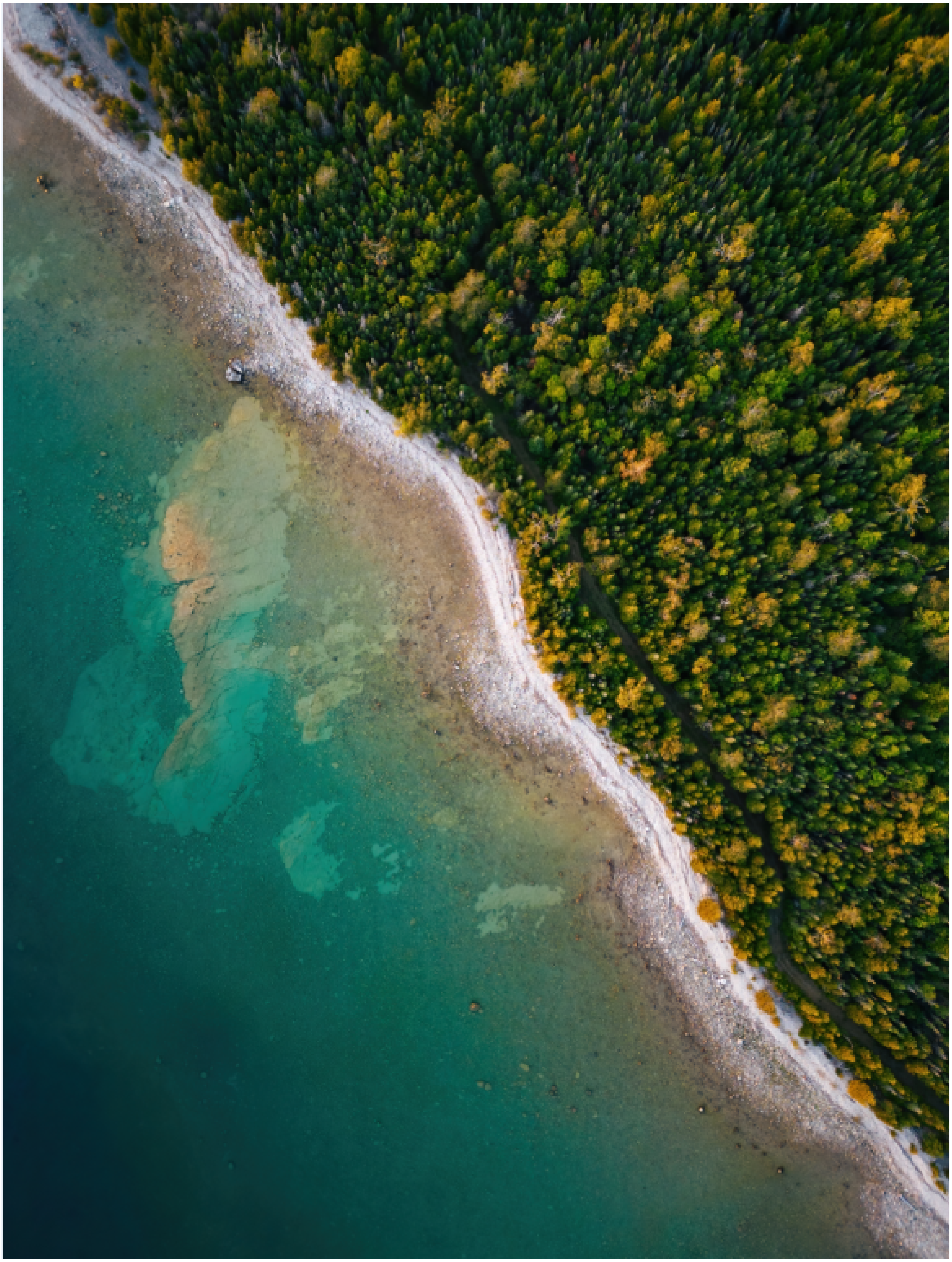


2023 Environmental Protection Report

B-REP-07000-00016

Master Created: 23Apr2024 1:28

PUBLIC

2023 ENVIRONMENTAL PROTECTION REPORT

B-REP-07000-00016

Rev 000

May 1, 2024

Prepared by: Joanna Moffat
Technical Officer, Environment & Sustainability

Verified by: Lyndsay Reid
SM, Environment Programs
Environment & Sustainability

Cherie-Lee Fietsch
Regulatory & Research Manager
Environment & Sustainability

Approved by: Danielle La Croix
Senior Director, Environment, Sustainability & Net Zero

Master Created: 23Apr2024 1:28

ABSTRACT OF PRESENT REVISION:

Initial Issue

ACKNOWLEDGEMENT

The Bruce Power site is located within the Saugeen Ojibway Nation Territory, the shared treaty and traditional Territory of the Chippewas of Saugeen First Nation and the Chippewas of Nawash Unceded First Nation (Neyaashiinigmiing). Bruce Power is dedicated to honouring Indigenous history and culture and is committed to moving forward in the spirit of reconciliation and respect with the Indigenous communities we work with. We are committed to strong and respectful relationships with the Saugeen Ojibway Nation, the Métis Nation of Ontario Region 7, the Historic Saugeen Métis.

