Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

CMD 26-H104.1

Date: 2026-03-31

Written Submission from Bruce Power

Mémoire de Bruce Power

In the matter of the

À l'égard du

Bruce Power

Bruce Power

Application to amend the licensing basis for Bruce A and B nuclear generating stations to increase reactor power limits

Demande de Bruce Power visant à modifier le fondement d'autorisation des centrales nucléaires de Bruce-A et B afin d'augmenter les limites de puissance des réacteurs

Hearing in Writing

Audience par écrit

July, 2026

Juillet 2026

Document ID: QQQVZZNDK725-166150894-11158

Canada

March 31, 2026

BP-CORR-00531-07412

Ms. Candace Salmon
Commission Registrar
Canadian Nuclear Safety Commission
P.O. Box 1046
280 Slater Street
Ottawa, Ontario
K1P 5S9

Dear Ms. Salmon:

Bruce A and B: Evidence for the Record for
Commission Approval of Change to Reactor Power Limits, Project 2030

The purpose of this letter is:

- to provide evidence for the record, at the request of CNSC staff, to support the request for Commission approval to change the reactor, channel, and bundle power limits at Bruce A and Bruce B (Reference 1); and,
- to request the Commission take measures to protect confidential technical information, pursuant to Canadian Nuclear Safety Commission Rules of Procedure, Rule 12, and in accordance with the Directive on Requesting Confidentiality, published September 15, 2025.

Bruce Power completed a gap analysis to consider the potential impact of Project 2030 on the Predictive Environmental Risk Assessment (PERA). This assessment describes the environmental impacts of Project 2030 and concludes the 2022 Environmental Risk Assessment (ERA) remains bounding. The next update to the ERA will be submitted to CNSC staff in 2027, in accordance with CSA N288.6.

Note that Project 2030 activities are conducted in accordance with Bruce Power's robust environmental protection program, and that no changes to regulatory limits or action levels have been requested.

Bruce Power submits the PERA gap analysis as evidence for the record in Enclosure 1.

Bruce Power completed integrated safety analysis summary reports for Project 2030, up to the Intermediate Power Level (IPL). These assessments conclude that it is safe to operate Bruce A and Bruce B up to the IPL in accordance with Project 2030. The assessments confirm the effectiveness of defence-in-depth provisions and special safety systems, and compliance with dose limits for workers and members of the public.

Note that safety analysis is integrated into processes for design and operations, and that all applicable acceptance criteria will continue to be met. The next update to safety analysis will be submitted to CNSC staff in 2027, in accordance with the Licence Conditions Handbook.

Maury Burton, Senior Director, Regulatory Affairs
177 Tie Rd, Tiverton ON N0G 2T0
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Bruce Power submits the integrated safety analysis summary reports as evidence for the record in Enclosures 2 and 3, respectively. These assessments incorporate previous CNSC feedback. Bruce Power anticipates receiving additional feedback from CNSC staff on the Bruce B summary report, which may necessitate a revision. Bruce Power will provide an update to the Commission if the submitted information necessitates a revision; however, Bruce Power does not anticipate that any revision would impact the public summary.

Bruce Power requests that the Registry take measures to protect information contained in this submission, pursuant to the Canadian Nuclear Safety Commission Rules of Procedure, Rule 12(1), and in accordance with the Directive on Requesting Confidentiality. Accordingly, Bruce Power submits the Request for Confidentiality as Enclosure 4.

Enclosures 2 and 3 contain technical information that is consistently treated as confidential and contains some third-party intellectual property.

Additionally, Bruce Power considers that some of the information provided in Enclosures 2 and 3 may meaningfully inform the design, operation, and/or maintenance of a nuclear reactor and therefore may be considered controlled nuclear information, pursuant to Part A.4 of the Nuclear Non-Proliferation Import and Export Control Regulations. As controlled nuclear information may not be exported, unless made public in accordance with the *Nuclear Safety and Control Act* (NSCA), posting of Enclosures 2 and 3 on the CNSC website is not authorized by the NSCA.

To assist the Registry in ensuring that these protective measures do not unduly affect the openness of the proceeding, non-confidential summaries of Enclosures 2 and 3 have been provided in Attachments A and B, respectively.

If you require further information or have any questions regarding this submission, please contact Mr. Maury Burton, Senior Director, Regulatory Affairs, at 519-386-2394 or maury.burton@brucepower.com.

Yours truly,

Lisa Clarke

Digitally signed by Lisa Clarke
Date: 2026.03.31 16:36:21 -04'00'

Maury Burton
Senior Director, Regulatory Affairs
Bruce Power

cc: CNSC Forms / Formulaires
registry-greffe@cnsc-ccsn.gc.ca
Anupama Bulkan, CNSC – Ottawa
Alexandre Viktorov, CNSC – Ottawa

Attach.

Enclosures:

1. B-REP-03443-02JAN2025 R000, Project 2030 Predictive Environmental Risk Assessment (PERA) Gap Analysis (2021-2026).
2. NK21-REP-03600-00058 R001, Bruce A Integrated Summary Report for P2030 Safety Analysis up to 95.5% FP.
3. NK29-REP-03600-00057 R001, Bruce B Integrated Summary Report for P2030 Safety Analysis up to 96% FP.
4. Request for Confidentiality.

Reference:

1. Letter, M. Burton to C. Salmon, “Bruce A and B: Request Commission Approval of Change to Reactor Power Limits, Project 2030”, August 19, 2025, BP-CORR-00531-06659.

Enclosure 1

B-REP-03443-02JAN2025

Project 2030 Predictive Environmental Risk Assessment (PERA) Gap Analysis (2021-2026)

PROJECT 2030 PREDICTIVE ENVIRONMENTAL RISK ASSESSMENT (PERA) GAP ANALYSIS (2021-2026)

B-REP-03443-02JAN2025

Rev 000

January 2025

Prepared by: Digitally signed by Minnie Huang Date: 2024.12.11 14:09:10 -05'00'

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Regulatory Support, Environment, Sustainability & Net Zero

Approved by: Cherie-Lee Fietsch Digitally signed by Cherie-Lee Fietsch Date: 2024.12.12 14:30:20 -05'00'

C. Fietsch
Section Manager, Environment, Sustainability & Net Zero

Master Created: 11Dec2024 2:08

ABSTRACT OF PRESENT REVISION:

Initial Issue

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1.0 PREDICTIVE ENVIRONMENTAL RISK ASSESSMENT GAP ANALYSIS FOR PROJECT 2030 FOR ACTIVIES PLANNED FROM 2021 TO 2026

The purpose of this report is to provide an environmental protection gap analysis for the Predictive Environmental Risk Assessment (PERA) of activities completed and planned for the execution of Project 2030 from 2021 to 2026. Additional activities associated with Project 2030 after this date will be assessed in the next full update to the Environmental Risk Assessment (ERA) and PERA for Bruce Power activities on site, due in 2027. The next full update will include predictive impacts for 2027-2031.

1.1 Predictive Risk Assessment Methodology

The overall approach for predicting and assessing effects of Project 2030 site activities is based on CSA N288.6-22 [R-1]. The CSA N288.6-22 standard does not provide specific guidance on predictive effects assessment scenarios; therefore, modifications to the ERA to complete the PERA are discussed in this section. The approach is presented schematically on Figure 1 (modified from Figure 5.1 in CSA N288.6-22 [R-1]). The PERA is designed to focus on those pathways which may introduce new or modified effects on the environment, as well as focusing on those interactions most likely to cause an adverse environmental risk, however beneficial changes are identified and are discussed qualitatively.

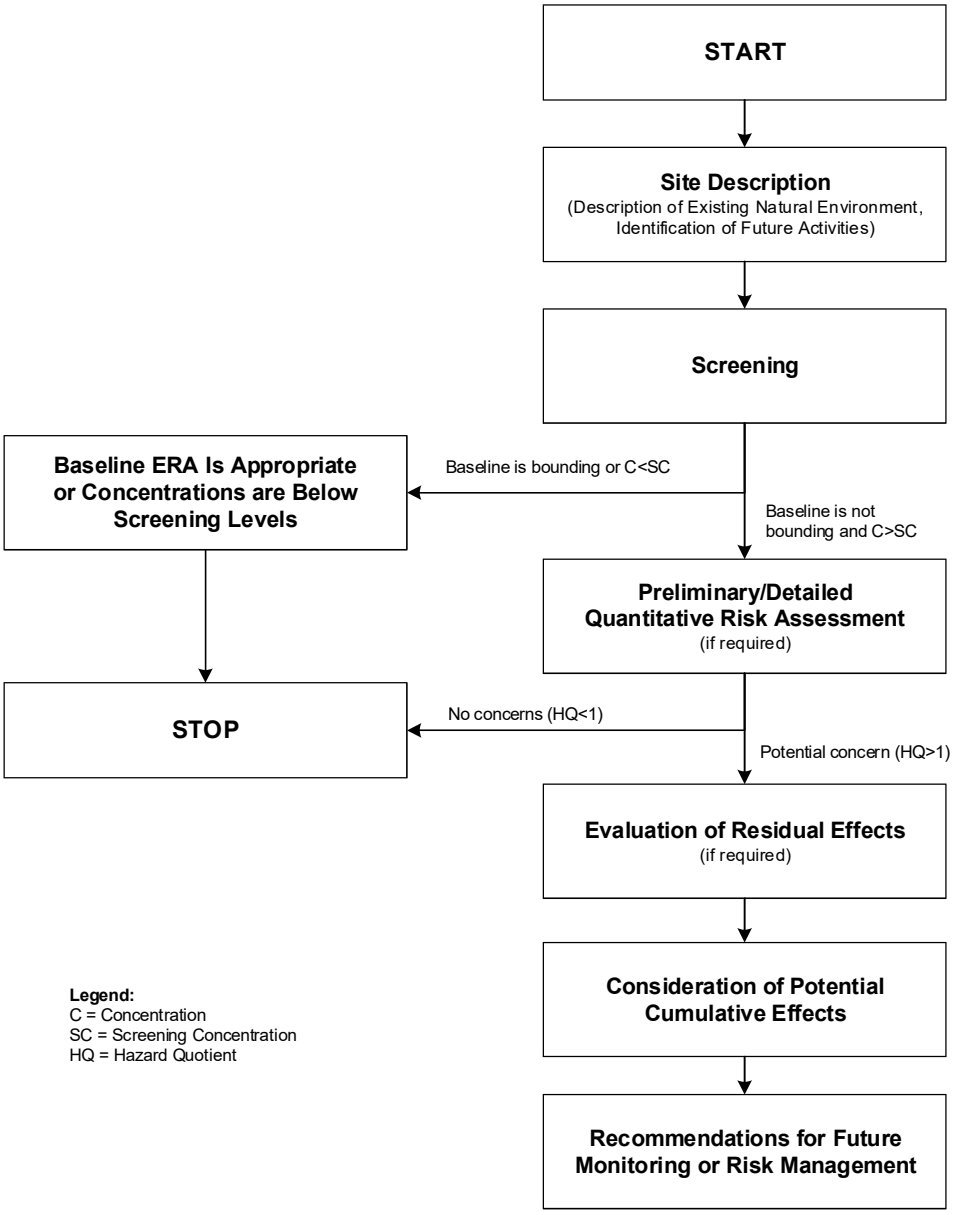

Figure 1 Predictive Effects Assessment Approach

The following sections describe project-environment interactions associated with future Project 2030 site activities for each aspect of the environment considered in the ERA. A step-wise predictive screening was carried out to identify and classify plausible interactions between future site activities and the environment. Each interaction is evaluated in detail in Appendix A and summarized in Section 1.3 below.

1.1.1 Predictive Risk Assessment Outcomes

Outcomes of environmental monitoring including Project 2030 activities completed between 2021 and 2023 are described in Section 1.4 and any measurable changes from routine operations are described.

1.1.2 Preliminary Screening

The preliminary screening includes evaluation of potential interactions of Project 2030 site activities with the environment to identify those receptors, exposure pathways and Contaminants of Potential Concern (COPC) that may warrant further assessment. The potential environmental interactions were evaluated to determine whether they are bound by existing or historical operational conditions and therefore adequately assessed in the current ERA or whether they are within screening criteria (eg. limits established for COPCs). Interactions bound by current or historical operations, including one-time interactions associated with maintenance, were not considered further in the PERA. Those interactions not readily bound by current or historical operations were considered in the PERA to identify whether predicted effects could exceed accepted screening values or compliance limits for the protection of human health and the environment. If the screening values or compliance limits have the potential to be exceeded, the interaction would be evaluated further in the predictive quantitative risk assessment or noted as recommendations to assess prior to recovery of reactor power in the next iteration of the PERA for 2027-2031. If the interaction is likely to be within screening values, the impact is not considered further.

For the human and ecological receptors, an evaluation is made regarding how exposure pathways may be modified in ways that have effects on the receptors(s) or their habitat as a result of Project 2030 site activities. The potential changes are discussed in the physical pathway-interaction discussions.

Taking into consideration the description of site activities in Section 1.2, the potential for interaction with each environmental pathway is considered and summarized within each relevant media in Section 1.3 for radiological contaminants, non--radiological contaminants, and physical stressors. Appendix A includes the impact tables for each environmental pathway. Where a potentially increasing interaction is identified, details are provided to describe and evaluate the interaction and the predicted change during future site activities. Proposed activities and the associated hazards are compared to periods of similar activity that have taken place, if applicable. Each interaction is evaluated as potentially resulting in:

- An increased interaction with the environment compared to current operational conditions (denoted in the summary table with “Increase”);
- A decreased interaction with the environment compared to current operational conditions (denoted in the summary table with “Decrease”);
- No change or negligible change from current or historical operational conditions. This includes one-time activities which may temporarily increase emissions but will not result

in a long-term change, and changes which decrease the risk to generating emissions but do not change actual emissions (denoted in the summary table with “Stable”); or

- No interaction/not applicable (i.e., the system or structure does not have an interaction with the specified environmental pathway (denoted in the summary table with “Not Applicable”).

This screening assessment, which is documented in each relevant media, is conducted using professional judgment and an understanding of Bruce Power operations. Where an interaction is identified, details are provided to describe and evaluate the interaction and the change during P2030 site activities. Those interactions that are likely to result in decreased or equivalent environmental effects are considered to be negligible and are not considered further in the PERA. For these interactions, the effects of the existing Bruce Power operations as described in the ERA are considered to be bounding.

Potential increases relative to existing or historical conditions are discussed further in the preliminary screening with the objective of determining if more detailed assessment is required. The predicted conditions are compared to accepted screening values or compliance limits for the protection of human health and the environment. If the predicted conditions exceed screening values, the interaction is then evaluated further in a predictive quantitative risk assessment.

1.1.3 Predictive Quantitative Risk Assessment

Where a pathway or receptor is not bound by current or historical operational conditions and the predicted change to a COPC and/or physical stressor cannot be screened using accepted guidelines, then the pathway and/or receptors are described in the conceptual site model and evaluated further in the predictive quantitative risk assessment, if required.

The quantitative risk assessment, if required, is a Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (EcoRA) conducted in accordance with CSA N288.6 [R-1]. The predictive quantitative risk assessment is focused only on those elements carried forward from the preliminary screening, as per the rationale described above.

1.1.4 Recommendations for Future Monitoring

Based on the results of the assessment, recommendations for monitoring or risk management may be made. Per CSA N288.4 [R-2], CSA N288.5 [R-3], and CSA N288.7 [R-4] the results of the PERA will inform the Bruce Power Environmental Monitoring Program (EMP), Emissions & Effluent Monitoring Program and the Groundwater Protection and Monitoring Program (GWMP). Monitoring recommendations from the PERA will be made in consideration of criteria provided in CSA N288.4 [R-2] and in CSA N288.7 [R-4]. Recommendations may include modifications to the EMP, Emissions & Effluent Monitoring Program or GWMP if the emissions/effluents and pathways for environmental effects are predicted to increase above screening criteria as a result of future site activities. The recommended changes to monitoring programs would be implemented to demonstrate that environmental effects from future site activities are acceptable. Risk management measures

may also be recommended to manage risks from predicted adverse effects. Recommendations are summarized in Section 1.5.

1.1.1 Quality Assurance and Quality Control

For QA/QC procedures undertaken during the planning and preparation of the PERA refer to Section 1.8 of the 2022 ERA [R-5].

1.2 Project 2030 Activities 2021-2026

The objective of P2030 is to safely and cost effectively maximize site electrical output to support the growing demand for electricity in Ontario with the existing generating stations, Bruce A (BA) and Bruce B (BB). The station reactor design bases for BA and BB were developed for 100% full power (FP) operation, however BA is currently licensed for 92.5%FP and BB is currently licensed for 93%FP.

P2030 completed system readiness reviews and analyses to identify potential opportunities and limitations to support operating at up to 100%FP at BA and BB and increased electrical (MW) output (at both current and recovered reactor power). Several design changes and improvements to existing systems were identified to both improve efficiency and accommodate recovered reactor power. The changes include asset management projects returning equipment to original design basis as well as design changes to Systems, Structures, or Components (SSCs). The scopes of work described in Section 1.2.2 and 1.2.3 range from development phase (conceptual) to closeout (execution and commissioning completed). Some scopes of work which are in the early stages of design and which will not have physical changes prior to 2027 have been excluded, however they will be evaluated and reported in the next PERA which will cover 2027-2031. This screening of potential changes to environmental impact is based on information available as of Q3 2024, and judgement from historical performance, predictions, and operating experience.

Any assessments or changes related to accident scenarios are outside the scope of this screening and assessment.

