COMPREHENSIVE STUDY REPORT

BRUCE HEAVY WATER PLANT DECOMMISSIONING PROJECT

Prepared by:

Canadian Nuclear Safety Commission

March 2003

TABLE OF CONTENTS

1.0 INTRODUCTION

The Canadian Nuclear Safety Commission (CNSC) staff ensured the conduct of a comprehensive study and the preparation of this Comprehensive Study Report (CSR) for the proposed decommissioning of the Bruce Heavy Water Plant (BHWP), located at the Bruce nuclear site near Tiverton, Ontario. The proponent of the decommissioning project is Ontario Power Generation (OPG). The Comprehensive Study Report was prepared for submission to the Minister of Environment and the Canadian Environmental Assessment Agency to fulfill CNSC obligations as a Responsible Authority (RA) under the *Canadian Environmental Assessment Act* (CEAA) in the assessment of the environmental effects of the proposed project, pursuant to section 21 of the CEAA. The CSR will allow for full review and decision making by the federal Minister of Environment pursuant to sections 22 and 23 of the CEAA.

The CSR was prepared to meet the environmental assessment requirements and the scope of the assessment for the BHWP decommissioning project under the CEAA. The preparation of technical support studies for the comprehensive study, as well as the conduct of public consultation activities, were delegated to OPG by CNSC staff pursuant to section 17 of the CEAA. OPG established several opportunities for input from local communities, aboriginal peoples, the general public and other interested stakeholders during the conduct of the environmental assessment. The results of the studies and consultations conducted by OPG were documented in an Environmental Assessment Study Report (EASR) submitted to CNSC staff. The EASR was independently reviewed by technical experts of the CNSC staff and the expert Federal Authorities, before being accepted by CNSC staff as the basis for the completion of the CSR. The Comprehensive Study Report is comprised of this environmental assessment overview document and the attached Environmental Assessment Study Report prepared by OPG entitled "*Bruce Heavy Water Plant Decommissioning, Environmental Assessment Study Report (December 2002)*". The overview document highlights the key aspects and results of the comprehensive study, and references more detailed supporting information provided in the attached EASR.

2.0 BACKGROUND

2.1 Project

The Bruce Heavy Water Plant is located on the Bruce nuclear site, on the east shore of Lake Huron, about midway between the towns of Kincardine and Port Elgin. The BHWP is sited in a fenced area on the western side of the Bruce nuclear site. Figures 1 and 1.2 of the EASR show the location of the Bruce nuclear site and the BHWP.

The BHWP was in continuous operation from April 1973 until March 1998, for the purpose of producing reactor-grade heavy water. The facility is no longer in operation. OPG (formerly Ontario Hydro) is the owner and operator of the facility. The facility consisted of two plants (A and B) which included enriching units, finishing units and associated auxiliary systems and buildings needed to support heavy water production. Construction of a third plant (D) was suspended in 1978 and that plant did not proceed to operation.

In 1997, Ontario Hydro (now OPG) decided to permanently shut-down the heavy water producing facilities. All of the hydrogen sulphide was removed from facility systems or disposed of by controlled flaring. Structures were placed in a safe mothballed state, or demolished for safety reasons. Chemicals associated with the production of heavy water were disposed of using approved conventional methods. At present, there are no active production facilities on the site.

Subsequent to the shut-down, OPG notified the Atomic Energy Control Board (AECB, now the CNSC) of its intention to apply for regulatory approval to decommission the facility. The decommissioning proposal involves permanently retiring and removing the remaining heavy water production facility, and includes the following primary components:

(i) the removal or demolition of buildings, structures and equipment used for heavy water production, except for infrastructure required for maintaining site service system integrity for other separately licensed facilities on the Bruce nuclear site;
(ii) the remediation of the site (removal of demolition debris and clean-up of contaminated soil) to a state suitable for general industrial land uses;
(iii) the recycling of any reusable and recyclable materials and equipment; and
(iv) the management of solid and liquid wastes generated during the conduct of the decommissioning project.

The decommissioning activities are proposed to take seven to eight years to complete, with environmental monitoring continuing for up to three years following completion of the work.

2.2 Purpose of Decommissioning Project

The purpose of the decommissioning project is to permanently retire the BHWP from service as a nuclear facility licensed for the production of heavy water. All heavy water plant buildings, structures and equipment would be removed or demolished, and the site restored to a state suitable for industrial purposes unrelated to the production of heavy water.

2.3 Regulatory Requirements

The BHWP currently is regulated by the CNSC under a Heavy Water Plant Operating Licence issued pursuant to the *Nuclear Safety and Control Act* (NSCA). A portion of the facility, for which construction was started but never completed, is governed under a Construction Approval issued by the AECB in 1980. These authorizations provide for the continued maintenance of the BHWP in its current shut-down state.

The decommissioning proposal cannot proceed without the prior licensing approval of the CNSC pursuant to section 24 of the NSCA. OPG has applied for regulatory approval to decommission BHWP, and has supported the application with a Detailed Decommissioning Plan. CNSC staff has initiated a licensing assessment process designed to provide recommendations to the Commission on the issuance of a decommissioning licence.

3.0 APPLICATION OF THE *CANADIAN ENVIRONMENTAL ASSESSMENT ACT*

CNSC staff determined that, pursuant to paragraph 5(1)(d) of the *Canadian Environmental Assessment Act* (CEAA), regulatory approval of the proposed decommissioning project would require that a prior environmental assessment of the project be completed pursuant to provisions of the CEAA. Specifically, it was determined that the CNSC, as a Responsible Authority for the project, would be required to ensure that a comprehensive study be conducted and that a Comprehensive Study Report be prepared and submitted to the federal Minister of Environment and the Canadian Environmental Assessment Agency (Agency), pursuant to section 21 of the CEAA.

CNSC staff subsequently established and managed an environmental assessment process for this purpose. Pursuant to section 12 of the CEAA and the *Federal Coordination Regulations* under the CEAA, Environment Canada and Health Canada declared themselves as expert Federal Authorities with interests in the decommissioning project. Fisheries and Oceans Canada initially indicated an interest in participating as an expert Federal Authority, but subsequently withdrew when it determined that there were no environmental assessment issues associated with the project that were relevant to their mandate. CNSC staff further determined that there are no provincial environmental assessment requirements under the Ontario *Environmental Assessment Act*.

4.0 SCOPE OF PROJECT

The scope of the BHWP decommissioning project was established pursuant to section 15 of the CEAA. The scope of the project includes the following decommissioning activities:

(i) demolition of the above-grade components of the BHWP within the area covered by the CNSC licence, except for those components and infrastructure required to maintain site service system integrity for other separately licenced facilities on the Bruce nuclear site;
(ii) segregation, preparation and transport off-site to appropriate locations, of any reusable and recyclable materials and equipment;
(iii) disposal of some non-hazardous waste at the Bruce nuclear site landfill;
(iv) segregation and transport off-site to authorized waste management facilities, of all remaining hazardous and non-hazardous waste; and
(v) remediation of the facility to a condition suitable for general industrial land uses.

A description of the proposed decommissioning project that elaborates on the scope of the project is provided in Section 3.0 of the attached Environmental Assessment Study Report.

5.0 SCOPE OF ASSESSMENT

5.1 Environmental Assessment Factors

The scope of the environmental assessment, including the factors considered in the assessment, was established in accordance with section 16 of the CEAA. These factors, along with an identification of the sections of the attached EASR where they are addressed in the CSR, include:

(i) the environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project (section 8.0 EASR) 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 (section 9.0 EASR);
(ii) the significance of the effects referred to in (i) (section 11.0 EASR);
(iii) comments from the public that are received in accordance with the CEAA and its regulations (section 5.0 EASR);
(iv) measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project (sections 8.0 and 9.0 EASR);
(v) the purpose of the project (section 2.2 EASR);
(vi) alternative means of carrying out the project that are technically and economically feasible and the environmental effects of any such alternative means (section 2.0 EASR);

(vii) the need for, and the requirements of, any follow-up program in respect of the project (section 10.0 EASR); and
(viii) 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 (section 8.5 EASR).

Pursuant to paragraph 16(1)(e) of the CEAA, and to enable adequate consideration of the above factors, the CNSC included the following in the scope of assessment:

(i) a description of the project (section 3.0 EASR);
(ii) a description of the existing environment that may be affected by the project activities (section 6.0 EASR);
(iii) a description of the environmental assessment methodology (section 4.0 EASR); and
(iv) likely effects of the environment on the project (section 8.4 EASR).

5.2 Environmental Assessment Methodology

A description of the methodology used in the environmental assessment is provided in Section 4.0 of the EASR. The methodology is consistent with that required to conduct a federal environmental assessment pursuant to the requirements of the CEAA, and with the definitions of "environment" and "environmental effects" contained in section 2 of CEAA. In summary, the methodology involved:

(i) identification and assessment of alternative means for carrying out the decommissioning;
(ii) defining and describing the project works and activities;
(iii) identifying relevant environmental components, Valued Ecosystem Components (VECs) and Valued Social Components (VSCs);
(iv) identifying project/environment interactions;
(vi) consideration of local community, aboriginal peoples, governmental and other stakeholder comments;
(vi) assessment of likely environmental effects and mitigation:
(vii) assessment of likely cumulative effects and mitigation;
(viii) assessment of significance of residual environmental effects; and
(ix) determination of the need and scope of environmental assessment follow-up and monitoring.

6.0 ALTERNATIVES

An assessment of alternative means for carrying out the decommissioning project is provided in section 2.0 of the EASR. The assessment included: (i) an evaluation of five decommissioning strategies for the purpose of selecting a preferred option; (ii) a determination of the most effective means of carrying out the preferred option; and (iii) an assessment of decommissioning methods for specific components of the project.

Four broad criteria relating to safety, environmental protection, cost and schedule were considered in the analysis. The preferred option that was selected from this process involves the demolition to grade of all structures, buildings and site services, followed by site remediation.

7.0 PUBLIC AND STAKEHOLDER CONSULTATION

Section 5.0 of the EASR describes the public and stakeholder consultation program conducted by OPG during the environmental assessment. A number of consultative activities involving local communities, aboriginal peoples, government departments and other stakeholders were conducted. Communication activities included project notification letters, public information open houses, newsletters, tours of the site, and project briefings to stakeholder committees. The consultation occurred in three periods: (i) an initial period from September 1998 to December 1998; (ii) an interim period from January 1999 to June 2002 that primarily involved governmental consultation; and (iii) a third period from July 2002 to September 2002 which involved distribution of a preliminary draft of the EASR to interested stakeholders in the local community for comment.

Issues raised by stakeholders during the consultation, and the consideration of these issues in the assessment, are identified in section 5.0 of the EASR. No public concerns associated with the decommissioning project were identified which would warrant a need to have the project referred to a mediator or review panel pursuant to section 25 of the CEAA.

8.0 PROJECT DESCRIPTION

Section 3.0 of the EASR describes the proposed decommissioning project that was assessed.

The current status of the site is described, including an identification of the structures and buildings associated with the BHWP (eg., enrichment and degassing towers, pipe racks); site services (eg., surface water treatment facility, process effluent lagoons, sludge lagoons); and substances (nuclear, chemical) remaining on site.

The proposed decommissioning project works and activities are described in Section 3.0 of the EASR, including:

(i) demolition methods;
(ii) decommissioning of structures;
(iii) decommissioning of buildings;
(iv) decommissioning of site services;
(v) land remediation; and
(vi) management of wastes generated during the project.

The regulatory compliance programs that will be in effect during the decommissioning project are described in Section 3.4 of the EASR, including those relating to radiation protection, health and safety, environmental protection, emergency preparedness, security and quality assurance.

Section 3.5 of the EASR outlines the proposed schedule for the decommissioning project. The work is scheduled to begin in 2003, and to consist of three primary phases: (i) preparatory; (ii) demolition/remediation; and (iii) follow-up. The demolition/remediation phase includes demolition activities, waste management, post-demolition monitoring and site remediation. The follow-up phase would continue for up to three years following completion of the demolition/remediation phase. A description of the decommissioning end-state is provided in section 3.6 of the EASR.

9.0 EXISTING ENVIRONMENT

Section 6.0 of the EASR provides a description of the existing environment of the BHWP and the regional and local study areas. This information is presented in terms of the following environmental components:

- (i) atmospheric environment (climate and meteorology; air quality; ambient noise);
- (ii) hydrology and surface water quality;
- (iii) aquatic environment (water bodies; fish communities; aquatic habitat);
- (iv) terrestrial environment;
- (v) geology, hydrogeology and seismicity (including ground stratigraphy, soil quality, and groundwater flow and chemistry);
- (vi) radiation and radioactivity;
- (vii) land use and transportation;
- (viii) physical and cultural resources;
- (ix) socio-economic conditions; and
- (x) aboriginal interests.

Section 6.11 of the EASR identifies the VECs and VSCs that were defined for the purpose of the environmental assessment.

10.0 ASSESSMENT OF ENVIRONMENTAL EFFECTS

The results of the assessment of environmental effects arising from the BHWP decommissioning project are presented in Sections 8.0, 9.0 and 11.0 of the EASR.

10.1 Effects of the Project

The assessment included an analysis of the following for each of the environmental components that were considered in the study:

(i) project/environment interactions;
(ii) likely environmental effects;
(iii) identified mitigation measures;
(iv) residual effects; and
(v) significance of residual adverse effects.

The analysis also included consideration of the likely environmental effects of accidents and malfunctions that may occur in connection with the project (section 8.3 EASR). No events that could result in either a significant adverse environmental effect or have serious implications for worker or public health and safety were identified.

Section 8.7 summarizes the mitigation measures that are proposed to be implemented to address potential adverse effects from the BHWP decommissioning project. These measures were determined from the analysis of the likely environmental effects of the project (section 8.2 EASR). The mitigation measures are primarily intended to deal with temporary, short-term effects which are related to construction-type activities.

No direct residual adverse environmental effects on VECs or VSCs from project works and activities were identified after mitigation in the analysis. Consequently, the assessment did not identify any significant adverse environmental effects likely to be caused by the BHWP decommissioning project. Nevertheless, some monitoring and follow-up activities are proposed to ensure that the conclusions of the assessment are valid for potential air quality (dust) and noise effects.

Several positive effects were identified, including removal of contaminated soil, consequent reduction of the potential for water quality contamination in Lake Huron, availability of land for new industrial use and aesthetic improvement of the visual landscape.

10.2 Effects of the Environment on the Project

Potential effects of the environment on the project are considered in Section 8.4 of the EASR. Potential events considered were: (i) flooding and wave run-up; (ii) temperature extremes; (iii) high winds and tornadoes; (iv) severe rains, thunderstorms and lightning; and (v) seismic events. It was determined that there are no events that could result in either a significant adverse environmental effect or have serious implications on worker or public health and safety.

10.3 Effects on Sustainable Use of Resources

No significant adverse effects on the capacity of renewable or non-renewable resources are anticipated as a result of the decommissioning project (section 8.5 EASR).

10.4 Cumulative Environmental Effects

Twenty-two other projects on or in the vicinity of the Bruce nuclear site were considered in the assessment of potential cumulative environmental effects associated with the BHWP decommissioning project. These other projects are identified in Table 9.2 of the EASR. Although no residual adverse effects were identified in the study, two potential direct effects (dust, noise) were considered (Section 9.0 EASR). No adverse cumulative effects are anticipated as a result of the decommissioning project.

11.0 FOLLOW-UP AND MONITORING PROGRAM

The proposed design of the environmental assessment (EA) follow-up and monitoring plan for the project is described in Section 10.0 of the EASR. The purpose of the EA Follow-up Program is to verify the accuracy of the EA predictions, determine the effectiveness of any measures taken to mitigate the effects of the project, and provide ongoing information about the status of the project and the site.

The proposed follow-up program would be conducted in three phases:

(i) the pre-demolition phase;
(ii) the demolition/remediation phase; and
(iii) the end-state phase.

The proposed scope of the program at each phase is identified in Tables 10.1 to 10.3 of the EASR. Follow-up activities will include monitoring, surveillance, inspection, data collection, analyses, evaluations and reporting.

In addition to the information an follow-up provided in the EASR, the proponent will be required, as part of the Follow-up and Monitoring Program, to monitor noise at the southern boundary of the BNPD site, adjacent to Inverhuron Provincial Park. Information obtained from the monitoring during the site demolition activities will be used to verify that noise resulting from those activities is not having a significant adverse environmental effect on wildlife, in particular breeding birds in Inverhuron Provincial Park.

Should the decommissioning project be approved, the EA Follow-up Program will be further developed in more detail during the licensing assessment of the detailed Decommissioning Plan submitted in support of OPG’s licensing application pursuant to the NSCA. The EA Follow-up Program would be referenced as a condition of the decommissioning licence for the project, should the project be approved. The results of the Program would be submitted to the CNSC staff for review in a manner and at a frequency specified through the decommissioning licence.

12.0 CONCLUSIONS

CNSC staff concludes that the proposed Bruce Heavy Water Plant Decommissioning Project is not likely to cause significant adverse environmental effects, taking into account the proposed mitigation measures. Should the decommissioning project proceed to licensing, the CNSC will ensure the implementation of a follow-up program in accordance with the commitments and the proposed program design detailed in this CSR.

The expert Federal Authorities for this project have signified their agreement that the CSR is considered complete for the purpose of submission for public review under the CEAA. The CNSC, as the Responsible Authority for the project under the CEAA, is satisfied that the Comprehensive Study Report meets the requirements of the CEAA, and that it may be forwarded to the Minister of Environment and the Canadian Environmental Assessment Agency for review and decision pursuant to sections 22 and 23 of the CEAA.

APPENDIX A:

Responses from Expert Federal Authorities Signifying Agreement that the CSR is Considered Complete for the Purpose of Submission for Public Review Pursuant to Section 22 of the CEAA

- Environment Canada

- Health Canada

Environment Canada | Environnement Canada

Environmental Protection Branch
Ontario Region
4905 Dufferin Street
Downsview, Ontario
M3H 5T4

Protection de l'environnement
Région de l'Ontario
4905, rue Dufferin
Downsview, Ontario
M3H 5T4

June 30, 2003

Larry Chamney
Canadian Nuclear Safety Commission
P.O. Box 1046, Station B
Ottawa, Ontario
K1P 5S9

RE: Request for "Sign-Off" on the Comprehensive Study Report (CSR) for the Bruce Heavy Water Plant Decommissioning Project

This is in response to your letter dated January 27, 2003, pursuant to section 12(3) of the *Canadian Environmental Assessment Act* (CEAA) regarding the above mentioned project. As per Environment Canada's May 10, 2002 letter (J. Clarke, EC to L. Chamney, CNSC) we are in possession of specialist or expert information and knowledge in relation to the assessment of this project.

In context of our role as an expert Federal Authority per section 12(3) of CEAA, we have reviewed the CNSC's Comprehensive Study Report (CSR) for the Bruce Heavy Water Plant Decommissioning Project (January 2003) and OPG's Bruce Heavy Water Plant Decommissioning Environmental Assessment Study Report (December 2002), and are providing comments with respect to the following areas of EC's mandate:

- section 36(3) of the *Fisheries Act*
- *Canadian Environmental Protection Act;*
- *Department of Environment Act;*
- *Migratory Birds Convention Act;*
- National Accord for the Protection of Species at Risk, which commits all provinces to the protection of species at risk as listed through the Committee on the Status of Endangered Wildlife in Canada (COSEWIC);
- *Canada Wildlife Act*, which provides information on species at risk as designated by COSEWIC;
- A Wildlife Policy for Canada, which aims to maintain and restore ecological processes and the diversity of ecosystems, species and genetic variability within species;
- Federal Policy on Wetland Conservation, which is a shared federal responsibility that directs all departments to sustain wetland functions in the delivery of their programs, services or expenditures;
- Canadian Biodiversity Strategy, which is in response to United Nations Convention on Biological Diversity;
- Environment Canada's Sustainable Development Strategy;
- *Canada Water Act*, which provides information on surface hydrology, water quality, hydrogeology; and
- any other federal policies respecting environmental matters.

This does not relieve the proponent from meeting the requirements of the federal *Fisheries Act*, including section 36(3), the *Migratory Birds Regulations*, or any regulations made under the Canadian Environmental Protection Act, 1999 that are applicable to the project or to any effluent or discharge that may result from the project. Information and comments provided here should not be construed as a fettering of the government's ability to make decisions and/or enforce any applicable regulations.

Our May 10, 2002 letter identified a number of areas that we suggested the CNSC should resolve during the public review of the EA Report. We are generally satisfied with the proponent’s response to our comments, as summarized in Table C.4.2(b). However, we would like to provide the following two comments.

Terrestrial Environment

Our May 10 letter noted that demolition activities, including the felling of towers, is expected to take place over a period of two years, during which time the proponent indicated that it would adhere to the Ontario Ministry of the Environment noise guidelines. We indicated that compliance with provincial noise guidelines would not necessarily ensure that there would be no adverse environmental effects on wildlife, in particular breeding birds in Inverhuron Provincial Park. We asked that residual noise generated by the felling of the towers in the adjacent habitat areas be assessed in the same manner as residual noise on local communities.

The December 2002 EA Study Report selects only human receptors as VECs, and does not appear to acknowledge potential impacts on wildlife, including breeding birds (p. 8-10). The noted “shielding effect” of forests in noise dissipation would not be applicable to species living near the edges of the forest. However, given the ~ 2 km separation between the Heavy Water Plant site and the nearest forest receptor, we do not expect that there is a likelihood of significant adverse environmental effects.

We would suggest however that this potential effect be monitored through the follow-up program. Noting that the proponent has indicated that a “fence-line” locations will be used for the noise monitors, we would request that such a monitored be installed at the southern boundary of the BNPD site, adjacent to Inverhuron Provincial Park.

Contaminated Soil and Groundwater

The December 2002 EA Study Report indicates that all soils that exceed applicable soil quality guidelines will be identified through additional soil sampling, and that soils exceeding these guidelines will be removed from the site. We further note that the “End State Follow-up Program” (Table 10.3) includes additional soil samples upon completion of the demolition and decommissioning work to ensure that no soils exceeding applicable guidelines remain. Noting that the CNSC’s CSR indicates that the follow-up program will be further developed in more detail during the licensing assessment of the detailed Decommissioning Plan, we would like to request that the CNSC provide EC with a copy of the Soils, Geology and Hydrogeology Demolition/Remediation Phase Monitoring and End State Follow-up monitoring programs.

We trust that the above information is satisfactory. If you have any questions, please do not hesitate to contact the undersigned at (416) 739-4636.

Sincerely,

Kathy Yew Woon
Environmental Contaminants Officer
Environmental Contaminants Nuclear Programs Division
Environmental Protection Branch – Ontario Region, Environment Canada

cc: John Clarke
Edwina Lopes

Health Canada / Santé Canada

Healthy Environments and Consumer Safety Branch / Direction générale, Santé environnementale et sécurité des consommateurs

Environmental Health Assessment Services, 6604M
Safe Environments Programme
2720 Riverside Dr.
Ottawa, ON
K1A 0K9

CNSC CCSN
1127951

Your file Votre référence

Our file Notre référence
CS02-002

FILE DOSSIER 27-1-8-0
REFERRED TO RÉFÉRÉ À Chamney, L.

February 13, 2003

Larry Chamney
Processing Facilities and Technical Services Division
Canadian Nuclear Safety Commission
P.O. Box 1046, Station B
Ottawa, ON
K1P 5S9
FAX : (613) 995-5086

Subject: Request for "Sign-off" on the Comprehensive Study Report for the Bruce Heavy Water Plant Decommissioning Project, January 2003

Dear Mr. Chamney,

Thank you for your letter of January 27, 2003, and a copy of the "Comprehensive Study Report for the Bruce Heavy Water Plant Decommissioning Project, January 2003" prepared by staff of the Canadian Nuclear Safety Commission and the support document prepared by the proponent Ontario Power Generation "Bruce Heavy Water Plant Decommissioning Environmental Assessment Study Report, December 2002".

Health Canada staff have reviewed these documents as a federal authority under subsection 12(3) of the *Canadian Environmental Assessment Act* (CEAA). We are in agreement that this comprehensive study report is acceptable for submission to the Minister of Environment and the CEA Agency for public review. We wish to point out that the Environmental Assessment Study Report is excellent. It is well organized, detailed, yet concise. Our review of the information, including health impacts and occupational health and safety, was facilitated by the excellent documentation.

Yours sincerely,

Diane McClymont Peace

Diane McClymont Peace

cc. R. Kwiatkowski
A. Baweja

18 FEB '03 8:45

Canada

BRUCE HEAVY WATER PLANT DECOMMISSIONING

ENVIRONMENTAL ASSESSMENT STUDY REPORT

Ontario Power Generation, Nuclear Waste Management Division
700 University Avenue, Toronto, Ontario, Canada M5G 1X6

December 2002

Bruce Heavy Water Plant Decommissioning Environmental Assessment Study Report

Submitted to:

Canadian Nuclear Safety Commission

by:

Ontario Power Generation

December 2002

EXECUTIVE SUMMARY

1. INTRODUCTION

The Bruce Heavy Water Plant (BHWP) is located on the Bruce nuclear site, on the east shore of Lake Huron, about midway between the towns of Kincardine and Port Elgin (see Figure 1.1 in Chapter 1). Parts of the BHWP have already been decommissioned, prior to 1996. Ontario Power Generation Inc. (OPG) proposes to decommission the remainder of the BHWP, which produced heavy water for use in OPG's and other CANDU reactors, as it is no longer in operation.

The Canadian Nuclear Safety Commission (CNSC) is responsible for the regulation of nuclear facilities in Canada. The decommissioning project cannot proceed without the prior licensing approval of the CNSC; this requirement invokes a federal environmental assessment pursuant to Section 5(1)(d) of the *Canadian Environmental Assessment Act* (the *Act*). The proposed decommissioning or abandonment of a heavy water production facility is included in the *Comprehensive Study List Regulations* under the *Act*. As the licensing body, the CNSC is the Responsible Authority (RA) under the *Act* for the purpose of this assessment.

As the RA, the CNSC has delegated the preparation of an Environmental Assessment (EA) Study Report to OPG. Once accepted, this report will be used by the CNSC as a basis for the preparation of the required Comprehensive Study Report.

The EA Study Report is organized into 12 chapters; the highlights of Chapters 2 to 12 are as follows.

2. ALTERNATIVES

Five decommissioning options were evaluated ranging from mothballing to total demolition, including removal of foundations and support piers. Four broad criteria (safety, environment, cost and schedule) were considered for each option. The preferred option involves demolition to grade of all structures, buildings and site services, including two lagoon systems and the Surface Water Treatment Facility (SWTF). Site remediation follows a period of post-demolition monitoring. This option allows continued operation of those BHWP facilities that provide services to Bruce Power and the Bruce Energy Centre. Dismantling and demolition were compared as alternative means of carrying out the preferred option. OPG selected demolition. In addition, six options for dismantling or demolition of the Enriching Unit towers were assessed. The preferred option involves demolition by felling the large structures and cutting them up on the ground, as was successfully carried out during previous stages of BHWP decommissioning.

3. DESCRIPTION OF THE PROPOSED DECOMMISSIONING PROJECT

This chapter provides a description of the existing facility, the proposed works and activities of the project, compliance programs, decommissioning schedule and the project end state. The remaining structures and buildings of the BHWP include large (up to 87 m high) cylindrical towers on large concrete pads, overhead pipe racks, one and two storey buildings of cinder block and brick construction, the SWTF, process effluent lagoons and sludge lagoons. A few buildings and structures are still in use and will remain so as part of the end state of the site. Figure 3.1 in Chapter 3 provides an aerial view of the site showing the existing BHWP facilities.

No radioactive materials were used as source material for the production of heavy water, and only small amounts of uranium metal foil are used in the on-site laboratory. A limited number of chemicals remain in use on site. OPG disposed of all of the on-site hydrogen sulphide (H_2S) from 1997 to 1998, by controlled flaring approved by the (then) AECB and the MOE, as part of the BHWP shutdown process.

The proposed decommissioning involves isolating facilities from services, demolishing facilities to grade level, removal of any hazardous material, separating materials for recycling and disposal, site clearing, monitoring, and soil remediation. Demolition of the lagoons and the SWTF will occur after other structures and buildings have been demolished. In general, the demolition methods to be used are expected to be similar to those used during previous BHWP demolition stages. A peak of 15 trucks per day is expected for transporting wastes and recyclables.

The decommissioning project has two main phases: demolition/remediation and end state. The demolition/remediation phase is expected to take approximately six to seven years (2003-2009). This phase includes demolition of structures, buildings and site services; a post-demolition monitoring period of up to three years to provide data to determine the extent of remediation required; and final remediation of the site. The end state phase occurs after all demolition and site remediation activities have been completed and includes a follow-up monitoring program.

4. ENVIRONMENTAL ASSESSMENT METHODOLOGY

The assessment methodology follows the general requirements of the *Act* and is reflected in each chapter of the report. It defines both temporal and spatial boundaries for the project. The spatial boundaries include a **Regional Study Area –** the 10 km primary evacuation area around the Bruce Nuclear Generating Stations; a **Local Study Area** - the entire Bruce nuclear site as well as areas of Lake Huron abutting the site; and a **Site Study Area –** all areas within the BHWP regulated by the CNSC (see Figures 4.1 and 4.2 in Chapter 4).

5. COMMUNITY AND STAKEHOLDER CONSULTATION

Consultation occurred in three periods: an initial period from September 1998, when the EA was publicly announced, to December 1998; an interim period from January 1999 to June 2002 when consultation focussed on the CNSC and other government departments or agencies; and, since July 2002 when OPG sent out copies of a preliminary draft of the EA Study Report to interested parties in the local community for comment.

6. DESCRIPTION OF THE EXISTING ENVIRONMENT

The BHWP site has been extensively modified by land clearing, filling, grading, road construction, and the construction of foundations and pads for numerous buildings, processing structures and lagoons. Buildings, concrete pads, and pavement or crushed rock cover most of the land area. The site provides little habitat for aquatic or terrestrial life. There is some soil contamination (non-radiological) on site. The analysis of baseline conditions in the regional, local and site study areas indicated the presence of the following Valued Ecosystem Components (VECs) and Valued Social Components (VSCs):

- Atmospheric Environment - campers at Inverhuron Provincial Park, and residents at Baie du Doré and Inverhuron;
- Aquatic Environment - fish and benthic invertebrates in Lake Huron;
- Terrestrial Environment - white-tailed deer;
- Aboriginal Interests - lake whitefish.

7. POTENTIAL PROJECT ENVIRONMENT INTERACTIONS

An initial screening of interactions between project works and activities and the environment was carried out to determine the potential for direct and indirect effects. The identified interactions were carried forward for a determination of the likelihood of their occurrence and the potential effects on VECs and VSCs.

8. ASSESSMENT OF LIKELY ENVIRONMENTAL EFFECTS AND MITIGATION

No residual adverse effects on VECs or VSCs from project works and activities were identified after mitigation. Also assessed were environmental effects of credible malfunctions and accidents, likely effects of the environment on the project, likely effects of the project on sustainable use of renewable resources, and effects on human health. No other adverse environmental effects were identified. Several positive effects were identified, including removal of contaminated soil, the consequent reduction of the potential for water quality contamination in Lake Huron, the availability of land for new industrial use, and aesthetic improvement with the felling of the towers.

9. ASSESSMENT OF LIKELY CUMULATIVE EFFECTS AND MITIGATION

Twenty-two other projects on and around the Bruce nuclear site were analyzed for possible cumulative environmental effects on relevant VECs and VSCs. Although no residual adverse effect on any VEC or VSC was identified, two potential direct effects (dust and noise) and their corresponding VECs (nearest residents and camper in nearby park) were also included in the analysis. None of the other projects were deemed to be able to interact with the BHWP project in such a way as to produce adverse effects on VECs from dust or noise. It was therefore concluded that no adverse cumulative effects were likely.

10. FOLLOW-UP AND MONITORING PROGRAM

A follow-up and monitoring plan was defined for each phase of the project to provide information about the current status of the site, to verify the accuracy of the EA predictions, and determine the effectiveness of any measures taken to mitigate the effects of the project. OPG will report regularly to the CNSC, and provide periodic updates to the Municipality of Kincardine, the local Medical Officer of Health, and other stakeholders.

The plan for follow-up and monitoring will be further developed during the CNSC licensing assessment of the project.

11. SIGNIFICANCE OF RESIDUAL ADVERSE EFFECTS

No residual adverse effects were identified in the analysis, and thus no assessment of significance was required.

12. CONCLUSIONS OF THE ASSESSMENT

Based on this assessment, OPG concludes that no significant adverse environmental effects will likely result from the BHWP Decommissioning Project. The end state will represent an improvement to the biophysical and human environment. A follow-up and monitoring program will ensure that the conclusions of the assessment remain valid and that the mitigation measures will be effective.

Accordingly, OPG recommends that the CNSC accept these conclusions as a basis for the preparation of its Comprehensive Study Report under the *Canadian Environmental Assessment Act.*

TABLE OF CONTENTS

Page No.

LIST OF TABLES

LIST OF TABLES (Cont'd)

Page No.

LIST OF FIGURES

Page No.

1.0 INTRODUCTION

1.1 Proposed Project and Proponent

The Canadian Nuclear Safety Commission (CNSC) defines decommissioning as "those actions taken, in the interest of health, safety and the protection of the environment, to retire a licensed activity/facility permanently from service and render it to a predetermined end-state condition" (CNSC, 2000a).

Ontario Power Generation Inc. (OPG) proposes to decommission the Bruce Heavy Water Plant (BHWP) facility on the Bruce nuclear site. The BHWP is no longer in operation. It produced heavy water for use as a moderator in OPG's and other CANDU reactors.

OPG is a successor company to Ontario Hydro which originally constructed and operated the BHWP. As the owner and operator of the facility, OPG is the proponent for the decommissioning project.

1.1.1 Purpose of the Project

The purpose of the project is to permanently retire the BHWP from service as a nuclear facility licensed for the production of heavy water. All of the buildings, structures and equipment required for the operation of the licensed nuclear facility are to be removed or demolished so that upon completion of this decommissioning, the site can be used by OPG for industrial purposes unrelated to the production of heavy water or continue to be used to store OPG's inventory of heavy water under the authority of a licence from the CNSC.

1.1.2 Project Need and Rationale

1.1.2.1 History of Operation

The history of the facility is included to explain how the facility arrived at its current state. Past activities at the BHWP are not part of the BHWP Decommissioning Project.

The BHWP was in continuous operation from April 1973 until March 1998, producing over 16,000 megagrams (Mg) of reactor grade heavy water. Originally, Ontario Hydro planned to build a total of four heavy water plants at the Bruce nuclear site (Plants A to D), each consisting of two enriching units, one finishing unit, and associated auxiliary systems and buildings required to support heavy water production. These plants were designed to produce 800 Mg/annum. The development or operating history of the four heavy water plants is briefly described below.

Plant A

Plant A consisted of Enriching Units Nos. 1 and 2 (E1 and E2), Finishing Unit No. 1 (F1), and associated auxiliary systems. It produced its first reactor grade heavy water in April 1973.

Plant A continued to operate until 1984 when it was shut down. All of the hydrogen sulphide (H_2S) was removed from both E1 and E2 and transferred to the H_2S storage area. The plant was placed in a safe mothballed state, and remained as such until approval to demolish most of the above-ground structures for safety and economic reasons was received from the Atomic Energy Control Board (AECB), predecessor to the CNSC. The following buildings were demolished during 1993-94:

- E1 (excluding its substation);
- E2 (excluding its substation);
- F1;
- South Flare Area;
- Plant A Substation;
- South Clarifier;
- Plant A Degassers;
- Plant A Acid & Caustic Storage Area.

The Utilities Building (excluding its substation) was demolished in 1995.

<u>Plant B:</u>

Plant B consisted of E3 and E4, F2, and associated auxiliary systems. Plant B was completed and placed in service in 1979.

By the end of 1993, Plant B had produced enough heavy water to meet Ontario Hydro’s needs. At that time, a decision was made to shut down and demolish one of the enriching units (E3) in Plant B, thereby reducing the plant’s capacity by 50%. E4 continued to operate to produce heavy water for external markets.

In 1994, Ontario Hydro received permission from AECB to demolish and remove the above-ground portions of E3. The unit (excluding its Antifoam Building) was successfully demolished during 1995. E4 was shut down on May 1, 1997 due to a problem with the steam supply from Bruce A. On May 24, 1997, this outage was extended into a planned maintenance outage. On August 30, 1997, a decision was made to permanently shut down the BHWP and the E4 outage became permanent. Subsequently, all of the H_2S was removed from E4 and was returned to the storage area.

Approval to dispose of the H_2S by controlled flaring was received from both the AECB and the MOE in early November of 1997. Controlled flaring commenced on November 6, 1997 and was completed on January 23, 1998. A total of 619.9 Mg of H_2S was flared during this period. Upon completion of flaring, only 1 Mg of H_2S remained in the plant. Removal of the H_2S from the remaining systems was completed by March 31, 1998. Integrity checks were carried out to ensure that the systems were totally free of all H_2S.

After the final shutdown, all other chemicals associated with the production of heavy water were disposed of using approved conventional methods. In addition, systems required for continued operation have been physically isolated from the shut down portion of the plant. To ensure continued operation of these systems, it was necessary to reconfigure some of the piping and electrical systems.

Plants C and D

Plants C and D were intended to consist of Enriching Units (E5 and E6 for Plant C, and E7 and E8 for Plant D), Finishing Units, and associated auxiliary systems. Plant C was cancelled in the early stages of construction. No above-ground structures were built nor were any underground services installed.

Construction of Plant D was suspended in 1978 after approximately 70% of the facility was completed. The structures that had been completed were mothballed and no part of Plant D was ever exposed to H_2S or other chemicals used in the production of heavy water. Ontario Hydro requested AECB approval to proceed with demolition and removal of the above-ground portions of E8 on December 21, 1994. The AECB responded on January 30, 1995 indicating that Ontario Hydro did not require AECB approval to demolish E8. The unit (excluding its Antifoam Building and substation) was demolished in 1995.

1.1.2.2 Rationale for Decommissioning Project

In August 1997 Ontario Hydro made a decision to stop the production of heavy water at the BHWP because it had determined that it had sufficient heavy water inventories to meet its own needs and its contractual commitments to AECL. A series of actions had been taken, involving the mothballing of some facilities and the demolition of others, notably the enriching towers E3 and E8. At present there are no active production facilities on the site. OPG proposes to complete the work started by Ontario Hydro during 1993-1995 and permanently retire and remove the remaining heavy water production facility that is surplus to OPG's business needs. There are several reasons why it wishes to proceed with the decommissioning.

- OPG intends to restore the site to a state suitable for industrial uses and would like to be able to respond to any requests to use the site for such purposes;
- While the facility has been safely mothballed, some facilities, particularly the enriching towers, are not being maintained and, as they age, are showing signs of deterioration. OPG would like to demolish the towers before deterioration of the structures increases the hazards of decommissioning;
- OPG would like to reduce maintenance and operating costs at the BHWP and would like to avoid any increase in costs that may emerge from decommissioning a more hazardous structure at a later date; and
- OPG would like to complete the environmental remediation of the site, in particular the contaminated (not radioactive) soils, and restore views of the site to a more natural pre-enrichment tower condition.

1.1.3 Location of the Project

The BHWP is located entirely on the Bruce nuclear site. The Bruce nuclear site (formerly known as the Bruce Nuclear Power Development or BNPD) occupies 932 ha (2300 acres) on the east shore of Lake Huron, about midway between the towns of Kincardine and Port Elgin (Figure 1.1). The Bruce nuclear site is located approximately 250 km north-west (geographic direction) of Toronto, Ontario at a longitude of 81°30' west and latitude 44°20' north. It may be reached from Provincial Highway No. 21 by one of two concession roads (No. 2 and No. 4).

The BHWP is situated in an irregularly shaped, fenced area on the western (lake) side of the Bruce nuclear site. It is located north and east of the Douglas Point Waste Management Facility (Figure 1.2). The BHWP site has maximum measurements of approximately 960 m by 750 m. Plant A was centrally located on the southern half of the BHWP site. The remainder of Plant B is located immediately east of the former Plant A, and the incomplete Plant D is located north of Plant B.

There are 914 m exclusion zones around the Bruce A and Bruce B stations. These zones restrict the types of uses that can occur within them. Several structures which are part of the BHWP are wholly or partly in the Bruce B exclusion zone.

1.1.4 Project Schedule

It is anticipated that decommissioning work on the BHWP, subject to environmental assessment (EA) and licence approvals, will begin in 2003. The demolition/remediation activities are expected to take seven to eight years to complete. Environmental monitoring will continue for up to three years after the end of the demolition/remediation work.

1.2 Regulatory Requirements

1.2.1 Canadian Environmental Assessment Act

The decommissioning project cannot proceed without the prior licensing approval of the CNSC pursuant to the *Nuclear Safety and Control Act* (*NSCA*). Licensing approval from the CNSC invokes a federal environmental assessment pursuant to Section 5 (1)(d) of the *Canadian Environmental Assessment Act* (the *Act*). This project is not of a type that is listed in the *Exclusion List Regulations* of the *Act*. As the licensing body, the CNSC is the Responsible Authority (RA) under the *Act* for the purpose of this assessment.

1.2.1.1 Comprehensive Study List Regulations

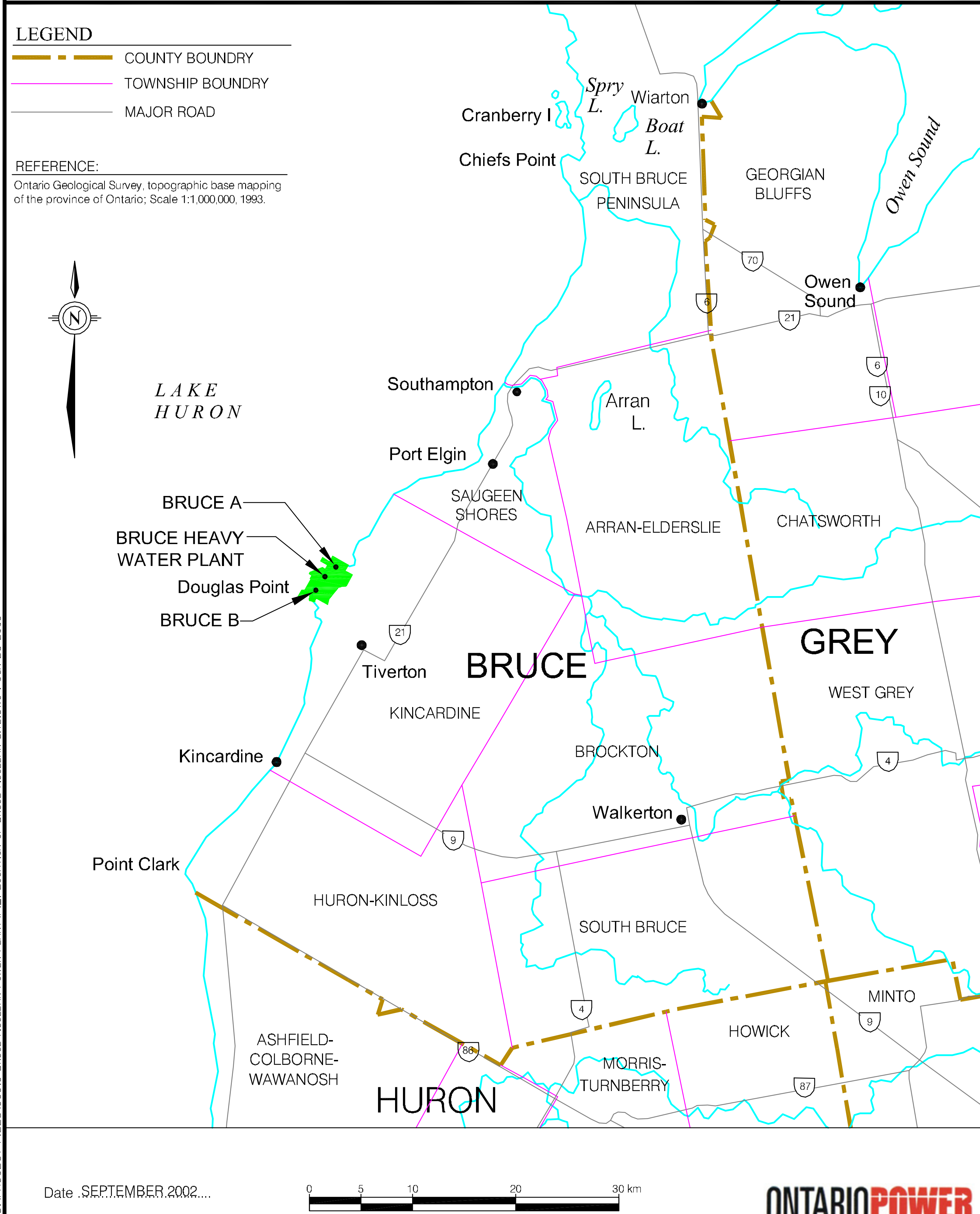
In accordance with the *Act*, only those projects which are listed in the *Comprehensive Study List Regulations* pursuant to the *Act* require a Comprehensive Study assessment. Part VI of these *Regulations* identifies those nuclear and related facility projects that require a Comprehensive Study and includes the proposed decommissioning or abandonment of a heavy water production facility. Therefore, a Comprehensive Study is required for the BHWP project.

1.2.1.2 Federal Roles and Responsibilities

The CNSC is currently the only RA under the *Act* that has been identified for this environmental assessment (EA). As the RA, the CNSC is required to ensure that a Comprehensive Study be

LOCATION OF BRUCE NUCLEAR SITE

FIGURE 1.1



Date SEPTEMBER 2002

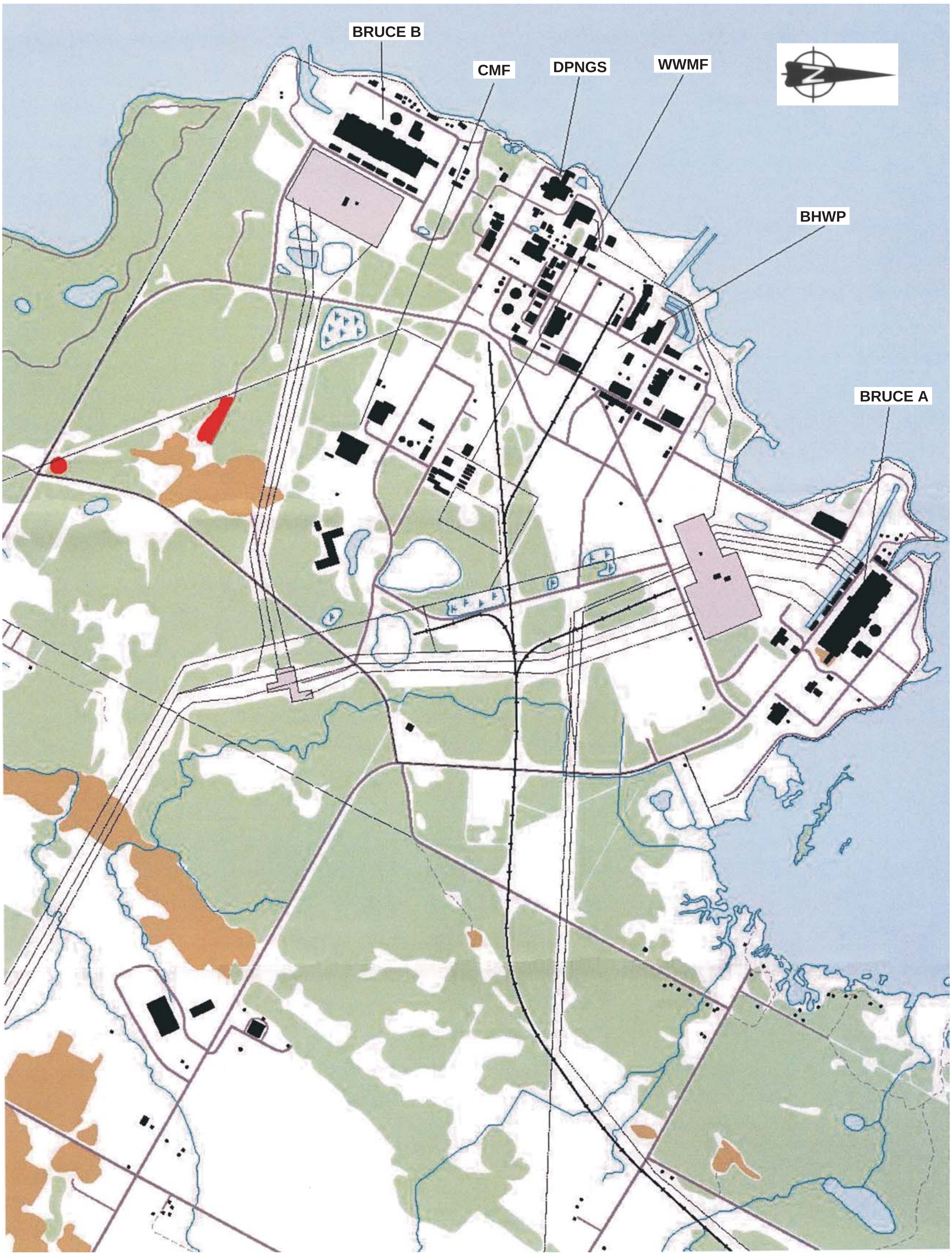
SENES 33315

ONTARIO POWER GENERATION

M.T.N. : D:\PROJECT FILES\33315 BRUCE NUCLEAR POWER PLANT\FIL\ LOCATION OF BRUCE NUCLEAR SITE.DWG : JUN 26 2003

LOCATION OF BRUCE HEAVY WATER PLANT ON BRUCE NUCLEAR SITE

FIGURE 1.2



LEGEND:

BHWP	Bruce Heavy Water Plant (Shut down)
BRUCE A	Bruce Nuclear Generating Station A
BRUCE B	Bruce Nuclear Generating Station B
DPNGS	Douglas Point Nuclear Generating Station (Shut down)
WWMF	Western Waste Management Facility
CMF	Central Maintenance Facility

FIG1.2 11x17.CDR

Date September 2002

SENES 33315

ONTARIO POWER GENERATION

conducted. A Comprehensive Study Report (CSR) is to be prepared and submitted to the federal Minister of Environment and the Canadian Environmental Assessment Agency (Agency), pursuant to section 21 of the *Act*, before the proposed licensing decision can be made pursuant to the *NSCA*.

Pursuant to the *Federal Coordination Regulations* under the *Act*, Environment Canada and Health Canada declared themselves as expert Federal Authorities with interests in the decommissioning project. Fisheries and Oceans Canada initially indicated an interest in participating as an expert Federal Authority, but subsequently withdrew when it determined that there were no environmental assessment issues associated with the project involving fish or fish habitat.

CNSC, pursuant to subsection 17(1) of the *Act*, has delegated to OPG the conduct of the technical support studies for the EA and the public consultation program as well as the preparation of the EA Study Report. CNSC and the expert Federal Authorities will review the EA Study Report. Once accepted, it will be used by the CNSC as the basis for the preparation of the Comprehensive Study Report under the *Act* for this project.

1.2.1.3 Public Registry

CNSC has established a public registry for the EA as required by section 55 of the *Act*. This includes identification of the EA in the Federal Environmental Assessment Index, which can be accessed on the website of the Canadian Environmental Assessment Agency (www.ceaa.gc.ca). The Federal Environmental Assessment Index reference number for this project is 16968.

1.2.1.4 Stakeholder Consultation

OPG undertook a number of community and stakeholder communications and consultation activities. These activities were undertaken with the following objectives:

- To update key stakeholders on plans to decommission the BHWP;
- To provide the Bruce Community with opportunities to learn about the BHWP decommissioning project;
- To ensure public comments are documented and addressed in the EA Study Report; and
- To maintain and build upon existing key stakeholder and local community support for on-going operations on the Bruce nuclear site.

1.2.2 Canadian Nuclear Safety Commission Licences

1.2.2.1 Nuclear Facility Licences

The BHWP is regulated by the CNSC under a Heavy Water Plant Operating Licence issued pursuant to the *NSCA*. A portion of the facility, for which construction was started but never completed, is governed under a Construction Approval issued by the AECB in 1980. The licence and approval provide for the continued maintenance of the facilities in their current shut-down state. Figure 1.3 shows the areas of the BHWP that are currently regulated by CNSC.

The current Heavy Water Plant Operating Licence HWPOL 405-12.3 was issued on June 1, 2001 and expires on October 31, 2002. The total area of the BHWP currently governed under this licence is approximately 30 hectares and includes:

- Plant B excluding E3;
- Common Services Area including the H_2S storage area;
- Drum Filling Building (Building 506, located in the area of the former Plant A); and
- Heavy Water Storage Area in Operations Building D.

Other areas of the BHWP that were previously governed under the Heavy Water Plant Operating Licence included Plant A and E3 of Plant B. The Plant D Construction Approval Amendment No. 1 was issued on February 1, 1980 and does not have an expiry date. The physical area of the BHWP governed under this licence includes the areas occupied by E7 and E8, which were never completed.

The southern third of the BHWP, including the former Plant A (now mostly demolished) lies within the exclusion zone of Bruce B. Some of those buildings, structures and pipe racks will be demolished during the course of the BHWP Decommissioning Project.

An application for a Licence to Decommission as described in Section 7 of the *Class I Nuclear Facilities Regulations* (CNSC, 2000b) has been submitted to the CNSC by OPG. This application requested permission to proceed with the decommissioning of the BHWP. The application was supported by a Detailed Decommissioning Plan (DDP) (OPG, 2002) prepared in accordance with the guidelines set out in CNSC Regulatory Guide G-219 (CNSC, 2000a) and submitted by OPG in May 2002. Upon completion of the decommissioning work, OPG will prepare a Final Decommissioning Report that will describe the decommissioning work that was performed and the results of that work. After the decommissioning is complete, OPG will apply to the CNSC for approval to abandon the BHWP site as described in Section 8 of the *Class I Nuclear Facilities Regulations*.

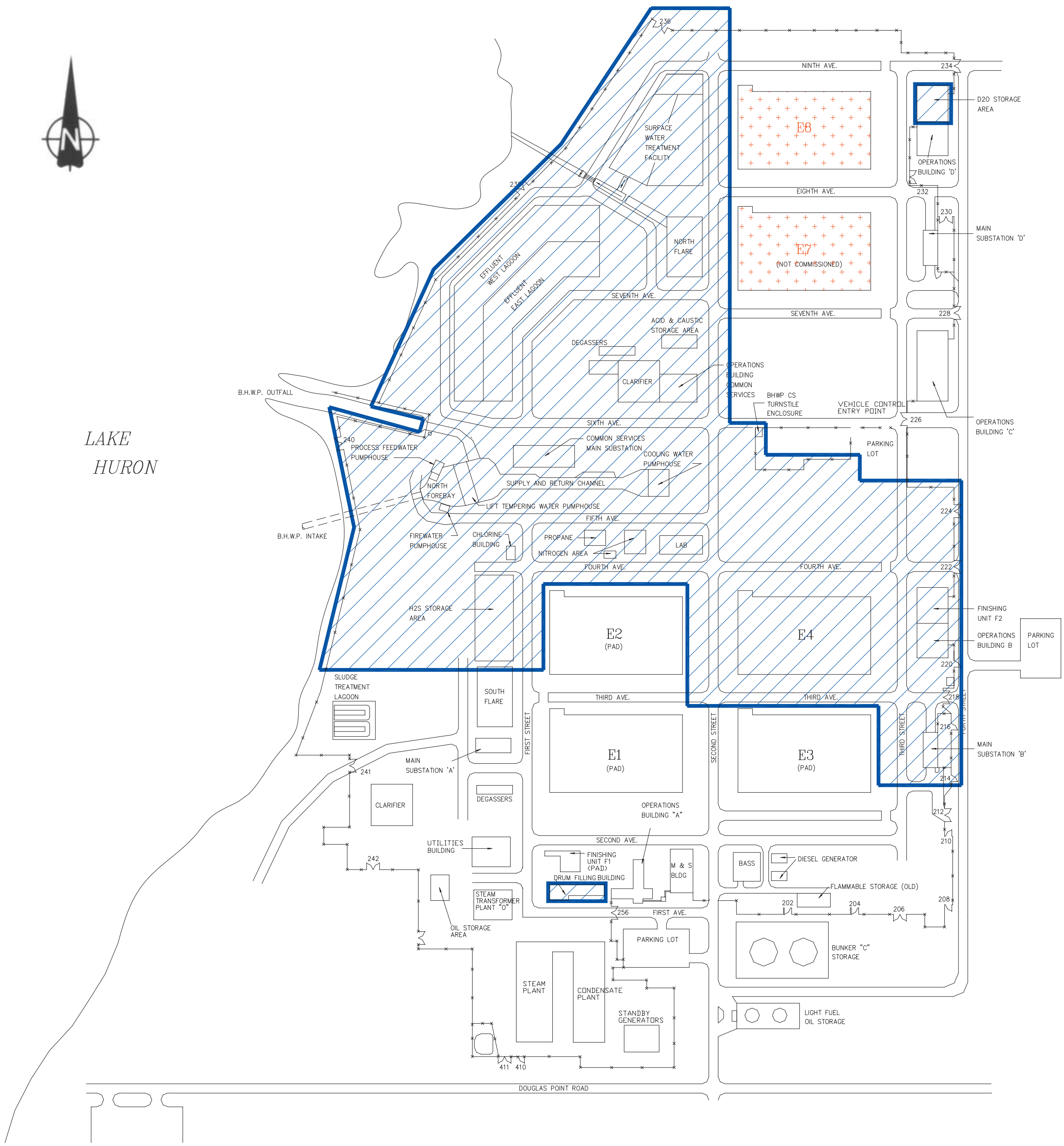
1.2.2.2 Nuclear Substance Licence

OPG currently stores non-radioactive heavy water in bulk tanks located in the Heavy Water Storage Areas of F2 and F4, attached to Operations Buildings B & D (buildings 528 and 578). OPG intends to continue this practice throughout the course of the BHWP Decommissioning Project and following the completion of the project. Heavy water will not be stored in the Drum Filling Building (building 506) during the course of the Decommissioning Project; however, OPG intends to store heavy water in this building following completion of the decommissioning project.

Neither F2 nor F4 will be demolished, renovated or modified during the course of the decommissioning and both buildings will remain outside of the designated Construction Islands

AREAS OF THE BRUCE HEAVY WATER PLANT CURRENTLY REGULATED BY CNSC

FIGURE 1.3



LEGEND:

- DENOTES BHWP BOUNDARY FENCE
- DENOTES AREA COVERED UNDER CURRENT CNSC OPERATING LICENCE
- DENOTES AREA COVERED UNDER 1980 PLANT 'D' CONSTRUCTION APPROVAL

Date September 2002

SENES 33315

Fig 1.3 8.5x11 CDR

ONTARIO POWER GENERATION

that will be placed under the control of the General Decommissioning Contractor (GDC). OPG staff will continue to operate the Heavy Water Storage Areas according to existing procedures throughout the project.

OPG will submit an application for a nuclear substance licence to permit the continued storage of its inventory of heavy water in the Heavy Water Storage Areas of F2 and F4 and the Drum Filling Building following the completion of the BHWP Decommissioning Project. The application for this licence will be submitted prior to, or in conjunction with, the application for a Licence to Abandon the BHWP site. Therefore, those buildings remaining would no longer be part of a Heavy Water Plant and would not be subject at a later date to undergoing a Comprehensive Study under the *Act*.

The possession and use of uranium metal foil in the infrared absorption analyzers in the Common Services Laboratory is already permitted under the terms of a Consolidated Radioisotope Licence applicable to this laboratory. No revision of this licence will be required as the result of the decommissioning.

1.2.3 Environmental Permits and Registrations

Although Ontario Hydro (predecessor to OPG) submitted a provincial EA in the mid-1970s in support of its proposal at that time to expand the BHWP (Plants B, C, and D), there are no provincial environmental assessment requirements applicable to this decommissioning project under the Ontario *Environmental Assessment Act*. However, the Ontario Ministry of the Environment (MOE) has issued guidelines for the cleanup of contaminated sites (MOE, 1997) that are applicable to the decommissioning work that will be performed at BHWP.

The Owen Sound District Office of the MOE was officially informed of this project in 1998. There is a Certificate of Approval (C of A) for the Surface Water Treatment Facility (SWTF). Discharge of water from the SWTF is the only regulated stream associated with this project.

OPG is registered with the MOE as a generator of hazardous wastes. OPG's Waste Generator Registration Number is ON0018401 (revised January 19, 2000). OPG will prepare and file an Annual Generator Registration Report with the MOE if one is required.

The MISA (Municipal Industrial Strategy for Abatement) Regulations for the Electrical Power Generation Sector apply to the BHWP. Four buildings that formerly housed equipment used to monitor compliance with MISA requirements will be demolished during the course of the decommissioning project. This equipment was used to monitor sampling points that have been eliminated in accordance with Section 7(3) of the MISA Regulations for the Electrical Power Generation Sector.

The GDC will file notice of the BHWP Decommissioning Project with the Ontario Ministry of Labour as required by Section 5(1) of the *Regulations for Construction Projects* made pursuant to the *Occupational Health & Safety Act*. The GDC will be the 'Constructor' on the BHWP Decommissioning Project and will fulfill all of the duties of the Constructor set out in the *Occupational Health & Safety Act* and the *Regulations for Construction Projects*.

1.2.4 Building Permits

One or more building permits will be required for the work to be performed during the BHWP Decommissioning Project. The GDC will acquire the necessary permits.

1.3 Scope of Project and Assessment

In 1997, Ontario Hydro's Board of Directors announced that it would permanently shut down and decommission the BHWP. Decommissioning requires approval from the AECB (now the CNSC) which in turn triggered the need for a Comprehensive Study pursuant to the *Act*. In September 1998, OPG, as the proponent of the project, announced that it was beginning the preparation of an EA.

1.3.1 Scope of the Project

A map of the BHWP showing the limits of the BHWP Decommissioning Project and the locations of the major structures scheduled for demolition is presented in Figure 4.2.

The scope of the BHWP Decommissioning Project includes the following activities:

- demolition of the above-grade components of the BHWP within the area regulated by the CNSC as described in Section 1.2.2.1, except for those components and infrastructure required to maintain site service system integrity for other separately licensed facilities on the Bruce nuclear site;

- segregation, preparation and transport off site to appropriate locations of any reusable and recyclable materials and equipment;
- disposal of some waste at the Bruce nuclear site landfill;
- segregation and transport off site of all remaining hazardous and non-hazardous waste to authorized waste management facilities; and
- remediation of the facility to a condition suitable for general industrial land uses.

Not included in the scope of the project is the removal of several buildings and facilities on the site that will be retained for office and laboratory uses, pumping of water, electrical distribution and the storage of residual heavy water inventory.

Further details on the scope of the project are provided in Chapter 3 of this report.

1.3.2 Scope of Assessment

The scope of the assessment under the *Act* must include all factors identified in paragraphs 16(1) (a) to (d) of the *Act*, and, as provided under paragraph 16(1)(e), any other matter that CNSC requires to be considered. The following factors are required:

- The environmental effects of the project, including the 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 carried out;

- The significance of the effects identified above;

- Comments from the public that are received in accordance with the *Act* and its regulations; and

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

In accordance with subsection 16(2) of the *Act*, a Comprehensive Study requires that the following additional factors be considered in the environmental assessment:

- 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 requirements of, a 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.

Further, and to enable adequate consideration of the above factors, the scope of assessment also includes a description of the project and a description of the existing environment that may be affected by the project activities.

The assessment deals only with decommissioning activities up to the “end state” of the project. The “end state” is defined as the state of the BHWP site after all decommissioning activities are completed and the requirements for regulatory approvals are met. The end state objectives are delineated in the DDP (OPG, 2002) and in Section 3.6 of this report.

1.3.3 Summary of Environmental Assessment Background

As indicated previously, OPG announced in September 1998 that it was beginning to prepare an EA to support regulatory approval of the BHWP Decommissioning Project.

In November of 1998, OPG initiated a program of consultation activities in the community in support of the EA. However, progress of the EA and related consultation was interrupted by OPG decontrol activities required by provincial legislation, as explained in Section 5.3. In June of 2001 OPG completed and submitted a preliminary draft EA Study Report to the CNSC (OPG, 2001).

In March of 2002, the CNSC, as the Responsible Authority, completed the preparation of a draft Comprehensive Study Report for the BHWP Decommissioning Project to which the OPG preliminary draft EA Study Report was attached as a supporting document. This was submitted to the Canadian Environmental Assessment Agency and other federal agencies for review. In May of 2002 the Agency, Environment Canada and Health Canada commented on the draft report and the consultation process requesting further information in some areas and new analyses in others. The comments from these government agencies are documented in Chapter 5.

In July of 2002, in response to comments from the CNSC and other federal agencies, OPG began the preparation of this revision of the earlier draft EA Study Report and resumed the community consultation program. In August of 2002, OPG submitted a document consisting of the earlier draft EA Study Report and sections of the Detailed Decommissioning Plan for review by interested members of the community and local government representatives.

Guidance on the required scope of the EA, including scope of the project and scope of the assessment, was obtained over time through consultation with CNSC staff in accordance with sections 15 and 16 of the *Act*.

1.3.4 Compliance with Requirements of the Canadian Environmental Assessment Act

This EA Study Report has been prepared in accordance with the requirements of the *Act*, as shown in the compliance table in Appendix C.4.1. In addition, it has taken into account all comments and direction from the CNSC and other Federal Authorities, as indicated in Appendix C.2 and Appendix C.4.

1.4 Purpose and Organization of this EA Study Report

This EA Study Report responds to the needs for a Comprehensive Study as outlined in Section 1.3. The report is organized into 12 chapters plus references, acronyms and appendices as follows:

1. **Introduction:** describes the purpose of the project, the history of the site, the regulatory environment, the scope of the project and the scope of this assessment;

2. **Alternatives:** describes and evaluates from cost, timing and environmental points of view, alternative options for carrying out the decommissioning and different means of dealing with specific aspects of the decommissioning activities.

3. **Description of the Proposed Decommissioning Project:** describes how the project will be carried out and the key works and activities that are involved;

4. **Environmental Assessment Methodology:** describes how environmental effects will be determined and measured;

5. **Community and Stakeholder Consultation:** outlines the consultation program undertaken and notes the concerns of the public and other stakeholders;

6. **Description of the Existing Environment:** describes the existing environment (i.e. baseline conditions) in the area of the project and its most important features, including a description of Valued Ecosystem Components (VECs) and Valued Social Components (VSCs);

7. **Potential Project/Environment Interactions:** shows how the various works and activities involved in the project might interact with the environment and in particular with VECs and with any public concerns;

8. **Assessment of Likely Direct Effects and Mitigation:** focuses on the potential interactions (identified in Chapter 7), determines any residual effects, and indicates ways by which such effects might be mitigated;

9. **Assessment of Likely Cumulative Effects and Mitigation:** addresses the possibility of residual effects from the decommissioning project interacting with effects from existing and future projects;

10. **Monitoring and Follow-up Program:** describes the nature of the program, locations for monitoring and the duration and/or frequency of monitoring activities.

11. **Significance of Residual Adverse Effects:** assesses the significance or importance of adverse residual effects on the environment;

12. **Conclusions of the Assessment:** indicates whether there are any likely adverse environmental effects which cannot be mitigated and whether there are any outstanding public concerns.

2.0 ALTERNATIVES

Section 16(2)(b) of the *Act* requires that this EA, being a Comprehensive Study, consider alternative means of carrying out the project that are technically and economically feasible and the environmental effects of any such alternative means.

The DDP (OPG, 2002) assessed the alternative means of carrying out the project in three steps as outlined below.

- evaluation of five decommissioning strategies (options) to select a preferred option
- determination of the most effective means of carrying out the preferred option
- assessment of decommissioning methods for specific structures

2.1 Alternative Means Of Carrying Out The Project

Five possible decommissioning strategies were identified and evaluated to select the preferred option for the BHWP Decommissioning Project. Four criteria (Safety, Environment, Cost, and Program) were considered for each of the options. Each option was given a score ranging from 1 (poor) to 10 (excellent) based on its relative merit or impact for each criterion. Different weights were assigned to each of these criteria to reflect the relative importance of the criteria. Safety, both to the workforce and to the public, was assigned the highest weighting, followed by consideration of environmental effects. Cost and program (i.e., timeframe or schedule) are considered to be relatively less important and to some extent they are interdependent. The final score is the product of the individual scores and the corresponding weight. The evaluation of each option is provided in Table 2.1 and described in the following subsections.

2.1.1 Option 1: Mothballing and Deferred Decommissioning

Mothballing the plant would not remove any of the existing hazards and would offer no long-term improvement to the environment. However, there would be no short-term adverse effects on the environment. The plant structures and buildings would require considerable maintenance to keep them in a safe state. This is particularly important on the tall structures, which could pose a serious hazard if they are corroded by weather. Carrying out the appropriate level of care and maintenance on the plant would be expensive and pose some risk to maintenance staff. There is no benefit to be gained from delaying the decommissioning (the plant is not radioactive so delay will not reduce hazards). It is unlikely that there will be sufficient future demand for heavy water to warrant the cost and effort required to mothball the heavy water production facilities (i.e. the process equipment and related buildings). OPG’s current inventory of heavy water is sufficient to meet all of its foreseeable needs and the demand for heavy water on the export market is expected to remain low for the foreseeable future. This option received the lowest score.

TABLE 2.1
COMPARISON OF THE DECOMMISSIONING OPTIONS

No	Option	Description	Safety (Weighting =10)			Environment (Weighting = 8)			Cost (Weighting = 6)			Program (Weighting = 6)			Total	
				M	WM		M	WM		M	WM		M	WM	M	WM
1	Mothball & decommission later	Leave structures in care and maintenance regime. Decommission at a later date.	Hazards remain plus maintenance risks.	3	30	No immediaate site improvement. Minimum socio-economic impact.	10	80	As option 1 plus cost of care and maintenance.	3	18	Long term.	2	12	18	140
2	Partial decommissioning A	Remove towers, pipe racks and other tall structures. Refurbish/maintain buildings. Remediate land.	Removes major hazard from towers. Improves buildings.	6	60	Removes main hazards. Improves view. Minimal remediation.	6	48	Cheapest removal. Cost of refurbishment.	10	60	Short program.	8	48	30	216
3	Partial decommissioning B	Remove towers, pipe racks, buildings and all above-ground structures. Leave underground items but isolate redundant services. Remediate Land.	Removes major hazard from towers & buildings.	7	70	Removes main hazards. Improves view. Partial remediation.	7	56	More expensive than option 2.	8	48	Short program.	10	60	32	234
4	Partial decommissioning C	Remove all above-ground items. Isolate and remove all redundant underground services. Reroute/refurbish remaining services, backfill trenches, etc. Remediate Land.	Removes major hazard from towers & buildings & services.	8	80	Removes hazards. Improves view. Partial remediation	8	64	More expensive than option 3.	6	36	Longer than options 2&3.	6	36	28	216
5	Decommission completely	Remove all components of the plant (including concrete pads, underground services). Remediate land.	Completely removes hazard.	10	100	Removes hazard. Improves view & terrain. Maximum remediation.	10	80	Expense of removing all items & remediation.	4	24	Longer than options 4.	4	24	28	228

M Mark (Score)
WM Weighted Mark

2.1.2 Option 2: Partial Decommissioning/Partial Mothballing and Selective Demolition

This option involves decommissioning the Enriching Unit towers, flare stack, pipe racks and other tall structures to ground level. The other unused buildings and structures on site would be mothballed. The redundant underground services would be isolated but left in situ.

Removing the tall structures and the pipe racks would reduce the potential hazards from falling objects and structural collapse. The visual environment would also be improved by the removal of these landmarks. Leaving the buildings on site and continuing care and maintenance on them would be costly and would not reduce the eventual demolition cost. This cost could be offset if the buildings were reused. Some of the buildings on site are currently being used for other purposes and it is not intended to decommission them at this stage. This option was ranked third, equal to Option 4.

2.1.3 Option 3: Partial Decommissioning/Demolition to Grade – No Mothballing

This option involves decommissioning the Enriching Unit towers, flare stack, pipe racks and other redundant buildings and structures to ground level. The redundant underground services would be isolated but left in situ.

This option has the same safety benefits as Option 2 but with the added advantage that hazards posed by the redundant buildings would be removed. It would also improve the environment and reduce the care and maintenance costs. However, it would cost more in the short term to implement than Option 2. Additionally, the underground services, concrete foundations, etc., which would remain after the decommissioning will eventually have to be removed. This option received the highest score.

2.1.4 Option 4: Partial Decommissioning/Demolition to Grade, Excavation and Removal of Underground Services

This option involves decommissioning the Enriching Unit towers, flare stack, pipe racks and other redundant buildings and structures to ground level. The redundant underground services would be excavated and removed.

Removal of all the redundant services would further reduce the hazards on site and enhance the environment. This would be a lengthy task and could threaten the integrity of services that were still required such that they might have to be re-routed. The cost would be higher and the program longer than for Options 2 and 3. This option was ranked third, equal to Option 2.

2.1.5 Option 5: Complete Decommissioning/Option 4 Plus Removal of Foundations and Support Piers

This option involves completely decommissioning the Enriching Unit towers, flare stack, pipe racks and other redundant buildings and structures including their underground foundations and support piers. The redundant underground services would be excavated and removed as in Option 4.