Bruce Power appreciates the support of the local residents, businesses and communities surrounding the Bruce Power site who voluntarily take part in the environmental monitoring programs. Results from air monitoring equipment placed throughout the communities and local sample results from fish, honey, eggs, beef, poultry, grains, fruits, vegetables, animal feed and water help confirm a representative dose to public result.

EXECUTIVE SUMMARY

The purpose of this report is to fulfill regulatory requirements on environmental protection in accordance with Condition 3.3 of the Bruce A and B Power Reactor Operating Licence [R-1] and Canadian Nuclear Safety Commission Regulatory Document REGDOC-3.1.1 Reporting Requirements for Nuclear Power Plants [R-2].

International Organization for Standardization 14001, Environmental Management Systems Standard provides organizations the framework to improve environmental performance and protect the environment. Bruce Power had a successful re-registration audit in 2023 to acquire re-certification to the International Organization for Standardization 14001 standard. More details are described in Section 9.0.

The Canadian Standards Association N288 series of Standards and Guidelines provide overall direction on environmental management and protection for nuclear facilities and several are a requirement of the operating licence for the facility. Bruce Power has implemented the Canadian Standards Association N288 standards as per requirements of the Licence Condition Handbook [R-3].

Site Description

Bruce Power has safely operated the Bruce Nuclear Facility (referred to as the “Site” herein) located near Tiverton, Ontario since May 2001. The Site is located on the east shore of Lake Huron about 18 kilometres (km) north of Kincardine. The Site includes Bruce Nuclear Generating Station A (Bruce A) and Bruce Nuclear Generating Station B (Bruce B), which each comprise four CANDU reactors, as well as ancillary facilities. Currently, seven of the eight reactors are operational. One reactor (Unit 3) is undergoing a Major Component Replacement until 2023, with additional reactors (Units 4, 5 and 7) starting MCR within the next five years. Unit 6 has completed its Major Component Replacement and was returned to service in September 2023.

Environmental Protection

Bruce Power's Environmental Protection Program is built upon an integrated monitoring approach that strives to understand environmental impact, verify environmental protection, and continuously improve by driving strategic research and innovation through collaborations with industry and community. Environmental safety and responsibility are woven into all aspects of the company's nuclear safety culture, and Bruce Power commits to meet or exceed all relevant legal and voluntary environmental requirements. The company holds itself accountable to prevent pollution through strong management of emissions, effluents, and waste and implements robust spill mitigation measures in order to provide effective containment and control of contaminants.

Dose to Public

Each year Bruce Power gathers information in order to calculate the radiological dose to representative persons living near the Site. This includes meteorological data, analysis of local environmental media and Site radiological emissions and effluents that include all utilities near or within the Bruce Power Site boundary. Following the methodology outlined in Canadian Standards Association N288.1 and using a site specific environmental transfer model, a dose is calculated for each representative person at three age classes – adult, child and infant. A representative person is determined using the lifestyle characteristics identified in the Site Specific Survey and is defined as an individual who receives a dose that is representative of the most highly exposed individuals in the population. The most limiting result, or highest calculated dose, is used as the annual dose to public and is published annually in this report.

For the thirty-second consecutive year, Bruce Power's contribution to the annual dose of a member of the public is less than the lower threshold for significance (less than 10 microsieverts per year) and is considered *de minimus*. The maximum dose associated with Bruce Power operations in 2023 was obtained for the Bruce Subsistence Farmer (BSF2) Child who received 1.4 microsieverts per year. All other representative persons have a lower dose. This maximum dose is a small fraction of a percent of the legal limit of 1,000 microsieverts per year.

Representative Person	Committed Effective Dose	Percentage of Legal Limit
BSF2 Child	1.4 microsieverts per year	0.14%

Community Investment and Sustainability

Social responsibility and environmental stewardship are key values within Bruce Power's business model. We are dedicated to facilitating community partnerships and supporting local environmental projects through our Environment & Sustainability Fund, where funding is provided for initiatives that promote environmental conservation and restoration, energy efficiency and carbon emission reductions, climate change mitigation and resilience, and environmental education, awareness, and research. The Environment & Sustainability Fund saw the distribution of $400,000 across sponsorships, long-term partnerships, and events in 2023.