Note the dates for the completed projects reflect the in-service date (for the final unit, if applicable). Dates are not included for safety analyses without physical changes.

1.2.1 Reactor Power Change Impacts

Potential impacts from design changes and operational changes are described in Section 1.2.2 and 1.2.3. Section 1.3 summarizes project specific interactions with the environment for activities from 2021-2026.

Recovery of reactor power is considered holistically, which includes all design changes which have occurred to the point of reactor power increase. In 2025, P2030 is pursuing an overarching engineering change to track the recovery of reactor power from 92.5%FP and 93%FP to 95.5%FP and 96%FP for BA and BB respectively. This will include submission of

an Environment Impact Workflow (EIW) where potential impacts will be identified and reviewed.

Although actual power recovery will not take place prior to 2027, a qualitative discussion of increasing reactor power to 95.5%/96%FP and to 100%FP is included. Section 1.5 includes recommendations for assessment based on the qualitative discussion of potential impacts from recovery of reactor power for inclusion in the future PERA covering 2027-2031.

1.2.2 Scopes of Work (2021-2026)

Project engineers use information on design changes and operational changes to complete EIWs to identify potential impacts to the environment. The following project summaries provide high level information on the potential impact associated with each scope where physical changes have been made or will be made prior to 2027.

1.2.2.1 P39000 – High Pressure Feedwater Heat Exchanger Bypass (completed 2024)

Aging of primary heat transport systems result in increased Reactor Inner Zone Inlet Header (RIZIH) temperature, which limits full power and ultimately electrical power output. An external bypass was designed and added to the high pressure feedwater heaters, with ability to control and measure the flow. The bypass consists of an NPS18 bypass line with a manual throttling valve and two isolating values. This bypass was installed on units 5, 7, and 8. The amount of valve throttle depends on the required reduction in RIZIH temperature, boiler pressure, full power and feedwater heater discharge temperature. This output benefit could only be realized by pre-MCR units, and thus was not installed on Unit 6. There have been no measured, adverse environmental impacts and no long-term environmental impacts from this work. This work improved the overall thermal efficiency of the units, which results in reduced thermal effluent to the lake.

1.2.2.2 P39203 - Bruce A Unit 1 Generator Rotor - Stator Rewind (completed 2021)

The purpose of this project is to improve life expectancy, performance and reliability of the Unit 1 generator by upgrading and rewinding the main generator rotor. The work includes rewinding the existing copper and adding new insulation, replacing retaining rings with non-magnetic rings, replacement of couplings, fans, studs, main leads, implementing damper winding segments, and others. These changes allow pressure test capability, accommodation of torque transmission at 900MW, reduced hot spot temperature, among other benefits. There have been no measured, adverse environmental impacts and no long-term environmental impacts from this work.

1.2.2.3 P39272 and 39681 – Composite Analytical Approach (CAA) for Large Break Loss of Coolant Accident (LBLOCA)

This project looks at using CAA to redefine LBLOCA events in larger piping and headers as beyond design basis accidents (BDBA) using tools and assumptions from a joint CNSC – Industry working group. Successful implementation will establish a more realistic set of accident scenarios and restore and improve safety margins for the very low probability

postulated LBLOCA accidents. No physical changes are associated with this project, and no environmental impacts are expected.

1.2.2.4 Project 39667 – Bruce A Unit 1 and 2 Main Output Transformer Replacement (completed 2022)

This project replaced the Unit 1 and Unit 2 main output transformers (MOTs) to a higher rating. This allows increased electricity generation to support existing operations and recovery of reactor power. The replacements were completed during unit outages and generated conventional, hazardous, and recyclable waste; some changes including reduced oil volume and rupture resistant tanks reduce the risk of spills from MOT failure. There have been no measured, adverse environmental impacts and no long-term environmental impacts from this work.

1.2.2.5 Project 39668 – Bruce A Unit 1 and 2 Isolated Phase Bus Cooling Upgrades (completed 2022)

The isolated phase bus (IPB) system connects the generator to the MOT and unit service transformer (UST). This project refurbished the system to upgrade its cooling capacity to support increased electricity generation. The refurbishment included replacement of instrumentation, air conditioning units, electrical wiring, and pipe rerouting. There have been no measured, adverse environmental impacts and no long-term environmental impacts from this work.

1.2.2.6 Project 39751 – Data Reconciliation/Measurement Uncertainty Recapture Implementation (completed 2024)

The scope of this project is to install a data reconciliation system for measurement uncertainty recapture (MUR). The goal of Data Reconciliation is to improve reactor power calibration to improve both safety and production. Data Reconciliation technology uses redundancies and thermodynamic relationships to identify, quantify and correct measurement errors of field installed instruments. When applied to instruments critical to reactor power calculation it results in increased reactor power accuracy leading to safer operation and generation loss avoidance. The intent of the system is to calculate correction factors for feedwater flow, feedwater temperature and reheater drains flow which will be used in the Class 2 Reactor Safety Heat Balance Program. Physical changes include installation of new cables, panels, and cabinets. There have been no measured, adverse environmental impacts and no long-term environmental impacts from this work. This work improved the overall thermal efficiency of the units, which results in reduced thermal effluent to the lake.

1.2.2.7 Project 39752 – Bruce A Seal Oil System Performance Improvements (completed 2022)

The scope of this project is to implement improvements to the Bruce A main generator seal oil system to achieve and maintain the required pressure at the hydrogen seals. This includes installing new sensing lines, increasing flow, upgrading cooler tube bundles, installing a new filter with better pressure drop performance and replacing valves. The system is normally closed loop. Improved equipment reliability and instrumentation reduces the risk of leaks.

There have been no measured, adverse environmental impacts and no long-term environmental impacts from this work.

1.2.2.8 Project 39753 – Bruce A Current Transformers and High Voltage Bushings Replacement (planned for 2025-2027)

The current transformers (CTs) and high voltage bushings (HVBs) at Bruce A were nearing their end of life. The scope of this project is to replace the CTs and HVBs with components that are capable of handling higher electrical output from the main generators. No adverse environmental impacts and no long-term environmental impacts are anticipated from this work.

1.2.2.9 Project 59357 – Preheater ID Cleaning (completed 2022)

Due to normal heat transport system ageing and feeder corrosion by flow accelerated corrosion (FAC), a deposit layer, primarily composed of magnetite builds on the steam generator (SG) and preheater (PH) tube inside diameter (ID) surfaces. To mitigate these effects, a means of removing deposits is required. The primary purpose of cleaning preheater and steam generator tubing are to improve heat transfer, thereby reducing reactor inlet header temperatures (RIHT), which removes limitations on full power to increase electrical output. The ID cleaning equipment utilizes a re-circulating shot blast system incorporating a remotely controlled manipulator to connect the blasting nozzles to each individual tube at the inlet side and the corresponding tube on the outlet side. The shot is separated by an aerodynamic separation system and is reused to reduce unnecessary waste. Dust/waste is transported by the air stream and filtered within a waste container. Extensive tenting and active ventilation are used to control contamination. This work produces one-time radiological emissions which are controlled within environmental action levels; there have been no measured, adverse environmental impacts and no long-term environmental impacts from this work. This work improved the overall thermal efficiency of the units, which results in reduced thermal effluent to the lake.

1.2.2.10 Project 39679 – Safety Analysis Integrated System Performance Assessment to Support Operation at up to 100% Reactor Power (2025)

The scope of work for this project is to update the Safety Analysis to support operation up to 100% FP. This is analysis only and there is no impact on the environment.

1.2.2.11 Projects 39730 and 39729 – BA/BB Condenser Tube Cleaning System (CTCS) Upgrades (2026+)

Condenser tube cleanliness impacts the efficiency of condenser performance and secondary side performance. The condenser tube cleaning system uses a ball wash system to remove deposits caused by fouling. The purpose of this project is to upgrade the condenser tube cleaning system to ensure continued automated functionality. The planned changes include replacing the differential pressure (DP) monitoring system, a complete control system upgrade, and mechanical equipment inspections and maintenance as required. These changes can resolve the issues with unreliable DP measurements and the obsolete control

system, allow operators increased system visibility, and address the CTCS mechanical equipment in unknown condition. This project may generate conventional waste and recyclables. Long term, an improvement in condenser ball collection can be expected leading to less risk of ball loss to the environment. No adverse environmental impacts and no long-term environmental impacts are anticipated from this work. This work improves the overall thermal efficiency of the units, which results in reduced thermal effluent to the lake.

1.2.2.12 Project 39755 and 39840 – BA/BB Moderator System Improvements (2025+)

Under current full power operating limits, the BA and BB moderator systems are subject to seasonal full power derates due to increasing peak lake temperatures. The scope of this project is to investigate improvements to the moderator systems which will increase moderator cooling capability and eliminate seasonal derates. Both projects are at the early stage of engineering design. To achieve increased cooling capability, BA will improve flow through the moderator system by removal of orifices. Radiological emissions and effluents are not anticipated change with this increase in flow as the system is closed loop and emissions and managed through heavy water recovery. The heavy water recovery program monitors leak rates. This work will generate radiological emissions and effluent when the system is opened for physical modifications similar to other normal outage maintenance. Emissions are routed through ventilation to the confinement vapour recovery system and monitored through contaminated exhaust stack monitors. Effluents are managed through heavy water collection and recovery systems. For effluents released through the active liquid waste system, tritium is measured prior to release to maintain concentrations as low as reasonably achievable (ALARA).

1.2.2.13 Project 39761 – BA/BB Conceptual Engineering to Determine Maximum Flow Away from Bruce Complex (FABC)

This project covers IESO conducting a confidential technical feasibility study to determine the maximum MW flow away from Bruce site. There are no environmental impacts associated with the conceptual study.

1.2.2.14 Project 39754 – 36 Month Outage Interval (2024)

The scope of this project is to assess and determine the feasibility of transitioning BA and BB to a three-year outage cycle at higher reactor power (from 24 months at BA U3-4 and 30 months for BB U5-8). At Bruce B, the project consists of assessments and physical changes to accommodate increased cobalt irradiation and to confirm it is within design margins. No adverse environmental impacts and no long-term environmental impacts are anticipated from this work.

1.2.2.15 Project 70038 – Unit 1 Power Discrepancy Resolution (completed 2021)

The scope of this project is to reolve the power discrepancy observed between Unit 1 and Unit 2. Unit 1 was found to be producing 14MW less than Unit 2 however was known to have the same pedigree of design and construction. The project looked at employing different troubleshooting and problem solving methods to determine the cause of discrepancy and

implement a solution. Through the use of a detailed FMEA as well as external vendor analysis, data reconciliation and first of a kind ASME Turbine Performance Testing (PTC 6) the cause of discrepancy was identified as overly conservative feedwater flow correction factors. Feedwater flow correction factors were determined based on Deaerator Mass Energy Balance test and implemented. No physical changes were made and therefore there were no adverse environmental impacts. This work improves the overall thermal efficiency of the units, which results in reduced thermal effluent to the lake.

1.2.2.16 Project 70044 – Bruce A Unit 1 and 2 Condenser Cooling Water Pumps (completed U2 2022, U1 2024)

As part of normal lifecycle asset management, the Unit 1 and Unit 2 CCW pumps required replacement. The condenser cooling water system supplies strained lake water to the turbine condensers to remove heat from the steam cycle. Pump degradation results in flow reduction and reduced condenser performance, which results in loss generation during perios of high lake temperature. The purpose of this replacement is to restore the system performance which was independent to full power increase. Returning CCW flow to the existing design basis results in increased flow and improves (reduces) the temperature difference of the effluent returned to the lake. Impacts to impingement and entrainment, and thermal are discussed in the impact tables.

1.2.2.17 Project 70090 – Bruce A Unit 1 Ultrasonic Measurement for Heat Transport System Pump Flows (completed 2024)

Heat transport system flow measurements are utilized for core modeling to improve power recovery efforts. The scope of the project is to install new ultrasonic flow measurement instrumentation on the common header and on the outer zone loop. The goal is to provide accurate measurement of total flow through the primary heat transport (PHT) system as well as accurate indication of the flow distribution between the outer zone loop and inner zone loop. The instrumentation is installed on the outside of the PHT piping and does not have an impact on emissions. Decontamination of installation tools is managed per normal outage work procedures; no measured adverse environmental impacts resulted from this work and there are no long term environmental impacts anticipated from this work.

1.2.2.18 Project 70097 – Bruce A Hybrid Rod Based Guaranteed Shutdown State (RBGSS) (completed 2024)

Guaranteed Shutdown States (GSS) are required for many forced outages and all planned outages, including lead-in and lead-out to a Major Component Replacement (MCR). Over Poisoned GSS (OPGSS) is the standard method used to place the unit in a GSS. This method is time consuming since the poison added to the moderator must be filtered out through the ion exchange (IX) columns while performing the approach to critical (ATC). RBGSS is an alternative to OPGSS which has been adopted by other CANDU facilities including Bruce B. RBGSS only will not provide sufficient sub-criticality, necessitating a hybrid approach that utilizes the OPGSS moderator poison in conjunction with the available solid absorbers. This change in operations and outages requires less IX processing, and therefore provides the environmental benefit of less radiological effluents, emissions and resin waste.

1.2.2.19 Project 70121 – Safety System Test (SST) Frequency Optimization (program implementation completed 2023, continuous improvements ongoing)

The scope of work for this project was to implement a Bruce A and Bruce B SST risk review and frequency optimization program, with the goal to reduce SST execution with a focus on improvements to the 4 pillars of nuclear safety. The SST reduction program reduces worker dose, operator burden, improves equipment reliability and the frequency of transients and forced outages. Overall, this work reduces risk of unplanned releases, and significantly reduces greenhouse gas air emissions associated with reduced standby generator testing.

1.2.3 Scopes of Work (2027+)

This section includes projects which have implementation schedules past 2027; this list of projects is not exhaustive as other projects in early stages of the engineering process may not have a selected option at this time. Impacts to the environment will continue to be identified and assessed throughout the lifecycle of a project through EIWs and the Engineering Change Control (ECC) process, with mitigation measures implemented as required. Changes to environmental effects will be evaluated through the next periodic iterations of the ERA in 5-year intervals.

1.2.3.1 Project 39680 – BA/BB Circulating Water System Improvements (2027+)

The purpose of this project is to identify long term improvements for the circulating water systems at BA and BB. This once through cooling water system directly affects the main condenser performance, thermal and secondary side efficiency, and electrical output. This project included various tests to validate station intake flow which determined that both BA and BB intakes were operating at up to 10% less than permit to take water (PTTW) limits. The next phase of this project will evaluate options such as intake flow flexibility, modification of the BA discharge channel, and other changes which could benefit system performance, reduce fish impingement and entrainment, and mitigate thermal effluent. Preliminary assessments have been completed for FP increase up to 95.5% for BA and 96% for BB which demonstrate no challenges with PTTW limits or environmental compliance approval (ECA) cooling water effluent temperature limits.

1.2.3.2 Project 39732 and 39731 – BA/BB Condenser System Improvements (2030+)

Using once through cooling water, condensers remove heat from the closed loop steam cycle. Several aspects of condenser performance such as aging, tube cleanliness, ability to establish and maintain vacuum, and lake water temperatures can reduce electrical output efficiency. This project investigates potential improvements to the condenser systems to mitigate the potential for derates from a higher reactor power due to warmer intake water. The project includes baseline measurements and potential modular tube replacement. If modular replacements are completed, conventional waste and recycleables are expected. Improving condenser performance improves the thermal efficiency of the units.

1.2.3.3 Project 39760– BA Unit 1 and 2 High Pressure Turbines Replacement (BA 2028+)

The Bruce A high pressure (HP) turbines are approaching end of life and require replacement or refurbishment to meet life-extension goals. The scope of work for BA is to complete inner module replacement and modernization to increase the capacity to support up to 100% FP. The changes may include a new rotor with modern blading design, new inner casing and guide blade carriers, coupling spacers and bolts, inlet pipe assemblies with piston seal rings and associated support hardware. This change is likely to produce conventional waste and recyclables.

1.2.3.4 Project 70070 – BA Moderator Heat Exchanger Replacement (2027+)

The scope of this project is to replace the main moderator heat exchangers in Unit 1 and 2 at BA. Unit 3 and 4 are covered under a separate project, with similar replacement scope. The replacement supports equipment reliability until end of life. Replacement work during unit outages will result in one-time radiological airborne emissions and radiological waste which are similar to normal outage maintenance. Replacing this aging equipment will reduce the risk of leaks to the environment over the long term.

1.2.3.5 Project 39758 and 39759 – BA/BB Low Pressure Service Water Improvements (2027+)

The scope of these projects are to investigate potential improvements to the low pressure service water system at BA and BB to support increased full power. BB will adjust travel stops on the temperature control valves to provide additional flow to the moderator heat exchangers. There are unlikely to be long term adverse environmental impacts from this work due to the proportion of loading contribution of LPSW to the total cooling water flow through the station; estimates of impact will be refined through the project.

1.2.3.6 Project 70248 – Hydrogen Production via Excess Electrical Generation Capability Utilization (conceptual designs 2025+)

The scope of this project is to investigate the feasibility of clean hydrogen co-generation with the existing nuclear power generating stations. The goal is to contribute to provincial Net Zero greenhouse gas emissions targets. Hydrogen co-generation can reduce greenhouse gas emissions by replacing fuel sources which are traditionally fossil fuel burners. Hydrogen also has the ability to act as electricity storage to replace fossil fuel burning sources of energy which are currently required to meet peak demands. The project is currently in conceptual design; if options are selected, the environmental impacts will be assessed and required regulatory approvals will be pursued.