This option has the potential for the most short-term effects on the environment but provides the safest and most improved environment at the end of decommissioning as all hazards will have been removed. This option involves the most land remediation of all the options. However, it would be more costly and inconvenient to complete decommissioning now, as some BHWP facilities provide services to other areas of the Bruce nuclear site and to the Bruce Energy Centre. Furthermore, some buildings and equipment must be retained to provide storage for OPG's current inventory of heavy water. This option was ranked second.

2.1.6 Environmental Effects and the Preferred Option

The environmental evaluation carried out at the time of selection of the preferred decommissioning option was comparative and at a more general level of detail than the later assessment of the preferred option which is documented in subsequent chapters of this report. This is consistent with normal project planning and assessment practice.

In general, since all of the H_2S was removed from Plant B during the shutdown process up to March 1998, as approved by the (then) AECB and the MOE, the potential for environmental effects of subsequent decommissioning was considered to be mostly localized, confined within the Bruce nuclear site.

All options, except Option 1, involve varying amounts of demolition of structures and buildings, and thus varying amounts of land available for remediation. Therefore, the length of time required for both demolition and remediation activities is dependent on which option is chosen. However, each of Options 2, 3, 4 and 5 would include a post-demolition monitoring period of up to three years prior to site remediation.

On a comparative basis, Option 1 was given a high environmental score, largely because it would defer potential adverse effects of demolition on the local natural environment. Visual impact was not considered explicitly at this time. On the other hand, Option 1 was rated low in terms of safety, program and cost criteria, and thus was ranked lowest overall.

Option 5 was also given a high environmental score, because of its long-term positive effects. It would provide the greatest removal of hazards, the greatest amount of site remediation (including removal of foundations and other subsurface structures), and visual improvement similar to Options 3 and 4. However, due to greater schedule and cost impacts (lower scores for those criteria), Option 5 only ranked second overall.

Option 3 was given a somewhat lower environmental score than Options 1 and 5. Its socio-economic impact would occur over a shorter period than that of Option 1, but similar to those of the other options. Its main disadvantage compared to Option 5 would be any effects of subsurface structures and isolated services which would be left in place. However, due to more favourable schedule and cost impacts, Option 3 ranked first overall.

Based on this evaluation as summarized in Table 2.1, OPG has selected Option 3 as the best combination of environmental, safety, cost and schedule criteria. Under this option, facilities would be demolished immediately and on-site land remediated following a period of post-demolition monitoring. Option 3 also permits the continued operation of those BHWP facilities that provide services to Bruce Power and the Bruce Energy Centre.

2.2 Alternative Means Of Carrying Out The Preferred Option

2.2.1 General Decommissioning

Two general alternative means of carrying out the Preferred Option (Option 3) for the decommissioning of the BHWP were considered: dismantling and demolition. Dismantling involves taking the plant apart in a slow methodical manner so that equipment can be salvaged for reuse and resale, while demolition involves knocking down the facilities and equipment and disposing of or recycling the debris.

Demolition is considered the most economical method and it can be completed in the shortest time. This will eliminate the hazard associated with the deterioration of the heavy water production facilities as quickly as possible. Standard techniques used throughout the demolition industry can be employed, thereby minimizing risk to employees and contractors. Restoration of the site can be completed in the shortest possible time, thus minimizing the expenditure of energy and resources. In addition, the demand for the BHWP equipment, especially items previously exposed to H_2S, is low and the salvage value would not offset the extra cost of dismantling. OPG has selected demolition as the preferred means of carrying out the decommissioning of the BHWP.

2.2.2 Special Considerations

The decommissioning of the Enriching Unit towers has been identified as requiring special consideration since the felling of the towers is the most hazardous activity with respect to worker safety. Six options related to either dismantling or demolition have been considered and are summarized in Table 2.2. This evaluation is similar to that undertaken for the selection of the overall preferred option, and again considers safety, environment, cost and program for each option. However, in this case, safety has been further subdivided into three factors:

- Working at heights;
- Hazards from the falling towers; and
- Lifting hazards and dropped loads.

Dismantling options (Options 4, 5 and 6) are labour intensive, which means that workers would be working at heights for most of the time. Dismantling would also require a large number of lifts by mobile cranes. However, because smaller amounts of noise and dust are generated and the opportunities for recycling may be greater, dismantling may be slightly preferred from an environmental viewpoint. Nevertheless, it should be pointed out that noise and dust impacts would likely be confined within the Bruce nuclear site and on balance, as Table 2.2 indicates, demolition (Options 1, 2, and 3) was considered preferable to dismantling.

The previous demolition of E1, E2, E3 and E8 was successfully carried out using standard demolition techniques (felling the large structures and cutting them up on the ground-Option 3) and OPG has gained considerable experience in this area. This experience has shown that the enriching towers can be demolished without harm to workers, the public or the environment.

TABLE 2.2
COMPARISON OF THE DECOMMISSIONING OPTIONS FOR THE ENRICHING UNIT TOWERS

No	Option	Description	Working at heights (Weighting=8)			Falling, missile hazards (Weighting=8)			Lifting, dropped load hazards (Weighting=8)			Environment (Weighting=7)			Cost (Weighting=6)			Program (Weighting=6)			Total	
				M	WM		M	WM		M	WM		M	WM		M	WM		M	WM	M	WM
1	Cut at base and topple individually	Remove pipework, walkways etc. Make cutout in direction of fall, cut at back until tower topples onto berm	Working at heights to remove pipework & walkways.	8	64	Falling tower creates missiles. Tower falls in wrong direction.	7	56	Pipework & walkways dropped or lowered to ground.	8	64	Noise, vibration and dust.	7	49	More expensive than option 3.	7	42	2-3 months to strip pipework & walkways	7	42	37	317
2	Explosive charge at base & topple individually	Remove pipework, walkways etc. Charge arranged to cut base so that tower topples in required direction.	Working at heights to remove pipework & walkways.	8	64	Explosion & falling tower creates missiles. Tower falls in wrong direction.	4	32	Pipework & walkways dropped or lowered to ground.	8	64	Noise, vibration and dust.	7	49	As option 2	7	42	2-3 months to strip pipework & walkways	7	42	37	293
3	Explosive charge at base & topple together	Charge arranged to cut base so that all the towers topple in required direction onto berm. Pipework & walkways remain connected.	Little	10	80	Explosion & falling tower creates missiles. Towers fall/twist in wrong direction.	1	8	Little	10	80	Noise, vibration and dust – highest level, shortest duration	5	35	Cheapest solution	10	60	Shortest program	10	60	45	323

TABLE 2.2 (Continued)
COMPARISON OF THE DECOMMISSIONING OPTIONS FOR THE ENRICHING UNIT TOWERS

			Working at heights (Weighting=8)			Falling, missile hazards (Weighting=8)			Lifting, dropped load hazards (Weighting=8)			Environment (Weighting=7)			Cost (Weighting=6)			Program (Weighting=6)			Total	
No	Option	Description		M	WM		M	WM		M	WM		M	WM		M	WM		M	WM	M	WM
4	Dismantle in large sections	Cut tower into large sections (say 10 m lengths) and lower to ground by crane.	Extensive working at heights.	5	40	Little	10	80	Large number of lifts. Loose items.	5	40	Little impact.	10	70	More labour intensive. Hire of crane.	5	30	Longer than options 1 & 2.	5	30	30	290
5	Dismantle in detail (for possible reuse)	Cut top of tower, progressively remove internals and reduce pressure vessel sides. Lower to ground by crane.	Continuous working at heights.	4	32	Little	10	80	Largest number of lifts.	4	32	Little impact.	10	70	More expensive than option 4	4	24	Longer than option 4	4	24	26	262
6	Lower complete tower by crane	Remove pipework, walkways etc. Detach at base and lower to ground by crane.	Working at heights to remove pipework & walkways.	7	56	Little	10	80	Difficult lift requiring very large crane. Possible base slip.	3	24	Little impact.	10	70	Less labour intensive. High cost of crane.	4	24	Shorter than option 4	6	36	30	290

M Mark (Score)

WM Weighted Mark

3.0 DESCRIPTION OF THE PROPOSED DECOMMISSIONING PROJECT

The information in this chapter is based largely on the DDP submitted by OPG in May 2002 (OPG, 2002). The main parts of this chapter include a description of the existing facility (section 3.1), roles and responsibilities (section 3.2), a description of the physical works and activities that will be undertaken during the course of the decommissioning project (section 3.3), compliance programs (section 3.4), decommissioning schedule (section 3.5) and the planned project end state (section 3.6).

3.1 Current Status of the Site

The major structures of the BHWP consist of large cylindrical towers (groups of large pressure vessels) as high as 87 m, situated on large concrete pads. Adjacent to, and encircling the towers, are a number of ancillary support facilities including overhead pipe racks. There are also a number of buildings, generally located near the BHWP site perimeter. These one or two storey buildings are constructed of cinder block and brick.

Some of the older components of the facility were mothballed in the early 1980s and were demolished in the 1990s with only concrete support piers and/or slab foundations remaining. The underground components (i.e. piping and wiring) remain intact.

Figure 3.1 provides an aerial view of the site showing the existing BHWP facilities. The facilities can be divided into three groups:

- structures, such as the enrichment and degassing towers and pipe racks;
- buildings ranging in size from large buildings (e.g. Operations Building Common Services) to small MISA huts; and
- site services, such as the process effluent lagoons.

These groups of facilities are discussed in more detail in the following sections.

3.1.1 Structures and Buildings

The majority of the buildings and structures within the licensed area are currently shut down, and have been "tied out" from the site services by the physical cutting of the piping and wires. These buildings and structures are listed below and shown in the numbered photographs which follow.

- E4 (photo 1) and E7;
- North Flare Area (photo 2);
- H_2S Storage Area (photo 3);
- Acid & Caustic Storage Area (photo 4);
- Operations Building Common Services, Clarifier Building & Plant D Filter Building (photo 5);
- Degasser Towers for Plants B (photo 6) and D;
- Chlorination Building (photo 7);
- Propane Storage Area (photo 8);
- Nitrogen Production Area (photo 9);
- Condensate Area (photo 10); and
- Process Effluent / Process Feed Water Heat Exchangers (photo 11).

Photo 1 – E4

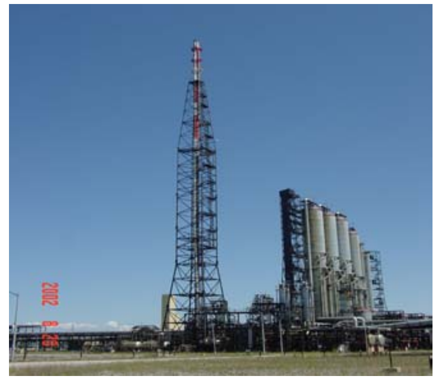


Photo 2 – North Flare Area


Photo 3 – H_2S Storage Area

Photo 4 – Acid & Caustic Storage Area

Photo 5 – Operations Building Common Services Clarifier Building & Plant D Filter Building

Photo 6 – Plant B Degasser Tower

Photo 7 – Chlorination Building


Photo 8 – Propane Storage Area

Fig 3.1 11x8.5 CDR

AERIAL VIEW OF BRUCE HEAVY WATER PLANT

FIGURE 3.1

Date September 2002

SENES 33315

ONTARIO POWER GENERATION

Photo 9 – Nitrogen Production Area

Photo 10 – Condensate Area

Photo 11 - Process Effluent/Process Feed Water Heat Exchangers

A few buildings and structures are still in routine use and will remain in use as part of the end state of the site. These include:

- Operations Buildings B (including F2) & Operations Building D (including F4);
- Common Services Laboratory Building;
- North Forebay;
- Process Feed Water Pump House; Firewater Pump House;
- Plant B & D Main Electrical Substations; and
- Common Services Electrical Substation.

In addition, several other buildings, including the Cooling Water Pump House and the Lift & Tempering Water Pump House are being maintained, although they are not currently in use.

Electrical Substation

Laboratory

3.1.2 Site Services

Site services consist of those secondary facilities that provided support to the operation of the BHWP. Details of these services are provided below.

- **Surface Water Treatment Facility (SWTF):** The Surface Water Treatment Facility is located at the northwest corner of the BHWP facility. The SWTF was constructed in the early 1990s to treat surface runoff water and discharges from the BHWP, primarily to remove iron. The facility is triangular in shape, consisting of three interconnected lagoons with provision for wastewater process control during operation of the BHWP. The SWTF consists of a 900 m^3 inlet chamber on the north side, an 8000 m^3 dirty cell on the east side, and a 4000 m^3 clean cell at the west end. The facility was designed to hold 6500 m^3 of equipment drainage and 5500 m^3 of maximum expected rainfall of 7.6 cm during a two-week period (i.e. a return period of 30 years). Clean effluents are discharged at the south end of the clean cell via the North Flare stormwater effluent stream to Lake Huron.

Since the BHWP is no longer operational, only stormwater is currently being routed to the SWTF.

The SWTF is operated under a Certificate of Approval (C of A) from the MOE. To comply with the C of A requirement, OPG has recently submitted iron monitoring results to the MOE. The monitoring data indicate that iron levels in the SWTF discharge do not exceed the C of A annual limit of 0.3 mg/L. OPG expects this condition will continue. The facility will continue to comply with MISA requirements for stormwater control.

The SWTF is to remain in operation to collect stormwater during the demolition of the enriching units and the major structures, but will be demolished at the end of the Decommissioning Project.

- **Process Effluent Lagoons:** There are two process effluent lagoons, each with a capacity of 12,000 m^3, located at the west side of the BHWP just south of the SWTF. These lagoons were designed as a hold-up facility for occasional sour effluent from the BHWP during the plant operation.

Under normal conditions, process effluent from the enriching units would flow directly to the outfall channel, bypassing the lagoons which would normally remain in an empty, standby state. The effluent water from each enriching unit was monitored continuously for hydrogen sulphide (H_2S) concentration. If the H_2S concentration exceeded the BHWP control standard, the process effluent was automatically diverted to the lagoons. The lagoons could accept the full effluent flow from one plant (two enriching units) for 6 to 7 hours.

The lagoons could be drained, under controlled conditions, to the outfall. The flowrate would depend on the H_2S concentrations in the lagoons.

After the shutdown of the BHWP, all systems were "sweetened" (i.e. H_2S removed) and drained. The drain valves remain open to prevent any accumulation of water from condensation of air in the systems. All vessels and equipment associated with these systems were confirmed to be neutralized. There have been no process effluents discharged to the lagoons since 1999.

- **Sludge Lagoons:** This lagoon complex was constructed in the 1970s in the form of two holding cells, located near the lakeshore west of the South Flare Area. The lagoons were lined to prevent transfer of water to groundwater and the lake, and the berms were topped with asphalt to prevent erosion. The lagoons are no longer in use.

During operation of Plant A, the enriching unit towers were flushed out as part of the annual maintenance outage activities. The flushing process created an iron/sulphide/water mixture which was transferred to the sludge lagoons. Over a period of time the sludge settled out and collected at the bottom of the lagoon. Liquid was removed from the lagoons and treated at the SWTF before being released to the lake. The sludge was then removed from the lagoons and disposed of at the on-site landfill site, as approved by the MOE.

After the shutdown of Plant A, the sludge lagoons were used temporarily to store any iron sulphide that was removed from process vessels during ongoing BHWP maintenance. As the lagoons are no longer in use, the only liquid entering them now is precipitation.

- **Piping and wiring**: Reconfiguration of the electrical distribution system and the other site utility systems, as well as their tie-out from the systems that are scheduled for demolition, was completed in 2001. The tie-outs included physically severing pipes, cables and overhead pipe racks.

- **Roadways:** All existing roadways have been maintained and currently remain in use.

- **Steam Boilers:** At different times in its history, steam for the BHWP was supplied from the Douglas Point Nuclear Generating Station, Bruce A and oil-fired boilers at the Bruce Steam Plant. The Bruce Steam Plant was the sole source of steam after heavy water production ceased in 1997.

In light of the reduced demand for steam following the shutdown of BHWP, OPG replaced the old Steam Plant with a new facility. Three new package boilers were installed in the New Steam Plant in 1999. These were placed in-service in the first quarter of 2000. Reconfiguration of the steam system was carried out in 1999 to accommodate various demolition and construction activities. This process involved the tie-out of old steam lines and the construction of new lines to feed the buildings and structures that will remain in service.

3.1.3 Substances Remaining On Site

3.1.3.1 Inventory of Nuclear Substances

No radioactive materials were used as source material for the production of heavy water. OPG's inventory of heavy water is currently stored in the Heavy Water Storage Areas of both F2 (attached to Operations Building B, #528) and F4 (attached to Operations Building D #573).

A small quantity (234 grams) of uranium metal foil is used in one of the Infrared Absorption Analyzers located in the Laboratory in the Common Services Area. In addition, approximately 2 kg of waste uranium metal foil is currently stored in the laboratory.

Sealed sources containing high-energy gamma emitting radionuclides were used in industrial radiography. These sources were stored in the Radiography Hut located just west of F1 (outside the currently licensed area). All radiography sources have been removed from the site. Some sealed sources were used in equipment on the site such as the level switches on the H_2S Storage Tanks. These have also been removed from the site. All sealed sources were leak tested as required by AECB/CNSC Regulations. There is no record of any leakage of radioactive material from a sealed source.

3.1.3.2 Inventory of Chemical Substances

OPG has already disposed of all of the H_2S on site by controlled flaring. Approval to perform this work was granted by the AECB and the MOE. All other chemicals associated with the production of heavy water have been disposed of; chemicals remaining on site are used in the current operation of facilities such as the new steam plant. Table 3.1 identifies the chemicals still in use on the BHWP site and lists the locations where they are known to be used.

TABLE 3.1
CHEMICALS REMAINING IN USE ON THE BHWP SITE

Chemical	Use	System	Building
Sodium Hypochlorite	Chlorination of water	Bruce Energy Center Water Supply	Process Water Pump
Sodium Hypochlorite	Chlorination of water	New Steam Plant Process Water	Firewater Pump Hose
Oils and greases	Lubrication	Numerous systems	All
Transformer Oils (with <50 ppm PCB content)	Transformer insulation and Cooling	Electrical distribution	Common Services Substations (outside) F2 Substation (outside) F4 Substation (outside)

3.2 Roles and Responsibilities

3.2.1 OPG

The overall responsibility for carrying out the decommissioning program lies with OPG as owner of the project. In general OPG will:

- hold and manage the Decommissioning Licence;
- ensure the work is performed in accordance with the DDP and applicable federal and provincial regulations;
- oversee the on-site activities of the General Decommissioning Contractor (GDC);
- audit compliance with the Environment, Health & Safety (EH&S) Management Plan;
- carry out environmental monitoring, including radiological sampling and associated work;
- review and accept the drawings, diagrams and procedures for the demolition of the enriching unit towers and other tall structures;
- prepare the Final Decommissioning Report and the application for the Licence to Abandon; and
- fund the project.

3.2.2 General Decommissioning Contractor

Following completion of the EA and assuming a Licence to Decommission is received from the CNSC, designated areas within the BHWP known as Construction Islands will be turned over to the control of the GDC who will carry out the planned demolition and other decommissioning work within those areas. The GDC will be responsible for all aspects of the decommissioning including the securing of permits, ensuring that the appropriate sampling is carried out, carrying out the demolition itself, remediating the site and generally executing the DDP. The work of the GDC will include:

Structures

- hazardous materials surveys of structures and task safety analyses;
- development of detailed demolition procedures;
- installation of berms associated with the felling of the first and second stage enriching unit towers;
- felling of the enrichment towers;
- cutting up of the felled material;
- removal of any berms;
- clean up of the site;
- grading of the site;

Buildings

- conducting a hazardous materials survey of the buildings;
- removal of any identified hazardous materials;
- demolition of the buildings using standard demolition techniques;
- removal of the debris from the site for recycling or disposal as appropriate;

Site Services

- checking the process effluent, sludge and SWTF lagoons for contaminants;
- removal of material exceeding MOE guidelines for contaminated sites for disposal in MOE licensed hazardous waste disposal sites;
- filling of the lagoons with their dyke wall material or other clean fill;

Remediation

- remediating soil and water contamination resulting from past activities to the criteria established by the MOE; and,
- remediating each area of the site following the demolition of facilities.

3.3 Project Works and Activities

3.3.1 Set-up and Preparation

Prior to the commencement of the decommissioning, the following activities must be undertaken by OPG and the GDC:

- register the project with the Ministry of Labour;
- obtain all permits and licences;

- prepare the EH&S Plan including safety training for workers and emergency preparedness procedures;
- prepare structural and condition surveys of the main structures and buildings to identify any repairs or refurbishment, restraining or guarding necessary to enable safe access to the BHWP for decommissioning work;
- carry out any remedial and maintenance work identified by the surveys to ensure personnel safety on the plant.

3.3.2 Demolition Methods

In general, the demolition methods to be employed are expected to be the same as those used during the previous demolition stages at the BHWP. The GDC will be required to produce detailed plans and procedures for acceptance by OPG before commencing work. These detailed plans and procedures will be available to the CNSC upon request. In addition, hazardous materials surveys and task safety analyses will be completed. It is proposed that presentations will be made to the Site CNSC Project Officer prior to the major demolition activities, as was done during the previous demolition projects.

3.3.3 Decommissioning of Structures

The main structures on site are the enriching units, the flare stack and H_2S recovery systems, the pipe racks, the H_2S storage area, the common services facilities and other smaller facilities such as the Acid and Caustic Rail Unloading Facility, the Nitrogen Unit, the Propane Storage Area (all located between 4th and 5th Avenues) and the oil storage tanks (located to the west of Steam Transformer Plant (STP) 'O'). These structures generally comprise towers, vessels, structural steelwork, walkways, pipe racks, valves and electric cabling. A list of structures that are to be demolished is given in Table 3.2. Demolition and removal of the structures will involve:

- isolating the structure from all services and connections;
- removing any remaining hazardous material (e.g. acid, caustic, asbestos, lead, PCBs);
- demolishing the structure safely in accordance with an accepted procedure and risk assessment; and
- disposing of all materials as scrap or waste.

To avoid the need to keep the above-ground electrical circuits alive, electrical power required for the demolition work could be provided by portable generators.

Felling of Towers

The felling of the enriching unit towers is likely to be carried out using an approach similar to the felling of a tree and similar to that carried out for the felling of E3 in 1995. The work involves three steps:

- building berms where the towers will fall to dissipate the energy of impact of the felling of the towers; this approach will be used to protect underground services and nearby electrical switchgear;
- cutting a V-shaped section at the base of the tower on the side where the tower will fall, using a small controlled charge; and,
- progressively cutting the tower base until the tower itself falls.

TABLE 3.2
STRUCTURES THAT WILL BE DEMOLISHED DURING THE BHWP DECOMMISSIONING PROJECT

a) Structures Within the Area Regulated Under the Heavy Water Plant Operating Licence and the Heavy Water Plant D Construction Approval

Name	Location[1]
Structures	
North Flare Area & H_2S Recovery	NW Corner of Seventh Ave. & Second St.
East & West Process Effluent Lagoons	North & west of Seventh Ave.
Acid & Caustic Storage Area	SW corner of Seventh Ave. & Second St.
Plant B Degassing Towers	Between Sixth & Seventh Ave., west of Second St.
Plant D Degassing Towers	Between Sixth & Seventh Ave., west of Second St.
Condensate Area	North side of Sixth Ave, south of Operations Building Common Services (901)
Process Effluent / Feed Water Heat Exchangers	North side of Sixth Ave., south of Clarifier Building (901)
Nitrogen Unit	Between Fourth & Fifth Ave., First & Second St.
Propane Storage Area	Between Fourth & Fifth Ave., First & Second St.
Acid & Caustic Rail Unloading	North of Fourth Ave. & west of First St., west of Chlorine Building (404)
Enriching Unit E4	Between Third & Fourth Ave., Second & Third St.
H_2S Storage Area	West side of First St., south of Fourth Ave.
Enriching Unit E7	Between Seventh & Eighth Ave., Second & Third St.
Pipe Racks	
Main N/S pipe rack	East side of Second St. , west of E4, E7 & E8
E/W pipe rack to E4	Connects main N/S pipe rack to E4
E/W pipe rack to E7	Connects main N/S pipe rack to E7
H_2S Storage Area pipe rack	
E/W pipe rack, north of E2	Along Fourth Ave.
E/W pipe rack, north of E4	Along Fourth Ave.
Acid & Caustic Rail Unloading pipe rack	
Lab pipe rack	E/W into Common Services Laboratory (406)
Cooling Water Pump House Recirculation Lines	Between Cooling Water Pump House (401) and Supply & Return Channel
E/W pipe rack, south of Operations Building Common Services (901)	
Degassing Area pipe rack	North of Operations Building Common Services (901)
E/W pipe rack, North Flare Area	

TABLE 3.2 (Continued)

b) Structures Outside of the Licensed Areas but Within the Scope of the BHWP Decommissioning Project

	Name	Location[1]
	Structures	
*	Oil Storage Area	SW part of BHWP Facility, west of Steam Transformer Plant ‘O’
	Pipe Racks	
*	N/S pipe rack	East side of First St., west of Drum Filling Building (506)
*	Main N/S pipe rack	East side of Second St., west of E3
	E/W pipe rack, north of E8	

* An asterisk indicates that a structure or pipe rack is wholly or partly within the Exclusion Zone of Bruce B.

[1] Locations are indicated on Figure 4.2 (Site Study Area).

3.3.4 Decommissioning of Buildings

Several buildings within the facility are redundant and will be decommissioned with the BHWP. The largest building is Operations Building Common Services, which is a three-storey building and has attached the buildings housing the Plant B Clarifier and the Plant D Filters. Smaller buildings include the seven electrical substations and a collection of minor buildings, huts and enclosures, which are single storey structures.

The buildings will be demolished using conventional techniques approved by OPG. Factors such as noise and dust levels will be considered. Steps involved in the decommissioning include:

- confirming the tie-outs of all services and connections. Power and lighting may be required for the dismantling work and could be provided by portable generators;
- confirming that the building is free of hazardous materials and chemical contamination;
- decontaminating or removing identified material and cleaning out sumps and drains;
- removing all remaining plant and equipment and disconnecting all services from the building;
- removing furniture, fixtures, fittings, etc. that could be reused;
- demolishing the building using conventional demolition techniques; these are likely to require the use of heavy equipment such as cranes and wrecking balls, bulldozers and excavators;

- separating out steel, electrical cables and other materials that can be recycled and removing them from the site;

- Size-reducing the building rubble for reuse on site to fill excavations or remove for disposal;
- Clearing the building structure to grade level but leaving building foundations; and
- Filling any remaining excavations.

A list of buildings that are to be demolished is presented in Table 3.3.

TABLE 3.3
BUILDINGS THAT WILL BE DEMOLISHED DURING THE BHWP DECOMMISSIONING PROJECT

a) Buildings Within the Area Regulated Under the Heavy Water Plant Operating Licence and the Heavy Water Plant D Construction Approval

Building Number		Name	Location[1]
404		Chlorine Building	NW Corner of Fourth Ave. & First St.
410		BHWP Common Services Turnstile Enclosure	South side of Sixth Ave., east of Second St.
411		Nitrogen Building	Between Fourth & Fifth Ave., First & Second St.
412		Outfall Analyzer Building	South side of BHWP Outfall Channel
415		Lagoon Electrical Substation	South end of Process Effluent Lagoon
416		Lagoon Aerator Blower Building	South end of Process Effluent Lagoon
526		Electrical Substation – E4	SE Corner of Fourth Ave. & Second St.
530		Antifoam Building – E4	NE Corner of Third Ave. & Second St.
531		Plant B Entry Control Point	NW Corner of Third Ave. & Fourth St.
575		Electrical Substation – E7	SE Corner of Eighth Ave. & Second St.
579		Antifoam Building – E7	NE Corner of Seventh Ave. & Second St.
580		Antifoam Building – E8	NE Corner of Eighth Ave. & Second St.
901		Operations Building Common Services	NE corner of Sixth Ave. & Second St.
901		Clarifier Building	North side of Sixth Ave., adjoined to Operations Building Common Services (901)
901		Plant D Filter Building	North side of Sixth Ave., adjoined to Clarifier Building (901)
902		H_2S Control Building	West side of First St., in H_2S Storage Area
-		MISA Hut – Process Effluent	Between Fifth & Sixth Ave., west of Second St.
-		MISA Hut – Process Effluent	Between Fifth & Sixth Ave., west of Second St.
-		MISA Hut – North Flare Outlet	North of Seventh Ave., west of Second St.
-		MISA Hut – Surface Water Treatment Facility	North of Seventh Ave., west of Second St.
-		Sample Hut – Plant B Degasser	Between Sixth & Seventh Ave., west of Second St.
-		Sample Hut – Plant D Degasser	Between Sixth & Seventh Ave., west of Second St.
-		Safety Shower – Acid & Caustic Area	SW Corner of Seventh Ave. & Second St.

TABLE 3.3 (Continued)

b) Buildings Outside of the Licensed Areas but Within the Scope of the BHWP Decommissioning Project

Building Number		Name	Location[1]
502A	*	Electrical Substation – E1	SE Corner of Third Ave. & First St.
502B		Electrical Substation – E2	SE Corner of Fourth Ave. & First St.
507	*	Utilities Electrical Substation	West side of First St. at Second Ave.
518	*	Radiography Source Storage Hut	SE Corner of Second Ave. & First St.
529	*	Antifoam Building – E3	East side of Second St., north of Second Ave.

* An asterisk indicates that a building is wholly or partly within the Exclusion Zone of Bruce B.

[1] Locations are indicated on Figure 4.2 (Site Study Area).

3.3.5 Decommissioning of Site Services

3.3.5.1 Services and Tie-outs

Surveys will be conducted to confirm that the various service structures and buildings are isolated and highlight any remaining tie-outs to be undertaken before or during the decommissioning (some facilities such as the SWTF will remain active until the latter phases of decommissioning). A program of remaining tie-outs will be carried out. All active services will be clearly marked to prevent inadvertent disconnection or severance. Some services that are to remain available after completion of this decommissioning stage may have to be protected, temporarily shut down and/or re-routed when demolition activities are in close proximity.

3.3.5.2 Surface Water Treatment Facility

The SWTF may be contaminated with seal, lube and insulating oils; methyldiethanolamine (DEA/MDEA); sulphuric acid; sodium hydroxide; and, iron, manganese, phosphorus, and sulphur from rusted steel. Some discolouration and algae growth is evident and there may be some contamination of the water content or the ground at the base of the cells. The decommissioning of this facility therefore involves:

- sampling the contents of each cell to determine if they are within the limits established by the applicable regulations;
- if the contents of the cells are within regulatory limits, draining and discharging onto the flood plain where it will eventually drain into Lake Huron;
- if the water is not within regulatory limits, preparing procedures to treat the water before discharge or removing it for disposal;

- isolating all services to the facility and removing all plant and equipment;
- collecting and analyzing samples of the sediment and other material from the cell beds and surrounding land (a portion of each sample will be submitted for radiological analysis);
- removing any contaminated material from the cell bed, or surrounding land for disposal at an appropriate waste management facility; and
- filling in the cells and any excavations using clean fill material from off-site or clean rubble recovered from the demolition of site buildings.

3.3.5.3 Process Effluent and Sludge Lagoons

Four lagoons are present on the site and are to be decommissioned. These include:

- two process effluent lagoons; and
- two sludge lagoons.

The process effluent lagoons have previously been drained and are isolated from the process systems; however, the lagoons contain some rain water, as do the sludge lagoons. Both lagoon systems may contain contaminants similar to those in the SWTF. The lagoons will be decommissioned following a similar sequence to that for the SWTF described above. The decommissioning process involves:

- sampling the contents to determine if they meet appropriate water quality criteria;
- if the contents are within regulatory limits, draining the sludge lagoons and discharging the contents onto the flood plain where they will eventually drain into Lake Huron;
- if the samples indicate that the appropriate water quality criteria are not met, preparing procedures to treat the water before discharge or removal for disposal;
- isolating all services to the lagoons and removing all plant and equipment;
- collecting and analyzing samples of the sediment and other material from the lagoon beds and surrounding land. Although the lagoons have never been used to hold water contaminated with radioactive materials, a portion of each sample will be analyzed for radionuclides;

- removing any contaminated material from the lagoon beds or surrounding land for disposal at an appropriate waste management facility; and
- filling in the lagoons and any excavations using clean fill material from off-site or clean rubble recovered from the demolition of site buildings.

A list of site services that are to be demolished is provided in Table 3.4.

TABLE 3.4

SITE SERVICES THAT WILL BE DEMOLISHED DURING THE BHWP DECOMMISSIONING PROJECT

a) Site Services Within the Area Regulated Under the Heavy Water Plant Operating Licence and the Heavy Water Plant D Construction Approval

Name	Location[1]
Surface Water Treatment Facility	SW Corner of Ninth Ave. & Second St.
East & West Process Effluent Lagoons	North & west of Seventh Ave.

b) Site Services Outside of the Licensed Areas but Within the Scope of the BHWP Decommissioning Project

	Name	Location[1]
*	North End Sludge Lagoon	West side of BHWP Facility, near lakeshore

* Wholly or partly within Exclusion Zone of Bruce B.

[1] Locations are indicated on Figure 4.2 (Site Study Area).

3.3.6 Land Remediation

Land remediation comprises two parts: removal of demolition debris and clean-up of contaminated soil. It will proceed following the decommissioning of individual structures and buildings and as a single campaign when demolition work in all areas and post-demolition monitoring have been completed. Remediation involves:

- removing any remaining scrap, waste materials and rubble from the site;
- carrying out post-demolition monitoring that is necessary to determine the potential presence of contamination and to accurately determine the extent of the contaminated areas. As recommended by Environment Canada, *Canada-wide Standards for Petroleum Hydrocarbons in Soil* and the *Canadian Environmental Quality Guidelines* (CCME, 1999) will be used for guidance in the monitoring program;
- removing any contaminated material until operational surveys confirm that all soil that exceeds the guidelines established in Table B of the MOE Guideline for Use at Contaminated Sites in Ontario (industrial land use, non-potable groundwater condition) (MOE, 1997) has been removed; and
- restoring the surface of the site by removing obstacles, filling excavations and holes using clean fill material from off-site or clean rubble from the demolition of site buildings.

3.3.7 Waste Management

Solid wastes generated during the course of the BHWP Decommissioning Project will be divided into the following categories:

- radioactive wastes (if any);
- hazardous wastes (including contaminated soil and refrigerants);
- recyclable or reusable materials; and
- demolition wastes.

A flow chart summarizing the waste management process is presented in Figure 3.2. In addition to the solid wastes, there will be wastewater (from the decommissioning of the SWTF, the sludge lagoons, and the process effluent lagoons) and waste gases (during the decommissioning of the HVAC systems).

3.3.7.1 Radioactive Waste

The BHWP currently meets all regulatory criteria for radioactive contamination, and thus routine monitoring of wastes will not be required. However, to provide assurance that no inadvertent radioactive material is being permitted to leave the BHWP site, all decommissioning project vehicles, including those carrying waste and materials destined for recycling or reuse, will be required to pass through vehicle radiation monitors operated by Bruce Power before they leave the Bruce nuclear site. It is not anticipated that any radioactive wastes will be found during the course of the BHWP Decommissioning Project. Nevertheless, if any is found, it will be packaged and transported according to the requirements set out in the *Packaging and Transport of Nuclear Substances Regulations* and the *Transportation of Dangerous Goods Regulations* to OPG's Western Waste Management Facility for further processing (if appropriate) and storage pending eventual disposal in a licensed disposal facility.

3.3.7.2 Subject (Hazardous) Waste

Wastes will be assessed to determine if they are subject wastes (hazardous wastes or liquid industrial wastes) as defined in the MOE *Waste Management – General Regulations* (O. Reg. 347). Hazardous waste will be characterized according to the requirements set out in the Regulations. It is expected that a variety of subject wastes will be generated during the course of the decommissioning project. A complete list of the potentially hazardous chemicals remaining at the BHWP Facility is given in the DDP. The principal hazardous wastes involved are described in Table 3.5.

Hazardous wastes will be transported in accordance with the requirements set out in the *Ontario Waste Management – General, the Dangerous Goods Transportation Regulations,* which reference the federal *Transportation of Dangerous Goods Regulations* and other applicable federal and provincial regulations. In addition to the regulations, municipal by-laws pertaining to the transportation, recycling and disposal of wastes will be observed. Waste Manifests will be prepared for each shipment and distributed as required by the Regulations.

FIGURE 3.2
SOLID WASTE MANAGEMENT AT THE BHWP DECOMMISSIONING PROJECT

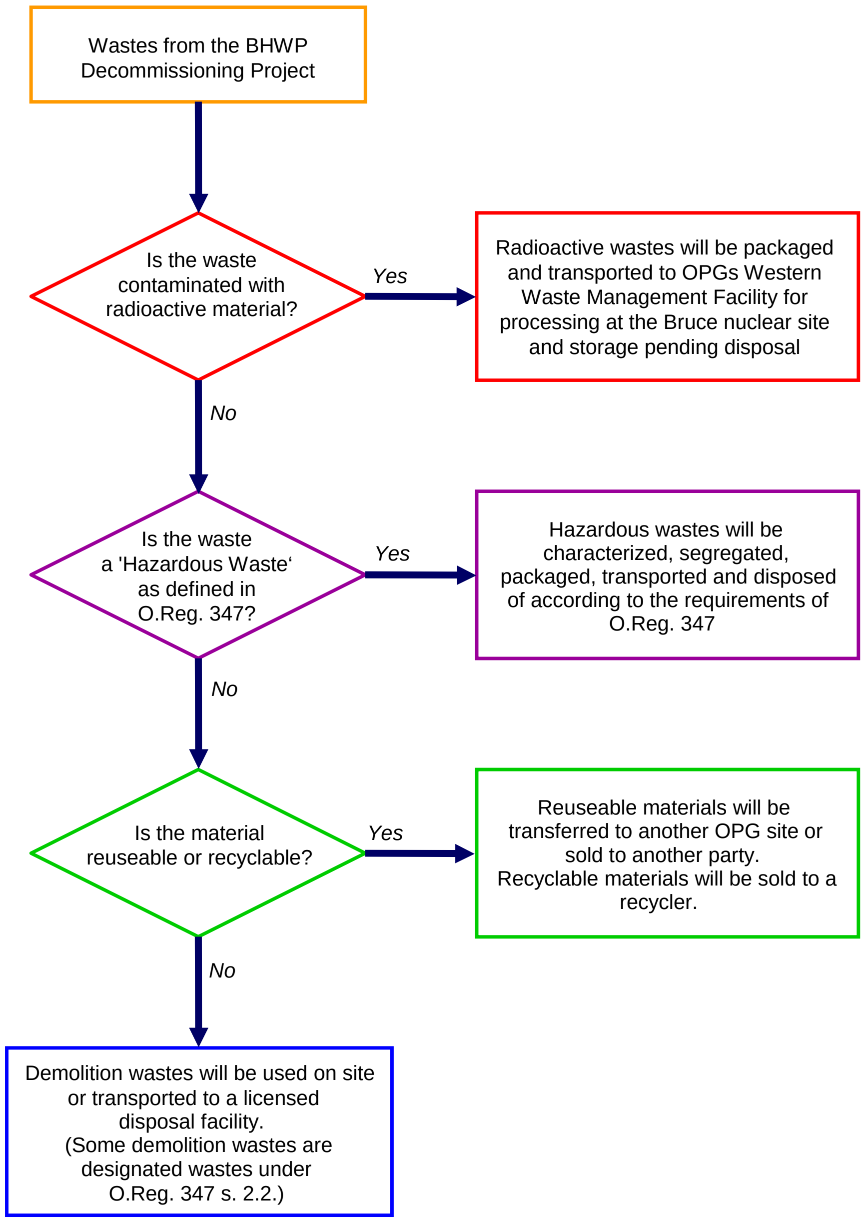


TABLE 3.5
PRINCIPAL HAZARDOUS WASTES

Waste	Source	Action	Applicable Regulation
Mercury	thermostats and fluorescent and High Intensity Discharge (HID) lamps	Recycling	Regulation Respecting Mercury, R.R.O. 1990, Reg.844 as amended to O. Reg. 520/92
Asbestos	floor tiles, ceiling tiles, older blown insulation	Removal/Disposal	Regulation Respecting Asbestos on Construction Projects and in Buildings and Repair Operations, R.R.O 1990 O. Reg. 838 as amended to O. Reg. 510/92
Lead	Soldering compounds and lead-based paints	Removal/Disposal	Regulation Respecting Lead, R.R.O. 1990, Reg. 843 as amended to O. Reg. 519/92
PCBs	Transformers (most have been removed), fluorescent and HID light fixture ballasts	Placed in suitable storage containers and removed	Waste Management – PCB, R.R.O. 1990, Reg. 362
Refrigerants	Air conditioning units	Removed by licenced personnel and reused, recycled or disposed of	Refrigerants, O. Reg. 189/94 as amended to O. Reg. 238/01 Federal Halocarbon Regulations, (SOR/99-255), June 17, 1999 Ozone-depleting Substances Regulations, (SOR/99-7), December 16, 1998
Sludge and Soil	Lagoons and other contaminated areas	Used as backfill, or if standards not met, disposed of according to O. Reg. 347.	Waste Management – General, R.R.O. 1990, Reg. 347 as amended to O. Reg. 460/99 and others listed therein
Waste Oil	Various	Burned on site in the Bruce Steam Plant Boilers	Applicable Certificates of Approval
Batteries	Various	Recycled at an approved facility	
Other Subject Wastes	Hazardous wastes and industrial liquid wastes	Manifested and transported off site by a registered carrier to an approved waste disposal site, to a recycling facility, or, if appropriate to the Bruce nuclear site landfill.	O. Reg 347

3.3.7.3 Recyclable & Reusable Materials

Any material that is not a subject waste as defined by O. Reg. 347 will be assessed to determine if it is suitable for reuse or recycling. Some of the materials that are suitable for recycling (e.g. steel) may be designated as wastes under Section 2.2 of the Regulations. If so, these materials will be handled in compliance with those Regulations.

Some materials from the demolition of the buildings, structures and pipe racks on the site may be recyclable. Metals such as stainless steel, carbon steel and aluminum are the most likely to be recycled. The Enriching Units are likely to be the largest single source of recyclable materials. Some of the waste concrete may be broken up and used during the remediation of the site to backfill the lagoons and other excavations. Materials that are designated for recycling will be transported from the site to a licensed recycling facility.

3.3.7.4 Demolition Waste

Any material that is not a subject waste as defined by O. Reg. 347 and is not suitable for reuse or recycling will be considered to be demolition waste. Some of the demolition waste may be designated waste under Section 2.2 of the Regulations and will be handled in compliance with those Regulations.

3.3.7.5 Solid Waste Volumes

The quantities of waste produced in the previous demolition of E3 and E8 are shown in Table 3.6. The total weight was approximately 28,500 mg (tonnes).

TABLE 3.6
SUMMARY OF THE WASTES PRODUCED DURING THE PREVIOUS DEMOLITION OF ENRICHING UNITS NOS. 3 AND 8 (Mg)

Material	Enriching Unit No. 3	Enriching Unit No. 8	Total
Carbon Steel	12,350	10,670	23,020
Stainless Steel	2,110	1,780	3,890
Aluminum	40	5	45
Electrical Cable	-	8	8
Electrical & Mechanical Equipment	340	260	600
Insulation & Garbage	740	60	800
Asbestos	1.6	-	1.6
Mixed Wastes	170	-	170
TOTAL			**28,530**

For the current decommissioning project, the two remaining enrichment units (E4 and E7) and other associated structures are expected to produce scrap metals as shown in Table 3.7. This table also shows demolition waste from building structures. In addition, there will be approximately 2,500 tonnes of fibreglass insulation, 6 tonnes of asbestos-contaminated waste, 250 tonnes of aluminum, 500 tonnes of electrical cable, and 600 tonnes of mixed waste generated from the demolition of buildings and services.

TABLE 3.7
SCRAP ESTIMATE FOR THE PROPOSED BHWP DECOMMISSIONING PROJECT (Mg)

	Carbon Steel	Stainless Steel	Construction & Demolition Waste	Total Weight
STRUCTURES				
Enriching Units (E4, E7)	24,790	4,030	-	28,820
Flare/H_2S Recovery Plant	350	-	-	350
Pipe Racks	1,480	-	-	1,480
H_2S Storage Area	260	-	-	260
Common Services Plant	230	-	-	230
Other Plant	40	-	-	40
TOTAL				**31,180**
BUILDINGS				
Common Services Building	-	-	60	60
Electrical Substations	-	-	10	10
Ancillary Buildings	-	-	5	5
TOTAL				**75**

3.3.7.6 Handling and Disposal of Wastewater

The only potential sources of wastewater are from the process systems or from any one of the lagoons that are to be decommissioned.

Wastewater in Process Systems

All vessels and equipment associated with process systems have been confirmed free of H_2S and the drain valves remain open to prevent any accumulation of water from condensation of air in the systems. Process systems containing residual acid or caustic were neutralized before being drained to the SWTF. The material in the SWTF is sampled and analyzed to ensure that it meets applicable regulatory requirements before it is drained to the flood plain and eventually to the lake. In the event that wastewater remains trapped in process equipment, it will be drained, analyzed and treated appropriately.

Wastewater in Process Effluent Lagoons

The process effluent lagoons were only used during operation under upset conditions (i.e. if and when process effluent exceeded 2 ppm H_2S). Prior to final draining, the material was sampled and analyzed. It was then drained at a controlled rate to ensure that the limits for the C of A were not exceeded. The lagoons remain isolated from all process systems. Any rainwater that has accumulated prior to final demolition will be sampled before the lagoons are drained. If necessary, it will be processed through the SWTF.

Wastewater in Sludge Lagoons

Prior to demolition, the water in the sludge lagoons will be analyzed. If it meets the Provincial Water Quality Objectives (PWQO), it will be drained to grade. With the long residence time of the wastewater in these lagoons, past experience has shown that the contents should meet the PWQO. In the event that it does not meet these requirements, the material will be pumped out to a tanker and disposed of in an appropriate manner. This material may be disposed of via the sewage plant on the Bruce nuclear site if it meets the criteria of the Model Sewage Bylaw and is not expected to have an adverse effect on the operation of sewage plant. If this is not possible, a certified waste disposal contractor will be used to remove the material.

Wastewater in the SWTF

This system is currently in operation and continues to collect stormwater from the site study area, except for the area covered by the original Plant A. The SWTF is to remain in operation during the demolition of the enriching units and the major structures and buildings. Prior to final draining, the contents will be analyzed to ensure that all regulatory requirements are met. This system was designed to handle large quantities of iron during tower steam outs. These operations have now ceased and it is expected that at its final disposition, the material in the SWTF will meet all applicable regulatory requirements.

In the worst case, there may be some delay in the final drainage until it has had sufficient residence time in the system.

3.3.7.7 Waste Gases

It is not expected that large quantities of waste gases will be generated during decommissioning.

3.3.8 Workforce

Total employment for the decommissioning work is estimated at up to 20 people. The final number will be determined by the GDC.

3.4 Compliance Programs

3.4.1 Radiation Protection and Safeguards

A Hazard Analysis undertaken by OPG and detailed in the DDP, has shown that workers engaged on the BHWP Decommissioning Project will be at no greater risk of exposure to ionizing radiation or radioactive contamination than workers employed on any other part of the public domain areas of the Bruce nuclear site. Accordingly workers employed on the BHWP Decommissioning Project will not be required to complete radiation protection training and will not be required to wear thermoluminescent dosimeters or participate in tritium bioassay programs. Contamination control procedures will not be necessary within the Construction Islands nor will contamination monitors be installed at the exits from the areas. Nevertheless, since the Bruce site is a nuclear site, prudence requires that certain actions be taken, such as the following:

- Training on the actions required in response to a site-wide emergency will be provided as part of the construction safety-training program. Decommissioning project workers will be required to comply with the radiation protection procedures established by Bruce Power for contractors working on projects in the Centre of Site areas.

- The drive-through vehicle radiation monitor operated by Bruce Power will be used to perform contamination surveys on:
  - all material being sent off site for reuse, recycling or disposal;
  - all heavy equipment used during the demolition or remediation of the BHWP; and
  - all contractor vehicles leaving the site.

  The monitoring will be performed according to established Bruce Power procedures.

- OPG may also conduct radioactive contamination surveys of the demolition equipment or the Construction Islands as part of routine contamination surveys that are occasionally performed on the Bruce nuclear site.

- OPG and Bruce Power personnel will be available throughout the course of the decommissioning to provide support in the event that radioactive material or radioactive contamination is discovered. In that event, decommissioning work in the contaminated areas will cease until qualified personnel from OPG or Bruce Power complete the necessary decontamination work and return control of the area to the GDC. In any such case, OPG will prepare a report describing the radioactive materials that were discovered, the actions taken following the discovery and the potential impacts on the health and safety of workers and the environment.

3.4.2 Health and Safety

3.4.2.1 General Requirements

All work on the BHWP Decommissioning Project will be conducted in accordance with the requirements set out in applicable occupational health and safety legislation, including:

- the *Occupational Health & Safety Act* and the regulations made pursuant to it including, but not limited to:
  - *the Regulations for Construction Projects;*
  - *the Asbestos on Construction Projects and in Buildings and Repair Operations Regulations;* and
  - *the Workplace Hazardous Materials Information System Regulations;*
- the *Workplace Safety & Insurance Act* and the regulations made pursuant to it;
- any other applicable federal or provincial statutes or regulations governing occupational health & safety.

The GDC will be responsible for ensuring the health & safety of any person working in, or visiting the Construction Islands. The GDC will also be responsible for ensuring that work within the Construction Islands does not present a hazard to those working in, or visiting, nearby areas and will be required to provide inspectors from the CNSC, the Ontario Ministry of Labour or other regulatory agencies with access to the Construction Islands. Finally, the GDC will also be required to comply with any order issued by the CNSC, the Ontario Ministry of Labour or other regulatory agencies.

The GDC will report any of the following events to the OPG within the period specified in any applicable regulations or the contract between OPG and the GDC:

- accidents, injuries, occupational illnesses, chemical spills, fires, floods or other significant events;
- work refusals;
- orders issued by regulatory agencies;
- inspections or audits performed by the GDC or the Joint Health & Safety Committee; and
- any unsafe conditions that are discovered during the course of the project.

OPG or the GDC shall report these events to the appropriate regulatory agencies as required by the applicable regulations, the terms and conditions of any applicable licence or permit and the terms and conditions of the contract between OPG and the GDC.

3.4.2.2 Environment, Health & Safety Management Plan

The GDC will prepare an Environment, Health & Safety (EH&S) Management Plan that will:

- describe the management systems intended to ensure that the work performed within the Construction Islands does not adversely affect the health, safety and security of workers, the public and the environment;
- describe the Internal Responsibility System as it will be implemented on the project;

- identify those members of the project staff with specific EH&S responsibilities and describe the responsibility, authority and accountability of each;
- identify the safety training required by workers engaged in various aspects of the work;
- describe the procedures used to identify, report and control hazards in the workplace;
- describe the procedures used to investigate accidents or injuries and eliminate the causes of those events;
- describe the procedures used to perform hazardous work;
- describe the procedures established to provide a safe work environment within the Construction Islands; and
- describe the procedures that will be implemented to prepare for any accident, fire, flood, spill or other emergency situation that might occur during the course of the work.

OPG will review the EH&S Management Plan prepared by the GDC who will not be permitted to begin work in any Construction Island until a plan acceptable to the OPG is in place. The GDC will be responsible for ensuring that all work in the Construction Islands, including work performed by subcontractors, is performed in accordance with the EH&S Management Plan.

3.4.2.3 Construction Safety

It is recognized that the demolition of the buildings, structures and pipe racks presents hazards to the safety of workers and visitors to the Construction Island. The GDC will be required to take all of the actions that are reasonably required to maintain a safe work environment within the Construction Islands, and must include Construction Safety procedures in the EH&S Management Plan. This may include procedures controlling:

- the distribution, use, maintenance and testing of personal protective equipment;
- work with power tools;
- work at heights and fall protection;
- work in confined spaces;
- work in inclement weather;
- hot work such as welding or cutting metals;
- asbestos removal;
- the operation and maintenance of heavy machinery;
- the operation of cranes and the lifting of heavy loads; and
- housekeeping.

OPG will be entitled to audit the GDC's compliance with the EH&S Management Plan. This may include inspecting the Construction Islands or observing work being performed. In the event that deficiencies are observed during the audits, OPG may issue corrective action notices to the GDC.

3.4.2.4 Chemical Safety

Four main steps to ensure safety in relation to chemicals that may still be on site will involve:

- OPG providing the GDC with information on all hazardous materials that have been used at the BHWP Facility. The information will include the identities of the materials, all Material Safety Data Sheets that are available, and the locations in which the hazardous materials were used or stored, as far as this is known. The GDC will assess the hazardous materials that might be encountered during the course of the work and prepare procedures to eliminate or control these hazards.

- providing all employees assigned to the BHWP Decommissioning Project with training on the Workplace Hazardous Materials Information System and the hazardous materials they may be expected to encounter during the course of their work.

- the GDC assigning qualified personnel, or retaining qualified subcontractors, to remove, package, transport and dispose of all hazardous materials.

- the GDC ensuring that its subcontractors provide employees with the personal protective equipment required for their protection, train the employees in its proper use and maintain this personal protective equipment in accordance with regulatory requirements, the manufacturer's recommendations or accepted practice.

3.4.2.5 Fire Safety

In accordance with accepted industry practice, the GDC will prepare and implement procedures intended to prevent, detect and respond to fires within the Construction Island. Additional assistance will be available from the Site Emergency Response Teams and other resources. In addition to the emergency preparedness and response procedures described in Section 3.4.3, the GDC will:

- provide for the safe storage and handling of flammable liquids and gases;
- minimize the quantity of combustible material stored within the Construction Islands as much as is practical;
- minimize or eliminate potential sources of ignition;
- implement the procedures and controls necessary to reduce the risk of fire during and after any hot work such as welding or cutting of metals;
- provide for the early detection of any fire that might occur;
- provide the facilities and equipment necessary for the safe storage and disposal of any materials liable to spontaneously combust (if they are likely to exist within the Construction Islands);

- provide the equipment necessary to control or extinguish small fires and train personnel in its proper use; and
- regularly inspect the work site for fire hazards and eliminate or control any hazards that are identified.

3.4.2.6 Motor Vehicle Safety

The GDC will ensure that all motorized vehicles used during the decommissioning project are properly maintained, provided with the necessary safety equipment and operated by properly qualified and licensed drivers. The GDC will ensure that all vehicles are operated in accordance with all applicable provincial regulations. Finally, the GDC will ensure that all motorized vehicles are insured in accordance with all applicable provincial regulations and any contractual requirements imposed by the OPG.

3.4.3 Emergency Preparedness

3.4.3.1 Emergencies Outside the Construction Islands

OPG has contracted Bruce Power to provide Emergency Response Services within those portions of the Bruce nuclear site that are under the control of OPG (including portions of the BHWP). It is anticipated that these provisions will remain in place through the end of the decommissioning project. As part of this service, Bruce Power will respond to any motor vehicle accident involving BHWP Decommissioning Project vehicles that occurs on the Bruce nuclear site outside of the designated Construction Islands.

3.4.3.2 Emergencies Within the Construction Islands

The GDC will have charge and control of those portions of the BHWP that are designated as Construction Islands. The GDC's responsibilities will include:

- identifying the emergencies that might reasonably be expected to occur during the work within the Construction Islands and the procedures that are required for these emergencies;
- establishing provisions for obtaining assistance from Bruce Power or public agencies in the event of an emergency;
- providing first aid to persons suffering minor injuries while working in or visiting the Construction Islands;
- obtaining medical aid for persons suffering more serious injuries or illness;
- obtaining assistance to extract or free victims of an accident;
- containing, collecting and removing any material spilled within the Construction Islands that might present a hazard to workers, the public or the environment;
- establishing procedures to prevent, detect, control and extinguish fires within the Construction Islands;

- evacuating workers and visitors in the event of a fire, chemical spill or other event that may present a hazard to them;
- obtaining assistance to deal with any real or threatened breach of security;
- training all employees engaged on the project on their responsibilities under the emergency preparedness and response procedures implemented by the GDC;
- co-operating with Bruce Power in the event of any site-wide emergency;
- ensuring that all of the subcontractors engaged by the GDC and their employees are aware of and prepared to carry out their responsibilities under the emergency preparedness and response procedures implemented by the GDC; and
- co-operating with OPG in the investigation of any unusual events that may occur.

OPG will review and approve the emergency preparedness and response procedures prepared by the GDC. The GDC will not be permitted to begin work in any Construction Island until emergency preparedness and response procedures acceptable to OPG are in place.

The Construction Islands will be located within the larger Bruce nuclear site; therefore, real or potential emergency situations elsewhere on the site could potentially affect workers engaged on the decommissioning project. The GDC will be contractually obligated to comply with the emergency preparedness and response procedures established by Bruce Power that are applicable to any real or potential site-wide emergency situation. OPG may at its discretion:

- order the GDC to conduct an emergency response exercise or drill;
- conduct an exercise or drill of the emergency preparedness and response procedures implemented by the GDC; and
- witness any emergency response exercise or drill conducted by the GDC.

OPG will provide the CNSC with prior notice of any emergency response exercises that are scheduled in the event that CNSC representatives wish to witness the exercise.

3.4.4 Security Program

Bruce Power is responsible for maintaining the security of the Bruce nuclear site and specifically the security of the BHWP under a written agreement with OPG. An 8-foot high, industrial grade fence surrounds the perimeter of the Bruce nuclear site and site security staff control entrance to the grounds. No changes to the established Bruce nuclear site security procedures will be required for the BHWP Decommissioning Project.

All decommissioning staff working on the Bruce nuclear site will be required to obtain security clearance from Bruce Power. The GDC will be responsible for controlling access to the Construction Islands. Staff will not be required to enter any radiologically-zoned area during their work on the BHWP Decommissioning Project.

Access restrictions to the BHWP were lifted after the last of the H_2S was removed from the site in 1998. Access to the BHWP as a whole will not be restricted during the decommissioning project except during specific periods (e.g. during the felling of the enriching towers) when the site will be closed for safety reasons. The GDC will be responsible for co-ordinating these periodic closures with Bruce Power site security.

The specific responsibilities of the GDC will include, but not be limited to:

- arranging for all decommissioning staff to obtain security clearance from Bruce Power;
- working with Bruce Power site security to ensure that the decommissioning work does not adversely affect the security of the site as a whole;
- working with Bruce Power site security to establish procedures for decommissioning project vehicles entering and leaving the site;
- installing fencing around the Construction Islands;
- controlling vehicle and personnel access to the Construction Islands;
- securing all offices, workshops, storage areas and vehicles within the Construction Islands; and
- working with Bruce Power site security to restrict access to the BHWP as a whole (and surrounding areas) whenever necessary to ensure public safety.

3.4.5 Quality Assurance

OPG has a program in place to assure that the required quality of products and services is properly defined and efficiently achieved in its nuclear facilities. This program provides a disciplined approach to determining, communicating and attaining the required level of safety, reliability, maintainability, environmental protection and performance. The program defines requirements for work to be done and provides for the integration and co-ordination of pertinent activities.

The existing OPG Nuclear Waste Management Division (NWMD) Quality Program will govern the work performed during the BHWP Decommissioning Project. This program is based on a set of expectations promulgated by the OPG Executive Vice President and Corporate Secretary. These expectations encompass all aspects of NWMD activities including engineering and design, procurement, manufacturing, construction and installation, commissioning, operation, decommissioning and record keeping. The expectations also provide overall direction regarding the administration of NWMD and establish requirements with which all employees must comply. It applies to all organizational units in NWMD that are involved with engineering and design, procurement, manufacturing, construction and installation, commissioning, operation or decommissioning. Quality assurance is accomplished by control of activities in keeping with the principles expressed in the Canadian National Standard CAN/CSA-N286.0 (CSA, 1998) and subsidiary standards where applicable. The following processes implement the program:

- a managed system of governing documents that communicate the elements of program activities;
- individuals that are accountable for implementing and adhering to the managed system elements; and
- program elements that are evaluated and enhanced through continuous improvement processes.

The NWMD Quality Program includes provisions for a system of planned audits and assessments designed to provide a comprehensive, critical and independent evaluation of all NWMD activities. The audits and assessments monitor compliance with governing codes, standards and technical requirements, and confirm that Quality Program requirements are being effectively implemented. Audit and assessment results are documented, reported to and assessed by a level of management having sufficient breadth of responsibility to assure that action is taken to address the findings.

Additional oversight of NWMD activities is provided through self-assessments and the corrective action program. In particular, the corrective action program assures that adverse conditions are identified, documented, reported, evaluated and corrected in a timely manner.

For critical parts of the work, the GDC will prepare Quality Plans that meet, or are equivalent to, Quality Standard Z299.3. These plans will be submitted to OPG for review and acceptance. OPG will perform audits to ensure that the GDC and all of its sub-contractors perform their work in accordance with the requirements of the Quality Plans.

3.5 Decommissioning Schedule

As noted in Section 1.1.4, it is anticipated that subject to EA and licence approval, decommissioning work on the BHWP will begin in 2003. The decommissioning project has two main phases: demolition/remediation and end state.

The demolition/remediation phase includes demolition activities, waste management, post-demolition monitoring and site remediation. Demolition of large structures such as the towers, flare stack and pipe racks is planned for 2003-2004. Demolition of buildings and small structures will occur after 2004 over a period of one or two years. Clean-up of the site, involving removal of rubble and scrap material, will occur on an on-going basis after each demolition activity. Post-demolition monitoring is planned for an interim period of up to three years to provide detailed data to determine the extent of on-site soil contamination and thus determine the extent of remediation required. The soil remediation stage will take place as soon as the extent of required remediation has been determined. Also during this remediation stage the demolition, removal and remediation of the SWTF and lagoons will take place. These facilities will remain in operation for as long as possible to ensure stormwater is managed during the decommissioning project activities.

The end state occurs after all demolition and site remediation activities are completed and regulatory approvals are met. It includes a follow-up monitoring program which is expected to continue for approximately three years after the demolition/remediation phase. When monitoring indicates that no further remediation is required, then OPG will apply to the CNSC for a Licence to Abandon the site.

A preliminary schedule for planning the BHWP Decommissioning Project was presented in the DDP submitted in May 2002. An updated summary of this schedule is presented in Table 3.8.

TABLE 3.8
APPROXIMATE SCHEDULE FOR BHWP DECOMMISSIONING

Item	Description	Target Dates*
1.	EA Process Complete	Spring 2003
2.	Decommissioning Licence Granted	Summer 2003
3.	Demolition Contract Start	Late Summer 2003
4.	Site Set-up	Late Summer 2003
5.	Complete Demolition of Large Structures	Fall 2003 - Fall 2004
6.	Complete Demolition of Common Services Area	Late Fall 2004 – Fall 2005
7.	Remove Scrap & Rubble	On-going 2003-2005
8.	Carry out Post-Demolition Monitoring	2005 – 2007
9.	Remove Identified Contaminated Soil	2008
10.	Drain, Demolish and Remediate SWTF	2008
11.	Grade Surface, Fill Holes, Remove Obstacles	2008
12.	Complete Demolition and Remediation	2008
13.	Follow-up Monitoring	2009 – 2011
14.	Apply for Licence to Abandon	2012

* The target dates indicated for the post-demolition activities are tentative, subject to the results of post-demolition monitoring and requirements of the CNSC. It is possible that the post-demolition activities will be completed in less time than is indicated here. However, these dates are intended to provide a reasonably conservative basis for EA purposes.

The GDC will be responsible for preparing and submitting to OPG a detailed schedule of the work that will be performed. The Preliminary Schedule assumes that the major site facilities will be demolished in the following order:

1. Large Structures (E4 and E7 and the North Flare Area and Major Pipe Racks)

These will likely be demolished first because of the increasing hazard posed by catwalks, cable trays, insulation cladding and small bore piping as they deteriorate, and the salvage value of the materials in the Enriching Towers.

2. Common Services Area

The Common Services Area Buildings and Structures will be demolished after the large structures. This will occur in two phases:

- Phase 1: Common Services Area Buildings and Structures north of the Supply & Return Channel (Operations Building Common Services, Clarifier Building, Plant D Filter Building, Plant B & D Degasser Towers, Acid & Caustic Storage Area, etc.);

- Phase 2: Common Services Area Buildings and Structures south of the Supply & Return Channel (Propane & Nitrogen Storage Areas, Chlorine Building, Acid & Caustic Rail Unloading Area, H_2S Storage Area, etc.).

The preliminary schedule assumes that the northern group of buildings and structures will be demolished first. The GDC may choose to reorder this work.

3. Other Small Buildings & Structures

The small buildings around the site and minor pipe racks will be scheduled for demolition at the most convenient time during the course of the project.

4. Lagoons and SWTF

The large lagoons will be scheduled for demolition toward the end of the decommissioning project. It is anticipated that the SWTF (cells, surface ditches and storm drains) will remain intact until most of the other demolition work on the site is complete. The continued operation of the SWTF will prevent any silt or spilled material from discharging directly to the lake.

3.6 Decommissioning End State

As outlined in the Scope of the Assessment (Section 1.3.2), the end state occurs after all decommissioning activities are completed and regulatory approvals are met. The EA process deals with all activities up to and including the end state which is described for buildings, structures, and site services.

3.6.1 Buildings and Structures

Buildings and structures which will be demolished will be taken down to grade level; that is, the above-ground structures will be removed, but items such as floor slabs and foundations will be left in place. Grade level equipment (e.g.: heat exchangers, pumps, small vessels, piping and pipe racks) will also be demolished. The remaining buildings and structures will be maintained in a condition suitable for future use unrelated to the production of heavy water. A list of the remaining buildings and structures is provided in Table 3.9.

TABLE 3.9
BUILDINGS AND STRUCTURES THAT WILL REMAIN ON THE BHWP SITE AT THE END OF THE BHWP DECOMMISSIONING PROJECT

a) Buildings and Structures Within the Area Regulated Under the Heavy Water Plant Operating Licence and the Heavy Water Plant D Construction Approval

Building Number	Name	Location[1]
	Buildings	
401	Cooling Water Pump House	Between Fifth & Sixth Ave., west of Second St.
402	Lift & Tempering Water Pump House	Between Fifth & Sixth Ave., west of Second St.
403	Fire Water Pump House	Between Fifth & Sixth Ave., west of Second St.
406	Laboratory	Between Fourth & Fifth Ave., west of Second St.
408	Process Water Pump House	Between Fifth & Sixth Ave., west of Second St.
409	Common Services Electrical Substation	Between Fifth & Sixth Ave., west of Second St.
506	Drum Filling Building	South of Second Ave., west of First St.
527	Main Substation B	Between Third & Fourth St., south of Third Ave.
528	Operations Building B (including Finishing Unit F2)	East side of Fourth St., between Third & Fourth Ave.
573	Operations Building D (including Finishing Unit F4)	East side of Fourth St., between Eighth & Ninth Ave.
578	Electrical Substation – E8	SE Corner of Second St. & Ninth Ave.
	Structures	
-	BHWP Intake Structure	Between Fifth & Sixth Ave., west of Second St.
-	North Forebay	Between Fifth & Sixth Ave., west of Second St.
-	Supply & Return Channel	Between Fifth & Sixth Ave., west of Second St.
-	BHWP Outfall Channel	Between Fifth & Sixth Ave., west of Second St.

TABLE 3.9 (Continued)
BUILDINGS THAT WILL REMAIN ON THE BHWP SITE AT THE END OF THE BHWP DECOMMISSIONING PROJECT

b) Buildings Outside the Area Regulated Under the Heavy Water Plant Operating Licence or the Heavy Water Plant D Construction Approval

Building Number	Name	Location[1]
	Buildings	
500*	Maintenance & Stores Building	SW Corner of Second Ave. & Second St.
509*	Flammable Storage Building	South of Second Ave., east of Second St.
510*	Operations Building A	South of Second Ave., west of Second St.
516*	Security Entry Building	South of Second Ave., west of Second St. (between Maintenance & Stores (500) and OBA (510))
577	Main Substation 'D'	West side of Fourth St., between Seventh & Eighth Ave.

* An asterisk indicates that a building is wholly or partly within the Exclusion Zone of Bruce B.

[1] Locations are indicated on Figure 4.2 (Site Study Area).

3.6.2 Site Services

The pipe racks that carry pipes, conduit and wiring no longer required will be demolished (see Table 3.10). Underground piping and electrical conduit will be cut off near grade level. Underground electrical wiring will be abandoned in situ. All aboveground (e.g. steam) and underground (e.g. electrical and firewater) services that support the operation of the other non-nuclear facilities on the Bruce nuclear site will remain in place and energized both throughout the decommissioning and at the conclusion of the project.

TABLE 3.10

PIPE RACKS[1] THAT WILL REMAIN ON THE BHWP SITE AT THE END OF THE BHWP DECOMMISSIONING PROJECT

Pipe Racks Within the Area Regulated Under the Heavy Water Plant Operating Licence or the Heavy Water Plant D Construction Approval

	Name	Location[2]
	N/S pipe rack from Lift & Tempering Water Pump House (402) to Condensate Plant (380)	Includes steam, electrical, control & telephone lines
	E/W pipe rack into Laboratory (406)	Along north side of Fourth Ave., south of Nitrogen & Propane Storage Areas
	Pipe rack into CS Substation	South of Sixth Ave.
	E/W pipe rack into Operations Building B (528)	Section east of Second Ave.
	E/W pipe rack into Operations Building D (578)	Section east of Second Ave.
*	E/W pipe rack into Operations Building A (510)	North of Drum Filling Building
*	E/W pipe rack north of Operating Building (510) & New Steam Plant (924)	Along Second Ave.

1 Some pipe racks continue outside of licensed areas.

2 Locations are indicated on Figure 4.2 (Site Study Area).

* An asterisk indicates that a pipe rack is wholly or partly within the Exclusion Zone of Bruce B.

3.6.3 Radiological Substances

Upon conclusion of the decommissioning project, no nuclear substances, other than the uranium foils in the infrared absorption analyzers in the Laboratory Building in the Common Services Area, will remain within the boundaries of the BHWP. The structures and equipment that are slated to remain, as well as the grounds, currently meet all regulatory requirements for radioactivity and will remain so upon completion of the decommissioning project.

3.6.4 Heavy Water

OPG will continue to store virgin heavy water in the Heavy Water Storage Areas of three of the buildings that will remain on the BHWP site after completion of the decommissioning, specifically:

- Drum Filling Building (Building 506);
- Operations Building B (Building 528); and
- Operations Building D (Building 578).

As indicated in Section 1.2.2.2, OPG will submit an application for a nuclear substance licence to permit this storage. This application will be submitted before the application for the Licence to Abandon.

3.6.5 Chemicals

Upon conclusion of the decommissioning project, all hazardous chemicals that were used in the production of heavy water will have been removed from the site. All chemical contamination identified during the Phase II Environmental Site Assessment (see Section 6.5.1.2) will have been remediated to the levels prescribed in the 1997 MOE Guideline for Use at Contaminated Sites in Ontario, Table B (industrial land use, non-potable groundwater condition).

3.6.6 Soil and Water

All of the soil and water contamination caused by past activities that is found to exist on the site will be remediated to the criteria presented in the 1997 MOE Guideline for Use at Contaminated Sites in Ontario Table B (industrial land use, non-potable groundwater condition). The debris generated by the demolition will be removed from the site for recycling or disposal as appropriate.

3.6.7 Future Use

Upon completion of the decommissioning, OPG will apply for a Licence to Abandon the BHWP as described in Section 8 of the Class I Nuclear Facilities Regulations. The BHWP is an integral part of the larger Bruce nuclear site, which includes the Bruce Nuclear Generating Stations A & B operated by Bruce Power and the Western Waste Management Facility operated by OPG. Consequently, future access to and use of the decommissioned BHWP will be restricted by the controls necessitated by the presence of the other nuclear facilities on the Bruce nuclear site. It is anticipated that these controls will remain in place until all of the other nuclear facilities on the Bruce nuclear site have been decommissioned. This is not expected to occur before 2063 (the reference plan date for decommissioning Bruce B).

4.0 ENVIRONMENTAL ASSESSMENT METHODOLOGY

4.1 Introduction and Overview

The methodology for the assessment of the effects of the project requires that the individual systems and works, activities, and events comprising the project be considered to determine how each one may interact with, and affect, the environment. To this end, it is first necessary to:

- Identify and assess the **alternative means for carrying out the undertaking**, including the selection of the preferred strategic alternative (i.e. preferred option). This is documented in Chapter 2.

- Define and describe the project within its individual systems and works, activities, and events referred to as the **project works and activities**. This is documented in Chapter 3.

- Establish **study areas** (geographical or spatial boundaries) relevant to the project (sub-section 4.1.1);

- Establish the **time frames** (temporal boundaries) relevant to the project (sub-section 4.1.2); and

- Identify the applicable **environmental components** (sub-section 4.1.3).

Once the project-environment interactions have been identified, each is then systematically evaluated to determine likely associated environmental effects, particularly with respect to Valued Ecosystem Components (VECs) and Valued Social Components (VSCs), mitigation opportunities, and residual effects.