The Environment & Sustainability Fund is managed by Bruce Power's Sustainability Program and endorsed by Bruce Power's Environment & Sustainability Oversight Committee. Bruce Power's Sustainability Program takes a balanced approach to responsible business practices and ensures that our reporting aligns with global standards and best practices. Bruce Power supports provincial and federal carbon-reduction goals through our 2027 Net Zero Strategy and Green Financing initiatives.

In 2023, Bruce Power continued its work with the Alternative Land Use Services New Acre Project, which supports nature-based carbon sequestering opportunities and the protection and enhancement of local ecosystem across Bruce and Grey counties. and saw the distribution of their first annual progress report. The first year of involvement saw support distributed to 20 local farmers to establish and maintain 200 acres of locally led nature-based projects on marginal land. In 2023, farmers in Bruce and Grey Counties again met the 200-acre annual target, with 22 participants enrolling projects preliminary estimates of 2023 projects forecast 830 tonnes of CO_2 emissions removed over five years, subject to site visits and satellite review in 2024.

Bruce Power undergoes an annual process to obtain an Environment Social Governance Risk Rating which is completed by Morningstar Sustainalytics, a leading third-party Environment Social Governance Risk Rating agency. In 2023, Bruce Power was recognized on Morningstar Sustainalytics' 2023 list as "Environment Social Governance Industry Top Rated" and "Environment Social Governance Regional Top Rated". Being recognized with a strong Environment Social Governance Risk Rating continues Bruce Power's trend of annual improvement while maintaining a "Low Risk" ESG Rating, with 2023 being our lowest, and most favourable, Environment Social Governance Risk Rating of 12.6.

Environmental Risk Assessment

An Environmental Risk Assessment was prepared in 2022 following the guidance of Canadian Standards Association N288.6-12 which defines an Environmental Risk Assessment as a systematic process used to identify, quantify, and characterize the risk posed by contaminants and physical stressors in the environment on biological receptors (human and non-human biota), including the magnitude and extent of the potential effects associated with a facility [R-4]. The Environmental Risk Assessment demonstrates that the operation of the Bruce Nuclear Facility has not resulted in adverse effects on human health of nearby residents or visitors due to exposure to radiological or conventional substances and physical stressors. For non-human biota exposure to radiological or conventional substances also resulted in no adverse effects. A very low to negligible risk for non-human biota was observed because of exposure to physical stressors. Risks to ecological receptors from exposure to conventional substances were limited to specific areas on site and are detailed in 4.1. Where risks have the potential to be elevated, follow-up monitoring at specific locations was recommended. Implementation of follow-up recommendations is in progress in preparation for the submission of the next Environmental Risk Assessment in June of 2027.

Environmental Monitoring

The environmental monitoring program is designed to meet the requirements of Canadian Standards Association N288.4-10 [R-5]. This consists of both radiological environmental monitoring program, which is used to characterize dose to public annually, and non-radiological (conventional) environmental monitoring program. Together, environmental monitoring and assessment verifies that emissions and effluents as a result of site operations have a minimal impact on the surroundings. Environmental safety and responsibility are woven into all aspects of the company's nuclear safety culture, and Bruce Power commits to meet or exceed all relevant legal and voluntary environmental requirements. The company holds itself accountable to prevent pollution through strong management of emissions, effluents, and waste, and it implements robust spill mitigation measures in order to provide effective containment and control of contaminants.

Radiological Environmental Monitoring

The Radiological Environmental Monitoring program establishes a database of radiological activity measured in the environment near Bruce Power and determines the contribution of overall radiation dose to members of the public as a consequence of the radiological releases from normal operations on Site. The radiological environmental monitoring data implicitly reflects the cumulative impact of releases from all Bruce Power licensed facilities as well as facilities within or adjacent to the Bruce Power Site boundary that are owned by other parties. The program involves the annual collection and analysis of environmental media for radionuclides specific to nuclear power generation. The program design is based on risk and is informed by a radionuclide and exposure pathways analysis. Monitoring locations are conservatively selected to be representative of locations of exposure of representative persons and also based on practical considerations, including the availability of samples and participation of local residents and farmers. Sampling locations are grouped by proximity to site and these groups include indicator, area near and area far locations. Generally, radionuclide concentrations decrease with distance from site and all levels result in a *de minimus* dose. In 2023, as stated above, the maximum dose associated with Bruce Power operations was obtained for the Subsistence Farmer BSF2 Child who received 1.4 microsieverts per year which is less than the lower threshold for significance (less than 10 microsieverts per year).