1.2.3.7 Project 70249 – Bruce A and B Main Generator System Improvements (2030+)

The scope of this project is to define the maximum power generation capability of the main generator systems and investigate changes required to support reactor power recovery. The project is currently in the conceptual design phase; adverse environmental impacts are not anticipated from this work, however subsequent proposed changes will be assessed for environmental impacts per normal process.

1.3 PERA Gap Analysis Preliminary Screening of Project 2030 Site Activities (2021 to 2026)

The following sections describe the Project-environment interactions associated with future site activities where potential increases were identified. Each interaction was assessed for environmental impact and documented in impact tables in Appendix A.

1.3.1 Noise

From 2021-2026, the level of activity required is considered routine for Site and does not constitute a substantial increase to noise levels above those associated with ongoing Site operations. The predicted change in noise levels as a result of P2030 activities will not likely be measurable (i.e., not discernible from existing conditions) at off-site receptors locations, as the predicted levels are consistent with current conditions.

For the 2027 ERA, the level of impact will be assessed if any changes will be made to the steam reject system which could impact noise levels.

1.3.2 Air Quality

1.3.2.1 Conventional Air Quality

From 2021-2026, the level of activity required is considered routine for Site and does not constitute a substantial increase to conventional air emission levels above those associated with ongoing Site operations. P2030 activities have the potential to interact with air quality through the production of airborne emissions. Maintenance activities which may require welding or the use of diesel generators are considered routine for Site and are reported and tracked through the EIW process.

Increasing steam flow has the potential to impact air and water via feedwater discharges which are released as steam or liquid. Chemicals such as hydrazine and morpholine are added to the feedwater loop to mitigate corrosion in the system. Dosing concentrations are not anticipated to change at this time, however with increase flow, the total loading utilized may increase. For the 2027 ERA, dosing and loading will be assessed prior to changes to the steam cycle systems.

The objective of P2030 is to safely and cost effectively maximize site electrical output to support the growing demand for electricity in Ontario with BA and BB. Overall, this contributes to reduced greenhouse gas emissions associated with the Ontario electricity grid. Bruce Power obtained verification of the greenhouse gas reductions for Project 2030 for a reporting period of May 1, 2022 to February 29, 2024 [R-6]. The results of the “Verification Report: Bruce Power Incremental Output Offset” confirmed a greenhouse gas emission reduction of 102,490 tCO2e. On a site scale, several activities reduce the total conventional air emissions from reduced generator testing and reduced releases through steam release valves during start up after outages.

1.3.2.2 Radiological Air Quality

From 2021-2026, the level of activity required is considered routine for Site and does not constitute a substantial increase to radiological air emissions above those associated with ongoing Site operations.

P2030 includes improvements to the moderator system. Currently, the change proposed for Bruce A is to improve the flow through the moderator system through removal of orifices. This is a closed loop system monitored by chemistry control, losses are managed through the heavy water program, and normal emissions are not anticipated to increase over existing EALs. There is risk to elevated emissions while the system is undergoing maintenance during installation. Emissions will be routed through the confinement vapour recovery system and monitored through the contaminated stacks.

Although activities such as system draining, welding, cutting, and decontamination are anticipated to result in airborne contamination, there are several engineered and administrative barriers in place to minimize the release of airborne radionuclides to the environment and keep releases as low as reasonably achievable (ALARA).

High Efficiency Particulate Air (HEPA) and High Efficiency Carbon Air (HECA) filters are in place to capture airborne particulates (beta/gamma and alpha) and radioiodine. Tritium is an activation product in the heavy water system, and leaks or maintenance activities could result in releases of tritium to the environment through the ventilation stacks. Vault Vapour Recovery (VVR) dryers minimize airborne emissions by removing moisture (including tritium) from vault air prior to release through the exhaust stacks.

The methods for establishing Derived Release Limits (DRLs) and Environmental Action Levels (EALs) are described in NK21-REP-03482-00002 [R-7] and NK29-REP-03482-00003 [R-8] for BA and BB respectively. No new radionuclides and no changes to DRLs or EALs are anticipated due to increasing full power. A review of historical radiological emissions and effluent with EALs against average thermal power from 2019 to 2023 was conducted for BA and BB to identify relationships based on historical data and OPEX. There was no significant correlation between radiological emission/effluent and average thermal power, however there is a potential risk to radiological airborne emissions associated with operating at higher reactor powers. As reactor power increases, the rate of tritium production increases in the moderator and therefore there is potential for increased tritium in emissions when completing activities such as system purges, off gassing or fresh air purges for maintenance or equipment repair if detritiation is not able to effectively mitigate the increases. Additionally, as fission product production increases, there is potential for increased IX resin usage and spent resin processing. For the 2027 ERA, an assessment of changes to IX usage and heavy water detritiation is recommended prior to recovery of reactor power to ensure adequate planning is in place to mitigate emissions and effluents associated with processing and dewatering spent resins.

1.3.3 Surface Water

1.3.3.1 Conventional Surface Water

Bruce A and Bruce B Discharges

Based on the scope of changes, it is concluded that there are no conventional COPCs to carry forward into the predictive assessment for 2021-2026.

Aqueous wastes generated at the stations are processed and the resulting effluent is discharged through the CCW duct, which is a monitored pathway to the environment. No change in operation of the ALW collection, handling and treatment system is expected as a result of P2030 activities. These are proceduralized activities on-site, and effluents will be be maintained within compliance limits.

Stormwater

All stormwater is managed in accordance with existing Site procedures and protocols, therefore, construction dewatering will be discharged to grade and erosion and sedimentation controls will be in place to manage sediment runoff to waterways. No impacts to stormwater are anticipated from P2030.

Inland Surface Water Quality

No future site activities were found to have a likely measurable change on inland surface water quality from P2030.

Surface Water

From 2021-2026, the level of activity required is considered routine for Site and does not constitute a substantial increase to conventional water emissions above those associated with ongoing Site operations. Surface water bodies in the vicinity of the Site are considered to be fully represented by past activites on Site.

For the 2027 ERA, changes to dosing of corrosion inhibition chemicals will be assessed for potential impact to surface water.

Impingement and Entrainment

Entrainment losses are not expected to increase due to the conservative assumptions used in previous calculations (assumed mortality of all entrained fish eggs and larvae). An entrainment study is planned to start in 2025 and run for a minimum of 12 months, with new methods from what was completed in past years. A comparison of this data against the data obtained in the 2013/2014 entrainment study will be completed and if there is a significant difference, an additional 12 months of sampling will be performed. There currently has not been a discernable increase, therefore minimal increases are expected compared to historical values as the change may be masked by annual variability in lake conditions and outages; impingement data is collected at station pumphouses and is monitored for trends. CCW

pumps have been replaced from 2018-2024 as part of normal asset management which have not resulted in increasing trends in impingement.

Near-shore Flow

This work involves returning the Unit 1 and 2 CCW pumps to original design flows. No significant changes are anticipated for the near-shore flow.

Near-shore Temperatures

From 2021-2026, the level of activity required is considered routine for Site and does not constitute a substantial increase to thermal effluent above those associated with ongoing Site operations. Through restoring CCW pumps to original design flows, thermal effluent dilution is expected. Each change being made supports improving energy conversion efficiency. This thermal energy is eventually converted to electrical energy, with majority of the remaining energy released as thermal energy into the receiving water body. Improving the energy conversion efficiency means increasing the proportion of electrical energy produced per unit of thermal energy produced in the core. Improving the energy conversion efficiency results in a reduction of thermal energy released to the receiving water body.

Increasing full power increases the amount of thermal energy that is produced in the core. While improving the energy conversion efficiency means increasing the proportion of electrical energy produced per unit of thermal energy produced in the core, the total thermal energy released to the lake will increase compared to historical releases at lower reactor power.

P2030 thermal effluent scenarios were included in the 2023 application for an extension to the thermal flexibility for the Bruce A discharge [R-9]. The thermal flexibility was approved for a 5-year extension out to 2028. As part of the application and assessment process, recovery of reactor power up to 100% thermal effluent scenarios were modeled using a conservative and bounding increased temperature differential of 2°C, and median and warm climate projections for 2030 to assess potential impacts. Aquatic biota impact results are described in Section 1.3.7. Preliminary assessments have been completed for FP increase up to 95.5% for BA and 96% for BB which demonstrate no challenges with PTTW limits or environmental compliance approval (ECA) cooling water effluent temperature limits. For the 2027 ERA, thermal effluent assessments will continue to be refined including recovery of reactor power up to 100% FP. Project 39680 will evaluate improvements to the circulating water system including potential mitigation measures.

1.3.3.2 Radiological Surface Water

From 2021-2026, the level of activity required is considered routine for Site and does not constitute a substantial increase to radiological water emissions above those associated with ongoing Site operations.

P2030 includes improvements to the moderator system. Currently, the change proposed for Bruce A is to improve flow through the moderator system through removal of orifices. This is a closed loop system monitored by chemistry control, losses are managed through the heavy

water program, and normal effluents are not anticipated to increase over existing EALs. Water generated as a result of this change and other P2030 activities will be collected and processed in the D20 upgraders for reintroduction to station systems and some will be processed through the ALWMS and then discharged through the CCW duct. The decision on how the water will be handled is based on the D20 isotopic of the water. Generally, water with a D2O isotopic of > 0.5% is to be processed through the upgraders, while water with a D2O isotopic of 0.5% or less will be directed to the ALWMS. No changes in the operation of the ALWMS collection, handling and treatment systems are expected as a result of P2030 activities and discharges will be maintained within compliance limits as per normal operation.

The methods for establishing Derived Release Limits (DRLs) and Environmental Action Levels (EALs) are described in NK21-REP-03482-00002 [R-7] and NK29-REP-03482-00003 [R-8] for BA and BB respectively. No new radionuclides and no changes to DRLs or EALs are anticipated due to increasing full power. A review of historical radiological emissions and effluent with EALs against average thermal power from 2019 to 2023 was conducted for BA and BB to identify relationships based on historical data and OPEX. There was no significant correlation between radiological emission/effluent and average thermal power, however there is a potential risk to radiological waterborne effluent associated with operating at higher reactor powers. As reactor power increases, the rate of tritium production increases in the moderator and therefore there is potential for increased tritium in effluent from normal processes during normal operation (e.g., Moderator Confinement Vapour Recovery condensate routing through active sumps to the ALWMS at Bruce B). Additionally, as fission product production increases, there is potential for increased IX resin usage and spent resin dewatering to the ALWMS. For the 2027 ERA, assessment of changes to IX usage and heavy water detritiation is recommended prior to recovery of reactor power to ensure adequate planning is in place to mitigate emissions and effluents associated with tritium increases as well as processing and dewatering of spent resins.

1.3.4 Groundwater

During P2030 activities, foundation drains and associated sumps and pumps will continue to remain in operation. Therefore, groundwater flow will continue to be controlled by groundwater collection system.

There are no predicted changes in conventional or radiological groundwater quantity or quality as a result of P2030 activities. The groundwater monitoring program will continue to monitor groundwater across site.

1.3.5 Geology, Sediment and Soil

For radiological impacts to soil due to atmospheric downwash of airborne emissions, there was no predicted change in environmental conditions from P2030. Changes to airborne emissions are expected to be negligible. In conclusion, radionuclide concentrations in soils are not expected to change from future site activities.

Conventional environmental impacts to soil are not anticipated from any activities associated with P2030.

1.3.6 Terrestrial Environment (Species and Habitat)

As identified in Section 1.3.2, 1.3.3 and 1.3.5, no significant changes to air, soil and surface water quality warranting quantitative analysis on or near site are anticipated from P2030 activities from 2021-2026. Therefore, no changes to the terrestrial environment, and the associated exposure to terrestrial receptors, are anticipated.

Wildlife are already deterred from using the Site (e.g. nesting bird deterrents for facilities). Existing site procedures and protocols will be implemented to ensure conditions are safe for workers and wildlife.

Current operational conditions have been shown to be bounding of predicted changes, as a result of future activities at site, for:

- Noise quality;
- Air quality;
- Surface water quality and hydrology;
- Geology and soil quantity and quality; and
- Groundwater quality and flow.

As such, changes predicted in these environmental components are not considered as potentially affecting terrestrial receptors.

The results of the 2022 radiological EcoRA demonstrate that doses to terrestrial non-human biota on-site remain a small fraction of UNSCEAR benchmarks [R-10]. Radiation dose rates for non-human biota are not anticipated to appreciably change with Project 2030 activities from 2021-2026.

1.3.7 Aquatic Environment (Species and Habitat)

As identified in Sections 1.3.3 and, 1.3.5 no changes to sediment and surface water quality warranting quantitative analysis on or near site with respect to conventional or radiological contaminants, or thermal effluent are expected from P2030 activities from 2021-2026. Therefore no changes to the aquatic environment, and the associated exposure to aquatic receptors, are anticipated.

Current operational conditions have been shown to be bounding of predicted changes, as a result of future activities at site, for:

- Geology and soil quantity and quality; and
- Groundwater quality and flow.

As such, changes predicted in these environmental components are not considered as potentially effecting aquatic receptors.

The results of the 2022 radiological EcoRA demonstrate that doses to terrestrial non-human biota on-site remain a small fraction of UNSCEAR benchmarks [R-10]. Radiation dose rates for non-human biota are not anticipated to appreciably change with Project 2030 activities.

Impingement and Entrainment

Entrainment losses are not expected to increase due to the conservative assumptions used in previous calculations (assumed mortality of all entrained fish eggs and larvae). An entrainment study is planned to start in 2025 and run for a minimum of 12 months, with new methods from what was completed in past years. A comparison of this data against the data obtained in the 2013/2014 entrainment study will be completed and if there is a significant difference, an additional 12 months of sampling will be performed. There currently has not been a discernable increase, therefore minimal increases are expected compared to historical values as the change may be masked by annual variability in lake conditions and outages; impingement data is collected at station pumphouses and is monitored for trends. CCW pumps have been replaced from 2018-2024 as part of normal asset management which have not resulted in increasing trends in impingement. Total impingement and entrainment losses for BA and BB combined ranged from 2444 kg/year to 2739 kg/year between 2021 and 2023.

Near Shore Temperatures

From 2021-2026, the level of activity required is considered routine for Site and does not constitute a substantial increase to thermal effluent above those associated with ongoing Site operations. Therefore, there are no anticipated adverse impacts to aquatic biota from P2030 activities for 2021-2026.

As described in the Thermal Risk Assessment (TRA) [R-9] under the conservative and bounding scenario described in Section 1.3.3.1, there is generally no significant difference in the extent of thermal exceedances under the 100%FP scenario (representative of a bounding

thermal effluent increase) and the present operational conditions scenario. In simple words, the increase in reactor power is not expected to result in a significant change in thermal benchmark exceedances compared to existing conditions, and will be further assessed in the 2027 TRA.

The effect of climate change on fish species in Lake Huron is difficult to predict. The gradual increase in water temperature is unlikely to result in fish mortality. Instead, gradual increases in temperature over time may initially increase growth and productivity for cold water fish species [R-11][R-12]. If absolute temperature increases cross thermal thresholds for cold water fish species, these cold water species will leave the area and the species composition will shift towards warmer water species [R-11][R-12]. The effect of climate change on fish species will be related to changes in the suitability of local habitat conditions, behavioural thermoregulatory ability and changes to prey availability [R-13]. For example, simulated growth of Yellow Perch and Lake Whitefish in Lake Huron increased with warming water temperature under a climate change scenario with high prey consumption but decreased if prey availability was reduced [R-13]. The overall effect of climate change on fish species in Lake Huron may not be directly related to thermal guild and encompasses complex interactions between environmental and ecosystem changes.

For the 2027 ERA, thermal effluent assessments will continue to be refined including recovery of reactor power up to 100% FP. Project 39680 will evaluate improvements to the circulating water system including potential mitigation measures.

1.3.8 Human Environment

As identified in Sections 1.3.2 and 1.3.3, no major changes to air and surface water quality warranting quantitative analysis are expected from P2030 activities. There are no major changes to conventional or radiological effluent or emission limits due to P2030 from 2021-2026 which are shown to be protective of humans in the surrounding environment as discussed in the 2022 ERA [R-5].

The radiological concentrations in environmental media off-Site are not expected to change significantly from normal or outage operational conditions and therefore the annual radiation dose to members of the public is anticipated to continue to be less than the 10 µSv *de minimis* value, the level which is considered to be negligible or insignificant [R-14].

Between 2021-2023, Bruce Power's radiological airborne emissions were well below regulatory limits (i.e., below EALs) with the exception of the activities described in Section 1.4.1 which were not related to P2030 activities. Historical trends are dominated by the implementation of the As Low As Reasonably Achievable (ALARA) principle, and all radionuclide concentrations are below Derived Release Limits (DRLs) that have been developed by Bruce Power to ensure releases to the environment will not exceed the annual regulatory public dose limits. These limits have been shown to be protective of humans in the surrounding environment.

1.3.9 Waste Generation

From 2021-2026, the level of activity required is considered routine for Site and does not constitute a substantial increase waste generation above those associated with ongoing Site operations. Overview of waste generation from 2021-2023 is discussed in Section 1.4.3.

For the 2027 ERA, assessment of changes to IX usage is recommended which includes potential spent resin waste.

1.3.10 Climate Change Impacts

The contribution of the project to reducing greenhouse gas emissions associated with the Ontario electricity grid is discussed in Section 1.3.2.