In addition to the assessment of likely effects of the project, the assessment methodology also provides for consideration of the likely cumulative environmental effects of the project in combination with those of other projects and activities that have been, or will be carried out, and which are likely to overlap. In considering these cumulative effects, all residual (i.e., after mitigation) effects are identified; other projects with likely effects occurring within the same temporal and spatial framework are identified, and the likely combined effects of the overlapping residual effects evaluated.

Finally, the assessment methodology also takes into account how the environment might adversely affect the project. Examples of such effects include those associated with severe weather or seismic events.

Most projects typically have two phases – construction and operation. EAs on these projects concentrate on the operation phase during which most of the likely adverse effects, including cumulative effects, would occur. By its nature, the construction phase is relatively short-term and any effects are likely to be predictable and able to be mitigated using conventional techniques. A decommissioning project, such as the current BHWP project, is similar to a construction phase in that any effects from demolition or remediation activities are temporary and related to construction-type activities.

The second phase of the BHWP project (i.e. the end state) has no physical activities associated with it, unlike the second phase of projects with an operation phase. Therefore, there will be no project-environment interactions and no project-specific or cumulative environmental effects associated with the end state.

4.1.1 Spatial Boundaries

Spatial boundaries define the geographical extent(s) within which likely or potential environmental effects will be considered. As such, these boundaries outline the "study areas" adopted for the EA Study Report. Three generic study areas have been defined that encompass the components of the environment relevant to each of the disciplines, including the people, land, water, air and other aspects of the natural environment. They have been tailored to suit the geographic extent of the effects anticipated from the project.

- **Regional Study Area** is defined as the area wherein there is at least the potential for measured direct, indirect and cumulative effects from the project. The Regional Study Area for this EA Study has been defined as the 10 km primary evacuation area around the Bruce Nuclear Generating Stations which includes the 8 km former BHWP development control area (Figure 4.1).

- **Local Study Area** is defined as that area, existing outside the site boundary, where there is a reasonable potential for direct effects due to either on-going normal activities or possible accidents or malfunctions. The Local Study Area for this EA Study has been defined as the entire Bruce nuclear site as well as areas of Lake Huron abutting the Bruce nuclear site (Figure 4.1).

- **Site Study Area** includes all of the areas within the BHWP that are regulated by the CNSC as described in Section 1.2.2.1 (Figure 4.2).

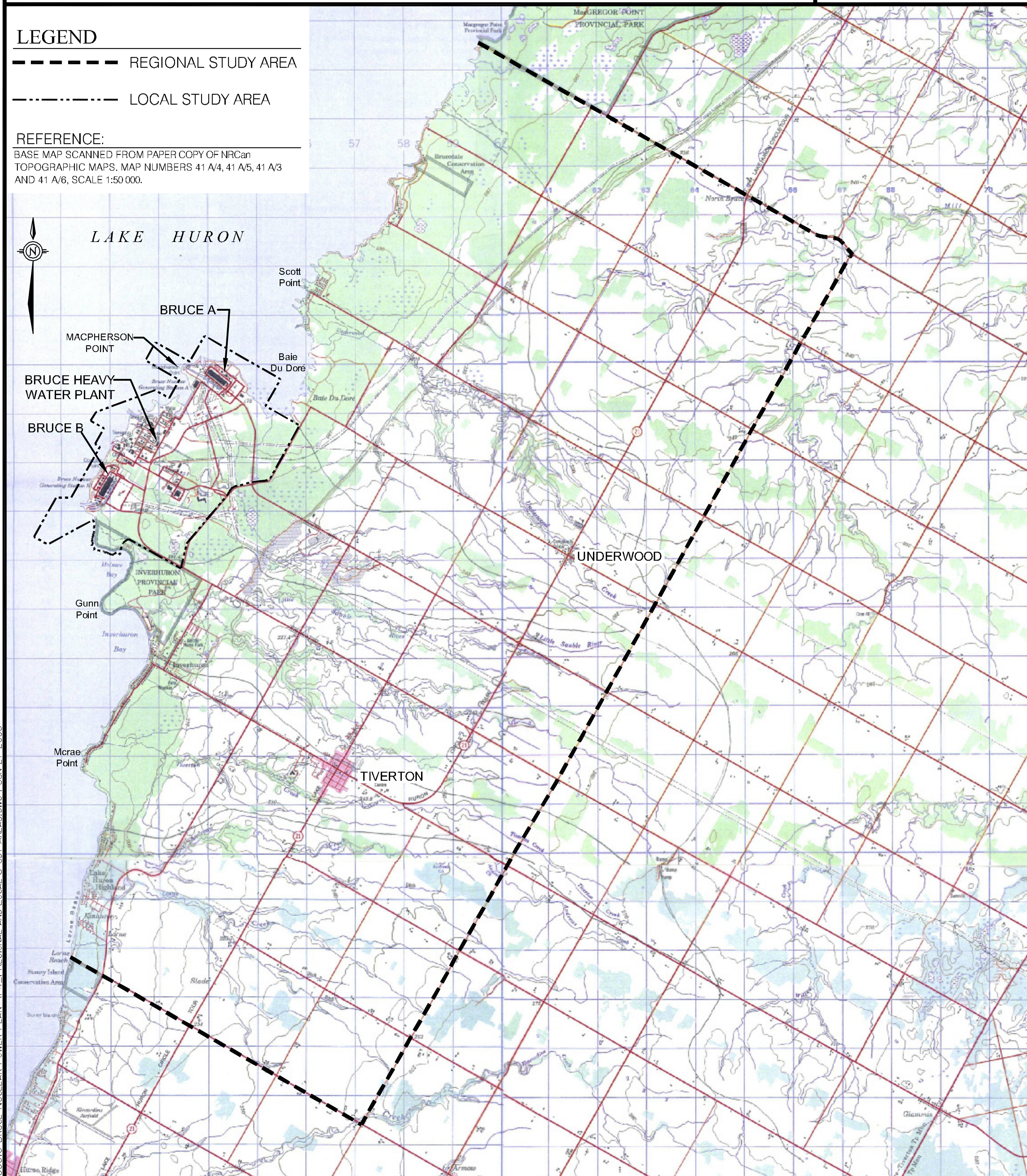
4.1.2 Temporal Boundaries

The temporal boundaries of a project define the time periods for likely direct environmental effects and for cumulative effects. For direct effects the BHWP Decommissioning Project has two phases: demolition/remediation and end state. The time-frame for the demolition/remediation phase is expected to be approximately seven years, including a three-year post-demolition monitoring period. The end state includes follow-up monitoring which is expected to take place over a three year period. Therefore, the total duration of the project is approximately ten years (2003 to 2012, inclusive).

For cumulative effects, the time-frame relates only to those past or future projects or activities that have effects which overlap with any residual adverse effects from the BHWP Decommissioning Project.

REGIONAL AND LOCAL STUDY AREAS
FOR THE BHWP DECOMMISSIONING PROJECT

FIGURE 4.1



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ONTARIO POWER GENERATION

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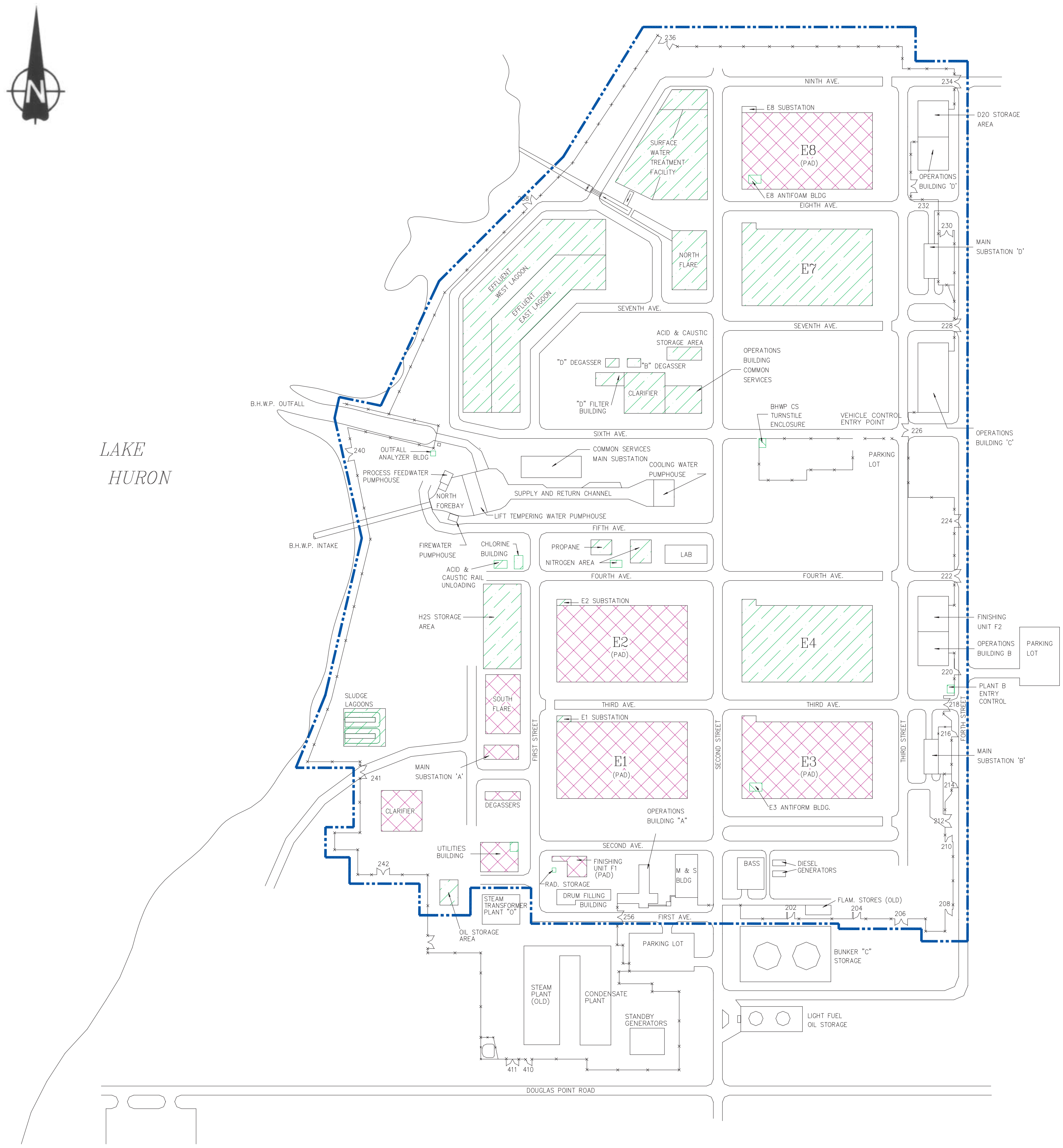
SITE STUDY AREA
FOR BHWP DECOMMISSIONING PROJECT

FIGURE 4.2



LEGEND:

DENOTES BHWP BOUNDARY FENCE

DENOTES BOUNDARY OF SITE STUDY AREA FOR ENVIRONMENTAL ASSESSMENT OF BHWP DECOMMISSIONING PROJECT

TO BE DEMOLISHED

ALREADY DEMOLISHED

Date September 2002

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FIG 4.2 11x17.CDR

ONTARIO POWER GENERATION

4.1.3 Environmental Components, VECs and VSCs

The *Act* (section 2) defines the "Environment" to include:

a) land, water and air, including all layers of the atmosphere,
b) all organic and inorganic matter and living organisms, and
c) the interacting natural systems that include components referred to in paragraphs (a) and (b).

For the purpose of this report, the environment comprises the following ten components that include the biophysical and social features that have the potential to be affected by the project.

- **Atmospheric Environment**: represents air quality with respect to non-radiological parameters, including noise, meteorology and climatic conditions;
- **Hydrology and Surface Water Quality:** represent surface water quality and conditions;
- **Aquatic Environment**: represents aquatic biota and habitat;
- **Terrestrial Environment**: represents terrestrial biota and habitat;
- **Geology, Hydrogeology and Seismicity**: represent geological and hydrogeological conditions, and seismic potential;
- **Radiation and Radioactivity**: represent environmental radiation and radioactivity, including radionuclide emissions and doses to humans and non-human biota;
- **Land Use and Transportation**: represent land use and transportation;
- **Socio-economic Conditions**: represent population and economy, community infrastructure, community services, municipal finance and administration, residents and communities.
- **Physical and Cultural Resources**: represent historical, cultural and archaeological resources;
- **Aboriginal Interests**: represent use of lands and other important issues for aboriginal persons.

Each environmental component is further divided into sub-components that represent fundamental constituent features susceptible to the project and/or a potential pathway.

Valued Ecosystem Components (VECs) are features of the environment selected to be a focus of the EA because of their ecological, social, or economic value, and their potential vulnerability to effects of the project. VECs are usually individual valued species or "guilds" (representing important groups of species within food webs).

VECs identified as relevant to the assessment include those that relate to the terrestrial and aquatic components of the environment, and human health. Social aspects of the environment are identified in terms of their valued components termed **Valued Social Components** (VSCs). All other environmental components were assessed with respect to specific features of the natural environment (e.g. water quality or air quality) and their roles in providing pathways and mechanisms for effects on the VSCs based on the inter-relationships of the environmental components.

The selection of VECs considered the following:

- abundance in the Regional, Local and Site Study Areas;
- ecological importance: position in the food web; relative contribution to productivity;
- baseline data availability: sufficient information to allow a reasonable evaluation of effects;
- native species;
- degree of exposure: the VEC must have a significant degree of exposure to the "stressors" produced by the physical works or activities of the project;
- sensitivity: the VEC must be sensitive to the "stressors" produced by the physical works or activities of the project;
- conservation status: specifically protected by law; designated as rare, threatened, or endangered.

The selection of VSCs considered the following:

- uniqueness or importance of the resource or community feature in maintaining the economic base;
- uniqueness or importance of the resource or community feature in maintaining the levels of service;
- uniqueness or importance of the resource or community feature in maintaining the social structure and/or community stability; and
- resources or features identified by community members as important to them.

It is within the framework of these individual environmental components, sub-components and VECs/VSCs that the likely environmental effects associated with the project are assessed.

4.1.4 Identification of Project-Environment Interactions

For EA purposes, it is necessary to define the project in terms of its potential to interact with and affect the environment. Accordingly, the project has been broken out into its individual Project Works and Activities. Each is evaluated to identify those that are judged to have a potential for project-environment interaction (Chapter 7). The potential effects include not only the direct changes to the biophysical environment, but also those effects that emanate from the direct effects, such as changes to socio-economic conditions. The identification of project-environment interactions allows the assessment to focus on the issues of key importance, thus avoiding unnecessarily large amounts of documentation of non-relevant or low-risk issues.

A review of the project, as documented in the DDP (OPG, 2002), was carried out to determine those individual Project Works and Activities that could potentially interact with, and affect, the environment. The initial screening was conducted as follows:

- All Project Works and Activities comprising the decommissioning project were described and analyzed for possible interactions between the project and the environmental/social components; and

- Each of the Project Works and Activities was individually evaluated to determine if there was a plausible mechanism whereby an effect on the environment might result. The analyses were based on professional judgement of technical specialists with regard for the physical and operational features of the project and their likely interactions with the environment.

The outcome of the initial screening was the identification of those Project Works and Activities that have a potential to affect the environment (Chapter 7). Those identified indicate project–environment interactions that warrant further assessment (Chapter 8).

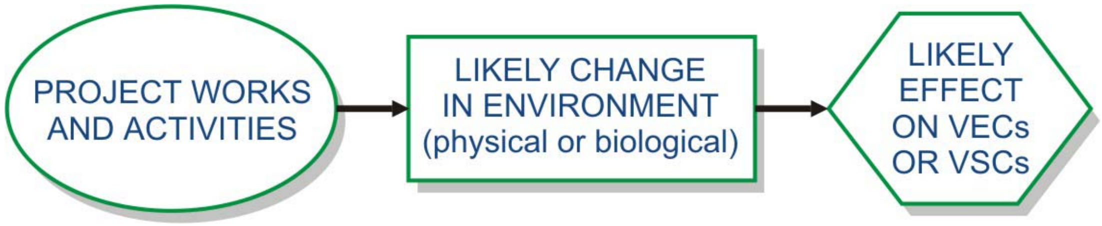
4.1.5 Consideration of Community and Stakeholder Comments

The assessment includes notification of, and consultation with, the potentially affected stakeholders, including the local public. Various stakeholders have been consulted at different stages in the EA process, including interested parties from the federal, provincial and local governments; First Nations, established communities and neighbouring residents; OPG employees and local businesses; as well as non-governmental organizations and interest groups. This is described more fully in Chapter 5.

4.1.6 Assessment of Likely Environmental Effects and Mitigation

4.1.6.1 Assessment of the Effects of the Project on the Environment

Each project-environment interaction with a likely measurable effect is advanced for a detailed assessment of effects (Chapter 8.0). Linkages represent the process whereby one or more of the Project Works and Activities contribute to a change in the environment that then leads to a likely effect on one or more of the VECs or VSCs. As such, linkages generally reflect the "**source – pathway – receptor**" model typically considered in ecological and human health impact assessment models. The concept is illustrated graphically below.



Each interaction is considered individually or collectively and the associated effects described. The likely environmental effects are assessed in the context of the applicable environmental sub-components. Consistent with accepted practice, quantitative as well as qualitative methods, including professional expertise and judgement, are used to predict and describe the likely effects. Specific assessment criteria are applied to assess the importance of each effect in each environmental component.

Where it is determined that the effects of the interaction are unlikely or clearly of no concern (i.e. not significant), no further assessment is conducted. Otherwise, the likely adverse effects are advanced for further consideration of mitigation and residual effects.

Each likely adverse effect is considered to identify possible means of mitigation to eliminate, reduce or control the adverse effect. Section 2 of the *Act* defines "**mitigation**" as:

"… the elimination, reduction or control of the adverse environmental effects of the project, and includes restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or other means."

Based on the assumed implementation of mitigation measures, each likely adverse effect (including both direct and indirect effects) is evaluated to identify the **residual effect**. The residual effect is that effect which remains after mitigation has been put into place, and would be measurable or observable on the selected VECs or VSCs. Effects that are unlikely or clearly of no concern are not identified as residual effects and are not considered further. The purpose of this assessment is to focus on the effects that are likely to have a measurable or observable effect on the selected VECs or VSCs. They also represent effects that have the potential to act cumulatively with those from other projects and activities. As such, this step accomplishes the first step of the Cumulative Effects Assessment.

All **adverse residual effects** are advanced for assessment in the Cumulative Effects Assessment in Chapter 9 and assessment of significance in Chapter 11.

4.1.6.2 Assessment of the Effects of the Project on the Sustainability of Renewable Resources

The *Act* requires that the assessment in a Comprehensive Study Report take into account whether the project will have an impact on the capacity of renewable resources to meet the needs of the present and those of the future. The potential interactions between the project and the environment are identified and assessed in order to determine the likelihood of interactions between the project and resource sustainability. This assessment is described in Chapter 8. For the BHWP Decommissioning Project, this assessment will be limited to the demolition/remediation phase up to the end-state phase.

4.1.6.3 Assessment of the Effects of External Natural Hazards on the Project

The *Act* requires that the assessment include the consideration of the likely effects of the environment on the project. Those conditions in the environment that are most likely to affect the project are identified based on the past experience and the professional judgement of the technical specialists conducting the EA. For each potential environmental condition, the design and contingency measures incorporated into the project to mitigate the effect of the conditions are identified and their likely effectiveness judged, also on the basis of experience and judgement.

Based on the evaluation of the potential environmental conditions and the effectiveness of the mitigation measures that can be reasonably expected, a determination of the effects of the environment on the project is made. This assessment is documented in Chapter 8.

4.1.7 Assessment of Likely Cumulative Effects and Mitigation

For purposes of this EA, cumulative effects are defined as those incremental environmental effects associated with the BHWP Decommissioning Project added to, or combined with, effects associated with other operations at the OPG site and other projects or activities beyond the site. The process for assessing cumulative effects involves the following:

- Determining if the project will have an effect on a VEC or VSC;
- If there is such an effect, determining if it acts cumulatively with effects of other projects or activities, either past, existing or reasonably foreseeable future; and,
- Determining if the effect of the project, in combination with the other effects, may cause a significant change now or in the future in the characteristics of the VEC or VSC after the application of mitigation for that project.

The direct effects of the project are determined in Chapter 8. Other considered projects and activities, either past, existing or future (up to the end state for the BHWP project), are described, including likely environmental effects associated with them, in Chapter 9. To establish if these project-related effects have the potential to act cumulatively, they are considered with the effects of the other projects and activities. To act cumulatively, the effects of the BHWP project and effects of other projects and activities must overlap in both time and geographic area.

Where there is a cumulative effect, it is evaluated in the context of each relevant environmental component. Where there is a likely adverse cumulative effect, mitigation measures are identified and the likely effect reconsidered to determine the residual condition.

The overall methodology for assessing the identified likely cumulative effects, including consideration of mitigation opportunities, identification of residual effects, and determination of significance, and the requirement for follow-up is the same as that used for assessment of direct project effects. The assessment of cumulative effects is documented in Chapter 9.

4.1.8 Assessment of Significance of Residual Environmental Effects

The **significance** of each adverse residual effect is established within a framework of criteria and effect levels. To ensure a consistent and reproducible evaluation, common criteria are used for all residual effects within all environmental components.

Each residual environmental effect is assessed with reference to the following criteria:

- **Magnitude**: the size or degree of the impact compared with baseline conditions and/or regulatory limits or guidelines where they are available;
- **Extent**: the area over, or throughout which, the effects will occur;
- **Duration**: the time period for which the effect will last;
- **Frequency**: the rate of recurrence of the effect (or conditions causing the effect); and,
- **Permanence**: the degree to which the effect can be or will be reversed (typically as measured by the time it will take to restore the environmental feature).

Measurement levels representing the effect within each criterion consider applicable regulatory guidelines or other published reference bases. Where no such reference bases are available, measurement levels are based on professional judgement. The measurement levels within all criteria are **low**, **moderate** or **high**.

Each adverse residual effect is evaluated within each assessment criterion and assigned an effect level (low, moderate or high) that reflects the degree of impact that could reasonably be expected. With consideration for the individual criterion levels in an overall context, a professional judgement is made of the significance of the residual effect.

Adverse residual effects are categorized as follows:

- **Minor Adverse Effect (not significant)**
  The residual effect is minor and/or can be effectively mitigated through the identified mitigation measures; and

- **Significant Adverse Effect**
  The residual effect is significant and further or more effective mitigation is not considered feasible.

It is acknowledged that some of the criteria for evaluating effects may be more important than others and that the importance rank may vary by environmental component. As a fundamental principle, however, it was established that an adverse residual effect would always be designated as significantly adverse if it was of high magnitude, high extent, and high duration.

The determination of the significance of any adverse residual effects is documented in Chapter 11.

4.1.9 Determination of Need and Scope of Follow-up and Monitoring

A follow-up program is required to assist in determining if the conclusions of the assessment, as documented in this EA Study Report, are valid. It is also used to ensure that the mitigation measures taken are effective, and to determine if there is a need for additional measures and/or strategies. A preliminary plan for a follow-up program is provided in Chapter 10. The design of the program will be appropriate to the scale of the project and the issues addressed in the EA.

5.0 COMMUNITY AND STAKEHOLDER CONSULTATION

5.1 Introduction

OPG undertook a number of activities to ensure that the relevant federal and provincial government departments, local municipalities, community groups, aboriginal communities, non-government organizations and the general public were aware of and informed about the proposed BHWP Decommissioning Project. The objectives of the consultation activity were as follows:

- to provide the Bruce community with opportunities to learn about the BHWP Decommissioning Project and exchange information with the project team;
- to update other key stakeholders on plans to decommission the BHWP;
- to ensure public comments and concerns are documented and addressed in the EA; and
- to maintain and build on existing key stakeholder and local community support for OPG's overall operations and plans.

The consultation with the local community has occurred primarily in two periods, separated by an interim period during which EA consultation was primarily with the CNSC and the federal agencies:

- The initial period from September 1998, when the EA was publicly announced, to December 1998.
- An interim period from January 1999 to June 2002.
- The current period starting July 2002.

5.2 Period 1: September 1998 to December 1998

5.2.1 The Program

The objective of the consultation program was to reach the following groups:

- General Public
- Bruce Township (Host Municipality)
- Bruce County (Warden, CAO and Director of Planning)
- South Bruce Impact Advisory Committee (IAC)
- Local MPP
- Local MP
- MOE (District Engineer)
- MOH (local Medical Officer of Health)
- Local municipalities (other than Bruce Township) that could be affected by the project including:
  - Town of Port Elgin
  - Town of Kincardine

- Town of Southampton
- Township of Saugeen
- Township of Kincardine
- Township of Huron
- Village of Paisley
- Chippewas of Nawash (Cape Croker) and Saugeen First Nations
- Bruce Community Development Corporation (BCDC)
- Lake Huron Shoreline Tourism Partners
- Bruce Pines Association
- Bruce Hydro Retirees Association
- Chambers of Commerce (Port Elgin, Kincardine, Southampton)
- Inverhuron and District Ratepayers Association (IDRA)
- Tiverton and District Fire Department
- Bruce nuclear site employees
- Southampton Beach Association
- Port Elgin and Saugeen Township Beachers Association
- Integrated Energy Development Corporation (IEDC)
- Bruce Energy Centre Ltd.

The consultation and communication activities during Period 1 are outlined below.

Public Information Open House

All stakeholders were sent a Notification Letter regarding the decommissioning project, inviting them to a Public Information Open House. To advertise this meeting, newspaper ads were placed in the four local weekly newspapers the week before and the week of the Open House. An ad was also placed in the Owen Sound Sun Times. Notification letters were sent to key stakeholders, inviting them to the open house. The Fall 1998 edition of the then Bruce Nuclear “Neighbours” newsletter also mentioned Ontario Hydro (now OPG) plans to host a BHWP Decommissioning Public Information Open House.

The open house provided a forum for interested groups and individuals to meet and raise questions/concerns with Ontario Hydro staff involved in the decommissioning project. The open house was preceded by a one-hour tour of the site. A display of 12 panels was set up which described the history of the BHWP and details of the decommissioning project, including maps and photos, and sketches showing the appearance of the decommissioned site.

- Approximately 40 people attended the Public Information Open House. Twenty-six participated in the tour of the BHWP site. A list of attendees is provided in Appendix C, Section C.1.

Newsletter Information

The local Bruce area community (i.e. general public) was also provided with information about the project via the (then) Bruce Nuclear “Neighbours” newsletter. Responses were provided to any questions or concerns raised by the public (see section 5.2.2). “Neighbours” is sent quarterly to all residents in the neighbouring shoreline area - from Kincardine north to Southampton including the Chippewas of Saugeen and Nawash First Nations at Cape Croker. Bruce nuclear site employees were provided with the latest information on the project through articles appearing in internal site publications. These newsletters have been issued periodically through all three periods of the consultation program.

Project Briefings

Project briefings were given during the early stages of project planning as shown in Table 5.1.

TABLE 5.1
STAKEHOLDER BRIEFINGS

Stakeholder	Communication Activity	Date/Location	Issues/ Opportunities
Bruce Township and Ontario Hydro Joint Liaison Committee	Briefing	October 28, 1998, 12:00 noon, Bruce Nuclear Information Centre	Update host municipality
Integrated Energy Development Corporation	Two tours of BHWP	October 27, 1998 and November 2, 1998	Interested in site redevelopment potential
Impact Advisory Committee	Briefing	November 12, 1998 at 7:30 p.m. at BMTS Board Room	Update committee

Tours of the Site

Tours of the BHWP site were provided in response to specific requests, most of which were related to use of the machinery and equipment. Groups involved in these tours are listed in Appendix C, Section C.1.

The Media

Articles on the open house appeared in the four local weekly newspapers and the Owen Sound Sun Times (see Appendix C). The local radio (CKNX) and television (CKNX-TV) stations interviewed OPG (then Ontario Hydro) staff at the open house and aired programs based on these interviews.

5.2.2 Issues Raised by Community and Other Stakeholders

Table 5.2 summarizes the comments raised by various groups. In general, most questions concerned the timing of activities and the future use of the site. Copies of communications made by OPG and responses are given in Appendix C, Section C.1.

TABLE 5.2
COMMENTS FROM STAKEHOLDERS – PERIOD 1

Stakeholder	Summary of Comments
Bruce Township	None
Impact Advisory Committee	Interest in timing; opportunities for local towns and others to visit site and check out the plant equipment – namely motors and pumps – in advance.
Integrated Energy Development Corporation	Supportive of OPG's plans to leave the site industrially zoned and site's redevelopment potential; wanted (and was given) information on the cost of maintaining the enriching unit towers and converting for use to store oxygen, nitrogen or hydrogen gas.
Town of Kincardine	Interest in schedule; interest in the possibility of using the flare stack for future use as a communications tower. Based on cost information, they have responded to OPG that they are not interested in continuing to pursue the concept of reuse of the flare stack.
Kincardine-Bruce-Tiverton.	Sought and received preliminary cost information on dismantling and removing the towers; a proposed schedule for demolition was also sent to the new municipality.
Public	No issues were identified; general interest in the "when" and "how" of the decommissioning.

5.3 Period 2: Interim Period January 1999 to June 2002

5.3.1 The Program

After 1998, progress on planning and assessment of the BHWP decommissioning project slowed considerably, although it did not stop. This was largely due to the priority OPG had to place on decontrol activities required by conditions in OPG's generating licence from the Ontario Energy Board. In particular, transactions for leasing the Bruce A and Bruce B nuclear generating stations to Bruce Power affected key staff who had been involved in the BHWP Decommissioning Project. With the Bruce lease transaction completed in May 2001, OPG was able to increase its effort on planning and assessment of the BHWP Decommissioning Project. As described in Section 5.4, by July 2002, OPG was able to resume consultation about the project with stakeholders in the local community.

During the interim period, from January 1999 to June 2002, OPG's consultation and communication efforts related to this project were primarily maintained with the CNSC and other government departments or agencies at the federal, provincial and local levels. Direct consultation with the public in the community was deferred until project plans and the regulatory review process were better defined.

The following is a summary of noteworthy consultation and communication activities carried out at different levels during this interim period:

Federal Government Level

- In 1999-2000, revisions of the 1998 initial draft EA document were prepared by OPG and reviewed by AECB / CNSC staff.

- CNSC staff provided scoping and technical direction to OPG for further revision of the EA document to be submitted as a support document for CNSC to prepare a Comprehensive Study Report (CSR) on the proposed BHWP project.

- In July 2001, OPG submitted a revised draft EA document (dated June 2001, later renamed "Environmental Assessment Study Report") to the CNSC, taking into account all CNSC staff comments and direction received to date.

- Up to March 2002, further information was provided to CNSC staff, as required for their preparation of a draft CSR.

- In May 2002, after CNSC had issued their draft CSR to Federal Authorities accompanied by OPG's June 2001 draft EA document, comments on both documents were received from Environment Canada, Health Canada and the Canadian Environmental Assessment Agency (see Appendix C, Section C.2 for summaries of these comments and responses to them). Fisheries and Oceans Canada elected not to participate in the review as they determined that no fisheries or habitat issues were associated with the project. The present EA Study Report takes all of these federal comments into account.

- Also in May 2002, OPG submitted a Detailed Decommissioning Plan (DDP) to the CNSC, in support of OPG's application for a Decommissioning Licence for the BHWP project and in accordance with CNSC Regulatory Guide G-219.

Provincial Government Level

- Semi-annual communication meetings with regional representatives of the MOE (usually the District Supervisor) and Ministry of Health (usually the Medical Officer of Health and staff). The meetings covered issues across the entire Bruce nuclear site, including the BHWP decommissioning.

- Periodic distribution of the "Neighbours" newsletter to regional representatives of provincial ministries, including the Ministries of Environment, Natural Resources (Parks & Conservation Authority) and Health (Regional Medical Officer of Health). Updates on the BHWP Decommissioning Project were published in the Fall 2001 and Summer 2002 editions of the newsletter.

Regional & Local Level

- Periodic briefings to local community committees such as the Kincardine / Bruce Power / OPG Joint Liaison Committee and the South Bruce Impact Committee.
- Briefings to other key stakeholders as requested.

- Tours of the BHWP and other facilities at the Bruce nuclear site, as requested.

- Periodic distribution of the "Neighbours" newsletter to stakeholders in the local communities and region, including the Saugeen and Nawash First Nations and special interest groups. Updates on the BHWP Decommissioning Project were published in the Fall 2001 and Summer 2002 editions of the newsletter.

No new issues among local / regional stakeholders, further to those identified during the initial consultation period (1998), were identified during the interim period (1999 to mid-2002).

5.3.2 Issues Raised by Government Agencies

Table 5.3 summarizes the comments raised by federal regulators and agencies. Detailed comments and responses by OPG are provided in Appendix C, Section C.2. As indicated in Section 5.3.1, all of these comments have been taken into account in preparing the current EA Study Report.

TABLE 5.3
COMMENTS FROM GOVERNMENT AGENCIES – PERIOD 2

Agency	Summary of Comments
Health Canada	- levels of tritium on site no cause for concern for protection of human health.
Environment Canada	- PCB-containing materials subject to provisions of Federal Storage of PCB Material Regulations. - proposed transportation routes and modes for all hazardous materials to be disposed of should be identified. - clarification needed on cumulative effects assessment. - suggested mitigation for dust during felling of towers. - potential for noise impacts on wildlife in Inverhuron Provincial Park. - consideration of Fisheries Act during EA analysis. - possibility of accident or malfunction with respect to SWTF. - additional study of soil and groundwater quality required to determine need for risk assessment.
Canadian Environmental Assessment Agency	- clarification of scope of the project and scope of the assessment; use of project/environment matrix. - identification of valued ecosystem components. - inconsistent statements with respect to on-site chemicals. - additional information on project description required. - assessment of alternative means of carrying out the project inadequate. - more detail on government, public and aboriginal consultation. - clarification of study area boundaries. - analyses needed for all aspects of “environmental effect” as defined in the Act. - more detail on air quality effects on local communities. - more detail on effects of groundwater on Lake Huron. - possibility of accident or malfunction with respect to SWTF. - more complete assessment of cumulative effects. - definition and application of significance criteria. - explicit identification of mitigation measures. - consideration of renewable resources. - overall, insufficient information to meet requirements of the Canadian Environmental Assessment Act.
Canadian Nuclear Safety Commission (CNSC)	- clarification needed on location of groundwater monitoring wells. - analytical results for each groundwater monitoring well should be presented. - identification of sources of contamination from metals (As, Sb, and Se). - need to evaluate ^{3}H and ^{137}Cs in groundwater. - clarification needed on statement concerning tritium in groundwater. - groundwater monitoring program should be consistent with General Nuclear Safety and Control Regulations.

5.4 Period 3: July 2002 – September 2002

5.4.1 The Program

On July 31, 2002, OPG sent out copies of a preliminary draft of the EA Study Report to interested parties in the local community and to other stakeholders, as listed in Appendix C.3, with a request for return of any comments by August 30, 2002. The copies included selected excerpts from the DDP. Comments were received from three parties (summarized in Section 5.4.2 and Appendix C.3), all of which were taken into consideration during preparation of this report.

In addition, another issue of the "Neighbours" newsletter, including an article about the BHWP Decommissioning Project, EA, and licensing process, was issued and distributed in the community.

5.4.2 Issues Raised by Community and Other Stakeholders

Table 5.4 summarizes the comments raised by interested parties in the local community. The detailed comments and responses by OPG are provided in Appendix C, Section C.3.

TABLE 5.4
COMMENTS FROM STAKEHOLDERS –PERIOD 3

Stakeholder	Summary of Comments
E. Bourgeois – local resident	- Focus on family health and sheep farming issues claimed to be related to past operation of BHWP. - Clarification of OPG policies for compensation; requested analyses of past activities on site. - Interested in public consultation between 1998 and 2002. - Clarification regarding construction licences for Plants C and D. - Questions regarding residual concentrations of metals and H_2S on towers slated for demolition, groundwater chemistry results for 1998, type of waste to be disposed of at Bruce nuclear site landfill, and future plans for BHWP site. - Requested copies of BHWP operational/significant event records, meteorological data set used in EA analysis, and decommissioning plans. - Details in Appendix C.3.
F. Baker and J. Kirby Bruce Hydro Retirees Association	- Expressed confidence in successful completion of decommissioning project without long-term adverse effects. - Possible concern in future related to leaving below grade piping and wiring in situ; offered suggestions for treatment of cables and in-ground piping.
S. Kleinau Citizens for Renewable Energy	- Comments on lengthy EA process and need for "timely action to decommission"; wants towers removed to eliminate any risk to human health and the environment.

5.5 Summary

Several regulators and government agencies reviewed a draft of the EA Study Report submitted by OPG in July 2001. Their comments on the draft report have been taken into consideration during the preparation of the current EA Study Report. The comments and the sections of the report where they are addressed are provided in a “Disposition” Table in Appendix C.4, Table C.4.2.

Particular attention has been paid to the specific requirements of the Canadian Environmental Assessment Act. The sections of the report where these key requirements are met are provided in Table C.4.1 in Appendix C.4.

6.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

Components of the existing environment (i.e. baseline conditions) are described for climate and meteorology, air quality, hydrology and surface water quality, the aquatic and terrestrial environments, geology, hydrogeology and seismicity, radiation and radioactivity, land use and transportation, socio-economic conditions, cultural resources and aboriginal interests. Taking these baseline conditions into account, VECs and VSCs are then identified.

6.1 Atmospheric Environment

This section describes the typical climate, meteorology, air quality and noise conditions for the regional and local study areas, where applicable.

The general climate data presented in this section were mainly based on Southampton and Wiarton Airport observations for the period 1961 to 1990. Their locations are shown on Figure 6.1. Local meteorological data were collected from 10 m and 50 m meteorological towers located approximately 6.3 km and 2.0 km, respectively, east of the BHWP. Local air quality data was collected from the Bruce nuclear site during a monitoring program in 1996.

6.1.1 Climate and Meteorology

6.1.1.1 Regional Study Area

Characterization of the existing climatological conditions in the vicinity of the BHWP site is important because these are the main forces of contaminant transport (dispersion) in the atmosphere.

Air Masses

The weather of the region is influenced by five types of air masses: arctic continental, polar continental, polar maritime, tropical continental and tropical maritime. The arctic continental and polar continental air masses usually approach from the north and north-west directions, the polar maritime air masses approach from the north-east and east directions and the tropical air masses from the south and south-west. Each type of air mass possesses different climate characteristics and their movements induce five distinct synoptic weather patterns. The frequency distribution of these weather patterns in the region is summarized in Table 6.1

TABLE 6.1
FREQUENCY DISTRIBUTION (%) OF SYNOPTIC WEATHER PATTERNS AT THE REGIONAL LEVEL

Synoptic Weather Pattern	Percentage (%)
High Pressure System	30
Low Pressure System	22
Cold Front	24
Warm Front	11
Ridge with Slack Pressure Gradient	13

Source: OPG, 2001.

In addition, the region has four distinct seasons with warm summers and mild winters. Because of lake effects, uncomfortably hot and humid conditions and long dry or wet spells are rare.

Temperature and Precipitation

The near surface temperature affects the reaction rates of contaminants as well as atmospheric stability. Contaminants in the atmosphere can be deposited to the Earth's surface by precipitation. This can contribute to contaminant levels in soil and groundwater.

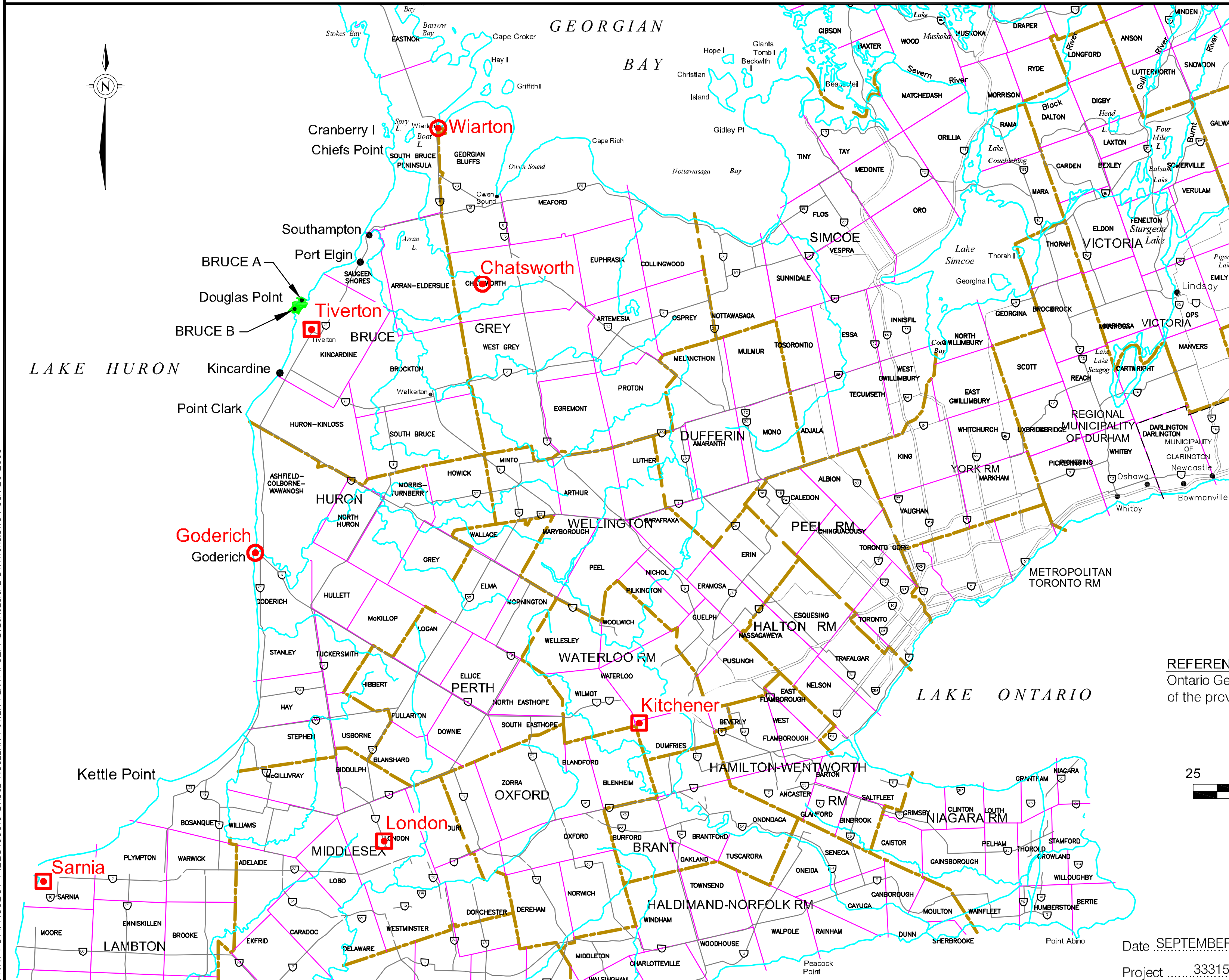
Table 6.2 presents the 30-year (1961 to 1990) temperature and precipitation normals at Wiarton and Southampton airports (Environment Canada, 1993). The average annual mean temperatures are from 6°C to 7°C in the vicinity of the Bruce nuclear site. The mean daily temperatures fall below freezing from December through March. The coldest months are January and February, with an average around -6°C to -8°C. The extreme lowest temperature recorded is -37°C. During June to August, the mean daily temperatures range from 15°C to 19°C. The extreme highest temperature recorded is 36.1°C.

Precipitation distribution indicates that there is more precipitation (combining rain, snow, drizzle and freezing rain) in winter than in the summer season. At Wiarton, the average annual measurable precipitation occurs on 210 days. The total annual precipitation averages about 1000 mm, of which slightly more than one fifth occurs as snowfall. Most summer rainfalls occur in the late afternoon. In winter, the region experiences a variety of storms with heavy snowfall and strong winds.

M.T.N. : D:\PROJECT FILES\33315 BRUCE NUCLEAR POWER PLANT\F6_1 METEOROLGICAL STATIONS.DWG : JUN 26 2003

LOCATION OF AIR QUALITY AND METEOROLOGICAL STATIONS

FIGURE 6.1



LEGEND

- COUNTY BOUNDARY
- TOWNSHIP BOUNDARY
- AIR QUALITY STATION
- METEOROLOGICAL STATION

REFERENCE

Ontario Geological Survey, topographic base mapping of the province of Ontario; Scale 1:1,000,000, 1993.

25 0 25 50

KILOMETRES

Date SEPTEMBER 2002

Project 33315

ONTARIO POWER GENERATION

TABLE 6.2
MEAN TEMPERATURE AND PRECIPITATION NORMALS (1961-1990): REGIONAL STUDY AREA

Month	Mean Temperature (°C)		Precipitation (mm)	
	Wiarton Airport	**Southampton Airport**	**Wiarton Airport**	**Southampton Airport**
January	-7.1	-6.3	94.0	87.9
February	-7.4	-6.6	63.4	50.1
March	-2.5	-1.5	67.0	46.4
April	4.7	5.0	64.4	53.2
May	10.5	10.8	66.7	59.1
June	15.3	15.8	71.4	70.6
July	18.6	18.7	71.3	66.5
August	17.9	18.4	88.6	82.8
September	14.2	15.1	107.4	85.9
October	8.7	9.7	88.2	71.2
November	2.9	3.8	103.8	71.8
December	-3.7	-2.7	113.2	83.1
	Average: 6.0	Average : 6.7	Total: 999.4	Total: 828.6

Source: Environment Canada, 1993.

Wind Speed and Wind Direction

Speed and direction of the wind dictates the distance and location from the source that a pollutant may travel. Dilution of airborne emissions increases with wind speed. Wind direction is reported as the direction from which the wind blows.

Table 6.3 presents the wind speed and wind direction normals at Wiarton (from 1961 to 1990) and Southampton (from 1955 to 1980). The average wind speeds in the Regional Study Area are between 14 and 15 km/h (about 4 m/s), but winds are generally stronger in the winter season. The prevailing winds are from the south and south-west. Northerly winds occur in winter.

TABLE 6.3
WIND SPEED AND WIND DIRECTION NORMALS (1961-1990):
REGIONAL STUDY AREA

Month	Wind Speed (km/h)		Wind Direction	
	Wiarton	Southampton	Wiarton	Southampton
January	19	18	S	SW
February	16	16	S	SW
March	16	17	NE	NW
April	16	15	W	SW
May	13	13	SW	SW
June	12	11	SW	SW
July	12	11	SW	SW
August	12	10	SW	SW
September	14	12	S	SW
October	16	14	S	SW
November	18	16	S	SW
December	18	17	S	SW
Average	15	14	S	SW

Source: Environment Canada, 1993.

Lake Breeze

Lake breeze occurs when there is a horizontal pressure gradient generated by the different thermal properties of land and water. On a calm, clear day, the air over land is heated more rapidly than the air over water. The air over land thus moves upward which generates a low pressure area on the surface. The air over the lake is then accelerated horizontally toward the land resulting in an onshore flow. The updraft creates a high pressure area aloft which accelerates horizontally toward the lake as a returning flow. At night, the situation is reversed which forms a land breeze circulation. In this region, lake and land breezes occur mostly in the summer months. The intensity of the lake breeze is usually greater than that of the land breeze. Due to the local topography, the lake breeze front near the Bruce nuclear site may extend only a few kilometres inland.

Severe Weather Events

Severe weather events in the region generally include thunderstorms and lightning, ice storms, wind storms, extreme heavy precipitation and fog.

In southern Ontario, thunderstorms normally occur for 20 to 25 days a year. Freezing rain occurs, on average, 25 to 50 hours per year and is usually accompanied or followed by precipitation such as snow, wet snow, ice pellets, rain and fog.

6.1.1.2 Local Study Area

Meteorology in the Local Study Area was characterized by using wind and temperature measurements from three separate sources:

- a 50 m meteorological tower on the Bruce nuclear site;
- a 10 m meteorological tower located on a bluff near the Bruce Power Visitors' Centre;
- the weather station at Wiarton airport.

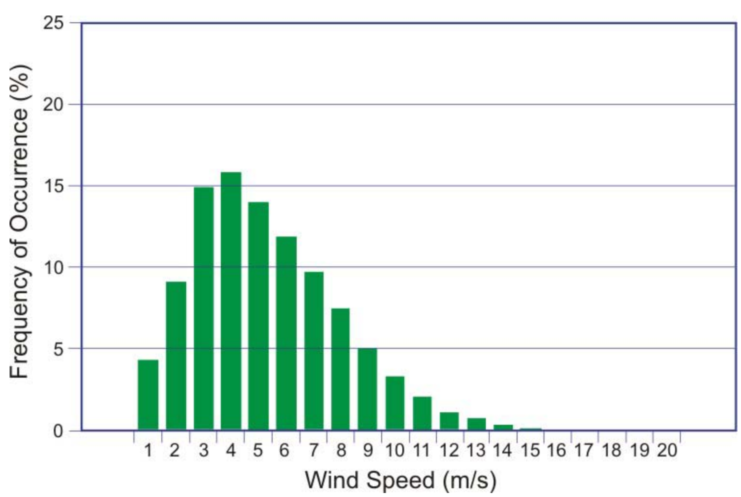
The focus is on those meteorological variables that would influence atmospheric dispersion characteristics: wind speed and direction, atmospheric stability, the height of mixed layers and the formation of thermal internal boundary layers.

Wind Speed and Wind Direction

The 5-year (1991 to 1995) average wind speed and wind direction distributions were determined from data recorded at the 10-m meteorological tower (Ontario Hydro, 1997a). As shown in Figure 6.2, the most frequent winds have speeds in a range of 3 to 6 m/s (10 to 20 km/h). Gusty winds of over 10 m/s (36 km/h) occur occasionally. The overall mean wind speed for these five years is 4.6 m/s (17 km/h). The winds are uniformly distributed with more frequent winds from the south-south-west.

Based on the geographic location of the site in the region, the onshore wind directions are from south-west (225^{o}) to north (360^{o}). Near the Bruce nuclear site, onshore winds occur about 40% of the time.

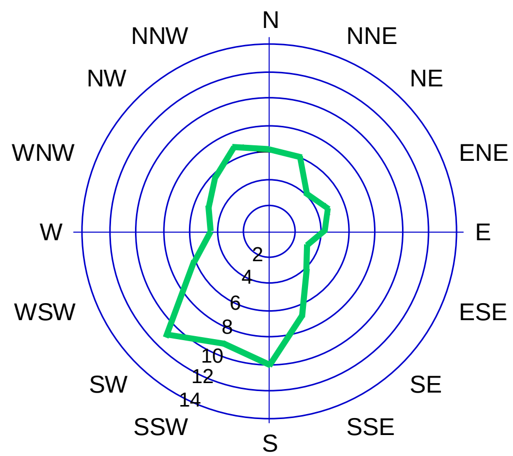
FIGURE 6.2
WIND SPEED DISTRIBUTION NEAR BRUCE NUCLEAR SITE
10 M METEOROLOGICAL TOWER (1991-1995)



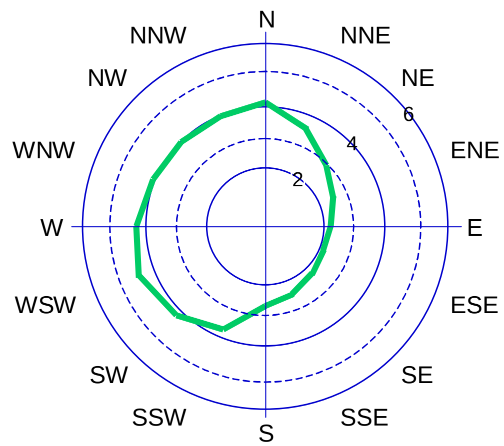
Recent data (i.e. 1998 – 2000) on wind speed and direction from the 10 m level of the on-site 50 m meteorological tower indicated an average wind speed of 3.45 m/s (Bruce Power, 2002). Calms (wind speed, 1m/s) were reported 0.35% of the time. The wind speeds recorded at the 10 m tower (located on a bluff) are higher than those recorded at the on-site tower because they are reflecting wind speeds at a higher elevation relative to sea level. Figure 6.3 presents a wind rose for the "on-site" 50 m tower station (measured at 10 m above surface level). The prevailing winds are from the south to southwesterly quarters and occur about 30% of the time.

FIGURE 6.3

Wind Direction Frequency (%) (1998-2000)
(Winds From)



Average Wind Speed (m/s) (1998-2000)

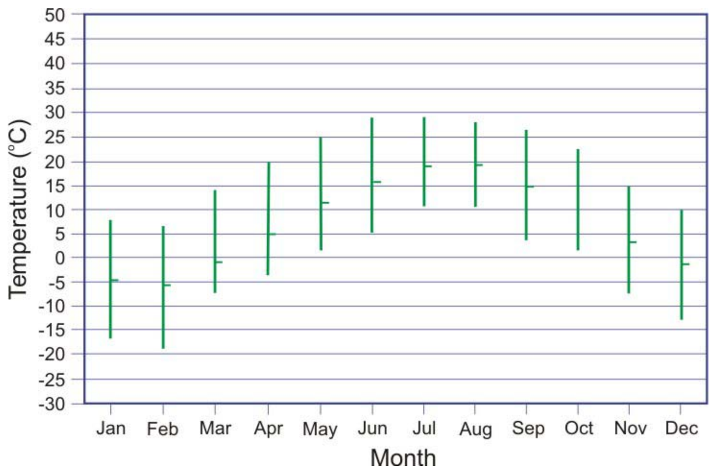


Note: Percentage of Calms = 0.35 %

Temperature

Air temperatures are measured at the 10 m level of the 50 m meteorological tower. Figure 6.4 displays the 5-year (1991 to 1995) average monthly air temperature distribution. The overall mean temperature is 7.2°C with an extreme minimum temperature of -19.0°C and an extreme maximum temperature of 28.9°C during this 5-year period.

FIGURE 6.4
AVERAGE MONTHLY AIR TEMPERATURE (1991-1995)
ON BRUCE NUCLEAR SITE



Data from 1998 – 2000 (Bruce Power, 2002), indicate that the mean annual temperature measured at the Bruce nuclear site is 8.9°C. The mean daily temperatures are below 0°C in December, January and February. The coldest month is January, with mean daily temperatures of –3.4°C. The lowest recorded temperature for this period was – 24.7°C, recorded in January of 1999. Summer temperatures average 19.0°C, or higher. The highest temperature recorded was 30.5°C, in August 1998 and June 2000.

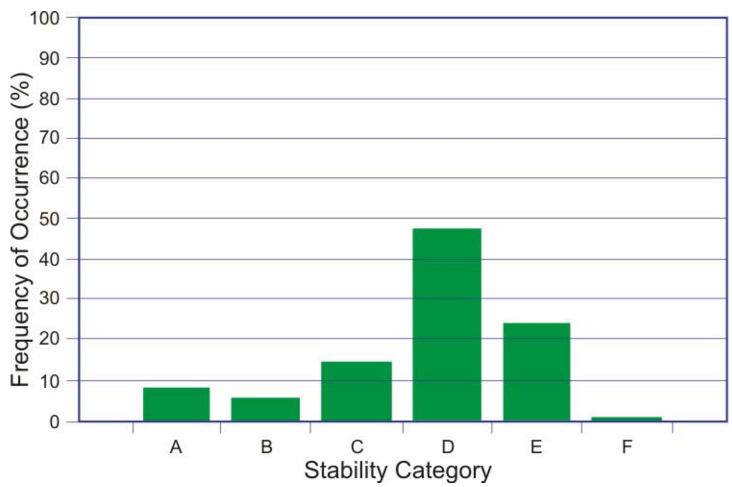
Atmospheric Stability

Atmospheric stability is a measure of the amount of vertical motion in the atmosphere, and thus its ability to mix pollutants. A stable atmosphere has little vertical motion (i.e. is less turbulent) and cannot disperse pollutants as well as a more turbulent, unstable atmosphere.

Atmospheric stability is one of the important parameters in dispersion models used to estimate downwind concentrations of pollutants released from upwind sources. A stability category, ranging from A, the most unstable, to F, the most stable, is commonly used to indicate the state of atmospheric stability. These categories are defined by conventional vertical temperature gradients on the basis of wind speed, cloud cover and solar insulation conditions. Some of these variables involved manual observation and are not readily available for this area.

An alternative method, as recommended by Davis et al. (1995) for classifying stability categories A through F, is based on the fluctuation of horizontal wind direction (σ_θ). Figure 6.5 displays the average frequency distributions of atmospheric stability at the Bruce nuclear site from 1991 to 1995, using this classification (Ontario Hydro, 1997a). During this 5-year period, the most frequent atmospheric condition is of neutral stability (Category D), occurring for almost 50% of the time. It is followed by slightly stable (Category E) and slightly unstable (Category C) conditions. Very stable (Category F) conditions are rare at the Bruce nuclear site.

FIGURE 6.5
AVERAGE FREQUENCY DISTRIBUTION OF ATMOSPHERIC STABILITY (1991-1995) AT BRUCE NUCLEAR SITE



Mixing Layer

The depth of the surface mixing layer is another important dispersion parameter, which determines the region of the lower atmosphere where pollutants can be dispersed vertically. At Bruce nuclear site, the monthly average depth of the mixing layer has been estimated to be about 1000 m (OPG, 2001).

6.1.2 Air Quality

6.1.2.1 Regional Study Area

Air quality in the Regional Study Area is typical of the general air quality in Southwestern Ontario. Air quality impacts are dominated by the substances which combine to produce smog or acid rain: carbon monoxide (CO); nitrogen oxides (NO_x); volatile organic compounds (VOCs); sulphur dioxide (SO_2) and suspended particulate matter (SPM) (Environment Canada, 1999). Air quality monitoring stations at Sarnia, London and Kitchener, the closest to the BHWP, monitor a large number of chemical constituents including combustion products (NO_x, SO_2, CO and SPM). Data on very few constituents are available for Tiverton (SO_2, hydrogen sulphide and $PM_{2.5}$). Table 6.4 summarizes the measured ambient air concentrations of these chemical substance in the Regional Study Area. Air concentrations for these constituents in the

Local and Site Study Areas are expected to be considerably lower because of the less industrialized nature of the area.

TABLE 6.4
ESTIMATED BACKGROUND POLLUTANT CONCENTRATIONS IN THE REGIONAL STUDY AREA

Chemical	Annual Criteria $\mu g/m^3$	Background Concentration $\mu g/m^3$
NO_x	100	20-80
SO_2	55	1-10
CO		200-1400
SPM	60	10-20

6.1.2.2 Local Study Area

Part of the EA is to evaluate the effect of site demolition and remediation activities on the existing air quality in the vicinity of the BHWP and the Bruce nuclear site. Since these activities will likely cause increased dust levels, the two components of the air quality discussed in this section are fugitive dust (dustfall) and total suspended particulate (TSP). The TSP and dustfall monitoring results obtained from a 1996 field study at the Western Used Fuel Dry Storage Facility (WUFDSF) site and other Bruce nuclear sites have been used to estimate the potential effect of the BHWP decommissioning activities on local air quality (Ontario Hydro, 1997).

Total Dustfall

Total dustfall (TDF) is a measure of the amount of settleable particulate matter in the atmosphere. The larger, more visible fraction of airborne particulate matter will settle out more rapidly than fine airborne particulate. Dustfall composition varies with sampling location and season, and normally includes soil particles, organic matter, sulphur and nitrogen compounds, metals and re-entrained road dust. TDF is composed of particulate matter that is less than 100 microns (μm) in size.

Particulate matter originates from industrial processes, urban activity and natural sources. Industrial processes such as combustion, incineration, construction, demolition, metal smelting and processing, mining and grinding, and cutting and welding contribute to atmospheric particulate. In the urban airshed, motor vehicle exhaust and road dusts are the major sources of particulate emissions. Natural sources of particulate matter include wind-blown soil, forest fires, ocean spray and volcanic activity.

There are generally no health effects associated with total dustfall; however, adverse health effects may be associated with dustfall which contains a toxic component or which has absorbed a gaseous pollutant on the surface of the particles. Corrosion, soiling, damage to vegetation and visibility reduction are additional effects.

The MOE criteria for total dustfall are 7.0 $g/m^2/30$ days (any consecutive 30 days) and 4.6 $g/m^2/30$ days (annual arithmetic mean).

Monitoring Results for Total Dustfall

TDF is collected by exposing an open-top plastic jar lined with a 0.13-mm thick polyethylene plastic bag for 30 days. The total amount of dustfall is determined by weighing the dry contents of the plastic bag and dividing the resulting weight by the open area of the plastic jar to give the results in $g/m^2/30$ days.

TDF was measured at four locations on and around the Bruce nuclear site: the Western Used Fuel Dry Storage Facility (WUFDSF), the former H_2S monitoring site in Inverhuron Park, the former H_2S monitoring site at Baie du Doré, and the Bruce Power Visitors' Centre (formerly called the Bruce Information Centre). During the sampling period, construction activities occurred occasionally near the WUFDSF site.

The TDF sampling period ran from June 20th to July 19th, 1996. Three collection jars were located at each site and one jar from each site was sampled at fifteen-day intervals. The remaining jars were removed after 30-day exposures.

The biweekly and monthly (30-day) results all normalized to a 30-day sampling period are given in Table A-1 in Appendix A. The MOE monthly criterion of 7.0 $g/m^2/30$ days for dustfall was not exceeded at any of the four sites used during the 1996 sampling period. The highest dustfall value was measured at the (then) Bruce Information Centre site. It was about twice the amount measured at the other sites for the same sampling period. The increased traffic in the vicinity of the Bruce Information Centre, the reduced tree cover around the site, and the close proximity of Bruce County Road 20 (a high traffic route) all likely contributed to additional dustfall at this site.

The TDF measured at each of the four sites during 1996 was at least 10 times less than the MOE 30-day criterion. The dustfall for the WUFDSF site was in fact the lowest of the four sites. The daily activity around the waste storage site was significantly less than for the other three sites. The construction of the spent resin storage facility adjacent to the WUFDSF site did not appear to bias the dustfall measurements.

Total Suspended Particulate

Total suspended particulate (TSP) is a term for airborne particles including smoke, fume, dust, fly ash, and pollen. Its composition varies with sampling location and season but normally includes soil particulate, organic matter, sulphur and nitrogen compounds, metals (e.g. lead) and carbon or higher molecular weight hydrocarbons formed by the incomplete combustion of fuels. Size range for TSP varies from 0.1 to 100 microns (μm) in diameter. Sources for TSP are the same as for total dustfall.

The greatest impact on health occurs from particles less than 10 microns in diameter (PM_{10}) that can penetrate deep into the lungs and contribute to respiratory disease. More serious health effects may be associated with suspended particulate matter which contains a toxic particulate component or which has absorbed a gaseous pollutant on the surface of the particles. Corrosion, soiling, damage to vegetation and visibility reduction are additional effects.

The MOE desirable ambient air criteria for TSP is 120 $\mu g/m^3$ (24 hours) and 60 $\mu g/m^3$ (annual geometric mean).

Monitoring Results for Total Suspended Particulates

TSP is collected by an instrument called a Hi-Vol sampler. Air is drawn through a fibre glass filter by a vacuum motor. The TSP is calculated by dividing the mass of TSP collected over a period of time by the volume of air sampled.

For the WUFDSF study, three sites were sampled: the WUFDSF site, the former H_2S monitoring site in Inverhuron Park, and the former H_2S monitoring site in Baie du Doré.

Each of the three sites had four Hi-Vol TSP samplers running sequentially under electronic timer control. Each sampler ran continuously for 24 hours. The sampling period was from June 21st to July 18th, 1996 inclusive.

The TSP results for the sampling period from June 21st to July 18th, 1996 are given in Appendix A, Table A-2. The arithmetic and geometric means for daily TSP for the three monitoring sites were essentially equivalent.

The TSP values were all below the MOE 24-hour criterion with the exception of the Inverhuron Park site on June 29th. In the field log, there was report of some local activity and construction near the Inverhuron Park site by the Parks staff during the June 29th sampling period.

The air sampled at the WUFDSF site prior to construction was low in TSP with a geometric mean of 15.1 $\mu g/m^{3.}$ The site daily TSP concentration compared well with the MOE rural site at Dorset which had an annual daily TSP level of about 14 $\mu g/m^3$ (geometric mean) and 17 $\mu g/m^3$ (arithmetic mean) as determined from the 1994 MOE annual report (MOE, 1995). For comparison, one of the highest arithmetic means for TSP in Ontario in 1994 is for the Hamilton site and is 81 $\mu g/m^3$ with a geometric mean of 75 $\mu g/m^3$. Generally, measurements of PM_{10} in Ontario are approximately one half of TSP. Therefore, a rough estimate of PM_{10} loadings at the Bruce nuclear site may be in the vicinity of 7-8 $\mu g/m^3$. These are well below the Ontario interim criterion for PM_{10} of 50 $\mu g/m^3$.

6.1.3 Ambient Noise

The technical terms and procedures used in the assessment of ambient noise are consistent with the requirements set by the MOE, Publication NPC-233. Ambient noise levels in the Local Study Area are based on data collected in 1996 and on recent observations made at the affected sites.

The noise-sensitive locations closest to the Bruce nuclear site are the communities of Baie du Doré, about 2 km north, and Inverhuron which is about 3 km south of the BHWP. The area immediately west of the Bruce nuclear site is bordered by Lake Huron. The area to the east is vacant land as part of the exclusion zone for development. The area to the south is a park that has had daytime access only. Consequently, there are no other noise-sensitive receptors within a 2-km radius of the BHWP.

The existing ambient noise levels in the vicinity of the two communities (Baie du Doré and Inverhuron) are typical of a rural recreational area. The noise is dominated by occasional local vehicular traffic, activities associated with residential living and recreation, and by sounds from nature. Some noise may also be contributed, occasionally, from operating activities at the Bruce nuclear site, other industrial/commercial sources existing in the vicinity, and from farming equipment.

A noise survey was conducted at the noise-sensitive locations in summer 1996, using continuous monitoring instruments over a period of 15 days (Ontario Hydro, 1997). Recent (i.e. 2002) observations in these areas revealed that no new sources of noise were present since the previous survey. Therefore, it is reasonable to expect that the ambient noise levels have remained stable, and that the 1996 analysis is applicable in 2002. The lowest, hourly ambient noise levels that were recorded are shown in Table 6.5.

TABLE 6.5
AMBIENT NOISE LEVELS AT NOISE-SENSITIVE RECEPTORS

	One Hour L_{eq}*(dBA)	
	Day	**Night (23:00 to 07:00 h)**
Baie du Doré	40	30
Inverhuron	42	30
Bruce nuclear site	43 – 47	38 – 45

* L_{eq} represents the A-weighted level of a steady sound having the same total energy in a one hour period as the observed fluctuating sound.
Source: Ontario Hydro, 1997a.

6.2 Hydrology and Surface Water Quality

6.2.1 Regional Study Area and Local Study Area

The BHWP site is located adjacent to the Lake Huron shoreline. In general, water depths in the near shore zone of the lake range from 10 to 20 m, except in Baie du Doré where depths do not exceed 5 m. Bedrock substrate predominates in the shallow areas of the more open shoreline, grading to a mixture of pebble, cobble and boulder at the 7 and 12-m depths. Extensive marsh areas are located along the shore of Baie du Doré.

Near shore currents and temperatures in Lake Huron have been measured during the ice-free period by Ontario Hydro since the early 1970's. Current direction is predominantly along shore with the frequency of northerly movement approximately two and one half times that of the south.

The Bruce nuclear site is located within a watershed which is bounded by the Underwood Creek watershed at the north and the Sauble River watershed at the south (Bruce Power, 2002). The site drainage system has an extensive stormwater infrastructure, including a network of sewer lines, catchbasins, manholes, open ditches, culverts and outfalls to Lake Huron.

Four water intake and discharge systems, one of which is part of the BHWP, are operated on the Bruce nuclear site.

Surface water quality has been monitored since the inception of the Bruce nuclear site. Analysis has indicated that the MOE criteria for the surface water treatment C of A have not been exceeded at the site.

The monitoring results for iron from 1998 indicate that the yearly volume weighted average has not exceeded 0.3 mg/L, and the maximum concentration has not exceeded 1.0 mg/L in any month, as required by the C of A. The average for 2002 and 2001 is 0.3 mg/L, which is up slightly from 0.2 mg/L in 1998, 1999 and 2000. However, the total iron released in 2001 was only 17.5 kg, compared to 21.7 kg in 2000 and 22.8 kg in 1999. The slight increase in iron concentration coincides with a large decrease in the volume of water drained through the system. The iron concentration is expected to remain within the limits prescribed in the C of A.

6.2.2 Site Study Area

Drainage characteristics for the BHWP site have been evaluated previously (Ontario Hydro, 1997b), and this evaluation indicated that the site has a runoff coefficient of 0.7. The runoff coefficient (0.0-1.0) is a measure of the amount of rainfall that will run off as a fraction of total rainfall following a rainfall event of given duration and intensity. A high runoff coefficient indicates low absorbency (low infiltration of rain into the ground). Essentially there are three drainage areas on the BHWP site that have been delineated by primary land use:

- Drainage Area 1 – includes the areas occupied by the former Plant A, bulk chemical storage, and bulk steam plant. All runoff from this area flows through a 1.83 m (72 inch) Concrete Sewer Pipe (CSP) that drains into the Douglas Point discharge channel.

- Drainage Area 2 – includes water intake and discharge facilities and bulk chemical storage. All runoff from this area flows through an open ditch into Lake Huron.

- Drainage Area 3 – includes the areas occupied by the former Plant B and the uncompleted Plant D. All runoff from this area is directed through the SWTF and then into Lake Huron via a ditch. The primary purpose of the SWTF was to remove iron from the runoff. This is achieved by allowing the runoff to drain through the base of the SWTF and into the groundwater flow system, leading eventually to Lake Huron.

6.3 Aquatic Environment

6.3.1 Regional and Local Study Areas

6.3.1.1 Water Bodies

The Regional Study Area is located on the east coast of Lake Huron. There are no major rivers in the Local or Regional Study Areas, but there is an extensive network of small rivers and creeks. The largest river is the Saugeen, which has a tributary creek within 13 km of the BHWP site. The Saugeen River enters Lake Huron at Southampton, 26 km to the northeast. There are two small east to west drainage courses entering the lake adjacent to the site. Underwood Creek empties into the Baie du Doré to the north and the Little Sauble River, which forms the southern boundary of Inverhuron Provincial Park, empties into Inverhuron Bay to the south. A depth of about 6 m is reached at a distance of 460 to 610 m from the shore of Lake Huron while the 9 m depth is encountered 60 to 150 m further offshore.

Lake Huron is a typical, cold and deep oligotrophic lake. As such, water quality within the Local and Regional Study Areas is reflective of lake-wide conditions with low nutrient levels. Most substrates consist of coarse sands and gravels, with fine grained materials located in the discharge channels of the facilities on the Bruce nuclear site and coastal wetland areas.

6.3.1.2 Fish Communities

Fish community monitoring has been conducted within the Local and Regional Study Areas since 1961. A total of 85 species have been recorded during these on-going field investigations. The fish community comprises two major types: those that range broadly throughout the region and Lake Huron and use the area on an occasional basis; and those that are confined to the local areas for most of their life stages. The local fish community includes yellow perch, smallmouth bass, northern pike, spottail shiner and bowfin. The habitats of Baie du Doré (located approximately 2 km from the BHWP site) provide a wider diversity of fish species. During various times of the year fish species will move in and out of the nearshore area. When rapid temperature fluctuations occur during windy periods, warm water fish often move out deeper into the lake.

The lake-wide fish community includes species that prefer open lake or deep coastal habitats. They include round whitefish, lake whitefish, lake trout, and deepwater sculpin. These fish spawn at depths greater than 2 m and make use of the nearshore area most frequently for spawning, but also for foraging and nursery function. Seasonal migrations into the nearshore areas occurs during the winter months for feeding and limited spawning.

Section 6.10 includes a discussion of special studies on whitefish impact and aboriginal diet being carried out in conjunction with the local First Nations.

6.3.1.3 Aquatic Habitat

Habitat conditions in the nearshore of Lake Huron within the Local and Regional Study Areas can be divided into two main zones: the area north of the former Douglas Point Generating Station discharge and the area south of the discharge (the BHWP is in close proximity to the Douglas Point Generating Station discharge). The habitat conditions depend upon the types of substrate, wave action and water temperature, which vary with depth. The northern portion is characterized by exposed shoreline of rock and bedrock from the north boundary of the Bruce nuclear site as far south as the discharge for the former Douglas Point Generating Station, extending out into the lake to approximately the 9 m depth. This area has the potential to be used by migratory fish species as a spawning area. South of the Douglas Point Generating Station for approximately 2 km, the nearshore area is characterized by a narrow shelf and a steep slope that extends into the lake to a 9 m depth within 1000 m from the shore. This area does not provide extensive habitat for warmwater fish or coldwater fall spawning fish, because of the absence of the necessary shoals and banks.