Conventional Environmental Monitoring

The Conventional Environmental Monitoring Program collects information about non-radiological contaminants, physical stressors, and biological effects in the environment around Bruce Power. This data is analyzed every five years through an Environmental Risk Assessment process to determine potential impacts on both human and non-human biota. Bruce Power has a strong water quality monitoring program that continues to verify that effluent and emissions, as well as physical stressors imposed by facility operations, have little-to-no effect on the surrounding waterbody, and that Bruce Power has effective containment and effluent control measures in place. Fish impingement and entrainment losses in 2023 were consistent with prior years and well below the maximum loss permitted in Bruce Power's *Fisheries Act* Authorization, when losses of Round Goby (invasive species) and Gizzard Shad (for the period between February 6, 2023, and April 30, 2023) are excluded. Fish offsetting activities continued as planned in 2023, with monitoring in the Saugeen River in the vicinity of the former Truax Dam as per Bruce Power's Offsetting Plan. This year's results continue to show a positive net balance between fish productivity in the Saugeen River versus losses at Bruce A and Bruce B through impingement and entrainment. Results of thermal monitoring in Lake Huron in 2023 are being used for ongoing verification of the thermal risk assessment to address both the Ministry of Environment, Conservation and Parks environmental compliance approval conditions and analysis for the Environmental Risk Assessment. Long term biological effects monitoring of local wildlife populations continues to demonstrate diverse and abundant communities of amphibians, reptiles, birds, waterfowl, and fish.

Groundwater Protection

The Bruce Power Groundwater Protection Program is aligned with Canadian Standards Association N288.7-15, Groundwater Protection Programs at Class 1 Nuclear Facilities and Uranium Mines and Mills. The program is designed in consideration of a conceptual site model to achieve the overall groundwater protection goal to protect the quality and quantity of groundwater by minimizing the interactions with the environment from activities associated with Bruce Power thereby allowing the effective management of groundwater as a resource. The groundwater goals are achieved through the setting of objectives which were developed through a systematic planning process and form the basis of program performance monitoring. Performance against program objectives is evaluated at least annually which allows for continuous program improvements.

The results of the 2023 Groundwater Monitoring program demonstrate that groundwater quality on the Bruce Power site is within historical trending. There were no observations of unforeseen conditions which would represent potential adverse impacts to human health or the environment.

Effluent Monitoring

Results of the Effluent Monitoring program demonstrate that all conventional and radiological effluents (waterborne and airborne) are, and continue to be, well below regulatory limits.

Radiological Emissions and Effluent Monitoring

In 2023, all radiological releases continued to remain well below the Derived Release Limits. Bruce Power has several engineered barriers in place, where possible, to minimize radionuclides released to the environment and keep airborne emissions and waterborne effluent as low as reasonably achievable. These barriers in addition to systematic monitoring, trending and investigation of emissions and effluent, as required, assists Bruce Power in minimizing releases and ensuring they remain well below regulatory limits.

Conventional Effluent Monitoring

Air emissions and water effluents are controlled to meet regulatory requirements and to minimize impacts to protect the natural environment. Emissions and effluents are discharged according to specific licenses, permits, and regulations under (but not limited to) the *Environmental Protection Act* [R-6] and the *Ontario Water Resources Act* [R-7]. Bruce Power performs extensive modelling and monitoring of its emissions and effluent to ensure that releases occur within acceptable limits and environmental impact are minimized.

Waste Management

Bruce Power complies with all waste regulations and requirements of the relevant federal, provincial, and municipal authorities. Further, Bruce Power has taken an active role for many years to reduce all forms of waste: from an environmental and financial standpoint waste reduction is good for our company and the community in which we reside. Our philosophy employs a whole life-cycle approach in that we reduce waste at the consumer level, generate less waste at the company level, find opportunities to reuse products (on-site, off-site donations, or auction), and implement recycling programs that are available in the ever-changing recycling market. Wherever its fate, each waste stream generated at Bruce Power is processed and disposed of in a safe and environmentally responsible manner.

Table of Contents

1.0 INTRODUCTION

1.1 Purpose

The purpose of this report is to fulfill regulatory requirements on environmental protection in accordance with Licence Condition 3.3 of the Bruce A and Bruce B Power Reactor Operating Licence Bruce Nuclear Generating Stations A and B 18:03/2028 [R-1] and the Canadian Nuclear Safety Commission Regulatory Document REGDOC-3.1.1 Reporting Requirements for Nuclear Power Plants, Section 3.5 [R-2]. This report meets the content, timing and reporting requirements of REGDOC-3.1.1 [R-2].

1.2 Regulatory Requirements

1.2.1 Licence Requirements

Bruce A and B Power Reactor Operating Licence [R-1] and the associated Licence Condition Handbook [R-3] has Section 3.3 Reporting Requirements that require Bruce Power to notify and report in accordance with Canadian Nuclear Safety Commission regulatory document REGDOC-3.1.1, version 2 [R-2]. Environmental Protection is one safety control area which covers programs that identify, control, and monitor all releases of radiological, non-radiological and hazardous substances, and monitors the effects on the environment from the operation of facilities or as the result of licensed activities.

The environmental protection report is submitted annually to the Canadian Nuclear Safety Commission and contains information as required by REGDOC-3.1.1, version 2 section 3.5 [R-2] posted publicly a, Publications – Bruce Power.