A task for designers to consider the potential impact of climate change on the project associated with P2030 was included in ECC. This includes assessing whether the change or equipment is vulnerable to climate hazards and the design margin considerations related to future projections. Consideration of climate hazards and their projections are critical for decision making, particulary for considering options and design requirements in the conceptual engineering phase. Potential interactions for each project are described in Appendix A.

1.4 Project 2030 Outcomes (2021 to 2023)

No adverse outcomes impacting radiological air emissions or waterborne effluent have occurred to date resulting from P2030 activities. In the absence of substantial changes to air emissions or waterborne effluent resulting from Project 2030 activities, there has been no substantial change in environmental monitoring results. With these stable environmental monitoring results, there has been no change to the overall outcome of the HHRA or EcoRA resulting from new Project 2030 activities occurring on site between 2021 and October 1, 2024 (or December 2023 based on available data).

1.4.1 Overview Emission and Effluent Outcomes

This section summarizes the conventional emissions and effluent outcomes to date.

Conventional Air Emissions and Noise

The estimated conventional air emissions from the 2022 ERA are comparable to 2021 to October 2024.

Additional modifications included temporary diesel combustion equipment for MCR activities (primary heat transport decontamination, vault pressure tests) and other outages which include P2030 activities. All modifications and baseline air quality measurements met their respective site-specific limits. The ESDM Reports prepared by Bruce Power from 2021 - 2023 and the ECA (7477-8PGMTZ) [R-15]–[R-19] issued by the MECP demonstrate that Bruce Power operates in compliance with applicable MECP limits. These limits have been shown to be protective of human and non-human biota in the surrounding environment.

Noise investigations conducted between 2015/2016 [R-20] and 2020 [R-21]–[R-24] are comparable to the previous PERA. The noise investigations demonstrated that the sound levels at receptor locations complied with the quantitative limits stipulated by the MECP NPC-232 Sound Level Limits for Stationary Sources in Class 3 Areas (Rural). The investigations revealed meteorological conditions influence the propagation of sound from the stations (i.e., Bruce Power is slightly audible during periods of low background noise).

There are no traffic impacts associated with P2030.

Conventional Water Emissions

Bruce A and Bruce B Condenser Cooling Water Discharge Duct conventional water effluents from 2016-2021 are comparable to 2021-2023. To date, there have been no exceedances of regulatory limits (e.g., of Bruce Bruce A or B's Environmental Compliance Approvals, the former Effluent Monitoring Effluent Limits regulation revoked July 1, 2021, or the Permits to Take Water) attributed to P2030 activities.

In 2023, Rhodamine WT dye was used in the Unit 1 condenser cooling water (CCW) system for the purpose of flow measurement to support P2030. Three locations in the system had dye injection stations injecting at a rate of approximately 150 g/min for 10-15 minutes for each test run. The Rhodamine WT dye was injected with a peristaltic pump via a carrier water pump. Three fluorometer sample stations were located before each condenser inlet water box to measure the diluted concentration via small streams of water from the system. Prior to the test, notification was made to the Spills Action Centre and the Municipality of Kincardine on December 4, 2023. Visual observations were conducted during the test and no discolouration of the cooling water was observed. All cooling water samples showed a Rhodamine WT concentration below 0.1 ppb. Similar testing will be occurring Unit 1 again in December 2024, to assess the performance of new CCW pumps that were installed in the A2411 outage.

Bruce Power routinely reports the results of the conventional effluent monitoring program to the Ministry of Environment, Conservation, and Parks in accordance with regulatory requirements (e.g., Environmental Compliance Approvals, Permits to Take Water).

Radiological Emissions and Effluent

This section summarizes the radiological emissions and effluent outcomes to date by comparing average annual emissions and effluent data for 2016-2020 against 2021-2023, which describes emissions and effluent pre- and post-P2030 related projects installed to date respectively.

Site radiological airborne emissions and waterborne effluents are controlled to meet regulatory requirements, reduce releases, and to minimize environmental impacts. Bruce Power routinely reports the results of the radiological emissions and effluent monitoring in accordance with their CNSC licence.

Tritium

Average annual airborne tritium releases increased from 5.01E+14 Bq/y in 2016-2020 to 7.7E+14 Bq/y in 2021-2023, and average annual waterborne tritium releases increased from 4.36E+14 Bq/y to 5.0E+14 Bq/y respectively. Airborne and waterborne tritium emission and effluent increases are anticipated to be unrelated to P2030 project activities with primary attributable causes described below.

In December 2021 and January 2022, airborne tritium emissions increased as a result of a moderator pump seal leak that occurred on Unit 1 and was contained within the station inside the confinement rooms. To maintain radiological safety and minimize radiological dose to workers it was important to purge the air from the moderator pump room (within confinement) to contaminated exhaust prior to initiating cleanup activities. In 2022, tritium emission increases at Bruce A were attributed to Bruce A's Vacuum Building Outage as well as moderator confinement vapour recovery and vault vapour recovery equipment challenges. Additionally in 2022 at Bruce A, equipment challenges and planned maintenance activities (primarily in Unit 3 and Unit 4) impacted availability of the moderator confinement vapour recovery (MCVR) and vault vapour recovery (VVR) systems. Reduced availability of this equipment due to replacement part availability caused increased tritium emissions exiting the exhaust stacks. In 2023 at Bruce A, a Unit 4 Heat Transport System leak occurred outside containment (within the powerhouse) due to a heat transport purification filter hose rupture. Airborne tritium emissions were slightly elevated during the event and subsequent clean-up activities. Additionally in 2023, temporary increased airborne tritium occurred during chemical decontamination activities supporting the Unit 3 Major Component Replacement. Although these activities caused elevated airborne releases of tritium, the impact to the dose to public remained very low.

In 2021, an increase in waterborne tritium was primarily attributed to a leaking motorized valve in the Unit 8 Emergency Coolant Injection (ECI) U loop which was identified and repaired in November 2021. In 2023, to prepare for the 2024 Bruce B Vacuum Building Outage, planned and closely monitored draining activities of the Bruce B Emergency Water Storage Tank

occurred contributing to waterborne tritium effluent. All effluent was well below regulatory limits with dose to public remaining *de minimus*.

Noble Gas

Average annual emissions of noble gases have decreased from 5.88E+13 Bq/yr (2016-2020) to 5.6E+13 Bq/yr (2021-2023).

Radioiodines

Average annual airborne iodine-131 releases increased from 1.04E+07 Bq/yr (2016-2020) to 1.2E+08 Bq/yr (2021-2023), however, Bruce A was the primary contributor of these increases and they are anticipated to be unrelated to P2030 project activities with primary attributable causes described below.

In February 2022, Bruce A experienced two weeks (09FEB2022 and 16FEB2022) of elevated radioiodine emissions above the new Environmental Action Level as a result of a required defect fuel removal. The primary causes of the elevated radioiodine emissions were determined to be: (1) insufficient filtration of the off-gassing Service Area Rehearsal Facility (SARF) drum that collects heat transport water from the fueling machine when defect fuel is discharged to the Primary Irradiated Fuel Bay; (2) degraded condition of the Irradiated Fuel Bay High Efficiency Carbon Air filters, and; (3) dampers that prevented iodine from being captured by the exhausted high efficiency carbon air filter beds. The High Efficiency Carbon Air filter beds were replaced, and an increased focus was placed on the filter maintenance and testing program. Although the radioiodine emissions in February 2022 were above the Environmental Action Level and reported to the Canadian Safety Nuclear Commission, all emissions during this time and historically were well below Bruce Power's Derived Release Limit and the dose to public remained *de minimus*.

Beta/gamma particulate and alpha particulate

Average annual airborne beta/gamma particulate and alpha particulate releases increased from 2.37E+06 Bq/y (2016-2020) to 4.5E+06 Bq/y (2021-2023) and 1.7E+04 Bq/y (2016-2020) to 5.4E+04 Bq/y (2021-2023) respectively, however, continue to remain low with many results less than the Minimum Detectable Activity (MDA). Additionally, average annual waterborne gross alpha releases increased from 1.16E+04 Bq/y to 8.8E+04 Bq/y, and also continue to remain low. It is important to note that while airborne beta/gamma particulate, as well as airborne and waterborne alpha particulate have increased, the calculated doses from these releases remain negligible.

Average annual waterborne beta/gamma particulate releases increased from 1.67E+09 Bq/y (2016-2020) to 2.1E+09 Bq/y (2021-2023). Waterborne gross gamma release increases during these years are anticipated to be unrelated to P2030 project activities with primary attributable causes described below.

Bruce A experienced slightly elevated levels of gamma in effluent in late 2021 due to water ingress into the Primary Irradiated Fuel Bay and the associated controlled discharges of this

water to the Active Liquid Waste System to maintain bay levels. In 2023, Bruce B experienced slightly elevated levels of gamma in effluent primarily due to planned spent resin dewatering activities that were processed through the active liquid waste system and discharged in a controlled manner. Gamma effluent remained well below regulatory limits with dose to public remaining *de minimus*.

Carbon-14

Airborne emissions and waterborne effluent of carbon-14 have increased from 1.32E+12 Bq/yr (2016-2020) and 1.5E+12 Bq/yr (2021-2023) and 1.75E+09 Bq/yr (2016-2020) to 3.0E+09 Bq/yr (2021-2023) respectively. Airborne and waterborne carbon-14 emission and effluent increases during these years are anticipated to be unrelated to P2030 project activities with primary attributable causes described below.

In 2022, Unit 3 conducted confinement room purges and moderator cover gas purging in support of maintenance activities, system chemistry specifications (moderator cover gas) and multiple and simultaneous outages, including the Vacuum Building Outage, as well as fueling ahead activities in preparation for Unit 3's Major Component Replacement. In 2023, contributing factors to carbon-14 emissions at Bruce A included increased resin demand for multiple forced and planned outages.

Carbon-14 in waterborne effluent fluctuates due to variations in the volume of moderator ion exchange resins that were processed each year, however, carbon-14 effluent increases were experienced in 2023 at Bruce A as a result of spent resin dewatering activities that were planned and required to support outages including Major Component Replacement heat transport chemical decontamination activities. Additionally in 2023, increases in carbon-14 effluent at Bruce B were attributed to preparation activities supporting the Vacuum Building Outage including drainage of the Emergency Water Storage Tank.

The Site has demonstrated that it operates in compliance with regulatory requirements. Air emissions and waterborne effluents at the Site are adequately managed well below regulatory limits with dose to public remaining *de minimus.* P2030 activities are not anticipated to result in air or water quality levels beyond those already experienced at the Site. The collected release data for 2016-2020 and 2021-2023 encompassed all sources of emissions and effluents from the facility before and after P2030-related projects began. During P2030 execution thus far, emissions and effluents were, and are expected to remain well below regulatory limits.

1.4.2 Environmental Monitoring Outcomes

Radiological and conventional environmental monitoring outcomes to date which includes Project 2030 activities are reported each year in the Environmental Protection Reports [R-25]–[R-27]. No substantial changes have occurred in radiological or conventional monitoring results since the start of Project 2030 activities. Radiological and conventional environmental monitoring programs are established, regularly reviewed and continue on an ongoing basis.

1.4.3 Overview of Waste Generation

1.4.3.1 Non-Radiological Waste

Collection and transfer of non-radiological (e.g. conventional and hazardous wastes) is performed in accordance with Bruce Power procedures.

Conventional waste and hazardous waste volumes generated by Bruce Power over the past three years are provided in Table 1.

Table 1 Non-Radiological Waste Types and Volumes for the Bruce Power Sitenfrom 2021 to 2023

Non-Radiological Waste Type	Examples	2021	2022	2023
Compost (metric ton)	• Food waste • Paper towels	98	93	78
Recyclables (metric ton)	• Paper • Plastics • Glass • Recyclable scrap metal	1,457	1,851	1,483
Landfill (metric ton)	• Domestic • Construction • Commercial	597	929	707
Hazardous (L)	• Oils • Glycol	858,630	537,599	645,409

Hazardous waste produced through P2030 activities on Bruce Power site are handled in accordance with all regulatory requirements to ensure proper handling, storage and off-site disposal. All hazardous wastes are sampled, packaged and labelled in accordance with all provincial and federal requirements. Pails and drums of hazardous wastes are transferred to a Station Chemical Waste Facility, where the waste is processed and prepped for shipment with other Bruce Power hazardous wastes. Bulk hazardous wastes are directly collected for disposal from its point of origin. Bruce Power ensures all hazardous wastes are transferred and received by licensed waste vendors. In general, equipment improvements reduce the risk of hazardous waste generated through leaks and spills (eg. Lube oil, diesel oil, glycol).

1.4.3.2 Radiological Waste

Normal operation and maintenance activities generate intermediate (ILW) and low level radiological wastes (LLW), which include those as result of P2030. Radiological waste is collected, monitored, segregated, sorted, processed, packaged and transferred to a third party waste contractor. To the extent practical, radioactive waste processing targets waste volume reduction so as to minimize the long-term storage volumes and costs. Spent fuel is anticipated to increase proportionally with full power increase.

1.5 PERA Conclusion and Recommendations

As the current operational conditions are demonstrated to be bounding of future activities, including P2030 activities, the 2022 ERA is, therefore, shown to be bounding of the proposed activities up to 2027.

The outcomes of predicted activities occurring from 2021 to 2026 will be reported in the 2027 ERA. The PERA process will be repeated for new activities predicted to occur on site from 2026 to 2031, which would include increasing reactor power which was qualitatively discussed throughout this report. Assessments for potential noise impacts from steam reject system changes, potential changes to chemical management, potential changes to IX usage and detritiation will be completed by engineering prior to uprates. Thermal effluent assessments will also continue to be refined including recovery of reactor power up to 100% FP (bounding scenario) for the 2027 ERA.

To support the objectives of P2030 the Bruce Power environment team provides environmental governance and oversight of the project, through stakeholder involvement in design reviews and work packages, completion of Environmental Impact Workflows (EIW), and walk downs. EIWs are Bruce Power's Environmental Management System tool to capture the environmental evaluation and outline environmental requirements necessary to ensure the work is carried out in an environmentally protective manner, mitigate risk, and ensure the evolutions remain in compliance with regulatory requirements. EIWs provide project execution vendors with key information regarding emissions, waste, spills and other notable issues for awareness including event reporting and regulatory requirements.

Environment personnel are key stakeholders in Project 2030 activities and provide document reviews, field walkdowns (as appropriate) and feedback throughout all stages of planning and execution. In the field walk downs and observations will continue to provide timely guidance and oversight in respect of activities which have the potential to impact the environment.

APPENDIX A: PERA GAP ANALYSIS PRELIMINARY SCREENING OF PROJECT 2030 SITE ACTIVITIES IMPACT TABLES

For human and ecological receptors, an evaluation is made regarding how exposure pathways may be modified in ways that have effects on the receptors(s) or their habitat as a result of Project 2030 site activities. The potential changes are discussed in the physical pathway interaction discussions (e.g., for air quality and surface water quality). For this gap analysis, the focus is narrowly defined as the scope of Project 2030 activities from 2021 to 2026.

The following sections describe Project -environment interactions associated with future site activities for each aspect of the environment considered in the ERA. A step-wise predictive screening was carried out to identify and classify plausible interactions between future site activities and the environment. The results of this screening are presented in the following sections. Each interaction is evaluated as potentially resulting in:

- An increased interaction with the environment compared to operational and outage conditions (denoted in the summary table “Increase”);
- A decreased interaction with the environment compared to operational and outage conditions (denoted in the summary table as “Decrease”);
- No change or negligible change from current or historical operational conditions. This includes one-time activities which may temporarily increase emissions but will not result in a long-term change, and changes which decrease the risk to generating emissions but do not change actual emissions (denoted in the summary table as “Stable”); or
- No interaction/not applicable (i.e., the system or structure does not have an interaction with the specified environmental pathway; indicated as “Not Applicable”).

In the interaction tables provided below, those interactions denoted with a note indicating a potentially increasing environmental effect as a result of a Project environment interaction are discussed or evaluated in the preliminary screening assessment.

A.1 NOISE

Project 2030 activities are evaluated for the potential to have an impact on noise in Table 2. Further discussion is included below the table for activities which have a predicted increase.

Table 2 Project 2030 Activities with Potential for Impacts on Noise

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
P39000 – High Pressure Feedwater Heat Exchanger Bypass	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to noise levels above those associated with ongoing Site operations.
P39203 - Bruce A Unit 1 Generator Rotor - Stator Rewind	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to noise levels above those associated with ongoing Site operations.
Project 39667 – Bruce A Unit 1 and 2 Main Output Transformer Replacement	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to noise levels above those associated with ongoing Site operations.
Project 39668 – Bruce A Unit 1 and 2 Isolated Phase Bus Cooling Upgrades	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to noise levels above those associated with ongoing Site operations.
Project 39751 – Data Reconciliation/Measurement Uncertainty Recapture Implementation	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to noise levels above those associated with ongoing Site operations.
Project 39752 – Bruce A Seal Oil System Performance Improvements	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to noise levels above those associated with ongoing Site operations.
Project 39753 – Bruce A Current Transformers and High Voltage Bushings Replacement	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to noise levels above those associated with ongoing Site operations.
Project 59357 – Preheater ID Cleaning	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to noise levels above those associated with ongoing Site operations.
Projects 39730 and 39729 – BA/BB Condenser Tube Cleaning System (CTCS) Upgrades	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to noise levels above those associated with ongoing Site operations.