Baie du Doré, located along the northern portion of the Bruce nuclear site, is the one major embayment within the Regional Study Area. It is characterized by shallow depths and rock outcrops. It's habitat is protected from Lake Huron by two major shoals. Nevertheless, the shoreline around the Baie du Doré remains subject to wave action and ice scour. Wetland areas exist at the head of the bay and are set back from the shoreline. However, they are connected to the bay through outflow channels. These wetlands provide nursery and spawning habitat for many Great Lakes species and are very productive. Average water temperatures in Baie du Doré are generally 2ºC warmer than those in the open lake, but it is often much more than 2ºC warmer during the summer.

6.3.2 Site Study Area

There is no natural aquatic habitat on the BHWP site. However, the on-site drainage ditches, effluent lagoons, stormwater retention ponds and sludge lagoons, all of which are described below, could be limited potential sources for aquatic habitat.

- All drainage ditches consist of crushed rock, contain no vegetation and are dry shortly after a rainfall.

- The effluent lagoons have no vegetative cover (other than algae growth) and contain rain water only. Even when these lagoons were in use, there was never any evidence of fish.

- The stormwater retention ponds contain water. There is algae growth present in the eastern pond and weed beds at the south end. During site visits for the preparation of another project (OPG, 2001), there were no fish observed in the ponds.

- The sludge lagoons, which are not in use, consist of two excavated pits lined with asphalt. They have no capture area for surface runoff and there is no inlet or outlet. These lagoons are similar to a swimming pool with the water source being precipitation only. Both lagoons contain sludge sediments over their entire bottom. There is a reasonably dense growth of submerged aquatic vegetation and some cattails along the lagoon edges. About 1.5 m of water were observed at the time of the site visits. Again, there is no evidence of a fish community in these lagoons.

In summary, most of the above-mentioned features are not permanently wetted, the vegetated areas are not well connected to Lake Huron or other aquatic habitats, and the site location and characteristics make it unlikely that aquatic amphibians and reptiles use them. Therefore, they do not likely represent fish habitat or significant aquatic habitat of any sort.

6.4 Terrestrial Environment

6.4.1 Regional Study Area

Much of the information for the terrestrial environment has been taken from a report written for the Bruce A Restart EA (Bruce Power, 2002) since it provides the most recent data available for the Regional and Local Study Areas.

The Regional Study Area is located within the Huron-Ontario section of the Great Lakes - St. Lawrence Forest Region. Although Bruce County contains a number of large forested areas and wetlands, providing core habitat for a variety of wildlife species, much of the Regional Study Area consists of agricultural land. Consequently, few natural terrestrial features or wildlife corridors exist.

Core natural areas within the Regional Study Area include Inverhuron Provincial Park; Baie du Doré Provincially Significant Wetland; and Scott Point Provincially Significant Wetland and Provincially Significant Life Science Area of Natural and Scientific Interest (ANSI). The Huron Fringe Deer Yard runs along the Lake Huron shoreline from Inverhuron Provincial Park to MacGregor Point Provincial Park and provides winter habitat for white-tailed deer.

Inverhuron Provincial Park located immediately south of the Bruce nuclear site contains primarily early succession and second growth vegetation communities resulting from past disturbances. The most mature forest within the park is found along the Little Sauble River near the river mouth. A sand dune succession system is also present.

The Baie du Doré Provincially Significant Wetland is located within and immediately north of the Bruce nuclear site. The wetland consists of shrub and open fen, shallow marsh, and swamp habitats for a number of rare species, including an overwintering population of bald eagles (MNR, 2000), spotted turtle, horned grebe, the great egret, canvasback, redhead, and Caspian tern. Under normal conditions, mudflat habitat is available for use by migratory shorebirds in the late summer as lake water levels decline. The presence of mudflats attracts a variety of shorebird species. Bird species identified in the Baie du Doré wetland include the blue-winged teal (*Anas discors*) and ducks such as mallard (*Anas platyrhynchos*). Species such as the common tern (*Sterna hirundo*) and bald eagle (*Haliaeetus leucocephalus*) forage along pond edges for food.

The Scott Point Provincially Significant Life Science ANSI is a complex of small coastal wetlands consisting of swamp, marsh, fen, shoreline bluffs and beach ridges.

6.4.2 Local Study Area

6.4.2.1 Lake Huron Shoreline

The Lake Huron shoreline within the Local Study Area provides limited habitat, used mostly by gulls, waterfowl and cormorants that use the large rocks at the water's edge, and occasionally by foraging shorebirds. Waterfowl and gulls include red-breasted merganser (*Mergus serrator*), American black duck (*Anas rubripes*), herring gull (*Larus argentatus*), Canada goose (*Branta canadensis*), and spotted sandpiper (*Actitis macularia*). A few songbirds, such as cedar waxwing (*Bombycilla cedrorum*), American goldfinch (*Carduelis tristis*) and purple finch (*Carpodacus purpureus*), move back and forth between the shoreline and the built environment.

6.4.2.2 Forest Communities and Bird Species

Other major habitats include coniferous forests, cultural meadow and thicket, and built structures. Due to the large area of the Bruce nuclear site, the extensive forest cover intermixed with open areas, and the lack of barriers to wildlife movement, some wildlife species move between the Site Study Area and the adjacent Local Study Area.

The upland forest community in the Local Study Area is dominated by eastern white cedar. The extensive coniferous content of the forest cover provides important overwintering and feeding sites for white-tailed deer.

Upland forest habitat supports a number of upland bird species including wild turkey (*Meleagris gallopavo*), eastern wood pewee (*Contopus virens*), great-crested flycatcher (*Myiarchus crinitus*), brown creeper (*Certhia americana*), house wren (*Troglodytes aedon*), and Baltimore oriole (*Icterus galbula*). Bird species using the cultural meadow and thicket habitats include savannah sparrow (*Passerculus sandwichensis*), brown thrasher (*Toxostoma rufum*), and American goldfinch (*Carduelis tristis*).

Coniferous swamp habitat within the Local Study Area is dominated by eastern white cedar with lesser amounts of balsam fir. This habitat can support more northerly bird species, and provides local amphibian breeding habitat. Species recorded to use the coniferous, mixed, and deciduous swamp habitats included Cooper's hawk (*Accipiter cooperii*), wild turkey, red-headed woodpecker (*Melanerpes erythrocephalus*), American redstart (*Setophaga ruticilla*), and brown-headed cowbird (*Molothrus ater*).

The extent of the blocks of forest habitat found within the Local Study Area supports bird species that are identified as forest interior species such as the black-and-white warbler (*Mniotilta varia*), Cooper's hawk (*Accipiter cooperii*), pileated woodpecker (*Dryocopus pileatus*) and winter wren (*Troglodytes troglodytes*).

6.4.2.3 Mammals, Amphibians and Reptiles

Mammals recorded in the Local Study Area include raccoon (*Procyon lotor*), skunk (*Mephitis mephitis*), woodchuck (*Marmota monax*), grey squirrel (*Sciuris carolinensis*), snowshoe hare (*Lepus americanus*), European hare (*Lepus europaeus*), muskrat (*Ondatra zibethicus*), beaver (*Castor canadensis*), and white-tailed deer (*Odocoileus virginianus*). The deer population within the Local Study Area is considered to make use of the large Huron Fringe Deer Yard that extends from Inverhuron Provincial Park in the south to MacGregor Point Provincial Park to the north.

Amphibian and reptile species include the northern spring peeper (*Pseudacris crucifer*), American toad (*Bufo americanus*), northern leopard frog (*Rana pipiens*), green frog (*Rana clamitans*), gray treefrog (*Hyla versicolor*), and wood frog (*Rana sylvatica*). Eastern garter snake (*Thamnophis sirtalis sirtalis*) is likely to be the most commonly encountered reptile within the Local Study Area.

6.4.3 Site Study Area

The BHWP site has been extensively modified by land clearing, grading and adding fill, road construction, and the construction of foundations and pads for numerous buildings, processing structures and water treatment lagoons. Buildings, cement pads, pavement or crushed rock cover most of the land area.

Vegetation at the BHWP site consists of:

- two small wooded areas (< 0.1 ha each) consisting of white cedar with a weak overstorey of trembling aspen; and
- old field conditions between the most westerly road and the lakeside fence.

Both wooded areas, even as small as they are, have been further fragmented through past activities and are completely isolated from any other woodlots on the Bruce nuclear site. The isolated, small, fragmented nature of the wooded areas indicates that they have little value as habitat. The old field habitat is a portion of the BHWP site that was formerly cleared and land filled. Disuse of the area has allowed vegetation to regenerate naturally. The site is completely enclosed by a chain link fence. During a site visit no wildlife was observed . However, deer have been seen on and adjacent to the site. Nonetheless, the nature of the vegetation on and adjacent to the site precludes this area as a source of habitat with any significance.

6.5 Geology, Hydrogeology and Seismicity

6.5.1 Ground Stratigraphy (Soils and Surficial and Bedrock Geology)

6.5.1.1 Regional Study Area and Local Study Area

The following description of the soils and geology for the Regional and Local Study Areas has been summarized from the Bruce A Restart EA (Bruce Power, 2002).

The shoreline of Lake Huron near the Bruce nuclear site has areas of bedrock outcrop and comparatively thin surficial deposits (typically less than 20 m). The rock consists of grey to buff brown interbedded limestone and dolostone of the Amherst formation. This stratum extends throughout the Regional Study Area beneath the surficial deposits. Inland, the surficial deposits become much thicker and include the fine grained till, glaciolacustrine and lacustrine deposits.

The dominant physiographic feature inland is the Algonquin Bluff, a ridge formed from shoreline erosion by post-glacial Lake Algonquin. This bluff rises approximately 30 m to elevations of 230 m to 235 m. The terrain above and inland from the Algonquin Bluff consists of comparatively flat clay plains.

Essentially all of the Regional Study Area situated above and east of the Algonquin Bluff is underlain by clayey soils comprising till deposits and glaciolacustrine deposits. The surficial deposits below the Algonquin Bluff and underlying the Bruce nuclear site include silty to clayey till of the Elma (Catfish Creek) sequence overlying the bedrock surface. This till sequence varies in thickness up to approximately 15 m and locally contains interbedded sequences of sand. The till below the Algonquin Bluff is locally overlain by sand and gravel beach deposits.

6.5.1.2 Site Study Area

The BHWP site rises across a distance of 320 m from an elevation of 176.5 m at the shoreline of Lake Huron to a flat region at 190.5 m. To illustrate the general stratigraphy of the area, geologic cross-sections were constructed; these are presented in Appendix B, Figures B.1-B.8.

The thickness of individual stratigraphic units represented at the BHWP site varies significantly throughout the site and unlike the construction backfill and the bedrock, is laterally discontinuous. All of the units, including the construction backfill, are heterogenious. A description of these units is presented below.

Upper, Weathered Till Unit: The till is of glacial origin and is a dense silt with varying amounts of clay, fine to coarse sand, and fine to coarse gravel. Approximate allocation of the grain-size distribution is 55 to 60% silt and clay (5-20% clay), 25 to 30% sand and 7 to 15% gravel.

Sand and Gravel Unit: This unit is made up of beds of silty fine sand to clean sand and gravel with occasional layers of silty till. At the BHWP location it appears as thin occurrences of sand and gravel from 0 m to 2 m thick, often associated with the basal, unweathered till unit and/or the stratified till unit and in direct association with the bedrock surface. This unit occurs in the eastern portion of the BHWP site, is discontinuous and is considered an important unit with respect to contaminant migration because of its position within the flow system. This material exhibits a cation-exchange capacity of from 0.7 to 0.9 meq per 100g and very low organic carbon contents of from 0.13 to 0.23.

Stratified, **Layered Silt Till Unit**: The layered till unit consists mostly of silty till but has occasional layers of fine to coarse sand which is hydraulically connected to the sand and gravel unit. The sand interbeds in this till unit provide increased permeability compared to the upper and lower till units. At the BHWP, this unit underlies a portion of E7 and the Operations Building C. Where it occurs, it is in direct contact with the sand and gravel unit.

Basal Unweathered Till Unit: This unit is not laterally extensive beneath the BHWP site. The till surface is irregular and is similar in appearance to the lower portions of the upper till unit. It is distinguished primarily on its stratigraphic position beneath the middle sand and gravel unit. In locations where the middle sand and gravel unit is absent, it is not a distinct, separate unit from the upper till section. The cation exchange capacity values vary from 1.7 to 3.1 meq. per 100g which reflect the slightly lower clay content (5% to 12%) of this unit from the upper, oxidized till layer. The organic-carbon content of the till is generally quite low, varying from 0.1 to 0.29.

Beach Shingle: This unit is a dense, fine to coarse sand with some silt and occasional sub-rounded pebbles and cobbles. At the northern fenced boundary of the BHWP site where it was encountered, it is approximately 0.5 m to 1.5 m thick. The beach shingle is free draining, having hydraulic properties similar to the sand and gravel unit.

Bedrock: The bedrock consists of Middle Devonian age, buff, silty to sandy dolomite inter-bedded with dark grey bituminous limestone. The upper few meters of the bedrock is fractured and highly weathered. The bedrock surface is approximately 3 m below ground surface along the shore of Lake Huron and dips to the north and east to depths of approximately 19 m along the eastern OPG property line. Within the BHWP, the bedrock surface is undulating; thus, the surface is very irregular with numerous “hills” and “valleys” varying from confirmed depths of from 172.5 m to 185.9 m. The low-lying depressions are often infilled with sand and gravel or glacial till.

In general, the BHWP site consists of construction backfill, beach shingle and pockets of till overlying dolomitic bedrock. During construction of the BHWP facility, portions of the natural overburden and the construction backfill originally placed in the area was removed, often down to the bedrock surface. When it was necessary to contact sound bedrock, the fractured, bituminous-stratified layer of the bedrock was also removed. Additionally, rock cuts and trenches were made for service utilities and then filled with granular backfill.

In the southeast quadrant of the BHWP site, approximately 4 m to 9 m of glacial till is in direct contact with the bedrock. In the northern portion of the site, the glacial till consists of 1 m to 3 m of stratified silt till that is directly connected to the underlying sand and gravel unit.

Soil Quality

Soil quality beneath the Site Study Area was determined through Phase I and Phase II Environmental Site Assessments (ESAs) which were conducted in 1998 (Ontario Hydro, 1998a).

The Phase I ESA identified 41 different areas that were assessed as being either potentially or actually contaminated (a 1999 addendum to the report indicated there were 39 areas). A number of spills have been recorded between 1973 and 1997, of which almost half involved release directly to Lake Huron or the atmosphere. Therefore, they would not likely have resulted in any contamination of soil at the BHWP or any portion of the Bruce nuclear site.

The following areas were identified through visual inspection as having contaminated soil:

- the north, south and east sides of E1, E2, E3, and E4;
- the north and south sides of E7;
- the east and west sides of the North Flare Area;
- the south and west sides of the heat exchanger pad;
- the east side of the Maintenance and Stores Building;
- the acid and sodium hydroxide storage area;
- main substations B and D;
- common services substation;
- the E4 and E7 substations;
- beneath the pipe rack system in the oil storage area;
- the sludge lagoons;
- abandoned tower bases at E5 and E8; and,
- the surface water drainage system, including the SWTF and the effluent process lagoons.

The contaminants associated with these areas included seal oil, lube oil, insulating oil; methyldiethamolamine (DEA/MDEA), sulphuric acid, sodium hydroxide, and, iron, manganese, phosphorus, and sulphide from rusted steel. Not all of these contaminants would be associated with all areas listed above.

The areas identified as being potentially contaminated are:

- the north and south sides of E8;
- the electrical substations associated with E1, E2, E3, and E8;
- Plant A substation;
- the previous process effluent lagoons east of the laboratory;
- the previous surface water runoff lagoon located northwest of the current SWTF; and
- the South Flare Area.

The contaminants identified in these areas included seal oil, lube oil, insulating oil and/or PCB-contaminated insulating oil, DEA/MDEA, and, iron, manganese, phosphorus, and sulphur from rusted steel. Not all of these contaminants would be associated with all areas listed above.

A Phase II Environmental Site Assessment was undertaken to confirm and delineate, or to demonstrate the absence of contamination at the locations identified in Phase I (Ontario Hydro, 1998a). The field-sampling program for the BHWP area included a series of 8 boreholes, 47 test pits, 45 hand holes and the installation of 31 monitoring wells, in 16 nested locations.

More than 200 soil samples were collected and analyzed. The locations of the sampling sites are shown in Figure 6.6. Parameters included in the analysis can be categorized into several groups including metals; oils and grease; benzene, toluene, ethylbenzene, xylene (BTEX); EPA 624; PCBs; Reg 347; and VOCs. Not all parameter groups were analyzed for each sample.

The data were compared to surface soil guidelines for industrial/commercial use with a potable and a non-potable groundwater condition (Tables A and B respectively, 1997 MOE Guideline for Use at Contaminated Sites in Ontario). Results of the sampling program are summarized below:

- **Metals**: Of the 154 samples analyzed, the MOE guidelines for one or more parameters were exceeded in 15 samples (including one duplicate) (Table 6.6). Copper, nickel and zinc were the metals most commonly reported to exceed the guidelines. Of the 38 values exceeding the guidelines, only 12 were more than a factor of two above the guidelines. The majority of samples exceeding the guidelines were collected at the ground surface and likely reflect the presence of metallic scale and rust particles that are accompanied by rust colour staining observed at the surface.

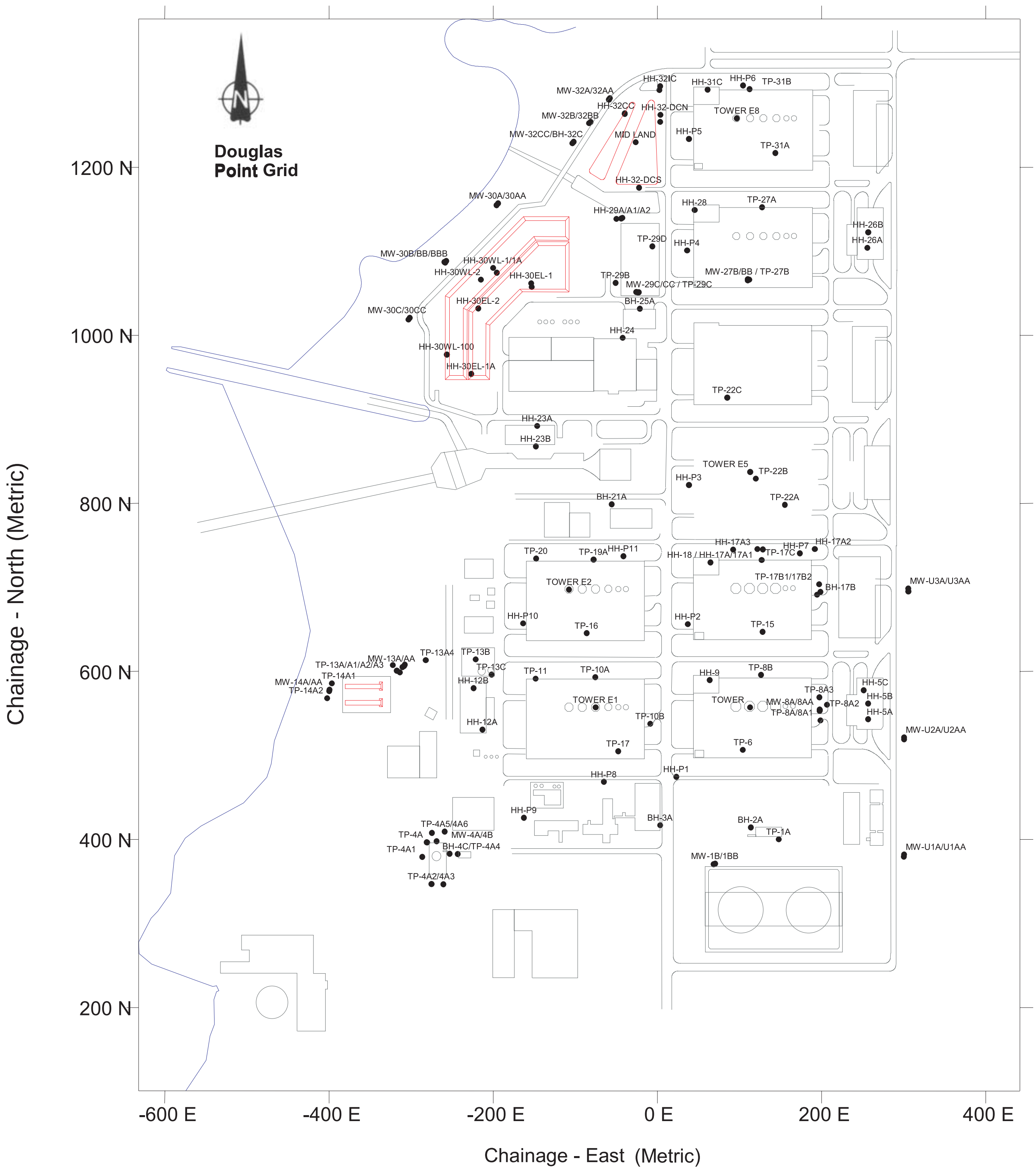
- ***Oil and Grease****:* More than 180 soil samples were analyzed for TPH (total petroleum hydrocarbons), heavy oil, EPH (extractable petroleum hydrocarbons), and PPH (purgeable petroleum hydrocarbons). Both the potable and the non-potable groundwater guidelines were exceeded in numerous samples. Overall, values exceeding the guidelines are limited to several specific locations where high concentrations of the oils/grease (TPH, heavy oil, EPH and PPH) are located at surface and at shallow depths. In general, concentrations decrease with increasing depth at individual sampling locations (see Figure B.9 in Appendix B). Thirty-seven of the samples that exceeded the guidelines were located at eleven sampling sites. These locations and the number of samples with one or more parameters that exceed both potable and non-potable guidelines are shown in Figure B.10, Appendix B.

- ***Reg 347****:* Fifteen samples were analyzed for Ontario Reg. 347 parameters (MOE, 1989). A limited suite of these parameters was analyzed on most soil samples. The analyses were conducted as a screening initiative to evaluate the soil quality. The MOE guidelines for Reg. 347 parameters were not exceeded.

- ***PCBs:*** None of the 91 soil samples analyzed exceeded the PCB guideline.

LOCATIONS OF SOIL SAMPLING ON BHWP SITE

FIGURE 6.6



LEGEND:

● Wardrop Engineering Sample

Date September 2002

SENES 33315

ONTARIO POWER GENERATION

Fig 6.6 8.5x11 CDR

TABLE 6.6
METAL PARAMETERS EXCEEDING MOE GUIDELINES

Sample	Depth (m)	Location	Parameter	Value (μg/g)	MOE guideline* (μg/g)
HH-P2	Surface	Pipe Racks NE Corner 2^{nd}-3^{rd} Ave.	Chromium Zinc Cadmium	850 800 12.6	(1000) 750 (800) 600 12
HH-P4	Surface	Pipe Racks E7	Copper Zinc	240 839	(300) 225 (800) 600
HH-P5	Surface	Pipe Racks W. of E8 Pad	Copper Nickel	228 204	(300) 225 (200) 150
HH-P6	Surface	Pipe Racks N. of E8	Nickel Zinc	167 2033	(200) 150 (800) 600
TP-10A	0.39	E1-North Side	Boron	4.06	2
HH-29A1	0.63	North Flare Ditch	Boron	166	2
HH-29A2	0.2	North Flare Ditch	Boron Copper	4.77 251	2 (300) 225
HH-29D	Surface	North Flare- East side	Copper Nickel Zinc Cadmium	563 280 1250 23.9	(300) 225 (200) 150 (800) 600 12
HH-29D South	Surface	North Flare- East side	Copper Nickel Zinc Cadmium	650 325 1210 12	(300) 225 (200) 150 (800) 600 12
BH-2A	Surface	Flammable Stores	Arsenic Chromium Copper Molybdenum Nickel Zinc	68 808 298 104 723 1290	(50) 40 (1000) 750 (300) 225 40 (200) 150 (800) 600
TP-13A	0.1	South Flare Drainage Ditch	Copper	475	(300) 225
TP-13B	0.15	South Flare Area	Copper Molybdenum Nickel	263 52.6 352	(300) 225 40 (200) 150
TP-13B Duplicate	0.15	South Flare Area	Copper Molybdenum Nickel	271 68.9 258	(300) 225 40 (200) 150
HH-17A1	0.05	E4-North Side	Copper Zinc	231 786	(300) 225 (800) 600
HH-17A1	Surface	E4-North Side	Nickel Zinc	176 747	(200) 150 (800) 600

* MOE guidelines for surface soil remediation criteria for industrial/commercial land use for potable and non-potable groundwater, Tables A and B (MOE, 1997). For these parameters the guidelines for potable and non-potable conditions are the same value. Guideline values in brackets apply to medium to fine textured soils.

- ***BTEX:*** MOE guidelines for Benzene, Toluene, Ethylbenzene and Xylene (BTEX) were not exceeded for the twenty-four samples analyzed. Values were reported as Not Detected in all twenty-four samples.

- ***EPA 624****:* The MOE guidelines for the constituents listed within the EPA 624 scan for VOCs (U.S. EPA, 1984)- were not exceeded for the 81 samples analyzed. The vast majority of values were reported as Not Detected.

- ***VOC:*** The MOE guidelines for VOC parameters were not exceeded for the 8 samples analyzed. Forty-seven parameters were included in the VOC parameter list. Results for all parameters, in all samples, were reported as Not Detected.

A number of areas that store materials, such as sodium hydroxide, sulphuric acid, hydrogen sulphide, diesel, light fuel oil and propane, were identified as being potentially contaminated. However, these areas are protected by spill containment facilities, and are therefore considered to present minimal risk of potentially contaminating soils.

6.5.2 Hydrogeology

6.5.2.1 Regional Study Area and Local Study Area

Groundwater Flow

Groundwater flow within Bruce County, including the Regional Study Area, is typically subparallel to the direction of surface water drainage which is predominately westward toward Lake Huron. Groundwater infiltration in the upland areas discharges as baseflow to the various streams that drain the area. Groundwater flow is ultimately directed toward Lake Huron.

Above the Algonquin Bluff (Section 6.5.1.1), groundwater gradients are downward from surface toward the bedrock. Below the bluff, adjacent to Lake Huron, the gradients are upward where groundwater in the bedrock, recharged over time from locations above the bluff, discharges into the lake. Lake Huron is the ultimate receptor of groundwater within the Local Study Area.

Groundwater Chemistry

The chemical concentrations of the groundwater at the Bruce nuclear site, including the BHWP, are shown in Table 6.7 (Ontario Hydro, 1997a).

TABLE 6.7
SUMMARY OF GROUNDWATER CHEMISTRY BY STRATIGRAPHIC UNIT

Stratigraphic Material / Analyte	Oxidized Till	Unweathered Till	Sand	Sand & Gravel /Beach Shingle	Upper Carbonate Aquifer
Analyte	**Concentration mg/L**				
Calcium (Ca^{2+})	69 to 123	44 to 143	94 to 200	100 to 263	40 to 174
Magnesium (Mg^{2+})	25 to 76	14 to 93	23.5 to 67	30 to100	7 to 25
Potassium (K^{+})	2.7 to 8.0	3.5 to 12.1	0.9 to 3.3	1.1 to 26.1	1.7 to 21
Sodium (Na^{+})	9.3 to186	37 to 261	3.8 to 34	3.1 to 100	22 to 57
Strontium (Sr^{2+})	0.34 to 2.1	0.2 to 25.8	0.23 to 3.9	0.23 to 3.9	~0.98
Cesium (Cs^{2+})	0.2 to 0.34	< 0.3 to 0.5	< 0.6	< 0.6	-
Chloride (Cl^{-})	8.6 to 13.8	3.6 to 44.9	2.9 to 15	21 to 284	21 to 87
Sulphate (SO_4^{2-})	49.5 to 766	24 to 1049	3.6 to 549	13 to 191	48 to 68
Bicarbonate (HCO_3^{-})	459 to 526	136 to 489	319 to 514	335 to 1254	151 to 423
Conductivity (μS)	1275	855 to 2075	460 to 726	56 to 1310	420 to 930
pH (in pH units)	6.55 to 8.03	6.89 to 7.92	7.03 to 7.15 lab:7.7 to 8.8	6.6 to 7.48	7.0 to 7.75

The electrical conductance varies from 56 μS (micro siemens) in the sand and gravel and beach shingle deposits to 2075 μS in the un-weathered (grey) till material. Electrical conductance is an approximate measure of the total dissolved solids in the water. Groundwaters with electrical conductivities above 1000 μS are primarily located in the silty till units while groundwaters at the lower end of the conductivity range are typically in the sand and gravel, beach shingle and upper carbonate bedrock strata. In general, total dissolved solids, and thus electrical conductivity, is primarily a result of three cations (Ca^{2+}, Mg^{2+}, Na^{+}) and two anions (HCO_3^{-}, SO_4^{2-}) in the groundwaters on the Bruce nuclear site. With respect to anions, chloride is not included, as the concentration is generally low (< 45 mg/L).

The concentration of bicarbonate ranges from 136 to 526 mg/L in the glacial till, and typically from 319 to 1,254 mg/L in the sand and gravel and beach shingle deposits. The groundwater, specifically in the till unit, is slightly over-saturated with respect to calcite and dolomite. This, coupled with the pH values, is typical of groundwater in carbonate-rich Quaternary deposits. The pH measurements vary from 6.55 to 7.92 in the till units, from 7.03 to 7.15 in the sandy unit, from 6.6 to 7.48 in the sand and gravel/beach shingle unit and from 7 to 7.75 in the upper bedrock. The presence of abundant bicarbonate (HCO_3^{-}) is common in carbonate-mineral rich deposits (calcite ($CaCO_3$)) and dolomite ($CaMg(CO_3)_2$) minerals) in southern Ontario, and buffers the system pH in the range of 7 to 8.

6.5.2.2 Site Study Area

Groundwater Flow

This area has an aquifer in both the overburden and the bedrock.

The upper most aquifer consists of two hydraulically connected stratigraphic units which consist primarily of construction backfill/sand and gravel material and/or beach shingle that overlies fractured dolomitic bedrock. The construction fill is compacted, coarse-grained material that is considered to be free draining and the size of coarse sand to cobble. This backfill, ranging in thickness from slightly less than 0.5 m to 4 m, is in direct contact with the bedrock aquifer in the northwest portion of the site. The underlying beach shingle is also free draining and is present in the north quadrant of the site.

A summary of the typical range of groundwater flow parameters and patterns (direction) for the major types of soil and bedrock found at the BHWP site are presented in Appendix B, Table B.1. Water levels collected from 1998 and 1999 were plotted to produce water table contours in the vicinity of the BHWP (Figure 6.7). The contours indicate that the groundwater flow in the area discharges directly to Lake Huron.

There are zones within the glacial till with hydraulic conductivities in the range of 1×10^{-8} to 5×10^{-5} $cm.s^{-1}$. These areas of low hydraulic conductivity indicate the till layer, when present, is relatively impermeable and would act as an aquitard to the overlying more permeable coarse-grained sediments. The more permeable deposits of sand, sand and gravel, beach shingle and construction backfill occur in the area and have hydraulic conductivities ranging from 1×10^{-5} to 3×10^{-3} $cm.s^{-1}$ with the construction fill and beach shingle falling within the higher numerical range.

In the immediate area of the BHWP, the local hydraulic gradient is much higher than that of the regional area; therefore, the corresponding average groundwater velocities under these elevated hydraulic gradients are estimated to be on the order of 58 $m.a^{-1}$ to 95 $m.a^{-1}$ (Jensen et al., 1991).

Groundwater Chemistry

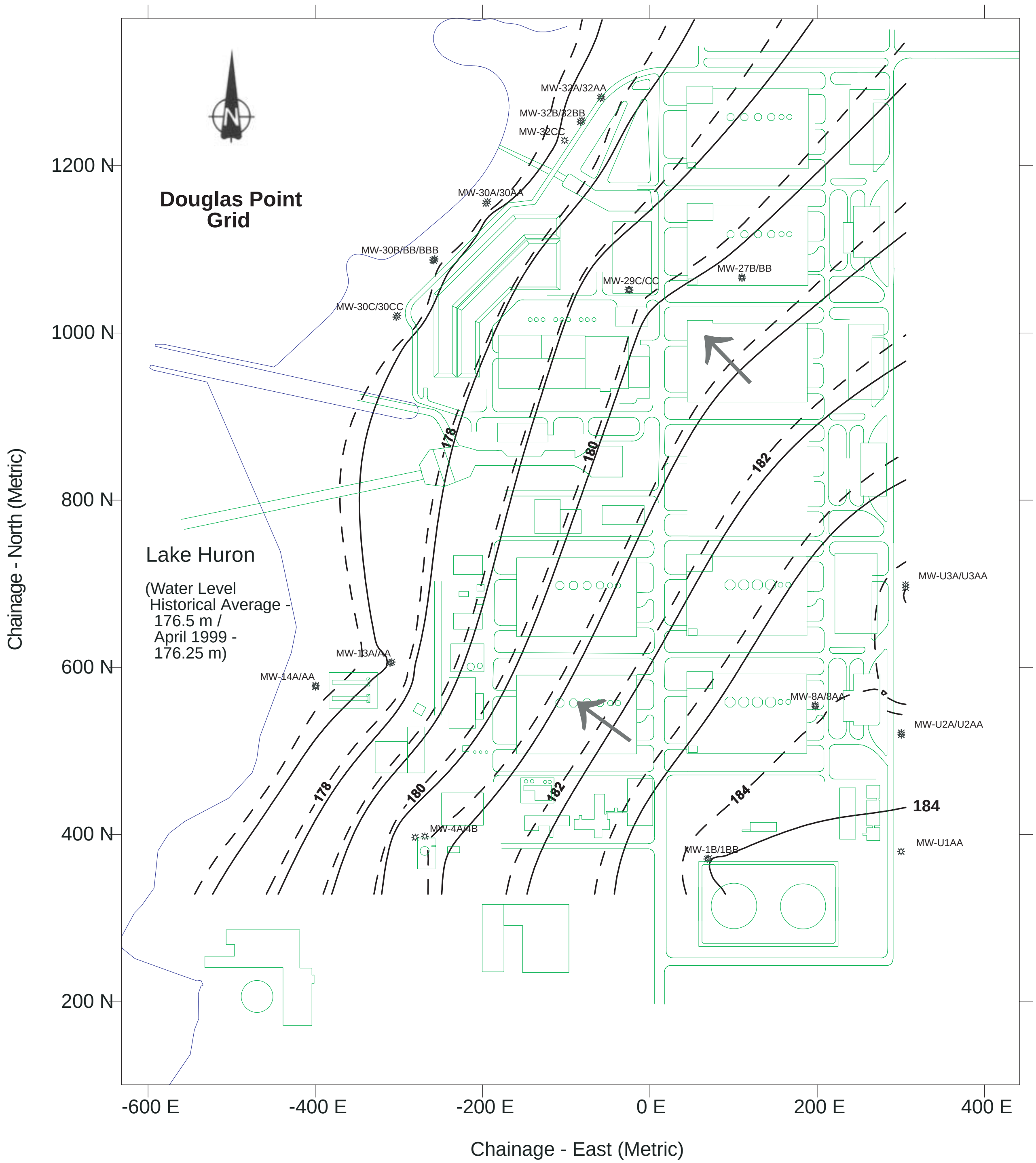
Detailed site-specific information is available from the Phase II Environmental Site Assessment which was undertaken in 1998 (Ontario Hydro 1998).

Groundwater samples were obtained from 7 monitoring wells installed upstream (upgradient with respect to groundwater flow and the enriching towers), 16 downstream (downgradient with respect to groundwater flow, along the shoreline of Lake Huron) and 8 monitoring wells within the BHWP site. The location classifications of these wells are provided in Appendix B, Table B.2.

Of the wells installed upstream, 4 have well screens located in the upper bedrock aquifer (upper carbonate bedrock) and 3 have well screens in the unconsolidated overburden material (sand and

WATER LEVEL CONTOURS ON BRUCE NUCLEAR SITE 1998-1999

FIGURE 6.7



LEGEND:

- Wardrop Monitoring Well Location
- Inferred Groundwater Flow Direction
- April 1999 Water Level Contour Line - Interval 1.0 m
- 1998 Water Level Contour Line - Interval 1.0 m

Elevations - Canadian Geodetic Datum - Metric

Date September 2002

SENES 33315

ONTARIO POWER GENERATION

Fig 6.7 8.5x11 CDR

gravel, silt till, construction fill). With respect to the downstream monitoring wells, 8 are screened in the upper bedrock aquifer and 8 are screened in the unconsolidated overburden.

Table 6.8 summarizes analytical results from the 1998 site assessment for several inorganic and organic parameters for the upgradient and downgradient wells located in both the bedrock and the overlying, unconsolidated overburden. Table 6.9 summarizes analytical results for the same parameters at monitoring wells within the BHWP site. It should be noted that the values presented in Tables 6.8 and 6.9 were obtained from a single groundwater-sampling event and provide a range of values. Results for individual monitoring wells are shown in Appendix B, Tables B.3 and B.4. Included in the tables are the MOE clean-up criteria for a potable and non-potable groundwater situation. A comparison of the groundwater chemistry to the clean-up guideline criteria indicates no significant impact to the environment as none of the analytes measured in the downgradient monitoring wells show appreciably higher concentration levels than those in the wells located upstream along the groundwater flow direction. None of the analytes measured from monitoring wells located in the interior of the BHWP site exceeded the MOE guideline for non-potable groundwater, although one analyte was at the guideline criterion.

TABLE 6.8
GROUNDWATER CHEMISTRY UPSTREAM AND DOWNSTREAM OF BHWP - 1998

Analyte Concentration (μg/L)	Stratigraphic Material				MOE* Guideline Criteria (μg/L)	
	Upper Carbonate Aquifer		Unconsolidated Overburden Aquifer (Fill/Sand & Gravel/Till)			
	Upstream	Downstream	Upstream	Downstream	Potable	Non-potable
Antimony	0.006 to 2	1 to 9[2]	2	2	6	16000
Arsenic	<1 (30)[1]	<1 to 22 (54)[2]	<1 to 3	<1	25	480
Copper	0.005 to 0.011	<0.005 to 2.1	0.6 to 21.4	0.027 to 22.2	23	23
Lead	<0.7	<0.7	<0.7 to 9.3	<0.7	10	32
Selenium	<0.003 to 4	<1 (51)[2]	0.004 to 2	< 1	10	50
Zinc	<10 to 10	<10	<10 to 45	<10	1100	1100
Benzene	<0.5	<0.5	<0.2	<0.2	5.0	1900
Toluene	<0.5	<0.2 to 0.2	<0.2	0.2 to 0.3	24	5900
Ethylbenzene	<0.5	<0.2	<0.2	<0.3	2.4	28000
Xylenes	<0.5	<0.2	<0.2	<0.2	300	5600
PCB	<0.1	<0.1	<0.1[3]	<0.2	0.2	0.2
$TPH_{gas/diesel\ (C10\text{-}C\text{-}24)}$	<100	<100	<100	600	1000	No Value
$TPH_{heavy\ (EPH)}$	<70	<70	<70	<70 to 101	1000	No Value
Phenol	<1	<1	<1	<1	4200	26000
^{3}H (Bq/L)	222 to 259	281	<185 to 296	Not Available	7000 Bq/L	
^{137}Cs (Bq/L)	<0.027	0.048	<0.027	Not Available	50 Bq/L	
pH (in pH units)	7.25	7.93	7.09 to 7.28	6.81 to 7.7	6.5 to 8.5	

*MOE Guideline For Use at Contaminated Sites in Ontario, Dated February 1997 (includes revisions made September, 1998): Table A, Criteria for Potable Groundwater, and Table B, Criteria for Non-potable Groundwater
1 Single result out of 5 upgradient groundwater samples within the BHWP
2 Single result out of 6 downgradient groundwater samples within the BHWP
3 Background results from upper unconfined sand & gravel aquifer south of the BHWP

TABLE 6.9
GROUNDWATER CHEMISTRY ON BHWP SITE - 1998

Analyte Concentration (μg/L)	Stratigraphic Material		MOE* Guideline Criteria (μg/L)	
	Upper Carbonate Aquifer	Unconsolidated Overburden Aquifer (Fill/Sand & Gravel/Till)	Potable	Non-potable
Antimony	<0.001 – 9	<1 – 2	6	16000
Arsenic	0.003 – 54	<1	25	480
Copper	0.0048 – 2.1	0.6 – 22.2	23	23
Lead	0.008 - <0.7	<0.7 – 9.3	10	32
Selenium	0.003 – 51	<1	10	50
Zinc	0.026 – 12	<10 – 45	1100	1100
Benzene	<0.2 - <0.5	<0.2 (single sample)	5.0	1900
Toluene	0.2 - <0.5	0.2 (single sample)	24	5900
Ethylbenzene	<0.3 - <0.5	<0.3 (single sample)	2.4	28000
Xylenes	<0.2 – 3.1	0.2 (single sample)	300	5600
PCB	NA	NA	0.2	0.2
$TPH_{gas/diesel\ (C10-C-24)}$	<0.5 - <1	<1 (single sample)	1000	No Value
$TPH_{heavy\ (EPH)}$	<0.5 - <1	<0.5 (single sample)	1000	No Value
Phenol	NA	NA	4200	26000
^{3}H (Bq/L)	281 (single sample)	NA	7000 Bq/L	
^{137}Cs (Bq/L)	24 (single sample)	NA	50 Bq/L	
pH (in pH units)	NA	NA	6.5 to 8.5	

NA= Not Analyzed/Not Reported.

*MOE Guideline For Use at Contaminated Sites in Ontario, Dated February 1997 (includes revisions made September, 1998): Table A, Criteria for Potable Groundwater, and Table B, Criteria for Non-potable Groundwater.

A summary of the 1998 groundwater chemistry results is provided below.

- ***Metals**:* Of the 45 water samples analyzed (groundwater, surface water, sump water), metal concentrations that exceeded the MOE guidelines for one or more parameters were observed in 7 samples. The metals group comprised 30 parameters. There were 4 sampling locations where potable groundwater guidelines were exceeded. Selenium (Se) exceeded the potable groundwater guideline and was at the non-potable groundwater guideline south of the North Flare area on the BHWP site. None of the groundwater samples from wells downgradient of the BHWP site had elevated Se concentrations. The potable groundwater guidelines were exceeded for Arsenic (As) west of the sludge lagoon and east of E3, and for Antimony (Sb) south of North Flare area. These values were only marginally over the MOE groundwater guidelines. Both As and Sb concentrations were well below non-potable groundwater guidelines.

- ***VOCs:*** Neither the non-potable nor potable groundwater MOE guidelines were exceeded for any of the 49 VOC parameters analyzed. Reported values were consistently below method detection limits. Values above method detection limits were reported for only 7 samples in the entire VOC data set.

- ***Selected Radioactive Isotopes:*** The radioactive isotope data set consists of C-14, tritium, Co-60, and Cs-137. All values reported for C-14 were below the detection limit (<0.1 or <0.3 Bq/kg). Tritium concentrations ranged from below detection limit (185 Bq/kg) to 296 Bq/kg. These values are in the low end of the range occurring in natural groundwater in and around the BHWP (Vorauer et al., 1998). Reported Co-60 values were below the detection limit of 0.74 Bq/kg in all instances. Reported Cs-137 values were below the detection limit of 0.74 Bq/kg except for one sample with a reported value of 0.89 +/- 0.37 Bq/kg that is considered to be at the detection limit.

- ***PCBs:*** The MOE PCB guideline (0.2µg/L) was exceeded in one of the 12 water samples where PCB was analyzed (sump water sample in the vicinity of E3). All other values reported were below the MOE guideline.

- ***BTEX:*** BTEX parameters included benzene, toluene, ethylbenzene, p+m xylene, and o-xylene. None of the BTEX parameters reported for the 7 groundwater samples submitted for analyses exceeded the guidelines. Values were below detection limits for all samples.

OPG recently completed additional groundwater sampling focussing on those locations where the 1998 results were close to or above the applicable MOE guidelines. Results of this sampling program will be reported as soon as they are available.

6.5.3 Seismicity

A seismic hazard summary was presented in the Bruce A Restart EA (Bruce Power, 2002). The conclusions reached for the Bruce A plant would be equally applicable to the BHWP.

The seismic hazard evaluation for the Bruce nuclear site used updated site-specific estimates of the ground motions, using recent seismicity and ground motion data. The hazard is represented by the expected earthquake ground motions for an annual exceedance probability of 1/10,000, corresponding to a 1% chance of being exceeded in 100 years.

The Western Ontario region lies within the tectonically stable interior of the North American continent, which is characterized by low rates of seismicity. The seismic zoning map in the National Building Code, for example, places the site in Zone 0, with Zone 6 corresponding to the most seismically active regions of the country. The Regional Study Area thus experiences low levels of seismicity.

The event locations and magnitudes of all known earthquakes of magnitude 1 or greater, through June 28, 2001, were obtained from the National Earthquake Database of the Geological Survey of Canada. Most events have magnitude less than 4, with rare occurrences of larger events.

Seismographic data indicate the Regional Study Area experiences sparse seismic activity, with no apparent concentrations of activity that might delineate regional seismogenic features.

Based on the seismicity catalogue of the Geological Survey of Canada, through to mid-2001, the rates of activity in the defined Western Ontario zone (42 to 48N, 78 to 84W) are 47 events of $\mathbf{M} \geq 3$ in 100 years and 8 events of $\mathbf{M} \geq 4$ in 100 years.

These regional seismicity rates are used to develop the magnitude recurrence relation. The magnitude recurrence relation implies a recurrence rate of 0.013 per annum, or 1 to 2 events every hundred years, for events of $\mathbf{M} \geq 5$ within the region. A magnitude 5 is considered a moderate earthquake, which may cause significant damage to poorly built (un-reinforced) structures in the epicentral area, but does not generally damage modern well-engineered structures or heavy industrial structures. Larger, more damaging earthquakes, say of $\mathbf{M} \geq 6$, are considered possible in the region (and indeed anywhere in North America). However, the rate of occurrence of $\mathbf{M}=6$ earthquakes is about 6 times lower than that of $\mathbf{M}=5$ earthquakes; thus an $M \geq 6$ event somewhere within the Bruce region would be expected about once every 500 years. This means that the likelihood of a large, potentially damaging event (of $\mathbf{M} \geq 6$) occurring close to the Bruce nuclear site is very low. The maximum magnitude for the region is assumed to be $\mathbf{M}=7.0$. Within a 100 km radius of the Bruce nuclear site, there have been no earthquakes of $\mathbf{M} \geq 4$ in the period of historic record (which would extend back about 200 years for events of this magnitude).

6.6 Radiation and Radioactivity

6.6.1 Current Inventory of Nuclear Substances

A small quantity (currently 234 grams) of uranium metal foil is used in the one of the Infrared Absorption Analyzers located in the Laboratory in the Common Services Area. In addition, approximately 2 kg of waste uranium metal foil is currently stored in the laboratory. The Laboratory will remain outside of the Construction Islands throughout the course of the decommissioning project.

6.6.2 Radiological Contamination

6.6.2.1 Possible Sources of Contamination

Sealed sources containing high-energy gamma emitting radionuclides were used in industrial radiography. These sources were stored in the Radiography Hut located just west of F1 (outside the currently licenced area). All radiography sources have been removed from the site. Some sealed sources were used in equipment on the site such as the level switches on the H_2S Storage Tanks. These have also been removed from the site.

All sealed sources were leak tested as required by AECB/CNSC Regulations. There is no record of any leakage of radioactive material from a sealed source.

No radioactive materials were used as source material for the production of heavy water:

- Plant B was only used to process virgin heavy water; no potentially contaminated recycled heavy water was processed in Plant B.
- Plant D was never commissioned and was never exposed to any potential sources of contamination except sealed industrial radiography sources used during construction;
- The buildings and structures in the Common Services Area were never exposed to any potential sources of contamination except the sealed sources noted above.

Heavy water from the former Douglas Point Nuclear Generating Station was reprocessed in F1 which has already been demolished.

There is no evidence to indicate that radioactive materials contained in high-pressure steam have contaminated any components of the Enriching Units. Steam generators in Steam Transformer Plant (STP) ‘A’ used the heat from the Bruce A Secondary Heat Transport System to produce medium-pressure steam for the heavy water plants. Tritium levels in the steam from the Bruce A Secondary Heat Transport System never exceeded the PWQO of 7,000 Bq/L during the three years of operation prior to May 1, 1997. The design of STP ‘A’ prevented steam from the Bruce A Secondary Heat Transport System from mixing with the medium-pressure steam generated for the BHWP. There were leaks from time to time (failed HX tubes allowed steam from Bruce A to enter the BHWP medium-pressure steam system) so the medium-pressure steam was routinely sampled for tritium. There is no history of significant cross-contamination. Radiological decay during the time between shutdown and the beginning of demolition will have reduced any tritium cross-contamination that may have occurred.

Steam Generators in STP 'O' used heat from steam produced in the Old Steam Plant and the former Douglas Point Generating Station to generate medium pressure steam for BHWP whenever STP 'A' was unavailable. The medium-pressure steam could have been contaminated by tritium from the Douglas Point Generating Station in the same manner as described above for STP 'A', but routine sampling did not detect any significant cross-contamination. Douglas Point steam has not been used as a heat source since the late 1970's and radiological decay would have reduced any cross-contamination even if it did occur.

6.6.2.2 Contamination Discovered during Previous Decommissioning Work

As described in Section 1.1.2.1, E1, E2 and E3 were successfully demolished between 1993 and 1995. No radioactive contamination was discovered during the course of this demolition work. E8 was also demolished without any contamination being discovered. However, this unit had never been commissioned, so no contamination was expected.

6.6.2.3 Ground Contamination Surveys

A ground contamination survey of part of the BHWP was performed during the spring of 2000 (CTECH, 2000). The survey included all of the roadways on the site and a few other areas near the Douglas Point Waste Management Facility (these areas were included because contamination was found on the grounds of the Douglas Point facility). Under the survey conditions, the Lower Limit of Detection (LLD) was approximately 500 Bq. However, the LLD could be as low as 150 Bq depending on the isotope as well as the survey methodology and conditions.

Only two instances of contamination were discovered. In both cases the activity was only slightly greater than the LLD.

- A contaminated particle containing approximately 1 kBq of Co-60 was discovered in a part of the BHWP that was never used or developed. The contamination was south of the sludge lagoons and east of the now demolished Plant A Clarifier Building. It was several metres from the fence separating the BHWP from the Douglas Point Waste Management Facility.
- Another contaminated particle containing a similar activity of cobalt-60 was discovered on the gravel on the south side of Second Ave close to the Maintenance and Stores Building (Building 500) in Plant A.

Both particles were collected and removed by OPG staff.

No evidence of contamination was discovered in any area where work would be performed during the course of the decommissioning proposed in this EA.

6.6.2.4 Sub-Surface Sampling

The results of a groundwater sampling program conducted around the BHWP is described in Section 6.5.2.2. There was no appreciable difference in radionuclide levels between groundwater upgradient and downgradient of the plant. Tritium levels were less than 300 Bq/L, which is in the low end of the range normally found in groundwater near the Bruce nuclear site. The levels of other radioisotopes were below the lower limit of detection (0.1 or 0.3 Bq/kg for carbon-14 and 0.74 Bq/kg for both Co-60 and Cs-137).

6.7 Land Use and Transportation

6.7.1 Land Use

6.7.1.1 Regional Study Area

The BHWP site is located in the Municipality of Kincardine in the County of Bruce (Figure 1.1). The Regional Study Area, and indeed the majority of the Municipality of Kincardine and the County of Bruce consists of rural land uses which are designated in the County's Official Plan as rural, agricultural, major open space, natural environment areas, shoreline development areas, special policy area, and Inverhuron Provincial Park No primary urban communities exist within the Regional Study Area. The nearest primary urban areas to the BHWP site are the communities of Kincardine and Port Elgin, located approximately 10 km southwest and 15 km northeast, respectively. A secondary urban community (Tiverton) and two hamlet communities (Underwood and Inverhuron) exist within the Regional Study Area. The only major industrial area within the Regional Study Area is the Bruce Energy Centre.

The municipal land use policies of Kincardine zone the majority of the lands in the Regional Study Area as Environmental Protection (EP) or Open Space (OS) which permit uses associated with agriculture and recreation. There is one home southeast of the Bruce nuclear site (outside the 914 m exclusion zone) located near Bruce Concession 6 and McFarland Road which is zoned Residential (R1).

The municipal land use policies direct the use and development of lands within the Regional Study Area. According to the County of Bruce Official Plan, the Bruce nuclear site is considered a Controlled Development Area. Within this area the County of Bruce intends that the majority of the lands be maintained as an agricultural area until such a time as they are required for industrial development, and that all planning approvals shall be reviewed by OPG to ensure compliance with licensing, operating and regulatory requirements of all Bruce nuclear site facilities. Within the Controlled Development Area, the County maintains strict control over existing and new residential developments and farm holdings.

6.7.1.2 Local Study Area

The Local Study Area consists of the Bruce nuclear site which is approximately 932 ha in size (Figure 6.8). It is fenced, with restricted and controlled access. There is a 914 m exclusion zone around both the Bruce A and the Bruce B stations. These exclusion zones restrict the types of uses that can occur within.

In addition to the designation of the Bruce nuclear site as a Controlled Development Area, two "Hazard Land Areas", an Active and Closed Landfill site and a Provincially Significant Wetland are identified in the County's Official Plan within the Local Study Area.

The Municipality of Kincardine zoning by-law identifies the Bruce nuclear site as "Institutional" and permits a variety of land uses related to electrical and heat energy production, transmission and distribution.

6.7.2 Transportation Network

6.7.2.1 Regional Study Area

The transportation network in the Regional Study Area consists of several concession roads or other rural roads and Highway 21. Highway 21 is a north-south highway that provides regional access to the Bruce nuclear site from Port Elgin and Kincardine. It is maintained by the Ontario Ministry of Transportation. Direct access from Highway 21 to the Bruce nuclear site is via two intersections at Bruce Concession 4 and Bruce Concession 2 which provide east-west access and a Tie Road. These concession roads are two-lane rural roads under the jurisdiction of the Municipality of Kincardine. The Tie Road provides the main access to the Bruce nuclear site. In accordance with the Ontario Highway Capacity Manual (2000), these roads provide employees and the general public an acceptable Level of Service. For example, Highway 21 and these rural roads currently operate at a Level of Service of "B" or better. Bruce Concession 4 at the Tie Road / North Gate operates at a Level of Service "C" during the morning peak hour. These Levels of Service ensure low collision rates. The key intersections in the Regional Study Area have collision rates well below three collisions per million vehicles, which is the acceptable threshold of concern. Approximately half of the reported accidents since 1998 were 'incidents with deer'.

6.7.2.2 Local Study Area

The Bruce nuclear site is well serviced by a paved internal road system. The internal road system is accessible from outside the Local Study Area via three main gates. The main gate off the Tie Road is open 24 hours per day. The other two gates located at the western ends of Bruce Concession 4 and Bruce Concession 2 are open on occasion to registered people and at selected shift changes.

6.8 Physical and Cultural Resources

6.8.1 Archaeology

Various archaeological resource assessments have been carried out for the Bruce nuclear site and the adjacent area. Research conducted consisted of reviews of current site files and maps located at the Ministry of Citizenship, Culture and Recreation. In consultation with the Chippewas of

Saugeen and the Nawash First Nations, a stage 2 archaeological survey was conducted in 1997 covering the entire Bruce nuclear site, as part of the EA for the WUFDSF (Ontario Hydro, 1998b). This survey clarified relationships between archaeological sites previously identified in the area, removing a long-standing misunderstanding regarding a suspected site east of the BHWP (i.e. the survey established that there is no archaeological site in that area). However, the survey identified two other archaeological sites located within the Bruce nuclear site. These two sites are shown on Figure 6.8.

Previous archaeological findings near the shore of Inverhuron Bay and the Little Sauble River showed that the area was settled at least 2000 years ago by the Iroquois Nation. Evidence includes pottery, tools and burial sites. The lands were generally occupied by the Ojibway tribe when the Europeans arrived. This area was part of lands ceded to the British in August 1836 and became part of the District of Wellington, later known as the District of Huron. Surveying and division of the area commenced in 1847.

Numerous other sites have been recorded within Inverhuron Provincial Park. An historic lime kiln is located adjacent to the site near former the Douglas Point Generating Station. The BHWP area has been heavily modified by land clearing, grading and adding fill, road construction, and the construction of foundations and pads for numerous buildings, processing structures and water treatment lagoons; therefore, it should not have any archaeological potential. This was confirmed by the 1997 survey (Ontario Hydro, 1998b).

6.8.2 Landscape and Visual Description

With scenic landscape and long lake shoreline, Bruce County provides some of the most distinctive and diverse visual settings in the province (e.g. cliff, river valley, pure white sand beach, rolling hill). The area attracts visitors from local, national and international locations. The natural and scenic beauty of the County has made tourism a significant contributor to the local economy.

Highways 4, 9, 6, 21 and 86 provide the main travel corridors through which most of these landscapes can be viewed and accessed. A grid network of concession roads bisects the flat semi-open agricultural landscape, which characterizes much of the eastern half of the township. County Road 20 carries travelers through this landscape to the Bruce nuclear site and the Bruce Energy Centre.

Boaters have views of the site shoreline and can access the numerous marinas and resort towns including the deep water harbour at Kincardine. The Bruce nuclear site in the southwest corner of Bruce Township and Bruce County is on an isolated shoreline setting.

The viewing deck of the Bruce Power Visitors' Centre provides a panoramic view of the massive scale of the industrial complex on the Bruce nuclear site. From this vantage point, the location of a band of woodland creates a natural landscape buffer to views of the complex. This buffer is diagonally severed by an abandoned rail line and several transmission line corridors.

Close proximity views of the Bruce nuclear site are not available to the general public as access to the site is controlled at the Central Guardhouse and security gates. The woodland vegetation obscures the complex from views along the local roads. However, approximately 4,500 plant workers, authorized visitors or off-site employees and contractors do have access to the site.

Within the Bruce nuclear site, the east/west Central Services Road serves as the main access corridor. The design of the entrance and roadway integrate the facilities within the woodland and meadow context and provides an aesthetic approach to the complex. However, near the Bruce stores and maintenance yards the view opens, revealing the array of structures and facilities.

Development of the Bruce nuclear complex resulted in the clearing of much of the woodland that once dominated this site. Remaining areas are fragmented patches of woodlots and trees with disturbed areas of successional regeneration. Expansive areas of paved surfaces associated with operations and parking dominate the developed areas. Land use patterns conform to the engineered grid and diagonals of road/rail alignment, building layout and drainage channels. Larger woodland areas remain along the southern and eastern sections of the site.

6.9 Socio-economic Conditions

This section describes existing socio-economic conditions that are relevant and useful in predicting environmental effects likely to result from the BHWP Decommissioning Project. Because there is no unrestricted public access to Bruce nuclear site and because there are no socio-economic features associated with the Local or Site Study Areas other than the nuclear operations on the Bruce nuclear site, the description of existing socio-economic conditions is focussed on the Regional Study Area and the Municipality of Kincardine and the County of Bruce.

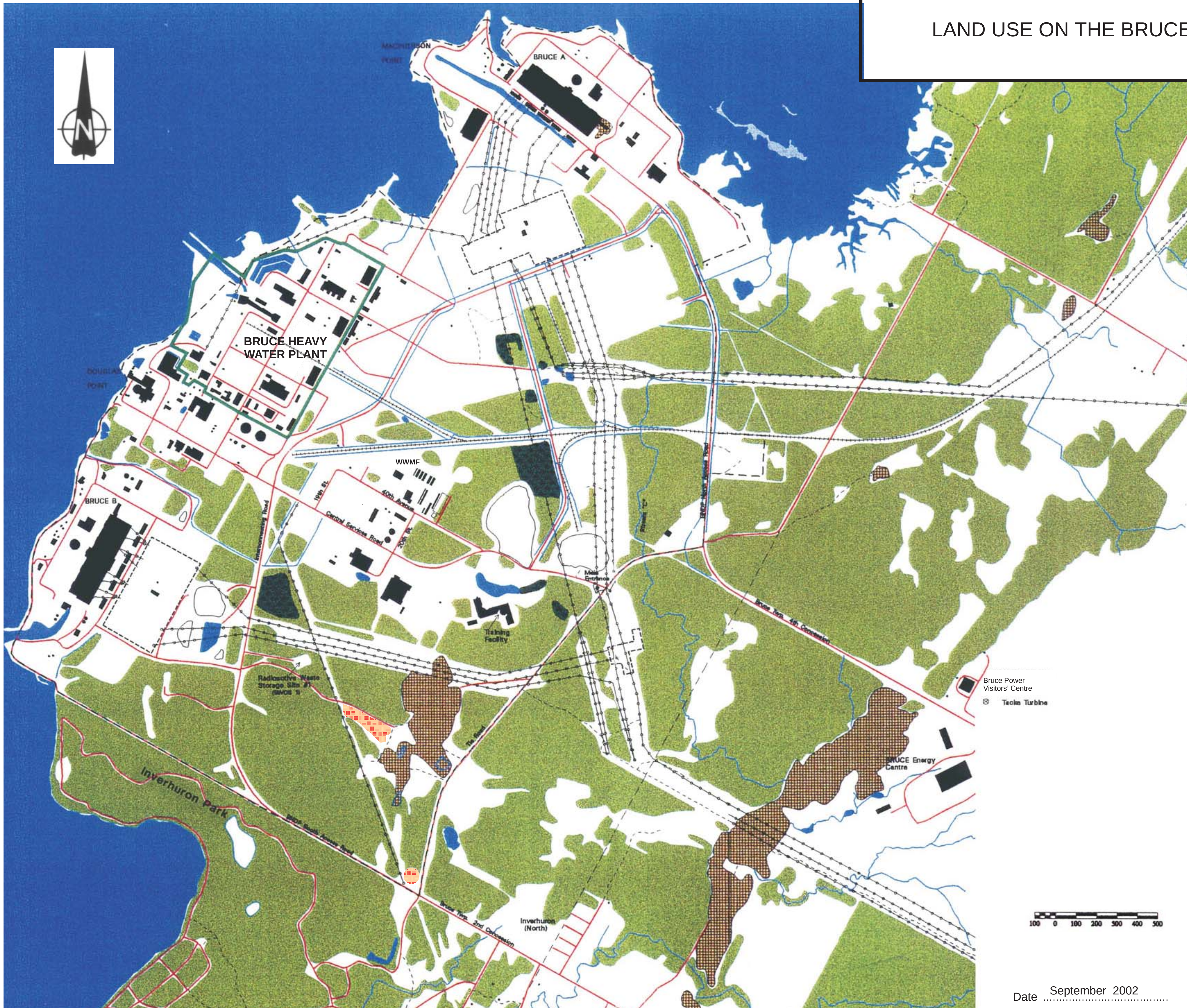
6.9.1 Population and Economy

The current population of Bruce County is estimated to be 66,700 and for the municipality of Kincardine, the population is 12,100. Ontario government statistics indicate that at any one time the maximum number of persons residing, working or visiting the Regional Study Area (including all day workers and visitors to the Bruce nuclear site) is approximately 9,569 persons, of which approximately half are permanent residents of the area (Province of Ontario, 1998). Permanent population growth within Bruce County and Municipality of Kincardine has been relatively modest over the last 10 years with the annual average rate of growth being about 0.4%. Projection indicates a County population of approximately 70,500 persons by the year 2016. The population of the Municipality of Kincardine will likely be approximately 12,800 persons by the year 2016. The demographic make-up of residents living nearest the Bruce nuclear site is not substantially different (i.e., typically within 5%) from that of the Bruce County (Statistics Canada, 1996).

Projected employment growth within Bruce County and Municipality of Kincardine is also expected to reflect population growth trends. By the year 2016 the County employment base is estimated to be 35,500 and corresponding employment base for the Municipality of Kincardine is

LAND USE ON THE BRUCE NUCLEAR SITE

FIGURE 6.8



LEGEND:

- Lakes or Lagoons
- Structures
- Pits or Piles
- Vegetation
- Wetland
- Archeological Sites
- Rivers or Drainage Ditches
- Switchyard
- Railways
- Trails
- Road Networks
- Transmission Lines
- Fence Lines
- Buildings
- Chimney/Tank/Tower
- BHWP Boundary

Date September 2002

SENES 33315

ONTARIO POWER GENERATION

FIG 6.8 11x17.CDR

expected to approach 5,400. The Bruce nuclear site is Bruce County's largest single employer with over 3,100 staff; however, Bruce County does not have a well-developed nuclear service industry.

The major industrial development within the Regional Study Area beyond the Bruce nuclear site is the Bruce Energy Centre (BEC). This is a 324 ha serviced industrial park established in 1986 and located immediately southeast of the Bruce nuclear site. Currently, six companies operate in the BEC. These companies produce polypropylene film, hydroponically grown tomatoes, processed foods, commercial alcohols, and nutrient-rich feed for livestock. One company is a privately funded applied research and development laboratory. Agriculture is an important component of Bruce County's economy and is the dominant land use within the Regional Study Area.

The Bruce nuclear site is located within the Lake Huron Management Area 4-4. The Ontario Ministry of Natural Resources indicates that there is only one non-Aboriginal commercial fishing licence issued within this area. An interview (Gartner Lee, 2001) conducted with the only licensed commercial fishing operation near the Bruce nuclear site indicated that its licence area extends approximately 18.5 km north of Point Clarke south to Point Edward. This area does not reach the Bruce nuclear site.

The tourism industry is one of the most important business sectors of the economy in Bruce County and the Municipality of Kincardine. Bruce County is recognized for its diverse natural beauty with over 2,400 km of Great Lakes shoreline, the Saugeen River and many other inland lakes and rivers. The tourism industry generates approximately $118 million annually and directly employs 1 in 7 persons.

Within the Regional Study Area there are only a few tourist attractions. The Bruce Power Visitors' Centre is considered to be an industrial tourist attraction. It is located east of the Bruce nuclear site along the main access road to the Bruce A and B stations from Highway 21 between Kincardine and Port Elgin. This attraction provides visitors with numerous exhibits, displays and pre-arranged guided tours that explain the production of nuclear electricity. Most other attractions are located within the communities along the shoreline of Lake Huron, including heritage attractions, natural attractions, industrial attractions and amusements. The Lake Huron Shoreline is in itself the most significant natural attraction within the Regional Study Area. It is the shoreline that draws tourists to the area whether it is for the beaches, fishing, boating, hiking or biking.

6.9.2 Community Infrastructure

Housing and Property Values

Approximately 5,320 housing units are found in the Municipality of Kincardine. Housing tenure data (Statistics Canada, 1996) indicates that much of the existing housing was either built before 1946 or during the 1970's in response to the construction of the nuclear generating stations and the BHWP. Roughly 76 % of the units are owner occupied and the remainder rented. A large proportion of these units are also seasonal residences. It is estimated that 583 (12%) of

Kincardine households are seasonal residences or cottages. Within the Regional Study Area, much of the cottage development is located within the community of Inverhuron.

Data obtained from the Grey-Bruce Owen Sound Real Estate Board (2001a) regarding the number of sales of residential property within the Municipality of Kincardine indicate that since 1998, average housing prices in Tiverton have recovered and exceed those prior to shutdown of the BHWP and lay-up of the Bruce A generating station, while average housing prices in Kincardine have remained low. In 2001, the announcement by Bruce Power that it intended to restart two units of the Bruce A has resulted in increased confidence in the local housing market. Data from the Grey-Bruce Owen Sound Real Estate Board confirm that as of May, 2001 average prices across the Municipality of Kincardine have fully recovered and are at approximately $103,000 per unit (Grey-Bruce Owen Sound Real Estate Board, 2001b).

Municipal Infrastructure

The communities of Kincardine, Port Elgin and Southhampton, all of which are outside the Regional Study Area, are supplied by three Water Supply Plants (WSP) which obtain their water from Lake Huron. The Kincardine WSP is located 15 km SSW of the BHWP. The Port Elgin WSP is located 17 km NE of the BWHP. It is a conventional treatment facility that has a rated capacity of 8700 m^3/day and serves a population of approximately 6,800. The Southhampton WSP is located 22 km NE of the BHWP.

The Municipality of Kincardine operates one water pollution control plant (WPCP). In addition, the Bruce Energy Centre has its own facility that discharges its treated effluent through the Bruce B discharge channel.

The Municipality of Kincardine operates a 9 ha solid non-hazardous conventional waste landfill which has between 6 and 11 years of capacity beyond 2002, allowing operations to continue to sometime between 2008 and 2013 (Pryde Schropp McComb, 2001; Conestoga-Rovers, 2001). A second landfill site is located on Lot 17, Concession 2 in the former Township of Bruce. This site services the community of Tiverton and surrounding rural areas. The possible life of the entire site was estimated to be 36 years beyond 2002, while the life of the currently excavated trenches is approximately 3 years (Maitland Engineering, 2000).

In 1998, all operations on the Bruce nuclear site generated 1,781 tonnes of solid non-radioactive waste that required disposal at the conventional waste landfill site at the Bruce nuclear site (Ontario Hydro, 1999). During 1999 and 2000, approximately 800 tonnes and 750 tonnes of solid non-radioactive waste required disposal at the conventional landfill site respectively (OPG, 2000a, b). Available data indicates that approximately 950 tonnes of materials are recycled from across the Bruce nuclear site on an annual basis (Ontario Hydro, 1999).

6.9.3 Community Services

Community and Recreational Facilities/Resource Use

Community and recreational facilities (i.e., parks, trails, schools, places of worship, etc.) within the Regional Study Area play an important role in maintaining community cohesion and the satisfaction of residents with their community by providing space for individuals and groups to participate in and contribute to community life. Most community facilities serve local residents, but some also attract others from across Southern Ontario.

The main community and recreational facilities in the Regional Study Area are the Underwood Community Centre, the Tiverton Community Centre, the Inverhuron Provincial Park and the Bruce Dale Conservation Area. A second provincial park, MacGregor Point Provincial Park, is located along the shoreline of Lake Huron, approximately 15 km north the Bruce nuclear site.

Inverhuron Provincial Park is the most popular recreational feature in the Regional Study Area. It is located immediately adjacent to the Bruce nuclear site along the shoreline of Lake Huron, and approximately 2.5 km south of the BHWP site. Inverhuron Provincial Park is 288 ha in size and has been in operation since 1959. Historic visitation data indicates that park visitation has varied from approximately 23,000 visitors per year in 1992 to approximately 44,000 visitors per year in 1994. Visitation in 2000 was approximately 27,000 day-use visitors.

The shutdown and planned decommissioning of the BHWP has allowed Ontario Parks to plan for Inverhuron Provincial Park to be converted from a day-use only park to a facility-based campground with a minimum of 250 camping sites. In 1998, the park's management plan was amended to allow expanded public access, extended hours of operation and four season operation, and the reintroduction of overnight camping (Ontario Parks, 2000). This plan will likely result in an increased visitation from between 27,000 and 34,000 visitors per year to 100,000 visitors (Ontario Parks, 2000).

The natural beauty of the Lake Huron shoreline is a major attraction for both residents and tourists. The two provincial parks, local beaches, the Brucedale Conservation Area and other hiking and cross-country ski trails provide access to the shoreline and wooded areas for nature enthusiasts.

Information on sport fishing in the vicinity of the Bruce nuclear site was obtained from the Lake Huron Fishing Club. Sport fishing is very active all year round and the species caught depends on the time of year. Typically, in the late fall, winter and early spring the fish caught are primarily rainbow trout, brown trout and walleye. In the late spring, fishing along the outfalls for trout (rainbow, brown) and salmon (chinook, coho) is popular. In the summer months, off the deep waters of Douglas Point, chinook salmon is the major part of the catch along with trout.

Health and Safety Facilities and Services

The Bruce nuclear site is served by its own internal emergency, medical aid and fire prevention facilities. In addition, a comprehensive on- and off-site emergency response plan is in place, as discussed in Section 3.4.3. All operations at the Bruce nuclear site are assisted by the Ontario Provincial Police (OPP) South Bruce Detachment as required.

The South Bruce Grey Health Services Corporation provides health care services in the Municipality of Kincardine and vicinity. The Kincardine Health Centre provides a wide range of health care services, diagnostic equipment, including emergency/acute care serving a population of approximately 15,000 people.

There is one fire station in Regional Study Area (25 volunteer staff in Tiverton) with additional support from fire stations in Kincardine (22 staff) and Paisley (21 staff). These stations are well equipped to service local community needs and those at the Bruce nuclear site (if required).

To maintain safe driving conditions, roads to the Bruce nuclear site are plowed and maintained by the Town of Kincardine Public Works Department and Bruce County crews. On-site snow removal service is provided by an on-site snowplow.

Educational Facilities and Services

The Municipality of Kincardine is served by two publicly funded educational systems. Within the Municipality of Kincardine, the Bluewater District School Board operates 50 public elementary schools and 11 secondary schools. The Bruce-Grey Catholic District School Board serves the Municipality of Kincardine with one elementary school. The nearest school to the BHWP site is the Bruce Township Central Public School, located just outside of the Regional Study Area and 11 km from the Bruce nuclear site boundary.

6.9.4 Municipal Finance and Administration

The 2000 Financial Information Return (FIR) for the Municipality of Kincardine (Ministry of Municipal Affairs and Housing, 2002) indicates that total revenue to the municipality was approximately $13.5 million while expenditures were approximately $12.5 million. The total assets of the Municipality of Kincardine were reported to be approximately $43.2 million.

