Enclosure 2

Darlington New Nuclear Project Environmental Impact Statement Review Report for Small Modular Reactor BWRX-300

NK054-REP-07730-00055 R000

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Reviewed by: [Electronic Signature]
Cammie Cheng
Senior Manager
Environment Health & Safety

Approved by: [Electronic Signature]
Tho Dien Le
Manager DNNP
New Nuclear Development

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DARLINGTON NEW NUCLEAR PROJECT ENVIRONMENTAL IMPACT STATEMENT REVIEW REPORT FOR SMALL MODULAR REACTOR BWRX-300

NK054-REP-07730-00055 R000

Submitted To:

Ontario Power Generation Inc.

Prepared By:

Calian Nuclear

October 2022

DNNP EIS REVIEW REPORT FOR SMR BWRX-300

EA Consulting Team

CALIAN Group Ltd.	Calian Group	EIS Review
SLR	SLR Consulting	EIS Review
Ecometrix	Ecometrix	Calculation of dose for normal operation
IEC	Independent Environmental Consultants	EIS Review, Atmospheric Environment (dust, noise)
Golder Associates	Golder Associates Limited	Surface water (hydrology, groundwater)
BEACON ENVIRONMENTAL	Beacon Environmental	Terrestrial Environment

DARLINGTON LANDS ACKNOWLEDGEMENT

The lands and waters on which the Darlington New Nuclear Project (DNNP) is situated are within the traditional and treaty territory of the Williams Treaties First Nations, which includes Curve Lake First Nation, Hiawatha First Nation, Alderville First Nation, Chippewas of Beausoleil First Nation, Chippewas of Georgina Island First Nation, Chippewas of Rama First Nation, and the Mississaugas of Scugog Island First Nation.

To acknowledge the traditional territories is to recognize its history, predating the establishment of the earliest European colonies. It is also to acknowledge the significance for the Indigenous peoples who lived and continue to live upon it, to acknowledge the people whose practices and spiritualties are tied to the land and water and continue to develop in relation to the territory and its other inhabitants today.

EXECUTIVE SUMMARY

This document is an Environmental Impact Statement Review Report for the deployment of up to four BWRX-300 small modular reactors (SMR) for the Darlington New Nuclear Project (DNNP), formerly referred to as the New Nuclear Darlington (NND) Project.

The DNNP, is a proposed new nuclear power plant on the north shore of Lake Ontario in the Municipality of Clarington, within the Regional Municipality of Durham. More precisely, the DNNP is located on the existing Darlington Nuclear (DN) site of Ontario Power Generation (OPG), about 70 km east of Toronto.

The DNNP was subject to an environmental assessment (EA) under the *Canadian Environmental Assessment Act (CEAA)*. The scope for the assessment included the site preparation, construction, operation, and decommissioning of up to four new nuclear power reactors to produce up to 4,800 megawatts of electrical generating capacity.

When the EIS was conducted in 2006 to 2009, no specific reactor technology was selected, rather, the EIS considered a Plant Parameter Envelope (PPE) that encompasses limiting design parameters from the reactor technologies under consideration for the DNNP at that time, as the basis for the EA. It was identified that the PPE may need to be modified when the specific reactor technology is selected.

For the DNNP, a federal joint review panel (JRP) conducted a review of the EA and considered the licence application to prepare the site for the Project. The JRP concluded that "the Project is not likely to cause significant adverse environmental effects, provided the mitigation measures proposed and commitments made by OPG during the review, and the JRP's recommendations are implemented." In May 2012, the Government of Canada (GOC) accepted the JRP's conclusions for the DNNP as well as the JRP's recommendations, in accordance with the GOC response, for the DNNP. Following that, the Canadian Nuclear Safety Commission (CNSC) issued a 10-year Power Reactor Site Preparation Licence (PRSL 18.00/2022) for the DNNP. The JRP's recommendations that the GOC assigned to OPG and commitments that OPG made during the EA process were consolidated in the Darlington New Nuclear Project Commitment Report NK054-REP-01210-00078-R007 [1].

Following OPG's application to renew the PRSL in 2020, the CNSC renewed the PRSL for another 10 years in 2021. For this licence renewal application, OPG had not initiated any licensed activities nor had OPG selected a reactor technology for DNNP, and the Project scope remained unchanged from that assessed in 2012. CNSC staff confirmed during the PRSL renewal public hearing that the EA accepted by the JRP and the GOC is still valid. There is no expiry on an EA decision as long as the scope of that project remains within the scope of the original EA.

One of the commitments listed in the DNNP Commitment report is D-P-12.1(a) - Comprehensive Environmental Impact Statement Review stated that *"Once the specific technology is selected and design information is available, OPG will comprehensively review the EIS to ensure that the results of the EIS remain valid. If this review indicates either a gap or a* *condition not bounded by the EIS, OPG will initiate corrective actions as necessary. This may include mitigation options."*

In December 2021, OPG selected the BWRX-300 for deployment at the DNNP site. OPG has been working with the vendor, GE Hitachi Nuclear Energy (GEH), to progress the design of the BWRX-300 and develop the required documents to support a Licence to Construct (LTC) Application. To fulfill the above commitment, OPG has conducted an EIS Review for the selected BWRX-300 which is the purpose of this EIS Review document.

As the EIS used the PPE as the basis for the environmental assessment, the commitment on PPE as listed in D-C-3.1 Preliminary Safety Analysis and Design [1] as stated below also needs to be considered in the EIS review: *"After the Licence to Prepare Site is issued the vendor will demonstrate to OPG's satisfaction that the design of the facility fits within the values used in the Plant Parameter Envelope. If the Nuclear Facility is not bounded by the Plant Parameter Envelope, the Envelope will be updated and appropriate assessment of the impacts will be undertaken or the design modified, as required."*

The GEH BWRX-300 reactor is a SMR using boiling water reactor (BWR) technology. The electrical power output for each reactor is about 300 MWe and its design life is 60 years. The BWRX-300 is a smaller reactor when compared to those evaluated for the PPE in the 2009 EIS as well as with the currently operating reactors at the DN site, both in electrical production and in physical size. BWR technology was considered during the development of the PPE for the EIS; however, insufficient information was submitted by the vendor in time for inclusion in developing the PPE. The JRP indicated in its EA report that "*should the Government of Ontario decide to include boiling water-type reactors in its procurement process, the plant parameter envelope would be updated accordingly."*

EIS Review Objective

Based on OPG's commitments mentioned above, the focus of this EIS Review is to ensure that the conclusion of the EIS remains valid for the deployment of the BWRX-300 at the DNNP site.

The EIS Review covers the following two components:

1. The Plant Parameter Envelope (PPE): An assessment of effects is conducted for BWRX-300 parameters that are not within the PPE, as indicated in Commitment D-C-3.1 [1], and
2. The EIS: A review of the EIS for the BWRX-300 deployment is undertaken to ensure that the results of the EIS remain valid as per Commitment D-P-12.1 [1].

Positive environmental effects are also identified and explained.

EIS Review Approach

While OPG's 2022 application for the LTC will be for one BWRX-300 reactor, the DNNP was envisaged as a build out of up to four BWRX-300 reactors. For this EIS Review, the deployment of four BWRX-300 reactors is considered as the DNNP, which is consistent with the Project that was defined and assessed in the EIS. This EIS Review used the following key data and information sources as input:

1. CNSC regulatory document REGDOC 1.1.1 *"Site Evaluation and Site Preparation for New Reactor Facilities*",
2. Baseline data of the site and site evaluation information that were updated to support the PRSL renewal including baseline data that have been collected since the PRSL renewal,
3. Refinements related to the selected reactor technology,
4. The PPE which was used as the basis for the EIS,
5. The EIS and its technical supporting documents, and
6. A conceptual project timeline with a start date of Q3/Q4 2022, and a completion of construction of the fourth reactors in 2035.

With respect to the review of the PPE, the EIS Review compared the parameters of the BWRX-300 with those PPE parameters used as the basis for the EIS. Nine BWRX-300 parameters were found to not fit within their respective PPE values and further evaluations were undertaken.

The EIS Review examined the fundamental elements of the EIS and compared to those resulting from the deployment of four BWRX-300 reactors at the DNNP site to confirm the EIS conclusion remains valid. This included the review of:

- Existing environmental conditions, including the identification of new Valued Ecosystem Components (VECs) and receptors, and changes in the conservation status of species on the DNNP site,
- Project works and activities for each project phase (i.e., site preparation, construction, operation, and decommissioning),
- Effects on VECs and new receptors, including cumulative effects,
- The significance of environmental effects, taking into consideration the availability of mitigation measures,
- Effects of the Environment on the Project (i.e., flooding, severe weather, biophysical effects, seismicity, and climate change),
- Malfunctions, Accidents, and Malevolent Acts (i.e., conventional and transportation accidents, nuclear and criticality accidents and malevolent and their effects on the human health and the health of non-human biota), and
- Follow-up and monitoring programs to verify predictions of environmental effects identified in the EIS, and to determine the effectiveness of mitigation measures.

The findings of this review are summarized in the section below and the detailed findings are presented in the EIS Review Supporting Document [3].

Conclusions

The review determined that of the 198 PPE parameters considered in the 2009 EIS, nine BWRX-300 parameters are currently not within the PPE. These are largely due to characteristics inherent to the design of the BWRX-300 reactor technology. Further assessment of these nine BWRX-300 parameters shows that they do not alter the conclusion of the EIS. These nine PPE parameters have been updated for the BWRX-300 deployment as required by Commitment D-C-3.1 [1].

In comparison to the environmental conditions described in the EIS, prevailing conditions are largely similar, but have not been static over the years. For example, since 2009, several bat species now inhabit areas of the DNNP site. Durham Region and its area municipalities have also continued to change due to population growth, urbanization, and economic development.

The BWRX-300 deployment is expected to involve works and activities that are essentially the same as those evaluated in the EIS. Compared to the reactors considered in the EIS, the BWRX-300 reactors are smaller in physical size and electrical power. As a result, the effects of the BWRX-300 deployment on the environment are generally less than those examined in the EIS. In addition, there are opportunities with the BWRX-300 deployment to retain some terrestrial habitats on the DNNP site. Additional studies are in progress to explore those opportunities. Since the BWRX-300 deployment does not include cooling towers, the adverse effects associated with them (e.g., effects on the visual landscape and socio-economic conditions) are no longer applicable.

Environmental effects (including effects from accidents, malfunctions and malevolent acts, effects of the environment on the Project, and cumulative effects) from the BWRX-300 are expected to be less than those assessed in the EIS. Therefore, the determinations regarding the significance of residual adverse effects made in the EIS remain valid. Where further assessments are being undertaken, and given the availability of mitigation measures, it is anticipated that residual adverse effects will be Not Significant.

As part of the EIS, OPG made a commitment to have an environmental monitoring and EA follow-up program in place to verify predictions of environmental effects identified in the environmental assessment, and to determine the effectiveness of mitigation measures. This EIS Review concluded that the EA follow-up and monitoring programs remain suitable for BWRX-300 deployment.

Overall, this EIS Review has determined that the conclusion of the 2009 EIS remains valid for the deployment of the BWRX-300 at the DNNP site, namely that the DNNP is not likely to cause significant residual adverse environmental effects, provided the mitigation measures are implemented. OPG also intends to fulfill commitments it made during the EIS review process and the recommendations made by the JRP.

OPG recognizes that while the assessment of environmental effects from DNNP has been satisfied from the Western scientific perspective, it may not fully address the impact of the DNNP on Indigenous inherent and treaty rights as they are understood today. OPG endeavors to continue to work with Indigenous nations and communities having a historical relationship with the site to appropriately identify the impacts of the Project on them and to achieve feasible mitigation measures and/or accommodation.

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LIST OF ACRONYMS

Acronym	Description
BWR	Boiling Water Reactor
CCW	Condenser Circulating Water
CEAA	Canadian Environmental Assessment Act
CNSC	Canadian Nuclear Safety Commission
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSA	Canadian Standards Association
DN	Darlington Nuclear
DNGS	Darlington Nuclear Generating Station
DNNP	Darlington New Nuclear Project
DSC	Dry Storage Containers
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPR	Evolutionary Pressurized-Water Reactor
ESA	Endangered Species Act (Ontario)
GEH	GE-Hitachi or General Electric Hitachi
GOC	Government of Canada
ha	Hectares
ICS	Isolation Condenser System
JRP	Joint Review Panel
L&ILW	Low & Intermediate Level Waste
LBD	Licence Basis Document
LCH	Licence Conditions Handbook
LSA	Local Study Area
LWR	Light Water Reactor
masl	Metres Above Sea Level
MW	Megawatt
MWe	Megawatt (electrical)
MWth	Megawatt (thermal)
NBCC	National Building Code of Canada
NFWA	Nuclear Fuel Waste Act
NND	New Nuclear Darlington
NSCA	Nuclear Safety and Control Act
NWMO	Nuclear Waste Management Organization
OPG	Ontario Power Generation Inc.
OTC	Once-Through Cooling
PDP	Preliminary Decommissioning Plan
PPE	Plant Parameter Envelope
PRSL	Power Reactor Site Preparation Licence
PSA	Probabilistic Safety Assessment
PWR	Pressurized Water Reactor
REGDOC	Regulatory Document

Acronym	Description
RSA	Regional Study Area
SAR	Species at Risk
SARA	Species at Risk Act
SMR	Small Modular Reactor
SSA	Site Study Area
U-235	Isotope 235 of Uranium
UHS	Ultimate Heat Sink
UO_2	Uranium Dioxide
VEC	Valued Ecosystem Component

SOME EIS REVIEW TERMINOLOGY

Term	Description
CNSC	The Canadian Nuclear Safety Commission. The organization that regulates the use of nuclear energy and materials to protect health, safety, security, and the environment.
Commission members	Members of the CNSC (i.e., Commission members) are appointed by Canada's federal government to make regulatory decisions regarding nuclear energy and materials and the protection of health, safety, security and the environment.
CNSC staff	CNSC's commission members are supported by professional staff who undertake the day-to-day activities of the organization and make recommendations to commission members.
EIS	The Environmental Impact Statement submitted by OPG in 2009 and accepted by the CNSC, Joint Review Panel and Government of Canada.
EIS Review Report	This current report, which considers the EIS in light of the BWRX-300 SMR.
EIS Review Supporting Document	A companion document to the EIS Review Report, the "Darlington New Nuclear Project Supporting Document for Comprehensive Review of EIS for BWRX-300" that comprehensively reviews the EIS, section by section, as it relates to the BWRX-300.
NND Project (New Nuclear Darlington Project)	Former name of Darlington New Nuclear Project (DNNP). It is used in EIS Review Report only when directly quoting from the EIS.
Darlington New Nuclear Project (DNNP)	Current Project name.
Darlington Nuclear Generating Station (DNGS)	The term used when describing the currently operating Darlington Nuclear Generating Station.
Darlington Nuclear site (DN site)	The term DN site is used when describing the whole Darlington site, including the DNGS site and the DNNP site.
Darlington New Nuclear Project site (DNNP site)	The term DNNP site is used to describe the easterly one-third (approximately) of the overall DN site. It is bordered by the DN site property limits on the east and north boundaries, by Lake Ontario to the south, and by Holt Road (including its southerly projection to Lake Ontario) on the west.

Term	Description
BWRX-300 deployment	Refers to the implementation (i.e., site preparation, construction, operation, decommissioning) of four BWRX-300 reactors on the DNNP site, and all information pertaining to it.
PPE	The Plant Parameter Envelop is a set of postulated design parameters that define the characteristics of reactors that might later be deployed at a site.
Reactors assessed in the EIS	Reactors that were considered for the purpose of developing the PPE, which were the EPR, ACR-1000, AP1000. The EC6 was added to the PPE after the EIS was issued, but before the JRP issued its decision.
Province	The Province of Ontario, as the sole shareholder of Ontario Power Generation (OPG), is the sponsor for the DNNP.
Used fuel	Fuel that has been irradiated in a reactor. In this review, "spent fuel" and "used fuel" are used interchangeably.

1. INTRODUCTION

1.1 Purpose of Environmental Impact Statement Review Report

This report documents the review of the selected reactor technology, the BWRX-300 small modular reactor (SMR), to be built at the Darlington New Nuclear Project (DNNP) site and determines whether it remains within the scope of the 2009 Environmental Impact Statement (EIS). The EIS review is to satisfy OPG commitment D-P-12.1(a) - Comprehensive Environmental Impact Statement Review as documented in Darlington New Nuclear Project Commitments Report [1].

1.2 Background of Darlington New Nuclear Project

The Ontario Power Generation (OPG) DNNP, formerly referred to as the New Nuclear Darlington (NND) Project, consists of the site preparation, construction, operation, and decommissioning of up to four nuclear power reactors and up to 4,800 megawatts of electrical generating capacity for supply to the Ontario grid. The DNNP is situated at the existing Darlington Nuclear (DN) site which is located on the north shore of Lake Ontario in the Municipality of Clarington, within the Regional Municipality of Durham, about 70 km east of Toronto (Figure 1). The DNNP is located on the eastern third of the DN site.

Figure 1: Map with Darlington Nuclear Site Location.

The lands and waters on which the DNNP is situated are the traditional and treaty territory of the Williams Treaties First Nations, which includes Curve Lake First Nation, Hiawatha First Nation, Alderville First Nation, Chippewas of Beausoleil First Nation, Chippewas of Georgina Island First

Nation, Chippewas of Rama First Nation, and the Mississaugas of Scugog Island First Nation It is also within the traditional territory of the Huron-Wendat peoples as shown in Figure 2.

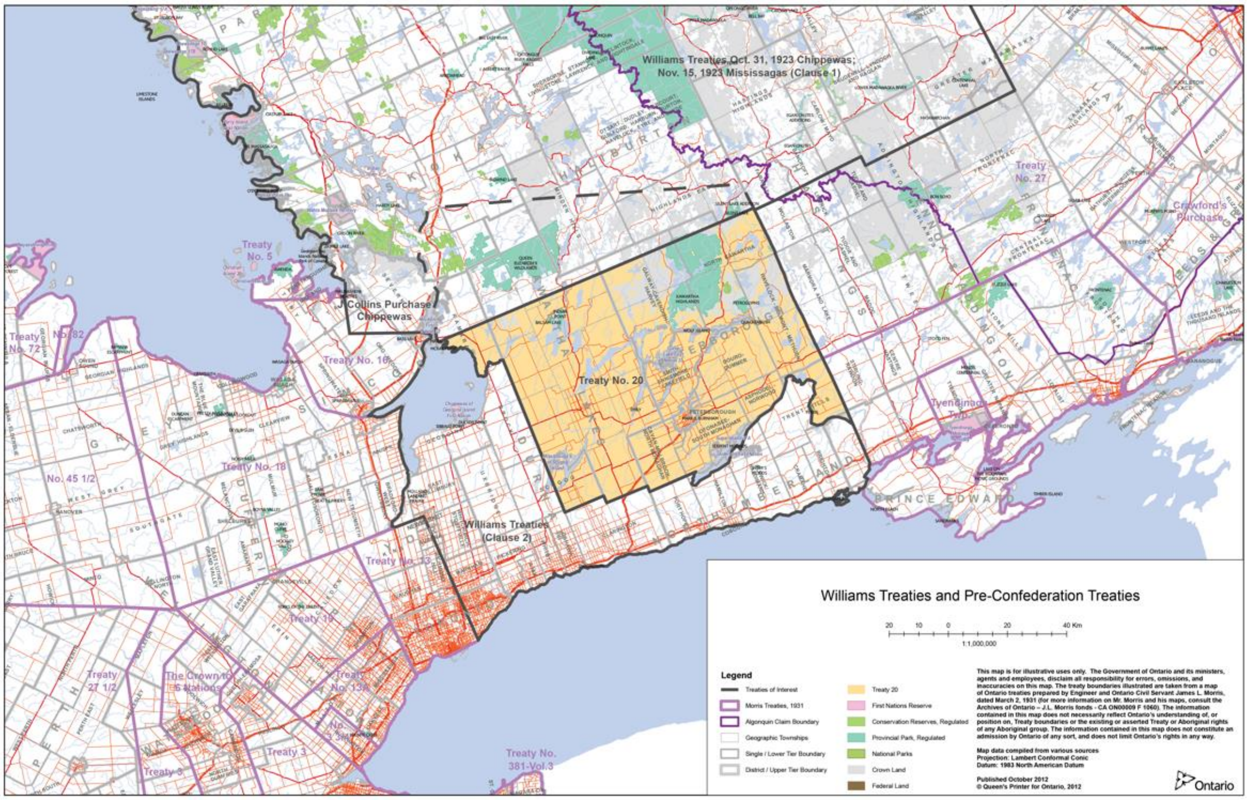

Figure 2: Williams Treaties and Pre-Confederation Treaties

OPG submitted in September 2006, a preliminary Licence to Prepare Site Application to the Canadian Nuclear Safety Commission (CNSC). The CNSC confirmed that a federal environmental assessment (EA) was required, and the federal Minister of the Environment determined that a Joint Review Panel (JRP) would be established to review the EA and the Licence Application.

The DNNP underwent an EA in accordance with the *Canadian Environmental Assessment Act (CEAA),* and in September 2009 OPG submitted the EIS [4] and an updated Licence to Prepare Site Application to the JRP. At the time the EIS was conducted, no specific reactor technology was selected; rather, the EIS considered a Plant Parameter Envelope (PPE) [5] as the basis for the environmental assessment. More specifically, the PPE was developed based on the limiting parameters for four different types of reactors that were considered at that time, and it was identified that the PPE may need to be modified when the specific reactor technology was selected.