Federal and Provincial regulations require licencees to monitor and report on the characteristics of airborne and waterborne effluent. Licencees are required to comply with any statutes, regulations, licences, or permits that govern the operation of the nuclear facility or licenced activity. The release of hazardous substances is regulated by both the Ontario Ministry of the Environment Conservation and Parks and Environment and Climate Change Canada through various acts and regulations, as well as by the Canadian Nuclear Safety Commission.

If the licencee is required to submit annual reports to other government departments concerning their environmental protection program, that show the results of the effluent/emission and environmental monitoring programs, sending a copy of the report to the Canadian Nuclear Safety Commission is acceptable. This satisfies the Canadian Nuclear Safety Commission's requirement for oversight of the Bruce Power environmental monitoring program.

1.2.2 Environmental Protection Program

Bruce Power's Environmental Protection Program is built upon an integrated monitoring approach that drives to understand environmental impact, verify environmental protection, and continuously improve by driving strategic research and innovation through collaborations with industry and community. Environmental safety and responsibility are woven into all aspects of the company's nuclear safety culture, and Bruce Power commits to meet or exceed all relevant legal and voluntary environmental requirements. The company holds itself accountable to prevent pollution through strong management of emissions, effluents, and waste and implements robust spill mitigation measures in order to provide effective containment and control of contaminants. To demonstrate environmental protection, Bruce Power performs extensive monitoring and modelling of radiological and conventional contaminants.

Bruce Power complies with Federal Regulations, programs, and standards which protect human health and the environment under the *Nuclear Safety and Control Act* [R-8]. The key elements are listed below:

- The *General Nuclear Safety and Control Regulations* [R-9] require every licensee to take all reasonable precautions to protect the environment and to control release of radioactive nuclear substances or hazardous substances within the site of the licensed activity and into the environment as a result of the licenced activity.

- The *Class 1 Nuclear Facilities Regulations* [R-10] set out environmental protection requirements that must be met.

- The *Radiation Protection Regulations* [R-11] prescribe radiation dose limits for the general public of 1 mSv (1000 μSv) per calendar year.

- Power Reactor Operating Licence 18.03/2028, Nuclear Reactor Operating Licence Bruce Nuclear Generating Stations A and B [R-1].

The Canadian Nuclear Safety Commission, when considering relicensing, has an obligation through the *Nuclear Safety and Control Act* [R-8] to consider whether an applicant will make adequate provision for the protection of the environment and the health and safety of people as outlined in REGDOC-2.9.1 Environmental Protection Policies, Programs and Procedures [R-12]. As a result, the Canadian Standards Association N288 standards are implemented through requirements set out in the License Condition Handbook [R-3].

REGDOC-2.9.1 [R-12] outlines the requirements needed for an environmental protection program consistent with the environmental management system standard, International Standards Association 14001, Environmental Management System [R-13]. BP-PROG-00.02, Environmental Management program that is used and followed to [R-14] implements its environmental protection program.

1.2.2.1 Canadian Standards Association N288 Series

The Canadian Standards Association N288 standards are part of a series of guidelines and standards on environmental management of nuclear facilities. Bruce Power will continue to strive to be industry best and implement newer versions of the Canadian Standards Association N288 series of environmental standards as they become available.

Bruce Power has implemented the following Canadian Standards Association standards that are relevant to the Canadian Nuclear Safety Commission's regulatory framework for environmental compliance:

- Canadian Standards Association N288.1-20, Guidelines for modelling radionuclide environmental transport, fate, and exposure associated with the normal operation of nuclear facilities [R-15];
- Canadian Standards Association N288.4-10, Environmental Monitoring Program at Class 1 nuclear facilities and uranium mines and mills [R-5];
- Canadian Standards Association N288.5-11, Effluent monitoring programs at Class 1 nuclear facilities and uranium mines and mills [R-16];
- Canadian Standards Association N288.6-12, Environmental Risk Assessments at Class 1 nuclear facilities and uranium mines and mills [R-17]; and
- Canadian Standards Association N288.7-15, Groundwater Protection Programs at Class 1 nuclear facilities and uranium mines and mills [R-18].
- Canadian Standards Association N288.8-17, Establishing and implementing action levels for releases to the environment from nuclear facilities [R-19].

Bruce Power is proactively implementing N288.0-22, Environmental management of nuclear facilities: Common requirements of the Canadian Standards Association N288 series of Standards. This standard is required to be implemented when moving to the new versions (2022 onwards) of the N288 standards.

Bruce Power is following the guidance provided in Canadian Standards Association N288.9-18, Guideline for design of fish impingement and entrainment programs at nuclear facilities [R-20]. This standard is currently under review and will enhance the fish impingement and entrainment programs. Canadian Standards Association N288.3.4-13, Performance testing of nuclear air-cleaning systems at nuclear facilities [R-21] is also being used.