6.9.5 Residents and Communities

Community Character

Residents in the Regional Study Area and beyond consider the natural beauty of the area, its focus on tourism and its rural and friendly small town atmosphere as the features that define the character of their communities. In Kincardine, many people identify with the Scottish heritage of their community. This heritage is visible in the downtown shops in Kincardine and most evident on Saturday nights in the summer with the Pipe Band Parades on Main Street and the Phantom Piper who pipes down the sunset from the Kincardine Lighthouse. The community of Kincardine is beyond the boundaries of the Regional Study Area.

Within the Regional Study Area are a number of smaller communities, including Tiverton, Underwood and Inverhuron. Of these, Inverhuron has the most distinctive character in comparison to the others. It is a cottage area with several hundred dwellings, which are not serviced by municipal water or sewage system. Some of these units are seasonal, while others have been converted to year-round use. There is also a mobile home park. This area is popular among local artisans, retirees and people from across Ontario and the United States.

Use/Enjoyment of Property

Residents' use and enjoyment of property is generally related to the presence of some form of physical disturbance (i.e., aesthetics, excessive noise, dust, debris, traffic) and the attributes or features of their communities that people either like or dislike. In terms of what residents across Bruce County most like about living in their communities, public attitude research (IntelliPulse, 2001) indicates that the peace and quiet of their community (21%), the slow pace and less hectic lifestyle (12%) are seen as the attributes most valued. Respondents in Kincardine value the same attributes of their community, but are more likely than the average to mention the beach and lake (17%) as features they like the most about living there.

The features or attributes that people most dislike about living in their communities are considered to be those that most adversely affect people's use and enjoyment of their property and their overall satisfaction with community. The survey indicated that in Kincardine (including the Regional Study Area), the local weather conditions (20%), accessibility to shopping (11%) and services (8%), and accessibility to a major city (7%) are the most disliked features. Only 3% in Kincardine identified the nuclear site as a negative attribute of their community.

Personal Security and Satisfaction with Community

In terms of people's feelings of personal security, the survey indicated that 17% of Kincardine respondents (including the Regional Study Area) named the nuclear stations as things or issues that affect their sense of health, safety or personal security. Typical comments by Kincardine respondents who named the nuclear station as an issue affecting their sense of health, safety and personal security expressed concerns about their personal health, safety of the facility (e.g. the potential for nuclear accidents), concerns over long-term storage of nuclear waste on site, and the role of the station in the local economy. Water quality and health care are the dominant health, safety and personal security issues.

The survey suggested that the nuclear operations at the Bruce nuclear site do not cause much concern for the residents of Kincardine and do not appear to affect people's sense of satisfaction with their community as a place to live. The level of satisfaction with Kincardine is high, where 98% of survey respondents indicated that they were either 'very satisfied' or 'somewhat satisfied' (IntelliPulse, 2001).

6.10 Aboriginal Interests

The Chippewas of Saugeen First Nation Reserve No. 29 is located adjacent to the town of Southampton on the shoreline of Lake Huron, between the mouths of the Saugeen and Sauble Rivers, approximately 30 km north of the BWHP (Figure 6.9). The population of this Reserve in 1991 was estimated by the Department of Indian & Northern Affairs at 651 with additional members living off Reserve, many within the traditional territory in Bruce County.

The Chippewas of Nawash First Nation is centred at Cape Croker Indian Reserve No. 27, located on the north side of Colpoys Bay and the east shore of the Bruce Peninsula north of the town of Wiarton approximately 80 km from the BHWP (Figure 6.9). The population of this Reserve in 1991 was estimated by the Department of Indian and Northern Affairs at 607 with additional members living off Reserve, many within the traditional territory in Bruce County.

The traditional territories of the Chippewas of Saugeen and Nawash First Nations "Sauking Territory" is identified by Treaty 45, dated August 9, 1836, including most of Bruce and Grey Counties, and subsequently on October 13, 1854, Treaty 72 Surrender of the Saugeen Peninsula, including most of the Bruce Peninsula. After that date, the Aboriginal communities on the Bruce coast settled permanently on Reserves. Both First Nations have described their traditional territories to include the lands and waters surrounding the Bruce nuclear site and extending in both directions along the Lake Huron shoreline, out into the lake, and inland. They have also indicated that on-going use of their traditional lands and waters by First Nation members includes personal and communal commercial harvesting of traditional foods and medicines (fish, plant material and wildlife).

Both the Chippewas of Saugeen and Nawash First Nations have initiated litigation against Canada, Ontario, and eight municipalities of the Bruce Peninsula and the Counties of Grey and Bruce. Amongst other issues, the claim alleges the waters of Lake Huron and Georgian Bay were not included in Treaty 72 signed in 1854.

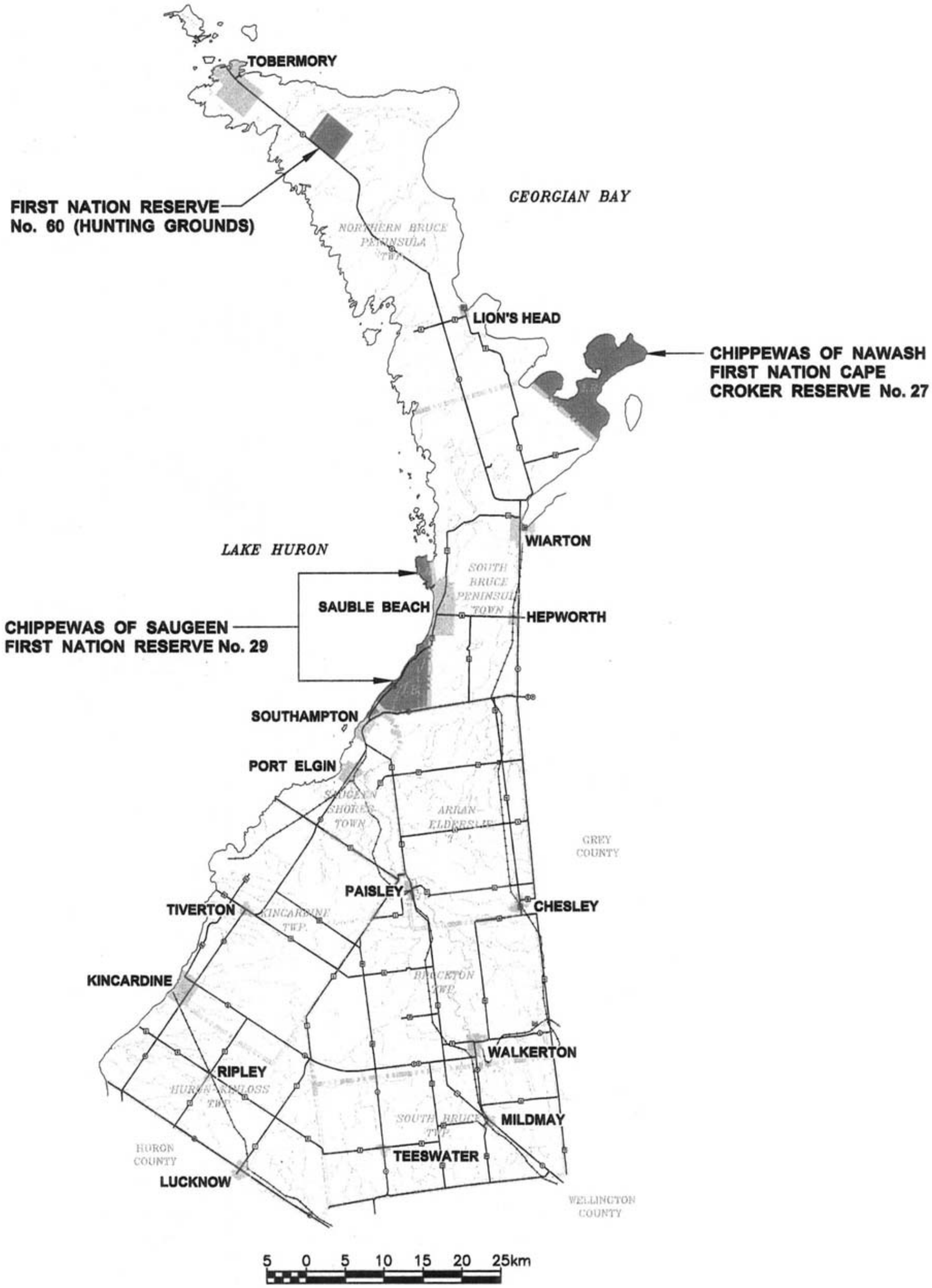
In 1995 the Saugeen First Nation claimed, through the "Duluth Declaration", its sovereign rights and jurisdiction over the waters around the Saugeen/Bruce Peninsula and extending 11 km into the lake to the median point with all other national territories. The declaration covers "jurisdiction over these waters in their entirety, which includes the fisheries, lands and minerals, above and below the waters, including the lake bed".

Both the Chippewas of Saugeen and Nawash First Nations have developed a wide range of community services on Reserve, including a fire hall, health clinic, day care centre, recreation centre, police station and band administration office. Water for the communities is obtained from wells on the Reserve or from the lake. Provincial Highways 6 and 21 pass through the Saugeen Reserve.

The First Nations' economies are associated with traditional and commercial harvesting of fish, tourism, agriculture, construction, cottage rental and native craft manufacture and sale. In addition to traditional commercial pursuits, a substantial number of people are employed by the First Nation government, while others are employed off Reserve.

LOCATION OF FIRST NATION COMMUNITIES

FIGURE 6.9



Date September 2002

SENES 33315

Fig 6.9 8.5x11 CDR

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Between 50 and 60 members of the Nawash people are employed in fishing and related activities. An economic analysis prepared for the First Nation found that the fishery accounted for about one half of all private commercial earnings in Cape Croker from 1996-97. That study estimated the net benefit of the fishery to be $387,584 over the same period (Federal Court of Canada, 2000).

Fish for the Chippewas of Nawash First Nation is an essential source of the band's sustenance, and the ancestral fishery is a cultural component of the Reserve. In the submission on the WUSDSF EA public consultation, the Chippewas of Nawash stated that the fishery is a "vital source of our cultural heritage, and of the values and attitudes that inform our spirituality". Fishing adjacent to the BHWP site is done for personal and community consumption, and as a continuation of traditional lifestyles. The site is not used for hunting or gathering of plants.

For several years, OPG has been co-operating with the First Nations through special studies on whitefish impact and aboriginal diet. In June 1997 leaders of the First Nations and Ontario Hydro Nuclear staff agreed to develop a mutually acceptable sampling program for lake whitefish. Subsequently, a monitoring program was established with input from fisheries biologists at the University of Guelph and the establishment of a post-doctoral fellowship at the university to assist in the program. In addition, a radiological assessment of the Lake Huron fish being caught and consumed by members of the First Nations was included in the existing environmental monitoring program at the Bruce nuclear site. Stakeholders in these programs include the Chippewas of Nawash and Saugeen, provincial Ministry of Natural Resources, federal Department of Fisheries and Oceans, Bruce community, and Bruce nuclear site employees. Bruce Power is now accountable for future actions related to the Whitefish Impact Study and Diet Study.

6.11 Identification of Valued Components

Valued Ecosystem Components (VECs) and Valued Social Components (VSCs) were defined and their importance as a focus of an EA described in Section 4.1.3. Identification of VECs and VSCs is based on existing conditions prior to the start of the project and their potential vulnerability to effects of the project.

Due to the relatively short-term nature of the BHWP Decommissioning Project, the construction-type nature of project activities (as compared to operation of a facility), and an improved environment at the end state, few VECs or VSCs have been identified for this project. Even those that have been identified will not necessarily be adversely affected by the project activities. Table 6.10 provides a list of the VECs and VSCs that have been selected and the rationale for their selection.

TABLE 6.10
VECs AND VSCs SELECTED FOR BHWP DECOMMISSIONING PROJECT

Environmental Component	VEC or VSC	Rationale
Atmospheric Environment	• Overnight camper at Inverhuron Provincial Park. • Resident at Baie du Doré. • Resident at Inverhuron.	- Could be affected by increased level of dust and noise from project activities. - Closest receptors to project site. - From a regulatory perspective are considered "sensitive receptors".
Hydrology and Surface Water Quality	[None identified].	
Aquatic Environment	Fish and benthic invertebrates in Lake Huron.	- Indicator species used to assess potential effects from sedimentation and contaminated sediments. - Recreational and limited commercial fishing on Lake Huron near site could be affected.
Terrestrial Environment	White-tailed deer.	- Most abundant species observed in Study Areas and therefore representative of terrestrial wildlife.
Geology, Hydrogeology and Seismicity	[None identified].	
Radiation and Radioactivity	[None identified].	
Land Use and Transportation	[None identified].	
Socio-economic Conditions	[None identified].	
Physical and Cultural Resources	[None identified].	
Aboriginal Interests	Lake whitefish.	- Commercial and traditional subsistence fishery in Lake Huron could be affected.

7.0 POTENTIAL PROJECT/ENVIRONMENT INTERACTIONS

7.1 Introduction

This section outlines the results of an initial screening to determine whether the proposed project activities outlined in Chapter 3 do or do not have the potential to generate a measurable effect on the environmental components described in Chapter 6. This screening is based on the consultants' review of the data and on their professional experience and judgement. The screening allows subsequent analysis (Chapter 8) to focus on those effects that are likely to be measurable.

The screening was carried out at two levels. The first level of screening involved the determination of potential direct effects from project activities on the environment. The results of the review of potential measurable direct effects are given in a screening matrix (Table 7.1). The second level of screening was the determination of indirect effects which are those which emanate from direct effects. As an example, a direct effect would occur if a toxic substance poisoned fish. The indirect effect would be the loss of income from a commercial fishery due to a reduction in number of fish. The results of this review are shown in Table 7.2. In both tables, the potential adverse effects are shown as a dot (•).

A decommissioning project, such as the BHWP Decommissioning Project, does not involve the building of new facilities, but rather the demolition of most of the existing buildings and structures on site and the remediation of the soil. Therefore, the end state is one with few or no structures and a site with environmental benefits in terms of a reduction in soil contamination, low risk of further contamination, and visual improvement. It is to be expected that the long-term effects of the project, after decommissioning activities have been completed, would be positive and that the only potential for any adverse effects would occur during the actual demolition/remediation stage. For this reason it is appropriate to address positive as well as negative effects. In Tables 7.1 and 7.2 positive effects are shown as a plus sign (+).

7.2 Potential Measurable Direct Effects

The following describes the potential measurable direct effects for each of the environmental components described in Chapter 6 and listed in Table 7.1.

7.2.1 Atmospheric Environment

7.2.1.1 Air Quality

Potential sources of air emissions are as follows:

- Dust generation during the construction of berms, the felling of the towers, excavations, grading, and truck and machinery traffic on site. Dust could range from fine particulates to particles of contaminated soil. No radioactive dust is expected. It is likely that most of the dust generated would be of short duration and would be confined to the BHWP site.

- Emissions from machinery, trucks and generators as well as from the cutting of metal with acetylene torches.

7.2.1.2 Noise

Demolition is inherently noisy, and noise typical of construction sites can be anticipated. Only controlled, highly localized blasting with small charges is planned. Truck noise will be similar to that which occurs on area roadways. The closest noise-sensitive locations are the communities of Baie Du Doré, about 2 km north, and Inverhuron which is about 3 km south of the planned work site. The area immediately north and west of the Bruce nuclear site is bordered by Lake Huron. The eastern area is vacant land as part of the Bruce B exclusion zone for development. The southern area is a provincial park. Consequently, there are no other noise- sensitive receptors within a 2-km radius of the work site. It is likely that noise will be of short duration, occur intermittently only during the daytime, and be confined to the site for all activities except the off-site trucking of wastes.

7.2.2 Hydrology and Surface Water Quality

7.2.2.1 Site Drainage

The effects on site drainage during demolition will result from minor alterations to the drainage pattern as a result of the piling of rubble or the construction of berms. These are temporary conditions lasting sometimes as little as a few days. In general, the filling in of excavations and holes as well as site grading should restore the site a more natural condition and should have a positive effect on site drainage during the end state.

7.2.2.2 Surface Water Quality

Surface water on site drains to Lake Huron. There is potential for surface water quality to be affected when sumps and drains are cleaned out, when the SWTF and lagoons are drained, and when contaminated sediments are removed. There is also the potential for some slight increase in sedimentation during the construction of berms and the filling in of excavations and holes. The removal of contaminated soil from the site should result in elimination of the potential for water quality contamination during the end state.

7.2.3 Aquatic Environment

There is currently no aquatic life on the BHWP site. The elimination of the potential for water quality contamination and any consequent effects on aquatic life in Lake Huron should have a positive effect on the environment during the end state.

7.2.4 Terrestrial Environment

While there is little terrestrial habitat on the BHWP site and few species, there is a deer population on the Bruce nuclear site. There have been a number of traffic accidents involving deer on local roads. The increase in traffic during the demolition period (approximately 15

Table 7.1

Potential Project/Environment Interactions (Direct Effects)

	Environmental Component																		
	Atmospheric Environment		Hydrology and Surface Water Quality		Aquatic Environment	Terrestrial Environment	Geology and Hydrogeology		Radiation and Radioactivity	Land Use and Transportation		Physical and Cultural Resources		Socio-Economic Conditions					Aboriginal Interests
	Air Quality	Noise and Vibration	Site Drainage	Surface Water Quality	Aquatic Habitat and Species	Terrestrial Habitat and Species	Soil Quality	Groundwater Flow and Quality	Radiological Contamination	Land use	Transportation Network	Archaeology	Landscape and Visual Description	Population and Economy	Community Infrastructure	Community Services	Municipal Finance and Administration	Residents and Communities	Aboriginal Interests
Project Activity	***DEMOLITION, REMEDIATION AND WASTE MANAGEMENT***																		
SET-UP AND PREPARATION																			
Prepare structural and condition surveys; undertake remedial and maintenance work																			
DECOMMISSIONING OF STRUCTURES																			
Isolate (Tie-out) Structures																			
Remove, Collect and Store Hazardous Materials from Structures	•	•																	
Construct Berms	•	•	•	•	•		•												
Fell Towers	•	•											+						
Demolish, Sort Materials and Clear Structures to Grade;	•	•	•				•	•		+			+				•	+	
DECOMMISSIONING OF BUILDINGS																			
Isolate (Tie-out) and Decontaminate Buildings; Clean Out Sumps and Drains				•	•														
Remove, Collect and Store Hazardous Materials from Buildings	•	•																	
Remove, Collect and Store Equipment from Buildings		•																	
Demolish, Sort Materials and Clear Buildings to Grade	•	•	•				•	•		+			+				•	+	
DECOMMISSIONING OF SITE SERVICES																			
Isolate (Tie-out) Services; Sample and Treat Effluent from Surface Water Treatment Facility and Lagoons				+															
Discharge Treated Water				•	•														
Demolish Surface Water Treatment Facility and lagoons	•	•	•	•	•	•	•	•		+			+						
Sample Sediments; Remove Contaminated Sediments	•	•		•	•		+	+	+									+	+
LAND REMEDIATION																			
Collect and Sort Remaining Scrap, Waste and Rubble	•	•							+										
Sample, Excavate and Collect Contaminated Soils	•	•			+		+	+	+										+
Fill Holes and Excavations; Regrade Site	•	•	+	•	•	+	•	•		+			+					+	
WASTE MANAGEMENT AND TRANSPORTION																			
Transport Materials for Recycling	•	•				•					•				+			+	
Transport Materials for Disposal	•	•				•					•					•			
WORKFORCE																			
Transportation	•	•				•					•								
	END STATE																		
END STATE			+	+	+	+	+	+	+	+			+	+				+	+

• denotes potential measurable adverse interaction.
\+ denotes potential long-term measurable positive interaction.

trucks per day) plus additional commuter traffic may temporarily increase the risk of deer-involved traffic accidents on the local roads.

7.2.5 Geology and Hydrogeology

Demolition activities such as construction of berms, clearing buildings to grade, demolition of SWTF and lagoons, and site remediation may change groundwater recharge and may affect soil and groundwater quality.

The extensive land remediation proposed should ensure improvement to on-site soils and should also reduce the potential for groundwater contamination. Therefore, effects on soils and groundwater should be positive during the end state.

7.2.6 Radiation and Radioactivity

There are no identified radioactive materials on site as documented in Section 6.6. If any is found during decommissioning activities, it will be removed thereby resulting in a positive effect on the environment during the end state.

7.2.7 Land Use and Transportation

The demolition of buildings and structures and the felling of the towers will allow the land to be available for other industrial use during the end state. The increase in truck traffic, during decommissioning activities, could have an adverse effect on transportation movements in the local and regional study areas.

7.2.8 Physical and Cultural Resources

The site has been completely developed and the earth has been disturbed from the previous activities. There are no cultural artifacts to be disturbed or damaged as a result of decommissioning activities. The felling of the towers will improve the view of the site during the end state.

7.2.9 Socio-Economic Conditions

Under the *Act*, effects on socio-economic conditions are assessed only where the effects stem from a project-induced effect on the natural environment (i.e., biophysical environment). No such effects have been identified for the BHWP Decommissioning Project. However, for general information purposes, effects on population and the economy, community services, municipal finance and administration, and resident and community perceptions of the area are included in this document. Adverse effects may come from the slight increase in demand for local services (e.g. waste disposal sites) and from the thirty additional workers and their families. However, these workers will likely generate additional spending in the area. There may also be adverse effects on municipal finance as a number of buildings and structures, which have generated tax, will be demolished. An increased amount of recycling may have a positive effect on the regional economy. Finally, the removal of a facility, which has already been closed down, and the availability of the land for other industrial uses should have a positive effect on the economy in general, and on the community.

7.2.10 Aboriginal Interests

None of the activities during demolition should have any direct adverse effects on aboriginal interests, particularly with respect to the commercial fishery. In general, the removal of contaminated soils and the reduction of the potential for contamination of water quality in Lake Huron would have a positive effect on aquatic biota (e.g. fish) in the lake during the end state.

7.3 Potential Measurable Indirect Effects

A second level of screening was used to determine the potential measurable indirect effects resulting from the potential measurable direct effects of the project identified during the first level of screening (Table 7.1).

Table 7.2 summarizes the potential indirect effects (both positive and negative) on the following socio-economic parameters for the environmental components used in the first level of screening, as well as health and safety.

- Population and Economy
- Community Infrastructure
- Community Services
- Municipal Finance and Administration
- Residents and Communities
- Aboriginal Interests
- Worker Health and Safety
- Public Health and Safety.

Table 7.2
Potential Project/Environment Interactions (Indirect Effects)

Environmental Component	Population and Economy	Community Infrastructure	Community Services	Municipal Finance and Administration	Residents and Communities	Aboriginal Interests	Worker Health and Safety	Public Health and Safety
	Socio-economic Parameters							
DEMOLITION, REMEDIATION AND WASTE MANAGEMENT								
Atmospheric Environment								
▪ **Air Quality**		●			●		●	●
▪ **Noise and Vibration**		●			●		●	
Hydrology and Water Quality								
▪ **Site Drainage**								
▪ **Surface Water Quality**						●		
Aquatic Environment								
▪ **Aquatic Habitat and Species**						●		
Terrestrial Environment								
▪ **Terrestrial Habitat and Species**								
Geology and Hydrogeology								
▪ **Soil Quality**								
▪ **Groundwater Flow and Quality**								
Radiation and Radioactivity								
▪ **Radiological Contamination**					+	+	+	
Land Use and Transportation								
▪ **Land use**	+				+			
▪ **Transportation Network**		●			●		●	●
Physical and Cultural Resources								
▪ **Archaeology**								
▪ **Landscape and Visual Description**		+			+	+		
END STATE								
End State		+			+	+	+	+

● Denotes potential measurable adverse indirect effect.
\+ Denotes potential long-term measurable positive indirect effect.

The potential indirect effects from the BHWP Decommissioning Project are summarized below.

- Potential adverse effects on air quality may arise, resulting in the potential for corresponding adverse effects on property values (community infrastructure), on residents' perceptions of their community, on worker health and safety on site, and on public health and safety.

- Noise and vibration is likely to be confined to the site, but occasionally noise may be heard off site. However, only those who are near the site boundary during demolition activities would be affected. Noise also has the potential to affect worker health and safety on site.

- Any deterioration in surface water quality may have an effect on aquatic life in Lake Huron, the local fishery and, in turn, an effect on aboriginal communities which rely on the fishery, as well as those who engage in sport fishing.

- The elimination of contaminated soil and radioactive contamination will have positive effects on residents' perceptions of their community, on the aboriginal community that will value a return to a less contaminated environment, and on worker heath and safety.

- The demolition of on-site buildings, structures and site services will have positive effects on land use and on perceptions of the site by local residents as well as the aboriginal community.

- Both worker and public health and safety may be affected by increased transportation activity on local roads.

- The improvements in the landscape and visual aspects of the site should have positive effects on perceptions of the site by local residents and tourists, as well as the aboriginal community.

7.4 Project/Environment Interactions Warranting Further Assessment

The first and second levels of screening identified the potential environmental effects, both direct and indirect, that could occur as a result of the BHWP Decommissioning Project. Only those potential project/environment interactions that are identified in Tables 7.1 and 7.2 by a dot (•) or a plus sign (+) will be assessed further in Chapter 8 to determine the likelihood of their occurrence. There was at least one interaction for each of the environmental components. As expected, the potential adverse direct effects arise only from the demolition/remediation phase (first phase) of the decommissioning project during which the activities take place. No adverse direct effect would occur during the end state (second phase) since no physical activities take place after the first phase.

8.0 ASSESSMENT OF LIKELY ENVIRONMENTAL EFFECTS AND MITIGATION

8.1 Introduction

This chapter addresses the likelihood of the occurrence of the potential positive and adverse effects of the project on the components of the environment identified in Chapter 7. It deals only with those effects which were deemed plausible and likely to be measurable. This chapter also considers the environmental effects of credible accidents and malfunctions related to the project (Section 8.3), the likely effects of the environment on the project (Section 8.4), the likely effects of the project on the sustainable use of renewable resources (Section 8.5), the human health implications of any potential effects (Section 8.6), and mitigation measures associated with any potential effects (Section 8.7). The purpose of this Chapter is to determine if, after appropriate mitigation, any adverse residual effects on the VECs or VSCs identified in Section 6.11 will remain.

8.2 Likely Effects of Project Works and Activities

8.2.1 Air Quality (Dust)

8.2.1.1 Project - Environment Interactions

Project works and activities likely to generate effects on air quality relate to the demolition/remediation phase only and include:

- Removal, collection and storage of hazardous materials from structures and buildings;
- Construction of berms;
- Felling of towers;
- Demolition, sorting of materials and clearing of structures to grade;
- Demolition, sorting of materials and clearing of buildings to grade;
- Demolition of SWTF;
- Collection of contaminated sediments;
- Collection and sorting of remaining scrap, waste and rubble;
- Excavation and collecting of contaminated soils;
- Filling in of excavations and regrading of site;
- Transportation of materials for recycling; and
- Transportation of materials for disposal;

The majority of these activities will result in dust emissions as Total Suspended Particulates (TSP) and Inhalable Particulates <10 μm diameter (PM_{10}). For the purposes of this assessment, all demolition activities were considered equivalent; therefore, only the maximum emission scenario for the maximum demolition activity is presented. This scenario is discussed in greater detail in the following sections.

The enriching towers are felled, similar to a tree, onto a sand berm which helps to absorb the impact. Although this activity results in dust re-suspension, it is of very short duration (a few seconds). In addition, the sand on which the tower falls is coarse and contains very little silt (the portion of soil that generally becomes airborne); consequently, the dust emissions are minimized. An additional consideration is that at the time this activity occurs, essentially all other site activity ceases (truck traffic, bulldozer activity, etc.). Therefore, any emissions that occur as a result of felling the towers are not additive to emissions from other site activities. It is estimated that emissions during the other demolition activities likely result in greater dust emissions than emissions from felling the towers. Therefore, this activity is not considered independently.

The increase in truck traffic due to the demolition activities is expected to be relatively small. The current peak traffic volume on the Bruce nuclear site is approximately 1335 vehicles per hour and the hourly truck traffic increase due to the BHWP project is estimated to be no more than one or two trucks/hr (15 trucks/day), an increase in vehicle traffic of <0.2%. The increase in traffic due to the demolition workforce is estimated to be approximately 20 vehicles/hr, or a 1.5% increase. Air impacts from the increase in vehicle traffic of <1.7% is considered insignificant and are not considered further.

8.2.1.2 Likely Environmental Effects

Dust and Particulate Generation

The equations used to estimate dust re-suspension due to the various activities were obtained from U.S.EPA, AP-42 (U.S.EPA 1995a) and are provided in Appendix A, Table A.3. The main issues of concern are TSP and PM_{10}.

Table 8.1. shows the activity levels associated with the different operations used to estimate the dust that may be re-suspended from each of these operations.

TABLE 8.1
ASSUMED/ESTIMATED PARAMETER VALUES FOR EMISSIONS ESTIMATION

Parameter		Value
Time of Operation (h/day)		10
Average Wind Speed (m/s)		5
Material Moved (Mg/day) – assumed		600
Grader travel speed (km/h)		5
Vehicle Average Weight (Mg)		10
Moisture Content (%)		5
Silt Content (%)		8
Number of Vehicles/day	Trucks	15
	Bulldozer/Backhoe/ Front-end loader	5
	Grader	1
Distance travelled per hour* (km)	Grader	3
	Truck	5

* Travel for the bulldozer/backhoe is included in the emission factor.

For this maximum emissions scenario, which assumes all activities are occurring simultaneously on a dry day (no precipitation) with no additional dust control measures, the maximum estimated TSP emission rate is 1.91 g/s and the maximum estimated PM_{10} emission rate is 1.57 g/s.

A small amount of soil contamination was identified on site. Table 8.2 presents the maximum measured soil concentrations of the contaminants that were found to be above the MOE Table B criteria (see Section 6.5.1.2). If the areas containing the contaminated soils are excavated or graded, the soil contaminants will be re-suspended with the TSP. The concentration of these contaminants in soil were applied to the TSP emission rate to estimate a maximum emission rate for these different constituents.

TABLE 8.2
MAXIMUM MEASURED SOIL CONTAMINANT CONCENTRATIONS

Constituent	Concentration (ppm)	% of TSP	Emission Rate (g/s)
arsenic	68	0.007%	1.30E-04
boron	166	0.017%	3.17E-04
cadmium	23.9	0.002%	4.57E-05
chromium	850	0.085%	1.62E-03
copper	650	0.065%	1.24E-03
molybdenum	104	0.010%	1.99E-04
nickel	723	0.072%	1.38E-03
zinc	2033	0.203%	3.88E-03

Dispersion of Dust and Particulates –Modelling Approach

Meteorological factors such as atmospheric stability, wind speed and direction, mixing height and temperature will affect the manner in which the emissions are dispersed. In Ontario and Canada it is accepted practice to evaluate atmospheric impacts through the use of an atmospheric dispersion model. In Ontario the U.S.EPA regulatory atmospheric dispersion models are generally considered the best available tools for these applications. The ISC3 series of dispersion models are considered appropriate (by the U.S.EPA) for industrial source complex applications in a rural or urban setting, for flat or rolling terrain at distances less than 50 km for continuous toxic air emissions. For these reasons, the ISC3 series of models were considered the appropriate dispersion models for the BHWP site.

At the BHWP site, dispersion modelling of all pollutants considered was accomplished using three years of actual, hourly, meteorological data from 1998 through 2000 (26,304 hours). (The U.S. EPA recommends five years of data from the nearest full weather station or at least one year of on-site data in order to include all the meteorological conditions expected in the area to be modelled (U.S. EPA, 2000). This data set included hourly measured temperature, wind speed and wind direction. Hourly stability class and hourly mixing heights were also included. The wind speeds and directions from the “on-site” meteorological stations were used in all predictions of concentrations resulting from releases due to the demolition activities. The use of this extensive data set means that all meteorological conditions that can occur have been considered in the modelling, including lake breezes and the effects of temperature inversions on mixing height.

Discrete receptors at Baie du Doré and Inverhuron Provincial Park (defined in this report as VECs) were used to estimate human impacts from emissions to air. The receptor locations were chosen to reflect sensitive areas closest to the demolition area.

In addition to discrete receptors, a receptor grid area surrounding the site was also used. This 200 m x 200 m grid covered an area of approximately 21 km^2. The data from this grid were used to prepare figures illustrating predicted concentrations over the local study area. An area source measuring 200 m x 200 m was used in the dispersion modelling to represent the area from which the emissions would be released.

Dispersion of Dust and Particulates –Modelling Results

Diagrams illustrating the predicted 24-hour average ground level TSP and PM_{10} concentrations for the maximum demolition/remediation activity are provided in Figures 8.1 and 8.2 respectively. These figures illustrate that at the discrete receptor locations the maximum predicted incremental TSP concentrations are less than 12 $\mu g/m^3$ and the maximum predicted PM_{10} concentrations are less than 10 $\mu g/m^3$.

These maximum predicted values would occur once under worst-case meteorological conditions (based on the 1996 though 2000 meteorological data - 1827 days). For all other meteorological conditions, the predicted TSP and PM_{10} concentrations are less than that reported above (Figures 8.3 and 8.4). The average measured baseline TSP concentrations at these sensitive receptor locations were 17.1±11 $\mu g/m^3$ at Baie du Doré and 20.9±14.7 $\mu g/m^3$ at Inverhuron Park. The predicted increase in dust levels at these locations is within the measured variability of dust concentrations and would therefore not be distinguishable from existing levels. All predicted concentrations at the VECs are well below the ambient air quality criterion (AAQC) for TSP of 120 $\mu g/m^3$ and the interim MOE PM_{10} criterion of 50 $\mu g/m^3$ (MOE, 2000).

These findings are consistent with the past experience that TSP associated with the construction activities during the in-ground container facility expansion adjacent to the new UFDSF site at the Western Waste Management Facility was not detectable when compared to the TSP values obtained at the two background sites during the four week 1996 monitoring period.

Based on the predicted TSP concentrations, the soil contaminant concentrations described previously at the discrete receptors were estimated to be a small fraction of the 24-hour AAQC (Table 8.3).

TABLE 8.3
ESTIMATED 24 HOUR AVERAGE SOIL CONSTITUENT CONCENTRATIONS IN AIR DUE TO DEMOLITION ACTIVITIES

Constituent	Concentration ($\mu g/m^3$)	AAQC ($\mu g/m^3$)	% of criterion
arsenic	7.96E-04	0.3	0.265
boron	1.94E-03	120	0.002
cadmium	2.80E-04	2	0.014
Chromium	9.95E-03	1.5	0.663
copper	7.61E-03	50	0.015
molybedenum	1.22E-03	120	0.0010
nickel	8.46E-03	2	0.423
zinc	2.38E-02	120	0.020

8.2.1.3 Identified Mitigation Measures

Construction-type activities, such as these undertaken as part of the BHWP Decommissioning Project, are short term in nature and are generally compared to the Ontario AAQC. Dispersion modelling results indicate that the predicted TSP and PM_{10} concentrations for a worst-case scenario are well below the applicable AAQC. Nonetheless, it is the responsibility of the contractors to ensure that all practicable means of dust control are used during decommissioning activities. As required, some or all of the following methods may be employed to mitigate dust:

- optimizing the timing of work activities/felling of towers to minimize local dust effects;
- wetting the land and roads during grading and earth moving;
- use of truck covers during the transport of fill materials; and
- felling of the enriching towers after normal work hours (i.e. after 4:00 p.m.).

8.2.1.4 Residual Effects

Taking into account the low-levels of TSP and PM_{10} that will be generated, the mitigation measures that will be taken during the demolition/remediation phase, and the fact that no dust-generating activities will take place during the end state, no residual adverse effects on air quality from the decommissioning project are anticipated. Therefore, no residual adverse effects are likely to occur on the sensitive receptors at Baie du Doré and Inverhuron Provincial Park, identified as VECs for this project.

Figure 8.1
Maximum Predicted Incremental 24 Hour Average TSP Concentrations ($\mu g/m^3$) Due To Excavation Activities

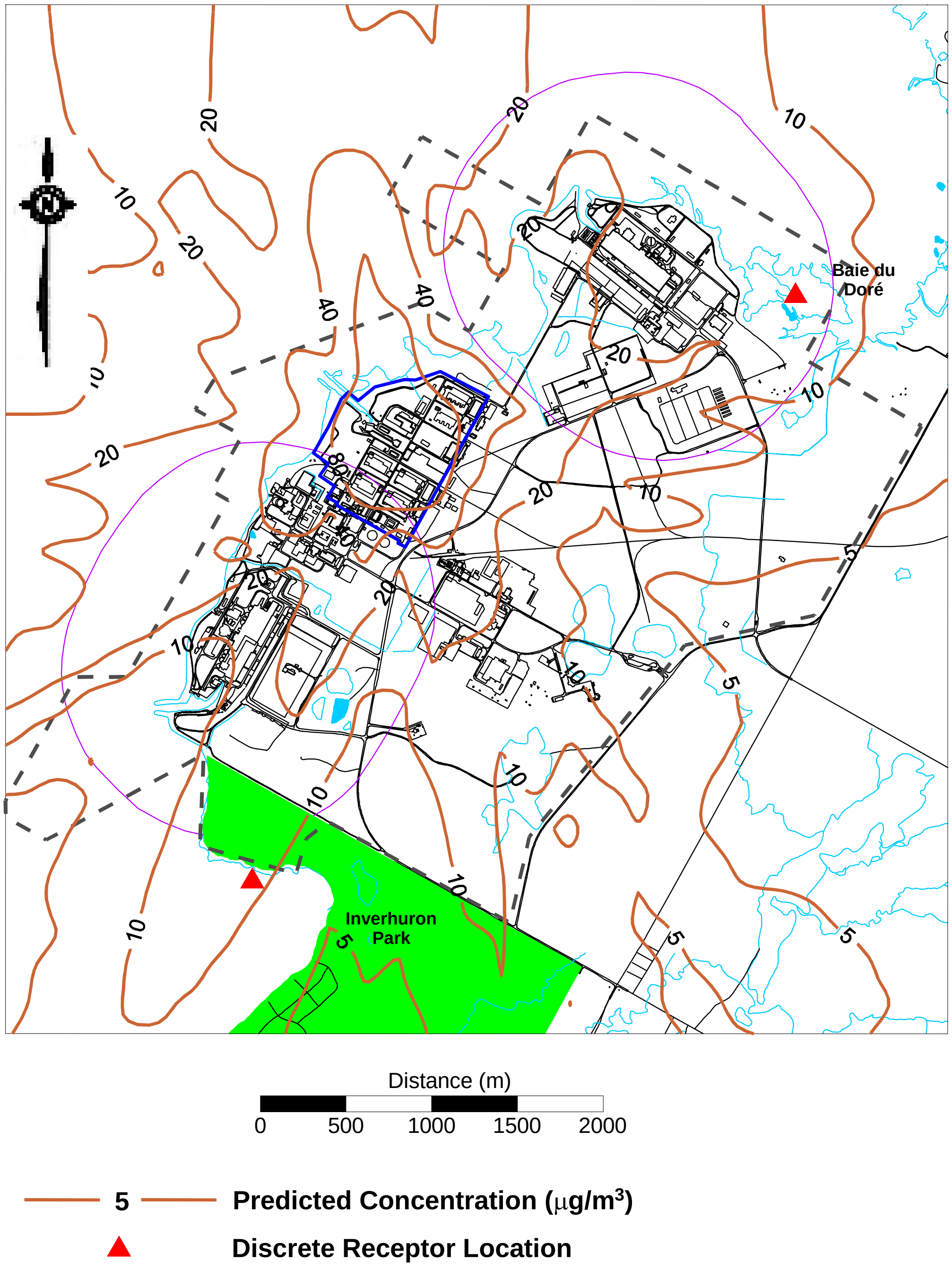


Figure 8.2
Maximum Predicted Incremental 24 Hour Average PM_{10} Concentrations ($\mu g/m^3$) Due To Excavation Activities

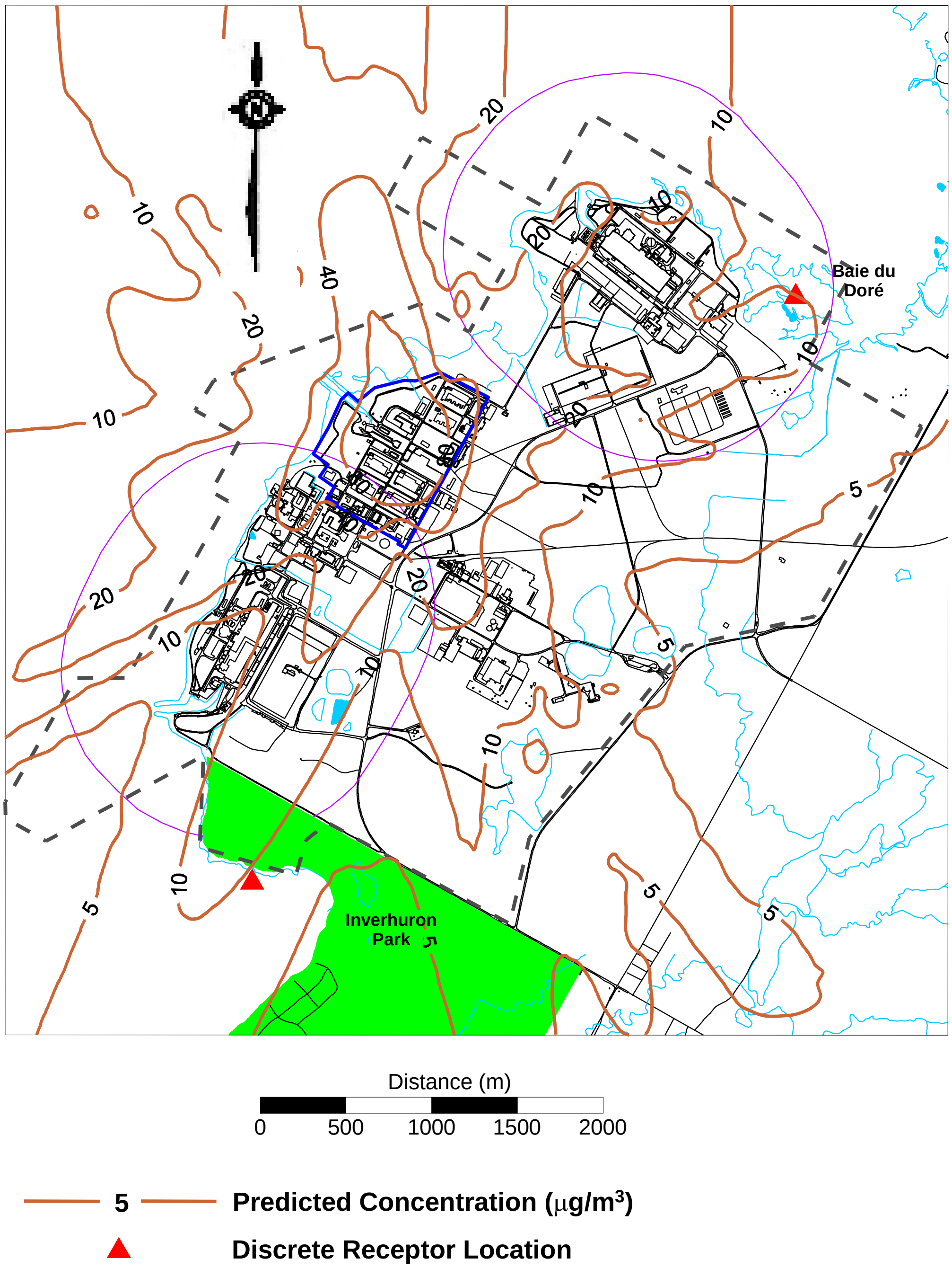
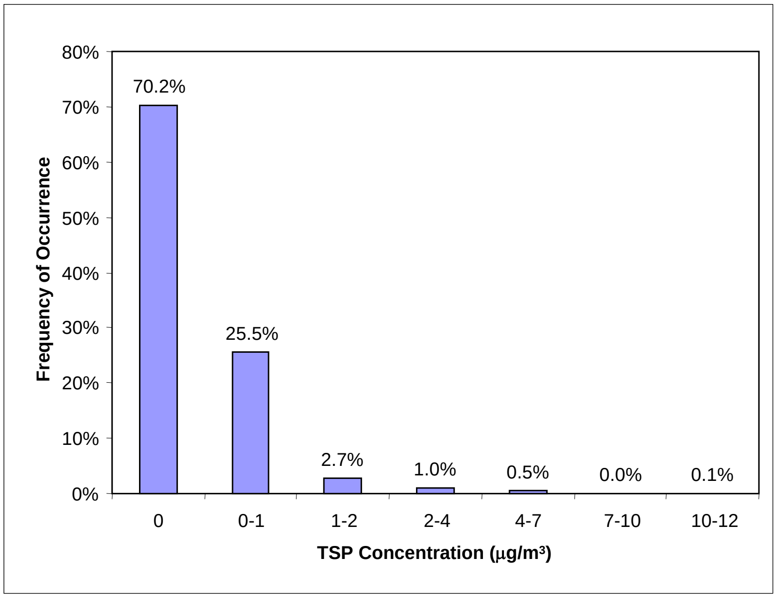


Figure 8.3

Frequency of Occurrence of Predicted Incremental 24 Hour Average TSP Concentrations at Inverhuron Park



Frequency of Occurrence of Predicted Incremental 24 Hour Average PM_{10} Concentrations at Inverhuron Park

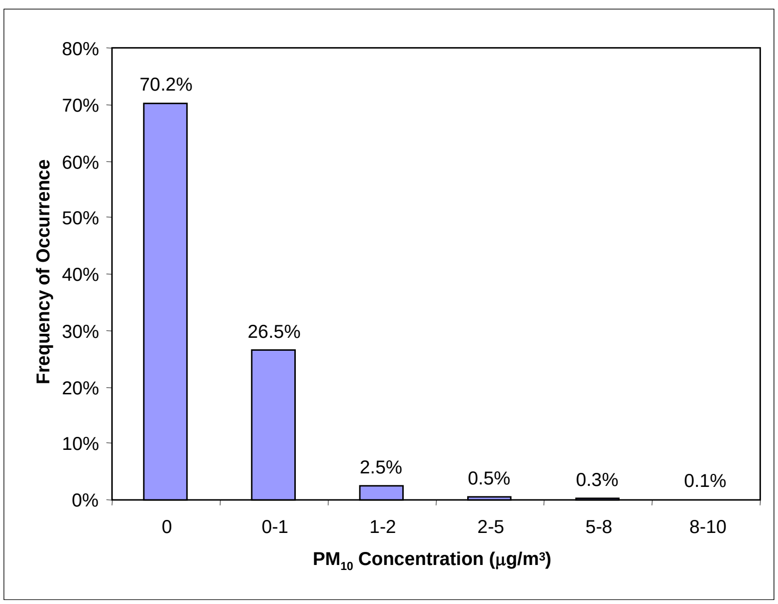
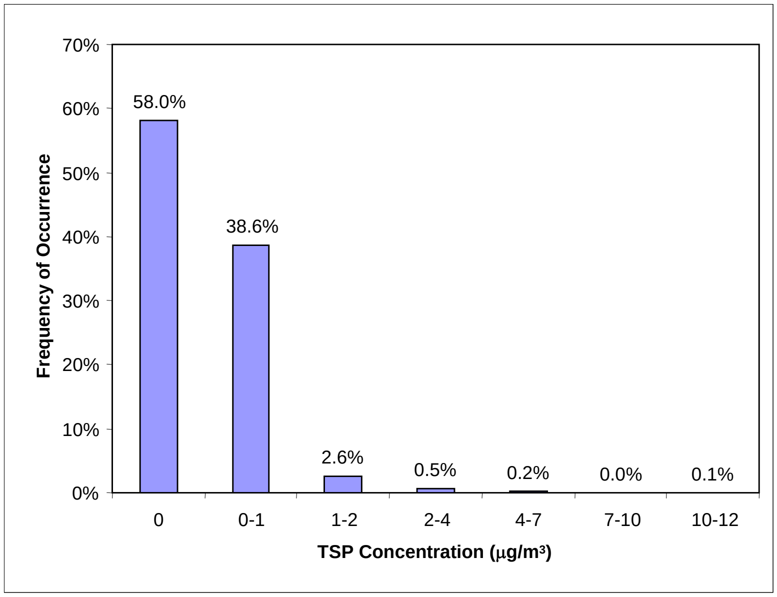
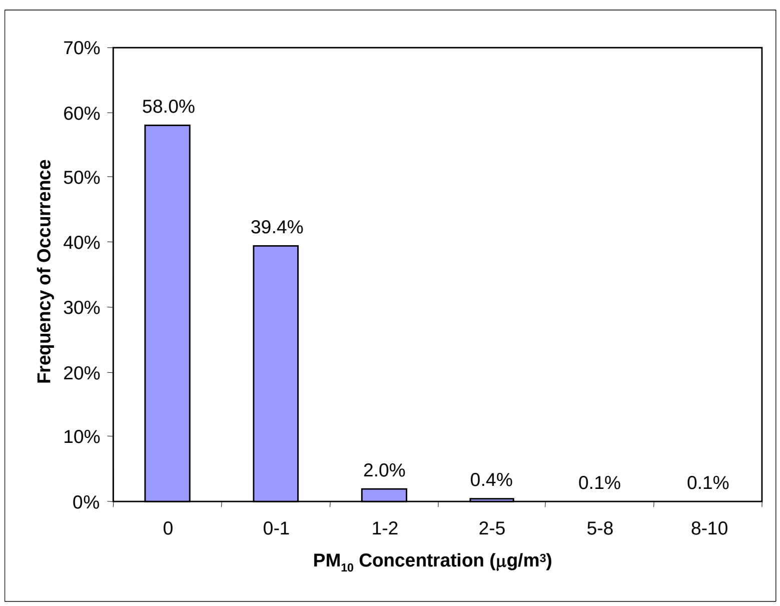


Figure 8.4

Frequency of Occurrence of Predicted Incremental 24 Hour Average TSP Concentrations at Baie du Doré



Frequency of Occurrence of Predicted Incremental 24 Hour Average PM_{10} Concentrations at Baie du Doré



8.2.2 Noise and Vibration

8.2.2.1 Project - Environment Interactions

The project works and activities that have been identified as having the potential to create noise and vibration would occur only during the demolition/remediation phase and are as follows:

- Removal, collection and storage of hazardous materials from structures and buildings;
- Construction of berms;
- Felling of towers;
- Demolition, sorting of materials and clearing of structures to grade;
- Removal, collection and storage of equipment from buildings
- Demolition, sorting of materials and clearing of buildings to grade;
- Demolition of SWTF;
- Collection of contaminated sediments;
- Collection and sorting of remaining scrap, waste and rubble;
- Excavation and collection of contaminated soils;
- Filling in of holes and excavations and regrading site;
- Transportation of materials for recycling; and
- Transportation of materials for disposal;

More specifically, the noise will be generated from

- excavating and grading with heavy equipment (up to six units at one time);
- cutting with hydraulic shears mounted on a tracked vehicle;
- cutting with propane/oxygen torch;
- felling of towers onto sand berms (only after 4:00 p.m. for safety); and,
- loading and hauling of scrap metal and site materials with trucks.

8.2.2.2 Likely Environmental Effects

There is limited blasting with small controlled charges during the felling of the towers, and there are no pile-driving activities planned for this project. The only potential source of ground vibration is expected from the felling of the towers. To minimize the impact on the ground, temporary berms of sand will be prepared for cushioning the impact. Since this will be a single event, and will be at a substantial distance from any receptors, there will be no noticeable ground vibration transmitted to any point of reception. These activities will be limited to between 7:00 a.m. and 7:00 p.m. during regular weekdays. There is no plan for this work to be conducted during Sundays or Statutory Holidays.

All equipment and vehicles used during the BHWP project will have noise control devices in place and in proper working condition. The noise emissions from the equipment will be in compliance with the MOE noise guideline NPC-115 (MOE, 1978). Based on the distances to the nearest receptors (more than 2 km) and shielding effects by the forested areas, any residual noise at these receptor locations (i.e. overnight camper at Inverhuron Provincial Park, resident in Baie du Doré, and resident in Inverhuron) will be below ambient noise levels. Due to the distances from the work areas to the noise-sensitive receptors, identified as VECs for this project, no adverse noise impact on the surrounding communities is expected.

Truck traffic to the work area will be via Concessions No 2 and 4 through the central entrance to the Bruce nuclear site. Currently the daily traffic count through these routes is approximately 2000 light vehicles (cars and pick-ups) and 20 heavy vehicles (trucks and buses). During some decommissioning activities, the daytime traffic could increase by an average of about 15 heavy vehicles per day. Since the percentage of heavy vehicles relative to the total traffic volume is very low, i.e. less than 1%, there will likely be no perceptible increase in noise level along these routes.

8.2.2.3 Identified Mitigation Measures

Mitigation measures that will be applied to assure noise and vibration control include:

- adhering to noise regulations for all demolition activities and operation of equipment;
- maintaining all equipment in good working order;
- use of sand berms to dissipate vibration generated by the felling of the towers; and
- felling of the enriching towers after normal work hours (i.e. after 4:00 p.m.).

8.2.2.4 Residual Effects

Taking into account that noise and vibration generated during most of the demolition/remediation activities will be confined to the site and will be of short duration, and the mitigation measures that will be taken, no residual adverse effects on noise levels from the decommissioning project are anticipated. Therefore, no adverse effects on sensitive receptors, identified as VECs for this project, are expected. In addition, since there will likely be no perceptible increase in noise levels from trucks along local roads, no residual adverse effects from noise on local communities are expected.

8.2.3 Site Drainage

8.2.3.1 Project - Environment Interactions

The demolition activities that have been identified as having the potential to affect site drainage are as follows:

- Construction of berms;
- Demolition, sorting of materials and clearing of structures and buildings to grade;
- Demolition of SWTF and lagoons; and
- Filling in of holes and excavations and regrading of site.

No adverse effects on site drainage will occur during the end state.

8.2.3.2 Likely Environmental Effects

Berms are essentially mounds of earth of 10 to 15 m^2. They will be constructed on a temporary (lasting about one week) basis and thus will have very little effect on the on-site drainage pattern. The clearing of the site will be conducted according to an existing drainage plan for the Bruce nuclear site, which takes into account the natural features of the land and will not alter the drainage pattern. The removal of the SWTF and lagoons, which were designed to remove contaminants from surface water runoff and process effluents prior to discharge to the flood plain, will not change the drainage pattern. The filling in of holes and excavations and the regrading of the site will allow surface water to drain in a more natural manner.

8.2.3.3 Identified Mitigation Measures

The site will be graded according to the overall stormwater master plan for the Bruce nuclear site.

8.2.3.4 Residual Effects

If the stormwater master plan is adhered to, no adverse residual effects on site drainage are anticipated.

8.2.4 Surface Water Quality

8.2.4.1 Project - Environment Interactions

The demolition activities that have been identified as having the potential to affect surface water quality are as follows:

- Construction of berms;
- Decontamination of buildings, cleaning out of sumps and drains;
- Treatment of contents of SWTF and lagoons;
- Discharging of treated water;
- Demolition of SWTF and lagoons;
- Removal of contaminated sediments; and
- Filling in of holes and excavations, and regrading of site.

No adverse effects on surface water quality will occur during the end state.

8.2.4.2 Likely Environmental Effects

The construction of berms may lead to minor sedimentation increases. Because of the small amount of material being used, these increases are expected to be very minor. The grading of the site may add to sedimentation, but site grading will be done according to the existing overall stormwater management plan for the Bruce nuclear site and will be designed to minimize sediment transport.

Contamination of surface water during the cleaning out of sumps and drains will be controlled by confirming that the water is suitable for draining, and if not, treated appropriately.

Contamination of surface water from soil remediation activities will be prevented by maintaining the SWTF in operation during this period to handle and control wastewater and surface drainage. The contamination of the SWTF itself will be controlled by monitoring the cell sludge prior to removal and disposal. The SWTF will remain in service during the demolition of all the other systems and will be the last structure to be removed.

To avoid any risk of contamination of surface water during the draining of the SWTF, a series of actions will be taken, specifically:

- ensuring that all discharges from the SWTF are in compliance with applicable regulations;
- before drainage, sampling the contents (including sampling by OPG for radiological content) to ensure that the contents do not exceed the levels set out in the appropriate water quality criteria;
- if the water exceeds the appropriate water quality criteria, procedures to treat the water before discharge or remove it for disposal will be implemented;
- delaying drainage in the event that more residence time is needed; and
- removing any contaminated material from the lagoon beds or surrounding land.

8.2.4.3 Identified Mitigation Measures

No mitigation measures other than those which are inherent in the DDP, as described above, are required.

8.2.4.4 Residual Effects

Taking into account the mitigation measures that are planned, no residual adverse effects on surface water quality from the decommissioning project are anticipated.

8.2.5 Aquatic Habitat and Species

8.2.5.1 Project - Environment Interactions

The decommissioning activities that have been identified as having the potential to affect aquatic habitat and species are the same as those identified for surface water quality. They would only occur during the demolition/remediation phase and include:

- Construction of berms;
- Decontamination of buildings; cleaning out of sumps and drains;
- Discharging treated water; and,
- Demolition of SWTF and lagoons.
- Removal of contaminated sediments;
- Excavation and collection of contaminated soils; and
- Filling in of holes and excavations, and regrading of site.

8.2.5.2 Likely Environmental Effects

The discussion in Section 8.2.4 showed that surface water quality would not be affected by demolition/remediation activities. Since water quality is the key determinant of project effects on aquatic habitat, it follows that with the exception of the removal of the lagoons and the SWTF, aquatic habitat and aquatic species, particularly the VECs identified in Section 6.11 (fish and benthic invertebrates), will be unaffected by the project.

The removal of the lagoons and the SWTF will remove a habitat opportunity. However, no fish have been observed in these lagoons which are shallow, currently not more than approximately 1.5 m. It is unlikely that this is an important loss and no effect is anticipated.

8.2.5.3 Identified Mitigation Measures

Due to the fact that no adverse effects on the aquatic environment are anticipated as a result of the decommissioning project, no mitigation measures are warranted other than those described in Section 8.2.4.2.

8.2.5.4 Residual Effects

No residual adverse effects on aquatic habitat or species, including the VECs (fish and benthic invertebrates), are expected.

The elimination of any risk of contamination to surface water quality during the end state represents an improvement to the safety of any aquatic species inhabiting the near shore of Lake Huron.

8.2.6 Terrestrial Habitat and Species

8.2.6.1 Project - Environment Interactions

The demolition/remediation phase activities that have been identified as having the potential to affect terrestrial habitat and species include:

- Demolition of SWTF and lagoons;
- Filling in of holes and excavation, and regrading of site;
- Transportation of materials for recycling and disposal; and
- Workforce transportation.

No adverse effects will occur during the end state.

8.2.6.2 Likely Environmental Effects

The demolition of the lagoons and the removal of bottom sediments represents a small loss in habitat for terrestrial species. However, the likelihood of these lagoons providing any more than a casual feeding space (insects) for a few passing small birds is extremely small. Accordingly, it is concluded that there will be no adverse effect on terrestrial habitat. The remediation of the site will provide additional habitat for terrestrial species.

The Bruce A Restart EA (Bruce Power, 2002) noted that "collisions between vehicles and white tailed deer have historically been a problem" at the Bruce nuclear site. Also, half of the reported collisions reported by the Ontario Provincial Police for the area around the Bruce nuclear site were "deer related incidents." A solar powered electric fence was installed along the interconnecting road in 1996. This is expected to have reduced the number of collisions, although no records to confirm this have been kept. The number of vehicles involved in waste transport (15 per day) and the number of worker commutes (20) represents an extremely small portion (<1.7%) of the total traffic of 1335 vehicles per hour on the roads leading to the Bruce nuclear site. Therefore, it is unlikely to lead to a measurable increase in deer mortality during the demolition period.

8.2.6.3 Identified Mitigation Measures

Because no adverse effects on the terrestrial environment are anticipated as a result of the decommissioning project, no mitigation measures are identified or warranted. The reduction in traffic to the BHWP during the end state may result in fewer incidents between vehicles and deer, a VEC identified for this project.

8.2.6.4 Residual Effects

No residual adverse effects on the terrestrial habitat or terrestrial species (including the VEC-white-tailed deer) are anticipated.

8.2.7 Soil Quality

8.2.7.1 Project/Environment Interactions

The project works and activities that have been identified as having the potential to affect on-site soil quality are as follows:

- Construction of berms;
- Demolition, sorting materials and clearing structures and buildings to grade;
- Demolition of SWTF and lagoons;
- Removal of contaminated sediments;
- Excavation and collection of contaminated soils; and
- Filling in of holes and excavations, and regrading of site.

8.2.7.2 Likely Environmental Effects

The likely environmental effect identified for soil quality is through the redistribution of potentially contaminated soil. Soil quality guidelines have been exceeded in several areas, as described in Section 6.5.1.2, within the Site Study Area. Therefore as a mitigation measure, all existing soil conditions from within the Site Study Area and the surrounding area will need to be taken into account during the demolition/remediation activities. Where necessary to meet appropriate soil quality guidelines, contaminated soil will be removed and disposed of in an appropriate licensed facility.

8.2.7.3 Identified Mitigation Measures

No mitigation measures with respect to soil quality other than those described above, are required within or around the Site Study Area.

8.2.7.4 Residual Effects

No residual adverse effects on soil quality from the decommissioning project are anticipated, taking into account the mitigation measures outlined above.

8.2.8 Groundwater Flow and Quality

8.2.8.1 Project/Environment Interactions

The project works and activities that have been identified as having the potential to affect groundwater recharge through increasing infiltration, and groundwater quality in turn, are as follows:

- Demolition, sorting materials and clearing structures and buildings to grade;
- Demolition of SWTF and lagoons;
- Removal of contaminated sediments;
- Excavation and collection of contaminated soils; and
- Filling in of holes and excavations, and regrading of site.

8.2.8.2 Likely Environmental Effects

The likely environmental effect identified for groundwater recharge was through increasing infiltration into the underlying aquifer, thereby increasing the potential for groundwater contamination due to contaminated soils. Remediation measures will be undertaken to ensure that the project works and activities do not cause significant residual adverse effects on groundwater quality. The exact scope and extent of this remediation will be determined through more detailed pre-demolition and follow-up monitoring, as indicated in Section 10.2. Where necessary to meet appropriate guidelines, affected soil will be removed and disposed of in an appropriate licensed facility.

8.2.8.3 Identified Mitigation Measures

The specific remediation/mitigation measures required to protect groundwater within and around the Site Study Area will be determined through further monitoring as indicated in Section 8.2.8.2.

8.2.8.4 Residual Effects

Taking into account the mitigation measures that are planned, no residual adverse effects on groundwater recharge or groundwater quality from the decommissioning project are anticipated.

8.2.9 Radiological Contamination

8.2.9.1 Project/Environment Interactions

The project works and activities that have been identified as having the potential to cause any on-site radiological contamination are as follows:

- Removal of contaminated sediments;
- Collection and sorting of remaining scrap, waste and rubble; and
- Excavation and collection of contaminated soils.

8.2.9.2 Likely Environmental Effects

There are no identified radioactive materials on site, as documented in Section 6.6. However, if any are found during demolition activities, they will be removed according to established collection and disposal procedures. The removal of these materials would result in a positive effect on the environment during the end state.

8.2.9.3 Identified Mitigation Measures

Since it is unlikely that there are any radioactive materials on site, and no adverse effects are expected, no mitigation measures have been identified. However, as described in Chapter 10, a final radiological contamination survey will be performed on the site at the end of the Demolition/Remediation Phase. This survey will confirm the absence of radioactive materials or identify where and/or if final remediation is required.

8.2.9.4 Residual Effects

No residual adverse effects with respect to radiological contamination are expected.

8.2.10 Land Use

8.2.10.1 Project - Environment Interactions

Potential effects on land use are related to the following project works and activities where there is a plausible mechanism by which the environment may be affected:

- Demolition, sorting of materials and clearing of structures to grade;
- Demolition, sorting of materials and clearing of buildings to grade;
- Demolition of SWTF and lagoons;
- Filling in of holes and excavations, and regrading of site.

8.2.10.2 Likely Environmental Effects

Because the project involves the demolition of structures and buildings and because no new land uses are currently being proposed for the BHWP site, the project is considered to be compatible with existing municipal planning policies and zoning by-laws. Adverse effects on land uses in the Local or Regional Study Areas are not anticipated as a result of the BHWP Decommissioning Project. Rather, a positive effect is anticipated from the complete demolition of structures and buildings to grade, filling of holes and excavations and re-grading of the site. The BHWP Decommissioning Project provides OPG, the Municipality of Kincardine and Parks Ontario with new opportunities for development both on the BHWP site and off the Bruce nuclear site.

During operation of the BHWP in the 1973-1998 period, Inverhuron Provincial Park was operated only as a day use facility because of the concern about H_2S at the facility. Following the removal of H_2S from the BHWP site in 1998, the park's management plan was amended to allow expanded public access, extended hours of operation and four season operation, and the reintroduction of overnight camping (Ontario Parks, 2000). As a result of the decommissioning, Ontario Parks has proposed that Inverhuron Provincial Park be converted from a day-use only park to a facility-based campground that will likely result in an increased visitation. Similarly, the decommissioning project may also result in changes in municipal land use policies that restricted development within the former Controlled Development Zone, allowing for additional residential or cottage developments in the Regional Study Area. Modifications to the Official Plans and by-laws will be required before such changes can occur.

8.2.10.3 Identified Mitigation Measures

Because no adverse effects on land use are anticipated as a result of the decommissioning project, no mitigation measures are identified or warranted.

8.2.10.4 Residual Effects

A residual positive effect during the end state of the decommissioning project on land use has been identified as new development opportunities for OPG on the Bruce nuclear site and new development opportunities for the Municipality of Kincardine and Ontario Parks off the Bruce nuclear site.

No residual adverse effects of the decommissioning project on land use during either the demolition/remediation phase or end state are anticipated.

8.2.11 Transportation Network

8.2.11.1 Project/Environment Interactions

Potential effects on transportation are related to the following project activities where there is a plausible mechanism by which the environment may be affected:

- Transportation of materials for recycling;

- Transportation of materials for disposal; and
- Workforce transportation.

8.2.11.2 Likely Environmental Effects

The BHWP Decommissioning Project will generate traffic of approximately 15 truck and 20 worker vehicle movements per day on local roads. These temporary vehicle movements represent an increase of less than 2% over current traffic of approximately 2000 vehicles per day to and from the Bruce nuclear site.

In addition, recyclable materials and small amounts of potentially hazardous waste (see Table 3.5) generated during the decommissioning activities will be transported to off site destinations. Any hazardous wastes will be trucked off site for disposal at a facility licensed to accept each specific type of waste. For example, asbestos waste will be transported to a licensed asbestos disposal facility.

As the specific needs for off site disposal of hazardous wastes will not be determined until demolition and subsequent remediation are under way, exact waste transportation routes are not yet known. Whatever off site waste disposal facilities may be selected, Highway 21 would likely be among the routes connecting the Bruce nuclear site and the off site facilities. Whatever the route, all hazardous waste shipments will be conducted in accordance with requirements of the Ontario Dangerous Goods Transportation (DGT) Act and the federal Transportation of Dangerous Goods (TDG) Act.

The primary environmental effects likely to result from project-related traffic would be a small increase in the traffic on local roads, traffic noise and emissions, and potential vehicle collisions.

Incremental traffic effect is measured by the “level of service" or traffic flow at intersections. It is dependent on vehicle delay and queuing length at the approaches. Level of Service is calculated as a ratio of traffic volumes to approach capacity (V/C). The V/C ratio is classified from A to F, with levels of service E and F representing unacceptable delay conditions.

As noted previously, roads in the Regional Study Area currently operate at an acceptable Level of Service. For example, the intersections at Highway 21 and the rural roads that service the Bruce nuclear site currently operate at a Level of Service of “B” or better. Bruce Concession 4 at the Tie Road / North Gate operates at a Level of Service “C” during the morning peak hour. Projections of future traffic levels indicate that acceptable levels of service are expected to continue well beyond the timeframe of this project. Because the decommissioning project is expected to only increase local traffic by about 2 %, the project is not likely to cause a measurable change in the current Level of Service on local roads. Moreover the incremental traffic is not likely to be noticeable over the course of the day given the large variability in traffic during peak and off-peak periods.

Similarly, an increase in traffic of about 2% would not generate noticeable increases in noise or air emissions to the local environment.

The existing environment conditions indicated that there are currently no safety concerns regarding off-site roads that would be used by trucks and other vehicles during the decommissioning project. All of the intersections have collision rates below the provincial average of three collisions per million vehicles. The small additional traffic resulting from the decommissioning project is not expected to measurably affect the collision rates at intersections, and is not likely to change existing collision rates. Because Levels of Service at these intersections will remain well within the acceptable range, no problems regarding collision rates are anticipated. There will likely be no measurable adverse effect on levels of service or collision rates as a result of the project.

8.2.11.3 Identified Mitigation Measures

Compliance with the requirements of the DGT and TDG Acts will ensure safe transport of hazardous materials and should avoid risk to the public and to the environment. Since no adverse effects on transportation are anticipated as a result of the decommissioning project, no mitigation measures are identified or warranted.

8.2.11.4 Residual Effects

No residual adverse effects of the decommissioning project on transportation during either the demolition/remediation phase or end state are anticipated.

8.2.12 Landscape and Visual Description

8.2.12.1 Project - Environment Interactions

Likely effects on physical and cultural heritage resources are related to the following project works and activities where there is a plausible mechanism by which the environment may be affected:

- Felling of towers;
- Demolition, sorting of materials and clearing structures to grade;
- Demolition, sorting of materials and clearing buildings to grade;
- Demolish Demolition of SWTF lagoons; and
- Filling of holes, and excavations, and regrading of site.

8.2.12.2 Likely Environmental Effects

A thorough archaeological study of the Bruce nuclear site in 1997 confirmed that no archaeological sites exist in the vicinity of the BHWP (Ontario Hydro, 1998b). Because all physical works and activities will be located on the BHWP site and on permanent roads on and off the Bruce nuclear site, the decommissioning project will not affect archaeological or cultural resources elsewhere locally or within the Regional Study Area.

The demolition of the BHWP structures and buildings will result in a change to the existing landscape and visual resources. The most noticeable change from off-site locations will be the removal of E4 and E7, and the north flare structure. These consist of towers up to 87 m in height. Their felling and removal will result in improved aesthetics in the area surrounding the Bruce nuclear site, including the cottage and recreational areas of Inverhuron, Baie du Doré and the Inverhuron Provincial Park. The reduced industrial presence in the area will also improve views from Lake Huron which is used by tourists, boaters and anglers.

8.2.12.3 Identified Mitigation Measures

Because no adverse effects on physical and cultural resources are anticipated as a result of the decommissioning project, no mitigation measures are identified or warranted.

8.2.12.4 Residual Effects

The residual positive effect of the decommissioning project on physical and cultural resources has been identified as improved aesthetics of area surrounding the Bruce nuclear site, including the cottage and recreational areas of Inverhuron, Baie du Doré and the Inverhuron Provincial Park.

8.2.13 Population and Economy

8.2.13.1 Project - Environment Interactions

Potential direct effects on population and economy are related to workforce payroll and purchasing, and potential indirect effects (Table 7.2) are related to aquatic habitats and species.

8.2.13.2 Likely Environmental Effects

The decommissioning project is anticipated to create some new employment opportunities, help maintain existing jobs and maintain the existing population base within the study areas. For an individual, family or household this employment will provide a source of income and a sense of personal security, all of which define their lifestyle and quality of life. The majority of new on-site jobs would be for additional personnel with civil, electrical and mechanical engineering skills and for administration and clerical support. These positions are likely to be filled by temporary or contract staff from outside the Regional Study Area.

In a separate study regarding the Bruce A Restart project (Bruce Power, 2002), the Statistics Canada Input / Output model was used to derive multipliers to enable calculation of direct and indirect employment. Household expenditure patterns were used as a basis for calculating induced employment. This study indicated that during the Bruce A restart phase, one on-site job results in another 0.61 direct jobs, and 1.13 indirect jobs. One on-site worker resident in Bruce County results in induced employment of 0.66 local jobs. These multipliers are likely to be similar for the BHWP Decommissioning Project. Therefore, the decommissioning project is likely to result in the employment levels noted in Table 8.4. All on-site employment will be associated with non-OPG personnel (i.e. GDC employees). The values presented in this table represent maximum employment likely to be generated.

TABLE 8.4
ANNUAL PROJECT-RELATED EMPLOYMENT
Demolition/Remediation Phase (2003-2009)

Employment Generation	OPG Employees	Other On-site Employees	Other Direct, Indirect & Induced Employment	Total Associated Employment
Associated Employment (Full-time Equivalents)	0	20	48	68

During the decommissioning project, the short-term employment opportunities generated are not anticipated to attract new permanent residents into the County or the Municipality of Kincardine. Workers are more likely to commute daily or weekly to the site, rather than relocate. Construction trade workers employed on projects outside of the jurisdictional areas of their respective trade unions can also be expected to return home for local work. Therefore, the positive effects of the project on population and employment are not likely to be measurable in the context of the current and projected population and employment.