Following the completion of a JRP process which included a 17-day public hearing, the JRP concluded that "the Project is not likely to cause significant adverse environmental effects, provided the mitigation measures proposed and commitments made by OPG during the review, and the JRP's recommendations are implemented." In May 2012, the Government of Canada (GOC) accepted the JRP's conclusions for the DNNP as well as the recommendations for the

DNNP and in accordance with paragraph 37(1.1) (c) of the CEAA, indicated that the Responsible Authorities (including the CNSC) may exercise any power or perform any duty or function conferred on them by or under any Act of Parliament that would permit the DNNP to be carried out in whole or in part. This determination was made on the basis that the DNNP would not cause significant adverse environmental effects provided that OPG implements the mitigation measures proposed, and commitments made during the review as well as other recommendations. Following that, the CNSC issued the Power Reactor Site Preparation Licence (PRSL 18.00/2022) for the DNNP.

In June 2020, OPG applied to the CNSC for a PRSL renewal. The CNSC renewed the PRSL in October 2021, for a duration of 10 years after a two-day public hearing. For this licence renewal application OPG had not initiated any licensed activities nor had OPG selected a reactor technology for DNNP and the Project scope assessed by the CNSC in 2012 remained unchanged. CNSC staff confirmed during the PRSL renewal public hearing that the EA accepted by the JRP in 2011 is still valid. There is no expiry on an EA decision as long as the scope of that project remains within the scope of the original EA [2].

In December 2021, OPG selected the BWRX-300 for deployment at the DNNP site and started working with the vendor, GE Hitachi Nuclear Energy, to progress the design of the BWRX-300 and develop the required documents in support of the Licence to Construct (LTC) Application.

1.3 OPG Commitments on EIS Review and Plant Parameter Envelope

The selection of a specific reactor technology represents another step in the development of the DNNP. In preparation for the LTC for DNNP, OPG needs to fulfill a regulatory commitment, D-P-12.1(a) [1], to conduct an EIS review for the selected reactor technology which is the purpose of this EIS Review document. The commitment is stated below:

D-P-12.1(a) Comprehensive Environmental Impact Statement Review:

> *"Once the specific technology is selected and design information is available, OPG will comprehensively review the EIS to ensure that the results of the EIS remain valid. If this review indicates either a gap or a condition not bounded by the EIS, OPG will initiate corrective actions as necessary. This may include mitigation options."*

As the EIS used the PPE as the basis for the environmental assessment, the commitment on PPE as listed in D-C-3.1 Preliminary Safety Analysis and Design [1] as stated below also needs to be considered in the EIS review:

> *"After the Licence to Prepare Site is issued the vendor will demonstrate to OPG's satisfaction that the design of the facility fits within the values used in the Plant Parameter Envelope.*

If the Nuclear Facility is not bounded by the Plant Parameter Envelope, the Envelope will be updated and appropriate assessment of the impacts will be undertaken or the design modified, as required."

1.4 Basis and Considerations for EIS review

1.4.1 Overall Basis

While OPG's 2022 application for the LTC will be for one BWRX-300 reactor, the DNNP considers a build out of up to four BWRX-300 reactors on the DNNP site. As such, for the purpose of this EIS review, the deployment of four BWRX-300 reactors is considered as the DNNP. The deployment of four reactors is consistent with the Project that was defined and assessed in the EIS. The EIS review also considers refinements related to the selected reactor technology, regulatory requirements, and the prevailing site conditions. Within this context, the EIS Review Report examines the effects of locating four BWRX-300 reactors on the DNNP site in relation to the EIS, and the PPE which was used as the basis for the EIS.

1.4.2 Applicable Regulatory Requirements for EIS Review

CNSC regulatory document REGDOC 1.1.1 *"Site Evaluation and Site Preparation for New Reactor Facilities*" is followed for the EIS Review per CNSC expectation as indicated in the following two documents:

1. In the Commission Member Document, CMD 21-H4, p. 43-44 [6] that CNSC staff prepared for the public hearing of the PRSL renewal, CNSC Staff stated that:

   "When OPG submits documentation regarding technology selection CNSC staff will review and confirm whether OPG has clearly demonstrated that reactor technology selected remains within the bounds of the JRP EA report and complies with CNSC regulatory requirements outlined in REGDOC 1.1.1. If OPG submits an application for a licence to construct that includes any changes to the predicted environmental effects from any revised design and/or baseline information, CNSC staff will conduct an environmental review determination to assess whether the proposed project is outside the bounds of the scope, predictions and conclusions of the previous EA. If CNSC staff determine that, the proposed project is outside the bounds of the previous EA scope, predictions and conclusions a further review will be required. CNSC staff would then determine what type of environmental review would be required."

2. Licence Condition 4.1 of the 2022 Licence Conditions Handbook [7] associated with the renewed PRSL 18.00/2031 indicates that:

   "OPG shall demonstrate that the selected nuclear reactor technology and updated site parameters have been taken into account in an assessment that demonstrate the effects

predicted in the EA and the 2009 application are met. OPG's demonstration is to be in accord with the requirements and guidance of REGDOC 1.1.1."

1.4.3 Baseline Data

This EIS review leveraged the updated information from the review of the DNNP site evaluation that OPG conducted to support the PRSL renewal. The review was to demonstrate that the DNNP site remains suitable for the construction and operation of a new nuclear power plant and included the following:

- A compliance review with the CNSC Regulatory Document REGDOC-1.1.1 baseline data where required or applicable, and a review of the current codes, standards, and practices in accordance with *Darlington New Nuclear Project Power Reactor Site Preparation Licence Renewal Plan* [8].
- An updated collection of baseline data in accordance with REGDOC-1.1.1.
- OPG also conducted various environmental studies, focused on DNNP commitments that require long lead time or additional baseline monitoring that could be advanced independently from a reactor technology selection.
- General site evaluation areas reviewed included:
    - An evaluation against the CNSC safety goals,
    - Natural and human induced factors,
    - Hazards associated with external events (natural and human induced),
    - Potential effects of the DNNP on the environment,
    - Demographics and emergency planning,
    - Consideration of future life extension of DNNP, and
    - Security threats and issues presented by the geographical location/characteristics of the DNNP site.

The EIS Review also includes examining baseline data collected following the PRSL renewal.

1.4.4 Role of Plant Parameter Envelope

When the 2009 EIS was submitted, OPG had not selected a particular nuclear technology. The Project was defined and described in the EIS in a manner to provide an assessment of effects that may result from a range of reactor technologies, as well as a number of reactors considered feasible for the DNNP site. Furthermore, when the JRP held its hearings for the DNNP and the GOC decided that the CNSC and other Responsible Authorities may exercise their powers or perform their duties that would permit the DNNP to be carried out, the technology still had not been selected.

In the EIS, the "Project for EA Purposes" was defined within a bounding framework that incorporated the PPE based on the following three reactor designs that were considered for the DNNP site:

- ACR-1000,
- Evolutionary Pressurized-Water Reactor (EPR) and
- AP-1000

Following the submission of the EIS, the JRP required OPG in August 2010 to re-evaluate the PPE to consider alternative technologies and to detail impacts on the EIS from their inclusion. As a result, the Enhanced CANDU 6 (EC6) heavy water reactor was incorporated in the PPE.

As stated in the EIS, *"A PPE is a set of design parameters that delimit the bounding framework for key features of the Project. A fully developed PPE represents the limiting values for the common elements of the different design options being considered and serves as a conservative surrogate for actual reactor design information that varies among the options."*

As well, the EIS provides *"works and activities associated with site development were also defined in a bounding framework. To create a bounding site development layout, three separate model plant layout scenarios were conceptualized, with each one representing the reasonable maximum extent for key parameters of the Project that would affect construction extent and effort."*.

This limiting value for each relevant parameter was used in the EIS for the assessment of environmental effects.

This approach was taken to facilitate the future selection of a specific nuclear technology and was consistent with CNSC licensing guidance for new nuclear power plants. To this end, the EIS states that [4]:

> *"Should the design that is ultimately selected by the Province be other than those considered in this EIS, any necessary adjustments would be made to the EIS to take into account any substantial changes in the environment, the circumstances of the Project, and new information of relevance to the assessment of effects of the Project"*.

The JRP, when recommending approval of the EIS, outlined in their Recommendation #1 [9]:

> *"The Panel understands that prior to construction, the Canadian Nuclear Safety Commission will determine whether this environmental assessment is applicable to the reactor technology selected by the Government of Ontario for the Project. Nevertheless, if the selected reactor technology is fundamentally different from the specific reactor technologies bounded by the Plant Parameter Envelope, the Panel recommends that a new environmental assessment be conducted."*

In approving the EIS and in response to the JRP, the GOC stated,

> *"The Government of Canada accepts the intent of this recommendation but acknowledges that any [Responsible Authority] RA under the CEAA will need to determine whether the future proposal by the proponent is fundamentally different from the specific reactor technologies assessed by the JRP and if a new EA is required under the CEAA."*

The GOC response therefore directed the CNSC (as a Responsible Authority) to determine if the selected technology is "fundamentally different" than the technologies specified in the EIS and if a new EA is required for the selected technology.

2. SCOPE OF THE EIS REVIEW

Based on the commitments and basis and considerations for EIS review described in the Sections 1.3 and 1.4 respectively above, the EIS Review covers the following two components:

1. **The Plant Parameter Envelope (PPE)** [5]**:** An assessment of effects is conducted for parameters where four BWRX-300 reactors are not within the PPE [Commitment D-C-3.1], and

2. **The EIS** [4]**:** A comprehensive review of the EIS for four BWRX-300 reactors is undertaken to ensure that the results of the EIS remain valid and if either a gap or a condition is not bounded by the EIS, corrective actions are provided [Commitment D-P-12.1].

For component 1, the assessment of how the deployment of four BWRX-300 reactors fits within the PPE bounding framework is described in Section 4. Where parameters are not within the PPE, further assessment is provided to examine the effects of the parameters on the significance of the residual effects defined in the EIS.

For component 2, a section-by-section review of the EIS was undertaken and is summarized in Section 5. Detailed review is presented in the EIS Review Supporting Document [3] which provides a comprehensive review using a systematic methodology to identify Project refinements related to BWRX-300 that could have an effect on the significance analysis of the EIS. Any additions to the environment effects identified in the EIS, and whether the results of its review would lead to any refinements in the EA follow-up program, are documented in the EIS Review Supporting Document. Applicable commitments specified in [1], JRP recommendations specified in [9], and Information Requests (IR) specified in [10], are also considered in the EIS Review Supporting Document.

The EIS Review and its associated studies cover the deployment of four BWRX-300 reactors on the DNNP site and consider all phases of the DNNP from site preparation, construction, operation, and decommissioning.

This EIS Review Report summarizes the results of these reviews and examines whether the construction and operation of four BWRX-300 reactors would result in any significant residual adverse effects as well as any opportunities for improvements.

3. PROJECT DESCRIPTION

This Section provides a description of the selected reactor design, refinements to the Project, and opportunities for improvements as a result of the construction and operation of four BWRX-300 reactors.

3.1 Selected Reactor Design

The reactor selected by OPG is the GEH BWRX-300, a SMR of the boiling water reactor (BWR) technology. The plant electrical power output is approximately 300 MWe and its design life is 60 years. The BWRX-300 implements enhanced safety features, such as the passive Isolation Condenser System (ICS) to remove the heat from the reactor when the normal heat removal system is unavailable. Passive safety systems enable simplifications that improve safety. As the tenth evolution of the BWR, the BWRX-300 represents the simplest BWR design since GE began developing nuclear reactors in 1955.

The BWRX-300 belongs to the same Light Water Reactor (LWR) family as the Pressurized Water Reactor (PWR) which was included as one of the reactors assessed in the EIS (referred to in this review as reactors assessed in the EIS). Its nuclear fuel has similar U-235 enrichment, up to 5%. Light (normal) water is used as coolant and moderator. The shape of the reactor core, a vertical arrangement of fuel assemblies, and the means of shutting down the nuclear reaction are the same: neutron absorbing control rods and injection of a liquid solution of boron. The turbine-generator of the BWRX-300 is similar to the equipment used in a PWR. In terms of ancillary equipment, the BWR does not require the steam generators that are included in the PWR design.

BWR technology was considered during the development of the EIS; however, insufficient information was submitted by the vendor for inclusion in developing the PPE. The JRP indicated in its EA report:

> *"OPG noted that should the Government of Ontario decide to include boiling water-type reactors in its procurement process, the plant parameter envelope would be updated accordingly."*

Table 1 provides an overall comparison of the reactors used to develop the PPE as a basis for the EIS with the BWRX-300 reactor that was selected for the current DNNP.

Table 1: Comparison of Reactors Used to Develop the PPE with BWRX-300 Reactor

Reactor Design	Reactors Considered in Developing the PPE				GEH (BWRX-300)
	AREVA (EPR)	Westinghouse (AP1000)	AECL (ACR-1000)	AECL (EC6)	
Number of plants on site	3	4	4	4	4
Reactor design	Pressurized light water	Pressurized light water	Pressurized hybrid (heavy and light water)	Pressurized heavy water	Boiling light water
Net electric power in MWe (per reactor)	1,580	1,037	1,085	740	300
Thermal power in MWth (per reactor)	4,500	3,415	3,200	2,084	870
Depth of foundation embedment	maximum 13.5 m below ground level	maximum 13.5 m below ground level	maximum 13.5 m below ground level	maximum 13.5 m below ground level	38 m below ground level
Fuel in assembly or bundle	5% U-235 enriched fuel in fuel assembly	2.35 to 4.8% U-235 enriched 17x17 XL Robust fuel assembly	2.4% U-235 enriched CANFLEX-ACR® fuel bundle	Natural uranium (0.7% U-235) 37-element fuel bundle	3.81-4.95% U-235 enriched GNF2 fuel assembly
Primary cooling system	Pressurized light water	Pressurized light water	Pressurized light water	Pressurized heavy water	Boiling light water
Secondary cooling system	Boiling light water	Boiling light water	Boiling light water	Boiling light water	Primary and Secondary cooling are combined in a single circuit
Moderator	Light Water	Light water	Heavy water	Heavy water	Light water
Plant life	60 years (with replacement of components)	60 years (with replacement of components)	60 years (with midlife refurbishment)	60 years (with midlife refurbishment)	60 years (with replacement of components)
Normal operation cooling system	Once through lake water cooling or natural draft, mechanical or fan-assisted natural draft cooling tower	Once through lake water cooling; or natural draft, mechanical or fan-assisted natural draft cooling tower	Once through lake water cooling; or natural draft, mechanical or fan-assisted natural draft cooling tower	Once through lake water cooling; or natural draft, mechanical or fan-assisted natural draft cooling tower	Once through lake water cooling

Reactor Design	Reactors Considered in Developing the PPE				GEH (BWRX-300)
	AREVA (EPR)	Westinghouse (AP1000)	AECL (ACR-1000)	AECL (EC6)	
Emergency cooling system	Borated water emergency core cooling, containment cooling and core melt cooling using in-containment refueling water storage tank	Passive Core Cooling System and Passive Containment Cooling System using in-containment refueling water storage tank	Emergency Core Cooling System using water from safety injection system	Emergency Core Cooling System to supply water to the heat transport system from the reserve water tank	Passive Isolation Condenser System (ICS)

Conceptually, a BWRX-300 and a PWR are very similar with one main difference. In the BWRX-300, heat produced by nuclear fission in the core heats up the surrounding cooling water creating steam, which is directly used to drive a turbine, while in a PWR, the reactor cooling circuit (primary cooling) is separate from the turbine circuit (secondary cooling). A schematic showing the similarities and difference between the PWR and BWR reactor technologies is illustrated in Figure 3.

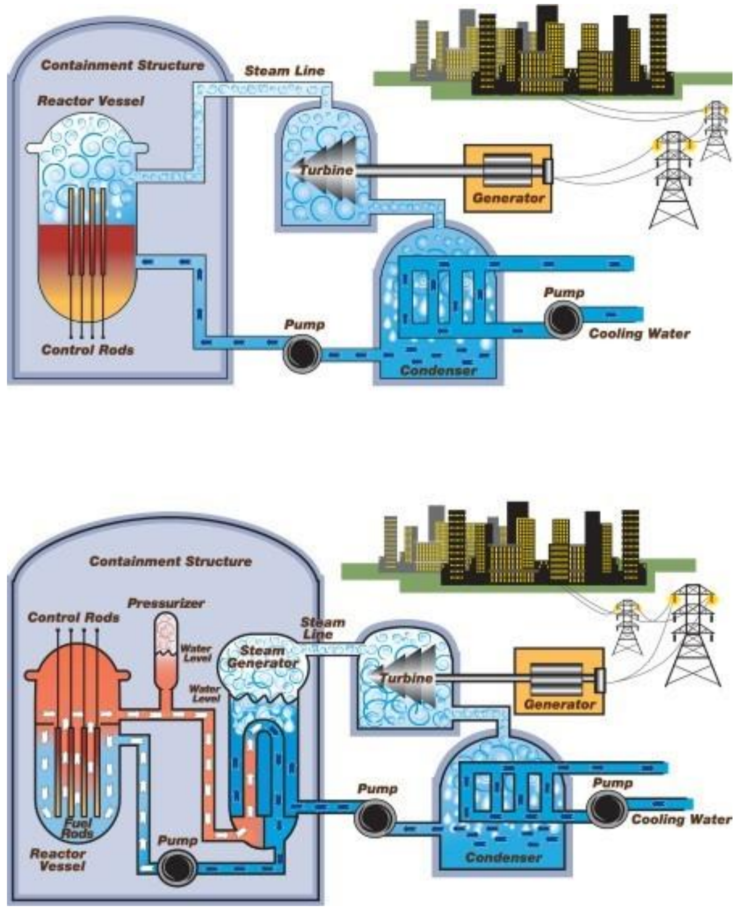

Figure 3: Simplified Schematics for Nuclear Power Reactors. (Top) Boiling Water Reactor such as BWRX-300. (Bottom) Pressurized Water Reactor

The BWRX-300 is a smaller reactor when compared to the DNGS reactors or other traditional nuclear reactors, both in terms of electrical production and physical size. Figure 4 shows the main buildings in the BWRX-300 power block.

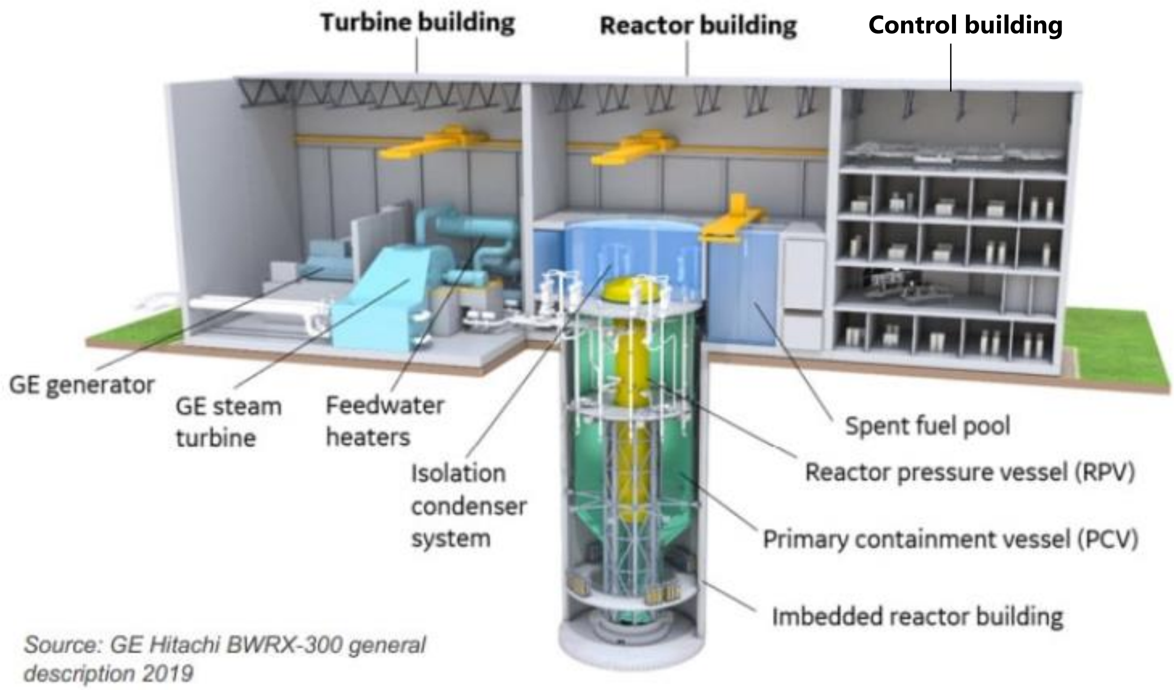

Figure 4: BWRX-300 Reactor and Turbine Building

The 2009 EIS and the JRP EA report both indicated that the reactors assessed in the EIS consist of up to four reactors and a maximum of 4800 MWe. For the purpose of the EIS Review, the Project consisting of four BWRX-300 reactors will provide up to approximately 1200 MWe, with each individual BWRX-300 reactor having a much smaller power output (300 MWe) than the reactors previously considered (up to 1580 MWe).

Therefore, the DNNP with its four BWRX-300 reactors will not exceed the total electrical output as it falls well within the maximum electrical output of 4800 MWe assessed in the EIS and used to develop the PPE.

3.2 Conceptual Plant Layout

The conceptual plant layout for the construction of four BWRX-300 reactors is shown in Figure 5.