1.2.2.2 Environmental Management System (International Organization for Standardization 14001 Standard)

International Standards Association 14001 [R-22] specifies the requirements for an environmental management system that an organization can use to enhance its environmental performance. The standard is used to manage its environmental responsibilities in a systematic manner that contributes to environmental sustainability and ensures environmental protection.

In 2023, Bruce Power had a successful re-registration audit to confirm that Bruce Power operates an Environmental Management System compliant with the requirements of

International Standards Association 14001:2015 [R-22]. The new certification is valid for an additional three years (2023-2026).

The Bruce Power environmental management system program oversees the planning, implementation, and operation of integrated activities, with a focus on minimizing the potential adverse impact of Bruce Power operations on the environment. This includes ensuring the Bruce Power's Environmental Safety Program as defined by BP-PROG-00.02, Environmental Management [R-22], conforms to the International Standards Association 14001 standard for Environmental Management System [R-22], environmental compliance obligations applicable to Bruce Power and the commitments made in the Environmental Policy.

The Environmental Management System serves as the management tool for integrating pollution prevention, changing environmental conditions (climate change), sustainability and environmental protection measures in a documented, managed and auditable process. The Environmental Management System at Bruce Power is implemented cohesively within the Bruce Power Management System implemented in accordance with Canadian Standards Association N286-12, Management System Requirements for Nuclear Facilities standard [R-23].

Environment and Sustainability Policy

The Environment & Sustainability Policy (2021) describes sustainability principles, addresses work in strategic research and innovation, and demonstrates our commitment of meeting or exceeding requirements. The Environment & Sustainability Policy establishes guiding principles and environmental expectations for employees and those working on behalf of Bruce Power. The Environmental Policy reflects the commitment of Bruce Power to protect the environment and states that you can count on Bruce Power to:

- Ingrain a healthy nuclear safety culture which promotes nuclear safety, radiological safety, industrial safety and environmental safety and sustainability;
- Commit to excellence by meeting or exceeding all relevant legal and voluntary requirements to which Bruce Power subscribes;
- Understand our environmental impact and verify environmental protection through monitoring the environment, collaborating with industry and the community, and driving related strategic research and innovation;
- Focus on continuous improvement by adopting applicable industry best practices and requirements of International Organization for Standardization 14001;
- Ensure our business decisions support the application and practice of sustainability principles by protecting, conserving, and restoring our resources through energy conservation, reducing water consumption, supporting waste diversion, and considering product life cycle in our Supply Chain;

- Hold ourselves accountable to prevent pollution through robust management of emissions, effluents and waste, as well as implementation of spill mitigation measures;
- Promote environmental stewardship and awareness at work, in the community, and across Ontario;
- Uphold the trust of the community through open and transparent communication with partners, Indigenous Nations, and stakeholders on environmental interests;
- Play a leading role in keeping the air clean and fighting climate change; supporting emissions reductions strategies to achieve a Net Zero Canada by 2050; adopting ambitious net reduction strategies for Bruce Power to achieve Net Zero (Greenhouse Gas); and
- Support partners, communities and organizations to drive innovations and projects to offset and sequester carbon in a real and tangible way.

2.0 BACKGROUND

The Site is located in the Municipality of Kincardine on the eastern shore of Lake Huron within Bruce County. The Municipality of Kincardine is comprised of the town of Kincardine and several small villages and towns including Inverhuron and Tiverton. The area is a popular tourist destination with many cottages and holiday parks attracting visitors from across Ontario, Canada and the United States. The next closest municipality to the Site is the Town of Saugeen Shores, which is approximately 25 kilometres from the Site. The Town of Saugeen Shores includes Southampton and Port Elgin.

Bruce County can be broadly split into three sections: (i) the Bruce Peninsula, part of the Niagara Escarpment, (ii) the Lakeshore that includes a number of sandy beaches and fresh water, and (iii) the Interior Region, also known as the “breadbasket” which has a strong history of farming and agriculture. Bruce County has economic strengths in many sectors including tourism, agriculture and energy. The 2021 Census showed a population of 12,268 people in the Municipality of Kincardine (an increase of 7.7% from 2016) and a population of 15,908 in the Town of Saugeen Shores (an increase of 16% from 2016), which includes Southampton and Port Elgin. Both municipalities are in Bruce County, which has a total population of 73,396 (an increase of 7.7% from 2016).

2.1 Bruce Power Site

Bruce Power has been safely operating the Bruce Nuclear Facility (referred to as the “Site” herein) located near Tiverton, Ontario since May 2001. The Site is located on the east shore of Lake Huron about 18 kilometres north of Kincardine. The Site includes Bruce Nuclear Generating Station A (Bruce A) and Bruce Nuclear Generating Station B (Bruce B), which each comprise four CANDU reactors, as well as ancillary facilities. The Site also encompasses lands currently occupied by Ontario Power Generation, Canadian Nuclear Laboratories Douglas Point and Hydro One.