It is expected that some workers will require temporary accommodation, and thus will help maintain the economic viability of several local hotels and motels. However, given the small number and temporary nature of the jobs to be generated by the decommissioning project, workers are not expected to compete with tourists for temporary accommodations to a degree that would result in any measurable adverse effect on tourism activity or result in reduced return visitation over the long term.

The expenditures of OPG staff and others who gain income as a result of the decommissioning project payroll, along with purchasing of goods and services by OPG, will generate some minor business activity. The majority of these purchases will likely be associated with the GDC and transportation services.

The majority of local businesses are not likely to be dependent upon these expenditures for most of their annual revenues; therefore, the project is not anticipated to generate an expansion of the local economic base or individual businesses. Trucking businesses and licensed private sector waste management companies that collect, transfer, and process recyclable materials are likely to benefit the most from the decommissioning project. Overall, in the context of the local and regional economy, the project spending on payroll, goods and services will not likely result in a measurable effect on business activity.

In the past, the only licensed commercial fishing company operating near the Bruce nuclear site did not have any concerns regarding operations at the Bruce nuclear site, and indicated that normal operations on the Bruce nuclear site have not influenced the business activity. Moreover, because no residual adverse effects on aquatic habitat and species are anticipated, no measurable effects on the commercial fishery in Lake Huron are expected.

8.2.13.3 Identified Mitigation Measures

Overall, the project is not anticipated to adversely affect economic development planning or specific economic development activities in the short or long terms. Therefore, no mitigation measures are identified or warranted.

8.2.13.4 Residual Effects

No residual effects of the decommissioning project on population and economy during either the demolition/remediation phase or end state are anticipated.

8.2.14 Community Infrastructure

8.2.14.1 Project/Environment Interactions

Potential direct effects on community infrastructure are related to the following project works and activities where there is a plausible mechanism by which the environment may be affected:

- Transportation of materials for recycling; and
- Workforce transportation.

Potential indirect effects (Table 7.2) relate to air quality, noise, and transportation.

8.2.14.2 Likely Environmental Effects

The BHWP Decommissioning Project is not anticipated to substantively change the availability or affect the quality of housing available in the area due to the fact that no significant changes in population from workforce in-migration are anticipated that would place additional demands on the current housing stock. However, for the purpose of this analysis, it is hypothesized that the decommissioning project might have an influence on residential property values.

As a general rule, decreased property values (an indirect effect) may result from significant increases in nuisance effects such as noise, dust, and traffic (direct effects) associated with a facility. Case studies on property value changes associated with a wide range of developments, including nuclear facilities, indicate that decreased property values as a result of nuisance effects are usually restricted to areas immediately surrounding the facility or access routes (Bruce Power, 2002). Property values also tend to recover close to pre-impact levels within a few years regardless of whether or not a nuisance has been eliminated. Given that no noticeable nuisance effects are anticipated as a result of the BHWP Decommissioning Project, decreased property values are also not anticipated. However, the decommissioning project will result in improved views from areas such as Inverhuron and along Baie du Doré after the towers are felled. This may serve to make properties in these areas more attractive to prospective homebuyers. Nevertheless, measurable positive effects on residential property values are not anticipated.

OPG does not rely on the municipal waste management system for its conventional waste management requirements. The majority of the waste generated by the project will be handled on site at OPG's conventional waste landfill on the Bruce nuclear site. No effects on public sector services in Kincardine or Bruce County are anticipated. Recyclable materials will be handled by licensed private sector waste management companies that collect, transfer and process recyclable materials generated on site.

8.2.14.3 Identified Mitigation Measures

The decommissioning project is not anticipated to affect community infrastructure in the short or long terms. Therefore, no mitigation measures are identified or warranted.

8.2.14.4 Residual Effects

No residual effects of the decommissioning project on community infrastructure during either the demolition/remediation phase or end state are anticipated.

8.2.15 Community Services

8.2.15.1 Project/Environment Interactions

Potential direct effects on community services are related to the transportation of materials for disposal. Potential indirect effects (Table 7.2) are related to air quality, noise and vibration, surface water quality and aquatic habitat and species.

8.2.15.2 Likely Environmental Effects

The BHWP Decommissioning Project is not anticipated to change the availability or quality of private and public recreational facilities, local parks, trails, churches, marinas, and community centres in the area. This is because project-related employment is not anticipated to result in a measurable change in local or regional population that would place additional demands on these resources. The nearest park to the BHWP site is the Inverhuron Provincial Park located approximately 2.5 km from the BHWP site and the nearest beach is Inverhuron Beach located 6.5 km from the site. All other facilities are located over 11.5 km from the BHWP site.

Because of the quietness and cleanliness of the natural surroundings, these recreational areas are highly valued by users, and any change in noise, dust, air quality or traffic has the potential to affect their use and enjoyment. The assessment of air quality indicates that changes in noise or dust levels as a result of the project will not be noticeable at any recreational facilities or areas. Similarly, the assessment on traffic effects indicates that no changes in levels of service are anticipated that would cause disruption to local traffic.

The decommissioning project will not affect the access to Lake Huron, marinas or boat launches in the area and no environmental effects are anticipated that could affect current anglers' decisions on where to fish. The project is not anticipated to change the availability or quality of educational facilities (i.e., primary and secondary schools, nurseries and day care facilities) in the area because project-related employment is not anticipated to result in measurable change in local or regional population. There is also little potential for the disruption of activities conducted at these schools (e.g., use of these facilities by staff, students, community groups and organizations). The nearest facility to the site is the Bruce Township Central Public School which is located over 13.5 km from the BHWP site. No noticeable nuisance effects (e.g., noise, and dust) are expected at these facility locations. Similarly, marginally increased traffic associated with the project would be largely restricted to road segments from Highway 21 to the Bruce nuclear site's main gate where there are no educational facilities.

The decommissioning project is not anticipated to change the availability or quality of health and safety facilities and services (i.e., hospitals, police and fire fighting facilities and services) due to the fact that project-related employment will be small and would not place additional demands on these services. In addition, the Bruce nuclear site is largely self sufficient in terms of fire protection, policing/security and first aid/medical services on-site. There is also little potential for the direct environmental effects of the project to disrupt activities conducted at health and safety facilities (e.g., use of these facilities by patients, clients or staff). The nearest facility to the BHWP site is located over 21.5 km from the BHWP site.

8.2.15.3 Identified Mitigation Measures

The decommissioning project is not anticipated to affect community services. Therefore, no mitigation measures are identified or warranted.

8.2.15.4 Residual Effects

No residual effects of the decommissioning project on community services during either the demolition/remediation phase or end state are anticipated.

8.2.16 Municipal Finance and Administration

8.2.16.1 Project/Environment Interactions

Potential direct effects on municipal finance and administration are related to the demolition of structures and buildings to grade. However, these effects are not environmental effects as defined by the *Act* (see Section 4.1.6.1)

8.2.16.2 Likely Environmental Effects

The decommissioning project will affect existing buildings and structures, some of which generate tax revenue for the Municipality of Kincardine. The removal of these buildings will result in reduced tax revenues. However, the anticipated loss of municipal revenues is a very small fraction of the total revenues of the Municipality of Kincardine.

The last detailed assessment of the BHWP by the Municipal Property Assessment Corporation (MPAC) was undertaken in 1998. The on-site buildings that are currently assessed and the municipal tax payable on these buildings are detailed in Table 8.4. MPAC is reassessing the Bruce nuclear site, and the re-assessment should be available in the late Fall of 2002.

TABLE 8.5
PROPERTY TAX ASSESSMENT ON BHWP BUILDINGS - 1998

Building #	Name	Assessment	Tax $
404	Chlorine Building	59192	$2,412.60
412	Outfall Analyzer Building	6586	$268.44
415	Lagoon Electric Sub-station	15834	$645.38
416	Lagoon Aerator Building	25508	$1,039.68
531	Security Entry	29684	$1,208.42
		TOTAL	**$5,574.50**

8.2.16.3 Identified Mitigation Measures

There are no mitigation measures warranted to address the effects of the project on municipal finance and administration. This is an unavoidable outcome of the decommissioning project. OPG will work with the Municipality of Kincardine to quantify the amount of revenues lost due to the removal of taxable buildings and structures and identify future OPG projects that may offset this lost revenue.

8.2.16.4 Residual Effects

An outcome of the decommissioning project on socio-economic conditions has been identified as the removal of taxable buildings and structures, resulting in reduced tax revenues to the Municipality of Kincardine. However, this is not a residual adverse effect under the *Act*.

8.2.17 Residents and Communities

8.2.17.1 Project/Environment Interactions

Potential direct effects from the project on residents and communities are related to the following activities:

- Demolition and clearing structures to grade;
- Demolition and clearing buildings to grade;
- Removal of contaminated sediments;
- Filling in of holes and excavation, and regrading of site; and
- Transportation of materials for recycling.

Potential indirect effects (Table 7.2) are related to air quality, noise, and transportation.

8.2.17.2 Likely Environmental Effects

People's use and enjoyment of property can be adversely affected if the project increases noise, dust, and traffic in residential areas, or if the project affects aspects of the community which are valued by residents (i.e., quietness, peacefulness, sense of community, nice/friendly people, the beaches and lake). Sections 8.2.1 and 8.2.2 concluded that no noticeable air quality effects or noise are expected as a result of the project at any residential or cottage properties and that marginally increased traffic would be largely restricted to road segments off Highway 21 leading to the main gate where there are only a few residential homes. Because the project is not likely to have a direct effect on residential properties or those aspects of community that are valued by local residents, few people, if any, should experience a loss of their use and enjoyment of property as a result of the project. The short duration of the projects works and activities that generate noise, dust and traffic further supports this conclusion.

Conversely, people's use and enjoyment of property may improve as a result of the improved visual quality of the area at the end state, particularly the views from residences of Inverhuron and Baie du Doré. Cottagers or others who consider the BHWP and other operations on the Bruce nuclear site as incompatible with their lifestyle and the character of their community may consider the reduced industrial presence in the area and improved environmental conditions as positive developments and an improvement in community character. Consultation activities conducted as part of this EA support this conclusion. Representatives of the Inverhuron community have expressed support for the removal of the BHWP and view the project as a positive influence on the health and safety of residents and the community in general.

8.2.17.3 Identified Mitigation Measures

The decommissioning project will likely result in positive effects on residents and communities. Therefore, no mitigation measures are identified or warranted.

8.2.17.4 Residual Effects

No residual adverse effects of the decommissioning project on residents and communities during either the demolition/remediation phase or end state are anticipated.

8.2.18 Aboriginal Interests

8.2.18.1 Project - Environment Interactions

Likely effects on aboriginal interests are related to the following project works and activities where there is a plausible mechanism by which the environment may be affected:

- Felling of towers;
- Demolition, sorting of materials and clearing structures to grade;
- Demolition, sorting of materials and clearing buildings to grade;
- Demolition of SWTP and lagoons; and
- Filling of holes and excavations, and regrading of site.

Table 7.2 identified the indirect effects on aboriginal interest which could result from the potential direct effects of the BHWP project. Those environmental parameters that were identified as having the potential to interact indirectly with an aboriginal interest were brought forward and are discussed in this section. These include:

- Surface Water Quality;
- Aquatic Habitat and Species;
- Radiological Contamination; and
- Landscape and Visual Resources.

8.2.18.2 Likely Environmental Effects

In the past, representatives of First Nation communities have expressed a concern that operations on the Bruce nuclear site have had adverse effects on the environment and, consequently, have been incompatible with their lifestyle and culture. For example, concerns have been expressed regarding the adverse influence of operations on the Bruce nuclear site on their commercial and traditional subsistence fishery in Lake Huron. As noted in Section 6.10, for several years OPG has been co-operating with the First Nations through special studies on whitefish impact and aboriginal diet. However, since no residual adverse effects on surface water quality or aquatic habitat and species from the BHWP project are anticipated, no measurable effects on their commercial and traditional subsistence fishery in Lake Huron, identified as a VEC for this project, are expected.

Aboriginal persons or others who consider the BHWP and other operations on the Bruce nuclear site as incompatible with their lifestyle or culture may consider the reduced industrial presence in the area and improved environmental conditions as positive developments. This will enhance the past (1997/1998) resolution of archaeological issues which the First Nations had with respect to the Bruce nuclear site (see Section 6.8.1). Clean-up and the rehabilitation of lands may serve to improve their perception of OPG’s environmental management capabilities and OPG’s responsibility for the care of lands which are important to First Nation communities.

The BHWP Decommissioning Project provides new development opportunities for the Municipality of Kincardine and Ontario Parks off the Bruce nuclear site. The removal of restrictions from lands in the former Controlled Development Area and the implementation of Ontario Parks plans for Inverhuron Provincial Park are linked to the removal of H_2S from the BHWP which has already occurred, rather than the physical works and activities planned as part of this project. Nevertheless, consultation with First Nations in the past has identified the concern that these developments may result in increased pressures on traditional heritage sites on such lands. Aboriginal interests will need to be addressed through the public review of the Park’s management plans.

8.2.18.3 Identified Mitigation Measures

Because no adverse effects on aboriginal interests are anticipated as a result of the decommissioning project, no mitigation measures are identified or warranted.

8.2.18.4 Residual Effects

The residual effect of the decommissioning project on aboriginal interests has been identified as positive; that is, improved compatibility of the Bruce nuclear site with aboriginal lifestyle or culture due to the reduced industrial presence in the area and improved environmental condition of the land, air and water.

8.3 Likely Effects of Accidents and Malfunctions

The *Act* requires that a Comprehensive Study of a project include the consideration of the environmental effects of accidents and malfunctions that may occur in connection with the project. Furthermore, the *Act* also requires a consideration of the effectiveness of measures provided to mitigate such effects. This section provides a description of the potential accidents and malfunctions considered for the BHWP Decommissioning Project, their environmental effects and identified mitigation measures. Almost all of the accidents and malfunctions that may occur in connection with the project are considered conventional events. Only one potential event in which there is the potential for release of radioactivity was identified.

The focus of this EA Study Report is on those events that are considered credible in the context of the BHWP Decommissioning Project. It is not the intent to address all conceivable abnormal occurrences, but rather to address those with a reasonable probability of occurring during the demolition phase. These accidents and malfunctions may be precipitated by external factors or human error.

The approach to the assessment of accidents and malfunctions involves identifying and screening those events with a reasonable probability of occurring and likely to result in a significant environmental effect or pose a hazard to workers or the public. This screening process took into account the results of a review of the available records of accidents and malfunctions that have occurred at the BHWP site, the current state of the BHWP site and experience gained from the decommissioning work that has already been completed, including the demolition of E1, E2, E3 and E8. The review, as documented in the DDP, did not reveal any accidents or other incidents that are relevant to the decommissioning project (OPG, 2002). In addition, past decommissioning works were successfully completed without any serious accidents, injuries, chemical spills or radiation exposure. No significant deviation from the methods employed during the previous decommissioning work is being proposed for this project.

Table 8.6 provides the results of the screening process. On the basis of this screening it was determined that there are no events that could result in either a significant adverse environmental effect or have serious implications for worker or public health and safety.

TABLE 8.6
IDENTIFICATION AND SCREENING OF CREDIBLE EVENTS

Potential Event	Project/Environment Interaction	Screening Decision
Accidental exposure to radiation from contaminated soils or unused radiation sources.	▪ Worker health and safety ▪ Public health and safety	All unused radiation sources have been removed from the site. The locations of remaining sources (i.e. uranium foils in the laboratory) are known and pose little risk of exposure. Ground contamination surveys indicate that there is no evidence of radioactive contamination in any area where work will be performed. The compliance programs to be implemented as part of the project (see Section 3.4) will ensure that worker and public health and safety are protected. ▪ **No further consideration required**
Accidental exposure to bulk / waste chemicals	▪ Worker health and safety	Most of the bulk chemicals have already been removed from the site. Most of those that remain are used in the New Steam Plant, which will not be demolished. The compliance programs to be implemented as part of the project (see Section 3.4) will ensure that worker health and safety is protected. ▪ **No further consideration required**
Accidental exposure to chemical contamination	▪ Worker health and safety	It is anticipated that some residual H_2S will be found in piping and vessels. Residual oil, scale and acidic sludge will likely be found in process equipment. Some metals that will be cut with torches may have been painted with lead-based paints. The compliance programs to be implemented as part of the project (see Section 3.4) will ensure that worker health and safety is protected. ▪ **No further consideration required**
Personal injury accidents due to work around open water during draining of lagoons	▪ Worker health and safety	The compliance programs to be implemented as part of the project (see Section 3.4) will ensure that worker health and safety is protected. Past decommissioning works were successfully completed without any serious accidents or injuries. ▪ **No further consideration required**

TABLE 8.6 (Continued)
IDENTIFICATION AND SCREENING OF CREDIBLE EVENTS

Potential Event	Project/Environment Interaction	Screening Decision
Personal injuries from work in confined spaces, near excavations or below grade.	▪ Worker health and safety	Little work will be performed in confined spaces. Only shallow excavations (less than 2 m deep) will be dug during the course of the project There are open, below-grade concrete structures on the site including the North Flare/H_2S Recovery Area and the H_2S Storage Area, but their depth is less than 2 m. The compliance programs to be implemented as part of the project (see Section 3.4) will ensure that worker health and safety is protected. Past decommissioning works were successfully completed without any serious injuries. ▪ **No further consideration required**
Personal injuries accidents due to work near and below ground live services (e.g. steam lines, electrical and water lines)	▪ Worker health and safety	The compliance programs to be implemented as part of the project (see Section 3.4) will ensure that worker health and safety is protected. Past decommissioning works were successfully completed without any serious injuries. ▪ **No further consideration required**
Personal injury accidents due to work near buildings and structures under demolition (e.g. felling towers)	▪ Worker health and safety	The compliance programs to be implemented as part of the project (see Section 3.4) will ensure that worker health and safety is protected. Past decommissioning works were successfully completed without any serious accidents or injuries. ▪ **No further consideration required**
Personal injury accidents due to work at heights on enriching unit towers, flare stacks or other tall structures.	▪ Worker health and safety	The compliance programs to be implemented as part of the project (see Section 3.4) will ensure that worker health and safety is protected. Past decommissioning works were successfully completed without any serious accidents or injuries. ▪ **No further consideration required**

TABLE 8.6 (Continued)
IDENTIFICATION AND SCREENING OF CREDIBLE EVENTS

Potential Event	Project/Environment Interaction	Screening Decision
Chemical or fuel spills from storage, handling or transport of bulk/waste chemicals and fuel.	▪ Worker health and safety ▪ Public health and safety ▪ Surface water quality ▪ Aquatic habitat and species ▪ Soils and geology ▪ Groundwater flow and quality	The soils and extent of pavement on site will effectively minimize the potential for adverse effects on surface water quality, soils and geology, groundwater flow and quality. The continued operation of the SWTP will serve to contain contaminated run-off from the site. The compliance programs to be implemented as part of the project (see Section 3.4) will ensure that the risk of spills are minimized and that appropriate containment and clean-up capabilities are provided on-site. Past decommissioning works were successfully completed without any serious spills. ▪ **No further consideration required**
Fires and explosion from ignition sources (e.g. cutting torches) or storage of flammable liquids.	▪ Worker health and safety ▪ Public health and safety ▪ Terrestrial habitat and species ▪ Air quality ▪ Noise	The fire, safety and emergency preparedness programs to be implemented as part of the project (see Section 3.4) will ensure that the risk of fires and explosions are minimized and that resulting effects can be adequately handled by on-site personnel. The BHWP site is not heavily vegetated, minimizing the effects on terrestrial habitat and species, and reducing the risk of fires spreading to other parts of the Bruce nuclear site. The BHWP site is located well away from residences that might experience smoke and noise during an emergency. ▪ **No further consideration required**
Motor vehicle accidents	▪ Worker health and safety ▪ Public health and safety ▪ Terrestrial habitat and species	Off-site traffic, including increased potential for motor vehicle accidents and collisions with deer have been addressed as part of the assessment of normal operations and are not repeated herein as they relate to accidents and malfunctions. On-site project-related traffic volumes will not be substantial in the context of traffic on the Bruce nuclear site; therefore, such motor vehicle accidents are not expected to be of concern. Traffic safety provisions, including road design, signage and speed limits are established and enforced at the Bruce nuclear site. The motor vehicle safety program to be implemented as part of the project (see Section 3.4) will ensure that motor vehicle accidents are avoided to the maximum extent possible. ▪ **No further consideration required**

8.4 Likely Effects of the Environment on the Project

The *Act* requires that a Comprehensive Study of a project include the consideration of the environmental effects of the environment on the project. Furthermore, the *Act* also requires a consideration of the measures provided or intended to mitigate such effects. This section deals with those requirements.

The focus of the EA Study Report is on those events that are considered credible in the context of the BHWP Decommissioning Project. The approach to the assessment of the effects of the environment on the project involves identifying and screening those events with a reasonable probability of occurring and likely to result in a significant environmental effect or pose a hazard to workers or the public. This screening process took into account the existing site conditions and the compliance programs that will be implemented as part of the project.

Table 8.7 provides the results of the screening process. On the basis of this screening it was determined that there are no events that could result in either a significant adverse environmental effect or have serious implications on worker or public health and safety.

TABLE 8.7
IDENTIFICATION AND SCREENING OF LIKELY EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Potential Event	Physical Works and Activities Affected	Project/Environment Interaction	Screening Decision
Flooding and wave run-up	▪ SWTF ▪ Waste materials storage area ▪ All outdoor works and activities	▪ Site drainage ▪ Surface water quality	No significant adverse effects on the effectiveness of the SWTF or storage areas are anticipated because of shoreline elevations and the setback of the SWTF and storage area for waste materials. Hazardous materials and other wastes will be securely stored or removed off-site promptly. ▪ **No further consideration required**
Temperature extremes	▪ All outdoor works and activities	▪ Worker health and safety	The compliance programs to be implemented as part of the project (see Section 3.4) including the wearing of appropriate clothing, the availability of heated/air conditioned shelters and stopping work during temperature extremes will ensure that worker health and safety is protected. Past decommissioning works were successfully completed without any serious accidents or injuries. ▪ **No further consideration required**

**TABLE 8.7 (Continued)
IDENTIFICATION AND SCREENING OF LIKELY EFFECTS OF THE ENVIRONMENT ON THE PROJECT**

Potential Event	Physical Works and Activities Affected	Project/Environment Interaction	Screening Decision
High winds, tornadoes	▪ Tower felling ▪ All outdoor works and activities	▪ Worker health and safety	The compliance programs to be implemented as part of the project (see Section 3.4), including suspending work during such events will ensure that worker health and safety is protected. Past decommissioning works were successfully completed without any serious accidents or injuries. ▪ **No further consideration required**
Severe rains, thunderstorms and lightning	▪ Work on towers and high structures ▪ All outdoor works and activities ▪ SWTF	▪ Surface water quality ▪ Worker health and safety ▪ Surface water quality	The compliance programs to be implemented as part of the project (see Section 3.4), including the suspension of work during such events will ensure that worker health and safety is protected. Past decommissioning works were successfully completed without any serious accidents or injuries. The ongoing operation of the SWTF and the implementation of standard construction best practices to prevent sedimentation and erosion will ensure that effects on surface water quality are minimized. During severe rainstorms or spring run-off, the SWTF has the potential to overflow, thereby releasing untreated water which ultimately drains to Lake Huron. The facility was designed for a maximum expected rainfall of 7.5 cm during a two-week period (i.e. a return period of 30 years). Furthermore, during operation of the BHWP, 46% of the retention volume of the SWTF was for stormwater. Since the BHWP is no longer operational, 100% of the retention volume of the SWTF can now be used for stormwater. Close monitoring and inspection of the SWTF during such events would allow appropriate measures to be taken in a timely manner, if required. ▪ **No further consideration required**

TABLE 8.7 (Continued)
IDENTIFICATION AND SCREENING OF LIKELY EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Potential Event	Physical Works and Activities Affected	Project/Environment Interaction	Screening Decision
Seismic events	▪ Tower felling ▪ All outdoor works and activities	▪ Worker health and safety	The likelihood of a large, potentially damaging seismic event (M≥6) occurring close to the Bruce nuclear site is very low. The compliance programs to be implemented as part of the project (see Section 3.4) will ensure that worker health and safety is protected. Past decommissioning works were successfully completed without any serious accidents or injuries. ▪ **No further consideration required**

8.5 Likely Effects on the Sustainable Use of Resources

The *Act* requires that a Comprehensive Study consider 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 (i.e. the sustainable use of renewable resources). This section assesses these project-related environmental effects on both renewable and non-renewable resources. The goal of the assessment is to determine whether renewable and non-renewable resources would be affected by the project to the point that they are not sustainable.

Three environmental components, namely hydrology and water quality, the terrestrial environment, and the aquatic environment are the focus of the assessment of effects on renewable resources. The assessment has already concluded, as documented in previous subsections, that no residual adverse effects on these resources are likely. After decommissioning is complete and the end state is achieved, improved environmental conditions will result in positive effects on these resources.

The materials consumed or produced by the project are the focus of the assessment of effects on non-renewable resources. The decommissioning project will require the use of various oils, chemicals and fuel. The quantities of these materials to be used are small and have not been quantified. However, it is considered very unlikely that their consumption could measurably affect the availability of these materials for other consumers now or in the future.

The decommissioning project has been designed to maximize the reuse and recycling of materials. Any material that is not a subject waste as defined by the MOE *Waste Management – General Regulations* will be assessed to determine if it is suitable for reuse or recycling. Any equipment that can be reused will be retained by OPG.

The project involves separating out steel, aluminum, copper, electrical cables, waste batteries and other materials to be recycled at an approved facility. Metals such as stainless steel, carbon steel and aluminum are the most likely to be recycled. The Enriching Units are likely to be the largest single source of recyclable materials. The types and amounts of the materials produced during the decommissioning project that are potentially recyclable are shown in Table 8.8. This estimate is based on the amounts of materials generated during the previous decommissioning works of E3 and E8.

TABLE 8.8
TYPES AND AMOUNTS OF POTENTIALLY RECYCLABLE MATERIALS

Potentially Recyclable Materials	Total Estimated Tonnes
Carbon Steel	23,025
Stainless Steel	3,885
Aluminum	45
Electrical Cable	10
Electrical & Mechanical Equipment	600

Some of the waste concrete may be broken up and used during the remediation of the site to backfill the lagoons and other excavations.

The end state of the decommissioning project will provide a sustainable resource that is likely to result in a positive effect on availability and use of these resources.

In summary, no significant adverse effects on the capacity of renewable or non-renewable resources are anticipated as a result of the project.

8.6 Human Health Implications

Effects related to air quality and noise have the potential to result in effects to human health. Because these effects are likely to be limited in geographic extent to essentially the BHWP site, no effects to members of the public are anticipated under normal demolition/remediation activities. Section 8.3 assessed the effects of accidents and malfunctions that are possible during the decommissioning project. Those that have human health implications are listed in Table 8.9.

TABLE 8.9
ACCIDENTS AND MALFUNCTIONS WITH POTENTIAL HUMAN HEALTH IMPLICATIONS

Potential Accident or Malfunction	Potential Effect
▪ Accidental exposure to radiation from contaminated soils or unused radiation sources.	▪ Worker health and safety ▪ Public health and safety
▪ Accidental exposure to bulk / waste chemicals.	▪ Worker health and safety
▪ Accidental exposure to chemical contamination.	▪ Worker health and safety
▪ Personal injury accidents due to work around open water during draining of lagoons.	▪ Worker health and safety
▪ Personal injuries from work in confined spaces, near excavations or below grade.	▪ Worker health and safety
▪ Personal injuries accidents due to work near, above, and below ground services (e.g. steam lines, electrical and water lines).	▪ Worker health and safety
▪ Personal injury accidents due to work at heights on enriching unit towers, flare stacks or other tall structures.	▪ Worker health and safety
▪ Personal injury accidents during felling of towers (e.g. tower does not fall as planned or presence of flying debris) or tower collapse under the influence of severe environmental forces (e.g. tornado).	▪ Worker health and safety
▪ Chemical or fuel spills from storage, handling or transport of bulk/waste chemicals and fuel.	▪ Worker health and safety ▪ Public health and safety
▪ Fires and explosion from ignition sources (e.g. cutting torches) or storage of flammable liquids.	▪ Worker health and safety ▪ Public health and safety
▪ Motor vehicle accidents	▪ Worker health and safety ▪ Public health and safety

In each case, the compliance programs to be implemented as part of the project (see Section 3.4) will ensure that worker and public health and safety is protected. Moreover, past decommissioning works were successfully completed without any serious accidents or injuries. Therefore, taking into account the compliance programs identified as part of the project, no residual effects on worker or public health and safety of the decommissioning project are anticipated.

8.7 Summary of Mitigation Measures

As mentioned previously, a decommissioning project is inherently different from a project involving both the construction and operation of a facility. A decommissioning project, such as the current BHWP project, is similar to the construction phase. There is no operating phase, but rather an end state in which no activities take place on the site.

The mitigation measures that are implemented in a decommissioning project are intended to deal, for the most part, with temporary, short-term effects which are related to construction – type activities. Therefore, the mitigation measures are generally standard practices that are historically well-regulated and designed to minimize these short-term effects.

Table 8.10 summarizes the mitigation measures proposed for the potential adverse effects from the BHWP Decommissioning Project. These measures were determined from an analysis of the likely environmental effects of the project as presented in Sections 8.2.1 to 8.2.18. All appropriate mitigation measures will be established as OPG commitments in the licensing process.

8.8 Summary of Residual Effects on Valued Components of the Environment

No direct adverse residual effects on VECs or VSCs were identified in the analysis.

Although no adverse residual effects have been identified for air quality (dust) and noise, a monitoring and follow-up program for each of these components has been proposed in Chapter 10 to ensure that the conclusions of the assessment are valid. Consistent with that approach and in the unlikely event that actual dust and/or noise measurements are greater than forecast, the possibility of interactions of these components with the air quality and noise components of other projects has also been carried forward into the cumulative effects analysis in Chapter 9.

TABLE 8.10
SUMMARY OF MITIGATION MEASURES

Component	Effect	Mitigation
Air Quality	Dust	▪ Optimizing the timing of work activities/felling of towers to minimize local dust impacts; ▪ Wetting the land and roads during grading and earth moving; ▪ Using truck covers during the transport of fill materials.
Noise and Vibration	Vibration	▪ Use of berms to dissipate vibration from the blow of the falling towers.
	Noise	▪ Use of well-maintained equipment and vehicles with noise control devices in place. The noise emissions from this equipment will be in compliance with the MOE noise protocol. ▪ Adhering to noise regulations for all demolition activities and operation of equipment.
Hydrology and Surface Water Quality	Site Drainage	▪ The site will be graded with reference to the overall stormwater master plan for the Bruce nuclear site.
	Surface Water Quality	
	▪ Sedimentation	▪ The site will be graded with reference to the overall stormwater master plan for the Bruce nuclear site.
	▪ Contamination of surface water during the cleaning-out of sumps and drains	▪ Confirming at the time of cleaning that the water is suitable for draining and if not, treated appropriately.
	▪ Contamination of surface water from soil remediation activities	▪ SWTF will remain in service during the demolition of all the other systems to handle and control wastewater and surface drainage and will be the last structure to be removed.
	▪ The contamination of the SWTF.	▪ Sampling cell sludge prior to removal and disposal.
	▪ Contamination from draining of SWTF	▪ Ensuring that all discharges from the SWTF are in compliance with its C of A; ▪ Before drainage, sampling the contents (including sampling by OPG for radiological content), to ensure that the contents do not exceed the levels set out in the appropriate water quality criteria; ▪ If the water exceeds the appropriate water quality criteria, procedures to treat the water before discharge or to remove it for disposal will be implemented; ▪ Delaying drainage in the event that more residence time is needed; and ▪ Removing any contaminated material from the lagoon beds or surrounding land.

9.0 ASSESSMENT OF LIKELY CUMULATIVE EFFECTS AND MITIGATION

9.1 Introduction

The *Act* requires the consideration of cumulative environmental effects in relation to the decommissioning project. The Canadian Environmental Assessment Agency's Cumulative Effects Assessment Practitioners Guide and Operational Policy Statement (Canadian Environmental Assessment Agency, 1999) provide guidance in conducting an assessment of cumulative effects to meet the requirements of the *Act*. According to the Practitioners Guide, a cumulative effects assessment is:

> *"…an assessment of those incremental effects of an action on the environment when the effects are combined with those from other past, existing and future actions" (pg. A1).*

In the case of the decommissioning project, the cumulative effects would be those incremental adverse effects caused by the proposed project during the demolition phase when added to or combined with the effects that are caused by projects or activities at the site as well as off-site. As noted in the Practitioner's Guide, the identification of direct project effects "paves the way" for cumulative effects to be assessed and for a:

> *"single project under regulatory review [a cumulative effects assessment] should fundamentally do the following:*

1. *Determine if the project will have an effect on a [Valued Ecosystem Component] VEC;*
2. *If such an effect can be demonstrated, determine if the incremental effect acts cumulatively with effects of other actions, either past, existing or future;*
3. *Determine if the effect of the project, in combination with the other effects, may cause a significant change now or in the future in the characteristics of the VEC after the application of mitigation for that project." (pg. 10)*

The cumulative effects assessment (CEA) for the BHWP Decommissioning Project addresses only those incremental adverse effects of the decommissioning works and activities undertaken in the demolition/remediation phase and not the long-term positive effects of the end state.

9.2 Identification of Effects to be Considered in the Cumulative Effects Assessment

As noted above, the first fundamental objective of the CEA is to determine if the project by itself will have an effect on a VEC. This first step has been accomplished throughout the previous sections of this EA Study Report. Typically, a CEA would build on these results and would consider only residual adverse effects of the BHWP Decommissioning Project in combination with similar residual effects from other projects and activities. Moreover, because a CEA is VEC focussed, only those residual adverse effects of the project that are likely to have a measurable effect on a VEC or VSC are considered.

In this EA Study Report, taking the proposed mitigation measures into account, there are no residual adverse effects that are likely to have any measurable effect on any VEC or VSC. Despite this conclusion, the scope of the CEA has been broadened to address two additional potential direct effects (air quality (dust) and noise). The rationale for including these potential direct effects in the CEA was provided in Section 8.8.

Table 9.1 summarizes the two potential direct effects of the BHWP Decommissioning Project and relevant VECs or VSCs considered in the cumulative effects assessment. Therefore, only past, present or future projects or activities related to these specific effects will be considered in the CEA.

TABLE 9.1
EFFECTS AND RELEVANT VEC/VSC's CONSIDERED

Environment Component	Effects Considered	Relevant VEC / VSCs
Atmospheric Environment	Air Quality (dust)	Nearest Resident (Baie du Doré) Nearest Resident (Inverhuron)
	Noise	Nearest Resident (Baie du Doré) Nearest Resident (Inverhuron) Future Overnight Camper at Inverhuron Provincial Park

9.3 Identification and Description of Other Projects and Activities

To determine if the likely adverse effects identified in Table 9.1 have the potential to act cumulatively with the effects of other projects and activities, either past, existing or future on VECs or VSCs, other projects and activities are identified and described in this section. These additional projects or activities may also represent on-going disturbances to the VECs and as such will have become part of the existing conditions.

In addition, the Canadian Environmental Assessment Agency's Operational Policy Statement indicates that the CEA should consider other 'certain' and 'reasonably foreseeable' projects. To this end, other such foreseeable projects and activities were considered in the cumulative effects assessment if they were likely to involve or represent one or more of the following:

- a major change in an existing or on-going project or activity;
- a project or activity that occurs immediately adjacent to the BHWP or on the Bruce nuclear site;
- a project or activity that uses services or facilities on the BHWP site;
- a project or activity on the Bruce nuclear site that involves the construction or removal of taxable buildings or structures;
- a project or activity that uses or influences surface water quality in Lake Huron;
- an additional source of dust to the air;
- an additional source of noise;

- an additional source of radioactive and/or non-radioactive chemical emissions to the air, land or water; and
- an additional source of traffic on local roads off the Bruce nuclear site.

Table 9.2 lists each of the projects and activities initially considered in the CEA and provides a summary description and rationale for why each has been initially considered in the cumulative effects assessment. To be consistent with the Practitioner's Guide, these other projects or activities are grouped into two major categories:

- past and existing projects and activities; and
- certain/planned projects and activities.

There were no reasonably foreseeable projects or activities identified, due to the relatively short time frame of the demolition/remediation phase of the decommissioning project, during which any potential effects would occur. No direct effects would occur in the end state since there are no activities associated with that phase.

TABLE 9.2
OTHER PROJECTS AND ACTIVITIES CONSIDERED

Project or Activity	Summary Description	Rationale
Past And Existing Projects And Activities		
Bruce A (Lay-Up State)	The Bruce A station is a four unit nuclear generating station located on the north west portion of the Bruce nuclear site. Bruce A is managed by Bruce Power. These units are currently shut down and in a de-fuelled lay-up state. Stand-by generators at Bruce A are used on an occasional basis.	▪ A project or activity that occurs immediately adjacent to the BHWP or on the Bruce nuclear site; ▪ Additional source of noise.
Bruce B Operations	Bruce B is a four unit nuclear generating station located to the south of the BHWP site. Bruce B is currently operated by Bruce Power. Bruce B is expected to continue normal operations until 2024.	▪ A project or activity that occurs immediately adjacent to the BHWP or on the Bruce nuclear site; ▪ A project or activity that uses or relies on or influences surface water quality in Lake Huron; ▪ Additional source of noise ▪ Additional source of traffic on local roads; ▪ An additional source of radioactive, and/or non-radioactive chemical emissions to the air, land or water.
Douglas Point Nuclear Generation Station (DPNGS)	The DPNGS was put into service in 1968 and was permanently shut down in 1984. The station is located south of the BHWP site and adjacent to the Bruce B station. Atomic Energy of Canada Limited maintains the DPNGS in a 'safe storage' state prior to complete decommissioning. All of its used fuel is stored in concrete containers within the DPNGS property. The decommissioning and disposal of all resultant radioactive materials is planned to be complete in approximately 50 to 100 years.	▪ A project or activity that occurs immediately adjacent to the BHWP or on the Bruce nuclear site; ▪ An additional source of radioactive, and/or non-radioactive chemical emissions to the air, land or water similar to those of the BHWP; ▪ Additional source of traffic on local roads.

TABLE 9.2 (Continued)
OTHER PROJECTS AND ACTIVITIES CONSIDERED

Project or Activity	Summary Description	Rationale
Past And Existing Projects And Activities		
Radioactive Waste Operations Site No. 1 (RWOS 1)	RWOS 1 is located in the south central area of the Bruce nuclear site, south east of BHWP site. RWOS 1 was established to manage the low and intermediate level wastes from the Douglas Point and the Pickering A nuclear generating stations. A program was undertaken in 1997 to remove the waste stored at RWOS 1 and consolidate it with the waste stored at Western Waste Management Facility (WWMF), also operated by OPG on the Bruce nuclear site. Some of the waste from the RWOS 1 trenches has already been transferred to the WWMF. This program is being reviewed and further waste transfer will be conducted as deemed necessary. It is anticipated that the RWOS 1 site will be remediated over the next several years.	▪ A project or activity that occurs immediately adjacent to the BHWP or on the Bruce nuclear site; ▪ An additional source of radioactive, and/or non-radioactive chemical emissions to the air, land or water
Western Waste Management Facility (WWMF)	The WWMF (formerly named RWOS 2) is located in the central portion of the Bruce nuclear site, ESE of the BHWP site. It is owned and operated by OPG. It provides processing and storage facilities for low and intermediate level (i.e., non-fuel) radioactive materials produced at nuclear generating stations across Ontario and other facilities currently operating or previously operated by OPG. A Waste Volume Reduction Building currently exists within the boundaries of the WWMF site. The WWMF is expected to be in service until at least 2015.	▪ A project or activity that occurs immediately adjacent to the BHWP or on the Bruce nuclear site; ▪ An additional source of radioactive, and/or non-radioactive chemical emissions to the air, land or water
Central Maintenance Facility (CMF)	The CMF is a 14,400 m^2 building located in the central portion of the Bruce nuclear site immediately south of the Central Services Road. The CMF is operated by Bruce Power. It comprises maintenance areas and laboratories that handle work involving both radioactive and non-radioactive materials. It is also used for maintaining, inspecting and decontaminating OPG's fleet of Radioactive Material Transportation Packages until spring 2004. The facility also handles instrumentation calibration and repair, laundering of radioactive protective clothing, drum cleaning and waste bag monitoring. It is anticipated that the CMF will operate well into the future to support operating nuclear plants, both on and off the Bruce nuclear site.	▪ A project or activity that occurs immediately adjacent to the BHWP or on the Bruce nuclear site; ▪ An additional source of radioactive, and/or non-radioactive chemical emissions to the air, land or water.

TABLE 9.2 (Continued)
OTHER PROJECTS AND ACTIVITIES CONSIDERED

Project or Activity	Summary Description	Rationale
Past And Existing Projects And Activities		
Buildings, Structures and Services remaining after the BHWP decommissioning	Several buildings, structures and pipe racks will be retained for future use unrelated to the production of heavy water. These include: pump houses, electrical substations, the BHWP intake, various storage buildings and diesel generators. OPG will continue to store virgin heavy water in the Heavy Water Storage Areas of three of the BHWP buildings that will remain.	▪ A project or activity that occurs immediately adjacent to the BHWP or on the Bruce nuclear site; ▪ An additional source of radioactive, and/or non-radioactive chemical emissions to the air, land or water
Ancillary Facility Operations	Ancillary facilities are located largely in the central portion of the Bruce nuclear site along the Central Services Road. They include a number of smaller buildings, some of which are no longer in operation. The major operating facilities include Sewage Processing Plant, the conventional landfill and the fire training facility. Other facilities include: parking lots, helicopter landing pad, the Training Centre and storage facilities. There is expected to be contamination associated with the fire training facility. Additional contamination may be present at oil unloading sites, and associated with underground oil piping systems used to distribute oil to and from the facilities. There are two licensed PCB storage facilities at the Bruce nuclear site. One storage building is located north of Bruce A and is used to store solid PCB waste. Another facility, located west of Bruce B, is used to store the liquid PCB waste.	▪ A project or activity that occurs immediately adjacent to the BHWP or on the Bruce nuclear site; ▪ An additional source of radioactive, and/or non-radioactive chemical emissions to the air, land or water
Bruce Bulk Steam Plant	The Bruce Bulk Steam Plant uses bunker 'C' oil and water drawn from Lake Huron through the existing intake at the BHWP to supply steam to Bruce Power facilities and the Bruce Energy Centre. It is anticipated that the steam plant will continue to operate under an approved C of A for air emissions from the MOE to support continuing operations on the Bruce nuclear site.	▪ A project or activity that occurs immediately adjacent to the BHWP or on the Bruce nuclear site; ▪ An additional source of radioactive, and/or non-radioactive chemical emissions to the air, land or water

TABLE 9.2 (Continued)
OTHER PROJECTS AND ACTIVITIES CONSIDERED

Project or Activity	Summary Description	Rationale
Past And Existing Projects And Activities		
Hydro One Switchyards, Transmission Facilities and Service Centre	Hydro One operates the Bruce A and Bruce B switchyards located immediately adjacent to the generation station buildings. These switchyards are used to transfer electricity generated at the stations to Hydro One transformer stations in Owen Sound, London, and Hanover, and further to transmission facilities which comprise the Ontario-wide electricity grid. Hydro One also operates a service centre adjacent to the Bruce A switchyard.	▪ A project or activity that occurs immediately adjacent to the BHWP or on the Bruce nuclear site; ▪ An additional source of noise.
Other CNSC Licensed Facilities	Several CNSC licensed facilities are located outside of the Bruce nuclear site. Within 5 km of the Bruce nuclear site, a total of 3 licensed facilities were identified, and all use sealed radioisotopes only. These facilities are expected to continue operations into the future.	▪ An additional source of radioactive, and/or non-radioactive chemical emissions to the air, land or water
Existing Water Supply Plants (WSPs)	The communities of Kincardine, Port Elgin and Southhampton are supplied by three WSPs which obtain their water from Lake Huron. The Kincardine WSP is located 17.5 km SSW of the BHWP site. The Port Elgin WSP is located 17.5 km NE of the BHWP site. The Southhampton WSP is located 22.5 km NE of the BHWP site. An additional surface water intake is located 14 km NE of the BHWP site and provides water to MacGregor Point Provincial Park.	▪ A project or activity that uses or relies on or influences surface water quality in Lake Huron.
Existing Water Pollution Control Plants (WPCP)	The Municipality of Kincardine operates one water pollution control plant, located 17.5 km SSW of the BHWP site. The Port Elgin WPCP is located 17.5 km NE of the BHWP site and the Southhampton WPCP, located 22.5 km NE of the BHWP site also serve areas outside of the Regional Study Area. The Bruce Energy Centre, located 4.5 km W of the BHWP site, has its own facility. This plant discharges its treated effluent through Douglas Point.	▪ A project or activity that uses or influences surface water quality in Lake Huron.

TABLE 9.2 (Continued)
OTHER PROJECTS AND ACTIVITIES CONSIDERED

Project or Activity	Summary Description	Rationale
Certain/Planned Projects And Activities		
Recreation and Commercial Fishing	Recreational fishing occurs along the shoreline of Lake Ontario and near the Bruce nuclear site. The most popular fish species caught by recreational anglers on Lake Huron are smelt, perch and smallmouth bass and pike. The Ontario Ministry of Natural Resources indicates that there is only one non-Aboriginal commercial fishing license issued within the vicinity of the BHWP site. This license extends from approximately 18.5 km north of Point Clarke south to Point Edward. This area does not reach the Bruce nuclear site.	▪ A project or activity that uses or influences surface water quality in Lake Huron.
Bruce Energy Center	The Bruce Energy Centre is a 324 ha serviced industrial park located immediately southeast of the Bruce nuclear site. It was established in 1986 with the intent to develop an industrial ecopark where waste and by-products of one industry could become the feedstock for a neighbouring industry.	▪ A project or activity that uses services or facilities on the BHWP site.
Bruce A Units 3 and 4 Restart	Bruce Power Limited (Bruce Power) has proposed to restart Bruce A Units 3 and 4. An EA process is currently in progress. These units are planned for restart in 2003 and would both be shut down by year end 2015.	▪ A major change in an existing or on-going project or activity; ▪ A project or activity that uses or influences surface water quality in Lake Huron; ▪ An additional source of radioactivity, and/or non-radioactive chemical emissions to the air, land or water
WWMF Upgrades	OPG has proposed several expansions and upgrades to the WWMF. The proposed storage structure upgrades include an additional low-level waste storage building and in-ground storage structures expected to be completed in 2003. Incremental expansions for Intermediate Level Waste (ILW) storage facilities are expected to occur in 2005, 2008, 2011, 2016 and 2022. Other upgrades and improvements are likely to be completed before the decommissioning project commences.	▪ A major change in an existing or on-going project or activity; ▪ An additional source of radioactivity, and/or non-radioactive chemical emissions to the air, land or water.

TABLE 9.2 (Continued)
OTHER PROJECTS AND ACTIVITIES CONSIDERED

Project or Activity	Summary Description	Rationale
Certain/Planned Projects And Activities		
Western Used Fuel Dry Storage Facility (WUFDSF)	OPG is in the process of commissioning a dry storage facility for used nuclear fuel currently stored in water-filled bays at the Bruce A and B. The proposed facility is located within the eastern area of the WWMF site.	▪ A major change in an existing or on-going project or activity; ▪ An additional source of radioactivity, and/or non-radioactive chemical emissions to the air, land or water.
Operational Changes at Inverhuron Provincial Park	Inverhuron Provincial Park is located approximately 1.5 km south of the BHWP site. It is operated by Ontario Parks and has been in operation since 1959. Due to the construction of the BHWP and the previous H_2S emissions during operations, the park operated as a day use facility only. In 1998, the park's management plan was amended to allow expanded public access, extended hours of operation and four season operation, and the reintroduction of overnight camping. Ontario Parks has proposed that Inverhuron Provincial Park be converted from a day-use only park to a facility based campground that will likely result in an increased visitation.	▪ A major change in an existing or ongoing project or activity.
Extension of Water and Sewer Service to Inverhuron Provincial Park	The Municipality of Kincardine has planned to extend water and sewage service to Inverhuron Provincial Park via a connection to the Kincardine WSP and the construction of approximately 14.5 km of watermain to reach the park entrance along County Road 23, County Road 15 and Albert Street to the park. The EA of the project is expected to commence in 2002, with construction to follow after approval.	▪ A major change in an existing or ongoing project or activity.

TABLE 9.2 (Continued)
OTHER PROJECTS AND ACTIVITIES CONSIDERED

Project or Activity	Summary Description	Rationale
Certain/Planned Projects And Activities		
Huron Wind Farm	Huron Wind is a partnership between British Energy (Canada) and OPG Evergreen Energy. Huron Wind is proposing to build a wind farm (a group of wind turbines) consisting of four to eleven turbines on a 40 ha lot beside the existing wind turbine unit adjacent to the Bruce Power Visitors' Centre. The wind turbines will operate 24 hours per day, 7 days per week. Construction would begin upon approval of the environmental screening report submitted in August 2001. Electrical generation is scheduled to begin in 2002.	▪ An additional source of dust to the air; ▪ An additional source of noise.
Municipal/County Road Upgrades	The Municipality of Kincardine has developed a roads management plan and has identified several road sections and bridges in the vicinity of the Bruce nuclear site that will require engineering works and upgrades.	▪ A major change in an existing or on-going project or activity; ▪ An additional source of dust to the air; ▪ An additional source of noise.

9.4 Likely Interactions of Effects of the BHWP Decommissioning Project and Other Projects and Activities

For CEA purposes it is necessary to determine if the other projects and activities identified in Table 9.2 have the potential to act cumulatively with the effects of the BHWP Decommissioning Project. Accordingly, a determination was made regarding whether or not the effects identified in Table 9.1 were similar to those likely to result from the other projects and activities identified in Table 9.2 and whether or not they are expected to occur during the same time and in the same geographic area (i.e. space) as the effects of the other projects and activities. In terms of the spatial overlap, the effects of the project and the effects of other projects and activities must occur at the location of a VEC or VSC. For example, in terms of noise, campers (i.e. a VEC) at Inverhuron Provincial Park would need to hear the noise from the BHWP decommissioning activities as well as from Bruce B operations. Where there is a likely overlap in effect (●), time (✓) and space (■), there is a potential for a cumulative effect. Therefore, further assessment of these likely cumulative effects is warranted as identified in Table 9.3.

TABLE 9.3
LIKELY INTERACTION OF EFFECTS

Projects and Activities	Atmospheric Environment	
	Air Quality	Noise
Proposed Project		
BHWP Decommissioning Project	● ✓ ■	● ✓ ■
Bruce A Units 1 and 2 (in Lay up State)		● ✓
Bruce B Operations		● ✓ ■
Douglas Point Nuclear Generating Station (DPNGS)		
Radioactive Waste Operations Site No. 1 (RWOS 1)	● ✓ ■	● ✓
Western Waste Management Facility (WWMF)		● ✓
Central Maintenance Facility (CMF)		● ✓
Buildings, Structures and Services Remaining on the BHWP site		● ✓
Ancillary Facility Operations		● ✓
Bruce Bulk Steam Plant		● ✓
Hydro One Switchyards and Transmission Facilities		● ✓
Other CNSC Licensed Facilities		● ✓
Existing Water Supply Plants (WSPs)		● ✓
Existing Water Pollution Control Plants (WPCP)		● ✓
Recreation and Commercial Fishing		✓
Bruce Energy Centre		● ✓
Certain / Planned Physical Works and Activities		
Bruce A Units 3 and 4 Restart		● ✓ ■
WWMF Upgrades	● ✓ ■	● ✓
Western Used Fuel Dry Storage Facility (WUFDSF)	● ■	● ✓
Conversion of Inverhuron Provincial Park	● ✓	● ✓
Extension of Water and Sewer Service to Inverhuron Provincial Park	● ✓	● ✓ ■
Huron Wind Farm		● ✓ ■
Municipal/County Road Upgrades	● ✓	● ✓

Notes:
● = Effects are similar to those of the BHWP Decommissioning Project or may combine to result in an adverse effect on a VEC or VSC.
✓ = Likely temporal overlap with the BHWP Decommissioning Project.
■ = Likely spatial overlap with the BHWP Decommissioning Project.

9.5 Cumulative Environmental Effects

The following sections describe those likely effects (i.e. cumulative effects) that overlap in time and space with the effects of the BHWP Decommissioning Project included in this CEA (i.e. the effects identified on Table 9.1). The information regarding the effects of other projects and activities is more conceptual and less detailed because those projects are more remote in distance and time than the effects of the BHWP project, and in some cases the information is not available. Therefore, the consideration of cumulative environmental effects has been conducted at a more general level of detail than that considered in the previous sections of this EA Study Report. This is consistent with normal EA practice.

9.5.1 Cumulative Effects on Air Quality

9.5.1.1 Project-Environment Interactions

This section describes the expected cumulative air quality effects that are attributable to the BHWP Decommissioning Project in combination (overlapping in time and space) with releases from other identified projects. As indicated in Table 9.3, the other projects and activities that may contribute to cumulative effects on air quality are:

- Radioactive Waste Operations Site No. 1 (RWOS 1)
- WWMF Upgrades

9.5.1.2 Likely Environmental Effects

The assessment of the air quality effects of the BHWP Decommissioning Project indicated that the increase in dust levels during the demolition phase at receptor locations in Baie du Doré, Inverhuron and at the fenceline of Inverhuron Provincial Park will be within natural background variability and would therefore not be distinguishable from existing levels. The maximum incremental concentrations of TSP and PM_{10} at these locations are predicted to be well below their respective regulatory criteria.

Considered individually, the remediation activities at RWOS 1 and the construction of additional storage facilities at the WWMF are not anticipated to generate more dust emissions than those of the BHWP Decommissioning Project. This is because they do not involve major earthworks over a large site area. However, even if it is assumed that each of these projects would generate the same amount of dust as the BHWP Decommissioning Project and occur at the same time, the regulatory criteria for TSP and PM_{10} at the VEC would still not be exceeded.

9.5.1.3 Identified Mitigation Measures

Because no adverse cumulative effects on air quality are anticipated as a result of the decommissioning project, no mitigation measures are identified or warranted.

9.5.1.4 Residual Effects

No residual cumulative effect of the decommissioning project on Air Quality has been identified.

9.5.2 Cumulative Effects on Noise

9.5.2.1 Project-Environment Interactions

This section describes the expected cumulative noise effects that are attributable to the BHWP Decommissioning Project in combination (overlapping in time and space) with releases from other identified projects. As indicated in Table 9.3, the projects and activities that may contribute to cumulative effects on noise are:

- Bruce B Operations;
- Bruce A Units 3 and 4 Restart;
- Extension of Water and Sewer Service to Inverhuron Provincial Park; and
- Huron Wind Farm.

9.5.2.2 Likely Environmental Effects

The assessment of the noise effects of the BHWP Decommissioning Project indicated that the increase in noise levels at receptor locations in Baie du Doré, Inverhuron and at the fenceline of Inverhuron Provincial Park will be below ambient levels and not likely noticeable over ambient noise levels which are dominated by the operations at the Bruce B station and natural noises such as waves on the shore of Lake Huron. It is not anticipated that the cumulative noise effect will be noticeable at any receptor location as these noises will likely be well below ambient levels. This conclusion is supported by the following:

- The Environmental Assessment for the Restart of the Bruce A Units 3 and 4 (Bruce Power, 2002) concluded that the restart would not result in an increase in the overall sound levels.
- The Environmental Assessment for the Huron Wind project concluded that construction of the wind farm will result in noise levels approaching ambient conditions within 500 m and that operation of the wind farm will result in noise levels approximately 40 – 45 dbA, similar to the lowest ambient levels at the BHWP as recorded in 1996.
- The construction of services to the Inverhuron Provincial Park are not expected to generate noise levels above ambient conditions.

9.5.2.3 Identified Mitigation Measures

Because no adverse cumulative effects on noise are anticipated as a result of the decommissioning project, no mitigation measures are identified or warranted.

9.5.2.4 Residual Effects

No residual cumulative effect of the decommissioning project on noise has been identified.

9.6 Summary of Cumulative Effects

Table 9.4 summarizes likely adverse cumulative effects of the BHWP Decommissioning Project in combination with other past, existing or reasonably foreseeable future projects and activities considered in this EA Study Report.

TABLE 9.4
SUMMARY OF LIKELY ADVERSE CUMULATIVE EFFECTS

Environmental Component	Effects Considered in the CEA	Summary of Cumulative Effects on VECs or VSCs
Atmospheric Environment	▪ Air Quality	▪ No cumulative effect
	▪ Noise	▪ No cumulative effect

10.0 MONITORING AND FOLLOW-UP PROGRAM

10.1 Overview of Monitoring and Follow-up Program

The *Act* defines "follow-up" as a program for:

- verifying the accuracy of the EA of a project; and
- determining the effectiveness of any measures taken to mitigate the adverse environmental effects of the project.

The CNSC has the overall responsibility for ensuring that appropriate mitigation measures are implemented and that an EA follow-up program is designed and carried out where required. OPG is responsible for implementing the mitigation measures and for carrying out the follow-up program as directed by the CNSC.

In general, an EA monitoring and follow-up program is considered an integral part of the EA and project implementation processes. The preliminary plan for the BHWP Decommissioning Project has been designed to provide information about the current status of the project within its environmental setting. It will be used as a mechanism for information feedback to OPG, the CNSC and the MOE to ensure that environmental impact predictions contained in the EA Study Report are accurate, that the mitigation measures implemented are effective; and that OPG's performance and end-state objectives have been achieved. The primary activities to be conducted are Environmental Effects Monitoring (EEM), final contamination and radiological surveys and associated analyses, evaluations, inspections and reporting.

The proposed monitoring and follow-up plan would be conducted in three phases: (1) Pre-Demolition Phase, (2) Demolition/Remediation Phase, and (3) End State Phase. Firstly, the activities to be conducted during the Pre-Demolition Phase will be intended to supplement certain baseline data (e.g. dust, noise, groundwater quality) used to conduct the EA where some uncertainty remains about the levels in relation to regulatory criteria or background. Secondly, the activities to be conducted during the Demolition/Remediation Phase will ensure that predictions contained in the EA Study Report regarding no significant adverse environmental effects are and remain valid. Also, post-demolition monitoring will be conducted to provide data to determine the extent of soil contamination and therefore the extent of remediation required. Thirdly, the activities to be conducted during the End State Phase will verify the end-state condition of the BHWP site by comparing actual conditions to those end-state conditions predicted in the EA Study Report and to relevant regulatory requirements.

This plan for monitoring and follow-up will be further developed during the CNSC licensing assessment of the DDP submitted in support of OPG's licensing application pursuant to the NSCA. Establishment of the final follow-up program will include full consideration of the comments and recommendations provided by the expert Federal Authorities. Monitoring and follow-up program activities will be integrated into the CNSC licensing and compliance program for the decommissioning project, and will be referenced in the decommissioning licence, should the project be approved.

10.2 Preliminary Scope of Monitoring and Follow-up Program

The preliminary scope of the three-phase monitoring and follow-up program is provided in Table 10.1 to Table 10.3. Each table summarizes the nature of the program, locations for monitoring and the duration and/or frequency of monitoring activities.

In addition to measures identified in Tables 10.1 to 10.3, OPG will monitor and/or audit the decommissioning contractors on an on-going basis with respect to adherence to relevant compliance programs outlined in Section 3.4, and monitor, investigate and record any deviations from these compliance programs in a Station Condition Record.

10.3 Reporting of Monitoring and Follow-up Program Results

Subject to CNSC licensing approval of the project, the results of the monitoring and follow-up program will be reported at regular intervals, submitted to the CNSC and made available by OPG and the CNSC to the public for review and comment. The frequency and method of reporting will be determined as part of the licensing process.

At a minimum, OPG envisages that regular updates would be presented to the CNSC on the progress and results of the monitoring and follow-up program and that the CNSC would post information on a public registry. In addition:

- periodic updates would be provided to the Municipality of Kincardine;
- periodic updates would be provided to the local Medical Officer of Health;
- results would be provided to other stakeholders as their interests and needs are identified; and
- a Final Decommissioning Report will be provided to the CNSC upon completion of the decommissioning project.

TABLE 10.1
PRE-DEMOLITION PHASE MONITORING

Environmental Component	Effect	Nature of Monitoring Program	Locations for Monitoring	Duration and/or Frequency of Monitoring
Atmospheric Environment	Air Quality	Dust (i.e. TSP and dustfall) levels will be monitored to ensure that regulatory limits and guidelines are not exceeded. The measured TSP and dustfall levels will be used as background for comparison during the demolition phase.	**Local Study Area** ▪ on BHWP site; ▪ Bruce nuclear site fence line; the Bruce Power Visitors' Centre; the Inverhuron Park area. Additional monitoring stations may be located at other sites off the Bruce nuclear site (if required).	TSP samples will be run for a 24-hour sample every 6th day. Dustfall jars will be operated for at least one full month prior to the demolition of any major building, tower or tall structure.
Atmospheric Environment	Noise	Noise levels will be monitored to ensure that regulatory noise limits are not exceeded. The measured noise levels will be used as background for comparison during the demolition/remediation phase.	**Local Study Area** ▪ on BHWP site; ▪ Bruce nuclear site fence line; the Bruce Power Visitors' Centre; the Inverhuron Park area. Additional monitoring stations may be located at other sites off the Bruce nuclear site (if required).	Noise monitors will be operated for at least one full month prior to the demolition of any major building, tower or tall structure.
Geology and Hydrogeology	Ground water Quality	Groundwater samples will be collected from the monitoring wells that were established during the Phase 2 Environmental Site Assessment. The groundwater samples will be analyzed for arsenic, antimony, and selenium. Analysis of radionuclides will also be included. The analysis will be performed according to the methods prescribed by the MOE (1996). Monitoring results will be compared to MOE standards. The monitoring results will be used to identify potential sources, if any, of arsenic, antimony and selenium. If a source of these metals is determined to be within BHWP site, appropriate mitigation measures will be taken to ensure that levels will not increase as a result of demolition/remediation work.	**Local Study Area and Site Study Area** At the monitoring wells located along groundwater flow direction both upgradient and downgradient of BHWP site: ▪ 7 upstream monitoring wells east of Enriching Units and associated concrete pads; ▪ 16 downstream monitoring wells at western side of the BHWP along Lake Huron shoreline; ▪ 8 monitoring wells within central portion of the BHWP site.	A groundwater monitoring program is underway at the BHWP site. Samples have been taken and results will be available for submission to the CNSC by December 2002.

TABLE 10.1 (Continued)
PRE-DEMOLITION PHASE MONITORING

Environmental Component	Effect	Nature of Monitoring Program	Locations for Monitoring	Duration and/or Frequency of Monitoring
Hydrology	Surface Water Quality	Surface water run-off will be monitored to ensure that the BHWP site will not adversely affect the water quality in Lake Huron.	**Site Study Area** ▪ at the SWTF. ▪ at groundwater monitoring wells west of E1 and E2 on flood plain.	Surface water will be sampled at the SWTF before being released to the lake. Surface water from areas west of E1 and E2 generally drain to the flood plain; monitoring wells are located such that water absorbed into flood plain is sampled as groundwater.

TABLE 10.2
DEMOLITION/REMEDIATION PHASE MONITORING

Environmental Component	Effect	Nature of Monitoring Program	Locations for Monitoring	Duration and/or Frequency of Monitoring
Atmospheric Environment	Air Quality	Dust (i.e. TSP and dustfall) levels will be monitored to ensure that regulatory limits and guidelines are not exceeded and to verify predictions and the effectiveness of mitigation. The measured TSP and dustfall levels will be compared to levels predicted in the EA Study Report and MOE standards.	**Local Study Area** ▪ on BHWP site; ▪ Bruce nuclear site fence line; near the Bruce Power Visitors' Centre; in the Inverhuron Park area. Additional monitoring stations may be located at other sites off the Bruce nuclear site (if required).	TSP samples will be run for a 24-hour sample every 6th day. Dustfall jars will be operated during the demolition of the major buildings, towers and tall structures and the remediation of the site.
Atmospheric Environment	Noise	Noise levels will be monitored to ensure that regulatory noise limits are not exceeded and to verify predictions and the effectiveness of mitigation. The measured noise levels will be compared to levels predicted in the EA Study Report and MOE standards.	**Local Study Area** ▪ on BHWP site; ▪ Bruce nuclear site fence line; near the Bruce Power Visitors' Centre; in the Inverhuron Park area. Additional monitoring stations may be located at other sites off the Bruce nuclear site (if required).	Noise monitors will be operated during the demolition of the major buildings, towers and tall structures and the remediation of the site.
Hydrology	Surface Water Quality	Surface water run-off will be monitored to ensure that the BHWP site will not adversely affect the water quality in Lake Huron.	**Site Study Area** ▪ at the SWTF. ▪ at groundwater monitoring wells west of E1 and E2 on flood plain.	Surface water will be sampled at the SWTF before being released to the lake. Surface water from areas west of E1 and E2 generally drain to the flood plain; monitoring wells are located such that water absorbed into flood plain is sampled as groundwater.

TABLE 10.2 (Continued)
DEMOLITION/REMEDIATION PHASE MONITORING

Environmental Component	Effect	Nature of Monitoring Program	Locations for Monitoring	Duration and/or Frequency of Monitoring
Soils, Geology and Hydrogeology	Soil Quality	Soil sampling will be conducted to determine extent of soil contamination and therefore extent of remediation required. Sample collection and analysis procedures will be based on MOE guidelines (1996). Soil Quality guidelines will include the *Canada-wide Standards for Petroleum Hydrocarbons in Soil* and the *Canadian Environmental Quality Guidelines* issued by CCME (1999).	**Site Study Area** ▪ Survey grids on known or suspected areas of contamination.	Soil sampling will occur for up to three years following demolition activities and prior to soil remediation activities.
Soils, Geology and Hydrogeology	Ground water Quality	Groundwater samples will be collected from the monitoring wells that were established during the Phase 2 Environmental Site Assessment. The groundwater samples will be analyzed for: ▪ Total Petroleum Hydrocarbons (gas/diesel and heavy oils); ▪ Metals (selenium, arsenic, antimony, copper, nickel, zinc, cadmium, boron, molybdenum and chromium); ▪ PCBs; ▪ pH; and ▪ radionuclides (tritium and cesium-137). Except for the radionuclides, the analysis will be performed according to the methods prescribed by the MOE (1996). Monitoring results will be compared to MOE standards.	**Local Study Area and Site Study Area** At the monitoring wells located along groundwater flow direction both upstream and downstream of BHWP site: ▪ 7 upstream monitoring wells east of Enriching Units and associated concrete pads; ▪ 16 downstream monitoring wells at western side of the BHWP along Lake Huron shoreline; ▪ 8 monitoring wells within central portion of the BHWP site.	Groundwater samples will be collected quarterly throughout the demolition phase. If groundwater quality shows signs of deterioration, a comprehensive monitoring study will be initiated.

TABLE 10.3
END STATE FOLLOW-UP

Environmental Component	Effect	Nature of Monitoring Program	Suggested Locations for Monitoring	Suggested Duration and Frequency of Monitoring
Atmospheric Environment	Air Quality	Dust (i.e. TSP and dustfall) levels will be monitored to ensure that regulatory limits and guidelines are not exceeded and to verify predictions and the effectiveness of mitigation. The measured TSP and dustfall levels will be compared to levels predicted in the EA Study Report and MOE standards.	**Local Study Area** ▪ on BHWP site; ▪ Bruce nuclear site fence line; near the Bruce Power Visitors' Centre; in the Inverhuron Park area. Additional monitoring stations may be located at other sites off the Bruce nuclear site (if required).	Dustfall jars will be operated for one full month after the completion of the site remediation.
Atmospheric Environment	Noise	Noise levels will be monitored to ensure that regulatory noise limits are not exceeded and to verify predictions and the effectiveness of mitigation. The measured noise levels will be compared to levels predicted in the EA Study Report and MOE standards.	**Local Study Area** ▪ on BHWP site; ▪ Bruce nuclear site fence line; near the Bruce Power Visitors' Centre; in the Inverhuron Park area. Additional monitoring stations may be located at other sites off the Bruce nuclear site (if required).	Noise monitors will be operated for one full month after the completion of the site remediation.

TABLE 10.3 (Continued)
END STATE FOLLOW-UP

Environmental Component	Effect	Nature of Monitoring Program	Suggested Locations for Monitoring	Suggested Duration and Frequency of Monitoring
Radiation and Radioactivity	Radio-logical Contamination	A Radiological Survey will be conducted to verify the assumption that the BHWP site is a Class 3 area under the classification scheme described in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) and that the site does not contain any residual radioactivity in accordance with criteria described in the MARSSIM Manual. The survey will be conducted according to the methods set out in the MARSSIM manual.	**Site Study Area** ▪ The BHWP site will be treated as a single survey unit, and scanned using gamma radiation survey instruments. Between 5% and 10% of the total area of the survey unit will be scanned. ▪ Where contamination is found and removed, 100% of that area (within a 10-meter by 10-meter square centered on the site of the contamination) will be re-surveyed. **Local Study Area** ▪ Ambient radiation levels in areas near the BHWP site that are reasonably believed to be free of radioactive contamination will be measured and taken as representative of the natural background radiation levels on the BHWP site.	▪ The radiological survey will be conducted upon completion of the decommissioning project.
Geology and Hydrogeology	Soil Quality	Soil sampling will be conducted to ensure that OPG's performance targets, end-state objectives and the requirements of the Ontario MOE Guidelines for Use at Contaminated Sites in Ontario (MOE 1997) are achieved. Sample collection and analysis procedures will be based on the recommendations set out by the MOE (1996). The samples will be analyzed for metals or petroleum hydrocarbons (as appropriate) using the methods prescribed by the MOE.	**Site Study Area** ▪ A survey grid (initially 3 meters by 3 meters) will encompass the entire suspect area and samples will be collected at the grid points. ▪ Where appropriate, the size of the grid will be reduced to more accurately determine the extent of the contamination.	Soil sampling will be conducted: ▪ Upon completion of the decommissioning project; and ▪ Until sampling results show that contaminants of concern have been reduced to below the levels specified in Table B (industrial land use, non-potable groundwater condition) in the MOE Guidelines for Use at Contaminated Sites in Ontario (MOE, 1997).

TABLE 10.3 (Continued)
END STATE FOLLOW-UP

Environmental Component	Effect	Nature of Monitoring Program	Suggested Locations for Monitoring	Suggested Duration and Frequency of Monitoring
Geology and Hydrogeology	Ground water Quality	Groundwater monitoring will be conducted to ensure that there is no environmental impact, to verify that performance targets and end-state objectives have been achieved and that mitigation has been effective. Groundwater samples will be collected from the monitoring wells that were established during the Phase 2 Environmental Site Assessment. The groundwater samples will be analyzed for: ▪ Total Petroleum Hydrocarbons (gas/diesel and heavy oils); ▪ Metals (selenium, arsenic, antimony, copper, nickel, zinc, cadmium, boron, molybdenum and chromium); ▪ PCBs; ▪ pH; and ▪ radionuclides (tritium and cesium-137). Except for the radionuclides, the analysis will be performed according to the methods prescribed by the MOE (1996) Monitoring results will be compared to MOE standards.	**Local Study Area and Site Study Area:** At the monitoring wells located along groundwater flow direction both upstream and downstream of BHWP site: ▪ 7 upstream monitoring wells east of Enriching Units and associated concrete pads; ▪ 16 downstream monitoring wells at western side of the BHWP along Lake Huron shoreline; ▪ 8 monitoring wells within central portion of the BHWP site.	Groundwater samples will be collected and analyzed: ▪ quarterly for one year after completion of demolition work; ▪ annually for years two and three after completion of demolition work.

11.0 SIGNIFICANCE OF RESIDUAL ADVERSE EFFECTS

The *Act* requires an assessment of the significance of residual effects. Only those residual effects which are considered to be adverse and likely to occur have been advanced for an assessment of significance. Those effects determined through the assessment to be positive are not considered further. No residual adverse effects were identified in the analysis. Thus, it has been determined that the BHWP Decommissioning Project will not result in significant adverse environmental effects.

12.0 CONCLUSIONS OF THE ASSESSMENT

The conclusion of this assessment is that, by following the extensive procedures outlined in the Detailed Decommissioning Plan and implementing the mitigation measures proposed in this report, the decommissioning of the BHWP will have no significant adverse environmental effects on the environment.

Furthermore, it is concluded that the project end state will represent an improvement to the biophysical and human environment: the removal of the towers will improve views of the area; soil remediation will eliminate the potential for surface water contamination; and land will become available for other industrial uses. These conclusions are based on an assessment which has been conducted in accordance with the *Act* and the requirements for Comprehensive Studies, including review of project purpose, evaluation of alternative means of carrying out the project, and assessment of the following major factors:

- cumulative effects;
- the effects of possible accidents and malfunctions;
- the effects of the environment on the project;
- the effects of the project on the capacity of renewable resources; and
- effects on human heath.

In addition, a follow-up and monitoring plan has been provided which should help ensure that the conclusions of the assessment remain valid and that the mitigation measures are effective or adjusted if required.