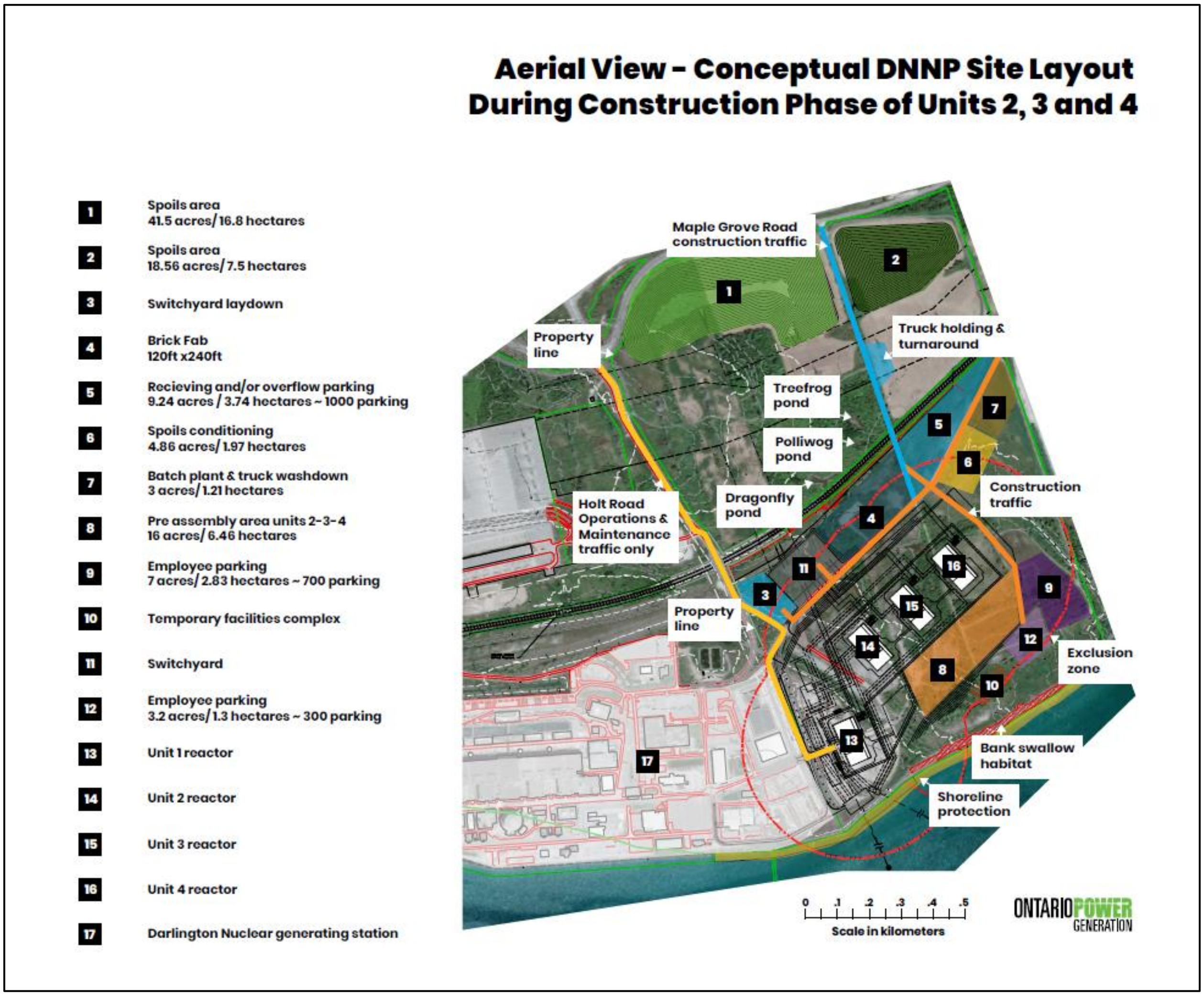

Figure 5: Conceptual Plant Layout for Construction of Four BWRX-300 Reactors

3.3 Conceptual Switchyard Location

The location of the switchyard considered in the 2009 EIS (West of Holt Road, south of the CN rail) is highlighted in blue and shown in Figure 6. Figure 7 displays the currently proposed switchyard location (highlighted in blue) for the deployment of the BWRX-300.

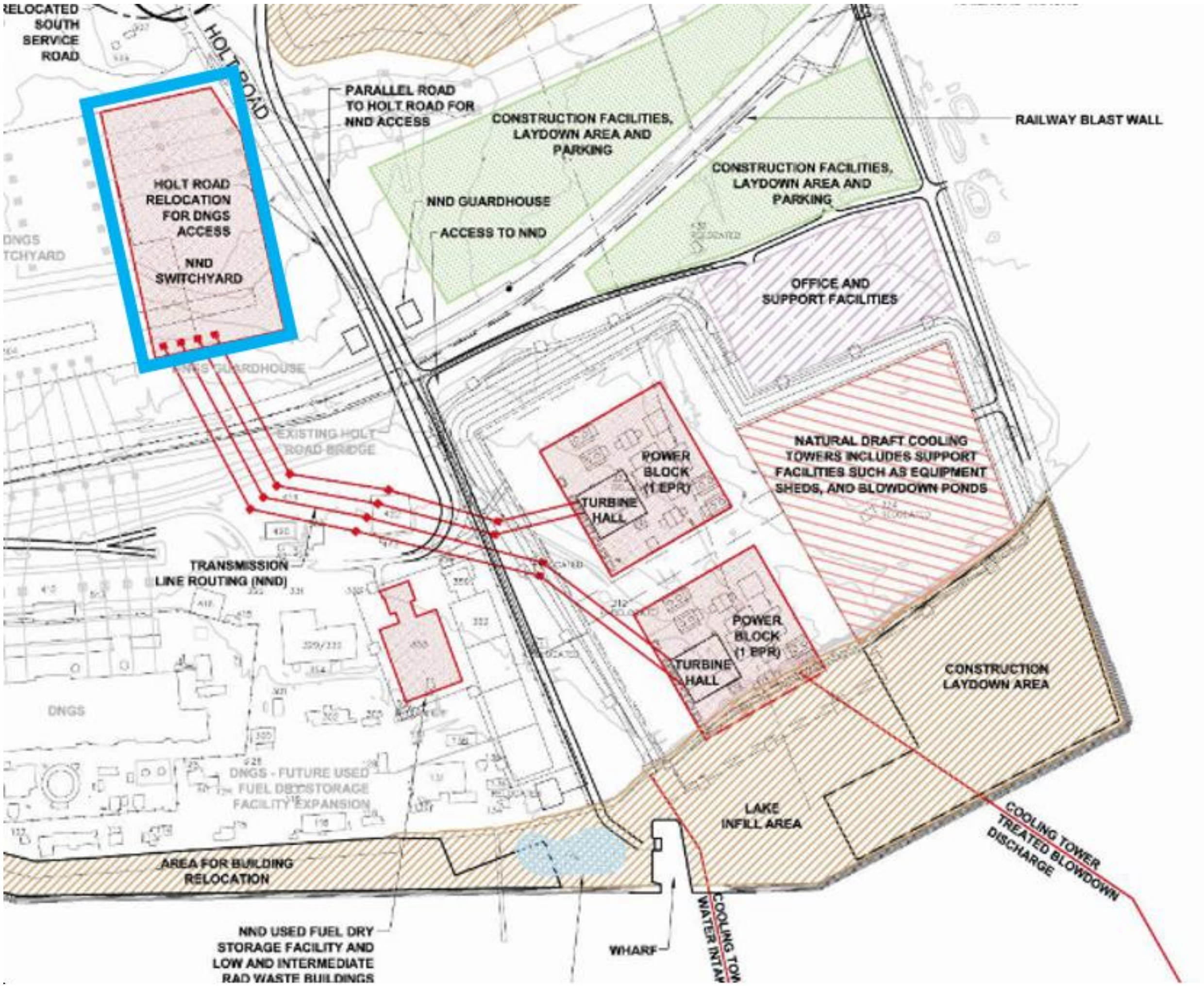

Figure 6: Switchyard Location from the 2009 EIS

Figure 7: Conceptual Switchyard Location - BWRX-300 Four Reactor Layout

3.4 Project Works and Activities

Based on the Project Description in the EIS, the BWRX-300 deployment is expected to be undertaken in three phases with their associated works and activities as follows:

Site Preparation and Construction Phase:

- Mobilization and Preparatory works (e.g., clearing and grubbing, services and utilities, and on-site roads and related infrastructure)
- Excavation and Grading (e.g., on-land earthmoving and grading, rock excavation, and development of construction laydown areas)
- Management of Stormwater (e.g., ditches, swales, and ponds)
- Development of Administration and Physical Support Facilities (e.g., offices, workshops, maintenance, storage and perimeter security buildings and utilities operating centres)
- Construction of the Power Block (e.g., reactor buildings, turbine-generator buildings, and related structures)

- Construction of Intake and Discharge Structures (e.g., offshore submerged intake and discharge structures for the once-through lake water cooling)
- Construction of Ancillary Facilities (e.g., switchyard)
- Marine and Shoreline Works (e.g., shoreline protection and some minor lake bottom dredging)
- Construction of Radioactive Waste Storage Facilities (e.g., facilities for dry storage of used fuel, following initial wet storage in bays within the Power Block, and facilities for storage of Low & Intermediate Level Waste (L&ILW))
- Supply of Construction Equipment, Material and Operating Plant Components (e.g., to the work site)
- Management of Construction Waste, Hazardous Materials, Fuels and Lubricants
- Workforce, Payroll and Purchasing (e.g., workers during construction)

Operation and Maintenance Phase:

- Operation of the Reactor Core (e.g., first fuel load and commissioning, start-up, reactivity control/operation and shutdown activities)
- Operation of the Heat Transport System
- Operation of Active Ventilation and Radioactive Liquid Waste Management Systems
- Operation of Safety and Related Systems (e.g., such that fundamental safety functions are ensured)
- Operation of Fuel and Fuel Handling Systems (e.g., receipt and storage of new fuel, fuelling / refuelling the reactors and transfer of used fuel from the reactors to wet storage)
- Operation of Condenser and Condenser Circulating Water, Service Water and Cooling Systems (e.g., once-through lake water cooling system)
- Operation of Electrical Power Systems (e.g., main transformers and emergency/standby power facilities)
- Operation of site services and utilities (e.g., sewage, stormwater, domestic water)
- Management of operational low and intermediate-level waste (e.g., including off-site transportation if applicable)
- Dry storage of Used Fuel (e.g., at an on-site facility pending eventual transfer to a long-term management facility)
- Management of Conventional Waste (e.g., including reuse and recycling)
- Replacement/Maintenance of Major Components and Systems (e.g., including possible refurbishment of major components)
- Administration, Purchasing and Payroll (e.g., workers during operations and maintenance)

Decommissioning Phase:

- Transition from operations to a safe shutdown state (including transfer of spent fuel to dry storage and eventual transfer to a long-term management facility)
- A period of storage with surveillance to allow for decay to decrease the radioactive hazard (inspection and maintenance of the facility is ongoing during this period)

- Preparation for dismantling (development of dismantling plans, decontamination as needed, acquisition of dismantling resources such as personnel, equipment, etc.)
- Dismantling, demolition, and site restoration (removal of all contaminated SSCs and restoration of the site to be available for other OPG uses)
- Release from regulatory control

3.5 Project Timeline

The 2009 EIS assumed that site preparation and construction of the first reactor would start in 2010. The conceptual timeline for the BWRX-300 deployment is presented in Table 2 with an anticipated start in Q3/Q4 2022, approximately 12 years later than the original date.

Table 2: Proposed Project Timeline

Single Project Phase	Start	Finish
Reactor 1 - Site Preparation	2022	2024 (2 years)
Reactor 1 - Construction	2025	2028 (4 years)
Reactor 1 - Operation and Maintenance	2029	2089 (60 years)
Reactor 1 - Decommissioning	2089	2119 (30 years)
Reactor 2, 3 and 4 - Site Preparation	2027	2029 (2 years)
Reactor 2 - Construction	2029	2033 (4 years)
Reactor 2 - Operation and Maintenance	2033	2093 (60 Years)
Reactor 2 - Decommissioning	2093	2123 (30 years)
Reactor 3 - Construction	2030	2034 (4 years)
Reactor 3 - Operation and Maintenance	2034	2094 (60 year)
Reactor 3 - Decommissioning	2094	2124 (30 years)
Reactor 4 - Construction	2031	2035 (4 years)
Reactor 4 - Operation and Maintenance	2035	2095 (60 years)
Reactor 4 - Decommissioning	2095	2125 (30 years)

The site preparation activities for the first reactor are expected to start two years in advance of the construction date. The site preparation activities for the next three reactors will start at the same time. The required time for site preparation and construction is six years per reactor for the first two reactors, and four years per reactor for the remaining two reactors.

3.6 Review of Basic Design Features

3.6.1 Comparison of Design Features and Energy Production

Table 3 below provides a comparison regarding basic reactor design features and how energy is produced for the reactors assessed in the 2009 EIS and for the BWRX-300 reactor.

For clarity:

- Blue shades mean that the design feature is consistent with the reactors assessed in the EIS.
- Green shades mean a process or design feature related to the BWRX-300 reactor is similar, but not fully consistent to the design features for the reactors assessed in the EIS.

Table 3: Comparison of How Energy is Produced

Description in the EIS	BWRX-300	Consistency with EIS Description
In the reactor core, heat is produced when a neutron strikes an atom of uranium in the fuel, causing it to split into lighter atoms. In addition to heat, this fission reaction releases additional neutrons that can split other uranium atoms in a chain reaction.	The BWRX-300 produces heat through a fission process that takes place in a reactor core.	Consistent.
To slow down the neutrons and control the fission process, the reactor contains a moderator (which may be light or heavy water).	The BWRX-300 uses light water for the moderator and coolant [11].	Consistent.
Water is passed over the fuel and through a series of pipes to transfer the heat to a set of steam generators (i.e., boilers). This water is the reactor coolant, and the system is collectively the Primary Heat Transport System (also known as the Reactor Coolant System). The heated reactor coolant water enters the tubes of the steam generators (i.e., the primary side of the steam generators). The heat is conducted across the tubes of the steam generator, resulting (i.e., the secondary side of the steam generators). The tubes in the steam generator prevent mixing of reactor coolant water from the primary heat transport system with the feedwater steam on the shell side of the steam generators. The steam produced in the shell side of the steam generators is transferred through a system of	The BWRX-300 does not use steam generators as it is a BWR design. Instead, heated cooling water turns into steam which is directly used to drive a turbine which results in the production of electricity.	Similar. The cooling of the fuel is consistent. For the reactors assessed in the EIS, the EIS assumed that the heated reactor coolant water enters the tubes of the steam generators, resulting in boiling of the feedwater on the shell side of the steam generators. In the BWRX-300 the heated reactor coolant turns directly into steam.

Description in the EIS	BWRX-300	Consistency with EIS Description
pipes that form a second closed-loop system (i.e., Secondary Heat Transport System). The steam passes through the turbines, causing the turbine rotors and the attached generator rotor to rotate. The spinning of the generator rotor results in the production of electricity.		
After the steam passes through the turbine, it is cooled and converted to water in the condensers and redirected for steam generation.	In the BWRX-300, steam is condensed after passing through the turbine in the condenser, and condensate is recycled for steam generation.	Consistent.
The condensers are cooled by another separate flow of water (the Condenser Circulating Water – CCW System) that travels through the condenser tubes. The feedwater and the condenser circulating water do not mix. As with the relationship between the reactor coolant water and the feedwater, the feedwater and the reactor cooling water do not mix.	In the BWRX-300, the condensers are cooled the same way as for the PWR: a separate flow of water (the CCW system) is used. The feedwater and the condenser circulating water do not mix. In the BWRX-300, the reactor coolant water and the feedwater are the same.	Similar. In the EIS, the reactor coolant water and the feedwater do not mix, the feedwater and the condenser circulating water do not mix. In the BWRX-300, the reactor coolant water and the feedwater are the same. The feedwater and the condenser circulating water do not mix.
The circulating cooling water system may be part of a "once-through" cooling system such as that at DNGS. Alternatively, it may be part of a "closed loop" cooling tower system [...]. In both cases, substantial volumes of cool water are cycled through the condensers thereby converting the turbine steam to water.	The BWRX-300 uses a once-through cooling system.	Consistent.
All nuclear generating stations incorporate comprehensive safety features and processes. Fast-acting safety systems and safety-related systems are in place to prevent and mitigate potential accidents. Further, the design and operation of	The BWRX-300 safety systems are in place to prevent and mitigate potential accidents. The design and operation of the BWRX-300 also incorporates defence-in-depth [11].	Consistent.

Description in the EIS	BWRX-300	Consistency with EIS Description
a nuclear generating station incorporates defence in-depth. This concept acknowledges that design flaws, equipment failures and/or mistakes may occur. However, there will be multiple, redundant, independent barriers in place such that no single mistake or failure can cause significant detriment to human health and/or the environment.		
Nuclear reactor fuel for typical Generation III reactors is manufactured off-site and delivered to the generating facility in various configurations depending on the reactor type (e.g., fuel rod assemblies or fuel bundles). The three reactors currently being considered by the province all use low enriched uranium fuel (i.e., up to 5% enrichment).	The process described in this section applies to the BWRX-300 deployment; the fuel for BWRX-300 will also be manufactured off-site and uses fuel less than 5% enrichment [11].	Consistent.
When removed from the reactor, used fuel is transferred to a water-filled Used Fuel Bay (alternatively known as Spent or Irradiated Fuel Bay) where it is contained to cool for a period of several years. Following the period of wet storage in the used fuel pool, the used fuel is transferred to dry storage containers and placed into appropriate facilities, also specific for the fuel type. The used fuel from all reactors in Ontario is currently stored in Spent Fuel Bays and dry storage facilities at the stations where the fuel was used. The Nuclear Waste Management Organization (NWMO) created under the auspices of the federal Nuclear Fuel Waste Act (NFWA), is charged with development of a long-term management approach for used fuel, which is subject to a	The process described in this section applies to the BWRX-300 deployment; spent fuel is also stored in a spent fuel pool (Figure 4) before being transferred to on-site dry storage. There is no change to the description of waste management practices in Ontario.	Consistent.

Description in the EIS	BWRX-300	Consistency with EIS Description
separate federal approvals process.		
In addition to used fuel, nuclear generating stations all produce a volume of Low & Intermediate Level Waste (L&ILW) radioactive waste. These waste products will be processed on-site and stored or otherwise managed in appropriate facilities either on-site or shipped to OPG licensed off-site facilities. OPG's Western Waste Management Facility currently receives and manages such wastes from existing OPG nuclear generating stations.	The process in this section applies to the BWRX-300 deployment; L&ILW will also be produced, and will be processed on-site, and shipped to an off-site OPG licensed facility.	Consistent.

For almost all items, the BWRX-300 design features and how energy is produced are consistent with the reactors assessed in the EIS.

For two items identified in light green in the table (i.e., the reactor cooling system and the condenser cooling system), the functions are similar, but the BWRX-300 design includes simplifications. The condenser cooling system is consistent (i.e., once-through cooling) with the reactors assessed in the EIS, but the reactor coolant water and the feedwater are combined. The function of the reactor cooling system is largely similar (i.e., use of light water as coolant to cool the fuel) to that of the reactors assessed in the EIS.

3.6.2 Conceptual Plant Layout

The BWRX-300 conceptual plant layouts will not require lake infilling. In addition, the smaller area required for the proposed BWRX-300 deployment and the conceptual layouts provides for the following opportunities:

- The EIS assumed that all habitat within the DNNP site footprint would be removed to allow for site preparation and construction. The smaller footprint for the BWRX-300 may provide an opportunity to retain some terrestrial habitats on the DNNP site.
- The conceptual site layout for the first BWRX-300 reactor provides an opportunity to preserve the Bank Swallow nesting habitat along the Lake Ontario shoreline in the short term. Ultimately however, the site layout for four BWRX-300 reactors will likely require some shoreline protection measures which may cause the bank to become unsuitable for Bank Swallows to inhabit.

In general, the BWRX-300 deployment has reduced volume of soil and rock excavation, smaller laydown areas, less construction traffic, all of which results in lower air emissions and noise during site preparation and construction than what was predicted in the EIS.

3.6.3 Other Design Features and Alternatives

The description of the "Project for EA Purposes" in the 2009 EIS included alternative means of carrying out the Project, and as a result, the assessment of environmental effects described in the EIS represents the "full reasonable range of possible ways the Project might be implemented". All were determined through the assessment to be acceptable (i.e., will not result in significant residual adverse effects). However, the EIS does conclude with statements of OPG's preference concerning the alternative means, where appropriate. The BWRX-300 deployment is consistent with OPG's preferred options as identified below:

- Condenser cooling is once-through cooling.
- Management of L&ILW is to transport off-site to an OPG licensed facility.
- Interim storage of spent fuel on site, in dry storage casks.
- Management of excavated material on-site.

To be licensed by the CNSC, used fuel handling and storage systems for the DNNP will be designed to comply with prevailing regulatory requirements.

3.7 Review of Project Works and Activities

The work and activities associated with the reactors assessed in the 2009 EIS have been reviewed to verify that they are consistent with the BWRX-300 deployment. The review considered works and activities related to alternative technologies and components that are applicable with both the BWRX-300 and the reactors assessed in the EIS, as well as those that are refinements unique to the BWRX-300.

Table 4 lists the Project works and activities associated with reactors assessed in the EIS and those for the BWRX-300, and a determination as to whether they are consistent. For clarity:

- Blue shades mean that the activity is consistent with the EIS.
- Green shades mean the activity is either a refinement unique to the BWRX-300 or is no longer required.