Currently, seven of the eight reactors are operational, and the facility also includes radioactive waste storage among other supporting facilities. Unit 3 at Bruce A is undergoing Major Component Replacement followed by Unit 4 in 2025.

2.1.1 Life Extension Program and Major Component Replacement

In December 2015, Bruce Power reached an agreement with the Independent Electricity System Operator to advance a long-term investment program to refurbish its nuclear fleet and secure the site's operation until 2064.

The Life-Extension Program started planning activities on January 1, 2016 and involves the gradual replacement of older systems in the company's eight reactor units during routine maintenance outages.

As part of the Life-Extension program, Bruce Power is carrying out an intensive Major Component Replacement project. The Major Component Replacement project activities began in January 2020 and focuses on the replacement of key primary side components in Units 3 to 8, including steam generators, pressure tubes, calandria tubes and feeder tubes.

Minor modifications were completed for existing Environmental Compliance Approvals as required. These were within the operational flexibility of the Environmental Compliance Approval and did not impact the environmental limits for effluent. As of February 2024, there were no environmental infractions related to the Life Extension program or Major Component Replacement project. Environment personnel continue to perform as key stakeholders in Life Extension and Major Component Replacement projects, providing document reviews and feedback throughout all stages of planning and execution. The Environment staff conduct routine field walk downs and observations; ensuring oversight on activities which have the potential to impact the environment and providing timely guidance on mitigation measures where appropriate.

Environmental Management Plans are created to manage potential environmental risks and mitigation strategies related to the larger project scopes of work. The Environmental Management Plans are developed to provide project execution vendors with key information regarding the environmental aspects of the activities covered in their scope of work, including conventional and radiological emissions, hazardous and conventional waste, and spills management. The Environmental Management Plans also provide the execution owner with awareness on items such as regulatory requirements and event reporting expectations. For the remainder of smaller scope planned evolutions, an Environmental Management Plan may not be appropriate but Environmental Impact Workflows are utilized to perform an environmental impact assessment of the activity. Environmental Impact Workflows prompt for a description of the activity being performed and contain a series of questions which allows for environment personnel to then assess the risk and provide relevant guidance to ensure any potential environmental risk the activity poses are appropriately managed and mitigated.

The Unit 6 Major Component Replacement project was completed and returned to service in September 2023 with minimal environmental impact as anticipated in the 2017 Predictive Environmental Risk Assessment. There were several lessons learned that were addressed through our corrective action program so that they will be applied to future Major Component Replacement projects to ensure continued environmental protection.

The Unit 3 Major Component Replacement project started with breaker open on March 01, 2023 and was safely taken into a defueled guaranteed shutdown state and the lead in vault work completed. Crews then drained and dried the Primary Heat Transport system. The Moderator system was then drained and dried in early 2024. The removal series of work that started in mid-2023 will continue with the removal of the upper and lower feeders as well as the pressure tubes and calandria tubes into 2024.

Construction and refurbishment of buildings was completed for Unit 3 Major Component Replacement project at Bruce A including a material handling building to support transfer of materials from the un-zoned area into Unit 3, refurbishment of spaces at Bruce A for offices for additional personnel, an Auxiliary Guardhouse for Bruce A, and the completion of construction trailers for the crane pad.

Environment assessment and guidance is integrated throughout all the Major Component Replacement projects; starting at the planning stage and continuing through execution to ensure that Environmental Management Plans and Environmental Impact Workflow guidance and requirements are adhered to. As the execution of Unit 3 Major Component Replacement project progresses, planning and preparation for future Major Component Replacement projects is ongoing while ensuring that previous experience and lessons learned are being incorporated.

2.1.2 Bruce C Project

To support Ontario's long-term energy needs and climate change goals, Bruce Power is evaluating the feasibility of expanding its nuclear fleet, to create an option to grow Ontario's nuclear capacity. This project, called the Bruce C Project, will undergo an Impact Assessment to consider adding 4800 megawatts of nuclear capacity to the Bruce site. Bruce Power is advancing the process with a focus on Indigenous and public engagement. Bruce Power has also launched a Request for Information process to evaluate potential new nuclear technologies in 2024. New nuclear is an integral part of a clean energy future in Ontario, Canada and around the world. Before any final decision is made to proceed with the Bruce C Project, long-term planning and open and transparent engagement with Indigenous Nations and communities and the broader region will be conducted.

2.1.3 Ontario Power Generation Land and Facilities

The Western Waste Management Facility is owned and operated by Ontario Power Generation. It is located centrally on the Bruce site and is designated for the management of radioactive waste and licensed for such use by the Canadian Nuclear Safety Commission. This 19-hectare facility contains the Low and Intermediate Level Waste storage area and the used fuel dry storage area [R-24].