Table 2 Project 2030 Activities with Potential for Impacts on Noise

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
Project 39755 and 39840 – BA/BB Moderator System Improvements	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to noise levels above those associated with ongoing Site operations.
Project 39754 – 36 Month Outage Interval	Decrease	Reducing the frequency of outages would reduce the frequency of noise associated with start up after outages.
Project 70038 – Unit 1 Power Discrepancy Resolution	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to noise levels above those associated with ongoing Site operations.
Project 70044 – Bruce A Unit 1 and 2 Condenser Cooling Water Pumps	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to noise levels above those associated with ongoing Site operations.
Project 70090 – Bruce A Unit 1 Ultrasonic Measurement for Heat Transport System Pump Flows	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to noise levels above those associated with ongoing Site operations.
Project 70097 – Bruce A Hybrid Rod Based Guaranteed Shutdown State (RBGSS)	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to noise levels above those associated with ongoing Site operations.
Project 70121 Safety System Test (SST) Frequency Optimization	Decrease	Reducing standby generator testing frequency reduces frequency of noise emissions.
Recover FP to 95.5%/96%	Stable	It is not anticipated that noise will significantly change due to increasing full power, however the level of change will be assessed with any changes to the steam reject system.
Recover FP to 100%	Stable	It is not anticipated that noise will significantly change due to increasing full power, however the level of change will be assessed with any changes to the steam reject system.

A.2 AIR QUALITY

A.2.1 Conventional Air Quality

Project 2030 activities are evaluated for the potential to have an impact on conventional air quality in Table 3. Activities that are predicted to have an increased environmental impact are discussed below.

Table 3 Project 2030 Activities with Potential for Impacts on Conventional Air Quality

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
P39000 – High Pressure Feedwater Heat Exchanger Bypass	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of conventional airborne emissions associated with ongoing Site operations.
P39203 - Bruce A Unit 1 Generator Rotor - Stator Rewind	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of conventional airborne emissions associated with ongoing Site operations.
Project 39667 – Bruce A Unit 1 and 2 Main Output Transformer Replacement	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of conventional airborne emissions associated with ongoing Site operations.
Project 39668 – Bruce A Unit 1 and 2 Isolated Phase Bus Cooling Upgrades	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of conventional airborne emissions associated with ongoing Site operations.
Project 39751 – Data Reconciliation/Measurement Uncertainty Recapture Implementation	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of conventional airborne emissions associated with ongoing Site operations.
Project 39752 – Bruce A Seal Oil System Performance Improvements	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of conventional airborne emissions associated with ongoing Site operations.
Project 39753 – Bruce A Current Transformers and High Voltage Bushings Replacement	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of conventional airborne emissions associated with ongoing Site operations.
Project 59357 – Preheater ID Cleaning	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of conventional airborne emissions associated with ongoing Site operations.

Table 3 Project 2030 Activities with Potential for Impacts on Conventional Air Quality

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
Projects 39730 and 39729 – BA/BB Condenser Tube Cleaning System (CTCS) Upgrades	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of conventional airborne emissions associated with ongoing Site operations.
Project 39755 and 39840 – BA/BB Moderator System Improvements	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of conventional airborne emissions associated with ongoing Site operations.
Project 39754 – 36 Month Outage Interval	Decrease	Reducing the frequency of outages would reduce the frequency of conventional air emissions associated with start up after outages.
Project 70038 – Unit 1 Power Discrepancy Resolution	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of conventional airborne emissions associated with ongoing Site operations.
Project 70044 – Bruce A Unit 1 and 2 Condenser Cooling Water Pumps	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of conventional airborne emissions associated with ongoing Site operations.
Project 70090 – Bruce A Unit 1 Ultrasonic Measurement for Heat Transport System Pump Flows	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of conventional airborne emissions associated with ongoing Site operations.
Project 70097 – Bruce A Hybrid Rod Based Guaranteed Shutdown State (RBGSS)	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of conventional airborne emissions associated with ongoing Site operations.
Project 70121 Safety System Test (SST) Frequency Optimization	Decrease	Reducing generator testing frequency reduces fuel consumption, greenhouse gas emissions, nitrous oxides and particulate.
Recover FP to 95.5%/96%	Stable Decrease (cumulative)	Increase in steam flow may increase the total amount of chemical usage and release, however concentration is unlikely to change. Recovery of full power and increasing secondary side efficiency with existing BA and BB generating stations reduces the CO2e emissions associated with power production for the Ontario grid through avoidance of generation by fossil fuel sources.

Table 3 Project 2030 Activities with Potential for Impacts on Conventional Air Quality

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
Recover FP to 100%	Stable Decrease (cumulative)	Increase in steam flow may increase the total amount of chemical usage and release, however concentration is unlikely to change. Recovery of full power and increasing secondary side efficiency with existing BA and BB generating stations reduces the CO2e emissions associated with power production for the Ontario grid through avoidance of generation by fossil fuel sources.

A.2.2 Radiological Air Quality

Project 2030 activities are evaluated for the potential to have an impact on radiological air emissions in Table 4. Activities that are predicted to have an increased environmental impact are discussed below.

Table 4 Project 2030 Activities with Potential for Impacts on Radiological Air Quality

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
P39000 – High Pressure Feedwater Heat Exchanger Bypass	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of radiological airborne emissions associated with ongoing Site operations.
P39203 - Bruce A Unit 1 Generator Rotor - Stator Rewind	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of radiological airborne emissions associated with ongoing Site operations.
Project 39667 – Bruce A Unit 1 and 2 Main Output Transformer Replacement	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of radiological airborne emissions associated with ongoing Site operations.
Project 39668 – Bruce A Unit 1 and 2 Isolated Phase Bus Cooling Upgrades	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of radiological airborne emissions associated with ongoing Site operations.

Table 4 Project 2030 Activities with Potential for Impacts on Radiological Air Quality

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
Project 39751 – Data Reconciliation/Measurement Uncertainty Recapture Implementation	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of radiological airborne emissions associated with ongoing Site operations.
Project 39752 – Bruce A Seal Oil System Performance Improvements	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of radiological airborne emissions associated with ongoing Site operations.
Project 39753 – Bruce A Current Transformers and High Voltage Bushings Replacement	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of radiological airborne emissions associated with ongoing Site operations.
Project 59357 – Preheater ID Cleaning	Stable	This work involves using a shot blast system to clean the inner diameter of preheater tubes. Dust and waste are transported by an air stream and filtered in a waste container. This was a maintenance evolution completed in 2022, and emissions were controlled by extensive tenting and routing through active ventilation.
Projects 39730 and 39729 – BA/BB Condenser Tube Cleaning System (CTCS) Upgrades	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of radiological airborne emissions associated with ongoing Site operations.
Project 39755 and 39840 – BA/BB Moderator System Improvements	Increase	This work involves increasing the flow through the moderator system by removal of orifices. This is a closed loop system monitored by chemistry control, losses are managed through the heavy water program, and normal emissions are not anticipated to change. Emissions while the system is undergoing maintenance to make this change will be routed through the confinement vapour recovery system and monitored through the contaminated stacks.
Project 39754 – 36 Month Outage Interval	Stable	Reducing the frequency of outages would reduce the amount of poison required for GSS, reducing IX usage. Under normal circumstances, there are no impacts associated with increased irradiation of cobalt adjuster rods.

Table 4 Project 2030 Activities with Potential for Impacts on Radiological Air Quality

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
Project 70038 – Unit 1 Power Discrepancy Resolution	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to production of radiological airborne emissions associated with ongoing Site operations.
Project 70044 – Bruce A Unit 1 and 2 Condenser Cooling Water Pumps	Not Applicable	The level of activity required is considered routine for Site and does not constitute a change to production of radiological airborne emissions associated with ongoing Site operations.
Project 70090 – Bruce A Unit 1 Ultrasonic Measurement for Heat Transport System Pump Flows	Stable	This work involves installing UT instrumentation external to PHT piping. Decontamination of installation tools are managed per normal outage work procedures which does not constitute a substantial change to production of radiological airborne emissions associated with ongoing Site operations.
Project 70097 – Bruce A Hybrid Rod Based Guaranteed Shutdown State (RBGSS)	Decrease	This operational change reduces the amount of IX processing, which reduces the amount of radiological airborne emissions from processing spent IX resins associated with establishing guaranteed shutdown states for planned and unplanned outages.
Project 70121 Safety System Test (SST) Frequency Optimization	Stable	The SST reduction program reduces worker dose, improves equipment reliability and reduces the frequency of transients and forced outages, therefore potentially reducing radiological airborne emissions and the risk of unplanned outages.
Recover FP to 95.5%/96%	Increase	Increasing full power will increase the rate of fission product generation in the fuel and rate of tritium production in the moderator. Fission products are normally contained in the fuel and heat transport system. Increased tritium production in the moderator may lead to increased detritiation and increased fission products may lead to increased IX processing. An analysis comparing station average full power to radionuclide emission levels associated with EALs shows negligible change associated with this level of FP% change.

Table 4 Project 2030 Activities with Potential for Impacts on Radiological Air Quality

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
Recover FP to 100%	Increase	Increasing full power will increase the rate of fission product generation in the fuel and rate of tritium production in the moderator. The fission products are normally contained in the fuel and heat transport system. Increased tritium production in the moderator may lead to increased detritiation and increased fission products may lead to increased IX processing. An analysis comparing station average full power to radionuclide emission levels associated with EALs shows negligible change associated with this level of FP% change.

A.3 SURFACE WATER

A.3.1 Conventional Surface Water

Project 2030 activities are evaluated for the potential to have an impact on conventional surface water in Table 5. Future activities that are predicted to have an increased environmental impact are discussed below. In this discussion, surface water includes changes in flow and quality, and considers changes in physical stressors such as thermal profile, entrainment and impingement.

Table 5 Project 2030 Activities with Potential for Impacts on Conventional Surface Water

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
P39000 – High Pressure Feedwater Heat Exchanger Bypass	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to conventional surface water quality or quantity associated with ongoing Site operations.
P39203 - Bruce A Unit 1 Generator Rotor - Stator Rewind	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to conventional surface water quality or quantity associated with ongoing Site operations.
Project 39667 – Bruce A Unit 1 and 2 Main Output Transformer Replacement	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to conventional surface water quality or quantity associated with ongoing Site operations.

Table 5 Project 2030 Activities with Potential for Impacts on Conventional Surface Water

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
Project 39668 – Bruce A Unit 1 and 2 Isolated Phase Bus Cooling Upgrades	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to conventional surface water quality or quantity associated with ongoing Site operations.
Project 39751 – Data Reconciliation/Measurement Uncertainty Recapture Implementation	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to conventional surface water quality or quantity associated with ongoing Site operations.
Project 39752 – Bruce A Seal Oil System Performance Improvements	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to conventional surface water quality or quantity associated with ongoing Site operations.
Project 39753 – Bruce A Current Transformers and High Voltage Bushings Replacement	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to conventional surface water quality or quantity associated with ongoing Site operations.
Project 59357 – Preheater ID Cleaning	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to conventional surface water quality or quantity associated with ongoing Site operations.
Projects 39730 and 39729 – BA/BB Condenser Tube Cleaning System (CTCS) Upgrades	Decrease	This work includes mechanical inspections and maintenance which will improve the overall reliability of the system, leading to less condenser ball losses to the lake. Improving system visibility will also improve troubleshooting and early identification of issues leading to ball loss. Improving the cleanliness of the condenser improves the overall secondary side performance, generating more electrical energy per thermal energy produced from the fuel.
Project 39755 and 39840 – BA/BB Moderator System Improvements	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to conventional surface water quality or quantity associated with ongoing Site operations.

Table 5 Project 2030 Activities with Potential for Impacts on Conventional Surface Water

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
Project 39754 – 36 Month Outage Interval	Decrease	Reducing the frequency of outages, including the lead in and lead out reduces the amount of boiler drains and boiler blow downs required. This reduces the usage and total loading of corrosion inhibition chemicals discharged to the lake. During outages, drains and releases for normal operation may be completed with less flow through the discharge duct, leading to higher contaminant concentrations.
Project 70038 – Unit 1 Power Discrepancy Resolution	Stable	This work involves improving feedwater flow correction factors to resolve the Unit 1 power discrepancy. Improving the accuracy of feedwater flow can support accuracy of flow reporting and chemical dosing.
Project 70044 – Bruce A Unit 1 and 2 Condenser Cooling Water Pumps	Increase (I&E) Decrease (thermal effluent concentration) Stable (contaminants)	This work involves returning the Unit 1 and 2 CCW pumps to original design flows. Entrainment losses are not expected to increase due to the conservative assumptions used in previous calculations (assumed mortality of all entrained fish eggs and larvae). There currently has not been a discernable increase, therefore minimal increases are expected compared to historical values as the change may be masked by annual variability in lake conditions and outages; impingement data is collected at station pumphouses and is monitored for trends. In terms of thermal effluent concentration, temperature change is inversely proportional to mass flow. With increased flow, it is expected that contaminant concentrations will reduce due to dilution, but loadings are not impacted by total CCW flow.
Project 70090 – Bruce A Unit 1 Ultrasonic Measurement for Heat Transport System Pump Flows	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to conventional surface water quality or quantity associated with ongoing Site operations.
Project 70097 – Bruce A Hybrid Rod Based Guaranteed Shutdown State (RBGSS)	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to conventional surface water quality or quantity associated with ongoing Site operations.
Project 70121 Safety System Test (SST) Frequency Optimization	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to conventional surface water quality or quantity associated with ongoing Site operations.

Table 5 Project 2030 Activities with Potential for Impacts on Conventional Surface Water

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
Recover FP to 95.5%/96%	Increase	Increased full power will likely increase the amount of thermal energy discharged to Lake Huron, however improvements to the secondary side will improve the efficiency at which thermal energy from the reactor core is converted to electrical energy. Therefore, the proportion of total energy sent to the lake compared to total thermal energy produced from fission is reduced. By restoring design flows to the CCW system, no increases to temperature change limits are required for the station Environmental Compliance Approvals and temperature limit margins are improved.
Recover FP to 100%	Increase	Increased full power will likely increase the amount of thermal energy discharged to Lake Huron. A preliminary assessment was conducted at 100% FP which indicates no challenges to temperature difference limits (delta of temperature between intake water and cooling water effluent) at Bruce B, however mitigation measures are likely required for Bruce A to meet existing temperature difference limits. Prior to the 100% FP assessment, an assumption of the potential effects of a 2°C increase in ECA limit for thermal effluent was evaluated as a bounding scenario in the thermal risk assessment provided to support the 2023 application to extend thermal flexibility at Bruce A. The results of this bounding scenario are presented in [R-9]; the results were formerly described as “Efficiency Gains” which represents the bounding case of 100%FP without improved efficiency.

A.3.2 Radiological Surface Water

Future site activities are evaluated for the potential to have an impact on radiological surface water in Table 6. Only activities with a potential for impact to radiological surface water quality are included.

Table 6 Project 2030 Activities with Potential for Impacts on Radiological Surface Water

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
P39000 – High Pressure Feedwater Heat Exchanger Bypass	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to radiological surface water quality or quantity associated with ongoing Site operations.
P39203 - Bruce A Unit 1 Generator Rotor - Stator Rewind	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to radiological surface water quality or quantity associated with ongoing Site operations.
Project 39667 – Bruce A Unit 1 and 2 Main Output Transformer Replacement	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to radiological surface water quality or quantity associated with ongoing Site operations.
Project 39668 – Bruce A Unit 1 and 2 Isolated Phase Bus Cooling Upgrades	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to radiological surface water quality or quantity associated with ongoing Site operations.
Project 39751 – Data Reconciliation/Measurement Uncertainty Recapture Implementation	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to radiological surface water quality or quantity associated with ongoing Site operations.
Project 39752 – Bruce A Seal Oil System Performance Improvements	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to radiological surface water quality or quantity associated with ongoing Site operations.
Project 39753 – Bruce A Current Transformers and High Voltage Bushings Replacement	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to radiological surface water quality or quantity associated with ongoing Site operations.
Project 59357 – Preheater ID Cleaning	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to radiological surface water quality or quantity associated with ongoing Site operations.
Projects 39730 and 39729 – BA/BB Condenser Tube Cleaning System (CTCS) Upgrades	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to radiological surface water quality or quantity associated with ongoing Site operations.

Table 6 Project 2030 Activities with Potential for Impacts on Radiological Surface Water

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
Project 39755 and 39840 – BA/BB Moderator System Improvements	Increase	Improving the cooling capability of the moderator system by increasing flow is unlikely to impact radiological effluent as the system is closed loop under normal conditions and monitored through chemistry control and leak detection systems. There may be effluent associated with opening the system to perform maintenance which will be controlled through heavy water collection systems.
Project 39754 – 36 Month Outage Interval	Decrease	Reducing the frequency of outages can reduce the amount of poison required for GSS and less IX processing.
Project 70038 – Unit 1 Power Discrepancy Resolution	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial change to radiological surface water quality or quantity associated with ongoing Site operations.
Project 70044 – Bruce A Unit 1 and 2 Condenser Cooling Water Pumps	Stable	With increased flow, it is expected that radiological effluent concentrations will reduce due to dilution; the total loading is not expected to change due to this project.
Project 70090 – Bruce A Unit 1 Ultrasonic Measurement for Heat Transport System Pump Flows	Stable	Additional instrumentation can improve detection of challenges such as PHT leaks.
Project 70097 – Bruce A Hybrid Rod Based Guaranteed Shutdown State (RBGSS)	Decrease	This operational change reduces the amount of IX processing, which reduces the amount of radiological effluent from processing spent IX resins associated with establishing GSS for planned and unplanned outages.
Project 70121 Safety System Test (SST) Frequency Optimization	Stable	The SST reduction program reduces worker dose, improves equipment reliability and reduces the frequency of transients and forced outages, therefore potentially reducing radiological effluent and the risk of unplanned outages.
Recover FP to 95.5%/96%	Increase	Increasing full power will increase the rate of fission product generation in the fuel and rate of tritium production in the moderator. The fission products are normally contained in the fuel and heat transport system. Increased tritium production in the moderator may lead to increased IX processing. An analysis comparing station average full power to radionuclide effluent levels associated with EALs shows negligible change associated with this level of FP% change.