Table 4: Project Works and Activities

Reactors Assessed in the EIS	BWRX-300	Consistency with EIS Description
Site Preparation and Construction Phase		
Mobilization and Preparatory works (e.g., clearing and grubbing, services and utilities, and on-site roads and related infrastructure)	The BWRX-300 reactor has a footprint of 19 ha. The site area for one reactor will be prepared for construction at the outset of the Project, with the additional preparation of the whole site undertaken if the deployment of four reactors proceeds.	Smaller footprint.
Excavation of approximating 12.4 Mm^3 and Grading (e.g., on-land earthmoving and grading, rock excavation, and development of construction laydown areas)	The BWRX-300 foundation embedment is 38 m below grade. The BWRX-300 deployment will require the excavation of approximately 1 million cubic metres (Mm^3) of soil and rock for a single reactor, or approximately 3.3 Mm^3 for four reactors [12].	Deeper foundations required. Smaller excavation volumes anticipated.
Marine and Shoreline Works (e.g., lake infilling, shoreline protection, wharf construction, and some minor lake bottom dredging)	The BWRX-300 deployment will require limited marine and shoreline works.	Less marine and shoreline works. No lake infilling or new wharf.
Development of Administration and Physical Support Facilities (e.g., offices, workshops, maintenance, storage and perimeter security buildings and utilities operating centres)	The BWRX-300 deployment requires the construction of administration and physical support facilities.	Smaller footprint.
Construction of the Power Block (e.g., reactor buildings, turbine-generator buildings, and related structures)	The construction methods will follow best industry practices, similar to those described in the EIS, although the scale of these activities is generally smaller.	Consistent.

Reactors Assessed in the EIS	BWRX-300	Consistency with EIS Description
Construction of Intake and Discharge Structures (e.g., offshore submerged intake and discharge structures similar to those of DNGS for the once-through lake water cooling option; or alternatively, smaller but generally similar structures for the cooling tower options)	The water intake and the discharge pipes will be sized for four reactors. The discharge pipe includes a series of diffusers from which the water is discharged to promote rapid thermal mixing in the lake. The BWRX-300 deployment will utilize either typical underground mining techniques involving blasting and excavation or by boring using a purpose-built tunnel boring machine and/or other modern construction techniques.	Smaller in scale.
Construction of Ancillary Facilities (e.g., including cooling towers and blow-down ponds, if applicable, and expansion of the existing switchyard)	The BWRX-300 deployment will not require the construction of cooling towers and blow-down ponds. The BWRX-300 deployment will not expand the DNGS switchyard (Bowmanville Switching Station) as described in the EIS but will establish a new one, adjacent to the reactor buildings. The BWRX-300 deployment assumes a concrete batch plant will be established on-site.	Consistent. except a new switchyard will be provided.
Construction of Radioactive Waste Storage Facilities (e.g., facilities for dry storage of used fuel, following initial wet storage in bays within the Power Block, and facilities for storage of L&ILW)	The volume of L&ILW and used fuel generated from the BWRX-300 deployment over the 60 years of operation is estimated to be less than for the larger reactors assessed in the EIS. The BWRX-300 deployment will transport the L&ILW off-site to an OPG licensed facility. The description of the on-site dry storage facility in the EIS is applicable to the BWRX-300 deployment.	Smaller in scale.

Reactors Assessed in the EIS	BWRX-300	Consistency with EIS Description
Management of Stormwater (e.g., ditches, swales, and ponds)	The general approach to stormwater management during site development and operation described in the EIS is applicable to the BWRX-300 deployment.	Consistent.
Supply of Construction Equipment, Material and Operating Plant Components (e.g., to the work site)	The description of the supply of construction equipment and concrete, manufactured construction materials and plant operating components in the EIS is applicable to the BWRX-300 deployment.	Consistent.
Management of Construction Waste, Hazardous Materials, Fuels and Lubricants	The description of the management of construction waste, hazardous materials and lubricants in the EIS is applicable to the BWRX-300 deployment.	Consistent.
Workforce, Payroll and Purchasing (e.g., up to 3,800 workers during Construction).	Approximately 2,100 workers are expected to be on-site during peak construction of three reactors.	Workforce is smaller.
Expansion of the DNGS Switchyard (Bowmanville Switching Station)	See Section 3.3.	New switchyard is within the area where the reactors were assessed in the EIS.
Operation and Maintenance Phase		
Operation of the Reactor Core (e.g., start-up, reactivity control/operation and shutdown activities)	Operation of the reactor core and related activities is required.	Consistent.
Operation of the Primary Heat Transport System (e.g., including management of heavy water with the ACR-1000 reactor option only)	Operation of a reactor cooling system is required.	Consistent.
Operation of Active Ventilation and Radioactive Liquid Waste Management Systems	Operation of active ventilation and radioactive waste management systems is required.	Consistent.
Operation of Safety and Related Systems (e.g., such that fundamental safety functions are ensured)	Operation of safety and related systems is required.	Consistent.

Reactors Assessed in the EIS	BWRX-300	Consistency with EIS Description
Operation of Fuel and Fuel Handling Systems (e.g., receipt and storage of new fuel, fuelling / refuelling the reactors and transfer of used fuel from the reactors to wet storage)	Operation of fuel and fuel handling systems is required.	Consistent.
Operation of Secondary Heat Transport Systems and Turbine-generators (e.g., comprising the secondary side of steam generators, main steam system, turbines, condensers, and generators)	The primary heat transport and secondary heat transport systems are combined. Operation of turbines, condensers and generators are required.	The primary heat transport and secondary heat transport systems are combined, but turbines, condensers and generators are consistent.
Operation of Condenser and Condenser Circulating Water, Service Water and Cooling Systems (e.g., once-through lake water cooling system; similar to the DNGS system; or natural draft, mechanical or fan-assisted natural draft cooling tower alternatives)	The cooling water flow rates, and temperatures for the once-through cooling fit within the parameters assessed in the EIS. Natural draft, mechanical or fan-assisted natural draft cooling towers are not required.	Consistent.
Operation of Electrical Power Systems (e.g., main transformers and emergency/standby power facilities)	Operation of an electrical power system is required.	Consistent.
Operation of site services and utilities (e.g., sewage, stormwater, domestic water)	Operation of site services and utilities is required.	Consistent.
Management of operational low and intermediate-level waste (e.g., including off-site transportation if applicable)	Management of operational low and intermediate-level waste is required.	Consistent.
Dry storage of Used Fuel (e.g., at an on-site facility pending eventual transfer to a long-term management facility)	Management of spent fuel for BWRX-300 will also use an on-site dry storage facility.	Consistent.
Management of Conventional Waste (e.g., including reuse and recycling)	Management of conventional waste is required.	Consistent.
Replacement/Maintenance of Major Components and Systems (e.g., including possible mid-life refurbishment of major components such as reactor components and steam generators)	Replacement/maintenance of major components and systems will be required.	Consistent.

Reactors Assessed in the EIS	BWRX-300	Consistency with EIS Description
Physical Presence of the Station (e.g., as an operating nuclear facility)	The BWRX-300 will be a new licensed operating nuclear facility on the DN site.	Consistent.
Administration, Purchasing and Payroll (e.g., involving a workforce estimated at 1,400 for the first two reactors and up to 2,800 for four reactors)	The maximum operations workforce is approximately 300 people considering operation of four reactors.	Workforce is smaller.
Decommissioning Phase		
Decommissioning strategy of deferred dismantling	A decommissioning strategy for BWRX-300 has not been established. A deferred dismantling strategy has been assumed. The overall approach and principles to be applied for decommissioning of the BWRX-300 reactors involve stages as described in Section 3.4.	Consistent.

3.8 Review of Project Timelines

In the 2009 EIS, the duration of the site preparation and construction period was assumed to be fifteen years, from 2010 to 2025 for four reactors, while the site preparation and construction of the BWRX-300 would be sequential with some overlap, with a duration of six years per reactor for the first two reactors, and four years per reactor for the remaining two reactors, within a total period of 13 years from 2022 to 2035 as shown in Table 2. The operation and decommissioning periods are the same for the BWRX-300 and those reactors considered in the EIS.

The delay in commencement of the DNNP of several years does not, on its own, have an adverse effect on the environment. However, over time some environmental conditions at the DNNP site have changed. For example, the intensity and frequency of extreme weather events such as storms and droughts has increased, and the impact of zebra and quagga mussels, attached algae on the circulating cooling water is susceptible to changes. The changes in environmental conditions since 2010 were considered in the EIS Review Supporting Document [3] and are summarized in Section 5.1.

Similarly, over time other projects on or near the DNNP site that might contribute to cumulative effects may have been completed, are currently in progress, or have not yet commenced. The cumulative effects from BWRX-300 deployment were considered in the EIS Review Supporting Document and are summarized in Section 5.8.

4. REVIEW OF PLANT PARAMETER ENVELOPE

As indicated in Section 1.4.4 above, the EIS used a PPE as the basis for the environmental assessment. Since the PPE encompasses design parameters that define the characteristics of the reactors considered in the EIS, a comparison the BWRX-300 design parameters with the PPE is required to satisfy the PPE commitment listed in the DNNP commitment D-C- 3.1, Preliminary Safety Analysis and Design. Where BWRX-300 parameters do not fit within the PPE, further assessment was required to determine whether the conclusions of the EIS remain valid or if additional mitigation is required.

The bounding value for each relevant parameter was used in the 2009 EIS for the assessment of environmental effects. This was completed for the following 20 categories and 198 parameters:

- Plant Thermal/Electric Characteristics (4 parameters)
- Structure (22 parameters)
- Normal Plant Heat Sink (48 parameters)
- Ultimate Heat Sink (UHS) (27 parameters)
- Containment Heat Removal System (Post Accident) (2 parameters)
- Potable Water / Sanitary Waste System (3 parameters)
- Demineralized Water System (3 parameters)
- Fire Protection System (3 parameters)
- Miscellaneous Drain (1 parameter)
- Airborne Effluent Release (21 parameters)
- Liquid Radwaste System (5 parameters)
- Solid Radwaste System (3 parameters)
- Fuel (10 parameters)
- Auxiliary Boiler Systems (4 parameters)
- Heating, Ventilation and Air Conditioning System (HVAC) (6 parameters)
- Onsite/ Offsite Electrical Power System (1 parameter)
- Standby Power (5 parameters)
- Plant Characteristics (9 parameters)
- Construction (7 parameters)
- Decommissioning (14 parameters)

4.1 ASSESSMENT OF BWRX-300 WITH PPE

The assessment of whether the BWRX-300 reactor design fits within the PPE was conducted by GEH [13]. The results of the assessment are summarized as follows:

- The 2009 EIS consisted of 198 PPE parameters.

- 34 PPE parameters related to cooling towers for the normal plant heat sink (line items 2.4.1 to 2.4.16, 2.5.1 to 2.5.16, 2.7.1 and 2.7.2 of reference [5]) are not applicable for the BWRX-300 deployment as Once-Through Cooling (OTC) system will be used.
- 4 PPE parameters related to auxiliary boiler (line items 13.1 to 13.4 [5]) are not applicable as BWRX-300 as will use emergency or standby generators and will not use auxiliary boilers.
- 22 PPE parameters related to UHS's heat exchanger and mechanical draft cooling towers (line items 3.3.1 to 3.3.16, and 3.4.1 to 3.4.6 [5]) are not applicable as BWRX-300's UHS is the ICS pool in which the water is allowed to boil, and the steam vented to the atmosphere.
- 129 BWRX-300 parameters are within their respective PPE, and
- 9 BWRX-300 parameters are outside of the PPE. They are largely due to characteristics inherent to the design of the GEH reactor technology and have been subjected to further assessment to determine whether the conclusions of the EIS remain valid or if additional mitigation is required.

The following subsections describe these nine parameters in detail and demonstrate that they do not result in significant residual environmental effects.

4.1.1 Fire Protection System

For the BWRX-300 deployment, the maximum short-term rate of withdrawal from the water source for fire protection [line item 7.1.1] [5]) is greater than the flow rate evaluated in the EIS. Further, the quantity of water stored in fire protection system impoundments, basins, or tanks [line item 7.1.3 [5]] is greater than the stored volume evaluated in the EIS.

The effect of the differences in water requirements is assessed in the EIS Review Supporting Document [3]. While the maximum short-term rate of withdrawal from the water source for fire protection, and the quantity of stored water for fire protection, exceed the PPE values, the average total raw water for the potable water/sanitary waste system, demineralized water system, and fire protection system combined is less than considered in the PPE, hence less water is withdrawn from municipal water supply. Correspondingly, less wastewater is discharged to the municipal system than what had been assessed in the EIS, and therefore the effect is less. The exceedances in the maximum short-term rate of withdrawal and quantity of water stored do not affect the EIS conclusions.

4.1.2 Structure (i.e., Foundation Depth)

The BWRX-300 foundation embedment is deeper (38 m below grade) than the reactors assessed in the EIS (13.5 m) [line item 1.1.2] [5]. Likely environmental effects from excavation and grading activities (such as groundwater flow and quality, soil and rock removal, air quality, blasting and ground vibrations, sound level, stormwater, and liquid effluents from dewatering operations) were reviewed because of this design change.

For groundwater flow, a separate study was prepared, and its results are discussed in Section 5.3.5. In contrast to the EIS, which considered permanent dewatering resulting in permanent changes to groundwater flow conditions, the study confirmed that for the BWRX-300 the effects of the dewatering operations on the groundwater flow during construction would be temporary. After the construction period, the dewatering operations would cease, and the effect of the deeper embedment on groundwater flow would be negligible.

Other effects resulting from BWRX-300 deployment on quantity of soil and rock removal, air quality, blasting and ground vibrations, sound level, stormwater, and liquid effluents from dewatering operations were assessed as consistent with the EIS.

4.1.3 Airborne and Waterborne Releases

Three parameters associated with airborne and waterborne releases of radioactive contaminants that result in doses to the public were outside of the parameters assessed in the EIS:

- The BWRX-300 normal operation minimum release height above finished grade is 35 m which is less than the height evaluated for the prior assessed technologies in the 2009 EIS which is 48.8 m [line item 9.4.2] [5].
- The BWRX-300 normal operation radioactive releases to the atmosphere [line item 9.5.1] and to water bodies [line item 10.3.1] [5] are outside of the airborne source-terms PPE parameters. The releases contain the same radionuclides as the previously assessed technologies, but in varying proportion.

The three parameters associated with airborne and waterborne radioactive releases required a separate study to assess their effect and compare it with what was assessed in the EIS. The BWRX-300 normal operation radioactive releases on the dose to the public was assessed. Calculations of the estimated dose to the public during normal operation confirm that the design and release characteristics of the BWRX-300 result in doses that are a small fraction of the dose limit for the public. This analysis is documented in a separate assessment [14] where the dose to members of the public for the deployment of four BWRX-300 reactors was found to be less than that assessed in the EIS.

4.1.4 Solid Waste and Spent Fuel

The solid waste volumetric activity (Bq/m^3) generated by the operation of the BWRX-300 is higher than what was assessed in the EIS [line item 11.2.1] [5]. The design of the handling equipment for waste containers will be adapted to manage the higher activity. The consequence of the higher activity on malfunctions and accidents is assessed separately in section 5.7.2.

The weight of the cask used to transport the BWRX-300 spent fuel on site (113 tonnes) is heavier than the cask assessed in the EIS (100 tonnes) [line item 17.1.2] [5]. This will mean upgrading the on-site hauling roads leading to the dry storage facility to accommodate heavier cask weight.

There is no impact on the EIS conclusions as a result of these mitigation measures.

4.1.5 Importance Factor for Wind Load

The importance factor for wind load (multiplication factor) [line item 1.7.2] [5] used to develop plant design for safety related structures is 1.0 for the BWRX-300, which is outside the PPE value of 1.15.

The importance factor defined in the PPE is based on an outdated methodology. The current methodology, adopted by GEH for the BWRX-300, uses an importance factor of 1.0 and various wind maps corresponding to the building classification (risk category) represented in the form of different event return periods. As per chapter 26 commentary in Standards ASCE 7-10 and ASCE 7-16, the new methodology meets the same strength target as the older methodology, therefore it is consistent with the EIS.

4.1.6 Summary

Table 5 provides a summary of results for the assessment of BWRX-300 parameters that are not within the PPE. Predicted impacts to the conclusions on the EIS are summarized.

Table 5: Summary of BWRX-300 PPE Parameters

<table>
<tr><th>PPE Line item [5]</th><th>Description</th><th>PPE value</th><th>BWRX-300 value</th><th>Impacts to EIS conclusions</th></tr>
<tr><td>7.1.1</td><td>Maximum Short-term Rate of Water Withdrawal for Fire protection</td><td>39.4 L/s</td><td>127 L/s</td><td>None</td></tr>
<tr><td>7.1.3</td><td>Quantity of Water Stored in Fire Protection System</td><td>3.78E+06 L</td><td>4.00E+06 L</td><td>None</td></tr>
<tr><td>1.1.2</td><td>Foundation Embedment</td><td>13.5 m</td><td>38 m</td><td>None</td></tr>
<tr><td>9.4.2</td><td>Elevation (Normal Operation)</td><td>48.8 m</td><td>35 m</td><td rowspan="3">None</td></tr>
<tr><td>9.5.1</td><td>Gaseous Radioactive Emissions (Normal)</td><td>See note</td><td>See note</td></tr>
<tr><td>10.3.1</td><td>Liquid Radioactive Emissions (Normal)</td><td>See note</td><td>See note</td></tr>
<tr><td>11.2.1</td><td>Solid Radwaste Volumetric Activity</td><td>See note</td><td>See note</td><td>None</td></tr>
</table>

PPE Line item [5]	Description	PPE value	BWRX-300 value	Impacts to EIS conclusions
17.1.2	Spent Fuel Cask Weight	100 tonnes	113 tonnes	None
1.7.2	Importance Factor for Wind Load	1.15	1.0	None

Note: the radionuclides in gaseous effluents, liquid effluents, and solid waste are the same as in the EIS, but their proportion has changed.

In summary, the assessment of BWRX-300 parameters shows no issues of significance for the BWRX-300 deployment at the DNNP site. The further assessment of nine PPE parameters that are not within the PPE shows that they would not alter the conclusion of the EIS. The PPE parameters have been updated [15] as required by Commitment D-C-3.1 [1].

5. COMPREHENSIVE REVIEW OF THE 2009 EIS

This section summarizes the comprehensive review of the EIS to ensure that the significance of residual adverse effects outlined in the 2009 EIS remain valid with respect to the deployment of four BWRX-300 rectors at the DNNP site. The detailed findings of this review are presented in Appendix A, of the EIS Review Supporting Document [3]. These are summarized in the following sections.

5.1 Review of Existing Environmental Conditions

The EIS Review examines the on-site and near-site existing environmental conditions and changes that have occurred after the completion of the EIS until now. Changes in baseline conditions including changes in conservation status are considered in the EIS Review of effects on valued ecosystem components (VECs) and new receptors documented in Section 5.

OPG has continued to monitor environmental conditions, including VECs, on a regular basis on the DN site. Current environmental conditions and any changes that have occurred since the EIS are presented in the EIS Review Supporting Document [3] for each of the following environmental components:

- Atmospheric environment
- Surface water environment
- Aquatic environment
- Terrestrial environment
- Geological and hydrogeological environment
- Radiation and radioactivity environment
- Land use environment
- Traffic and transportation
- Physical and cultural heritage resources
- Socio-economic environment

Atmospheric Environment

Baseline air quality is considered to have generally improved or to be within the natural variability experienced in the area as compared to conditions documented in the EIS. No significant differences in meteorological conditions have been identified compared to that of the EIS.

Surface Water Environment

Baseline conditions for surface water environment have remained similar to conditions documented in the EIS., Surface water and sediment quality remain within their respective surface water quality and sediment quality guidelines with few exceptions.

Aquatic environment

OPG has conducted a number of baseline studies for the aquatic environment since the completion of the EIS. Aquatic studies were completed for plankton community, benthic invertebrates, fish impingement and entrainment, fish community (adult, juvenile, larvae, and eggs), thermal plume, and fish habitat. These studies demonstrated similar findings as those documented in the EIS and any differences observed are attributed to natural variability.

Since the completion of the EIS, two fish species, Lake Sturgeon and American Eel have become listed provincially as endangered under Ontario's Endangered Species Act (ESA).

Terrestrial environment

Additional terrestrial baseline data has been collected through a variety of studies conducted since the EIS. Surveys for species at risk (Eastern Meadowlark, Bobolink, Barn Swallow, Least Bittern, Bank Swallow, and Bats), amphibians, reptiles, breeding birds, and pond biodiversity were conducted on the DNNP site, providing updated information on these species. Conservation status of several terrestrial species changed since the EIS, in particular Bank Swallow, and several bat species that had not been identified in the EIS. Each is discussed below.

<u>Bank Swallow</u>:

In 2017, the Bank Swallow became listed as threatened on the federal Species at Risk Act (SARA) and as a threatened species under the provincial ESA, which protects both the bird and its habitat. OPG has been conducting annual surveys of the number of Bank Swallow burrows since the implementation of the Bank Swallow monitoring studies in 2008 [16]. In 2010, the peak number of burrows was recorded in the survey area, and there has been variation in the number of burrows recorded annually. In 2012, a decrease in the number of burrows within the survey area began with 2019 being the lowest number of burrows recorded since the inception of the monitoring program. In the past two monitoring years (2020 and 2021) burrow counts have increased by 13% but still remain about 6% lower than the average number of burrows recorded during the monitoring period.

Despite the average change between years for the survey area being relatively minor, there has been a notable decreasing trend (-30%) in the burrow counts since the inception of the program.

<u>Bats:</u>

In anticipation of several bat species becoming listed as a species at risk, OPG began annual bat monitoring on the DNNP site in 2012. In addition, passive monitoring was conducted in 2018, and snag surveys and acoustic monitoring in 2021. The results of the bat monitoring have provided new information related to the use of habitat on the DNNP site. Several species of bats are using the woodlands on the DNNP site for roosting and foraging activities, which represents a baseline condition that was not previously considered. Four of the species documented (Little Brown Myotis, Northern Myotis, Eastern Small-footed Myotis, and Tri-colored Bat) are listed provincially under the ESA as endangered and three species (Little Brown Myotis, Northern Myotis, and Tri-colored Bat) are listed as endangered on Schedule 1 of the federal SARA.