Accordingly, OPG recommends that the CNSC accept these conclusions as a basis for the preparation of its Comprehensive Study Report under the Canadian Environmental Assessment Act.

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14.0 ABBREVIATIONS AND ACRONYMS

AAQC	ambient air quality criterion
AECB	Atomic Energy Control Board
ANSI	Area of Natural and Scientific Interest
As	arsenic
BCDC	Bruce Community Development Corporation
BEC	Bruce Energy Centre
BHWP	Bruce Heavy Water Plant
BMTS	
Bq/L	becquerels per litre
Bruce A	Bruce A Nuclear Generating Station
Bruce B	Bruce B Nuclear Generating Station
BTEX	benzene, toluene, ethylbenzene, xylene
C of A	Certificate of Approval
C-14	carbon 14
Ca^{2+}	calcium
$CaCO_3$	calcite
$CaMg(CO_3)_2$	dolomite
CANDU	Canada Deuterium Uranium
CAO	Chief Administrative Officer
CEA	cumulative effects assessment
Cl^-	chloride
cm	centimetre
CMF	Central Maintenance Facility
CNSC	Canadian Nuclear Safety Commission
Co	carbon monoxide
Co-60	cobalt 60
Cs-137	cesium 137
Cs^{2+}	cesium
CSP	concrete sewer pipe
CSR	Comprehensive Study Report

dBA	A-weighted decibel
DDP	Detailed Decommissioning Plan
DEA/MDEA	diethanolamine/methyldiethanolamine
DPNGS	Douglas Point Nuclear Generation Station
E1, E2 etc.	Enriching Unit No. 1, Enriching Unit No. 2, etc.
EA	Environmental Assessment
EEM	Environmental Effects Monitoring
EH&S	Environment, Health and Safety
EP	Environmental Protection
EPA	Environmental Protection Act
EPH	extractable petroleum hydrocarbons
F1, F2, etc.	Finishing Unit No. 1, Finishing Unit No. 2, etc.
FIR	Financial Information Return
GDC	General Decommissioning Contractor
hr	hour
H_2S	hydrogen sulphide
ha	hectares
HCO_3^-	bicarbonate
HID	high intensity discharge
HVAC	Heating, Ventilation and Air Conditioning
HX	Heat Exchanger
IAC	Impact Advisory Committee
IDRA	Inverhuron District Ratepayers Association
IEDC	Integrated Energy Development Corporation
ILW	Intermediate Level Waste
K^+	potassium
kBq	kilobequerel
kg	kilogram
km	kilometre
L	litre

L_{eq}	A-weighted level of a steady sound having the same total energy in a one-hour period as the observed fluctuality sound
LLD	lower limit of detection
m	metre
M	magnitude (with reference to earthquakes)
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
meq	milliequivalent
Mg	megagrams (tonnes)
µg	microgram
µm	micron
µS	micro siemens (conductivity)
mg	milligram
Mg^{2+}	magnesium
MISA	Municipal Industrial Strategy for Abatement
MNR	Ontario Ministry of Natural Resources
MOE	Ontario Ministry of the Environment
MOH	Medical Officer of Health
MP	Member of Parliament
MPAC	Municipal Property Assessment Corporation
MPP	Member of Provincial Parliament
Na^+	sodium
nCi	nano-curie
NO_x	nitrogen oxides
NSCA	Nuclear Safety and Control Act
NWMD	Nuclear Waste Management Division
O. Reg. 347	Ontario Regulation 347
OHN	Ontario Hydro Nuclear
OPG	Ontario Power Generation Inc.
OPP	Ontario Provincial Police
OS	Open Space
PCB	polychlorinated biphenyl

pCi	pico curie
PM_{10}	particulate matter < 10 microns in diameter
$PM_{2.5}$	particulate matter < 2.5 microns in diameter
PPH	purgeable petroleum hydrocarbons
ppm	parts per million
PWQO	Provincial Water Quality Objectives
RA	Responsible Authority
RWOS 1	Radioactive Waste Operations Site No. 1
s	second
Sb	antimony
Se	selenium
SO_2	sulphur dioxide
SO_4^{2-}	sulphate
SPM	suspended particulate matter
Sr^{2+}	strontium
STP	steam transformer plant
SWTF	Surface Water Treatment Facility
TDF	total dustfall
TLV	Threshold Limit Value
TPH	total petroleum hydrocarbons
TSP	total suspended particulate
U.S. EPA	U.S. Environmental Protection Agency
UFDSF	Used Fuel Dry Storage Facility
VEC	Valued Ecosystem Component
VOCs	volatile organic compounds
VSC	Valued Social Component
WPCP	water pollution control plant
WSP	water supply plant
WUFDSF	Western Used Fuel Dry Storage Facility
WWMF	Western Waste Management Facility

APPENDIX A

AIR QUALITY

TABLE A.1
TOTAL DUSTFALL MEASUREMENTS: 1996

Sampling Site Description	Sampling Period 1996	Dissolved Solids (g/m^2/30 day)	Total Solids (g/m^2/30 day)
Bruce Information Centre Site	June 21 to July 6	No sample	No sample
"	July 6 to July 19	0.18	0.33
"	June 21 to July 19	0.36	0.77
"	June 21 to July 19	0.24	0.58
Ontario Hydro Used Fuel Dry Storage Facility Site	June 21 to July 6	0.06	0.09
"	July 6 to July 19	0.33	0.61
"	June 21 to July 19	0.08	0.11
"	June 21 to July 19	0.15	0.22
Ontario Hydro Inverhuron Park H_2S Monitoring Site	June 21 to July 6	0.04	0.10
"	July 6 to July 19	0.33	0.61
"	June 21 to July 19	0.12	0.28
"	June 21 to July 19	0.11	0.29
Ontario Hydro Baie du Doré H_2S Monitoring Site	June 21 to July 6	0.06	0.13
"	July 6 to July 19	0.24	0.33
"	June 21 to July 19	0.18	0.33
"	June 21 to July 19	0.16	0.30

Ontario Criteria: 7.0 g/m^2/30 days (30 days).
4.6 g/m^2/30 days (annual arithmetic mean).

TABLE A.2
TOTAL SUSPENDED PARTICULATE (TSP) (μg/m^3): 1996

Sampling Date	Ontario Hydro Proposed Used Fuel Dry Storage Facility Site (μg/m^3)	Ontario Hydro Baie du Doré H_2S Monitoring Site (μg/m^3)	Ontario Hydro Inverhuron Park H_2S Monitoring Site (μg/m^3)
21 June 1996	12.4	16.1	15.7
22 June 1996	16.9	14.0	27.4
23 June 1996	-	8.1	14.7
24 June 1996	-	12.3	-
25 June 1996	-	8.0	12.5
26 June 1996	-	12.6	18.2
27 June 1996	33.9	29.5	24.5
28 June 1996	38.5	1.8	46.8
29 June 1996	11.8	35.7	60.4
30 June 1996	16.5	29.0	3.6
1 July 1996	16.1	15.4	15.6
2 July 1996	7.2	-	9.6
3 July 1996	6.0	6.9	12.6
4 July 1996	-	6.0	-
5 July 1996	19.7	-	-
6 July 1996	15.3	21.4	3.7
7 July 1996	16.9	23.2	22.9
8 July 1996	8.0	8.0	7.7
9 July 1996	6.0	6.0	2.8
10 July 1996	7.7	8.1	39.3
11 July 1996	12.2	12.0	11.7
12 July 1996	27.6	22.9	32.0
13 July 1996	29.5	52.0	47.9
14 July 1996	21.4	24.2	26.0
15 July 1996	8.5	12.8	9.9
16 July 1996	19.9	18.8	21.3
17 July 1996	17.9	17.0	16.4
18 July 1996	28.1	22.1	19.0
Arithmetic Mean	17.3 ± 9.1	17.1 ± 11.0	20.9 ± 14.7
Geometric Mean	15.1	13.9	16.1

Ontario Criteria: 120 μg/m^3 (24 hour) and 60 μg/m^3 (annual geometric mean).

TABLE A.3
DUST EMISSION FACTOR EQUATIONS (AP-42)

	TSP	PM_{15}	PM_{10}	$PM_{2.5}$
Excavation Area				
Material Drop (kg/Mg)	$\frac{0.74(0.0016)(U/2.2)^{1.3}}{(M/2)^{1.4}}$		$\frac{0.35(0.0016)(U/2.2)^{1.3}}{(M/2)^{1.4}}$	$\frac{0.11(0.0016)(U/2.2)^{1.3}}{(M/2)^{1.4}}$
Bulldozer (kg/h)	$\frac{2.6(s)^{1.2}}{M^{1.3}}$	$\frac{0.45(s)^{1.5}}{M^{1.4}}$	=PM15*0.75	=TSP*0.105
Grader (kg/VKT)	$0.0034(S)^{2.5}$	$0.0056(S)^{2.0}$	=PM15*0.60	=TSP*0.031
Roads				
Truck travel (kg/VKT)	$\frac{10(s/12)^{0.8}(W/3)^{0.5} \times 0.2819}{(M/0.2)^{0.4}}$		$\frac{2.6(s/12)^{0.8}(W/3)^{0.4} \times 0.2819}{(M/0.2)^{0.3}}$	$\frac{0.38(s/12)^{0.8}(W/3)^{0.4} \times 0.2819}{(M/0.2)^{0.3}}$

U – wind speed (m/s)
M – moisture content (%)
s – silt content (%)
S – vehicle speed (km/h)
W – vehicle weight (Mg)
VKT – vehicle kilometres travelled

Notes:

1) The U.S. EPA Industrial Source Complex Short-Term Prime model (ISC3-PRIME) (Schulman et al 1997) was used for the atmospheric dispersion modelling of the emissions from demolition activities. The ISCST3 (U.S.EPA 1995b) model is the regulatory model currently recommended for simulating short-term air quality impacts from industrial complexes. The ISCST3 model is specifically designed to permit the analysis of emission sources from complex industrial settings (multiple stacks, fugitive emissions, building wake effects, etc.). This model is currently recommended by the U.S. Environmental Protection Agency for compliance modelling, and has been accepted by Canadian regulatory agencies. ISC3-PRIME is an enhanced version of ISCST3 that was designed to better simulate the building wake effects. This enhanced model has been proposed by the U.S.EPA as a regulatory model (U.S.EPA 2000). The ISC3-PRIME model is a steady-state Gaussian Plume model that provides options to model emissions from a wide range of sources (U.S. EPA 1995a). The model accepts hourly meteorological data records to define the conditions for plume rise, transport and dispersion. The model estimates the concentration or deposition value for each source-receptor combination, for each hour of input meteorology, and calculates short-term averages, such as one-hour, eight-hour and 24-hour averages. The hourly averages can also be combined into longer averages (monthly, seasonal, annual or period).

2) An effective release height of 1.5 m was also assumed. The following switches were incorporated in the modelling for this site: the elevated terrain module was not considered as the topography in the vicinity of BHWP site is not extreme; concentrations were predicted; and, rural dispersion was assumed.

APPENDIX B

GEOLOGY AND HYDROGEOLOGY

APPENDIX B – GEOLOGY AND HYDROGEOLOGY

B.1 General Stratigraphy of the BHWP Site

Figure B.1 depicts the locations of the stratigraphic sections with reference to BHWP structure locations while Figure B.2 represents the historic Ontario Hydro plus Wardrop Engineering Inc. boreholes and test pits used in delineation of the stratigraphy. The actual cross-sections are provided in Figures B.3 to B.6, oriented along a north to south direction, and in Figures B.7 and B.8, oriented in the east to west direction.

Figure B.1

LOCATION MAP OF STRATIGRAPHIC CROSS-SECTIONS: STRUCTURE LOCATIONS

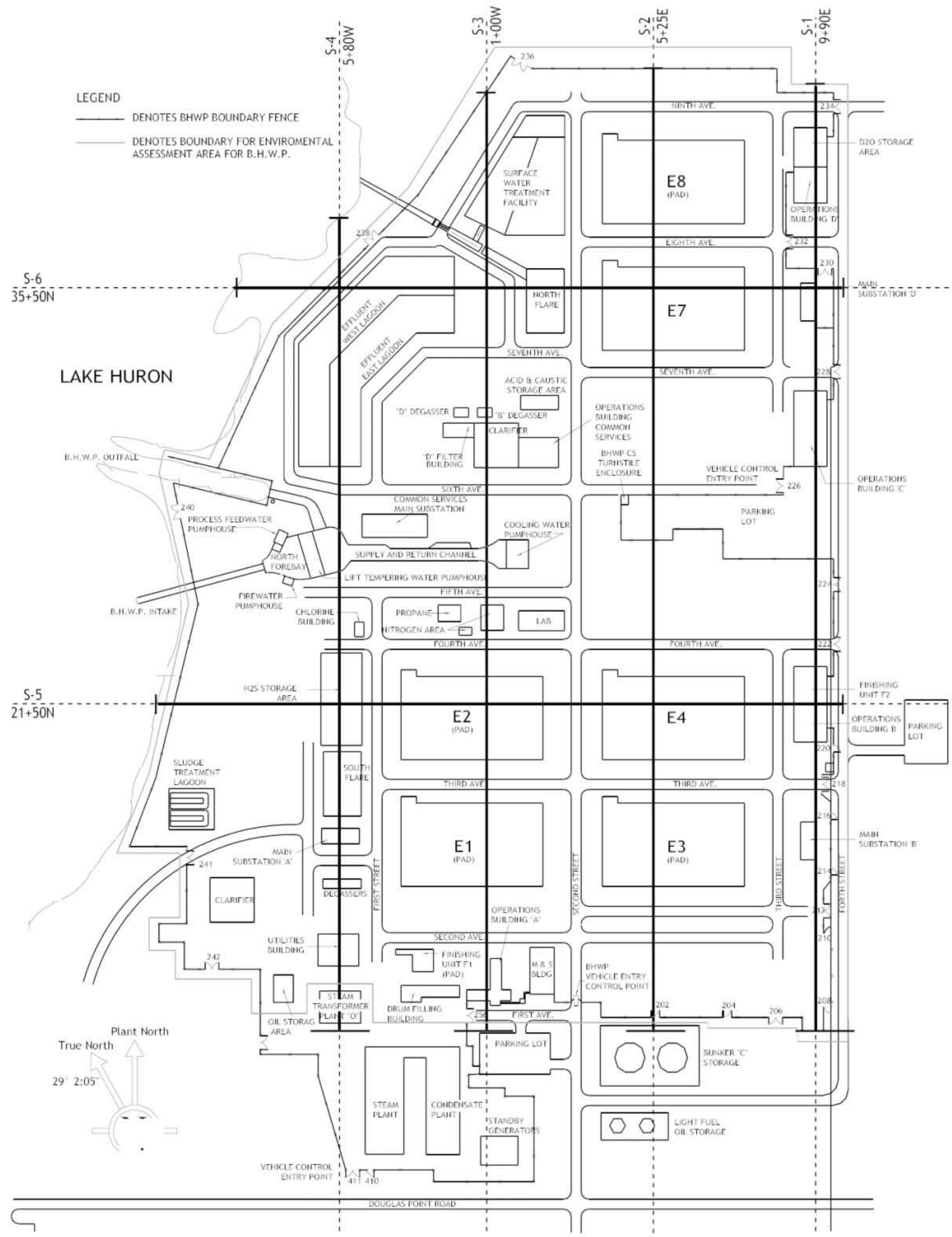
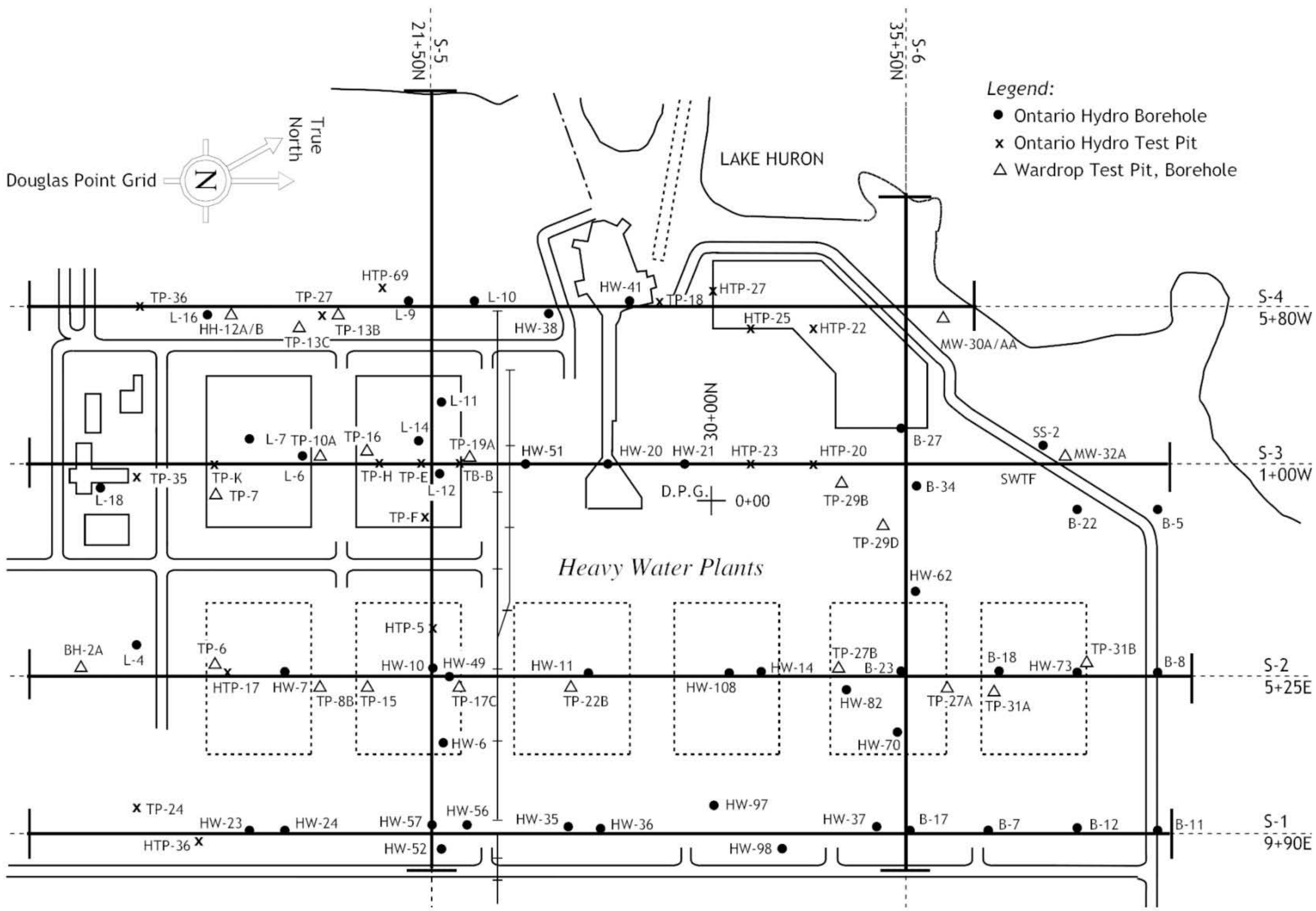


Figure B.2

LOCATION MAP OF STRATIGRAPHIC CROSS-SECTIONS: BOREHOLES AND TEST PITS



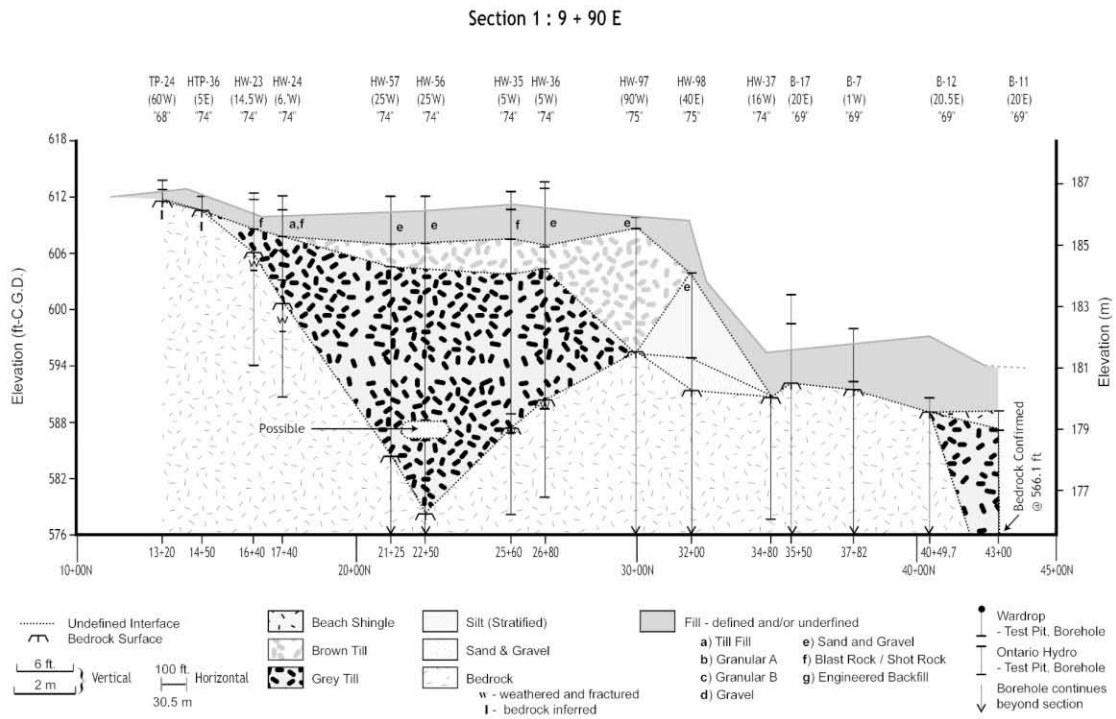


Figure B.3

STRATIGRAPHIC CROSS-SECTION S1

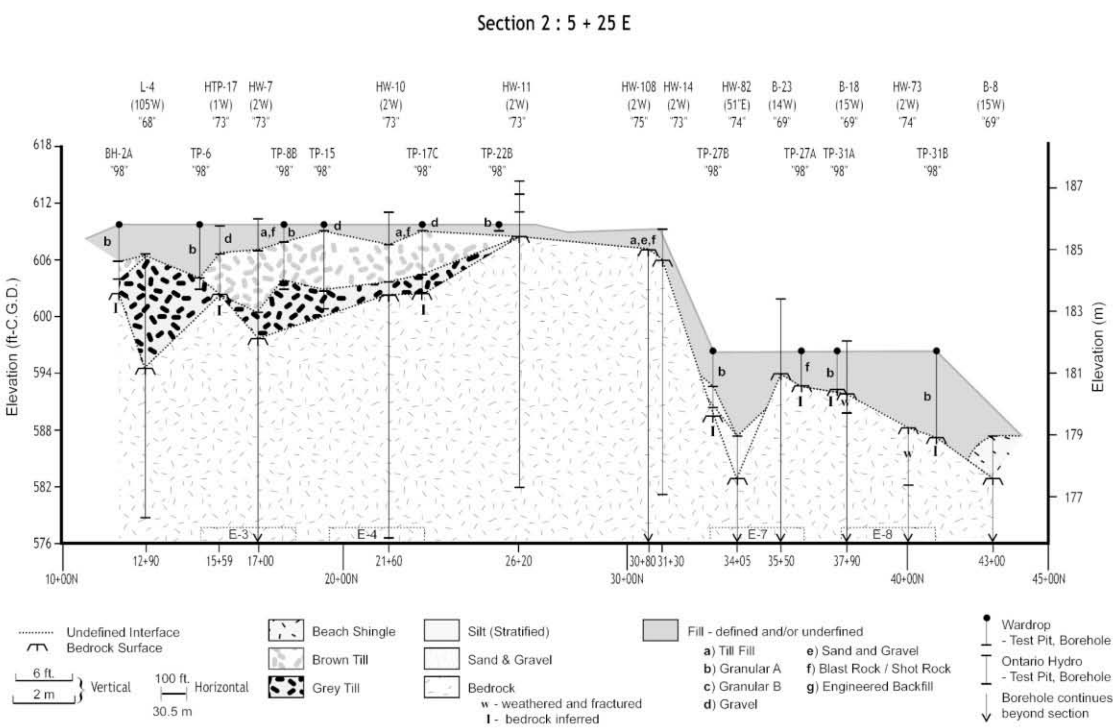


Figure B.4

STRATIGRAPHIC CROSS-SECTION S2

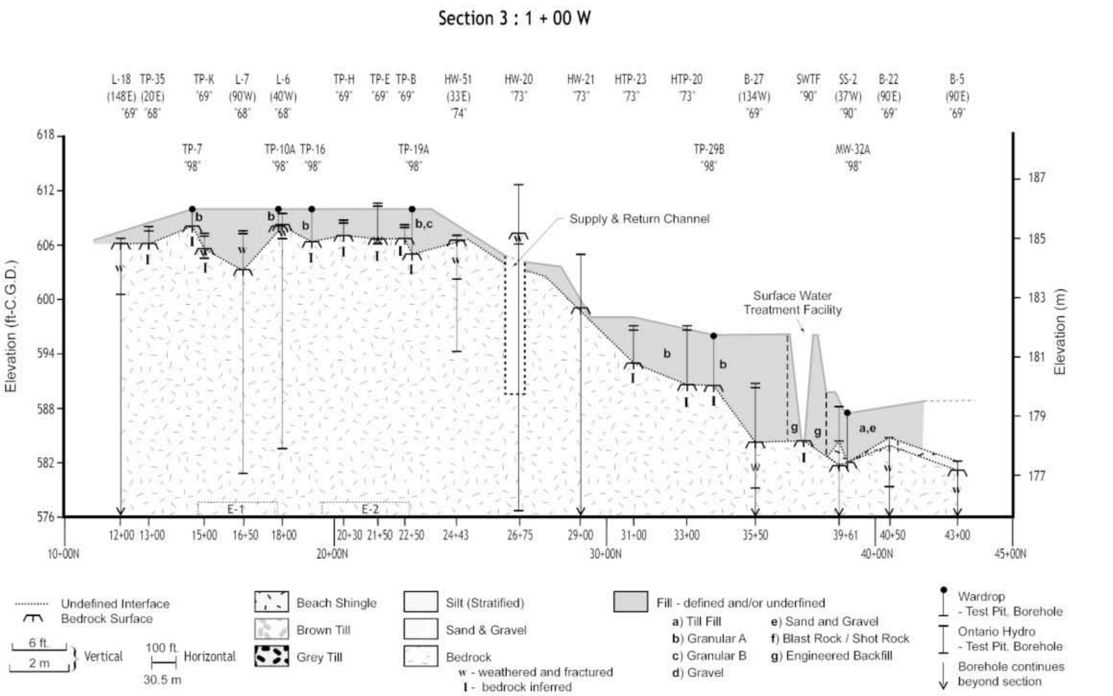


Figure B.5

STRATIGRAPHIC CROSS-SECTION S3

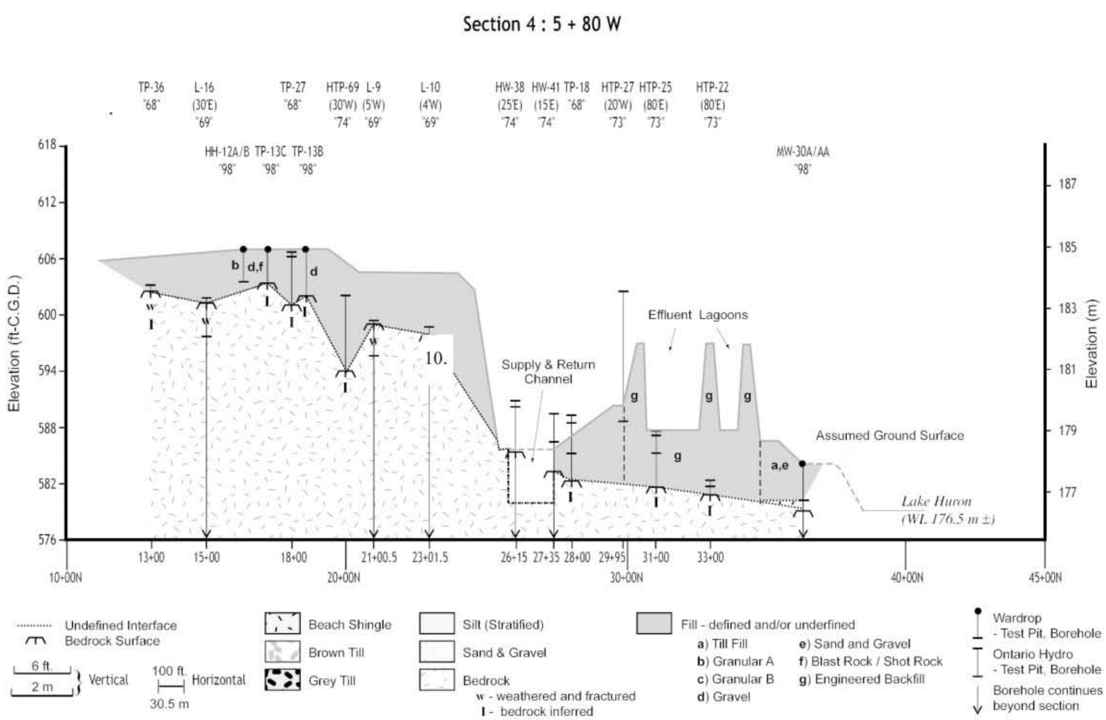


Figure B.6

STRATIGRAPHIC CROSS-SECTION S4

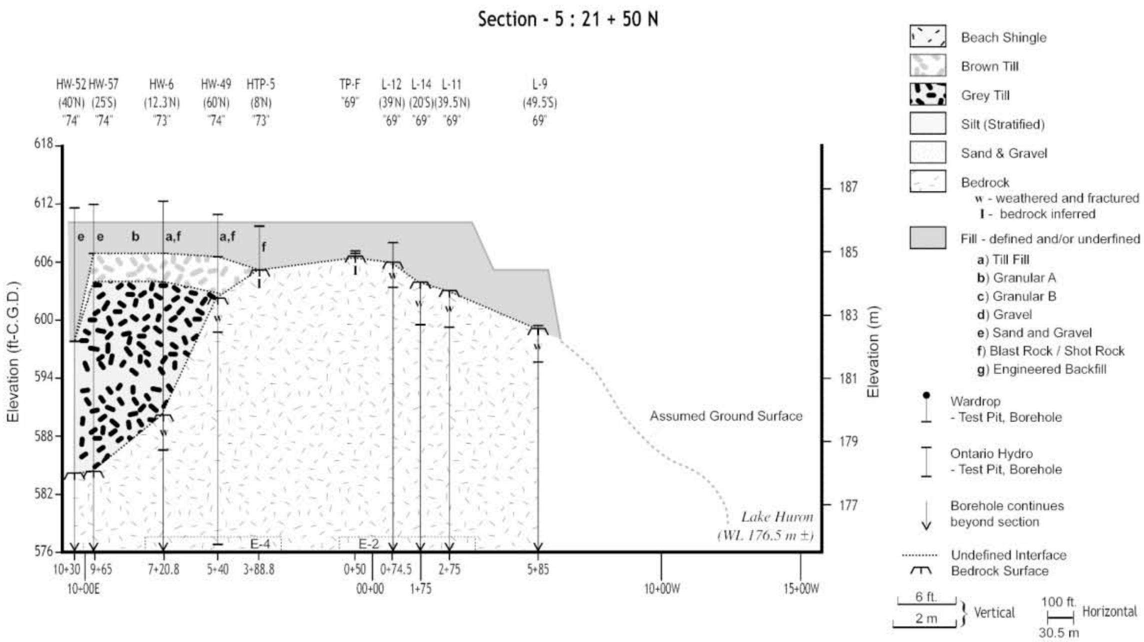


Figure B.7

STRATIGRAPHIC CROSS-SECTION S5

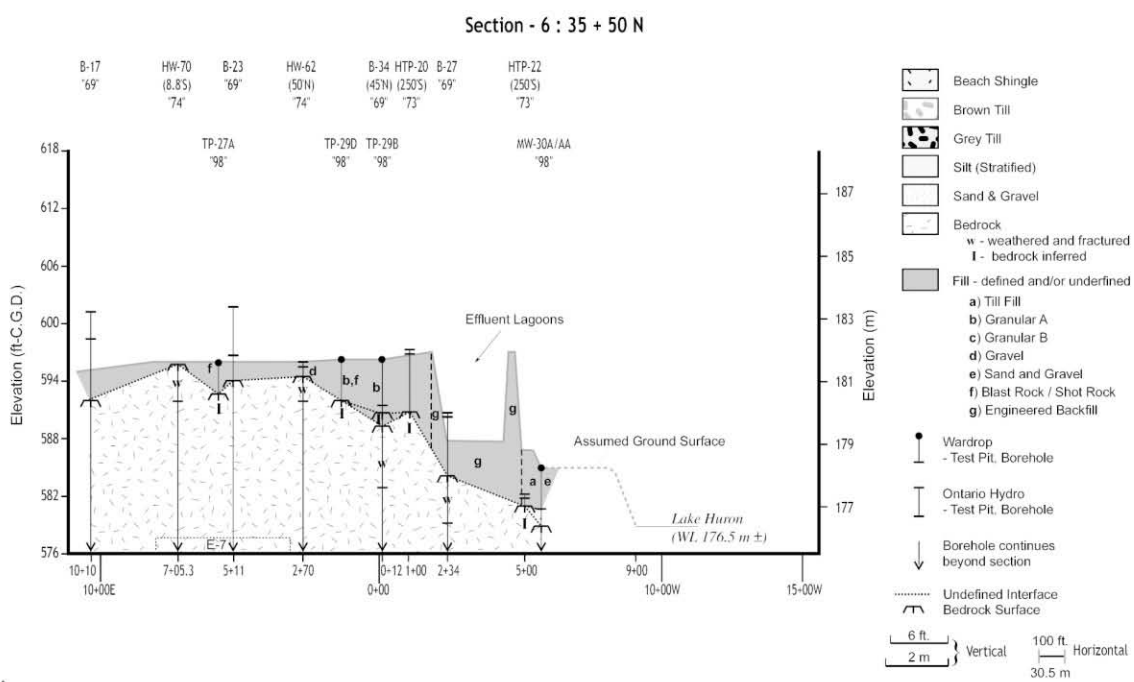
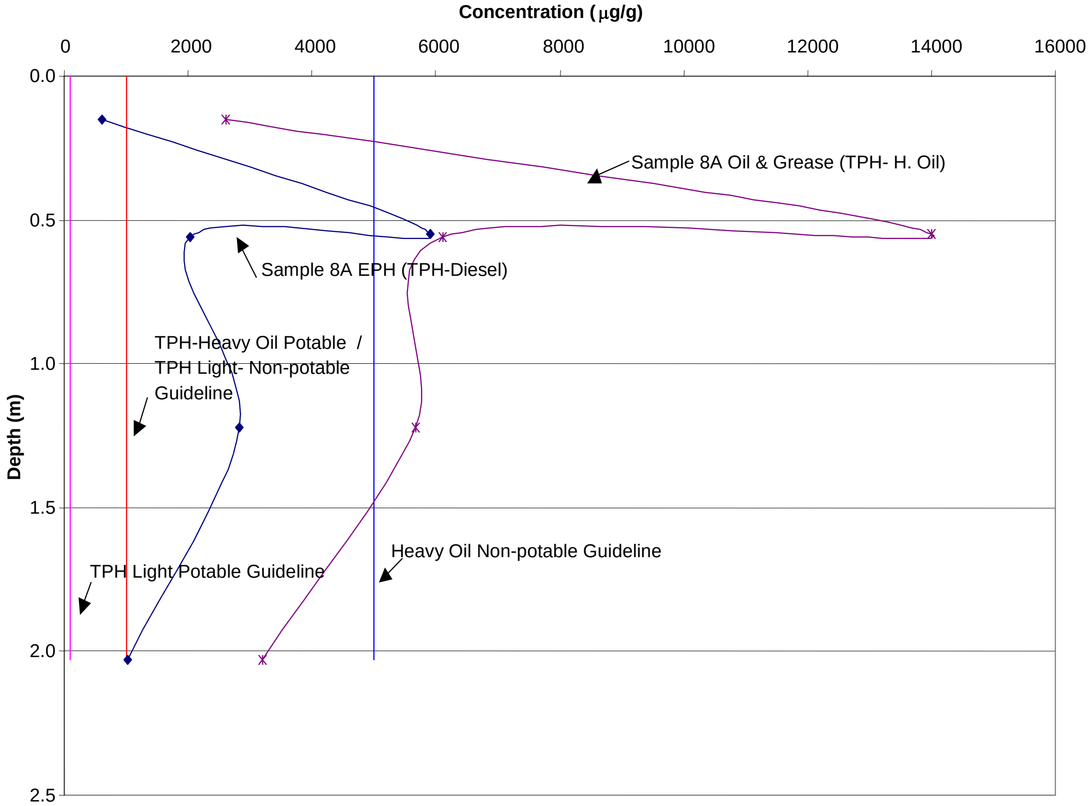


Figure B.8

STRATIGRAPHIC CROSS-SECTION S6

Figure B.9

DEPTH vs. CONCENTRATION OF SOIL SAMPLE FOR EPH (TPH-Diesel) AND OIL & GREASE (TPH- H. Oil) FOR SAMPLING SITE 8A

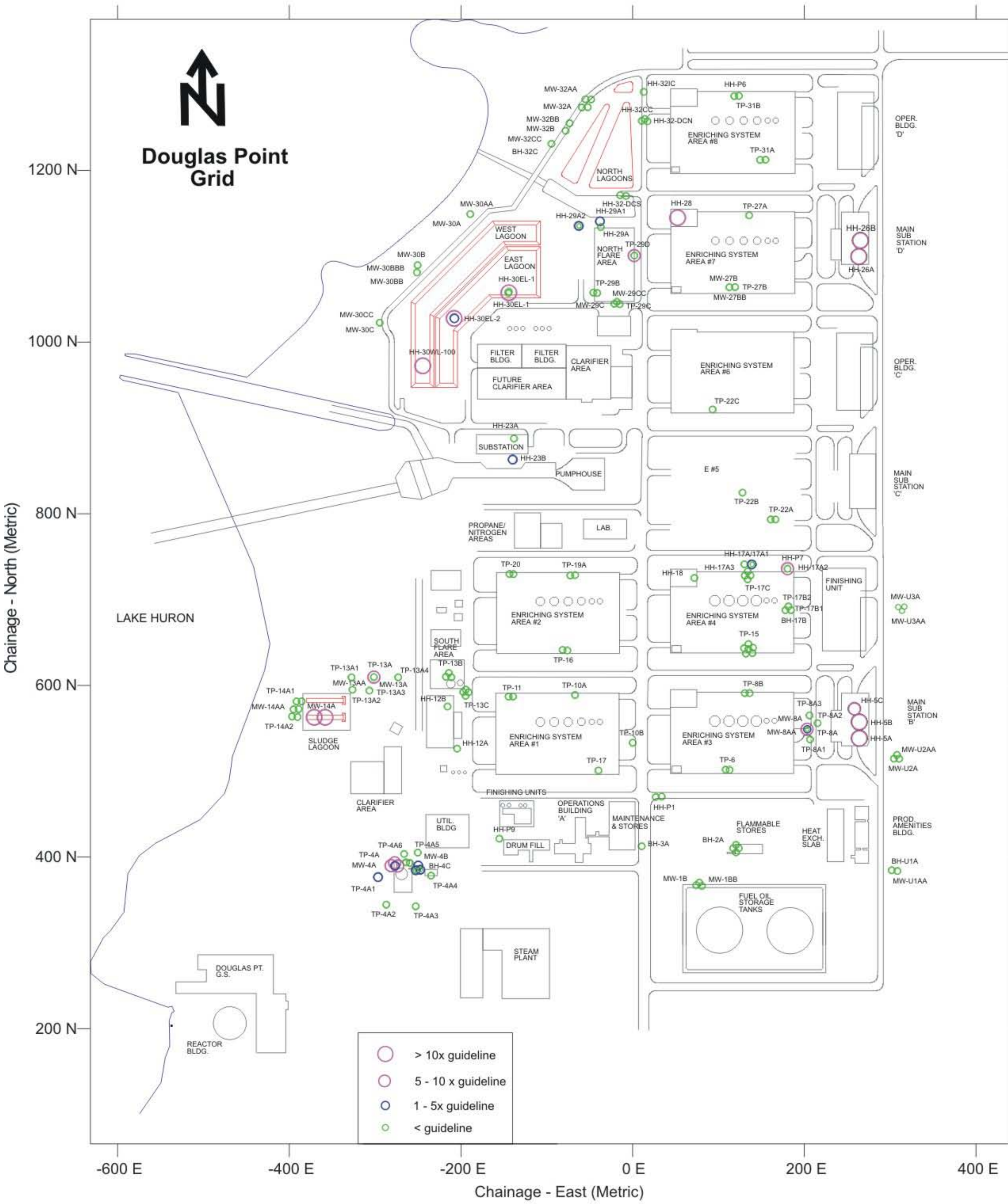


NOTE:

Sampling Site 8A, located east of Enriching Unit No. 3, exhibited highest measured concentrations for petroleum hydrocarbons at the site. In general, concentrations decrease with increasing depth.

Figure B.10

RESULTS OF PETROLEUM HYDROCARBON ANALYSIS CONDUCTED ON SOIL SAMPLES



Note:
Circle size indicates degree of contamination,
it is not an indication of the extent of contamination.

Table B.1 provides a summary of the typical range of groundwater flow parameters and patterns (direction) for the major types of soil and bedrock found at the BHWP site.

TABLE B.1
SUMMARY OF GENERAL GROUNDWATER FLOW PARAMETERS

Parameter / Layer Material	Hydraulic Conductivity ($cm.s^{-1}$)	Porosity	Flow Direction
Brown/Grey Till	5×10^{-5} to 1×10^{-8} (mean $\approx 6 \times 10^{-7}$)	0.2	Vertically downward
Sand	3×10^{-3} to 10^{-5} (mean $\approx 2.7 \times 10^{-4}$)	0.3	Sub-vertically to carbonate aquifer
Fill/Beach Shingle	$(7.9 \text{ to } 4) \times 10^{-3}$	0.3	Sub-vertically to carbonate aquifer and/or NW to Lake Huron
Upper Bedrock (Fractured zone)	1.2×10^{-3} to 5×10^{-5}	0.02	NW to Lake Huron

TABLE B.2
LOCATION CLASSIFICATIONS OF BHWP MONITORING WELLS

Designated Location	Well Number	Screened Unit
Upstream[1]	MW-U1AA	Limestone Bedrock
	MW-U2A	Lower Clay Till
	MW-U2AA	Limestone Bedrock
	MW-U3A	Lower Clay Till
	MW-U3AA	Limestone Bedrock
	MW-U8A	Lower Sand Fill
	MW-U8AA	Limestone Bedrock
Downstream	MW-13A	Lower Sand and Gravel
	MW-13AA	Limestone Bedrock
	MW-14A	Lower Gravel
	MW-14AA	Limestone Bedrock
	MW-30A	Lower Gravel
	MW-30AA	Limestone Bedrock
	MW-30B	Lower Sandy Silt Till
	MW-30BB	Lower Sandy Silt Till
	MW-30BBB	Limestone Bedrock
	MW-30C	Lower Gravel
	MW-30CC	Limestone Bedrock
	MW-32A	Lower Sand and Gravel
	MW-32AA	Limestone Bedrock
	MW-32B	Lower Silty-Sand Till
	MW-32BB	Limestone Bedrock
	MW-32CC	Limestone Bedrock
Internal	MW-1B	Lower Silt Till
	MW-1BB	Limestone Bedrock
	MW-4A	Limestone Bedrock
	MW-4B	Limestone Bedrock
	MW-27B	Lower Gravel
	MW-27BB	Limestone Bedrock
	MW-29C	Lower Gravel
	MW-29CC	Limestone Bedrock

Note: 1 Monitoring Wells located east of the Enriching Units

TABLE B.3
GROUNDWATER CHEMISTRY UPSTREAM AND DOWNSTREAM OF BHWP

Stratigraphic Material / Analyte Concentration (µg/L)	Upper Carbonate Aquifer												Unconsolidated Media Aquifer (Fill/Sand & Gravel/Till)											MOE* Guideline Criteria (µg/L)	
	Upstream				Downstream								Upstream			Downstream									
	MW-U1AA	MW-U2AA	MW-U3AA	MW-U8AA	MW-13AA	MW-14AA	MW-30AA	MW-30BBB	MW-30CC	MW-32AA	MW-32BB	MW-32CC	MW-U2A	MW-U3A	MW-U8A	MW-13A	MW-14A	MW-30A	MW-30B	MW-30BB	MW-30C	MW-32A	MW-32B	Potable	Nonpotable
Antimony	0.006	<0.001	<0.001	4	<0.001	NA	<0.01	NA	<0.01	NA	1	1	<0.001	<0.001	<1	NA	NA	<0.01	NA	NA	<0.01	NA	2		
Arsenic	<0.002	<0.002	<0.002	30	<0.002	NA	<0.01	NA	<0.01	NA	20	22	0.09	<0.002	3	NA	NA	<0.01	NA	NA	>0.01	NA	11	25	480
Copper	0.011	0..5	0..007	1.9	NA	NA	0.008	NA	<0.005	NA	6.6	<0.005	0.004	0.003	21.4	NA	NA	0.035	NA	NA	0.027	NA	<0.4	23	23
Lead	0.006	<0.001	<0.001	<0.7	NA	NA	<0.005	NA	<0.005	NA	4.0	<0.01	<0.001	<0.001	3.2	NA	NA	0.06	NA	NA	<0.005	NA	<0.7	10	32
Selenium	0.004	<0.003	0.034	2	NA	NA	<0.01	NA	<0.01	NA	<1		0.008	0.004	2	NA	NA	<0.01	NA	NA	<0.01	NA	<1	10	50
Zinc	0.088	0.052	<0.003	10	NA	NA	0.02	NA	0.17	NA	<10	0.026	<0.003	<0.003	45	NA	NA	0.21	NA	NA	<0.005	NA	28	1100	1100
Benzene	<0.5	<0.5	<0.5	NA	<0.5	NA	NA	NA	NA	NA	NA	<0.5	<0.5	<0.5	>0.2	NA	NA	NA	NA	NA	NA	NA	NA	5.0	1900
Toluene	<0.5	<0.5	<0.5	NA	<0.5	NA	NA	NA	NA	NA	NA	<0.5	<0.5	<0.5	<0.2	NA	NA	NA	NA	NA	NA	NA	NA	24	5900
Ethylbenzene	<0.5	<0.5	<0.5	NA	<0.5	NA	NA	NA	NA	NA	NA	<0.5	<0.5	<0.5	<0.3	NA	NA	NA	NA	NA	NA	NA	NA	2.4	28000
Xylenes	<0.5	<0.5	<0.5	NA	<0.5	NA	NA	NA	NA	NA	NA	<0.5	0.9	<0.5	<0.2	NA	NA	NA	NA	NA	NA	NA	NA	300	5600
PCB	<0.5	<0.5	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2	0.2
$TPH_{gas/diesel\ (C10\text{-}C\text{-}24)}$	NA	NA	NA	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	1000	No Value
$TPH_{heavy\ (EPH)}$	NA	NA	NA	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.4	NA	NA	NA	NA	NA	NA	NA	NA	1000	No Value
Phenol	<0.002	<0.002	NA	<1	NA	NA	NA	NA	NA	NA	NA	NA	0.002	<0.002	NA	NA	NA	NA	NA	NA	NA	NA	NA	4200	26000
^{3}H (Bq/L)	222	259	<185	NA	NA	NA	NA	NA	NA	NA	111	111	296	<185	NA	NA	NA	NA	NA	NA	NA	NA	NA	7000 Bq/L	
^{137}Cs (pCi/L)	<20	<20	<20	NA	NA	NA	NA	NA	NA	NA	<20	<20	<20	<20	NA	NA	NA	NA	NA	NA	NA	NA	NA	50 Bq/L (1350 pCi/L)	
pH (in pH units)	NA	NA	7.28	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.39	7.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.5 to 8.5	

NA=Not Analyzed/Not Reported

*MOE Guideline For Use at Contaminated Sites in Ontario, Dated February 1997 (includes revisions made September, 1998): Table A, Criteria for Potable Groundwater, and Table B, Criteria for Nonpotable Groundwater

TABLE B.4
GROUNDWATER CHEMISTRY INTERNAL TO BHWP: 1998

Stratigraphic Material / Analyte Concentration (µg/L)	Upper Carbonate Aquifer					Unconsolidated Media Aquifer (Fill/ Sand & Gravel/Till)				
	Internal					Internal			MOE* Guideline Criteria (µg/L)	
	MW-1BB	MW-4A	MW-4B	MW-27BB	MW-29CC	MW-1B	MW-27B	MW-29C	Potable	Nonpotable
Antimony	2	5	<0.001	2	9	2	<1	2	6	16000
Arsenic	<1	54	0.003	19	<1	<1	<1	<1	25	480
Copper	0.4	1.7	0.0048	1.2	2.1	0.6	1.9	22.2	23	23
Lead	<0.7	<0.7	0.008	<0.7	<0.7	<0.7	<0.7	9.3	10	32
Selenium	<1	<1	<0.003	<1	51	<1	<1	<1	10	50
Zinc	<10	12	0.026	<10	<10	<10	<10	45	1100	1100
Benzene	NA	<0.2	<0.5	<0.2	NA	NA	<0.2	NA	5.0	1900
Toluene	NA	<0.2	<0.5	0.2	NA	NA	0.2	NA	24	5900
Ethylbenzene	NA	<0.3	<0.5	<0.3	NA	NA	<0.3	NA	2.4	28000
Xylenes	NA	<0.2	3.1	<0.2	NA	NA	0.2	NA	300	5600
PCB	NA	NA	NA	NA	NA	NA	NA	NA	0.2	0.2
$TPH_{gas/diesel\ (C10\text{-}C\text{-}24)}$	NA	<0.5	NA	<1	NA	NA	<1	NA	1000	No Value
$TPH_{heavy\ (EPH)}$	NA	<1	NA	<0.5	NA	NA	<0.5	NA	1000	No Value
Phenol	NA	NA	NA	NA	NA	NA	NA	NA	4200	26000
^{3}H (Bq/L)	NA	NA	281	NA	NA	NA	NA	NA	7000 Bq/L	
^{137}Cs (pCi/L)	NA	NA	24	NA	NA	NA	NA	NA	50 Bq/L	
pH (in pH units)	NA	NA	NA	NA	NA	NA	NA	NA	6.5 to 8.5	

NA≡ Not Analyzed/Not Reported

*MOE Guideline For Use at Contaminated Sites in Ontario, Dated February 1997 (includes revisions made September, 1998): Table A, Criteria for Potable Groundwater, and Table B, Criteria for Nonpotable Groundwater

APPENDIX C

DETAILS OF CONSULTATION PROGRAM

APPENDIX C – DETAILS OF CONSULTATION PROGRAM

C.1 Period 1: September 1998 to December 1998

- List of attendees at Open House
- Groups involved in site tours
- Media articles
- Open House notice

Attendees at the Public Information Open House 1998:

- Local municipal council members representing Bruce Township, Kincardine Township, Saugeen Township, Huron Township, Town of Kincardine and Town of Port Elgin;
- Bruce nuclear site employees;
- Ontario Hydro retirees;
- Bruce Energy Centre representatives;
- Atomic Energy of Canada Limited representative;
- Bruce County Federal of Agriculture representative;
- Local residents; and
- Local media.

Groups involved in tours of the BHWP site 1998:

- Bruce Energy Centre;
- Integrated Energy Development Corporation (IEDO);
- Syn-Energy Systems Development Int'l Inc.;
- Transalta Inc. and Agra Monenco;
- Acres International, along with Wardrop Engineering Inc. and Canatom NPM;
- Qualitech Foods Inc. looked at purchasing surplus structural steel;
- Crofton Paper Mill;
- Greenspoon Iron & Metal Co.;
- The Pump and Motor Works Inc.;
- BI-AX; and
- Commercial Alcohols.

ontario hydro

Box 1000, Tiverton, Ontario NOG 2TO
Telephone (519) 361-3492

November 19, 1998

Mr. Normand de la Chevrotiere
President and Chair, Committee of Concern
Inverhuron and District Ratepayers Association
1806-81 Church Street
Kitchener, Ontario N2G 2M1

Dear Normand:

I would like to extend an invitation to you and your association to attend a Public Information Open House on "Decommissioning the Bruce Heavy Water Plant."

The Public Information Open House is on Thursday, December 3, 1998 from 3:00 p.m. to 9:00 p.m. at the Bruce Nuclear Information Centre.

As part of the Open House a tour of the Heavy Water Plant site is planned. The one hour tour will depart from the Information Centre at 3:00 p.m. To register for the site bus tour, please contact Jo Anne Rocheleau, Bruce Nuclear Public Affairs, at 361-7777.

Last year Ontario Hydro made the decision to permanently shut down the Bruce Heavy Water Plant and to decommission the facility. Ontario Hydro is presently conducting an environmental assessment regarding decommissioning. Decommissioning involves the demolition and the removal of all above ground buildings and structures that are no longer required. Some of the facilities and buildings will remain in operation in order to support the operation of other facilities on the BNPD site and the Bruce Energy Centre.
The final decommissioning will include cleanup and remediation of the land to industrial land use standards.

The Public Information Open House is being held to provide local officials and interested residents with an opportunity to learn more about Ontario Hydro's plans to decommission the Bruce Heavy Water Plant.

For more information on the Public Information Open House please do not hesitate to contact me.

K. Cassidy for
Kevin Orr
Bruce Nuclear Public Affairs
(519) 361-3675

THE KINCARDINE INDEPENDENT, Wednesday, November 25, 1998

Public Information Open House

Bruce Heavy Water Plant Decommissioning

You are invited to attend a Public Information Open House to learn more about Ontario Hydro' s plans to decommission the Bruce Heavy Water Plant located at the Bruce Nuclear Power Development (BNPD). The Open House will be held on:

THURSDAY, DECEMBER 3, 1998
3:00 p.m. - 9:00 p.m.
Bruce Nuclear Information Centre

Last year Ontario Hydro made the decision to permanently shut down the Bruce Heavy Water Plant and to decommission the facility. Ontario Hydro is presently conducting an environmental assessment regarding decommissioning. Decommissioning involves the demolition and the removal of all above ground buildings and structures that are no longer required. Some of the facilities and buildings will remain in operation in order to support the operation of other facilities on the BNPD site and the Bruce Energy Centre. The final decommissioning will include cleanup and remediation of the land to industrial land use standards.

As part of the Open House a tour of the Heavy Water Plant site is planned. The one hour tour will depart from the Information Centre at 3:00 p.m. To register for the site bus tour, please contact Jo Anne Rocheleau at 361-7777.

For more information on the Public Information Open House please contact:

Kevin Orr
Bruce Nuclear Public Affairs
361-3675

BRUCE NUCLEAR

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For more Ontario Hydro information and services, visit our corporate website at www.hydro.on.ca

Heavy Water decommissioning planned

The BNPD skyline will be changing. The Heavy Water Plant towers that have so distinctively defined the site since the early 1970's will be demolished late next year at the conclusion of an extensive decommissioning program. The decommissioning will meet the regulatory requirements of the Atomic Energy Control Board, and the guidelines set by the Ontario Ministry of the Environment and Environment Canada.

Prior to the demolition Ontario Hydro will conduct an environmental assessment of the Heavy Water Plant site. The first phase of this assessment will be a review of station records, environmental reports and a site inspection. The second phase will entail sampling and analysis of any possible contaminated soil sites that were identified in the first phase. The results of the analysis will be used to assess the environmental impact of the past operation of the plant and the decommissioning and demolition. The final phase of the environmental assessment will be remediation of any contaminated land sites that are identified by the earlier phases of the process to ensure that they meet regulatory guidelines.

We'll be holding a public information open house dealing with the decommissioning of the Bruce Heavy Water Plant in November. Please watch your local newspapers for notice of how you can get involved. For further information call Kevin Orr, Bruce Nuclear Public Affairs, (519) 361-3675.

Environmental performance advisory group to be formed

Ontario Hydro Nuclear (OHN) is establishing an Environmental Advisory Group (EAG) to help improve the environmental performance of our nuclear generating stations.

At various times over the past few years, provincial and federal government agencies, Ontario Hydro management, special interest groups, and the public, have all expressed concern about the operation of our nuclear plants and their environmental performance.

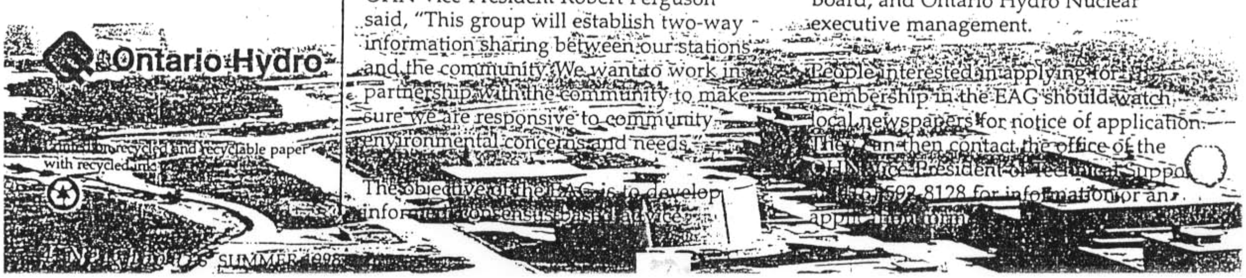
Ontario Hydro Nuclear is committed to improving environmental performance and strengthening relationships with stakeholders, and the formation of the EAG will assist us in achieving our goal.

In announcing the formation of the EAG, OHN Vice-President Robert Ferguson said, "This group will establish two-way information sharing between our stations and the community. We want to work in partnership with the community to make sure we are responsive to community environmental concerns and needs."

The objective of the EAG is to develop informed consensus-based advice regarding environmental operations and activities, in a manner that brings the diverse perspectives of the group's members to bear on an issue.

The EAG will be comprised of 12 to 18 members with a variety of backgrounds and interests, from the geographic areas around our three nuclear generating stations. Ferguson said he is hoping people from various sectors will consider applying for membership. "We're encouraging people from the First Nations, local government, university, high school, industry, environmental and medical communities, as well as the general public, to become involved", he said. The EAG will consider the technical and regulatory perspective provided by the ex-officio participation of the Ministry of Environment, Atomic Energy Control Board, and Ontario Hydro Nuclear executive management.

People interested in applying for membership in the EAG should watch local newspapers for notice of application. They can then contact the office of the OHN Vice-President of Technical Support at (416) 592-8128 for information or an application form.



Ontario Hydro

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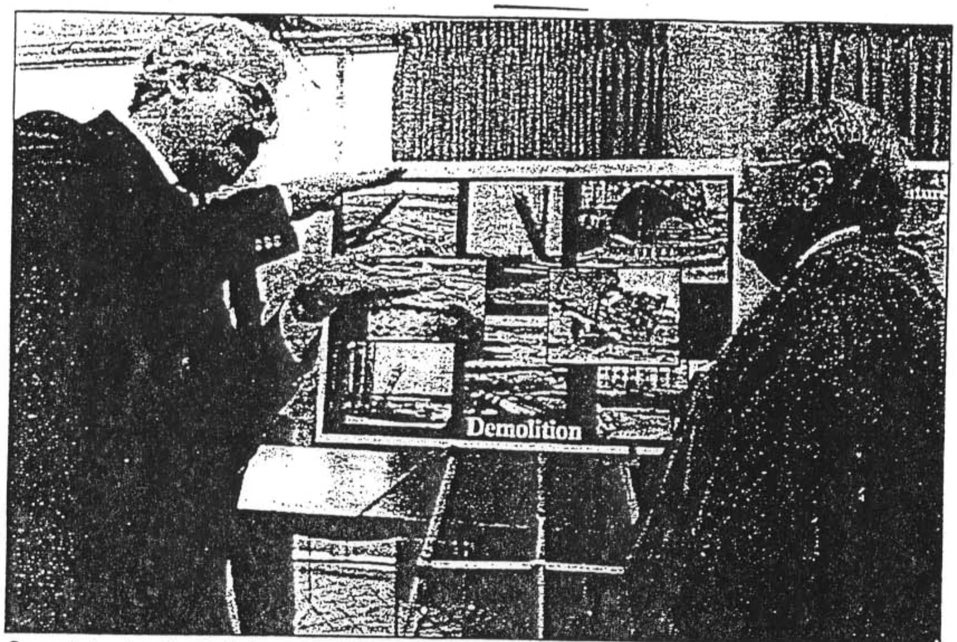

George Antinori, an Ontario Hydro senior technical supervisor for decommisioning the Bruce Heavy Water Plant, speaks to Peter Landry, a retired heavy water lab chemical technician. Landry was at the heavy water plant decommissioining open house held at Ontario Hydro's information centre last Thursday afternoon. Both men are from Port Elgin.

Hydro holds openhouse about Heavy Water Plant

By Bev Fry
Kincardine News staff

An open house on the decommissioning of the Bruce Heavy Water Plant brought retired employee Peter Landry to Ontario Hydro's information centre last Thursday.

Landry, of Port Elgin, was a lab chemical technician for 22 years at the heavy water plant. He was at the open house because he wanted to see what was happening.

"I'm still interested. The heavy water plant was the best plant in all of Ontario Hydro. We met our production quota and budget every year. We were the jewel in Ontario Hydro's crown."

The plant will be completely dismantled by the end of 2000.

Last year Ontario Hydro decided to shut down and decommission the heavy water plant. Before decommissioning, the Atomic Energy Control Board requires an environmental assessment, which, Bob Simmons, technical superintendent at the heavy water plant, says will be to the standard of the Canadian Environmental Assessment Act.

Part of the environmental assessment, is public discussion.

George Antinori, senior technical supervisor for decommissioning, said Phase One of the assessment, which included visual inspection to determine any potential problem areas, has been completed.

Sampling from soil around the plant has also been completed. All that remains is the results from the sampling program.

"So far there have been no surprises," Antinori said.

After the results have been analyzed, Simmons said "we will know what areas need remediation and to what extent."

Antinori said Hydro is anticipating have to clean up some areas.

"The assessment will confirm what areas need to be cleaned."

He said there have been oil traces in some of the soil samples. Oil was used to provide sealing capability to the hydrogen sulphide compressors at the plant.

There also may be some corrosion by-products of carbon and steel in the lagoons.

"The site will be cleaned to the standards of an industrial site, available for future industrial use," Simmons said.

There will still be services on the site which will remain in operation. Heavy water will be stored on the site.

"We'll still be supplying steam and water to the Bruce Energy Centre. The is a big maze of underground piping. We're just taking down some of the above ground structures," Simmons said.

Landry, who came from Shawinigan, Quebec, to work at the heavy water plant in 1971, said there was never a loss of life during the operation of the plant.

"I'm very proud of the people who worked at the heavy water plant. All of them."

Landry said he wasn't sad to see the towers come down.

"I'm proud to have gone through a long time of job employment. The towers coming down is reality. This is old technology. It's time for new technology."

Antinori agreed. He was involved in the commissioning of Heavy Water Plant B, in 1977, and worked with Landry.

"Being here for the decommissioning brings closure to a project. We saw the full cycle. Did I expect to see the towers come down when I started working here? No," he laughed.

Bruce Heavy Water Plant towers coming down

By Christine Russwurm

A public information open house was held at the Bruce Nuclear Information Centre Thursday designed to outline plans to decommission the Bruce Heavy Water Plant (BHWP).

"This is our opportunity today for the public to see what is happening here on the site and get an idea of what's going on with the decommissioning," said Bob Simmons, technical superintendent at the BHWP and organizer of the event.

The plant has been shut down since August of last year. Ontario Hydro is now beginning the decommissioning and demolition phase.

"In preparation for our decommissioning, we're doing an environmental assessment," Simmons said. "This assessment is looking at the impact of the decommissioning on the environment. We've been looking at possible areas that have been contaminated and looking at what remedial steps we'll take to clear up the site."

Simmons could not provide a cost for the assessment but estimated it at close to $250,000. He said the actual decommissioning work is expected to be "revenue neutral."

"What we do is bring in a contractor who removes the towers and the material and sells it at scrap value," he said.

"The actual decommissioning will start in about November of next year and will end by December 2000, we hope," he said. "(By then) the towers will be down. We'll be taking down all the above grade structures. There still will be some systems in operation, we will still be storing heavy water in bulk storage and supplying steam and water to the energy centre. We will be supplying some utilities to some of the other site facilities. There still will be some buildings in place."

The water for the energy centre is supplied from the pumphouses at the BHWP and there is a steam distribution system which goes to the BHWP to supply the energy centre.

About 50 people attended the open house, which Simmons said was designed to provide people with an overview of the BHWP and Ontario Hydro's intentions for the site. Thirty-one people took advantage of the offered opportunity to tour the site by bus. Simmons said that there has not been a lot of public involvement in the process to date.

Decommissioning of heavy water plant explained at open house

By Bev Fry

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Landry, of Port Elgin, was a lab chemical technician for 22 years at the heavy water plant. He was at the open house because he wanted to see what was happening.

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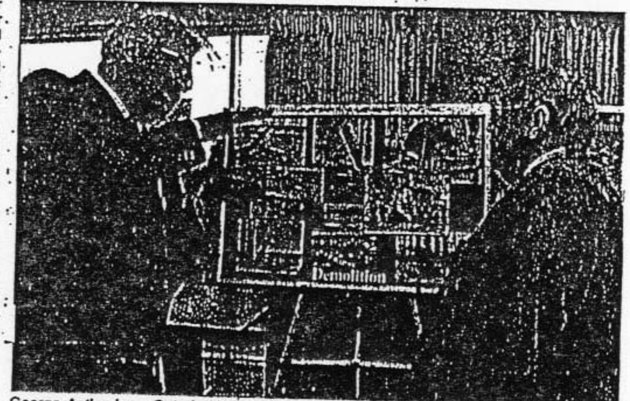

George Antinori, an Ontario Hydro senior technical supervisor for decommissioning the Bruce Heavy Water Plant, speaks to Peter Landry, a retired heavy water lab chemical technician. Both men, who are from Port Elgin, were at the heavy water plant decommissioning open house held at the BNPD information center Thursday afternoon.

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Meeting held to outline plans for Heavy Water plant shutdown

By Christine Russwurm
For The Beacon Times

An open house was held at the Bruce Nuclear Information Centre on Thursday to outline plans to decommission the Bruce heavy water plant.

It was an "opportunity . . . for the public to see what is happening here on the site and get an idea of what's going on with the decommissioning," said Bob Simmons, technical superintendent at the plant and organizer of the event.

The plant has been shut down since last August.

Ontario Hydro is now beginning the decommissioning and demolition phase.

"In preparation for our decommissioning, we're doing an environmental assessment . . . looking at possible areas that have been contaminated and looking at what remedial steps we'll take to clear up the site," Simmons said.

He could not provide a cost for the assessment but estimated it at close to $250,000.

As for the cost of demolition, "What we do is bring in a contractor who removes the towers and the material and sells it at scrap value," he said.

"The actual decommissioning will start in about November of next year and will end by December 2000, we hope," he said.

By then "the towers will be down. We'll be taking down all the above-grade structures. There still will be some systems in operation.

"We will still be storing heavy water . . . and supplying steam and water to the energy centre. We will be supplying some utilities to some of the other site facilities.

"There still will be some buildings in place."

Water for the energy centre is supplied from the pumphouses at the heavy water plant and there is a steam distribution system which goes to the plant to supply the energy centre.

About 50 people attended the open house. Simmons said there has not been a lot of public involvement in the process to date. "This is their opportunity to come and see what's going on and give us some input."

Scrap heap for heavy water plant

BY CHRISTINE RUSSWURM
Sun Times correspondent

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C.2 Period 2: Interim Period January 1999 to June 2002

- OPG responses to CNSC staff comments on the preliminary draft EA Study Report (June 2001).

CNSC Comment	Reply
1. OPG separates the monitoring wells into three groups: upstream, downstream, and internal (to the BHWP) monitoring wells. OPG needs to identify where the boundaries between these three regions are situated.	The boundaries to the three classifications of the 31 monitoring wells are identified in Table 1 (attached). The general grouping of wells are • Upstream monitoring wells are located East of the Enriching Units and associated concrete pads. These 7 wells are MW-U1AA, MW-U2A, MW-U2AA, MW-U3A, MW-U3AA, MW-U8A, and MW-U8AA. • Downstream monitoring wells are located at the Western side of the BHWP along the shoreline of Lake Huron. These 16 wells are MW-13A, MW-13AA, MW-14A, MW-14AA, MW-30A, MW-30AA, MW-30B, MW-30BB, MW-30BBB, MW-30C, MW-30CC, MW-32A, MW-32AA, MW-32B, MW-32BB and MW-32CC. • Internal monitoring wells are located within the central portion of the BHWP. The 8 monitoring wells in this group are MW-1B, MW-1BB, MW-4A, MW-4B, MW-27B, MW-27BB, MW-29C, and MW-29CC.
2. The monitoring wells have only been sampled once. OPG should tabulate and present the analytical results for each monitoring well, not just the range in concentrations for each analyte.	The results of the groundwater sampling and analyses conducted at the BHWP in 1999 were presented to OPG as an Excel spreadsheet by the contractor (external Consulting Company). The data is incomplete as not all analytes were analyzed for each monitoring well sampled. No formal, final or draft report was generated. The results presented in the technical document supplied to the CNSC are thus provided as upper and lower ranges for each analyte as determined for the specific monitoring well groupings of "upstream" and "downstream". The intent being that water quality impact, as a direct result of the operation of the BHWP itself, would be discernable from observed changes (increases) in analyte concentrations between groundwater supplied from monitoring wells located up-gradient along the local groundwater flow direction compared to those from monitoring wells located down-gradient of the physical works of the BHWP. As requested, Tables 2 and 3 present the reported analytical results for groundwater samples taken from the "upstream" and "downstream" monitoring wells, and the remaining, or "internal", monitoring wells, respectively.
3. Table 17 purports to present the range in contaminant concentrations for only upstream and downstream monitoring wells. The data for the internal monitoring wells is not included. From the discussion on p.82 and p.84 it appears that all the groundwater data have actually been separated into only two groups, ie., downstream and upstream wells.	The copy of the BHWP Decommissioning EA dated June , 2001 we have has, as Table 17, Noise Levels. Assuming the table being referred to is *Groundwater Chemistry Upstream and Downstream of BHWP* (Table 20) the actual location description of the wells that were categorized as "upstream" and "downstream" are given in the response to CNSC comment #1.. Also provided is the listing of wells that are "internal" to the central portion of the BHWP.

CNSC Comment	Reply
3. (cont'd) CNSC staff believe that the monitoring results of all the wells should be tabulated and presented in the document. The boundaries between upstream, internal and downstream wells should also be clearly indicated in the table or on existing Figure 14. This request is mainly for the sake of completeness and transparency of the EA document. Given that the wells have been sampled only once, the amount of monitoring data involved is relatively small.	As requested, all reported analytical results for the monitoring wells sampled and submitted for chemical analysis by the external consulting company is provided in Table 2 and 3 for the "upstream" and "downstream" monitoring wells, and the remaining, or "internal", monitoring wells, respectively.
4. As, Sb, and Se appear to be common metal contaminants of concern in the groundwater. Since natural exceedences of MOE guidelines by these metals are rare, OPG needs to identify the contaminant sources for these metals. CNSC staff continue to believe that the issue related to the source of these contaminants must be discussed and clarified by OPG. In particular, OPG needs to discuss what precautionary measures will be taken to not increase the level of contamination during the decommissioning work if the source of contaminant is within the BHWP. This is because Table 20 shows that the MOE guideline criterion for Selenium for non-potable water has been slightly exceeded and that the contamination of the upper carbonate aquifer by these three elements appears to be more important than that of the unconsolidated media aquifer.	As noted in the EA document, there was one exceedence of the MOE guideline criteria for a nonpotable groundwater situation. This occurred for the parameter selenium in groundwater obtained from MW 29CC. The recorded Se concentration was 51 µg/L. With respect to potable groundwater guidelines, four exceedences were found. Two exceedences of the potable water guidelines were observed for arsenic (As), one (54 µg/L) at MW 4A (west of Sludge Lagoon) and the other (30 µg/L) at MW 8AA (east of Enriching System #3). One exceedence was reported for antimony (Sb) at MW 29CC (south of North Flare). Exceedences were only marginally over the MOE guidelines (see Tables 2 and 3, attached). The elevated concentration for Se was detected in groundwater taken from a monitoring well located internal to the BHWP. Please note that none of the groundwater sampled from wells designated as "downstream" or down-gradient of the BHWP works had elevated Se concentrations. With respect to arsenic, none of the results were in excess of the nonpotable water guideline of 480 µg/L although one was above the potable water criterion of 25 µg/L. These values were from a one-time sampling of the wells by the external consulting company. The fact that they were from a "one of" sampling event, requires they be validated as they could be real or outliers. This would indeed be the intent of the Groundwater Monitoring Program, that would be established to monitor groundwater to ensure that there is no environmental impact, to be established and implemented at the completion of the decommissioning project.

