG will establish and justify the acceptance criteria adopted for any assessment. It is also expected that CNSC staff will be consulted on the suitability of the

acceptance criteria and on the balance between conservatism in the assessment and conservatism in the acceptance criteria.

When interpreting the assessment results, the applicant should demonstrate a thorough understanding of the underlying science and engineering principles which are controlling the assessment results. The results of the assessment should be analyzed to show they are consistent with expectations of system performance and with the complete set of assumptions and simplifications used in developing the model(s) and scenarios. Any unexpected assessment results or discrepancies should be investigated and explained.

An uncertainty analysis of the predictions should be performed to identify the sources of uncertainty and determine the effects of these uncertainties on safety (e.g., through sensitivity analysis). This analysis should distinguish between uncertainties arising from uncertainties in site characterization date, in the conceptual site descriptive model, in assumptions of the scenario, and in the mathematics of the assessment model. For the uncertainties which have important impact on long-term safety, follow-up field and laboratory investigation programs in combination with refinement of mathematical models should be proposed.

4.2.8.5 Assessment of Effects of the Environment on the Project

The assessment must take into account how the environment could adversely affect the project; for example, from severe weather or seismic events. The assessment must also take into account any potential effects of climate change on the project, including an assessment of whether the project might be sensitive to changes in climate conditions during its life span.

This part of the assessment will be conducted in a step-wise fashion, similar to that described for the foregoing assessment of the project effects. The possible important interactions between the natural hazards and the project will be first identified, followed by an assessment of the effects of those interactions, the available additional mitigation measures, and the significance of any remaining likely adverse environmental effects.

4.2.8.6 Assessment of the Effects on the Capacity of Renewable and Non-Renewable Resources

The potential interactions between the project and the environment will be identified and assessed in order to determine the likelihood of interactions between the project and resource sustainability.

4.2.8.7 Assessment of Cumulative Effects

The effects of the project must be considered together with those of other projects and activities that have been, or will be carried out, and for which the effects are expected to *overlap* with those of the project (i.e., overlap in same geographic area and time). These are referred to as *cumulative environmental effects*.

An identification of the specific projects and activities considered in the cumulative effects will be included in the Comprehensive Study Report. In general, the cumulative effects assessment will consider the combined effects of the project with the neighbouring or regional industries and other developments.

The information available to assess the environmental effects from other projects can be expected to be more conceptual and less detailed as those effects become more remote in distance and time to the project, or where information about another project or activity is not available. The consideration of cumulative environmental effects may therefore be at a more general level of detail than that considered in the assessment of the direct project-environment interactions.

Where potentially significant adverse cumulative effects are identified, additional mitigation measures may be necessary.

4.2.9 Determination of Significance

The preceding steps in the Comprehensive Study will consider the significance of the environmental effects of the project on the environment; of the natural hazards on the project; of project malfunctions and accidents; and of other projects and activities that could cause cumulative effects.

The Comprehensive Study will consider all of these effects in coming to a final conclusion as to whether the project, taking into account the mitigation measures, will likely cause significant adverse environmental effects. The CNSC, as the responsible authority, will document this conclusion in the Comprehensive Study Report.

4.2.10 Follow-up Program

A preliminary design and implementation plan for a follow-up program will be included in the Comprehensive Study Report. The purpose of the follow-up program is to assist in determining if the environmental and cumulative effects of the project are as predicted in the Comprehensive Study Report. It is also to confirm whether the impact mitigation measures are effective, and to determine if any new mitigation strategies may be required. The design of the program will be appropriate to the scale of the project and the issues addressed in the EA.

If a licence is issued to OPG under the NSCA, the CNSC licensing and compliance program will be used as the mechanism for ensuring the final design and implementation of any follow-up program and the reporting of program results. The follow-up program would be based on the regulatory principles of compliance, adaptive management, reporting and analysis.