Geological and hydrogeological environment

Areas on DNNP that are potentially contaminated with non-radioactive substances were initially identified by the baseline studies completed in support of the EIS. OPG subsequently conducted remediation and decommissioning activities for several areas on DNNP site and more recently completed a soil characterization program in 2021. Based on the results of the soil characterization study overall, baseline conditions have remained similar to those presented in the EIS.

An examination of groundwater flow and quality data collected as part of OPG's annual groundwater monitoring for the DN site and a geotechnical investigation conducted in the DNNP's onshore power block area in 2021 concluded that the findings of these studies were consistent with the hydrogeological conditions described in the EIS.

Radiation and radioactivity environment

It was determined that radioactivity documented in the EIS for air, soil, groundwater, surface water, sediment, aquatic and terrestrial communities is similar to current baseline data. Public dose from the operating facilities on DN site remains essentially unchanged from that reported in the EIS and is less than 1% of the regulatory limit.

Land use environment

Since 2011, OPG has been actively monitoring land use within 10 km of the DN site, including the review of planning and development applications. These applications consist of official plan amendments, zoning by-law amendments, draft plans of subdivision and condominium, and other miscellaneous planning related documents. The focus of the monitoring is to determine whether there are any proposed land uses that would be of concern from the perspective of sensitive land uses locating within the vicinity of the DN site.

The review and update show that the majority of new development is occurring within existing urban areas (Oshawa, Courtice, Bowmanville, and Newcastle). This pattern of growth and development is consistent with the latest provincial plans, which, representing the most noteworthy changes in land use at a policy level, seek to focus urban growth within existing urban areas, while maintaining limited development with the Greenbelt and Oak Ridges Moraine

Traffic and transportation

OPG completed a review of the DNNP area road network since the EIS and noted improvements in the surrounding road network including, Highway 401 ramps at Holt Road, Courtice Road, and Energy Drive (previously South Service Road), the expansion of the 407 East, new roundabout intersection at Energy Drive and Holt Road, and intersection improvements at King Street and Courtice Road, Solina Road and Maple Grove Road.

Physical and cultural heritage resources

Following the completion of EIS, the two Euro-Canadian sites, known as the Brady (AlGq-83) and Crumb (AlGq-86) sites have undergone a Stage 4 mitigative excavation in accordance with the terms of the Ministry of Tourism, Culture and Sport's (MTCS) standards and guidelines. No additional physical or cultural heritage resources have been identified since the completion of the EIS.

Socio-economic environment

Since 2009, the social and economic conditions across Ontario have changed. Durham Region and its area municipalities have also continued to change due to population growth, urbanization, and economic development. Along with the rest of the Greater Golden Horseshoe Area, their populations and economies have experienced extensive growth and are projected to continue to mature, expand and diversify. Since 2009, the immediate area surrounding the DN site has experienced an ongoing transition from the "look and feel" of a rural area to a planned mix of light industrial and commercial uses south of Highway 401 within the bounds of the Darlington Provincial Park and St. Marys Cement and to the north of Highway 401 as well. As in 2009, the current state of Durham Region and its area municipalities can be characterized as having a reasonably healthy balance of Community Assets in terms of skills and labour supply, municipal infrastructure, health and safety services, financial wealth, and a healthy environment. These ingredients of sustainable development are continually being upgraded.

5.2 Review of Project Work and Activities

Section 3.7 provides a review of the Project work and activities described in the EIS to verify that they are consistent with the BWRX-300 deployment. The following Section provides additional information related to the refinements of project works and activities resulting from BWRX-300 deployment in relation to the work and activities described in the EIS.

5.2.1 Mobilization and Preparatory Works

The conceptual site layout for the construction of four BWRX-300 reactors is presented in Figure 5.

Site preparation activities for the deployment of the BWRX-300 reactor are consistent with the clearing and grubbing and installation of services and utilities described in the EIS. The site area for one reactor will be prepared for construction at the outset of the Project, with the additional preparation of the whole site undertaken if the deployment of four reactors proceeds. For the development of roads and infrastructure, the multi-reactor deployment approach is consistent with the EIS, requiring the same development and upgrades.

Overall, the DNNP site footprint for BWRX-300 deployment is smaller resulting in opportunities to refine locations of on-site roads to minimize disruption to nearby terrestrial environmental features.

5.2.2 Excavation and Grading

For excavation and grading, the lowering of the foundation for the BWRX-300 Reactor Building shaft below what was assessed in the EIS means that there is a potential for an effect on groundwater flows that was not fully considered in the EIS.

The BWRX-300 deployment will require the excavation of approximately 1 million cubic metres (Mm^3) of soil and rock for a single reactor, or approximately 3.3 Mm^3 for four reactors [12], substantially less than the 12.4 Mm^3 of excavation assessed in the EIS for four reactors. This reduced excavation is a positive outcome as less material will need to be stockpiled, transported, and stored on the DNNP site for the long-term. Off-site transport of excavated materials may also be avoided if all the excavated material can be stored on the DNNP site. These refinements are likely to result in lower dust and noise levels during the Site Preparation and Construction phase than anticipated in the EIS.

5.2.3 Marine and Shoreline Works

The BWRX-300 deployment will require less marine and shoreline works than what was assessed in the EIS. The EIS anticipated to fill in approximately 40 hectares (ha) of lake bottom, extending to a water depth of 5 m. No lake infilling will occur, nor will a new wharf need to be constructed.

The BWRX-300 deployment, however, will still require some shoreline works, such as excavating the existing shoreline to prepare for shoreline protection, which will result in some sediment transport. The scale of these shoreline works is smaller than assessed in the EIS.

Apart from these refinements, the BWRX-300 deployment is expected to occur in a manner consistent with that described in the EIS.

5.2.4 Development of Administration and Physical Support Facilities

The BWRX-300 deployment of the administration and physical support facilities will require less land area than described in the EIS, resulting in a smaller footprint and opportunities to refine locations of on-site roads to minimize disruption to nearby terrestrial environmental features.

5.2.5 Construction of the Power Block

The construction method for the Power Block (i.e., reactor building, the generator building/turbine hall, and related structural features) is similar to that described in the EIS, although the scale of these activities is generally smaller than what was assessed in the EIS. Less above ground construction activity may result in reduced dust and noise.

The foundations for the BWRX-300 Power Block will be set deeper in the bedrock. This will likely require more below grade drilling and blasting than assessed in the EIS. Nonetheless, the volume of excavated material will be less than what was assessed in the EIS. Deeper foundations may also change groundwater flows. An assessment of the deeper foundation of the BWRX-300, its construction activities, and the determinations made in the EIS regarding significance are summarized in section 5.3.5. The deployment of four BWRX-300 reactors remains consistent with the construction of the power block for the reactors assessed in the EIS.

5.2.6 Construction of Intake and Discharge Structures

The EIS assumed that the once-through cooling water intake and diffuser structures would be similar to the existing structures at DNGS, although appropriately sized to accommodate the required water flow rates. For the BWRX-300 the water intake and the discharge pipes will be sized for four reactors. The discharge pipe includes a series of diffusers from which the water is discharged to promote rapid thermal mixing in the lake.

The BWRX-300 deployment will utilize the industry best practices and construction methods described in the EIS, using typical underground mining techniques involving blasting and excavation, and by boring using a purpose-built tunnel boring machine and/or other modern construction techniques.

5.2.7 Construction of Ancillary Facilities

The BWRX-300 deployment will not require the construction of cooling towers and blow-down ponds, avoiding land use and visual effects that affect socio-economic conditions in the surrounding communities.

The BWRX-300 deployment will not expand the DNGS switchyard (Bowmanville Switching Station) as described in the EIS but will establish a new one, adjacent to the reactor buildings. The location of the new switchyard is within the area where reactors considered in the EIS were conceptually located and assessed in the EIS. As such, the effects of the new switchyard to the atmospheric and terrestrial environments have been considered in the EIS.

Regarding the use of concrete, the BWRX-300 deployment assumes a concrete batch plant will be established on-site, which is consistent with the assumptions in the EIS. The BWRX-300 deployment will use less concrete than assessed in the EIS due to the considerably smaller power block. This means that less material will need be transported to the DNNP site, stockpiled, processed, and used on the DNNP site. Less processing reduces atmospheric emissions.

Overall, the construction of ancillary facilities for BWRX-300 deployment is likely to require fewer vehicle movements, resulting in less traffic both on and off the DNNP site.

5.2.8 Construction of Radioactive Waste Storage Facilities

The volume of L&ILW and used fuel generated from the BWRX-300 deployment over the 60 years of operation is estimated to be less than for the larger reactors assessed in the EIS.

The BWRX-300 deployment will transport the L&ILW off-site to an OPG licensed facility. This is consistent with one of the options assessed in the EIS.

For a four reactor BWRX-300 deployment, the land area required for used fuel dry storage is smaller than what was assessed in the EIS. The description of the on-site dry storage facility in the EIS is applicable to the BWRX-300 deployment.

5.2.9 Management of Stormwater

The general approach to stormwater management during site preparation, construction, and operation, as described in the EIS, is applicable to the BWRX-300 deployment.

5.2.10 Supply of Construction Equipment, Material and Operating Plant Components

The description of the supply of construction equipment and concrete, manufactured construction materials and plant operating components described in the EIS is applicable to the BWRX-300 deployment.

5.2.11 Management of Construction Waste, Hazardous Materials, Fuels and Lubricants

The description of the management of construction waste, hazardous materials, fuels, and lubricants described in the EIS is applicable to the BWRX-300 deployment.

5.2.12 Workforce, Payroll and Purchasing

The EIS assessment was based on a maximum workforce on site of approximately 5,200 people on the DNNP site, which included 1,400 workers involved in reactor operation, approximately 3,500 construction workers, and 300 involved in Project management.

The BWRX-300 deployment expects the peak workforce to be smaller, with some 3,100 workers expected to be on-site during peak construction of three reactors and 75 workers involved in reactor operation.

5.2.13 Operation and Maintenance Phase

Apart from some small refinements listed below, the deployment of four BWRX-300 reactors is consistent with the EIS:

- The cooling water flow rates, and temperatures for the once-through cooling of the BWRX-300 are aligned with the parameters assessed in the EIS.
- For radioactive effluents to the atmosphere, the contaminants are the same, but their proportion has changed. For radioactive effluents to water, the description of the BWRX-300 Liquid Waste Management system reduces the releases of radioactive liquids to surface water relative to what was assessed in the EIS. The effects of those releases in terms of the dose to the public and non-human biota, are assessed in Section 5.3.12 and 5.3.13.
- The BWRX-300 used fuel pool is smaller than what was assessed in the EIS; however, the change in capacity is accounted for through the availability to move used fuel earlier. It is planned that used fuel storage facilities will be available once the BWRX-300 starts operation and that dose consequence due to higher activity will be managed through appropriate cask and shielding design.
- The solid waste activity generated by the operation of the BWRX-300 is higher than what was assessed in the EIS. The design of the handling equipment for waste containers will be adapted to manage the higher activity. The weight of the cask to be used to transport spent fuel on site (113 tonnes) is heavier than the cask assessed in the EIS (100 tonnes). This will mean upgrading the hauling roads to accommodate heavier cask weight. This upgrade is feasible and does not change the conclusions of the EIS.

5.2.14 Decommissioning Phase

The EIS defines the preferred decommissioning strategy for the reactors assessed in the EIS as one of “deferred dismantling”. The EIS further states that while the specific details for each of the EIS reactor technologies differ depending on the design and layout of the buildings and systems, the overall decommissioning strategy remains the same. The phases of decommissioning described in the EIS are Preparation for Safe Storage, Safe Storage and Monitoring (if required), and Dismantling, Disposal, and Site Restoration.

As the decommissioning strategy for the BWRX-300 has not been established, it is assumed that the overall approach and principles to be applied for decommissioning of the BWRX-300 reactors are consistent with those described in the EIS. Therefore, their effects are anticipated to be similar as considered in the EIS. If the decommissioning strategy differs from this assumption, after submission of the PDP, OPG will review the assessment of the effects as part of its licensing commitments.

5.2.15 Summary

Overall, the works and activities associated with the deployment of the BWRX-300 have a smaller scale, a smaller footprint and require less resources.

5.3 Review of Effects on VECs and New Receptors

The following Section reviews the environmental effects of the project works and activities resulting from BWRX-300 deployment in relation to those in the EIS.

5.3.1 Atmospheric Environment

The Atmospheric Environment comprises two environmental sub-components: Air Quality and Noise. Air Quality and Noise represent features that can be affected by the Project and as such would be pathways or mechanisms for transfer of an effect to another environmental component.

The BWRX-300 deployment has an excavation requirement of approximately 3.3 Mm^3 for four reactors, which is lower than the excavation assessed in the EIS. The anticipated amount of fuel consumption for heavy equipment and haul truck usage for the BWRX-300 deployment is expected to be proportional to the total excavated volume, which would be considerably less than what was considered in the EIS. Likewise, workforce vehicle use would also be appreciably less. Emissions associated with concrete batching will be less than those assessed in the EIS since the BWRX-300 deployment will use less concrete.

The foundations for the BWRX-300 reactors will require blasting and drilling, which were assessed in the EIS.

Overall, the reduction in excavated materials, associated material handling requirements (i.e., reduced construction equipment usage, reduced truck hauling, etc.), overall workforce, Project footprint, and equipment usage are expected to result in reduced effects compared to those assessed in the EIS in terms of emissions of fugitive dust (particulate matter), gaseous emissions, and noise.

5.3.2 Surface Water Environment

The Surface Water Environment comprises four sub-components within the lake: Lake Circulation, Lake Water Temperature, Site Drainage and Water Quality, and Shoreline Processes.

The BWRX-300 deployment will not require lake infilling, and the associated adverse effects on site drainage and water quality will not occur. The BWRX-300 deployment will still require some shoreline works, but the works are expected to be smaller in scale resulting in smaller residual adverse effects on shoreline processes than those assessed in the EIS.

The adverse effects anticipated from BWRX-300 operation of condenser, condenser circulating water, service water and cooling systems as well as the replacement/maintenance of major components and systems on lake water temperature are consistent with the effects examined in the EIS. Lower flow rates required for the BWRX-300 will tend to result in reduced effects to the aquatic environment.

The EIS identified the Deepwater Sculpin, Lake Sturgeon, Atlantic Salmon and American Eel as fish species at risk. Since the EIS concluded that the nearshore area does not contain critical habitat for any of these species, (EIS p. 4-45) and significant interactions with the existing DNGS have not been detected in monitoring studies to date (although entrainment of some Deepwater Sculpin has recently been identified), there is no further concern for these species. Nevertheless, fish protection measures will be taken if needed at the intake structure, especially for Deepwater Sculpin, so as to have no significant effects.

Prior to commencing in-water works, the provincially listed American Eel and Lake Sturgeon would have to be included as part of the permitting process under the *ESA* (S. 17(2)(c) or (d)). Requirement for this permit was identified under D-P-3.7 of the DNNP Commitments Report (OPG 2019c). Overall, the listing of these two fish species do not alter the determinations made with respect to residual adverse effects of the Project and do not change the overall determination of the significance of residual adverse effects made in the EIS.

The assessment of the surface water hydrology confirmed that the BWRX-300 deployment will have no residual adverse effects on site drainage. The assessment identified minor changes in flows and the number of days per year that an area of land is wet that can be mitigated using best industry practices.

5.3.3 Aquatic Environment

The Aquatic Environment comprises two environmental sub-components: Aquatic Habitat and Aquatic Biota. The Aquatic Environment in the DNNP site area includes three on-site ponds, two tributaries to Darlington Creek and a tributary to Lake Ontario, along with Lake Ontario itself.

The area required for BWRX-300 deployment is smaller in size and deployment may not require infilling of on-site ponds. As a result, there is an opportunity to retain some of the on-site aquatic features, where they were once slated for removal. An evaluation of the effects on aquatic habitat features (i.e., the three on-site ponds) to explore the opportunity to retain them on-site will be considered as part of the environmental management and protection plan for site preparation and construction activities. The assessment of changes to the hydrology was completed [17], and it determined there will be negligible hydrological change to the wetlands and ponds. For noise and dust, the studies are being completed. If the evaluation shows adverse effects on aquatic receptors, OPG will implement mitigation measures to ensure that there are no significant residual adverse environmental effects. Any effects can be expected to be less than the effects of the losses of aquatic habitat features in the EIS.

The location and design of the intake will include screening and reduced intake (approach) velocities to mitigate fish impingement and entrainment with an emphasis on excluding Deepwater Sculpin and American Eel. Furthermore, the operation of the condenser circulating water and service water requires a smaller flow rate than the description in the EIS. Residual adverse effects different than those in the EIS are not anticipated.

5.3.4 Terrestrial Environment

In the EIS, the assessment of likely effects on the Terrestrial Environment was based on the bounding site development layout which considered the removal of the vegetation within the areas of construction. As previously indicated in the other review areas of this section, given the BWRX-300's smaller footprint than the reactors assessed in the EIS, an opportunity exists to conserve some of the vegetation communities, such as meadow and thicket, and the species and habitat functions associated with them within the DNNP site. This represents an effects level that falls below that anticipated by the EIS.

Although the EIS did consider the removal of woodlands, the BWRX-300 deployment results in the potential for interactions specifically with bats and bat habitat that were not previously considered in the EIS. These interactions include removal of bat habitat as well as potential interactions between the Project and bat species and bat habitats that may be retained on the DNNP site. These potential interactions are detailed in the EIS Review Supporting Document [3], and further studies are ongoing to identify and mitigate any potential effects.

Based on updated baseline information, nature of the effects pathways and potential interactions with the BWRX-300 deployment, OPG can implement relevant mitigation to address impacts to bats and bat habitat. It is anticipated that the residual effects after mitigation will not be significant. Furthermore, as several of the bat species are regulated as endangered species under the provincial ESA, OPG will obtain a permit under Section 17(2)(d) of the ESA, which includes requirements for beneficial actions for bat species.

The construction of the first BWRX-300 would provide an opportunity to retain the Bank Swallow nesting habitat along the Lake Ontario shoreline as the bluff would be remaining in place. Recent hydrogeological investigations [18] have demonstrated that no appreciable drying effect of the bluff face is anticipated with the first BWRX-300 reactor [18]. Investigations are underway to determine if vibration levels associated with drilling and blasting activities might have any adverse effects on the Bank Swallow's and their nesting habitat. If this remains a possibility, then measures will be undertaken to reduce residual adverse effects to a minimum.

If the DNNP site is built out to include additional BWRX-300 reactors, additional shoreline protection would be implemented to stabilize the shoreline, and the result would likely be that this would make the nesting habitat unsuitable for Bank Swallows to inhabit. Recent hydrogeological investigations have demonstrated that there will be a measurable decrease in groundwater contribution to the bluff during the construction phase of additional BWRX-300 reactors [17]. The possibility of this decrease in groundwater negatively affecting Bank Swallow habitat will be partially dependent on the project timeline for installation of the shoreline protection. Regardless of the pathway (i.e., shore protection or changes in groundwater) the overall effect to Bank Swallow nesting habitat remains consistent with the EIS.

Regarding the disruption of landscape connectivity affecting wildlife travelling along the east-west corridor, the DN site annual biodiversity monitoring since 1997 has led to the observation that wildlife are present and have been around for a long period, despite the roads and other disturbances on site. However, periodic and short-term disruption to wildlife travel along the east-west wildlife corridor are expected during the Site Preparation and Construction phase of the Project. This is consistent with the assessment in the EIS.

Overall, the BWRX-300 deployment will provide opportunities to preserve more on-site habitats than assumed in the EIS. However, to determine whether some features can remain, additional studies are being conducted for the site preparation and construction phase, to assess effects pathways from noise, dust and vibration, and effects in hydrogeology or surface water to specific terrestrial environment elements that were not assessed as part of the EIS. The assessment of changes to the hydrology was completed [17], and it determined there will be negligible hydrological change to amphibian and reptile habitat. For the other pathways, if these studies show adverse effects on terrestrial receptors, there are mitigative options available to reduce or eliminate effects to ensure that any residual effect is not significant. Any residual effects can be expected to be less than the effects of the losses of habitat in the EIS.

5.3.5 Geological and Hydrogeological Environment

The excavation depth required for the BWRX-300 reactors will be deeper than defined in the EIS. An assessment of the effects on groundwater flow and quality associated with the deeper foundation has been completed in a separate Groundwater Flow Modelling study [18]. This study confirmed that the dewatering operations during construction would affect the groundwater flow, which normally flows towards Lake Ontario, but this effect would be temporary. After the construction period, and thereafter during the operation phase, the dewatering operations would cease, and the effect of the deeper embedment on groundwater flow would be negligible. In contrast, the EIS considered permanent dewatering resulting in permanent changes to groundwater flow conditions. These changes were not considered to represent an adverse effect in the Geological and Hydrogeological Environment. Given that the BWRX-300 deployment will involve dewatering only during construction, and changes following construction are negligible, the deployment of four BWRX-300 reactors can be expected to have less anticipated effect on the hydrogeological environment than what was assessed in the EIS.

5.3.6 Radiation and Radioactivity Environment

The Radiation and Radioactivity Environment is considered a pathway to effects in other environmental components, such as Aquatic, Terrestrial, Non-Human Biota Health and Human Health. The EIS determined that there are no significant adverse residual effects on these environmental components.

A comparison of emissions from the BWRX-300 reactor and the reactors assessed in the EIS, found that tritium, carbon-14, particulates, and noble gases emissions from the BWRX-300 are less than these emissions for the reactors assessed in the EIS. In contrast, the emissions of iodine are higher for the BWRX-300 than the values assumed in the EIS. The BWRX-300 liquid emissions are less than the emissions in the EIS.