Table 6 Project 2030 Activities with Potential for Impacts on Radiological Surface Water

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
Recover FP to 100%	Increase	Increasing full power will increase the rate of fission product generation in the fuel and rate of tritium production in the moderator. The fission products are normally contained in the fuel and heat transport system. Increased tritium production in the moderator may lead to increased IX processing. An analysis comparing station average full power to radionuclide effluent levels associated with EALs shows negligible change associated with this level of FP% change.

A.4 GROUNDWATER

Project 2030 activities are evaluated for the potential to have an impact on groundwater in Table 7. The groundwater flow regime is not anticipated to change due to P2030. No changes to contaminants in groundwater are expected as part of Project 2030 activities.

Table 7 Project 2030 Activities with Potential for Impacts on Groundwater

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
P39000 – High Pressure Feedwater Heat Exchanger Bypass	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to groundwater associated with ongoing Site operations.
P39203 - Bruce A Unit 1 Generator Rotor - Stator Rewind	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to groundwater associated with ongoing Site operations.
Project 39667 – Bruce A Unit 1 and 2 Main Output Transformer Replacement	Stable	The level of activity required is considered routine for Site and does not constitute a substantial impact to groundwater associated with ongoing Site operations. Changes were made to MOT design to reduce the risk of groundwater contamination from spills.
Project 39668 – Bruce A Unit 1 and 2 Isolated Phase Bus Cooling Upgrades	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to groundwater associated with ongoing Site operations.

Table 7 Project 2030 Activities with Potential for Impacts on Groundwater

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
Project 39751 – Data Reconciliation/Measurement Uncertainty Recapture Implementation	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to groundwater associated with ongoing Site operations.
Project 39752 – Bruce A Seal Oil System Performance Improvements	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to groundwater associated with ongoing Site operations.
Project 39753 – Bruce A Current Transformers and High Voltage Bushings Replacement	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to groundwater associated with ongoing Site operations.
Project 59357 – Preheater ID Cleaning	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to groundwater associated with ongoing Site operations.
Projects 39730 and 39729 – BA/BB Condenser Tube Cleaning System (CTCS) Upgrades	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to groundwater associated with ongoing Site operations.
Project 39755 and 39840 – BA/BB Moderator System Improvements	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to groundwater associated with ongoing Site operations.
Project 39754 – 36 Month Outage Interval	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to groundwater associated with ongoing Site operations.
Project 70038 – Unit 1 Power Discrepancy Resolution	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to groundwater associated with ongoing Site operations.
Project 70044 – Bruce A Unit 1 and 2 Condenser Cooling Water Pumps	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to groundwater associated with ongoing Site operations.

Table 7 Project 2030 Activities with Potential for Impacts on Groundwater

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
Project 70090 – Bruce A Unit 1 Ultrasonic Measurement for Heat Transport System Pump Flows	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to groundwater associated with ongoing Site operations.
Project 70097 – Bruce A Hybrid Rod Based Guaranteed Shutdown State (RBGSS)	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to groundwater associated with ongoing Site operations.
Project 70121 Safety System Test (SST) Frequency Optimization	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to groundwater associated with ongoing Site operations.
Recover FP to 95.5%/96%	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to groundwater associated with ongoing Site operations.
Recover FP to 100%	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to groundwater associated with ongoing Site operations.

A.5 GEOLOGY, SEDIMENT AND SOIL

Project 2030 activities are evaluated for the potential to have an impact on geology, sediment and soil in Table 8. Future activities that are predicted to have an increased environmental impact are discussed below. No changes to geology, sediment or soil are expected during Project 2030.

Table 8 Project 2030 Activities with Potential for Impacts on Geology, Sediment and Soil

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
P39000 – High Pressure Feedwater Heat Exchanger Bypass	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to geology, sediment and soil associated with ongoing Site operations.

Table 8 Project 2030 Activities with Potential for Impacts on Geology, Sediment and Soil

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
P39203 - Bruce A Unit 1 Generator Rotor - Stator Rewind	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to geology, sediment and soil associated with ongoing Site operations.
Project 39667 – Bruce A Unit 1 and 2 Main Output Transformer Replacement	Stable	The level of activity required is considered routine for Site and does not constitute a substantial impact to geology, sediment and soil associated with ongoing Site operations. Changes were made to MOT design to reduce the risk of soil contamination from spills.
Project 39668 – Bruce A Unit 1 and 2 Isolated Phase Bus Cooling Upgrades	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to geology, sediment and soil associated with ongoing Site operations.
Project 39751 – Data Reconciliation/Measurement Uncertainty Recapture Implementation	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to geology, sediment and soil associated with ongoing Site operations.
Project 39752 – Bruce A Seal Oil System Performance Improvements	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to geology, sediment and soil associated with ongoing Site operations.
Project 39753 – Bruce A Current Transformers and High Voltage Bushings Replacement	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to geology, sediment and soil associated with ongoing Site operations.
Project 59357 – Preheater ID Cleaning	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to geology, sediment and soil associated with ongoing Site operations.
Projects 39730 and 39729 – BA/BB Condenser Tube Cleaning System (CTCS) Upgrades	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to geology, sediment and soil associated with ongoing Site operations.
Project 39755 and 39840 – BA/BB Moderator System Improvements	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to geology, sediment and soil associated with ongoing Site operations.

Table 8 Project 2030 Activities with Potential for Impacts on Geology, Sediment and Soil

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
Project 39754 – 36 Month Outage Interval	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to geology, sediment and soil associated with ongoing Site operations.
Project 70038 – Unit 1 Power Discrepancy Resolution	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to geology, sediment and soil associated with ongoing Site operations.
Project 70044 – Bruce A Unit 1 and 2 Condenser Cooling Water Pumps	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to geology, sediment and soil associated with ongoing Site operations.
Project 70090 – Bruce A Unit 1 Ultrasonic Measurement for Heat Transport System Pump Flows	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to geology, sediment and soil associated with ongoing Site operations.
Project 70097 – Bruce A Hybrid Rod Based Guaranteed Shutdown State (RBGSS)	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to geology, sediment and soil associated with ongoing Site operations.
Project 70121 Safety System Test (SST) Frequency Optimization	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to geology, sediment and soil associated with ongoing Site operations.
Recover FP to 95.5%/96%	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to geology, sediment and soil associated with ongoing Site operations.
Recover FP to 100%	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to geology, sediment and soil associated with ongoing Site operations.

A.6 TERRESTRIAL ENVIRONMENT (SPECIES AND HABITAT)

Project 2030 activities are evaluated for the potential to have an impact on the terrestrial environment in Table 9. Future activities that are predicted to have an increased environmental impact are discussed below.

Table 9 Project 2030 Activities with Potential for Impacts on the Terrestrial Environment

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
P39000 – High Pressure Feedwater Heat Exchanger Bypass	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact the terrestrial environment associated with ongoing Site operations.
P39203 - Bruce A Unit 1 Generator Rotor - Stator Rewind	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact the terrestrial environment associated with ongoing Site operations.
Project 39667 – Bruce A Unit 1 and 2 Main Output Transformer Replacement	Stable (groundwater, soil)	The level of activity required is considered routine for Site and does not constitute a substantial impact the terrestrial environment associated with ongoing Site operations. The reduction in risk to oil contamination for groundwater and soil is a benefit to the terrestrial environment.
Project 39668 – Bruce A Unit 1 and 2 Isolated Phase Bus Cooling Upgrades	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact the terrestrial environment associated with ongoing Site operations.
Project 39751 – Data Reconciliation/Measurement Uncertainty Recapture Implementation	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact the terrestrial environment associated with ongoing Site operations.
Project 39752 – Bruce A Seal Oil System Performance Improvements	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact the terrestrial environment associated with ongoing Site operations.
Project 39753 – Bruce A Current Transformers and High Voltage Bushings Replacement	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact the terrestrial environment associated with ongoing Site operations.
Project 59357 – Preheater ID Cleaning	Stable (radiological air)	This was a maintenance evolution completed in 2022, and emissions were controlled by extensive tenting routed to active ventilation. The level of activity required is considered routine for Site and does not constitute a substantial impact the terrestrial environment associated with ongoing Site operations.
Projects 39730 and 39729 – BA/BB Condenser Tube	Decrease (conventional water)	Improvement in generation efficiency and improved reliability of ball washing system is a benefit to the terrestrial environment.

Table 9 Project 2030 Activities with Potential for Impacts on the Terrestrial Environment

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
Cleaning System (CTCS) Upgrades		
Project 39760 – BA Unit 1 and 2 High Pressure Turbines Replacement	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact the terrestrial environment associated with ongoing Site operations.
Project 39755 and 39840 – BA/BB Moderator System Improvements	Increase (radiological air, radiological water)	This work involves increasing the flow through the moderator system by removal of orifices. This is a closed loop system, monitored by chemistry control, and normal emissions are not anticipated to change. Emissions while the system is undergoing maintenance to make this change will be routed through the confinement vapour recovery system. Potential increases in emissions or effluents due to increased IX processing will be assessed however, are not anticipated to constitute a major impact to the terrestrial environment associated with ongoing Site operations.
Project 39754 – 36 Month Outage Interval	Decrease (noise, conventional air, conventional water, radiological water, vehicle-wildlife collisions) Stable (radiological air)	Reducing the frequency of outages would reduce the amount of poison required for GSS, reducing IX usage. Under normal circumstances, there are no impacts associated with increased irradiation of cobalt adjuster rods. The level of activity required is considered routine for Site and does not constitute a substantial impact on the terrestrial environment associated with ongoing Site operations. A reduced frequency in outages would reduce the vehicles traveling on roads within site and nearby, which could decrease vehicle-wildlife collisions.
Project 70038 – Unit 1 Power Discrepancy Resolution	Stable (conventional water)	Improvements to flow measurement do not constitute a major impact the terrestrial environment associated with ongoing Site operations.
Project 70044 – Bruce A Unit 1 and 2 Condenser Cooling Water Pumps	Increase (I&E) Decrease (thermal effluent concentration) Stable (conventional water, radiological water)	Returning flow to design basis values is considered routine for Site and does not constitute a substantial impact the terrestrial environment associated with ongoing Site operations.

Table 9 Project 2030 Activities with Potential for Impacts on the Terrestrial Environment

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
Project 70090 – Bruce A Unit 1 Ultrasonic Measurement for Heat Transport System Pump Flows	Stable (radiological air, radiological water)	One-time activites required are considered routine for Site and do not constitute a major impact the terrestrial environment associated with ongoing Site operations.
Project 70097 – Bruce A Hybrid Rod Based Guaranteed Shutdown State (RBGSS)	Decrease (radiological air, radiological water)	This reduction in emissions is a benefit tothe terrestrial environment associated with ongoing Site operations.
Project 70121 Safety System Test (SST) Frequency Optimization	Decrease (noise, conventional air, radiological water)	This reduction in emissions is a benefit to the terrestrial environment associated with ongoing Site operations.
Recover FP to 95.5%/96%	Stable (conventional air, radiological air, radiological water) Decrease (cumulative GHG)	A cumulative reduction in greenhouse gas emissions is expected to be a benefit to the terrestrial environment. No significant increases in emissions are expected to impact the terrestrial environment associated with ongoing Site operations. With climate change, near shore temperatures and reduced ice cover may support terrestrial wildlife through water access during the winter.
Recover FP to 100%	Stable (conventional air, radiological air, radiological water) Decrease (cumulative GHG)	A cumulative reduction in greenhouse gas emissions is expected to be a benefit to the terrestrial environment. No significant increases in emissions are expected to impact the terrestrial environment associated with ongoing Site operations. With climate change, near shore temperatures and reduced ice cover may support terrestrial wildlife through water access during the winter.

A.7 AQUATIC ENVIRONMENT (SPECIES AND HABITAT)

Future site activities are evaluated for the potential to have an impact on the aquatic environment in Table 10. Future activities that are predicted to have an increased environmental impact are discussed below.

Table 10 Future Site Activities with Potential for Impacts on the Aquatic Environment

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
P39000 – High Pressure Feedwater Heat Exchanger Bypass	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact the aquatic environment associated with ongoing Site operations.
P39203 - Bruce A Unit 1 Generator Rotor - Stator Rewind	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact the aquatic environment associated with ongoing Site operations.
Project 39667 – Bruce A Unit 1 and 2 Main Output Transformer Replacement	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact the aquatic environment associated with ongoing Site operations.
Project 39668 – Bruce A Unit 1 and 2 Isolated Phase Bus Cooling Upgrades	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact the aquatic environment associated with ongoing Site operations.
Project 39751 – Data Reconciliation/Measurement Uncertainty Recapture Implementation	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact the aquatic environment associated with ongoing Site operations.
Project 39752 – Bruce A Seal Oil System Performance Improvements	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact the aquatic environment associated with ongoing Site operations.
Project 39753 – Bruce A Current Transformers and High Voltage Bushings Replacement	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact the aquatic environment associated with ongoing Site operations.
Project 59357 – Preheater ID Cleaning	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact the aquatic environment associated with ongoing Site operations.
Projects 39730 and 39729 – BA/BB Condenser Tube Cleaning System (CTCS) Upgrades	Decrease (conventional water)	Improving reliability to the ball wash system is an overall benefit to the aquatic environment.
Project 39760 – BA Unit 1 and 2 High Pressure Turbines Replacement	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact the aquatic environment associated with ongoing Site operations.

Table 10 Future Site Activities with Potential for Impacts on the Aquatic Environment

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
Project 39755 and 39840 – BA/BB Moderator System Improvements	Increase (radiological air, radiological water)	This work involves increasing the flow through the moderator system by removal of orifices. This is a closed loop system, monitored by chemistry control, and normal emissions are not anticipated to change. Emissions while the system is undergoing maintenance to make this change will be routed through the confinement vapour recovery system. Potential increases in emissions or effluents due to increased IX processing will be assessed however, are not anticipated to constitute a major impact to the aquatic environment associated with ongoing Site operations.
Project 39754 – 36 Month Outage Interval	Decrease (noise, conventional air, conventional water, radiological water) Stable (radiological air)	The level of activity required is considered routine for Site and does not constitute a substantial impact the aquatic environment associated with ongoing Site operations.
Project 70038 – Unit 1 Power Discrepancy Resolution	Stable (conventional water)	Improved flow measurement does not constitute a substantial impact the aquatic environment associated with ongoing Site operations.
Project 70044 – Bruce A Unit 1 and 2 Condenser Cooling Water Pumps	Increase (I&E) Decrease (thermal effluent concentration) Stable (conventional water, radiological water)	This work involves returning the Unit 1 and 2 CCW pumps to original design flows. Entrainment losses are not expected to increase due to the conservative assumptions used in previous calculations (assumed mortality of all entrained fish eggs and larvae). There currently has not been a discernable increase, therefore minimal increases are expected compared to historical values as the change may be masked by annual variability in lake conditions and outages; impingement data is collected at station pumphouses and is monitored for trends. In terms of thermal effluent concentration, temperature change is inversely proportional to mass flow. With increased flow, it is also expected that contaminant concentrations will reduce due to dilution, but loading is not impacted by CCW flow.

Table 10 Future Site Activities with Potential for Impacts on the Aquatic Environment

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
Project 70090 – Bruce A Unit 1 Ultrasonic Measurement for Heat Transport System Pump Flows	Stable (radiological air, radiological water)	One-time effluent associated with this activity is considered routine for Site and does not constitute a substantial impact the aquatic environment associated with ongoing Site operations.
Project 70097 – Bruce A Hybrid Rod Based Guaranteed Shutdown State (RBGSS)	Decrease (radiological air, radiological water)	This reduction in effluent is an overall benefit to the aquatic environment.
Project 70121 Safety System Test (SST) Frequency Optimization	Decrease (noise, conventional air, radiological water)	The level of activity required is considered routine for Site and does not constitute a substantial impact the aquatic environment associated with ongoing Site operations.
Project 39963 – Station Containment Outage (SCO) and Vacuum Building Outage (VBO) elimination/reduction	Stable (conventional air, radiological air, radiological water) Decrease (cumulative GHG) Increase (conventional water)	The level of activity required is considered routine for Site and does not constitute a substantial impact the aquatic environment associated with ongoing Site operations.
Recover FP to 95.5%/96%	Stable (conventional air, radiological air, radiological water) Decrease (cumulative GHG) Increase (conventional water)	Increased full power will likely increase the amount of thermal energy discharged to Lake Huron, however improvements to the secondary side will increase the efficiency at which thermal energy from the reactor core is converted to electrical energy. Therefore, the proportion of total energy sent to the lake compared to total thermal energy produced from fission is reduced. By restoring design flows to the CCW system, no increases to temperature change limits are required for the station Environmental Compliance Approvals.