5.0 PUBLIC PARTICIPATION IN THE FEDERAL ENVIRONMENTAL ASSESSMENT

5.1 Invitation for Public to Comment on this Scoping Document

The public is invited to comment on the following:

- the proposed scope of the project for the purposes of the EA (Section 2 of this document);
- the factors proposed to be considered (Section 3 of this document);
- the proposed scope of those factors (Section 4 of this document); and
- public concerns in relation to the proposed project including:
  - the potential for the project to cause adverse environmental effects, and
  - the ability of a Comprehensive Study to address issues relating to the project.

Persons wishing to submit comments on the proposed project may do so in writing. Comments should be sent to the CNSC at the addresses or facsimile transmission numbers provided above, and must be received no later than July 17, 2006.

Please reference the file name, "Ontario Power Generation - Proposal to Construct and Operate a Deep Geologic Repository for Disposal of Low- and Intermediate-Level Radioactive Waste", and the Canadian Environmental Assessment Registry number 06-03-17520, in your submission. The CNSC will receive and share all public comments on this document, and will distribute them to all other federal authorities.

Further, pursuant to the federal *Canadian Environmental Assessment Act* (CEAA), Subsection 55(1), the Canadian Environmental Assessment Registry (CEAR), which includes a project file and related records, can be accessed at the following address: www.ceaa-acee.gc.ca.

The Comprehensive Study Report will demonstrate how comments from the public were considered and note any changes made as a result of that consideration.

5.2 Public Consultation on the Comprehensive Study Report

The public will be given an opportunity to participate in the conduct of the EA through public meetings to be held by the proponent. The requirements for this participation are set out in Section 4.2.6 of this document. If the EA continues as a Comprehensive Study, the public will also be provided with an opportunity to examine the EASR and comment on an early draft of the Comprehensive Study Report.

The Canadian Environmental Assessment Agency will facilitate public consultation on a final draft of the Comprehensive Study Report.

5.3 Public Registry

A public registry for the assessment has been established as required by Section 55 of the CEAA. This includes identification of the assessment in the CEAR, which can be accessed on the Web site of the Canadian Environmental Assessment Agency at www.ceaa.gc.ca. The CEAR number for this project is 06-03-17520.

The CEAR will include the following documentation:

- description of the project;
- notices of commencement and termination;
- EA Decisions; and
- notices requesting public input.

Interested parties will be able to obtain copies of these documents when they are available by accessing the CEAR website, and downloading the files. Interested parties may obtain copies of specific documentation on the list from the CNSC contact for the project (see section 5.4).

5.4 Contacts for Assessment

Persons wishing to obtain additional information or provide comments on the EA being conducted on the proposed Deep Geologic Repository for Low- and Intermediate-Level Radioactive Waste at the Bruce Nuclear Site near Tiverton, Ontario may do so through the following contact:

Michael Rinker, EA Specialist Environmental Assessment and Protection Division Canadian Nuclear Safety Commission 280 Slater Street P.O. Box 1046 Ottawa, Ontario K1P 5S9 Phone: 1-800-668-5284 Fax: (613) 995-5086 Email: ceaainfo@cnsc-ccsn.gc.ca	Don Howard, Project Manager Wastes and Decommissioning Division Canadian Nuclear Safety Commission 280 Slater Street P.O. Box 1046 Ottawa, Ontario K1P 5S9 Phone: 1-800-668-5284 Fax: (613) 995-5086 Email: ceaainfo@cnsc-ccsn.gc.ca

6.0 REFERENCES

1. Letter, K.E. Nash (OPG) to B. Howden (CNSC), "Intent to Construct a Geologic Repository for Low and Intermediate Level Waste", December 2, 2005. BITS# 1294561 (includes Project Description attachment)

2. Food and Agriculture Organization of the United Nations, International Atomic Energy Agency, International Labour Organisation, OECD Nuclear Energy Agency, Pan American Health Organization, United Nations Office for the Co-Ordination of Humanitarian Affairs, World Health Organization, "Preparedness and Response for a Nuclear or Radiological Emergency, Safety Requirements", Safety Standards Series No. GS-R-2, IAEA, Vienna, Austria, 2002

3. Health Canada, "Canadian Guidelines for Intervention during a Nuclear Emergency", Document H46-2/03-326E, Ottawa, Ontario, 2003 November