The EIS assumed a high rate of emission of tritium, which resulted in elevated tritium concentrations in soil, surface water, ground water and vegetation. The emissions of tritium from the BWRX-300 are negligible in comparison. Since the overall emissions of the BWRX-300 are lower than what was assessed in the EIS, the effects on the Terrestrial and Aquatic Environment are consistent with the EIS.

The assessment of the effect of radioactive emissions on Human Health is presented in Section 5.3.12. Calculations of the estimated dose to the public during normal operation confirm that the design and release characteristics of the BWRX-300 result in doses that are a small fraction of the dose limit for the public. This analysis is documented in a separate assessment [14] where the dose to members of the public for the deployment of four BWRX-300 reactors was found to be less than that assessed in the EIS.

The assessment of the effect of radioactive emissions on Non-Human Biota Health is presented in Section 5.3.13. The calculated dose to non-human biota is lower than the doses calculated in the EIS.

5.3.7 Land Use

The BWRX-300 deployment information is consistent with the Project information in the EIS, except for the effects associated with lake infilling and cooling towers, which are not applicable. BWRX-300 deployment does not require lake infilling. The visual effect of cooling towers is not applicable for the BWRX-300 reactor since no cooling towers are required.

5.3.8 Traffic and Transportation

The BWRX-300 deployment is expected to generate far less (3.3 Mm^3) excavated material than what was assessed in the EIS (12.4 Mm^3) and this excavated material will be used or stored on site. Nonetheless, should off-site transport be required, the BWRX-300 would require the transport of less excavated material than the amount assessed in the EIS. As such, impact to traffic and transportation infrastructure both on and off the DNNP site would be lower.

The BWRX-300 deployment requires a smaller workforce throughout each phase of the Project. As such, impact to traffic and transportation infrastructure both on and off the DN site would be lower.

Apart from these refinements, the BWRX-300 deployment information is consistent with the Project information in the EIS.

5.3.9 Physical and Cultural Heritage Resources

The survey conducted during the EA, indicated that there are no heritage resources sites at the DNNP site or along the access road, apart from the Brady and Crumb sites that were recovered in 2012/2013. However, should previously undocumented archaeological resources be discovered, procedure that complies with the Ontario Heritage Act would be followed and OPG would inform and consult with Indigenous Nations and communities. Any identified heritage resource sites will be protected and monitored during project activities.

5.3.10 Socio-economic Environment

The BWRX-300 deployment information is consistent with the Project information in the EIS used for the evaluation of effects of the Project on the socio-economic environment. The Project's employment and payroll spending will generate beneficial economic effects, but less than anticipated in the EIS. Residual adverse effects associated with population growth, housing, infrastructure, and service demands will also be less than anticipated in the EIS.

5.3.11 Indigenous Rights and Interests

The lands and waters on which the Darlington New Nuclear Project is situated are the traditional and treaty territory of the Williams Treaties First Nations, which includes Curve Lake First Nation, Hiawatha First Nation, Alderville First Nation, Chippewas of Beausoleil First Nation, Chippewas of Georgina Island First Nation, Chippewas of Rama First Nation, and the Mississaugas of Scugog Island First Nation. It is also within the traditional territory of the Huron-Wendat peoples.

The EIS for DNNP was completed in 2009 to assess the environmental impacts of the Project. OPG recognizes that the EIS, while accurate in its assessment of environmental impacts, may not fully address the impact of the Project on Indigenous inherent and treaty rights as they are understood today. This is particularly true in light of the Williams Treaties First Nations (WTFN) 2018 settlement agreement with the Governments of Canada and Ontario. While OPG is not privy to the contents of the settlement agreement, OPG recognizes the importance of furthering our knowledge and understanding, in ongoing meaningful engagement with the WTFN.

OPG will continue to work with Indigenous Nations and communities to appropriately identify the rights impacted by the Project, and to work toward mitigation measures and/or accommodation. These commitments are reinforced by OPG's dedication to reconciliation and to renewing its relationships with Indigenous peoples.

Through discussions with Indigenous Nations and communities on DNNP to date, as well as the interventions made by the Indigenous Nations and communities at the PRSL Renewal public hearing in 2021 and WTFN input on this EIS Review report, OPG understands that key interests include:

- Meaningful engagement and relationship building.
- Identification of impact to Indigenous Rights.
- Environmental impacts, including: the effect on aquatic and terrestrial species, with specific interest in biocultural species; air and water emissions, including thermal emissions; overall effect on the water; and respectful use of the land.
- Radioactive waste streams and management.
- Incorporation of Indigenous Knowledge and Ceremony.
- Community and environmental safety.
- Climate change mitigation.
- Opportunities for Indigenous communities and Indigenous people, including: training and employment; community benefits; Indigenous business opportunities; investment opportunities.

OPG remains committed to protecting the environment, and meeting commitments made throughout the EA process. As OPG develops our DNNP plans and designs further, OPG wishes to engage further on the specific items listed above, and any other matters of interest that may be identified. OPG will seek to create opportunities for additional dialogue on potential impacts to Indigenous rights and interests, Indigenous Knowledge, and to identify mitigation measures with input from Indigenous Nations and communities.

5.3.12 Health – Human

Calculations of the estimated dose to the public during normal operation of four BWRX-300 reactors confirm that its design and release characteristics do not present an adverse effect on human health. This analysis is documented in a separate assessment [14] where the dose to the public from deployment of the BWRX-300 reactors was found to be less than the dose calculated for the reactors assessed in the EIS.

In the EIS, radiation doses to Nuclear Energy Workers were calculated to be well below CNSC regulatory limits. The overall regulatory compliance will be the same for the BWRX-300 deployment.

5.3.13 Health – Non-Human Biota

Estimated doses to non-human biota as a result of expected radiological atmospheric and aquatic emissions from four BWRX-300 reactors have been calculated [14] and are confirmed to be less than those calculated for the reactors assessed in the EIS.

5.3.14 Summary of Effects Review

The results of the review of effects on VECs and new receptors are summarized in Table 6. For clarity, please note that:

- Blue shades indicate that, just as determined in the EIS, No Residual Adverse Effects are anticipated on the receptor from the BWRX-300 deployment.
- Green shades indicate that BWRX-300 deployment is likely to result in "less effect" on a VEC than assessed in the EIS and therefore it was determined there was "No Residual Adverse Effect", as concluded in the EIS.
- Pink shades indicate that there is potential for a Residual Adverse Effect from BWRX-300 deployment that is different than that described in the EIS or was not considered in the EIS.
- Yellow shades indicate that the Residual Adverse Effect assessed in the EIS is no longer expected as it is related to an original DNNP feature that is not applicable to BWRX-300 deployment at the DNNP site.
- White shades indicate that residual adverse effects assessment is ongoing.

Table 6: Summary of Residual Adverse Effects and Relevant VECs

Environment Component	EIS		BWRX-300
	Likely Residual Adverse Effects	Relevant VECs	
Atmospheric Environment	No residual adverse effect. Mitigation measures reduced potential adverse effect from dust and noise.	Air quality (dust) and noise are pathways to VECs in other environmental components	No residual adverse effect in the Atmospheric Environment. Residual effects in other environmental components potentially resulting from dust and noise as a pathway are described in the appropriate sections of this table, including any additional studies required.
Surface Water Environment	No residual adverse effect. Effects of modification of surface water environment on other VECs is assessed in Aquatic Environment.	Lake Circulation, Lake Water Temperature, Site Drainage and Water Quality, and Shoreline Processes are pathways to VECs in other environmental components	No residual adverse effect in the Surface Water Environment. Residual effects in other environmental components potentially resulting from lake circulation, lake water temperature and quality, shoreline processes, as a pathway are described in the appropriate sections of this table. The completed additional analysis on the surface water hydrology confirmed that the BWRX-300 deployment will have no residual adverse effects to on-site wetlands.

Environment Component	EIS		BWRX-300
	Likely Residual Adverse Effects	Relevant VECs	
Aquatic Environment	Loss of approximately 40 ha of Lake Ontario nearshore aquatic habitat as a result of lake infilling and construction of cooling water intake and discharge structures.	Aquatic habitat	Less effect anticipated No lake infilling. Footprint of in-water structures would be smaller.
	Loss of some aquatic biota (i.e., benthic invertebrates, fish) during the construction of the lake infill and the cooling water intake and discharge structures.	Benthic invertebrates and VEC fish species	Less effect anticipated No lake infilling. Footprint of in-water structures would be smaller.
	Impingement and entrainment losses associated with the operation of the once-through lake water cooling option and, to a far lesser degree, the cooling tower option.		Less effect anticipated The location and design of the intake will include screening and reduced intake (approach) velocities to mitigate fish impingement and entrainment Furthermore, the operation of the condenser circulating water and service water requires a smaller flow rate than the description in the EIS.

Environment Component	EIS		BWRX-300
	Likely Residual Adverse Effects	Relevant VECs	
	No residual adverse effect. Mitigation measures reduced the effect of the removal and/or alteration of on-site ponds, a portion of two intermittent tributaries to Darlington Creek and intermittent portions of a tributary to Lake Ontario; road crossing of Darlington Creek and other physical works in proximity to the creek.	On-site Aquatic Habitat	Residual adverse effect not considered in the EIS Potential preservation of on-site ponds and other wetlands due to smaller scale of Project. An assessment of the effects on the biota in the wetlands which may remain on the DNNP site will be required. Mitigative measures are available to eliminate or reduce residual adverse effects to a non-significant level. Hydrological assessment determined there will be minimal hydrological change to on-site ponds or tributaries.
Terrestrial Environment	Loss within the DN Site of approximately 40 to 50 ha of mostly Cultural Meadow Ecosystem.	Cultural Meadow and Thicket Ecosystem	Residual adverse effect not considered in the EIS Footprint and facility would be smaller, potential preservation of some meadow and thicket due to smaller scale of project. New pathway for effects of dust on terrestrial habitats potentially remaining require further study. Mitigative measures are available to eliminate or reduce residual adverse effects to a non-significant level.

Environment Component	EIS		BWRX-300
	Likely Residual Adverse Effects	Relevant VECs	
	No residual adverse effect.	Wetland Ecosystem	Residual adverse effect not considered in the EIS Footprint and facility would be smaller, potential preservation of some wetlands, including ponds due to smaller scale of Project. Hydrological assessment determined there will be minimal surface water or groundwater change to wetlands. New pathway for effects of noise and dust on potential areas remaining require further study. Mitigative measures are available to eliminate or reduce residual adverse effects to a non-significant level.
	No residual adverse effect.	Woodland Ecosystems	Residual adverse effect not considered in the EIS Footprint and facility would be smaller, potential preservation of some woodlands due to smaller scale of Project. New pathway for effects of noise and dust on potential areas remaining require further study. Mitigative measures are available to eliminate or reduce residual adverse effects to a non-significant level.

Environment Component	EIS		BWRX-300
	Likely Residual Adverse Effects	Relevant VECs	
	No residual adverse effect.	Rare Plant Species	Residual adverse effect not considered in the EIS Footprint and facility would be smaller, potential preservation of some habitat where these species may occur due to smaller scale of Project. Hydrological assessment determined there will be minimal hydrological change to habitat for rare plants. New pathway for effects of dust on potential areas remaining require further study. Mitigative measures are available to eliminate or reduce residual adverse effects to a non-significant level.

Environment Component	EIS		BWRX-300
	Likely Residual Adverse Effects	Relevant VECs	
	No residual adverse effect.	Amphibians and Reptiles	Residual adverse effect not considered in the EIS Footprint and facility would be smaller, potential preservation of some habitat where these species may occur, such as the ponds, due to smaller scale of the Project. Hydrological assessment determined there will be minimal hydrological change to amphibian and reptile habitat. New pathway for effects of noise and dust on potential areas remaining require further study. Mitigative measures are available to eliminate or reduce residual adverse effects to a non-significant level.
	The net loss of approximately 24 to 34 ha of on-site habitat currently used as butterfly stopover area migration.	Insects - Migrant butterfly stopover areas	Residual adverse effect not considered in the EIS Footprint and facility would be smaller, potential preservation of meadow habitat where these species may occur, due to smaller scale of Project. New pathway for effects of dust on potential areas remaining require further study. Mitigative measures are available to eliminate or reduce residual effects to a non-significant level.

Environment Component	EIS		BWRX-300
	Likely Residual Adverse Effects	**Relevant VECs**	
	No residual adverse effect.	Insects – Dragonflies and Damselflies	Residual adverse effect not considered in the EIS Footprint and facility would be smaller, potential preservation of some habitat where these species occur - the ponds - due to smaller scale of Project. Hydrological assessment determined there will be minimal hydrological change to on-site ponds. New pathway for effects of dust on potential areas remaining require further study. Mitigative measures are available to eliminate or reduce residual adverse effects to a non-significant level.
	Decrease in populations of breeding birds on the DN Site.	Migrant songbirds and their habitat, winter raptor feeding and roosting	Residual adverse effect not considered in the EIS Footprint and facility would be smaller, potential preservation of some wetlands, woodlands, and meadow, due to smaller scale of Project. New pathway for effects of dust and noise on potential areas remaining require further study. Mitigative measures are available to eliminate or reduce residual adverse effects to a non-significant level.

Environment Component	EIS		BWRX-300
	Likely Residual Adverse Effects	Relevant VECs	
	Loss of nesting habitat for up to 1,000 Bank Swallow burrows; however, some mitigation not directly comparable to effect, will result in advances for the species elsewhere.	Breeding birds	Similar effect anticipated Footprint and facility would be smaller, which will allow the Bank Swallow habitat to remain for one BWRX-300 reactor deployment. For the four-reactor scenario the habitat would likely be rendered unsuitable due to shoreline protection and/or hydrogeological changes; this is consistent with the effects assessed in the EIS.
			Residual adverse effect not considered in the EIS For the one-reactor scenario, additional studies are underway to assess the effects of construction (noise, dust or vibration) on Bank Swallows. Mitigative measures are available to eliminate or reduce residual effects to a non-significant level.
	Bird strike mortalities associated with natural draft cooling towers (estimated at <110 in the spring and <300 in the fall, assuming four natural draft cooling towers).	Breeding birds Migrant songbirds and their habitat	Not applicable No cooling towers will be used.

Environment Component	EIS		BWRX-300
	Likely Residual Adverse Effects	Relevant VECs	
	No residual adverse effect.	Mammal communities and species	Residual adverse effect not considered in the EIS Footprint and facility would be smaller, potential preservation of habitat for mammals (wetlands, woodlands, and meadow), due to smaller scale of Project. New pathway for effects of noise and dust on potential habitat areas remaining require further study. Mitigative measures are available to eliminate or reduce residual adverse effects to a non-significant level.

Environment Component	EIS		BWRX-300
	Likely Residual Adverse Effects	Relevant VECs	
	Loss of habitat for mammals (new)	Bats (new baseline condition)	Residual adverse effect not considered in the EIS Not considered a VEC or indicator species in the EIS, represents a baseline condition not previously considered. Footprint and facility would be smaller, potential preservation of habitat for bats woodlands and foraging areas, due to smaller scale of Project. Habitat loss (woodland) was considered in the EIS. Potentially less woodland habitat will now be removed. New pathway for effects of noise, dust and light, on potential areas remaining that represent occupied bat habitat require further study. Mitigative measures are available to eliminate or reduce residual adverse effects to a non-significant level and consistent with other regulatory requirements.
	Periodic and short-term disruption to wildlife travel along the east-west wildlife corridor during the Site Preparation and Construction phase of the Project.	Landscape connectivity	Less effect anticipated Footprint and facility would be smaller, potentially increasing the preservation of connecting habitat, due to smaller scale of Project.

Environment Component	EIS		BWRX-300
	Likely Residual Adverse Effects	Relevant VECs	
Geological & Hydrogeological Environment	No residual adverse effect	Soil quality, groundwater quality, and groundwater flow are pathways to VECs in other environmental components	No residual adverse effects
Radiation & Radioactivity Environment	No residual adverse effect	Radioactivity in the Atmospheric, Surface Water, and the Hydrogeological Environments are pathways to VECs in other environmental components	No residual adverse effects

Environment Component	EIS		BWRX-300
	Likely Residual Adverse Effects	Relevant VECs	
Land Use	Changes in the quality of existing views of the DN Site throughout the operating life of the Project from viewing locations in the Local Study Area (LSA) and Regional Study Area (RSA) as a result of the presence of natural draft cooling tower structures and the associated plumes released from either natural draft or mechanical draft cooling towers.	Visual aesthetics	Not applicable No cooling towers will be used.
Traffic & Transportation	No residual adverse effect	N/A	No residual adverse effects
Physical & Cultural Heritage Resources	No residual adverse effect	N/A	No residual adverse effects

Environment Component	EIS		BWRX-300
	Likely Residual Adverse Effects	Relevant VECs	
Socio-Economic Environment	Change in the character of communities in the RSA and LSA as a result of the presence of the natural draft cooling tower structures, and the associated plumes released from either natural draft or mechanical draft cooling towers (if the NND Project were to be implemented with cooling towers).	Community character	Not applicable No cooling towers will be used.
	Reduced use and enjoyment of the recreational features on the DN Site during the Site Preparation and Construction phase.	Community and recreational facilities (also applies to Health-Human VEC – members of the public)	Less effect anticipated Nuisance effects at recreational features on-site are reduced.
	Disruption to use and enjoyment of property because of nuisance-related effects (e.g., dust, noise, traffic) during the Site Preparation and Construction phase for some residents living along the truck haul routes.	Use and enjoyment of property (also applies to Health-Human VEC – members of the public)	Less effect anticipated Nuisance effects are reduced.

Environment Component	EIS		BWRX-300
	Likely Residual Adverse Effects	Relevant VECs	
	Reduced enjoyment of private property in the RSA and LSA as a result of the visual dominance of the natural draft cooling tower structures and the associated vapour plumes released from either the natural draft or mechanical draft cooling towers (if the NND Project were to be implemented with cooling towers).	Use and enjoyment of property (also applies to Health-Human VEC – members of the public)	Not applicable No cooling towers will be used.
Indigenous Rights and Interests	Refer to Section 5.3.11	N/A	Refer to Section 5.3.11
Health - Human	No residual adverse effects except for those noted above under Socio-Economic Environment.	Health and Well-being of the General Public and Health and Safety of Workers.	No residual adverse effects (except for those noted above under Socio-Economic Environment)
Health - Non-Human Biota	No residual adverse effects	Aquatic and terrestrial non-human biota.	No residual adverse effects

Note: N/A = Not Applicable

Potential habitats and species requiring further assessment if they are to be retained are:

- cultural meadows/cultural thickets,
- wetlands,
- woodlands,
- rare plants,
- migrant butterfly stopover,
- dragonfly/damselflies,
- amphibians and reptiles,
- migrant songbirds and their habitats,
- breeding birds,
- breeding mammals (including bats).

Additional studies have been undertaken on surface water, groundwater, dust, noise, and vibration to determine effects on potential habitats and species to be retained. For surface water, and groundwater, the studies concluded that no significant residual effects are likely. For dust and noise and vibrations, if residual effects are identified, mitigation measures (including those required for a provincial ESA permit) are available to ensure that there are no significant residual adverse effects.

Although Human Health was assessed as No Residual Adverse Effect in the EIS and for the BWRX-300, there is public interest in doses to the public, therefore the doses to Members of the Public from DNNP are considered further in terms of cumulative effects for Human Health.

5.4 Review of Significance of Residual Adverse Effects

In the EIS, 24 likely residual adverse effects were identified. In accordance with the requirement of the *CEAA*, these effects were assessed for their significance. The assessment of the significance of residual adverse effects for the reactors assessed in the EIS and for the BWRX-300 deployment is summarized below in Table 7.

For clarity, please note that:

- Blue shades indicate that no residual adverse effects are anticipated on the receptor from BWRX-300 deployment, the same as was concluded in the EIS.
- Green shades indicate that the significance of residual adverse effects from BWRX-300 deployment are considered to be “minor” and “not significant” because they are likely to have less effect on the receptors (characterized as a VEC) than assessed in the EIS.
- Pink shades indicate that there is potential for a residual adverse effect from BWRX-300 deployment and additional studies to characterize these effects are being undertaken.
- Yellow shades indicate that the residual adverse effect assessed in the EIS is no longer expected as it is related to a DNNP feature assessed in the EIS that is not applicable to BWRX-300 deployment at the DNNP site.
- White shades indicate that residual adverse effects assessment is ongoing.

Table 7: Determination of Significance of Residual Adverse Effects

Likely Residual Adverse Effect (After Mitigation) from the Reactors Assessed in the EIS	Valued Ecosystem Component Affected	Significance of Results (After Mitigation)	
		From the EIS	BWRX-300
ATMOSPHERIC ENVIRONMENT			
No residual adverse effects	Air quality (dust) and noise are pathways to VECs in other environmental components		No residual adverse effect in the Atmospheric Environment Residual effects in other environmental components potentially resulting from dust and noise as a pathway are described in the appropriate sections of this table, including any additional studies are required.
SURFACE WATER ENVIRONMENT			

Likely Residual Adverse Effect (After Mitigation) from the Reactors Assessed in the EIS	Valued Ecosystem Component Affected	Significance of Results (After Mitigation)	
		From the EIS	BWRX-300
No residual adverse effects	Lake Circulation, Lake Water Temperature, Site Drainage and Water Quality, and Shoreline Processes are pathways to VECs in other environmental components		No residual adverse effects in the Surface Water Environment. Residual effects in other environmental components potentially resulting from lake circulation, lake water temperature and quality, shoreline processes, as a pathway are described in the appropriate sections of this table.
AQUATIC ENVIRONMENT			

<table>
<tr><th rowspan="2">Likely Residual Adverse Effect (After Mitigation) from the Reactors Assessed in the EIS</th><th rowspan="2">Valued Ecosystem Component Affected</th><th colspan="2">Significance of Results (After Mitigation)</th></tr>
<tr><th>From the EIS</th><th>BWRX-300</th></tr>
<tr><td>Loss of approximately 40 ha of Lake Ontario nearshore aquatic habitat as a result of lake infilling and construction of cooling water intake and discharge structures.</td><td>Aquatic Habitat</td><td>Minor Residual Adverse Effect (Not significant)
There is nothing distinctive about the DN Site nearshore habitat as a spawning or feeding area that is not shared by adjacent areas for many kilometers east and west of the site, influenced to a limited extent by the seasonal presence of warmwater fish from nearby tributaries, bays, and coastal marshes. The nearshore in this area is a high energy environment. Its ecology is heavily skewed toward the seasonal and intermittent presence of migratory Lake Ontario fish species.