Table 10 Future Site Activities with Potential for Impacts on the Aquatic Environment

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
Recover FP to 100%	Stable (conventional air, radiological air, radiological water) Decrease (cumulative GHG) Increase (conventional water)	Increased full power will likely increase the amount of thermal energy discharged to Lake Huron. A preliminary assessment was conducted at 100% FP which indicates no challenges to temperature difference limits at Bruce B, however mitigation measures are likely required for Bruce A to meet existing temperature difference limits. Prior to the 100% FP assessment, an assumption of the potential effects of a 2°C increase in ECA limit for thermal effluent was evaluated as a bounding scenario in the thermal risk assessment provided to support the 2023 application to extend thermal flexibility at Bruce A. The results of this bounding scenario are presented in [R-9]; the results were formerly described as "Efficiency Gains" which represents the bounding case of 100%FP without improved efficiency.

A.8 HUMAN ENVIRONMENT

Project 2030 activities are evaluated for the potential to have an impact on the environment in Table 11, which includes consideration of conventional and radiological contaminants.

Table 11 Project 2030 Activities with Potential for Impacts on the Human Environment

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
P39000 – High Pressure Feedwater Heat Exchanger Bypass	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to the human environment associated with ongoing Site operations.
P39203 - Bruce A Unit 1 Generator Rotor - Stator Rewind	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to the human environment associated with ongoing Site operations.
Project 39667 – Bruce A Unit 1 and 2 Main Output Transformer Replacement	Stable (groundwater, soil)	The level of activity required is considered routine for Site and does not constitute a substantial impact to the human environment associated with ongoing Site operations.

Table 11 Project 2030 Activities with Potential for Impacts on the Human Environment

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
Project 39668 – Bruce A Unit 1 and 2 Isolated Phase Bus Cooling Upgrades	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to the human environment associated with ongoing Site operations.
Project 39751 – Data Reconciliation/Measurement Uncertainty Recapture Implementation	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to the human environment associated with ongoing Site operations.
Project 39752 – Bruce A Seal Oil System Performance Improvements	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to the human environment associated with ongoing Site operations.
Project 39753 – Bruce A Current Transformers and High Voltage Bushings Replacement	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to the human environment associated with ongoing Site operations.
Project 59357 – Preheater ID Cleaning	Stable (radiological air)	One-time emissions associated with this activity are considered routine for Site and does not constitute a substantial impact the human environment associated with ongoing Site operations.
Projects 39730 and 39729 – BA/BB Condenser Tube Cleaning System (CTCS) Upgrades	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to the human environment associated with ongoing Site operations.
Project 39760 – BA Unit 1 and 2 High Pressure Turbines Replacement	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to the human environment associated with ongoing Site operations.
Project 39755 and 39840 – BA/BB Moderator System Improvements	Increase (radiological air, radiological water)	This work involves increasing the flow through the moderator system by removal of orifices. This is a closed loop system, monitored by chemistry control, and normal emissions are not anticipated to change. Emissions while the system is undergoing maintenance to make this change will be routed through the confinement vapour recovery system. Potential increases in emissions or effluents due to increased IX processing will be assessed however, are not anticipated to constitute a major impact to the human environment associated with ongoing Site operations.

Table 11 Project 2030 Activities with Potential for Impacts on the Human Environment

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
Project 39754 – 36 Month Outage Interval	Decrease (noise, conventional air, conventional water, radiological water) Stable (radiological air)	This reduction in emissions and effluent are expected to be a benefit to the human environment.
Project 70038 – Unit 1 Power Discrepancy Resolution	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to the human environment associated with ongoing Site operations.
Project 70044 – Bruce A Unit 1 and 2 Condenser Cooling Water Pumps	Not Applicable	The level of activity required is considered routine for Site and does not constitute a substantial impact to the human environment associated with ongoing Site operations.
Project 70090 – Bruce A Unit 1 Ultrasonic Measurement for Heat Transport System Pump Flows	Stable (radiological air, radiological water)	One-time emissions and effluent associated with thisactivity is considered routine for Site and does not constitute a substantial impact to the human environment associated with ongoing Site operations.
Project 70097 – Bruce A Hybrid Rod Based Guaranteed Shutdown State (RBGSS)	Decrease (radiological air, radiological water)	This reduction in emissions and effluent are an overall benefit to the human environment.
Project 70121 Safety System Test (SST) Frequency Optimization	Decrease (noise, conventional air, radiological water)	This reduction in emissions and effluent are an overall benefit to the human environment.
Recover FP to 95.5%/96%	Stable (conventional air, radiological air, radiological water) Decrease (cumulative GHG)	The level of activity required is considered routine for Site and does not constitute a substantial impact to the human environment associated with ongoing Site operations. A cumulative reduction in greenhouse gas emissions associated with the Ontario electricity grid is an overall benefit to the human environment.
Recover FP to 100%	Stable (conventional air, radiological air, radiological water)	The level of activity required is considered routine for Site and does not constitute a substantial impact to the human environment associated with ongoing Site operations.

Table 11 Project 2030 Activities with Potential for Impacts on the Human Environment

Future Site System, Structure or Activity	Direction of Potential Effect Relative to Current Operations	Discussion of Potential Interaction
	Decrease (cumulative GHG)	A cumulative reduction in greenhouse gas emissions associated with the Ontario electricity grid is an overall benefit to the human environment.

A.9 WASTE GENERATION

Project 2030 activities are evaluated for the potential to produce waste in Table 12.

Table 12 Project 2030 Activities with Potential to generate Conventional, Hazardous or Radiological Waste

Future Site System, Structure or Activity	Conventional or Hazardous Waste or Recyclables (Increase/Decrease/Stable/Not Applicable))	Radiological Waste (Increase/Decrease/Stable/Not Applicable)
P39000 – High Pressure Feedwater Heat Exchanger Bypass	Stable (one time during installation)	Not Applicable
P39203 - Bruce A Unit 1 Generator Rotor - Stator Rewind	Stable (one time during installation)	Not Applicable
Project 39667 – Bruce A Unit 1 and 2 Main Output Transformer Replacement	Stable (one time during installation)	Not Applicable
Project 39668 – Bruce A Unit 1 and 2 Isolated Phase Bus Cooling Upgrades	Stable (one time during installation)	Not Applicable
Project 39751 – Data Reconciliation/Measurement Uncertainty Recapture Implementation	Not Applicable	Not Applicable

Table 12 Project 2030 Activities with Potential to generate Conventional, Hazardous or Radiological Waste

Future Site System, Structure or Activity	Conventional or Hazardous Waste or Recyclables (Increase/Decrease/Stable/Not Applicable))	Radiological Waste (Increase/Decrease/Stable/Not Applicable)
Project 39752 – Bruce A Seal Oil System Performance Improvements	Stable (one time during installation)	Not Applicable
Project 39753 – Bruce A Current Transformers and High Voltage Bushings Replacement	Stable (one time during installation)	Not Applicable
Project 59357 – Preheater ID Cleaning	Stable (one time during cleaning)	Stable (one-time shot blast and dust)
Projects 39730 and 39729 – BA/BB Condenser Tube Cleaning System (CTCS) Upgrades	Stable (one time during installation, long term reduction in ball loss)	Not Applicable
Project 39755 and 39840 – BA/BB Moderator System Improvements	Stable (one time during installation)	Stable (one-time, decontamination of tools)
Project 39754 – 36 Month Outage Interval	Stable	Decrease (IX resin)
Project 70038 – Unit 1 Power Discrepancy Resolution	Not Applicable	Not Applicable
Project 70044 – Bruce A Unit 1 and 2 Condenser Cooling Water Pumps	Stable (one time during installation)	Not Applicable
Project 70090 – Bruce A Unit 1 Ultrasonic Measurement for Heat Transport System Pump Flows	Stable (one time during installation)	Stable (one-time, decontamination of tools)
Project 70097 – Bruce A Hybrid Rod Based Guaranteed Shutdown State (RBGSS)	Not Applicable	Decrease (IX resin)

Table 12 Project 2030 Activities with Potential to generate Conventional, Hazardous or Radiological Waste

Future Site System, Structure or Activity	Conventional or Hazardous Waste or Recyclables (Increase/Decrease/Stable/Not Applicable))	Radiological Waste (Increase/Decrease/Stable/Not Applicable)
Project 70121 Safety System Test (SST) Frequency Optimization	Decrease (reduction in diesel oil waste which is removed during SG SSTs)	Not Applicable
Recover FP to 95.5%/96%	No	Yes (proportional fuel waste increase, IX resin)
Recover FP to 100%	No	Yes (proportional fuel waste increase, IX resin)

A.10 CLIMATE CHANGE IMPACTS

Project 2030 activities are evaluated for the potential to to be impacted by climate change in Table 13, including the potential improvement to climate resilience.

Table 13 Project 2030 Activities which have Potential to be impacted by Climate Change (2021-2026)

Future Site System, Structure or Activity	Climate Variable	Discussion of Potential Improvement to Resilience
P39000 – High Pressure Feedwater Heat Exchanger Bypass	Not Applicable	This activity is unlikely to be significantly impacted by climate change.
P39203 - Bruce A Unit 1 Generator Rotor - Stator Rewind	Not Applicable	This activity is unlikely to be significantly impacted by climate change.
Project 39667 – Bruce A Unit 1 and 2 Main Output Transformer Replacement	Air Temperature	Main output transformers are housed in concrete structures outside the generating station, which may be impacted by air temperature. Degraded equipment can be vulnerable to increasing air temperatures due to reduced margins. Replacement of the equipment improves climate resilience.
Project 39668 – Bruce A Unit 1 and 2 Isolated Phase Bus Cooling Upgrades	Air Temperature	Increasing cooling capability increases margins, which improves climate resilience.

Table 13 Project 2030 Activities which have Potential to be impacted by Climate Change (2021-2026)

Future Site System, Structure or Activity	Climate Variable	Discussion of Potential Improvement to Resilience
Project 39751 – Data Reconciliation/Measurement Uncertainty Recapture Implementation	Not Applicable	This activity is unlikely to be significantly impacted by climate change.
Project 39752 – Bruce A Seal Oil System Performance Improvements	Not Applicable	This activity is unlikely to be significantly impacted by climate change.
Project 39753 – Bruce A Current Transformers and High Voltage Bushings Replacement	Air Temperature	Current transformers and associated HVBs are outside the generating station, which may be impacted by air temperature. Degraded equipment can be vulnerable to increasing air temperatures due to reduced margins. Replacement of the equipment improves climate resilience.
Project 59357 – Preheater ID Cleaning	Not Applicable	This activity is unlikely to be significantly impacted by climate change.
Projects 39730 and 39729 – BA/BB Condenser Tube Cleaning System (CTCS) Upgrades	Water Quality	Improving the cleaning capability of the condenser tubes will increase the resilience against biofouling and invasive species growth.
Project 39755 and 39840 – BA/BB Moderator System Improvements	Water Temperature	This system is already impacted by elevated water temperatures leading to derates during certain times of the year. Improving the cooling capacity improves climate resilience.
Project 39754 – 36 Month Outage Interval	Not Applicable	This activity is unlikely to be significantly impacted by climate change.
Project 70038 – Unit 1 Power Discrepancy Resolution	Not Applicable	This activity is unlikely to be significantly impacted by climate change.
Project 70044 – Bruce A Unit 1 and 2 Condenser Cooling Water Pumps	Water Temperature	Replacing degraded pumps to return to original design flows improves the condenser performance and contributes to thermal effluent dilution, mitigating impact to the potential changes to water temperature due to climate change.
Project 70090 – Bruce A Unit 1 Ultrasonic Measurement for Heat Transport System Pump Flows	Not Applicable	This activity is unlikely to be significantly impacted by climate change.

Table 13 Project 2030 Activities which have Potential to be impacted by Climate Change (2021-2026)

Future Site System, Structure or Activity	Climate Variable	Discussion of Potential Improvement to Resilience
Project 70097 – Bruce A Hybrid Rod Based Guaranteed Shutdown State (RBGSS)	Not Applicable	This activity is unlikely to be significantly impacted by climate change.
Project 70121 Safety System Test (SST) Frequency Optimization	Not Applicable	This activity is unlikely to be significantly impacted by climate change.
Recover FP to 95.5%/96%	Not Applicable	This activity is unlikely to be significantly impacted by climate change. Several systems which are required to operate the stations can be impacted by climate hazards for example air temperature and water temperature, however raising full power is considered separate from equipment resilience.
Recover FP to 100%	Not Applicable	This activity is unlikely to be significantly impacted by climate change. Several systems which are required to operate the stations can be impacted by climate hazards for example air temperature and water temperature, however raising full power is considered separate from equipment resilience.

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Attachment A

Summary of Bruce A Integrated Summary Report for P2030 Safety Analysis up to 95.5% FP

Attachment A:
Summary of Bruce A Integrated Summary Report for P2030 Safety Analysis up to 95.5% FP

This document is the Integrated Summary Report (ISR) for Safety and Control Area (SCA) Safety Analysis (SCA 4) for operation of the Bruce A units at the Intermediate Power Level (IPL) of 95.5% Full Power (FP) under Project 2030 (P2030). The analyses and assessments established by the Bruce A Safety Analysis Impact Report (SAIR) have been performed to demonstrate safe operation at the IPL, with other analyses in the Bruce A Safety Report, Part 3, confirmed to be applicable by means of the SAIR process.

The SAIR identified analyses and assessments to be performed for postulated initiating events associated with:

- Fuel Handling Failures
- Electrical Failures / Loss of Flow
- Control Failures
- Small Break Loss of Coolant Accidents (LOCAs)
- Large Break LOCA
- Heat Transport System and Auxiliary System Failures Outside of Containment
- Feedwater and Steam Supply System Failures
- Shutdown Cooling and Maintenance Cooling Failures
- Main Moderator and Moderator Auxiliary System Failures
- Common Mode Events

These analyses and assessments have:

- confirmed safety related system effectiveness for the postulated anticipated operational occurrences (AOOs) and safety system effectiveness for design basis accidents (DBAs) identified in the SAIR by applying safety analysis limits updated to accommodate operation up to the IPL; and,
- demonstrated that applicable safety analysis acceptance criteria are met, including dose limits to individuals and the public, as well as derived acceptance criteria that, when met, preclude release of radionuclides from the plant.

Details are provided in the analysis and assessment reports submitted to the CNSC.

There are no expected impacts on the Level 1 and 2 Probabilistic Safety Assessment (PSA) due to an increase to the IPL of 95.5% FP.

Bruce Power's experience in planning, executing, overseeing and implementing safety analysis has been incorporated into the standards, processes and procedures applied to the production and acceptance of the safety case for operation at up to the IPL.

Management of safety analysis is integrated with other SCAs, in particular, operational performance (SCA 3) and design (SCA 5) by means of procedures for identifying plant design changes to be incorporated into safety analysis and for updating the Operational Safety Requirements (OSRs) and Safe Operating Envelope (SOE) to support operation up to the IPL. The analyses and assessments submitted in support of the safety case for operation up to the IPL constitute part of the Analysis of Record (AoR) and are to be incorporated into Part 3 of the Safety Report.

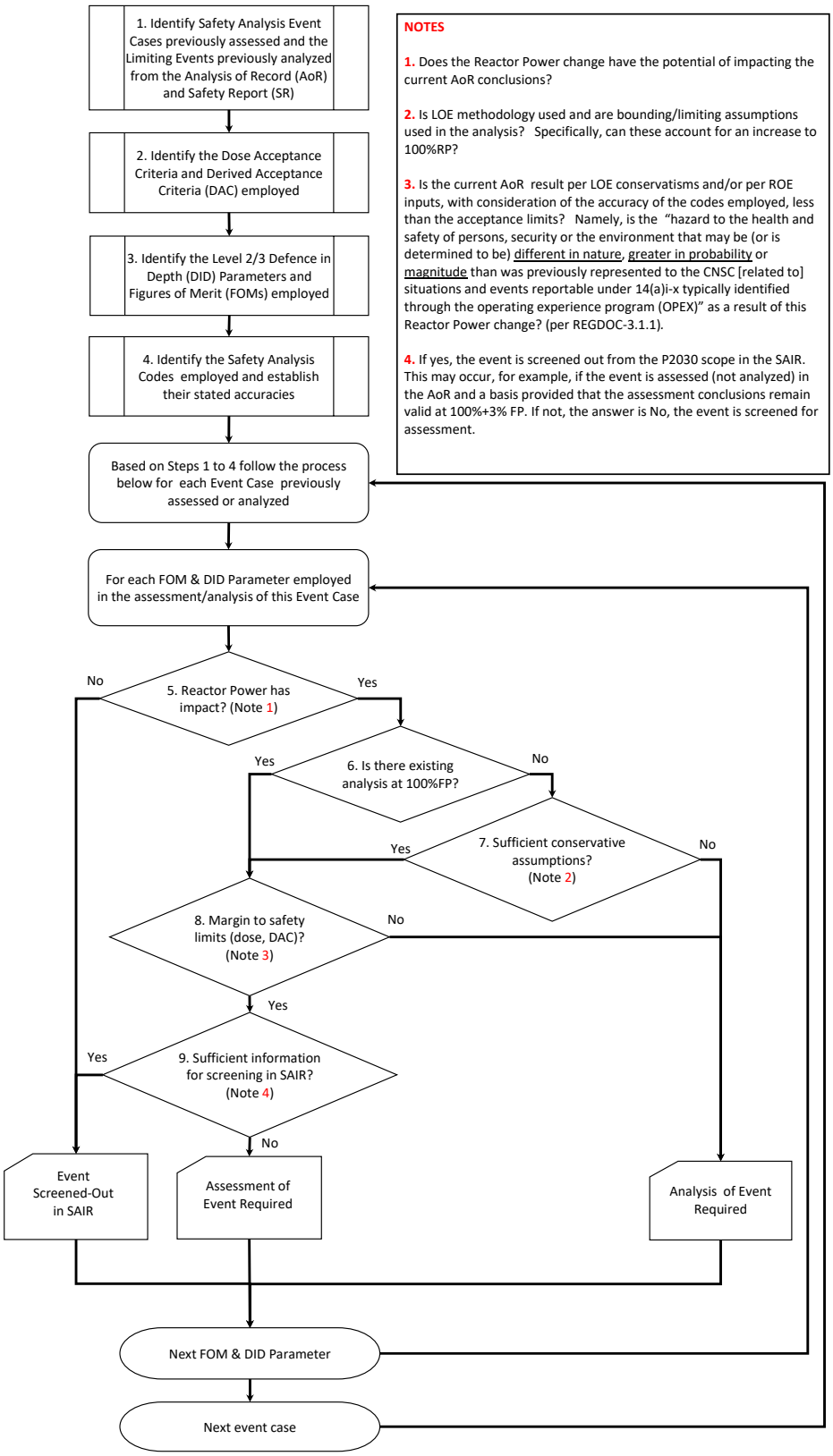

Figure 1. Screening and impact assessment flowchart

Table 1. ***Confirmation That Safety Analysis Acceptance Criteria Are Met for Bruce A Events Up to Intermediate Power Level of 95.5% FP***