CNSC Comment	Reply
5. Text on page 64, with respect to groundwater, states that: "A comparison of the groundwater chemistry to the clean up criteria indicates no significant impact to the environment as none of the analyses measured in the upstream monitoring wells show appreciably higher concentration levels than those in the wells located down gradient along the groundwater flow direction". CNSC staff indicated previously [2,3] that higher results in *downstream* samples would indicate an effect from the plant, rather than the other way around. OPG should review the current wording to determine if it is correct.	You are correct. The revised wording, which was inadvertently omitted from the June 2001 EA document, is: A comparison of the groundwater chemistry to the cleanup *guideline* criteria indicates no significant impact to the environment as none of the analytes measured in *the down gradient* monitoring wells show appreciably higher concentration levels than those in the wells located *upstream* along the groundwater flow direction.
6. Table 20 indicates that for the unconsolidated media aquifer, downstream ^{3}H and ^{137}Cs data are "Not Available". CNSC staff previously commented that this data gap precludes making a conclusion on the residual environmental effects following decommissioning with respect to these nuclear substances [1]. Therefore, OPG should acquire downstream ^{3}H and ^{137}Cs data for the unconsolidated media aquifer in order that the environmental effects may be properly assessed.	Your point is well taken. Radionuclides are not identified as a contaminant of concern related to the operation of the Bruce Heavy Water Plant, however, concentrations of selected radionuclides were measured and reported by the external Contractor. Unfortunately, the data set, as shown in Tables 2 and 3 (attached) is small and focuses on "upstream" groundwater. With regard to the carbonate aquifer, the upstream tritium concentrations ranged from <185 to 296 Bq/L. The single "internal" result is reported as 281 Bq/L while the two "downstream" groundwater results were both reported as 111 Bq/L. The Radioactive Isotope data set consists of C-14, Tritium, Co-60, and Cs-137. All values reported for C-14 were below the detection limit (<0.1 or <0.3 Bq/kg). As stated in the EA document, tritium values ranged from below detection limit (<5 nCi/kg (185 Bq/kg) to 8 nCi/kg (296 Bq/kg). These values are in the low end of the range occurring in groundwater and precipitation at the Bruce Nuclear Power Development site (Vorauer et. al., 1998)2. Reported Co-60 values were below the detection limit of 20 pCi/kg (0.74 Bq/kg) in all instances. Reported Cs-137 values were below the detection limit of 20 pCi/kg (0.74 Bq/kg) except for one sample with a reported value of 24+/-10 pCi/kg (89 ±0.37 Bq/kg) that is virtually at the detection limit. It is the intent to include radionuclides as part of the required analytes to be incorporated into the Groundwater Monitoring Program to be established.

1 C. Taylor and S. Munger (CNSC\REPD) to P. Fundarek (CNSC\WDD). June 30, 1999. Bruce Heavy Water Plant Environmental Assessment - REPD Comments (JMS 12812).

2 : Vorauer, A., H.M. Johnston and M.R. Jensen, 1998. Reconnaissance Level Groundwater Quality Monitoring Program Bruce Nuclear Power Development Generating Stations Bruce 1-4 and Bruce 5-8. OHT Report 6292-001-1997-RA-0001-R00.

CNSC Comment	Reply
7. Text on page 66 states that, with respect to measured groundwater tritium of up to 296 Bq/L, "These values are in the low end of the range occurring in natural groundwater". CNSC staff previously requested that a reference to support this statement be provided[3]. OPG has not provided any such reference. However, CNSC staff has reviewed OPG's Annual Summary and Assessment of Environmental Radiological Data for 2000[4]. Groundwater monitoring data for the Bruce site (Table 3.3.5, page 42) suggests that the following text is more accurate: "These values are in the low end of the range occurring in and around the Bruce site".	A reference for this statement is provided in Vorauer et al., 1998[2], as noted above. The revised wording of the text is: "These values are in the low end of the range occurring in and around the Bruce Heavy Water Plant".
8. All units for the measure of nuclear substance activity should be expressed in SI units. For example, the values expressed in nCi/kg and pCi/kg on page 66 require conversion to Bq/kg.	The rewritten EA sections, with the conversion in place is:: "Tritium concentrations ranged from below detection limit (185 Bq/kg) to 296 Bq/kg." Reported Co-60 values were below the detection limit of 0.74 Bq/kg in all instances. Reported Cs-137 values were below the detection limit of 0.74 Bq/kg except for one samples with a reported values of 0.89 ±0.37 Bq/kg that is virtually at the detection limit."

3 S. Munger and B. Richard (AECB\REPD) to P. Fundarek (AECB\WDD). April 14, 2000. Subject: Bruce Heavy Water Plant Environmental Assessment. BITS 708922.

4 Ontario Power Generation, Technical Support Branch, Environmental Affairs Subdivision. April 30, 2001. Annual Summary and Assessment of Environmental Radiological Data for 2000. N-REP-03419-10001-R00.

CNSC Comment	Reply
9. The first bullet in Section 8.2, Follow-up and Monitoring Program, states that: "A program to monitor groundwater, to ensure that there is no off-site environmental impact, will be carried out at the completion of the project". The term "off-site" should be removed from this statement. Then the monitoring program will be consistent with the requirement in S.12(1)(f) of the General Nuclear Safety and Control Regulations that: "every licensee shall take all reasonable precautions to control the release of radioactive nuclear substances or hazardous substances ***within the site*** of the licensed activity and into the environment as a result of the licensed activity".	We agree to the rewording of the sentence to: "A program to monitor groundwater, to ensure that there is no environmental impact, will be carried out at the completion of the project".

C.3 Period 3: July 2002 to September 2002

- Distribution List for Preliminary Draft EA Study Report
- Comments from local public.
- Responses by OPG.

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Canadian Nuclear Safety Commission Wastes and Geosciences Division 280 Slater Street Ottawa, Ontario K1P 5S9	Mr. Peter Fundarek, Project Officer	Peter	and your staff,		
Atomic Energy of Canada, Ltd. Bruce Nuclear Power Development P. O. Box 500, B01 Tiverton, Ontario N0G 2T0	Mr. David Harrington, Director, Bruce Power Services	David	and your staff,	Ext 2881	

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Friends of MacGregor Point Park R.R #1 Port Elgin, Ontario N0H 2C5	c/o Ms. Nora Toth	Nora	and your associates,		
Grey County County Admin Bldg., 595 9th Ave., E., Owen Sound, Ontario N4K 3E3	Mr. Larry Miller, Warden	Larry	and your Council and staff	519 376-2205	

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Probus 205 Kearns Lane Kincardine, ON N2Z 2X9	Alex Clarke	Alex		396-4505	
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Saugeen Valley Conservation Authority R. R. 1 Hanover, Ontario N4N 3B8	Mr. James Coffey, General Manager	Jim	and your staff,	519-364-1255	519-364-6990
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Canadian Nuclear Safety Commission Processing Facilities and Technical Support Division 280 Slater Street Ottawa, Ontario K1P 5S9	Mr. Larry Chamney Project Officer				
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817 Reynolds Drive
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N2G 3A5

Date: 17 August 2002

Your Ref: Letter 31 July 2002
Pre-Sub. Review

Ontario Power Generation,
700 University Avenue,
Toronto,
ON M5G 1X6 Attn: Mr. Tat Wong, Office H16-C27

Subject: **Pre- Submission Review Opportunity**
Draft Environmental Assessment Study Report
Bruce Heavy Water Plant Decommissioning Project.

In response to the invitation sent to Mr. Frank Baker, President, Bruce Hydro Retirees Association, for comments on the subject document, we respectfully submit as follows:

In general we believe that experience gained todate will result in a successful completion of the decommissioning project without long time adverse affects.

However, one aspect of possible concern in the future is the intention to leave 'below grade piping and wiring in-situ'. Experience of this past practice at the BNPD site often resulted in disproportionate costs being incurred when subsequent redevelopment was undertaken on previously developed/dismantled facilities.

This particularly applies to cabling which must always be treated as 'live' until proven to be completely isolated from all possible sources of energy. For this reason alone ALL unused circuit cabling/wiring should be pulled back, leaving only that currently in service. These to be marked above ground by warning signs, i.e. 'buried live cable – do not excavate'. (Drawings often fail to reflect 'field' conditions; 'temporary' feeds becoming permanent without being formally recorded.)

In ground piping should be isolated and capped with 'blanks' or blind flanges to prevent them becoming rodent warrens, which open ended piping could encourage. Large bore piping could be plugged with concrete rather than use fittings if these are not readily available or surplus.

Yours truly,

FBaker

Frank Baker, President.

J. F. Kirby

John F. Kirby, P.Eng., (Retired)

CMD 02-H20.2

File/dossier 1-3-1-7
Date 2002-08-27

Oral Presentation

Submission from Citizens for Renewable Energy

In the Matter of

Ontario Power Generation Inc.

Application by Ontario Power Generation Inc. for the renewal of the Bruce Heavy Water Plant Facility Operating Licence

One-Day Hearing

September 13, 2002

Exposé oral

Mémoire de Citizens for Renewable Energy

À l'égard de

Ontario Power Generation Inc.

Demande présentée par Ontario Power Generation Inc. visant le renouvellement du permis d'exploitation de l'usine d'eau lourde de Bruce

Audience d'un jour

Le 13 septembre 2002

CITIZENS FOR RENEWABLE ENERGY

CFRE

Ziggy Kleinau
Co-Ordinator
R.R. #4 Lion's Head
Ontario N0H 1W0
Phone/Fax: (519) 795-7725
http://www.web.net/~cfre

To the President and Members
Canadian Nuclear Safety Commission
Submission re: Licence renewal HWPOL 405-12.4, Hearing Sept. 13,2002

Dear President And Commission Members,
Thank you for the opportunity to comment on the request by Ontario Power Generation (OPG) for renewal of above operating licence for the Bruce Heavy Water Plant Facility (BHWP).

Citizens For Renewable Energy (CFRE) is a non-profit organization incorporated in Ontario in 1996 and comprised of over 1,000 members, with a large number residing in Bruce, Grey and Huron Counties.

The BHWP has ceased production as long as five years ago.. Part of the facility has been dismantled and the hydrogen sulphide inventory has been flared off - a very environmentally damaging activity!

In reviewing the CNSC staff CMD02-H20 and the OPG cmd02-20.1 we detected a number of inconsistencies in those reports:

OPG claims no radioactive or hazardous materials on site, posing no risk to public safety(4.1,Pg.2), while CNSC staff reports sealed sources of radioactive material in the facility and releases of hazardous substances, being controlled, with a 'very' low risk to environment and human health and safety. - There is obviously a distinct discrepancy in assessing risks!

CNSC staff reports that no triggers for Environmental Assessment are found under the CEAA, while OPG decided to do an EA. We certainly are curious about the reason. While it is recommendable to assess risks to environment and health from the decommissioning activity it seems this exercise is drawn out unnecessarily! In their Draft BHWP Decommissioning EA Study Report(July 2002) OPG mentions several times the positive effects of timely action to decommission the BHWP facility(Pgs. 94 and 98).

For this reason we have problems with a 2-year renewal of this facility's operating licence. Is OPG just trying to postpone the financial burden of the decommissioning activity? Of course there would be cost savings after the facility's removal as all kinds of safeguarding and security expenses as well as licensing fees would be eliminated.

We ask the Commission, therefore, to disregard staff's recommendation and instead approve only a one-year renewal, the same term as the previous licence. It would be advantageous for the Commission to encourage the proponent to apply for the final decommissioning licence in 2003, so that those ugly towers are removed and even the slightest risk to human health and the environment be speedily eliminated!

Thank you very much for taking our recommendations under serious consideration.

On behalf of the Directors and Members of CFRE

respectfully submitted,

Ziggy Kernau

S.(Ziggy) Kleinau, Coordinator;

RR #2
Tiverton, ON
N0G 2T0

Aug. 14, 2002

Mr. Tat Wong
Ontario Power Generation
700 University Ave., H16-C27
Toronto, ON
M5G 1X6

Dear Mr. Wong:

The July 31, 2002 “Dear Neighbour” letter directs my comments and questions to you for response. Thank you for receiving these.

To address the concerns I may have about the Environmental Assessment to decommission the BHWP, I need to review certain files and documents referred to in this report, but not included as part of the package Mr. Johansen sent me.

First, let me extend my appreciation that OPG is now willing to share such documents and requests with the concerned public. On page 87, this document states: “OPG will monitor the project activities and will exchange information on a regular basis with local municipalities and interested groups/individuals as decommissioning proceeds.” This apparent change in OPG policy is very helpful and, as a result, I feel confident in forwarding the following requests to you. However, before I do so, I wonder if, in your reply, you would inform me as to why OPG has decided to be more forthcoming with the information individuals and groups may require? And thank you for doing so.

Also, I note two other apparent changes in corporate policy, changes I find most welcoming.

- On page 90, this report states: “When the decommissioning project is initiated, Ontario Hydro will ensure that the work complies with the current legislation that is in effect at the time.” However, in your letter to Ms. Barbara Brownlee, MOE, of Oct. 5, 1998, you state on page 2: “Construction of the BHWP was undertaken prior to the enactment of the Environmental Assessment Act, and therefore, pursuant to section 4 of the General Regulation, R.R.O. 1990, Regulation 334, the retirement of the facility is also exempted.”. Can you explain this apparent discrepancy of statements made in the current Environmental Assessment? Will agreement to comply with current legislation mean that OPG will accept to be bound legally to its commitments to both ALARA and the precautionary principle, as specified in its Policy Directives?
- On page 101, you state that OPG will: “Investigate and compensate any claimed loss or disruption of business facilities as per OPG policy.” How long has this policy been in effect? Was it carried over from Ontario Hydro’s policy and, if so, how long was this policy in effect at Ontario Hydro? Thank you for your attention to these two specific concerns.

I am now preparing an analysis of this document. In order to address some areas of concern, I am requesting the following files:

1. The Detailed Decommissioning Plan (DDP), excerpts of which form Part 2 of this Environmental Assessment
2. Page 92, in reference to the SWTF, says: "This system was designed to handle large quantities of iron during steamouts." Were these concentrations monitored and measured? Were summary and detailed logs kept describing the monitored
   concentrations of iron? What other metals and minerals were present and/or monitored during steamout and were summary and detailed logs of these kept? If so, please send me copies of these summaries, logs and/or statistics. If not, please indicate why not and send any relevant data and/or explanations.
3. Could I have a summary of significant event reports logged during the operations of the BHWP?

Thank you.

Yours truly,

Eugene Bourgeois.

This is 2002 and the open house to discuss this project was done 4 years ago. Has nothing happened between 1998 and 2002 to warrant a current period of public comment? I believe both that the world has changed, particularly since Sept. 11, 2001, and public opinion about OPG and its projects have changed, particularly since the court rulings and costs awards against the IDRA, a local beach association.

Although OPG makes the claim that no comments of significance were made in 1998, it does state that comments were made, but fails to elucidate them. Without this information, it is impossible to know whether this report does meet the specifics of the comments received, if they are relevant, and why these comments are not addressed, if deemed to be irrelevant. A current period of public comment is essential for this Environmental Assessment as well as list of the questions raised by the public in 1998 and the actions taken in this report to address these concerns.

The history of the operations of the BHWP, Section 2.1, makes no mention of the serious environmental harm caused by the plant, particularly here on our farm and to me and my family. In fact, an article reprinted in the appendices to the report makes safety claims which I find outrageous in light of my direct experience with the very negative impact of "planned emissions" from BHWP.

In this article, Mr. Peter Landry, a retired heavy water plant employee, states the following: "I'm still interested. The heavy water plant was the best plant in all of Ontario Hydro. We met our production quota and budget every year. We were the jewel in Ontario Hydro's crown." Later in the article, Mr. Landry states: "there was never a loss of life during the operation of the plant."

This biassed approach gives an impression of an operation whose environmental impact has been benign. When Mr. Landry claims that there has been no loss of life, I assume he is referring to human death because our farm lost in excess of 300 sheep and lambs, hundreds of chickens and all of our barn kittens. I suffered grievous bodily harm on at least 2 occasions and my youngest daughter once. Our sheep on pasture went blind after one gaseous excursion and when they lambed a month and a half later, two out of three lambs born were dead within four days.

As this news article indicates, it was **production and budget that ruled at BHWP**. The University of Guelph epidemiological study demonstrated that our neonatal lamb loss was in the 99th percentile, and that there was no discernible cause for such bizarre birthing patterns based on farm management or flock health. Ontario Hydro (if it actually followed the commitment to the precautionary principle specified in its Policy Directives) ought to have ceased operations or modified them to mitigate this ongoing harm. No such action occurred and the BHWP continued to flare through the Thermal Internal Boundary Layer (TIBL), even when the operators were made aware of the harm and havoc these emissions were creating here.

Following the University of Guelph epidemiological study, the Atomic Energy Control Board commissioned a study to question the cause/effect relationship between plant operations and death on our farm (BMD ****). This study, which was not implemented, would have lasted five years and involved removing half our flock to a secure location and replacing this half with a flock from that location. I would not have been able to farm, as such, and the authors of this study believed that I needed to be compensated for the loss of income over that period while I transferred our farm operation to that of a research station. Because this study was never completed, a cause/effect relationship has yet to be determined to the satisfaction of the regulator or yourselves; both of you chose to devalue or ignore the evidence I produced for Hydro/OPG at the time.

However, over the ensuing years since the plant was shut-down, I have continued to tabulate the data of our lambing records. When the five year period is finished, I will be able to bring forth the data which both you and the regulator have said you are interested in amassing, thereby demonstrating either that the BHWP produced heavy water safely, or that it has failed to do so safely.

The collection of that data is now virtually complete. Here is how it was done.

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world has changed, particularly since Sept. 11, 2001, and public opinion about OPG and its projects have changed, particularly since the court rulings and costs awards against the IDRA, a local beach association.

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The collection of that data is now virtually complete. Here is how it was done.

The BHWP ceased production on Nov. 6, 1997. It flared its last H2S on Jan. 23, 1998. It completed the "sweetening" of the system by March 31, 1998. Thus, as of Nov. 6, 2002, we will have had 5 years of lambing data without the impact of heavy water production, as of Jan. 23, 2003, 5 years free of the impact of the flare stack operations, and as of Mar. 31, 2003, 5 years of operations with no impact whatsoever from H2S and its by-products. The results of this data to date show conclusively a cause/effect relationship between plant operations and morbidity and mortality on our farm.

The damage was not contained to my flock. On May 8, 1985, I walked into a pocket of flare stack emissions while picking stones on a neighbour's farm. I was almost overcome with the gas and managed to struggle home where I rested and recovered. My doctor, who was trained by the BHWP in symptom diagnosis, confirmed H2S as the cause. Sheep and lambs exposed on our farm began dying or showing signs of ill health soon afterwards, with subsequent lambing characterised by lambs born in gelatinous sacs and/or lambs who refused to nurse. Over the course of the next 10 years, we lost more than 300 sheep and lambs, always in conjunction with flaring operations at the BHWP.

On page 101, this EA states that OPG will: "Investigate and compensate any claimed loss or disruption of business facilities as per OPG policy". Why was compensation not paid to us? Ontario Hydro was well aware that I claimed this operation to be the cause and that I sought payment from Ontario Hydro for both the loss of income and the disruption of business.

Just what was done?

BMD **** discusses the impact of BHWP operations on my personal health. McMaster University Occupational Health Clinic demonstrated that I had indeed suffered from central nervous system disorders and they suspected flare stack emissions to be that cause. AECB staff asked the Ontario Ministry of Health whether 25 ppb, the peak concentration measured by the monitoring station, was sufficient to have been that cause. It failed to inform the Ministry that this representation of 25 ppb could have been in response to an assault of 110 ppm, due to the way this monitor collects data, as my consultants had demonstrated and was agreed to by all parties, Ontario Hydro, the MOE and the AECB. The Ministry confirmed that 25 ppb could not have caused these disorders in my central nervous system and the AECB accepted that the BHWP could not have caused these symptoms.

The problem of neonatal loss took longer to dismiss. The University of Guelph epidemiological study was followed by a draft report to determine cause/effect. This was not pursued by the responsible authority, the AECB, for reasons which have never been disclosed to me or the authors.

In 1994, the Ministry of the Environment of Ontario conducted a phytotoxicological study of our vegetation and concluded that it was adequate to support the nutritional needs of our sheep. Our feed had been analysed and was demonstrated to be adequate. Our farm management practices were demonstrated to be adequate. Our flock itself was in good health and this too had been demonstrated by research results. The Federal Health of Animals inspector concluded that H2S had caused the loss of life on our farm as did every other independent study or report.

In 1997, the AECB completed its analysis of my lambing data and concluded that what occurred here during flare stack emissions was a simple statistical anomaly, and that my neonatal lamb loss was within the range given by the "Shepherds" study. I was hardly surprised they had reached such a conclusion because data from our farm had contributed to the study! Our horrendous experience was included in the "Shepherds" study and thus it was a necessary proposition that our lambing data should be consistent with the range of data collected. What astonishes me is that our regulator, knowing that my data was part of the "Shepherds" study, would make this sort of statement without the necessary qualifications.

To date, no explanation has been put forward by AECB, OPG or any other authority to explain why our sheep on pasture went blind following a fumigation.

- The meteorology was also studied and commented on by all sides. My consultants, from Cornell University, concluded that up to 110 ppm of H2S and/or SO2 could descend on our farm during a fumigation through a TIBL.
- Robert Bloxam of the MOE (letter dated ****) agrees with this.
- Robert Franklin, then President and CEO of Ontario Hydro in a letter dated ****, unwittingly agrees with me. In his letter, he purports that concentrations 5,000 times greater than those monitored would be required to cause the symptoms our farm recorded. That's an amount equal to 100 ppm, or what we have shown to be possible on the basis of modelling systems used to determine concentrations of these gases.
- The AECB (BMD ****) found that 10 ppm were the highest possible concentrations, and that 10 ppm could not have caused the effects observed here. This is indeed a fortunate conclusion

because: "... H2S concentrations below the H2S Threshold Limit Value (TLV) of 10 ppm must be achieved". (Part 2, page 13)

Our lambing data now confirms that Prof. Lumley's analysis (he is the meteorologist from Cornell University who was my consultant) is the correct one. With these high concentrations now plausibly confirmed with this data, there can be no doubt that my symptoms, as well as those of my daughter, will have been caused by flare stack emissions.

An Environmental Assessment that includes a summary of the impact of the production operations of the heavy water plant on this community must also recognise the plant's culpability in causing both grievous bodily harm to outside members of the public, and wanton loss of life to livestock. This report purports the opposite and, so, is deeply flawed. I look forward to seeing these facts correctly discussed and described in the final report.

Page 99 states boldly: "All H2S and other bulk chemicals were removed from the systems and disposed of in an approved manner, without any environmental incidences." This is pejorative. An analysis of my lambing data from that period has not been undertaken and I did have two very suspicious deaths immediately following the flaring activity of lambs who were <u>in utero</u> at the time. Until all of this data is analysed (something that cannot be done to determine cause/effect until a period of five years has passed) no such conclusion can be reached.

Pages 100-2 discuss the mitigation measures proposed during this demolition. Missing is any reference to an analysis of the metallic composition of the towers. This report earlier details the damage done to the towers during the production process; something apparently happened which rendered these materials unsuitable for salvage (Part 2, page 2). On numerous occasions during the production of heavy water and when our lamb losses were high, I requested information from both Ontario Hydro and the Atomic Energy Control Board for details relating to the metals and minerals which will have been released to the atmosphere during steamout. Without exception, I was told it would either be too difficult, too unsafe or impossible to determine what metals and minerals were included with the H2S being flared. My concern was a reasonable one: what new toxins might have been created in the tort of the flare stack during steamout when these gases were flared with the addition of propane. Could these metallic contaminants have added to the problems created here by flare stack emissions? This report suggests that data was collected at the SWFT analysing iron content. What else has been measured and how might this have changed the composition of flare stack emissions? Part 2, page 2 states: "In addition, the demand for this equipment especially items exposed to hydrogen sulfide, is low and the salvage value would not offset the extra cost of dismantling." Hence, an analysis of this data now will help to determine the exact residual concentrations that went to the flare stack.

Page 94 states: "Consideration was given to a range of possible interactions between the decommissioning activities of the BHWP facility and past development. This included effects on biological resources (e.g. wildlife and wildlife habitat), land resources, communities, water quality, air quality and human health."

Where are the details of this consideration?

Between 1985 and 1998 (when all operations ceased), I was seriously harmed twice, my daughter once and my livestock frequently. However, there is no report of this harm. Merely because the time-frame has yet to elapse to demonstrate conclusively the cause/effect relationship between **past** activity and these incidents, you cannot make the claim that no effects occurred.

While you state on page 99: "Mitigation measures are based on good environmental management practices prior to, during, and after the demolition and removal of the facilities and its associated materials", my experience demonstrates that these practices were not in place when heavy water was being produced. Mitigation would have been simple: since the study prepared by Y.A. Tam in 1985 demonstrated that the TIBL occurred daily during April/May (46.9% of the time), mitigation was simple once you knew, as you did in April, 1985 that I and my sheep suffered from flare stack emissions.

Both the precautionary principle and ALARA, then part of Ontario Hydro's Policy Directives, demand that you take appropriate mitigating action, a practice you steadfastly refused to take. I demonstrated "uncertainty", by hiring health scientists and meteorologists accepted as world class to make the case that these emissions had caused these problems. Both the precautionary principle and ALARA now demand a change in BHWP operations to mitigate this harm. Instead, the industry and regulators demanded that I provide proof "beyond a shadow of doubt". Since all analysis is based on modelling systems, such proof is impossible, at least as long as the BHWP was in operation. A review of my lambing records between then and now, however, will confirm this cause/effect relationship "beyond a shadow of doubt".

While it is admirable that you intend to comply with such objectives now, there appear to me no grounds for your failure to do so during production.

On page 95, you state: "An adverse effect is normally deemed to be significant where a regulatory standard, guideline or objective is exceeded." The Atomic Energy Control Board, as both the regulator and the licensor, adheres to the ALARA and, in accepting a licence to operate the BHWP you agreed to abide by this condition. When you didn't, the adverse effects experienced by both people and livestock here were in evidence. As I said, mitigation was simple: since these effects were observable following flaring at these critical periods, you need not have flared routinely during these periods. That may only have meant rescheduling your maintenance schedules to avoid flaring during daylight hours in April/May, or whenever the TIBL was present; you could have attempted to mitigate the harm we encountered, but did not.

Since this report clearly refers to past activity, a detailed explanation is in order.

The deadline for these comments preclude many other deficiencies of this Environmental Assessment being set forth. If you were to grant an appropriate extension, I will be happy to help you make this a world class Environmental Assessment, one which accepts both the benefits and pitfalls of the operations of the BHWP here.

Eugene Bourgeois

RR #2
Tiverton, ON
N0G 2T0

Sept. 9, 2002

Tat Wong
Senior Specialist
Environmental Assessment Department
Nuclear Waste Management Division
Ontario Power Generation

Dear Mr. Wong:

Thank you for telling me you received my comments on time and that you will be considering them in light of writing the EA for the decommissioning of the BHWP.

I am writing now to inquire about the status of my request for further information, which this draft suggests you wish to share with me. You mentioned that my request for the Detailed Decommissioning Plan (DPP) had been forwarded to your consultant, who prepared it, so they could print a copy. That was two weeks ago. With respect to my other queries, you responded then that it had been sent to a team at OPG for review and action. When might I expect a response?

Further to this draft EA, I have a few more requests for information:

- page 5 states: "At that time a decision was made to continue to produce heavy water for external markets." Prior to this time (1993) heavy water was produced for domestic needs only, an action that could, perhaps, be deemed to be in the greater public good, thus protecting this operation from the harm it may or may not do, either intentionally or unintentionally, to a small subset of the population as a whole. Once you engaged in routine commercial operations, would this have changed your liability to, perhaps, that small subset of the population?
- Page 9 states: "The decommissioning project encompasses all the heavy water plant areas previously licenced by the AECB/CNSC." Does this mean that the construction licenses for plants 'C' and 'D' , which have no expiry date, are hereby revoked and cancelled?
- Would it be possible to get a copy of the preliminary BHWP Decommissioning Plan, Revision 1, 2000, as described on page 11?
- Page 17 states: "At present there are no definitive plans for the balance of the BHWP site." Are there currently any credible ideas or plans for this site and, if so, what are they?
- Page 19 asserts that the alternative means of achieving the goals of the project were dismantlement and demolition. Is this a complete list?
- Page 24 states: "Questions were also asked about the history of the plant ..." What were those questions?
- Page 35, "Site-Specific Meteorology" states: "These data [referring to the 5-year wind speed and direction study] were recorded at the on-site 10-m meteorological tower." May I have a copy of these data?

- Page 41 states: "We chose 1994 as a reference year and compiled an extensive yearly meteorological data set. The data set consists of 8760 hourly records and each of the records contain all of the above mentioned parameters." May I have a copy of this data set?
- The chart on page 41 states that the mean wind speed is 5 m/s, and on page 34, it is stated that mean wind speed is 4 m/s. Which is correct and why is there a discrepancy?
- Part 2, page 3 of your October, 1998 letter to Bill Hutchinson of the MOE states: "The initial phase is a review of station records, environmental reports and a site inspection." may I have a copy of the records reviewed?
- Part 2, page 7, in the "Groundwater" section describes the metals detected in the Phase 2 ESA water samples. Would these be indicative of the process deterioration of the BWHP and its component parts? If so, in what ways will they have been included in the effluent flared during "planned emissions"?
- On page 12, part 2, you state: "Some waste may also be disposed at the BNPD site landfill." What percentage, both in terms of volume and weight, is expected to be transported to the BNPD landfill site, and will any of this material be contaminated with radiological wastes?
- Part 2, page 16, is Table 3.1. Will there be a continuous survey of these waste materials that will demonstrate how much of each category will have been filled as presented in this Table?

Thank you so much for your time.

Yours truly,

Eugene Bourgeois

cc: Linda S. Keen, CNSC

OPG Responses to Public Comments on Draft EA Study Report Prior to Submission

No.	Comments from Members of the Public	OPG Responses
Mr. Eugene Bourgeois (No. 1 of 3, August 14, 2002)		
1.	On page 87, this document states: "OPG will monitor the project activities and will exchange information on a regular basis with local municipalities and interested groups/individuals as decommissioning proceeds." This apparent change in OPG policy is very helpful and, as a result, I feel confident in forwarding the following requests to you.	Noted.
2.	I wonder if, in your reply, you would inform me as to why OPG has decided to be more forthcoming with the information individuals and groups may require?	There has been no change in OPG policy in this regard. We are following normal EA practice.
3.	On page 90, this report states: "When the decommissioning project is initiated, Ontario Hydro will ensure that the work complies with the current legislation that is in effect at the time." However, in your letter to Ms. Barbara Brownlee, MOE, of Oct. 5, 1998, you state on page 2: "Construction of the BHWP was undertaken prior to the enactment of the Environmental Assessment Act, and therefore, pursuant to section 4 of the General Regulation, R.R.O. 1990, Regulation 334, the retirement of the facility is also exempted.". Can you explain this apparent discrepancy of statements made in the current Environmental Assessment? Will agreement to comply with current legislation mean that OPG will accept to be bound legally to its commitments to both ALARA and the precautionary principle, as specified in its Policy Directives?	There is no discrepancy. Plant A was constructed by AECL well before provincial EA legislation came into effect. Expansion (Plants B, C & D) was subsequently undertaken by (then) Ontario Hydro following provincial government approval, based on an EA submitted by OH prior to enactment of the provincial EA Act, and construction approval by the (then) AECB. The CNSC, as Responsible Authority under CEAA for this EA, has determined in consultation with the MOE that there are no provincial EA requirements that apply to this project. Compliance with current legislation is not a matter of agreement, it is OPG policy. OPG's environmental (sustainable energy development) policy includes commitments to continual improvement in emission prevention and application of the precautionary principle, among other things. Definition of the latter in OPG's policy includes a commitment to implement cost-effective mitigation measures for impacts that cannot be avoided.
4.	On page 101, you state that OPG will: "Investigate and compensate any claimed loss or disruption of business facilities as per OPG policy." How long has this policy been in effect? Was it carried over from Ontario Hydro's policy and, if so, how long was this policy in effect at Ontario Hydro?	This statement in the previous draft EA report was not as clear as it could have been. It will be revised or removed as appropriate. Consistent with general practice, it was never OH policy to compensate claims of loss or disruption unless OH deemed it appropriate on the basis of an assessment of environmental effects and related impact on the public. The OH policy in this regard (now an OPG standard) dates back to the early 1980s.

No.	Comments from Members of the Public	OPG Responses
5.	… I am requesting the following files: 1. The Detailed Decommissioning Plan (DDP), excerpts of which form Part 2 of this Environmental Assessment.	A copy was mailed on September 11, 2002.
6.	2. Page 92, in reference to the SWTF, says: "This system was designed to handle large quantities of iron during steamouts." Were these concentrations monitored and measured? Were summary and detailed logs kept describing the monitored concentrations of iron? What other metals and minerals were present and/or monitored during steamout and were summary and detailed logs of these kept? If so, please send me copies of these summaries, logs and/or statistics. If not, please indicate why not and send any relevant data and/or explanations.	Yes, we did monitor iron concentrations and a number of other parameters for MISA compliance purposes. No other metals were expected to be present in the condensate/water directed to the SWTF. All monitoring results were reported to the MOE. Results relevant to current assessment of the decommissioning project will be included in the revised EA report. The assessment is indicating that iron concentrations from the SWTF will remain within the limits of the MOE Certificate of Approval. A copy of the revised EA report will be provided to Mr. Bourgeois after it has been issued.
7.	Could I have a summary of significant event reports logged during the operations of the BHWP?	Significant event reports (now referred to as Station Condition Records) are restricted under information exchange rules established between OPG and Bruce Power. All SERs were reported to the (then) AECB. The revised EA report will include information on past operational events to the extent that these are relevant to assessment of the decommissioning project.
Mr. Eugene Bourgeois (No. 2 of 3, August 30, 2002)		
8.	This is 2002 and the open house to discuss this project was done 4 years ago. Has nothing happened between 1998 and 2002 to warrant a current period of public comment? …… Although OPG makes the claim that no comments of significance were made in 1998, it does state that comments were made, but fails to elucidate them. Without this information, it is impossible to know whether this report does meet the specifics of the comments received, if they are relevant, and why these comments are not addressed, if deemed to be irrelevant. A current period of public comment is essential for this Environmental Assessment as well as list of the questions raised by the public in 1998 and the actions taken in this report to address these concerns.	Since 1998, the only work on the remaining BHWP facilities has been reconfiguration of some steam, electrical and water systems to allow continued operation of parts of these systems, as required, after the BHWP is fully decommissioned. Section 5.3 of the revised EA report will explain the consultation that continued during the interim period between the end of 1998 and mid-2002, primarily with federal, provincial and regional/local government staff. The consultation in August of this year was intended to update the status of local community views regarding the proposed decommissioning project. The revised EA report will summarize the 1998 consultation results as well as provide responses to all public comments received this summer.
9.	The history of the operations of the BHWP, Section 2.1, makes no mention of the serious environmental harm caused by the plant, particularly here on our farm and to me and my family.	The purpose of this section (1.1.2 in the revised EA report) is to explain how the BHWP evolved to its current status. It is not intended to be an assessment of the effects of past operation of the BHWP (outside the scope of this EA).

No.	Comments from Members of the Public	OPG Responses
10.	In fact, an article reprinted in the appendices to the report makes safety claims which I find outrageous in light of my direct experience with the very negative impact of "planned emissions" from BHWP.	The article in question was one of a number of news clippings intended to illustrate local media coverage of the public open house conducted in December 1998. OPG cannot be responsible for statements made by members of the public (incl. retired employees) or how the media report them.
11.	In this article, Mr. Peter Landry, a retired heavy water plant employee, states the following: "I'm still interested. The heavy water plant was the best plant in all of Ontario Hydro. We met our production quota and budget every year. We were the jewel in Ontario Hydro's crown." Later in the article, Mr. Landry states: "there was never a loss of life during the operation of the plant." This biassed approach gives an impression of an operation whose environmental impact has been benign.	These aspects of past BHWP operation are not relevant to the current EA. Inclusion of such news clippings was not intended to bias the EA assessment which has been conducted in a methodical and disciplined manner using well established procedures and criteria.
12.	When Mr. Landry claims that there has been no loss of life, I assume he is referring to human death because our farm lost in excess of 300 sheep and lambs, hundreds of chickens and all of our barn kittens. I suffered grievous bodily harm on at least 2 occasions and my youngest daughter once. Our sheep on pasture went blind after one gaseous excursion and when they lambed a month and a half later, two out of three lambs born were dead within four days.	See above responses to comments 10 & 11.
13.	As this news article indicates, it was **production and budget that ruled at BHWP**. The University of Guelph epidemiological study demonstrated that our neonatal lamb loss was in the 99th percentile, and that there was no discernible cause for such bizarre birthing patterns based on farm management or flock health. Ontario Hydro (if it actually followed the commitment to the precautionary principle specified in its Policy Directives) ought to have ceased operations or modified them to mitigate this ongoing harm. No such action occurred and the BHWP continued to flare through the Thermal Internal Boundary Layer (TIBL), even when the operators were made aware of the harm and havoc these emissions were creating here.	Disagree. The BHWP was subject to environmental and safety regulations and AECB licence conditions throughout its operating life, until it was shut down in November 1997. These concerns about past operation of the BHWP are noted and will be included in the revised EA report (in this table) for the information of the regulator, the CNSC. However, they are not relevant to the current EA. This EA is required to focus on assessing the likely environmental effects of the proposed decommissioning. Mr. Bourgeois will have an opportunity to comment directly to federal authorities re: the revised EA report during the post-submission review period which will be administered by the CEAA Agency after referral from the CNSC.

No.	Comments from Members of the Public	OPG Responses
14.	Following the University of Guelph epidemiological study, the Atomic Energy Control Board commissioned a study to question the cause/effect relationship between plant operations and death on our farm (BMD ****). This study, which was not implemented, would have lasted five years and involved removing half our flock to a secure location and replacing this half with a flock from that location. I would not have been able to farm, as such, and the authors of this study believed that I needed to be compensated for the loss of income over that period while I transferred our farm operation to that of a research station. Because this study was never completed, a cause/effect relationship has yet to be determined to the satisfaction of the regulator or yourselves; both of you chose to devalue or ignore the evidence I produced for Hydro/OPG at the time.	See response to comment 13.
15.	However, over the ensuing years since the plant was shut-down, I have continued to tabulate the data of our lambing records. When the five year period is finished, I will be able to bring forth the data which both you and the regulator have said you are interested in amassing, thereby demonstrating either that the BHWP produced heavy water safely, or that it has failed to do so safely.	See response to comment 13.
16.	The collection of that data is now virtually complete. Here is how it was done. The BHWP ceased production on Nov. 6, 1997. It flared its last H2S on Jan. 23, 1998. It completed the "sweetening" of the system by March 31, 1998. Thus, as of Nov. 6, 2002, we will have had 5 years of lambing data without the impact of heavy water production, as of Jan. 23, 2003, 5 years free of the impact of the flare stack operations, and as of Mar. 31, 2003, 5 years of operations with no impact whatsoever from H2S and its by-products. The results of this data to date show conclusively a cause/effect relationship between plant operations and morbidity and mortality on our farm.	See response to comment 13.
17.	The damage was not contained to my flock. On May 8, 1985, I walked into a pocket of flare stack emissions while picking stones on a neighbour's farm. I was almost overcome with the gas and managed to struggle home where I rested and recovered. My doctor, who was trained by the BHWP in symptom diagnosis, confirmed H2S as the cause.	See response to comment 13.

No.	Comments from Members of the Public	OPG Responses
18.	Sheep and lambs exposed on our farm began dying or showing signs of ill health soon afterwards, with subsequent lambing characterised by lambs born in gelatinous sacs and/or lambs who refused to nurse. Over the course of the next 10 years, we lost more than 300 sheep and lambs, always in conjunction with flaring operations at the BHWP.	See response to comment 13.
19.	On page 101, this EA states that OPG will: "Investigate and compensate any claimed loss or disruption of business facilities as per OPG policy". Why was compensation not paid to us? Ontario Hydro was well aware that I claimed this operation to be the cause and that I sought payment from Ontario Hydro for both the loss of income and the disruption of business. Just what was done?	See response to comment 4. While this issue is not relevant to the current EA, OPG continues to believe that the operation of the BHWP could not have caused the effects claimed by Mr. Bourgeois. OPG's position is supported by independent determinations by the AECB and the MOE.
20.	BMD **** discusses the impact of BHWP operations on my personal health. McMaster University Occupational Health Clinic demonstrated that I had indeed suffered from central nervous system disorders and they suspected flare stack emissions to be that cause. AECB staff asked the Ontario Ministry of Health whether 25 ppb, the peak concentration measured by the monitoring station, was sufficient to have been that cause. It failed to inform the Ministry that this representation of 25 ppb could have been in response to an assault of 110 ppm, due to the way this monitor collects data, as my consultants had demonstrated and was agreed to by all parties, Ontario Hydro, the MOE and the AECB. The Ministry confirmed that 25 ppb could not have caused these disorders in my central nervous system and the AECB accepted that the BHWP could not have caused these symptoms.	See response to comment 13.
21.	The problem of neonatal loss took longer to dismiss. The University of Guelph epidemiological study was followed by a draft report to determine cause/effect. This was not pursued by the responsible authority, the AECB, for reasons which have never been disclosed to me or the authors.	See response to comment 13.

No.	Comments from Members of the Public	OPG Responses
22.	In 1994, the Ministry of the Environment of Ontario conducted a phytotoxicological study of our vegetation and concluded that it was adequate to support the nutritional needs of our sheep. Our feed had been analysed and was demonstrated to be adequate. Our farm management practices were demonstrated to be adequate. Our flock itself was in good health and this too had been demonstrated by research results. The Federal Health of Animals inspector concluded that H2S had caused the loss of life on our farm as did every other independent study or report.	See response to comment 13.
23.	In 1997, the AECB completed its analysis of my lambing data and concluded that what occurred here during flare stack emissions was a simple statistical anomaly, and that my neonatal lamb loss was within the range given by the "Shepherds" study. I was hardly surprised they had reached such a conclusion because data from our farm had contributed to the study! Our horrendous experience was included in the "Shepherds" study and thus it was a necessary proposition that our lambing data should be consistent with the range of data collected. What astonishes me is that our regulator, knowing that my data was part of the "Shepherds" study, would make this sort of statement without the necessary qualifications. To date, no explanation has been put forward by AECB, OPG or any other authority to explain why our sheep on pasture went blind following a fumigation.	See response to comment 13.
24.	An Environmental Assessment that includes a summary of the impact of the production operations of the heavy water plant on this community must also recognise the plant's culpability in causing both grievous bodily harm to outside members of the public, and wanton loss of life to livestock. This report purports the opposite and, so, is deeply flawed. I look forward to seeing these facts correctly discussed and described in the final report.	This EA is not intended to include a summary of the impact of BHWP operation. The purpose of providing an overview summary of past operation and staged decommissioning (section 1.1.2.1 in the revised EA report) was explained in response to comment 9.

No.	Comments from Members of the Public	OPG Responses
25.	Page 99 states boldly: "All H2S and other bulk chemicals were removed from the systems and disposed of in an approved manner, without any environmental incidences." This is pejorative. An analysis of my lambing data from that period has not been undertaken and I did have two very suspicious deaths immediately following the flaring activity of lambs who were in utero at the time. Until all of this data is analysed (something that cannot be done to determine cause/effect until a period of five years has passed) no such conclusion can be reached.	The latter part of this statement has been removed in the revised EA report, as it is not required for current EA purposes. However, OPG notes that controlled flaring to dispose of the H_2S remaining in the BHWP after shut-down in 1997, as approved by the AECB and MOE, was deferred if the wind was blowing in the direction of Mr. Bourgeois' residence.
26.	Pages 100-2 discuss the mitigation measures proposed during this demolition. Missing is any reference to an analysis of the metallic composition of the towers. This report earlier details the damage done to the towers during the production process; something apparently happened which rendered these materials unsuitable for salvage (Part 2, page 2). On numerous occasions during the production of heavy water and when our lamb losses were high, I requested information from both Ontario Hydro and the Atomic Energy Control Board for details relating to the metals and minerals which will have been released to the atmosphere during steamout. Without exception, I was told it would either be too difficult, too unsafe or impossible to determine what metals and minerals were included with the H2S being flared. My concern was a reasonable one: what new toxins might have been created in the tort of the flare stack during steamout when these gases were flared with the addition of propane. Could these metallic contaminants have added to the problems created here by flare stack emissions? This report suggests that data was collected at the SWFT analysing iron content. What else has been measured and how might this have changed the composition of flare stack emissions? Part 2, page 2 states: "In addition, the demand for this equipment especially items exposed to hydrogen sulfide, is low and the salvage value would not offset the extra cost of dismantling." Hence, an analysis of this data now will help to determine the exact residual concentrations that went to the flare stack.	Analysis of the metallic composition of the towers is not relevant for mitigation of likely environmental effects of the proposed BHWP decommissioning. No metallic contaminants were directed to the flare stack. The SWTF was not connected to the flare system. Propane was added to promote complete combustion of the gas mixture at the flare tip. The flare stack was not a reaction vessel (or tort).

No.	Comments from Members of the Public	OPG Responses
27.	Page 94 states: "Consideration was given to a range of possible interactions between the decommissioning activities of the BHWP facility and past development. This included effects on biological resources (e.g. wildlife and wildlife habitat), land resources, communities, water quality, air quality and human health." Where are the details of this consideration?	This was in the context of cumulative effects assessment. This part of the EA has been substantially revised and expanded in the revised EA report, consistent with the defined spatial and temporal boundaries of the EA.
28.	Between 1985 and 1998 (when all operations ceased), I was seriously harmed twice, my daughter once and my livestock frequently. However, there is no report of this harm. Merely because the time-frame has yet to elapse to demonstrate conclusively the cause/effect relationship between **past** activity and these incidents, you cannot make the claim that no effects occurred.	See response to comment 27.
29.	While you state on page 99: "Mitigation measures are based on good environmental management practices prior to, during, and after the demolition and removal of the facilities and its associated materials", my experience demonstrates that these practices were not in place when heavy water was being produced. Mitigation would have been simple: since the study prepared by Y.A. Tam in 1985 demonstrated that the TIBL occurred daily during April/May (46.9% of the time), mitigation was simple once you knew, as you did in April, 1985 that I and my sheep suffered from flare stack emissions.	See response to comment 13. Mitigation of any past effects of BHWP operation is beyond the scope of this EA. The extent to which aspects of past operation are relevant to the current EA is discussed in the cumulative effects assessment (section 9) of the revised EA report.

No.	Comments from Members of the Public	OPG Responses
30.	Both the precautionary principle and ALARA, then part of Ontario Hydro's Policy Directives, demand that you take appropriate mitigating action, a practice you steadfastly refused to take. I demonstrated "uncertainty", by hiring health scientists and meteorologists accepted as world class to make the case that these emissions had caused these problems. Both the precautionary principle and ALARA now demand a change in BHWP operations to mitigate this harm. Instead, the industry and regulators demanded that I provide proof "beyond a shadow of doubt". Since all analysis is based on modelling systems, such proof is impossible, at least as long as the BHWP was in operation. A review of my lambing records between then and now, however, will confirm this cause/effect relationship "beyond a shadow of doubt". While it is admirable that you intend to comply with such objectives now, there appear to me no grounds for your failure to do so during production.	See responses to comments 3, 13 and 29. The BHWP is no longer operating, so a change in its operation now is not practical or logical.
31.	On page 95, you state: "An adverse effect is normally deemed to be significant where a regulatory standard, guideline or objective is exceeded." The Atomic Energy Control Board, as both the regulator and the licensor, adheres to the ALARA and, in accepting a licence to operate the BHWP you agreed to abide by this condition. When you didn't, the adverse effects experienced by both people and livestock here were in evidence. As I said, mitigation was simple: since these effects were observable following flaring at these critical periods, you need not have flared routinely during these periods. That may only have meant rescheduling your maintenance schedules to avoid flaring during daylight hours in April/May, or whenever the TIBL was present; you could have attempted to mitigate the harm we encountered, but did not. Since this report clearly refers to past activity, a detailed explanation is in order.	This statement was in the context of determination of significance of the predicted residual effects of BHWP decommissioning, taking proposed mitigation measures into account, not effects of past operation. This part of the assessment has been substantially revised in the revised EA report (now section 11).

No.	Comments from Members of the Public	OPG Responses
Mr. Eugene Bourgeois (No. 3 of 3, September 9, 2002)		
32.	Page 5 states: "At that time a decision was made to continue to produce heavy water for external markets." Prior to this time (1993) heavy water was produced for domestic needs only, an action that could, perhaps, be deemed to be in the greater public good, thus protecting this operation from the harm it may or may not do, either intentionally or unintentionally, to a small subset of the population as a whole. Once you engaged in routine commercial operations, would this have changed your liability to, perhaps, that small subset of the population?	Although the market changed from domestic to external at that time, neither the method of operation nor the regulatory requirements governing that operation changed. Corporate policy and regulatory requirements are intended to protect the public and environment regardless of the market.
33.	Page 9 states: "The decommissioning project encompasses all the heavy water plant areas previously licenced by the AECB/CNSC." Does this mean that the construction licenses for plants 'C' and 'D' , which have no expiry date, are hereby revoked and cancelled?	OPG has no plans to produce heavy water at this site in future. The CNSC will disposition this construction approval, along with the operating licence, at the time of their decision on OPG's application for the decommissioning licence.
34.	Would it be possible to get a copy of the preliminary BHWP Decommissioning Plan, Revision 1, 2000, as described on page 11?	This document has been superseded by the Detailed Decommissioning Plan (DDP) of May 2002, a copy of which has been sent to Mr. Bourgeois.
35.	Page 17 states: "At present there are no definitive plans for the balance of the BHWP site." Are there currently any credible ideas or plans for this site and, if so, what are they?	Section 3.6 of the revised EA report will describe the planned decommissioning "end state" and discuss future use of the site.
36.	Page 19 asserts that the alternative means of achieving the goals of the project were dismantlement and demolition. Is this a complete list?	Section 2 of the revised EA report will outline a more complete range of alternative means, based on the options described in the DDP document.
37.	Page 24 states: "Questions were also asked about the history of the plant ..." What were those questions?	Questions included: • When were the plants built, production rates, etc.? • When and why were previous plant facilities shut down and decommissioned? • How much heavy water inventory? • What does OPG plan to do about future heavy water needs?
38.	Page 35, "Site-Specific Meteorology" states: "These data [referring to the 5-year wind speed and direction study] were recorded at the on-site 10-m meteorological tower." May I have a copy of these data?	The raw data in question (from 1991-95) is no longer in readily available form. However, after the revised EA report has been submitted, we will undertake to recompile this data and provide a copy to Mr. Bourgeois. A summary of more up-to-date wind data (1998-2000) will be presented in the revised EA report.

No.	Comments from Members of the Public	OPG Responses
39.	Page 41 states: "We chose 1994 as a reference year and compiled an extensive yearly meteorological data set. The data set consists of 8760 hourly records and each of the records contain all of the above mentioned parameters." May I have a copy of this data set?	OPG does not have the detailed data in question. It was collected by a consultant for input to the modelling of atmospheric dispersion of Total Suspended Particulate (TSP) for EA of a different project, also located at the Bruce nuclear site. OPG only obtained the modelling output for inclusion in the EA report for the other project. OPG later adapted this output to the BHWP project EA. OPG will provide Mr. Bourgeois a copy of this modelling output.
40.	The chart on page 41 states that the mean wind speed is 5 m/s, and on page 34, it is stated that mean wind speed is 4 m/s. Which is correct and why is there a discrepancy?	The value on p.34 (4 m/s) is based on actual monitoring. The value on p.41 (5 m/s) was selected for conservative prediction of off-site dust concentration (ie. the higher value producing a higher off-site dust concentration).
41.	Part 2, page 3 of your October, 1998 letter to Bill Hutchinson of the MOE states: "The initial phase is a review of station records, environmental reports and a site inspection." may I have a copy of the records reviewed?	This letter was in Part 1 (not 2) of the preliminary draft EA report. The results of the initial information review and site inspection are documented in the previous draft EA report and in the DDP document. Mr. Bourgeois has been given copies of both.
42.	Part 2, page 7, in the "Groundwater" section describes the metals detected in the Phase 2 ESA water samples. Would these be indicative of the process deterioration of the BWHP and its component parts? If so, in what ways will they have been included in the effluent flared during "planned emissions"?	No. No metals were directed to the flare stack.
43.	On page 12, part 2, you state: "Some waste may also be disposed at the BNPD site landfill." What percentage, both in terms of volume and weight, is expected to be transported to the BNPD landfill site, and will any of this material be contaminated with radiological wastes?	Waste quantity estimates will be updated in the revised EA report. Any material going to the on-site landfill will not be contaminated with radioactive wastes. This decommissioning project is not expected to produce any radioactive waste. No radioactive materials were used in the production of heavy water. No radioactive contamination was discovered during the course of earlier BHWP demolition work and none has been discovered in areas involved in the current decommissioning project. Nevertheless, as will be explained in the revised EA report (consistent with the DDP), if any radioactive contamination were found during the decommissioning project, the material would be packaged and transported in accordance with applicable regulations to OPG's Western Waste Management Facility within the Bruce nuclear site.

No.	Comments from Members of the Public	OPG Responses
44.	Part 2, page 16, is Table 3.1. Will there be a continuous survey of these waste materials that will demonstrate how much of each category will have been filled as presented in this Table?	OPG is not planning to undertake a continuous survey of actual quantities of different wastes arising from decommissioning, but some accounting of waste quantities is likely based on earlier decommissioning practice. The estimated quantities in Table 3.1 are based on previous BHWP demolition experience, and are considered reasonable and adequate for EA purposes.
Mssrs. Frank Baker & John F. Kirby - Bruce Hydro Retirees Association (August 17, 2002)		
45.	In general we believe that experience gained to date will result in a successful completion of the decommissioning project without long time adverse affects.	Noted.
46.	… one aspect of possible concern in the future is the intention to leave 'below grade piping and wiring in-situ'. Experience of this past practice at the BNPD site often resulted in disproportionate costs being incurred when subsequent redevelopment was undertaken on previously developed / dismantled facilities. This particularly applies to cabling which must always be treated as 'live' until proven to be completely isolated from all possible sources of energy. For this reason alone ALL unused circuit cabling/wiring should be pulled back, leaving only that currently in service. These to be marked above ground by warning sighs, i.e. 'buried live cable - do not excavate'. (Drawings often fail to reflect 'field' conditions; 'temporary' feeds becoming permanent without formally recorded.) In ground piping should be isolated and capped with 'blanks' or blind flanges to prevent them becoming rodent warrens, which open ended piping could encourage. Large bore piping could be plugged with concrete rather than use fittings if these are not readily available or surplus.	These suggestions will be considered during the detailed planning of the demolition work.
Mr. S. (Ziggy) Kleinau - Citizens for Renewable Energy (Submission to CNSC for September 13, 2002 Hearing on BHWP Operating Licence)		
47.	… OPG decided to do an EA. …it seems this exercise is drawn out unnecessarily.	EA process background is explained in section 1.3.3 of the revised EA report.
48.	… In their Draft BHWP Decommissioning EA Study Report (July 2002) OPG mentions several times the positive effects of timely action to decommission the BHWP facility (Pgs. 94 and 98).	Noted.

No.	Comments from Members of the Public	OPG Responses
49.	It would be advantageous for the Commission to encourage the proponent to apply for the final decommissioning licence in 2003, so that those ugly towers are removed and even the slightest risk to human health and the environment be speedily eliminated!	Noted.

C.4 Compliance with Requirements of the Canadian Environmental Assessment Act and Disposition of Comments from Federal Authorities

Table C.4.1 Compliance with General Requirements of Canadian Environmental Assessment Act

Table C.4.2 Guide to Where CNSC and Other Government Agencies' Comments are Addressed in the Revised EA Study Report

TABLE C.4.1
COMPLIANCE WITH GENERAL REQUIREMENTS OF CANADIAN ENVIRONMENTAL ASSESSMENT ACT

REQUIREMENTS OF CANADIAN ENVIRONMENTAL ASSESSMENT ACT			Corresponding Sections of the EA Study Report
a)		**Section 16(1) of the *Act*, factors applicable to <u>all</u> EA's conducted under the *Act*.**	
	(a)	the environmental effects of the project…	Chapter 7 and Chapter 8.
		…including the environmental effects of malfunctions or accidents that may occur in connection with the project…	Sections 8.3 and 8.6.
		…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;	Chapter 9; Table 9.2.
	(b)	the significance of the (residual) effects identified;	Section 11.2; Table 11.2.
	(c)	comments from the public that are received in accordance with the *Act* and its regulations;	Chapter 5 and Appendix C.
	(d)	measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project;	Chapter 8 and Chapter 9; Summary in Table 8.10.
	(e)	any other matter that the RA may require to be considered.	CNSC comments addressed in Appendix C.2.
b)		**Section 16(2) of the *Act*, additional factors that must be considered in all comprehensive study EA's conducted under the *Act*:**	
	(a)	the purpose of the project;	Section 1.1.1.
	(b)	alternative means of carrying out the project that are technically and economically feasible and the environmental effects of any such alternative means;	Chapter 2, Section 2.1.
	(c)	the need for, and requirements of, any follow-up program in respect of the project;	Chapter 10; Tables 10.1, 10.2 and 10.3.
	(d)	the capacity of renewable resources that is likely to be significantly affected by the project to meet the needs of the present and those of the future.	Section 8.5.
c)		**Other information pertaining to requirements of the *Act***	
		Objectives of ultimate BHWP site and end state	Section 3.6.
		Assessment of potential effects of the environment on the project (severe weather, flooding, seismic events, etc.)	Section 8.4., Table 8.7.

TABLE C.4.2
GUIDE TO WHERE CNSC AND OTHER GOVERNMENT AGENCIES' COMMENTS ARE ADDRESSED IN THE REVISED EA STUDY REPORT

a) CANADIAN NUCLEAR SAFETY COMMISSION (CNSC) [November 30, 2001]	**Corresponding Section of EA Study Report**
▪ **Groundwater Monitoring Wells** OPG separates the monitoring wells into three groups: upstream, downstream, and internal (to the BHWP) monitoring wells. OPG needs to identify where the boundaries between these three regions are situated.	Section 6.5.2.2 Section 10.3; Tables 10.1, 10.2 and 10.3; Appendix B, Table B.2.
The monitoring wells have only been sampled once. OPG should tabulate and present the analytical results for each monitoring well, not just the range in concentrations for each analyte. Table 20 purports to present the range in contaminant concentrations for only upstream and downstream monitoring wells. The data for the internal monitoring wells is not included. From the discussion on p.82 and p.84 it appears that all the groundwater data have actually been separated into only two groups, i.e., downstream and upstream wells. CNSC staff believes that the monitoring results of all the wells should be tabulated and presented in the document. The boundaries between upstream, internal and downstream wells should also be clearly indicated in the table or on existing Figure 14. This request is mainly for the sake of completeness and transparency of the EA document. Given that the wells have been sampled only once, the amount of monitoring data involved is relatively small.	Appendix B, Tables B.3 and B.4. Section 6.5.2.2, Table 6.8; Table 6.9; Appendix B, Tables B.3 and B.4.
▪ **Metal Contaminants** As, Sb, and Se appear to be common metal contaminants of concern in the groundwater. Since natural exceedences of MOE guidelines by these metals are rare, OPG needs to identify the contaminant sources for these metals. CNSC staff continue to believe that the issue related to the source of these contaminants must be discussed and clarified by OPG. In particular, OPG needs to discuss what precautionary measures will be taken to not increase the level of contamination during the decommissioning work if the source of contaminant is within the BHWP. This is because Table 20 shows that the MOE guideline criterion for Selenium for non-potable water has been slightly exceeded and that the contamination of the upper carbonated aquifer by these three elements appears to be more important than that of the unconsolidated media aquifer.	Section 6.5.2.2 Section 10.3, Table 10.1.
▪ **Reporting of Groundwater Chemistry** Text on p.64, with respect to groundwater, states that: "A comparison of the groundwater chemistry to the clean-up criteria indicates no significant impact to the environment as none of the analyses measured in the upstream monitoring wells show appreciably higher concentration levels than those in the wells located down gradient along the groundwater flow direction". CNSC staff indicated previously [2,3] that higher results in *downstream* samples would indicate an effect from the plant, rather than the other way around. OPG should review the current wording to determine if it is correct.	Section 6.5.2.2 ("Groundwater Chemistry").

TABLE C.4.2 (Continued)
GUIDE TO WHERE CNSC AND OTHER GOVERNMENT AGENCIES' COMMENTS ARE ADDRESSED IN THE REVISED EA STUDY REPORT

a) CANADIAN NUCLEAR SAFETY COMMISSION (CNSC) (Cont'd) [November 30, 2001]	**Corresponding Section of EA Study Report**
▪ **Radionuclides** Table 20 indicates that for the unconsolidated media aquifer downstream ^{3}H and ^{137}Cs data are "Not Available". CNSC staff previously commented that this data gap precludes making a conclusion on the residual environmental effects following decommissioning with respect to these nuclear substances. Therefore, OPG should acquire downstream ^{3}H and ^{137}Cs data for the unconsolidated media aquifer in order that the environmental effects may be properly assessed.	Response in Appendix C, Section C2.
Text on p. 66 states that, with respect to measured groundwater tritium of up to 296 Bq/L. "These values are in the low end of the range occurring in natural groundwater". CNSC staff previously requested that a reference to support this statement be provided. OPG has not provided any such reference. However, CNSC staff has reviewed OPG's Annual Summary and Assessment of Environmental Radiological Data for 2000. Groundwater monitoring data for the Bruce site (Table 3.3.5, p.42) suggests that the following text is more accurate. "These values are in the low end of the range occurring in and around the Bruce site".	Section 6.5.2.2 ("Groundwater Chemistry").
All units for the measure of nuclear substance activity should be expressed in SI units. For example, the values expressed in nCi/kg and pCi/kg on p.66 require conversion to Bq/kg.	Section 6.5.2.2.
▪ **Follow-up Program** The first bullet in Section 8.2, Follow-up and Monitoring Program, states that: "A program to monitor groundwater, to ensure that there is no off-site environmental impact, will be carried out at the completion of the project". The term "off-site" should be removed from this statement. Then the monitoring program will be consistent with the requirement in S.12(1)(f) of the General Nuclear Safety and Control Regulations that: "every license shall take all reasonable precautions to control the release of radioactive precautions to control the release of radioactive nuclear substances or hazardous substances *within the site* of the licensed activity and into the environmental as a result of the licensed activity".	Section 10.3, Table 10.3.

TABLE C.4.2 (Continued)
GUIDE TO WHERE CNSC AND OTHER GOVERNMENT AGENCIES' COMMENTS ARE ADDRESSED IN THE REVISED EA STUDY REPORT

b) ENVIRONMENT CANADA [May 10, 2002]	**Corresponding Section of EA Study Report**
▪ **Hazardous Wastes**	
For clarification, storage of PCB-containing materials is subject to the provisions of the Federal Storage of PCB Material Regulations, in addition to the guidelines and provincial regulations listed in section (p.91). These regulations must be adhered to during the project.	Response in Appendix C, Section C.2.
The report describes OPG's procedures for handling hazardous wastes on-site but does not elaborate on the extent to which compliance with the *Transportation of Dangerous Goods Act* addresses possible spills, accidental exposure and clean-up procedures after hazardous materials are taken off-site (p.90-91, 97). The proposed transportation routes and modes for all of the various hazardous materials to be disposed of should be identified. These routes should be assessed in the context of any environmentally sensitive or inhabited areas that could be at risk during the handling and transportation of hazardous materials off-site.	Sections 3.3.7.2 and 8.2.11.
▪ **Cumulative Effects** Cumulative effects assessment is described in Section 6.4 of the EA Report, with a conclusion in Section 7.0 that the cumulative effects for this undertaking will be positive (p.97). This appears to be based on the rationale that since the undertaking is considered to have no significant adverse environmental effects, there would be no resultant impacts from a cumulative or incremental point of view. However, cumulative effects should not be dismissed simply because the residual adverse effects are expected to be insignificant. While the implementation of mitigation measure may result in no significant direct environmental effect from noise and dust, it does not seem reasonable to state that the proposed mitigation measures have "essentially eliminated" these environmental effects (p.94). The cumulative effect of minor contributions can become significant over time. While we recognize that the potential for cumulative impacts from noise, dust or continued impacts on groundwater from on-site significant contamination may be low, it does not appear that the EA report has specifically addressed these potential impacts. Further clarification from the proponent on the cumulative effects assessment methodology should be sought.	Section 4.1.7; Chapter 9.
▪ **Air quality** One major potential source of dust and total suspended particulates (TSP) will be the demolition of the towers. Environment Canada supports the proposal in Section 8.1 of the EA report that these demolitions be undertaken during daylight hours but outside of normal working hours (i.e., between 16:00 and 19:00 hours). In order to minimize dust impacts it is further recommended that the demolition not be undertaken under poor dispersion conditions. Two examples of poor dispersion days are under heavily overcast conditions or on days in April through July with light onshore winds. In addition it would be advisable not to conduct the demolition when winds are blowing towards the listed "sensitive receptor zones", including Baie du Doré. Winds from the southwest would carry dust directly to this receptor.	Section 8.2.1.3.

TABLE C.4.2 (Continued)
GUIDE TO WHERE CNSC AND OTHER GOVERNMENT AGENCIES' COMMENTS ARE ADDRESSED IN THE REVISED EA STUDY REPORT

b) ENVIRONMENT CANADA [May 10, 2002] (Cont'd)	**Corresponding Section of EA Study Report**
▪ **Terrestrial Environment** Demolition activities, including the felling of towers, is expected to take place over a period of two years, during which time there will be adherence to the MOE Noise protocol (p.100). Compliance with provincial noise guidelines may not effectively mitigate impacts on wildlife in the adjacent Inverhuron Provincial Park. The residual noise in the adjacent forested areas generated by the felling of the towers should be assessed in the same manner as residual noise on local communities. The potential for the noise impacts on those species of wildlife, particularly migratory birds, found in the natural areas adjacent to the demolition site should be determined, and certain activities should be restricted during sensitive breeding periods.	Section 8.2.2.2.
▪ **Aquatic Environment** Subsequent 36(3) of the *Fisheries Act* specifies that, unless authorized by federal regulation, no person shall deposit or permit the deposit of deleterious substances of any type in water frequented by fish, or in any place under any conditions where deleterious substance, may enter any such water. The broad definition of fish and fish habitat should be considered by the proponent when any precautions are taken to ensure that the requirements of the Fisheries Act are adhered to.	Section 8.2.5; Response in Appendix C, Section C.2.
During spring run-off, the EA Report indicates that the Surface Water Treatment Facility (SWTF) "needs constant attention to prevent overflowing and has the risk of catastrophic failure" (p.86). The proper operation of this facility appears crucial in ensuring that there are no significant impacts on Lake Huron. This type of failure of the SWTF does not appear to be addressed *under "Accidents and Malfunctions – Waste Water Handling"* (p.89). Therefore, the specific measures taken to ensure that such a failure does not occur should be documented, and activities that may generate contaminants should not be conducted at times when there is a significant risk of catastrophic failure of this SWTF.	Section 8.4, Table 8.7.

TABLE C.4.2 (Continued)
GUIDE TO WHERE CNSC AND OTHER GOVERNMENT AGENCIES' COMMENTS ARE ADDRESSED IN THE REVISED EA STUDY REPORT

b) ENVIRONMENT CANADA [May 10, 2002] (Cont'd)	**Corresponding Section of EA Study Report**
▪ **Contaminated Soil and Groundwater** The stated purpose of the project is to remediate the site "to a condition commensurate with that of an industrial site" (p.105). In determining the extent of the required soil remediation, OPG may wish to consider the guidance provided by the <u>Canada-wide Standards for Petroleum Hydrocarbons in Soil</u> and the <u>Canadian Environmental Quality Guidelines</u>.	Section 3.3.6. Chapter 10, Table 10.2.
In some instances it appear that, after the completion of the project, soil and groundwater quality may continue to exceed MOE criteria for industrial sites. The report justifies this by stating that the exceedences are "marginal" (p.97). Generally, a risk assessment should be completed to ensure that the exceedences of generic soil quality criteria are not likely to have environmental impacts. However, we support CNSC's proposal for OPG to complete a study to determine the sources of the metal impacts on groundwater before initiating any risk assessment activities.	Section 6.5.2.2 ("Groundwater Chemistry"); Chapter 10, Table 10.1.
c) HEALTH CANADA [May 3, 2002]	
Table 20, p.65, of this report shows levels of tritium somewhat higher than the natural background which is usually 5-10 Bq/L. It appears that these elevated levels are ensuing from surface contamination. Nonetheless, these levels are much below the provincial and federal guidelines for potable water, and are therefore of no cause for concern for the protection of human health.	Response in Appendix C, Section C.2.

TABLE C.4.2 (Continued)
GUIDE TO WHERE CNSC AND OTHER GOVERNMENT AGENCIES' COMMENTS ARE ADDRESSED IN THE REVISED EA STUDY REPORT

d) CANADIAN ENVIRONMENTAL ASSESSMENT AGENCY [May 24, 2002]	**Corresponding Section of EA Study Report**
▪ **Scope of Project and Scope of Assessment** Scope of the project and accompanying description of the project and its components not sufficiently clear to explain what the project involves.	Section 1.3.1; Chapter 3.
Scope of the assessment may not sufficiently capture the range of potential environmental effects that the project may cause.	Section 1.3.2.
Addition of a matrix showing key project components on one axis, and the potential associated effects along the other would help resolve issues related to scope.	Tables 7.1 and 7.2.
▪ **Alternative Means of Carrying Out the Project** Section on alternative means of carrying out the project is inadequate. Further information is required to describe each feasible alternative; explain criteria used to rate alternatives.	Chapter 2.
▪ **Consultation** …there is little information about questions and concerns from people in the community and very little description as to how any concerns were addressed.	Section 5.2.2; Section 5.4.2; Appendix C, Sections C1 and C3.
It appears that consultation occurred in 1998, then again in 2001, through scant detail is provided about the 2001 activities. Further information should be provided in this regard.	Sections 5.2, 5.3 and 5.4.
Specific aboriginal consultation activities should be described.	Sections 6.8.1 and 6.10.
▪ **Boundaries** A complete description of the study area boundaries should be provided.	Section 4.1.1; Figure 4.1 and Figure 4.2.
In describing the existing environment it would be appropriate to identify Valued Ecosystem Components within the study area to focus the assessment of environmental effects.	Section 6.11; Table 6.10.
▪ **Environmental Effects** All factors included in the definition of "environmental effect" in the Canadian Environmental Assessment Act need to be addressed.	Chapter 8, Sections 8.2, 8.3, 8.4, 8.5 and 8.6.
One of the primary effects appears to be a potential decrease in local air quality. Although some analysis is provided to describe potential effects on Baie du Doré and Inverhuron, the potential for adverse air quality effects at other dwellings, or agricultural land, Inverhuron Provincial Park, Lake Huron shoreline. This issue should also be related to aboriginal traditional use within the study area.	Section 8.2.1. Section 6.10.
Potential effects of project on groundwater needs to be addressed in discussion of potential environmental effects and in a follow-up program.	Section 8.2.8; Section 10.2; Tables 10.1, 10.2 and 10.3.
Any potential for the process effluent lagoons, sludge lagoons or the surface water treatment facility to have an effect on groundwater, and thus have an effect on Lake Huron, needs to be explicitly addressed.	Section 3.3.5.2 Section 3.3.5.3 Section 8.2.4.

TABLE C.4.2 (Continued)
GUIDE TO WHERE CNSC AND OTHER GOVERNMENT AGENCIES' COMMENTS ARE ADDRESSED IN THE REVISED EA STUDY REPORT

d) CANADIAN ENVIRONMENTAL ASSESSMENT AGENCY (Cont'd)	**Corresponding Section of EA Study Report**
▪ **Environmental Effects (Cont'd)**	
Potential effects on heritage and historical resources in the vicinity of the project need to be addressed.	Section 7.2.8; Table 7.1.
Section on accidents and malfunctions needs to discuss potential failure of Surface Water Treatment Facility.	Section 8.4, Table 8.7.
▪ **Cumulative Effects Assessment**	
In the section on cumulative effects, neither the interactions with the decommissioning activities nor the past developments are identified.	Chapter 9; Table 9.2.
No future ("reasonably foreseeable") projects or activities have been identified; new steam plant should be referenced in cumulative effects assessment.	Table 9.2.
A more complete assessment of potential cumulative effects needs to be presented for this comprehensive study.	Section 4.1.7; Chapter 9; Table 9.2.
▪ **Significance**	
Section on significance does not demonstrate how the significance criteria were applied to the environmental effects, nor does it provide any definition of the criteria.	Chapter 11; Section 11.1; Table 11.1.
▪ **Residual Effects and Mitigation**	
The comprehensive study report must clearly identify what mitigation measures are required for the potential environmental effects to be considered not significant.	Chapter 8, Sections 8.2 to 8.10.
▪ **Capacity of Renewable Resources**	
The report does not explicitly consider 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", as required by the *Act*.	Section 8.5.