Preliminary results of the Habitat Alteration Assessment Tool (HAAT) model also suggested the low productivity of the proposed lake infill area, and areas affected by the construction of the cooling water intake and discharge structures.

The Project will not result in a residual adverse effect on Aquatic Habitat because of the mitigation measures that will be implemented (notably, the Fish Habitat Compensation Plan).</td><td>Minor Residual Adverse Effect

Effect on Lake Ontario nearshore aquatic habitat is less than that described in the EIS.

(Not significant)</td></tr>
</table>

Likely Residual Adverse Effect (After Mitigation) from the Reactors Assessed in the EIS	Valued Ecosystem Component Affected	Significance of Results (After Mitigation)	
		From the EIS	BWRX-300
Loss of some aquatic biota (i.e., benthic invertebrates, fish) during the construction of the lake infill and the intake and discharge structures.	Benthic Invertebrates, VEC Fish Species	**Minor Residual Adverse Effect (Not significant)** Near shore environment of proposed infill is a high energy zone (typically shallow; influenced by waves, storm events), with few documented invertebrate species. Round gobies are an invasive species. Footprint of cooling/service intake and discharge structures is small, and habitat loss is not significant relative to entire area.	Minor Residual Adverse Effect Effect is less than that described in the EIS. (Not significant)
Impingement and entrainment losses associated with operation of the once-through lake water cooling option, and to a lesser degree, with the cooling tower option.	Benthic Invertebrates, VEC Fish Species	**Minor Residual Adverse Effect (Not significant)** Once-through-cooling porous veneer intake has been designed specifically for reducing entrainment and impingement of fish. The intake incorporates design features based on fish behavioural principles and is also located offshore at depths which are less productive than inshore locations. The expected losses will be low relative to Lake Ontario populations.	Minor Residual Adverse Effect Effect is less than that described in the EIS. (Not significant)

Likely Residual Adverse Effect (After Mitigation) from the Reactors Assessed in the EIS	Valued Ecosystem Component Affected	Significance of Results (After Mitigation)	
		From the EIS	BWRX-300
No residual adverse effect	On-site Aquatic Habitat (ponds, intermittent tributaries to Darlington Creek and to Lake Ontario, Darlington Creek)	No residual adverse effect	Residual Adverse Effects anticipated to be not significant More of the habitat may remain. Effect from habitat removal may be less than that described in the EIS. Additional studies required An assessment of the effects on the biota in the wetlands which may remain on the DNNP site will be required. Mitigative measures are available to eliminate or reduce residual adverse effects to a non-significant level.

Likely Residual Adverse Effect (After Mitigation) from the Reactors Assessed in the EIS	Valued Ecosystem Component Affected	Significance of Results (After Mitigation)	
		From the EIS	BWRX-300
TERRESTRIAL ENVIRONMENT			
Loss within the DN Site of approximately 40 to 50 ha of mostly Cultural Meadow Ecosystem.	Cultural Meadow and Thicket Ecosystem, including Breeding Mammals Migrant Butterfly Stopover Area Breeding Birds, including Winter Raptor Feeding and Roosting Area, and Migrant Songbirds and their Habitat	**Minor Residual Adverse Effect (Not significant)** Cultural meadows and other terrestrial habitat of the types found at DN Site are widespread in the environment in southern Ontario, and in the RSA and LSA. Many of those at the DN Site are hydroseed mixture or otherwise of low ecological function. The effect is also confined to the DN Site. The VECs will persist at the DN Site as some habitat will remain where raptors can feed or roost. Breeding birds occupy almost all habitats, constructed and natural. None of the breeding bird habitats being reduced due to effects of the Project are unique to the DN Site and they occur commonly in the RSA and LSA, VECs will persist at the DN Site as will most of the suite of breeding birds known to occur.	Residual Adverse Effects anticipated to be not significant More of the habitat may remain. Effect from habitat removal may be less than that described in the EIS. Additional studies required New pathway for effects of dust on terrestrial habitats potentially remaining require further study. Mitigative measures are available to eliminate or reduce residual adverse effects to a non-significant level.

Likely Residual Adverse Effect (After Mitigation) from the Reactors Assessed in the EIS	Valued Ecosystem Component Affected	Significance of Results (After Mitigation)	
		From the EIS	BWRX-300
No residual adverse effect	Wetland and Woodland Ecosystems, Rare Plant Species, Amphibians and Reptiles, Insects – Dragonflies and Damselflies, Mammal communities and species	No residual adverse effect	Residual adverse effects anticipated to be not significant More of the habitat may remain. Effect from habitat removal may be less than that described in the EIS. Additional studies required New pathway for effects of dust on habitats potentially remaining require further study. Mitigative measures are available to eliminate or reduce residual adverse effects to a non-significant level.

Likely Residual Adverse Effect (After Mitigation) from the Reactors Assessed in the EIS	Valued Ecosystem Component Affected	Significance of Results (After Mitigation)	
		From the EIS	BWRX-300
Loss of nesting habitat for up to 1,000 active Bank Swallows	Breeding Birds (Bank Swallows)	**Minor Residual Adverse Effect (Not significant)** The mitigative options being advanced for consideration are innovative including the long-term protection of important nesting areas, design and construction of artificial Bank Swallow colonies, and research into declines in aerial foraging birds. These actions are expected to bring long-term tangible benefits to the species and perhaps others. The portions of the colony being removed are confined to the Site Study Area (SSA) and a larger portion of the associated colony will remain viable.	Minor Residual Adverse Effect Anticipated Residual adverse effect anticipated to be not significant. For the four-reactor scenario, the habitat would likely be rendered unsuitable due to shoreline protection and/or hydrogeological changes; this is consistent with the effects assessed in the EIS. Residual Adverse Effects anticipated to be not significant For the one reactor deployment, footprint and facility would be smaller, which will allow the Bank Swallow habitat to remain. For this scenario, additional studies are underway to assess the effects of construction (noise, dust or vibration) on Bank Swallows. Mitigative measures are available

Likely Residual Adverse Effect (After Mitigation) from the Reactors Assessed in the EIS	Valued Ecosystem Component Affected	Significance of Results (After Mitigation)	
		From the EIS	BWRX-300
			to eliminate or reduce residual effects to a non-significant level.
Loss of habitat for mammals (new)	Bats (new baseline condition)	Impacts to bats were not considered in the EIS as this is a new condition.	Residual Adverse Effects anticipated to be not significant New baseline condition. Additional studies required New pathway for effects of noise, dust and light, on potential areas remaining that represent occupied bat habitat require further study. Mitigative measures are available to eliminate or reduce residual adverse effects to a non-significant level and consistent with other regulatory requirements.

Likely Residual Adverse Effect (After Mitigation) from the Reactors Assessed in the EIS	Valued Ecosystem Component Affected	Significance of Results (After Mitigation)	
		From the EIS	BWRX-300
Bird strike mortalities associated only with natural draft cooling tower structures. (Estimated at <110 in the spring and <300 in the fall assuming natural draft cooling towers).	Migrant Songbirds and their Habitat	**Minor Residual Adverse Effect (Not significant)** Compared to the large numbers of migrant birds passing over the DN Site in spring and fall, or to the known level of mortalities at lit buildings in Toronto or due to other anthropogenic sources (e.g., residential windows, pet cats) these anticipated strike numbers are low. In addition, the effect will occur in a relatively small area associated with the tower structures in the SSA only. The effects are unlikely to result in measurable change to bird populations	Not applicable
Disruption to wildlife travel along the east-west wildlife corridor during Site Preparation and Construction phase.	Landscape connectivity	**Minor Residual Adverse Effect (Not significant)** Although there is no major wildlife corridor on site, a corridor does exist. Wildlife using the east-west corridor through the DN Site are already adapted to the road network and high levels of human disturbance that characterize both the LSA and SSA. The DN Site remains permeable for many of these species and the period of disturbance will be relatively limited.	Minor Residual Adverse Effect Effect is less than that described in the EIS. (Not significant)
GEOLOGICAL AND HYDROGEOLOGICAL ENVIRONMENT			

Likely Residual Adverse Effect (After Mitigation) from the Reactors Assessed in the EIS	Valued Ecosystem Component Affected	Significance of Results (After Mitigation)	
		From the EIS	BWRX-300
No residual adverse effects	Soil quality, groundwater quality, and groundwater flow are pathways to VECs in other environmental components		No residual adverse effects
RADIATION AND RADIOACTIVITY ENVIRONMENT			
No residual adverse effects	Radioactivity in the Atmospheric, Surface Water, and the Hydrogeological Environments are pathways to VECs in other environmental components		No residual adverse effects
LAND USE			

Likely Residual Adverse Effect (After Mitigation) from the Reactors Assessed in the EIS	Valued Ecosystem Component Affected	Significance of Results (After Mitigation)	
		From the EIS	BWRX-300
Changes in the quality of existing views of the DN Site throughout the operating life of the Project from viewing locations in the RSA and LSA as a result of the presence of the natural draft cooling tower structures and the associated plumes released from either natural draft or mechanical draft cooling towers. (Residual Project effect considered in combination with the effects of other tall structures existing and foreseeable in the DN Site vicinity.)	Visual Aesthetics	**Minor Residual Adverse Effect (Not Significant)** The combined residual adverse effect and likely cumulative effect will not likely preclude the use and enjoyment of private property in LSA communities. Although the conditions creating the effect will not be reversible, the magnitude of the effect is likely to further diminish over time as the structures become a familiar feature of the landscape.	Not applicable

Likely Residual Adverse Effect (After Mitigation) from the Reactors Assessed in the EIS	Valued Ecosystem Component Affected	Significance of Results (After Mitigation)	
		From the EIS	BWRX-300
TRAFFIC AND TRANSPORTATION			
No residual adverse effects.			No residual adverse effects
PHYSICAL AND CULTURAL HERITAGE			
No residual adverse effects.			No residual adverse effects
SOCIO-ECONOMIC ENVIRONMENT			
Change in the character of communities in the RSA and LSA because of the presence of the natural draft cooling tower structures and the associated plumes released from either natural draft or mechanical draft cooling towers.	Community Character	**Minor Residual Adverse Effect (Not significant)** Although there is likely to be a cumulative visual effect, the NND Project (in combination with other tall structures existing and foreseeable in the DN Site vicinity) will not likely change the unique and distinctive qualities of LSA communities. The area in the immediate vicinity of the DN Site is a mix of industrial, commercial, and residential land uses. The presence of industrial and commercial land uses is increasing.	Not applicable

Likely Residual Adverse Effect (After Mitigation) from the Reactors Assessed in the EIS	Valued Ecosystem Component Affected	Significance of Results (After Mitigation)	
		From the EIS	BWRX-300
Reduced use and enjoyment of community and recreational features on the DN Site during the Site Preparation and Construction phase	Community and Recreational Facilities and Services (also applies to Health-Human VEC – members of the public)	**Minor Residual Adverse Effect (Not significant)** The Project does not preclude the use of the DN Site for recreational purposes. The reduced use and enjoyment of the DN Site for recreational purposes will likely be experienced by a small number of users for a few years prior to its restoration.	Minor Residual Adverse Effect Effect is less than that described in the EIS. (Not significant)
Disruption to use and enjoyment of property because of nuisance-related effects (e.g., dust, noise, traffic), during the Site Preparation and Construction phase for some residents living along the truck haul routes.	Use and Enjoyment of Private Property (also applies to Health-Human VEC – members of the public)	**Minor Residual Adverse Effect (Not significant)** Although those affected will likely notice increased traffic, noise and dust, these effects are not anticipated to be of sufficient magnitude to preclude continued use of private property. Effects will also be limited to a few properties along the haul route within the LSA during the Site Preparation and Construction phase.	Minor Residual Adverse Effect Effect is less than that described in the EIS. (Not significant)

Likely Residual Adverse Effect (After Mitigation) from the Reactors Assessed in the EIS	Valued Ecosystem Component Affected	Significance of Results (After Mitigation)	
		From the EIS	BWRX-300
Reduced enjoyment of private property in the RSA and LSA because of the visual dominance of the natural draft cooling tower structures and the associated vapour plumes released from either the natural draft or mechanical draft cooling towers.	Use and Enjoyment of Property (also applies to Health-Human VEC – members of the public)	**Minor Residual Adverse Effect (Not significant)** Although there is likely to be a cumulative visual effect, the NND Project (in combination with other tall structures existing and foreseeable in the DN Site vicinity) will not likely preclude the use and enjoyment of private property in LSA communities. Although the conditions creating the effect will not be reversible, the magnitude of the effect is likely to further diminish over time as the structures become a familiar feature of the landscape and the Project establishes a positive track record.	Not applicable
INDIGENOUS RIGHTS AND INTERESTS			
Refer to Section 5.3.11			Refer to Section 5.3.11
HEALTH HUMAN			
No residual adverse effects (except for those noted above under Socio-Economic Environment)			No residual adverse effects (except for those noted above under Socio-Economic Environment)

Likely Residual Adverse Effect (After Mitigation) from the Reactors Assessed in the EIS	Valued Ecosystem Component Affected	Significance of Results (After Mitigation)	
		From the EIS	BWRX-300
HEALTH NON-HUMAN BIOTA			
No residual adverse effects			No residual adverse effects

Note: the assessment of the effects of malfunctions, accidents, malevolent acts and their significance is assessed in section 5.7. The determination of significance for cumulative effects can be found in section 5.8.

As shown in the table above, the EIS significance analysis had assessed all the residual adverse effects to be "Not Significant". Of the likely residual adverse effects that were forwarded for assessment of significance in the EIS:

- seven (7) were also determined to result in minor residual adverse effects from the BWRX-300 but less than that described in the EIS
- four (4) were not applicable to the BWRX-300 reactor
- one (1) was identified as requiring additional studies

In addition to these,

- five (5) residual adverse effects have been identified that require additional studies. These residual adverse effects were not considered in the EIS and are anticipated to be not significant.

The additional studies will identify any further mitigation necessary to ensure no significant residual adverse effects are anticipated from BWRX-300 deployment at the DNNP site.

OPG will continue to work Indigenous Nations and communities to appropriately identify the rights impacted by the Project, and to work toward mitigation measures and/or accommodation. These commitments are reinforced by OPG's dedication to reconciliation and to renewing its relationships with Indigenous peoples.

In the EIS, no residual adverse effect was anticipated for seven (7) environmental components. This remains unchanged for the deployment of BWRX-300 reactors.

5.5 Environmental Assessment Follow-Up Program

As part of the EIS, OPG made Commitment D-P-12.1 [1] to have an environmental monitoring and EA follow-up monitoring program in place as well as the methodologies to implement this program. The purpose of the EA follow-up monitoring program is to:

1. Verify predictions of environmental effects identified in the environmental assessment
2. Determine the effectiveness of mitigation measures in order to modify or implement new measures where required

OPG has designed an EA follow-up monitoring program and will implement it to support the DNNP activities. As concluded from this EIS review for the BWRX-300 reactor technology, the EA follow up monitoring remains suitable for the deployment of BWRX-300 [3]. Should unanticipated adverse environmental effects emerge, they will be addressed through adaptive management measures.

5.6 Review of Effects of the Environment on the Project

The EIS assessed how the environment could adversely affect the DNNP, for a range of environmental conditions such as flooding, severe weather, biophysical effects, seismicity, and climate change. The following sections summarize this assessment for the BWRX-300 deployment.

5.6.1 Flooding, Severe Weather, and Biophysical Effects

The BWRX-300 deployment is consistent with the assessment of the risk of flooding, severe weather, or biophysical effects conducted in the EIS, since these are site-specific hazards independent of the Project and reactor technology selected. Design requirements and mitigation measures related to flooding, severe weather, and biophysical effects are noted in the OPG Commitment Report [1].

5.6.2 Seismicity

The local and regional seismic hazards and how their affect could impact the BWRX-300 deployment were assessed. It is concluded that no seismicity related issues would render the DNNP site unsuitable for construction of new nuclear facilities, provided that the BWRX-300 deployment meets all site-specific geotechnical and seismic requirements noted in the OPG Commitment Report [1].

5.6.3 Climate Change Considerations

The effects of climate change on the BWRX-300 deployment, and effects of the Project on climate change, were assessed.

The EIS concluded that there are no medium or high-risk interactions between the climate change parameters and the Project due to the mitigations incorporated in the Project design, such as enhanced ability to deal with extreme weather events. BWRX-300 deployment does not change this determination. Prior to construction, OPG will prepare a contingency plan for the construction, operation, and decommissioning Project phases, to account for uncertainties associated with flooding and other extreme weather hazards. As part of this work, OPG will conduct localized climate change modelling or utilize published studies to evaluate the effect of climate change on the Project area (OPG commitment D-C-7.1 [1]).

As discussed previously, the scale of site preparation and construction activities is smaller than what was assessed in EIS, therefore it is expected that the GHG emissions from the deployment of the BWRX-300 reactors will be less than those assessed in the EIS.

Since 2009, there has been a sustained effort to ensure that projects help reduce emissions of GHG. SMRs are non-emitting sources of reliable energy that have the potential to replace fossil fueled electricity, such as coal-fired power for provincial energy grids and diesel power in remote locations. They also reduce the need for natural gas generation as a transition fuel to decarbonization. SMRs can complement intermittent renewable energy sources in the on-grid context, as well as produce high-quality steam and reduce emissions from industrial processes.

In Ontario, over 90 per cent of the electricity consumed is supplied from clean and non-emitting sources, with nuclear representing about 60 per cent. Nuclear energy played a key role in Ontario's ability to phase out coal-fired generation by 2014, which was the single largest greenhouse gas emissions reduction on the continent. SMRs are a potential source of baseload energy to meet future electricity demand and reduce reliance on natural gas-fired generation.

5.6.4 Summary of Review of Effects of the Environment on the Project

In the EIS, no significant residual adverse effects of the environment on the Project were anticipated following the consideration of design and mitigation features. The determinations made in the EIS apply to the BWRX-300 deployment. The design requirements identified in the EIS are applicable to the BWRX-300 reactor. Further details on the ability of the BWRX-300 to satisfy these design requirements will be contained in the future safety analysis report for the BWRX-300 deployment.

The summary of the analysis of the significance, as presented in the EIS, are shown in Table 8.

Table 8: Summary of Effect of the Environment on the Project

Environment Effect	EIS Significance	BWRX-300
Flooding	No significant residual adverse effects	Consistent
Severe Weather	No significant residual adverse effects	Consistent
Biophysical Effects	No significant residual adverse effects	Consistent
Seismicity	No significant residual adverse effects	Consistent
Climate Change	No significant residual adverse effects	Consistent

5.7 Review of Malfunctions, Accidents, and Malevolent Acts

The safety of the BWRX-300 reactor and the effects of malfunctions and accidents were reviewed and compared to the assessment included in the EIS.

5.7.1 Conventional Malfunctions and Accidents

The review of the list of conventional malfunction and accident scenarios showed that most are also applicable to the BWRX-300 deployment, except for the *Leak or release of chemicals from the blowdown ponds for cooling towers*, since the BWRX-300 deployment will not include cooling towers nor blowdown ponds. Table 9 identifies the relevance of conventional malfunction and accident scenarios to the BWRX-300 reactors. No additional conventional malfunctions and accidents were identified for the BWRX-300 deployment.

Table 9: Potential Conventional Malfunction and Accident Scenarios Screened in EIS

Potential Malfunction or Accident Scenario	Relevance to BWRX-300
Boat or barge accident resulting in release of oil or fuel into the lake	Yes
Transportation or vehicle accident resulting in a spill of fuel, oil, transmission fluid, hydraulic fluid, coolant or lubricant to land	Yes
Fire event at transformer with associated release of oil due to operation of deluge system	Yes
Fuel spill from standby power generator fuel storage tank.	Yes
Spill of oil or lubricant from fuelling equipment	Yes
Leak or release of chemicals from blowdown ponds for cooling towers	No The BWRX-300 deployment will not use cooling towers.
Spill of hazardous waste during handling, processing, or transport	Yes
Spill of sewage during tie-in to site services and utilities	Yes
Spill of chemicals used for construction such as cement, paints, solvents or sealants	Yes
Spill of process chemicals or fluids, lubricants or oils during maintenance and operation activities, or during transport of chemicals for addition to process systems	Yes Spill of hydrazine is not applicable since BWRX-300 will not use this chemical
Crane failure resulting in damage to existing structures and facilities	Yes
Accident involving moving heavy equipment from barge or rail	Yes
Fire involving hazardous waste packaging or shipment	Yes
Blasting accidents resulting in chemical release, personnel injury, or damage to existing structures and processes	Yes

Potential Malfunction or Accident Scenario	Relevance to BWRX-300
Release of hydrogen resulting in fire or explosion	Yes Although the generator of the BWRX-300 turbine is air-cooled instead of hydrogen-cooled, the BWRX-300 uses hydrogen injection in the reactor cooling system to control corrosion.
Fire or explosion of transformer	Yes
Fire from fuel or oil	Yes
Accidents involving compressed gas cylinders	Yes
Dry storage container (DSC) accident resulting in non radiological consequence and personnel injuries (Note: Potential radiological consequences are addressed in Section 7.3.1)	Yes
Personnel injury during the performance of maintenance or operation activities	Yes
Water-related accident resulting in personnel injuries and drowning	Yes
Potential personnel injury due to construction activities.	Yes
Sediment release during water related activities (i.e., dredging, building cofferdam).	Yes The BWRX-300 deployment will not require the construction of cofferdams but will involve construction activities in the lake for the water intake and outlet diffuser.