#	Accident Category	Events Analyzed	Analysis Conclusion
1	**Fuel Handling Failures**	Design Basis Accident (DBA) Events	
		• Incomplete discharge of two irradiated bundles in the irradiated fuel port	**Acceptance Criterion Met**
2	**Electrical Failures / Loss of Flow**	Anticipated Operational occurrence (AOO) Events	
		• Total Loss of Class IV Power (AOO) • Partial Loss of Class IV Power to 2 Heat Transport (HT) Pumps and Single HT Pump Trip with no additional failures	**Acceptance Criteria Met**
		DBA Events	
		• Total Loss of Class IV Power (DBA) • Partial Loss of Class IV Power to 2 HT Pumps • Single HT Pump Trip • Single HT Pump Seizure	**Acceptance Criteria Met**
3	**Control Failures**	AOO Events	
		• Transient Loss of Reactivity Control • Loss of Power Regulation Unbounded • Loss of HT Pressure Control - Low • Loss of HT Pressure Control - High	**Acceptance Criteria Met**
		DBA Events	
		• Transient Loss of Reactivity Control – Fast (> 0.25 mk/s) • Transient Loss of Reactivity Control – Slow (≤ 0.25 mk/s)_ • Loss of Power Regulation (Unbounded or Bounded) • Loss of HT Pressure Control - Low	**Acceptance Criteria Met**
		Neutron Overpower Protection (NOP) Analysis	
		• Slow Loss of Reactivity (LOR) to establish required NOP trip setpoint	**Acceptance Criterion Met**

#	Accident Category	Events Analyzed	Analysis Conclusion
4	**Small Break Loss of Coolant Accident (LOCA)**	DBA Events	
		Out-of-Core Breaks • Break at the Top of Pressurizer • Guillotine Break of the Largest Inlet Feeder	**Acceptance Criteria Met**
		In-Core Breaks • Pressure Tube/Calandria Tube (PT/CT) rupture with no end-fitting ejection • Severe Channel Flow Blockage	**Acceptance Criteria Met**
5	**Large Break LOCA**	DBA Events	
		• Inner Zone Reactor Inlet Header (RIH) break • Pump Discharge break	**Acceptance Criteria Met**
		DBA Transition Break	
		• Break sizes from 950 kg/s to 3000 kg/s	**Acceptance Criterion Met**
6	**Heat Transport System and Auxiliary System Failures Outside of Containment**	AOO Events	
		• Consequential Leak Assessment – Spurious Opening of six (6) Safety Relief Valves (SRVs)	**Acceptance Criterion Met**
		DBA Events	
		• Consequential Leak Assessment Secondary Side – 100% Steam Generator Feedwater Nozzle Break • Heat Transport Pump Gland Seal Failure – Failure of Primary and Backup Seals in One Heat Transport System (HTS) Pump • Heat Transport Pump Gland Seal Circuit Failure – Guillotine Failure of the Gland Seal Pipe Downstream of the Last Check Valve; and • Steam Generator / Preheater Tube Failure - D_2O Feed/ D_2O Transfer System Unavailable	**Acceptance Criteria Met**

#	Accident Category	Events Analyzed	Analysis Conclusion
7	**Feedwater and Steam Supply System Failures**	AOO Events	
		• Leak in Feedwater (FW) system • Total loss of FW supply • Asymmetrical FW events • Symmetric FW line break • Inadvertent opening of SRVs • Turbine trip	**Acceptance Criteria Met**
		DBA Events	
		• Total loss of FW supply • Asymmetric FW line break • Small break in steam balance header or main steam line • Large break in steam balance header or main steam line	**Acceptance Criteria Met**
8	**Shutdown Cooling and Maintenance Cooling System Failures**	AOO Events	
		• Loss of Maintenance Cooling System (MCS) Forced Circulation - HTS Drained and Open	**Acceptance Criterion Met**
		DBA Events	
		• Loss of MCS inventory due to pipe failure with HTS pressurized at 90°C without forced circulation	**Acceptance Criterion Met**
9	**Main Moderator and Moderator Auxiliary System Failures**	DBA Events	
		• Small and Large Loss of Moderator Inventory (LOMI) Inside Containment	**Acceptance Criterion Met**
10	**Shield Cooling System Failures**	• No events analyzed. Current Analysis of Record applicable to IPL	Current analysis of record applicable to IPL.
11	**Common Mode Events**	DBA Events	
		• Seismic event with loss of Class IV power, moderator purification line break, chronic Steam Generator (SG) tube leakage, fuel bundles in Irradiated Fuel Port (IFP) transfer mechanism and fuel bundles in fueling machine in transit	**Acceptance Criterion Met**
12	**Legacy Design Basis Events (BDBAs by Frequency)**	• No events analyzed. Current Analysis of Record applicable to IPL	Current analysis of record applicable to IPL.

Attachment B

Summary of Bruce B Integrated Summary Report for P2030 Safety Analysis up to 96% FP

Attachment B:
Summary of Bruce B Integrated Summary Report for P2030 Safety Analysis up to 96% FP

This document is the Integrated Summary Report (ISR) for Safety and Control Area (SCA) Safety Analysis (SCA 4) for operation of the Bruce B units at the Intermediate Power Level (IPL) of 96% Full Power (FP) under Project 2030 (P2030). The analyses and assessments established by the Bruce B Safety Analysis Impact Report (SAIR) have been performed to demonstrate safe operation at the IPL, with other analyses in the Bruce B Safety Report, Part 3, confirmed to be applicable by means of the SAIR process.

The SAIR identified analyses and assessments to be performed for postulated initiating events associated with:

- Fuel Handling Failures
- Electrical Failures / Loss of Flow
- Control Failures
- Small Break Loss of Coolant Accidents (LOCAs)
- Large Break LOCA
- Heat Transport System and Auxiliary System Failures Outside of Containment
- Feedwater and Steam Supply System Failures
- Shutdown Cooling and Maintenance Cooling Failures
- Main Moderator and Moderator Auxiliary System Failures
- Common Mode Events

These analyses and assessments have:

- confirmed safety related system effectiveness for the postulated anticipated operational occurrences (AOOs) and safety system effectiveness for design basis accidents (DBAs) identified in the SAIR by applying safety analysis limits updated to accommodate operation up to the IPL; and,
- demonstrated that applicable safety analysis acceptance criteria are met, including dose limits to individuals and the public, as well as derived acceptance criteria that, when met, preclude release of radionuclides from the plant.

Details are provided in the analysis and assessment reports submitted to the CNSC.

There are no expected impacts on the Level 1 and 2 Probabilistic Safety Assessment (PSA) due to an increase to the IPL of 96% FP.

Bruce Power's experience in planning, executing, overseeing and implementing safety analysis has been incorporated in the standards, processes and procedures applied to the production and acceptance of the safety case for operation at up to the IPL.

Management of safety analysis is integrated with other SCAs, in particular, operational performance (SCA 3) and design (SCA 5) by means of procedures for identifying plant design changes to be incorporated into safety analysis and for updating the Operational Safety Requirements (OSRs) and Safe Operating Envelope (SOE) in support of operation up to the IPL. The analyses and assessments submitted in support of the safety case for operation up to the IPL constitute part of the Analysis of Record (AoR) and are to be incorporated into Part 3 of the Safety Report.

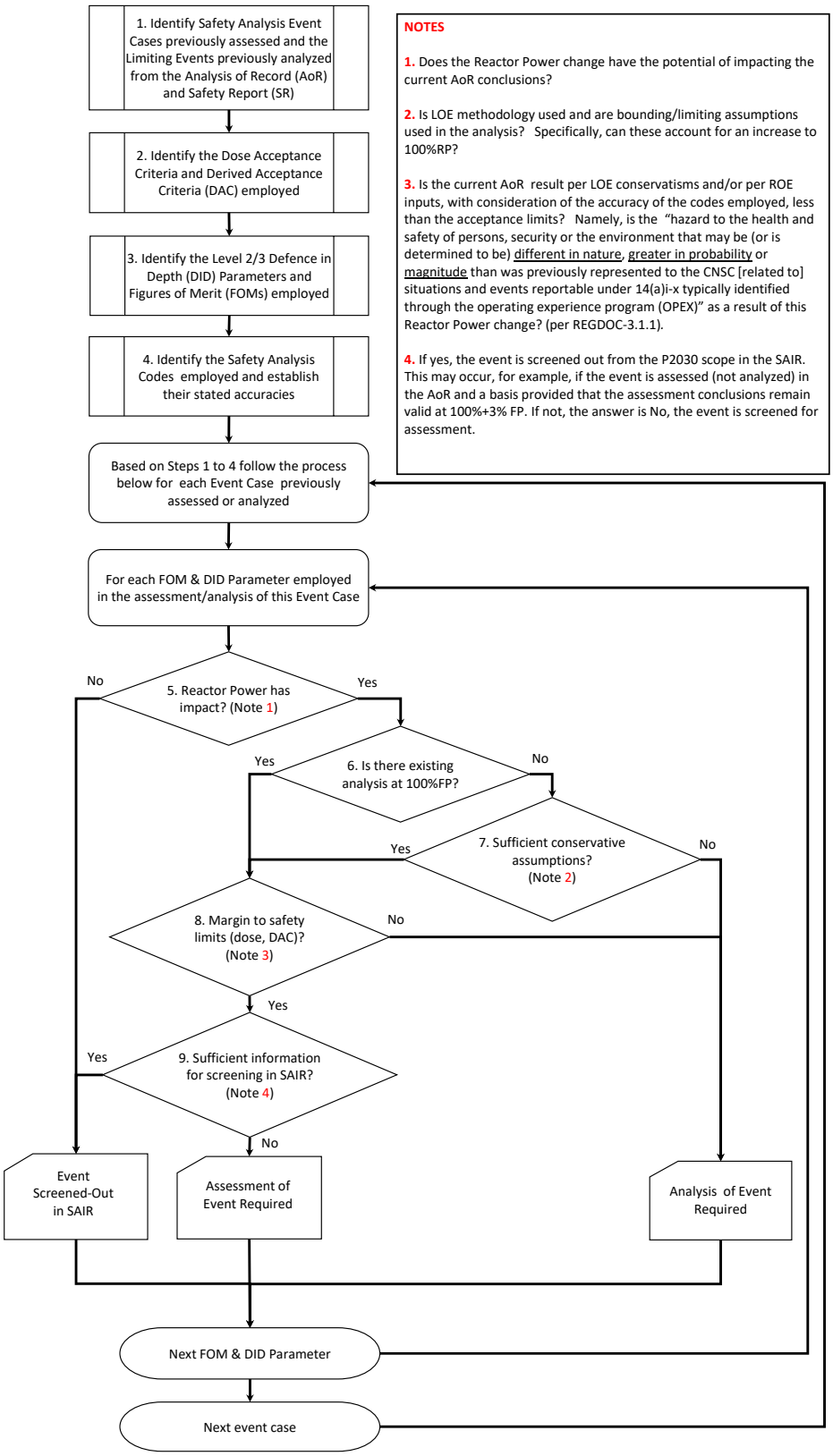

Figure 2. Screening and impact assessment flowchart

Table 2. Confirmation That Safety Analysis Acceptance Criteria Are Met for Bruce A Events Up to 95.5% FP

#	Accident Category	Events Analyzed	Analysis Conclusion
1	**Fuel Handling Failures**	DBA Events	
		• Incomplete discharge of two irradiated bundles in the irradiated fuel port	**Acceptance Criterion Met**
2	**Electrical Failures / Loss of Flow**	AOO Events	
		• Total Loss of Class IV Power (AOO)	**Acceptance Criterion Met**
		• Partial Loss of Class IV Power to 2 Heat Transport (HT) Pumps and Single HT Pump Trip with no additional failures	**Acceptance Criterion Met**
		DBA Events	
		• Total Loss of Class IV Power (DBA) • Partial Loss of Class IV Power to 2 HT Pumps • Single HT Pump Trip • Single HT Pump Seizure	**Acceptance Criteria Met**
3	**Control Failures**	AOO Events	
		• Transient Loss of Reactivity Control • Loss of Power Regulation Unbounded	**Acceptance Criteria Met**
		• Loss of HT Pressure Control - Low	
		• Loss of HT Pressure Control - High	
		• Loss of SG Pressure Control - High	
		DBA Events	
		• Transient Loss of Reactivity Control – Fast (> 0.25 mk/s)	**Acceptance Criterion Met**
		• Transient Loss of Reactivity Control – Slow (≤ 0.25 mk/s) • Loss of Power Regulation (Unbounded or Bounded)	**Acceptance Criteria Met**
		• Loss of HT Pressure Control - Low	**Acceptance Criterion Met**
		NOP Analysis	
		• Slow LOR to establish required NOP trip setpoint	**Acceptance Criterion Met**

#	Accident Category	Events Analyzed	Analysis Conclusion
4	**Small Break LOCA**	AOO Events	
		• Very Small Break (40 kg/s) at the Top of the Pressurizer	**Acceptance Criterion Met**
		DBA Events	
		Out-of-Core Breaks • Break at the Top of Pressurizer • Guillotine Break of the Largest Inlet Feeder • Small Transition Break 950 kg/s • Containment Blinding Break (excluding Break at the Top of the Pressurizer]BTP])	**Acceptance Criteria Met**
		In-Core Breaks • Pressure Tube/Calandria Tube (PT/CT) rupture with no end-fitting ejection • Severe Channel Flow Blockage	**Acceptance Criteria Met**
5	**Large Break LOCA**	DBA Events	
		• Inner Zone RIH break • Outer Zone RIH break • Pump Discharge break	**Acceptance Criteria Met**
		DBA Transition Break	
		• Break sizes from 950 kg/s to 3000 kg/s •	**Acceptance Criterion Met**

#	Accident Category	Events Analyzed	Analysis Conclusion
6	**Heat Transport System (HTS) and Auxiliary System Failures Outside of Containment**	AOO Events	
		• Consequential Leak Assessment – Spurious Opening of six (6) Safety Relief Valves (SRVs)	**Acceptance Criterion Met**
		DBA Events	
		• Consequential Leak Assessment Secondary Side – Failure of the Emergency Water Supply Line Connected to a Steam Generator • Heat Transport Pump Gland Seal Failure – Failure of Primary and Backup Seals in One HTS Pump • Heat Transport Pump Gland Seal Circuit Failure – Guillotine Failure of the Gland Seal Pipe Downstream of the Last Check Valve; and • Steam Generator / Preheater Tube Failure - D_2O Feed/ D_2O Transfer System Unavailable	**Acceptance Criteria Met**
7	**Feedwater and Steam Supply System Failures**	AOO Events	
		• Leak in FW system • Total loss of FW supply • Asymmetrical FW events • Symmetric FW line break • Inadvertent opening of SRVs • Inadvertent closure of 1 MSIV • Turbine trip	**Acceptance Criteria Met**
		DBA Events	
		• Total loss of FW supply • Asymmetric FW line break • Small break in steam balance header or main steam line • Large break in steam balance header or main steam line • Turbine Trip	**Acceptance Criteria Met**

#	Accident Category	Events Analyzed	Analysis Conclusion
8	**Shutdown Cooling and Maintenance Cooling System (MCS) Failures**	AOO Events	
		• Loss of MCS Forced Circulation - HTS Drained and Open	**Acceptance Criterion Met**
		DBA Events	
		• Loss of MCS inventory due to pipe failure with HTS pressurized at 90°C without forced circulation	**Acceptance Criterion Met**
9	**Main Moderator and Moderator Auxiliary System Failures**	DBA Events	
		• Small and Large Loss of Moderator Inventory (LOMI) Inside Containment	**Acceptance Criterion Met**
10	**Shield Cooling System Failures**	• No events analyzed. Current Analysis of Record applicable to IPL	Current Analysis of Record applicable to IPL.
11	**Common Mode Events**	DBA Events	
		• Seismic event with chronic SG tube leakage, tritium from the moderator system inventory as it boils off, fuel bundles in IFP transfer mechanism and fuel bundles in fuelling machine in transit	**Acceptance Criterion Met**
12	**Legacy Design Basis Events (BDBAs by Frequency)**	• No events analyzed. Current Analysis of Record applicable to IPL	Current Analysis of Record applicable to IPL.