With one exception, the conventional accident scenarios and their assessment presented in the EIS are applicable to the BWRX-300 deployment and led to the same determinations relative to the absence of significant residual adverse effects. For the BWRX-300, accidents related to the operation of cooling towers are not applicable.

5.7.2 Radiological and Transportation Malfunctions and Accidents

For the BWRX-300, the radiological waste contains different proportions of radionuclides than the waste that was assessed in EIS. In addition, the mass of fuel placed in the spent fuel transfer cask is different than what had been assessed in the EIS. As a result, the assessment of radiological malfunctions and accidents involving radioactive waste and used nuclear fuel was reanalyzed for the BWRX-300 using the same scenario as was examined in the EIS [3]. Since the dose to members of the public and to the workers met the same criteria as the accidents analyzed in the EIS (i.e., regulatory dose limits of 1 mSv for members of the public or 50 mSv for worker dose resulting from the accident), the reassessment led to the same determination relative to the absence of significant residual adverse effects.

A re-evaluation of nuclear material transportation accidents presented in the EIS for the BWRX-300 deployment led to the same determinations.

In the EIS, accidents involving damage to spent fuel were classified as radiological accidents. For the BWRX-300, the drop of a heavy load over the core or in the spent fuel pool is included in the nuclear accident analysis for the BWRX-300 and is reflected in the core damage frequency and the large release frequency analyzed for nuclear accidents. Consequently, the drop of a heavy load over the core is not included in the radiological accidents, and no other radiological or transportation accident specific to the BWRX-300 has been identified.

5.7.3 Nuclear Accidents

The EIS described the CNSC licensing requirements for new reactors that existed at the time (Regulatory Document RD-337 [19]). This document has been superseded by REGDOC-2.5.2 [20], however, the safety goals and limits have remained the same. The evaluation of BWRX-300 PSA indicates that the design, as it has progressed to date, meets the stated safety goals, with calculated results in nuclear accident frequencies much below the relevant limits.

The nuclear accidents assessed in the EIS were based on the safety goals and limits from RD-337. These safety goals put a limit on the likelihood that the reactor core can be damaged, or that a small or large release of radioactivity can occur. The radioactive releases that are associated with the small release are 10^{15} Bq of I-131 and for the large release, 10^{14} Bq of Cs-137.

These releases and their consequences on the human health and the environment were assessed in the EIS. The EIS concluded that no residual adverse effects are expected from nuclear accidents on humans or non-human biota. Since the BWRX-300 deployment meets the same safety goals and the same accident scenarios apply, the EIS remains valid.

5.7.4 Criticality Accident

Out of core criticality was assessed in the EIS for uranium fuel that is enriched to between 1% and 5% (by mass) of U-235. The fuel of the BWRX-300 reactor will have a maximum enrichment of less than 5%, therefore the BWRX-300 fuel is within the range assessed in the EIS and its determination as to the absence of significant residual adverse effects.

5.7.5 Malevolent Acts

Malevolent acts were assessed in the EIS which concluded that the physical consequences of a malevolent act are likely to be bounded by the consequences of a nuclear accident discussed in Section 5.6.3 above. This determination remains valid for the BWRX-300.

5.7.6 Summary of Review of Malfunctions, Accidents, and Malevolent Acts

A summary of residual adverse effects for malfunctions, accidents, and malevolent acts is presented in Table 10. No residual adverse effects are anticipated from any malfunctions and accidents related to BWRX-300 deployment. Except where otherwise noted, these scenarios and the conclusions regarding residual effects are still relevant to the BWRX-300 deployment. Additional discussion of these scenarios is provided in the EIS Review Supporting Document [3].

Table 10: Summary of Residual Adverse Effects of Malfunctions, Accidents, and Malevolent Acts

Scenario	EIS		BWRX-300
	Potential Environmental Effects	Residual effects	
Spill of transformer oil to soil, along with deluge water following a transformer fire	Surface water effects due to oil draining into catch basins or stormwater management system.	No long term or residual adverse effects	No residual adverse effects
	Terrestrial and hydrogeological effects due to spill on land.		
Boating accident during marine activities that could result in a release of fuel to Lake Ontario.	Surface water and aquatic effects due to spill of fuel directly to water.	No residual adverse effects	No residual adverse effects

Scenario	EIS		BWRX-300
	Potential Environmental Effects	Residual effects	
Spill of hydrazine solution during transport	Air quality effect from evaporation of hydrazine spill.	No residual adverse effects	No residual adverse effects In the EIS, the spill of hydrazine is a bounding scenario for the spill of chemicals, oils, or fuel. The BWRX-300 will not use hydrazine but will use oils and fuel.
Fire in a fuel storage tank	Air quality effect from smoke plume resulting from the fire. Human health effect to workers from exposure to smoke and heat from the fire and to members of the public through atmospheric effects.	No long term or residual adverse effects	No residual adverse effects
Lost time accident to, or fatality of, personnel during Site Preparation and Construction Phase	Human health effect to the health and safety of workers.	No residual adverse effects	No residual adverse effects
Radiological Malfunctions and Accidents	Dose to members of the public and dose to workers. Dose to non-human biota.	No residual adverse human health effects No significant residual adverse effects to populations of non-human biota	No residual adverse effects
Transportation Accidents	Dose to members of the public and dose to workers. Dose to non-human biota.	Not likely to result in an effect on the environment or on human health.	No residual adverse effects

Scenario	EIS		BWRX-300
	Potential Environmental Effects	Residual effects	
Nuclear Accidents	Dose to members of the public.	No residual adverse effects	No residual adverse effects The accident scenarios are the same as those assessed in the EIS.
	Dose to non-human biota.	No residual adverse effects	
	Social, mental, and economic health effects of sheltering and evacuation following a nuclear accident.	No long-lasting residual adverse effects	
Out of Core Criticality	Dose to members of the public.	No residual adverse effects	No residual adverse effects
	Dose to workers.	No residual adverse effects	
Malevolent acts	The consequences of malevolent acts are encompassed by the assessment of nuclear accidents.	No residual adverse effects	No residual adverse effects

5.8 Review of Cumulative Effects

In the EIS, residual adverse effects of the proposed DNNP were identified in the aquatic, terrestrial, visual landscape, and socio-economic components/sub-components of the environment. Therefore, the assessment of cumulative effects focused on relevant receptors (VECs) within these four areas of the environment.

The EIS identified other projects and activities that would coincide or overlap with DNNP within the Regional Study Area which had a reasonable degree of certainty to proceed at the time the EIS was written.

Most of the planned and future activities listed are still relevant and there currently are no new major developments planned or underway that were not considered in the EIS. The larger off-site construction projects that were expected to occur at the same time as the construction of the original DNNP have either already been completed (e.g., Highways 407, 412, and Highway 401 improvements) or have yet to commence (e.g., GO Transit expansion). The expansion of St. Marys Cement, adjacent to the DNNP site has been cancelled.

The status of some of the larger projects on the DN site that could have had a cumulative effect include:

- The refurbishment of DNGS is currently under way in 2022 and its completion is expected in 2026. Since DNGS is being refurbished, its dismantling will not take place until approximately 2055. The DNGS refurbishment was considered in the EIS.
- The Pickering U05-08 refurbishment considered at the time of the EIS may not take place. Pickering U05-08 is currently approved to continue operation until the end of 2024, however OPG has recently announced a plan to seek approval to operate until Sept 2026 and plans to reassess the feasibility of refurbishing Pickering U05-08. The Pickering U05-08 refurbishment and continued operation was considered in the EIS.
- The Construction of OPGs Clarington Corporate Campus and the implementation of an anaerobic digestion facility in Clarington Energy Park are currently being planned for construction during DNNP. These two projects are consistent with the Clarington Energy Business Park (CEBP) development anticipated in the EIS.
- The GO Transit Rail Extension from Oshawa to Bowmanville is currently in the constructor procurement process. Construction will take place during DNNP. The GO Transit Rail extension was considered in the EIS.
- The expansion of the Newcastle Municipal Pollution Control Plant is undergoing environmental assessment. Expansion will overlap with DNNP. The expansion of Municipal Pollution Control Plants was considered in the EIS.
- Ongoing growth and development as planned in urban communities including Courtice, Bowmanville, Newcastle and Oshawa will overlap with DNNP. The ongoing growth and development in the area was considered in the EIS.

The timeline of the BWRX-300 deployment starts in 2022 instead of the 2010 start discussed in the EIS. Beyond the change of date for the initiation of DNNP, the foreseeable projects considered in 2009 are consistent with or bounded by their descriptions in the EIS. While the site preparation and construction period was assumed to be fifteen years, from 2010 to 2025 for four reactors in the EIS, the total deployment period for four BWRX-300 reactors as shown in Table 2 is about 13 years, from 2022 to 2035, which is generally consistent with the EIS.

The EIS described how the residual effects of the DNNP were considered in the cumulative effect assessment. Most of the adverse residual effects in the EIS are still applicable to the BWRX-300 deployment, except for the effects of the cooling towers, which are not included for the BWRX-300 deployment. The other adverse residual effects identified in the EIS are consistent with the effects of the BWRX-300 deployment and the assessment remains valid.

The likely beneficial effects identified in the EIS remain applicable to the BWRX-300 deployment.

5.8.1 Aquatic Environment

The EIS considered the cumulative effect of the DNNP and other projects that would coincide with DNNP that could affect the same aquatic environment, with the predominant relevant effect of the DNNP being impingement losses of fish for the once-through cooling system. The EIS concluded that no measurable cumulative effect is likely to occur. The BWRX-300 will require a smaller flow rate of cooling water (less than 68 m^3/s) for four reactors than what has been assessed in the EIS (228 m^3/s) for four reactors, therefore the assessment of cumulative effects on the aquatic environment is consistent with the effects in the EIS.

5.8.2 Terrestrial Environment

The BWRX-300 reactor has a smaller footprint (19 ha for one reactor) than what has been assessed in the EIS (35.33 ha for one reactor) resulting in opportunities to retain some habitats that were considered to be lost in the EIS. Additional studies are in progress to explore these opportunities.

5.8.3 Land Use and Visual Setting

The BWRX-300 has a smaller footprint (19 ha for 1-unit) and will require less landfill (soil and rock removal can be estimated at about 1 Mm^3 for a single reactor, and approximately 3.3 Mm^3 for four reactors [12]) for the excess soil from its deployment. It will also require less material (40,000 m^3 of concrete for the plant facilities including the reactor, turbine, and fuel buildings) for construction of plant facilities than what was assessed in the EIS (400,000 m^3 of concrete for the EPR).

Since the BWRX-300 deployment does not include cooling towers, the visual effect of the cooling towers is no longer applicable.

5.8.4 Socio-Economic Conditions

The smaller footprint of the BWRX-300 deployment means less disruption in terms of nuisance effects such as dust, noise, and traffic, to recreational facilities located near the DN Site.

The EIS concluded that the other projects that would coincide with DNNP are not likely to contribute measurably to cumulative concerns about truck traffic along excess soil haul routes through residential areas or related property value effects. As mentioned in Section 5.7.5 below, most large projects in the Durham Region have been completed and with the smaller quantity of soil, rock, and materials to be transported, and the smaller DNNP construction workforce means less traffic associated with the Project.

5.8.5 Effect of Radiation and Radioactivity on Human Health

The dose to the most exposed members of the public from the BWRX-300 deployment was calculated in the Dose Estimation Report [14] and was found to be 0.5 μSv/year for a single reactor, or 2 uSv/year for four reactors. These calculated doses are less than the pro-rated value 4.4 μSv/year in the EIS.

5.8.6 Community Concerns Regarding Concentration of Projects and Activities

The larger construction projects that were expected to occur at the same time as the construction of the original timeline for DNNP have either already been completed (e.g., Highways 407, 412, and Highway 401 improvements) or have yet to commence (e.g., GO Transit expansion). Since the EIS assumed that these projects would occur at the same time as the construction of the BWRX-300, their impact had already been assessed as minor residual cumulative effects in the EIS.

Regarding the cumulative socio-economic effects on local labour supply, community services and infrastructure, the EIS concluded that the DNNP is not likely to result in residual adverse effects. Given the completion of large projects over the past decade, the short overlap period of the Darlington Refurbishment and the DNNP construction, and a smaller scale of the BWRX-300 deployment, this determination remains valid.

The effect on the community character was mostly due to the presence of the cooling towers, which are not part of the BWRX-300 deployment.

5.8.7 Summary of Cumulative Effects

In the EIS, the assessment of cumulative effects focused on receptors (VECs) where residual adverse effects of the proposed DNNP were identified.

Since the BWRX-300 deployment does not include cooling towers, the adverse effects associated with them (e.g., effects on the visual landscape and socio-economic conditions) are no longer applicable. In the remaining aquatic, terrestrial, visual landscape and socio-economic components of the environment, minor residual cumulative effects were found, such that no additional mitigation measures were deemed to be necessary in the EIS. This conclusion remains valid for the BWRX-300 deployment.

In the EIS, and in the assessment of the BWRX-300, there are no residual adverse effects associated with Radiation and Radioactivity and Human Health components. Nevertheless, the Human Health component is discussed further in this section because of concerns generally expressed by some members of the public that their health, safety, and well-being may be affected by radiation and radioactivity from any nuclear project or operation.

The assessment of the significance of the residual adverse cumulative effects is summarized in Table 11. For clarity, please note that:

- Green shades mean that the significance of residual adverse effects from BWRX-300 deployment are considered to be “minor” and “not significant” because they are likely to have less effect on the VEC than assessed in the EIS.

- Pink shades mean that there is potential for a residual adverse effect from BWRX-300 deployment and additional studies to characterize these effects are being undertaken.
- Yellow shades mean that the residual adverse effect assessed in the EIS is no longer expected as it is related to an original DNNP feature that is not applicable to BWRX-300 deployment at the DNNP site.

Table 11: Determination of Cumulative Residual Adverse Effects

Likely Residual Adverse Effect (After Mitigation) from the Reactors In EIS	Valued Ecosystem Component Affected	Significance of Likely Residual Adverse Effect (After Mitigation)	
		From EIS	BWRX-300
Aquatic environment	Benthic Invertebrates, VEC Fish Species	Minor Residual Adverse Effect (Not significant)	Minor Residual Adverse Effect Less than the effects assessed in the EIS. No lake infilling. Once-through cooling withdraws less water, less impingement. (Not significant)
	On-site Aquatic Habitat (ponds, intermittent tributaries to Darlington Creek and to Lake Ontario, Darlington Creek)	No Residual Adverse Effect	Residual Adverse Effects anticipated to be not significant Additional studies are required to assess the effects on the biota in the wetlands which may remain on the DNNP site. (Not significant)

Likely Residual Adverse Effect (After Mitigation) from the Reactors In EIS	Valued Ecosystem Component Affected	Significance of Likely Residual Adverse Effect (After Mitigation)	
		From EIS	BWRX-300
Terrestrial environment	Cultural Meadow and Thicket Ecosystem Winter Raptor Feeding and Roosting Area Breeding Mammals Migrant Butterfly Stopover Area Migrant Songbirds and their Habitat	Minor Residual Adverse Effect (Not significant)	Residual Adverse Effects anticipated to be not significant More of the habitat may remain. Effect from habitat removal may be less than that described in the EIS. Additional studies are required to assess the effects of construction on vegetation communities, breeding birds and breeding mammals. (Not significant)
	Wetland and Woodland Ecosystems, Rare Plant Species, Amphibians and Reptiles, Insects – Dragonflies and Damselflies, Mammal communities and species	No Residual Adverse Effect (Not Significant)	Residual Adverse Effects anticipated to be not significant Additional studies are required to assess the effects of construction on rare plants, amphibians, insects, reptiles, mammals. (Not significant)

Likely Residual Adverse Effect (After Mitigation) from the Reactors In EIS	Valued Ecosystem Component Affected	Significance of Likely Residual Adverse Effect (After Mitigation)	
		From EIS	BWRX-300
	Breeding Birds (Bank Swallows)	Minor Residual Adverse Effect (Not significant)	Minor Residual Adverse Effect Anticipated Residual adverse effect anticipated to be not significant. For the four-unit scenario is consistent with the effects assessed in the EIS.
			Residual Adverse Effects anticipated to be not significant Bank Swallow habitat to remain for one BWRX-300 reactor deployment. For the one-unit scenario additional studies are underway to assess the effects of construction.

Likely Residual Adverse Effect (After Mitigation) from the Reactors In EIS	Valued Ecosystem Component Affected	Significance of Likely Residual Adverse Effect (After Mitigation)	
		From EIS	BWRX-300
	Bats (new baseline condition)	Impacts to bats were not considered in the EIS as this is a new condition.	Residual Adverse Effects anticipated to be not significant New baseline condition. Additional studies are required to assess the effects of noise, dust and light, on bats.
	Landscape connectivity	Minor Residual Adverse Effect (Not significant)	Minor Residual Adverse Effect Effect on wildlife corridor is less than that described in the EIS. (Not significant)
Land use	Visual Aesthetics	Minor Residual Adverse Effect (Not Significant)	Not applicable No cooling towers.
Socio-economic environment	Community Character	Minor Residual Adverse Effect (Not significant)	Not applicable No cooling towers.
	Community and Recreational Facilities and Services	Minor Residual Adverse Effect (Not significant)	Minor Residual Adverse Effect Less dust, noise and traffic than assessed in the EIS. (Not significant)

Likely Residual Adverse Effect (After Mitigation) from the Reactors In EIS	Valued Ecosystem Component Affected	Significance of Likely Residual Adverse Effect (After Mitigation)	
		From EIS	BWRX-300
	Use and Enjoyment of Private Property	Minor Residual Adverse Effect (Not significant)	Minor Residual Adverse Effect Less dust, noise and traffic than assessed in the EIS. No cooling towers. (Not significant)
Human health	Dose to members of the public	No Residual Adverse Effect (Not Significant) Included to address public interest.	Minor Residual Adverse Effect Less than the dose estimated from reactors assessed in the EIS. (Not significant)

6. CONCLUSION

The EIS has been comprehensively reviewed to confirm that the results of the EIS remain valid in consideration of the BWRX-300 deployment. The detailed findings of the review are presented in a separate document, the EIS Review Supporting Document [3].

6.1 The PPE

Of the 198 PPE parameters, 60 PPE parameters were not applicable to the BWRX-300. Of the 138 applicable PPE parameters evaluated, nine (9) BWRX-300 parameters are currently not within their respective PPE parameters. These are largely due to characteristics inherent to the design of the GEH reactor technology. These nine parameters are related to the following topics:

- the rate of fire protection water withdrawal and the quantity of water in storage,
- deeper foundations (38 m below grade) than the reactors previously assessed in the EIS (13.5 m),
- airborne and waterborne releases of radioactive contaminants and normal operation minimum release height above finished grade,
- the solid waste specific activity (Bq/m^3) generated by the operation of the BWRX-300,
- the weight of the cask used to transport the BWRX-300 spent fuel on site, and
- the multiplication factors applied to basic wind speed to develop the plant design.

An assessment of the BWRX-300 design parameters with the PPE values has been completed. As concluded in Section 4 of this EIS Review, the assessment of BWRX-300 parameters shows no issues of significance for the BWRX-300 deployment at the DNNP site. The further assessment of nine PPE parameters that are not within the PPE shows that they would not alter the conclusion of the EIS. The PPE parameters have been updated [15] as required by Commitment D-C-3.1 [1].

6.2 The EIS

The BWRX-300 deployment is expected to involve project works and activities that are essentially the same as those evaluated in the EIS with the exception of some key refinements. The key refinements to the Project description are:

- cooling towers will not be used for the BWRX-300 for either normal or ultimate plant heat sink,
- lake infilling is not required, and
- the primary and secondary heat transport systems are combined.

As compared to the reactors considered in the EIS, the BWRX-300 reactors are smaller in physical size and electrical power. As a result, the effects of the BWRX-300 deployment on the environment are generally less than those examined in the EIS. Positive outcomes or opportunities with the BWRX-300 deployment could be realized through conservation of some habitats that were considered to be removed in the EIS. Additional studies are in progress to explore those opportunities and potential effects to those retained habitats.

As part of the EIS, OPG made a commitment to have an environmental monitoring and EA follow-up program in place to verify predictions of environmental effects identified in the environmental assessment, and to determine the effectiveness of mitigation measures. This EIS Review concluded that the EA follow-up and monitoring programs remain suitable for BWRX-300 deployment.

Overall, given that the BWRX-300 is smaller in size and requires less footprint, it is expected that effects on the environment within the EA Study Areas would be less than those assessed in the EIS. Therefore, the determinations regarding the significance of residual adverse effects made in the EIS remain valid. The DNNP, considering the mitigation measures identified, will not result in significant adverse environmental effects, including effects from accidents, malfunctions and malevolent acts, effects of the environment on the Project, and cumulative effects.

OPG recognizes that while the assessment of environmental effects from DNNP has been satisfied from the Western perspective, it may not fully address the impact of the DNNP on Indigenous inherent and treaty rights as they are understood today. OPG endeavors to continue to work with Indigenous Nations and communities to appropriately identify the rights impacted by the Project and to achieve feasible mitigation measures and/or accommodation.

7. REFERENCES

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