The objectives of the Western Waste Management Facility are to provide safe material handling (receipt, transfers, and retrieval), treatment, and storage of radioactive materials produced at nuclear generating stations and other facilities currently or previously operated by Ontario Power Generation or its predecessor, Ontario Hydro. This facility also provides safe storage of Bruce Power's used fuel in Dry Storage Containers until it can be transported to an alternative long term used fuel storage or disposal facility. The used fuel dry storage area is a security protected area located northeast of the Low and Intermediate Level Waste storage area and consists of Dry Storage Containers processing and storage buildings.

The Low and Intermediate Level Waste portion of the facility consists of various structures such as the Amenities Building, Waste Volume Reduction Building, Transportation Package Maintenance Building, low level and intermediate level waste storage buildings, quadricells, in ground containers, trenches, and tile holes. These structures are primarily used for processing of low-level waste and storage of Low and Intermediate Level Waste from Ontario Power Generation's Pickering and Darlington Nuclear Generating Stations as well as Bruce Power operations.

2.1.3.1 Ontario Power Generation Western Waste Management Facility

The Ontario Power Generation Western Waste Management Facility operates under a Waste Facility Operating Licence (WFOL-W4-314.00 2027) [R-25] and monitors emissions in accordance with Ontario Power Generation's N-STD-OP-0031 Monitoring of Nuclear and Hazardous Substances in Effluents [R-26]. N-STD-OP-0031 establishes the minimum standards for monitoring airborne and waterborne releases for Ontario Power Generation nuclear facilities in accordance with Canadian Standards Association N288.5 [R-27]. The effluent monitoring program ensures emissions are maintained well below the Derived Release Limits established in the Licence Condition Handbook (LCH-W4-314.00 2027) [R-28] and provides for early detection of potential adverse trends. The effluent monitoring results are reported quarterly to the Canadian Nuclear Safety Commission by Ontario Power Generation. The effluent monitoring program is reviewed and updated as necessary to ensure it is inclusive of changing site conditions (e.g., expansions and aging management), historic performance, updated standards and industry best practices.

The efficacy of the effluent monitoring program is also assessed by the Western Waste Management Facility specific Environmental Risk Assessment process and the Environmental Monitoring Program. The Environmental Risk Assessment and Environmental Monitoring Program are completed in accordance with Canadian Standards Association N288.6 and N288.4 [R-5] [R-29]. The Environmental Risk Assessment is updated at a minimum of once every five years and the Environmental Monitoring Program is reviewed annually.

The most recent Western Waste Management Facility Environmental Risk Assessment update was completed in 2021 [R-30]. The conclusions of the Environmental Risk Assessment and the Environmental Monitoring Program indicate that there are no adverse effects to human health or to the local community level ecology from the operation of the Western Waste Management Facility [R-24]. The Environmental Risk Assessment and Annual Environmental Monitoring Program reports are available to the public on Ontario Power Generation's website [R-31].

2.1.4 Canadian Nuclear Laboratories Lands and Facilities

The Douglas Point Waste Facility is operated by Canadian Nuclear Laboratories and is located on the Bruce Nuclear Power Development Site. Douglas Point, which operated between 1966 and 1984, was the prototype commercial-scale Canada Deuterium Uranium (CANDU) nuclear power plant. With full operation commencing in 1968, the Douglas Point Generating Station supplied 220 Megawatts to the Ontario grid over the next 16 years. Eventually a decision was made to shut down Douglas Point rather than undertake the refurbishment of the pressure tubes that was required for continued operation. While the Douglas Point facility structures remain in place today, the reactor has been permanently shut down since 1984. Used fuel from the reactor is stored in dry storage modules at the facility. Decommissioning of the Douglas Point Facility is progressing with a 2070 timeline for completion. The decommissioning plans for the coming years include the dismantling of non-nuclear buildings and nuclear support buildings. The reactor and its building are anticipated to be decommissioned after 2030 [R-32].

In 2020, the facility was in Phase 2 of decommissioning, known as “Storage with Surveillance”. In 2021, the Canadian Nuclear Safety Commission amended the decommissioning licence to allow Canadian Nuclear Laboratories to begin Phase 3 of the five-phase process of decommissioning activities [R-33].

2.1.5 Hydro One Lands and Facilities

Hydro One owns and operates a number of assets within Bruce Site. These include, but are not limited to, office and workshops for maintenance, switchyards at Bruce A and Bruce B, switching stations and transformer stations, and transmission corridors [R-34].

2.2 Nuclear Processing Facilities Near Site

2.2.1 Kinectrics’ Ontario Nuclear Services Facility

Kinectrics’ Ontario Nuclear Services Facility is located in Tiverton, Ontario, approximately 3 kilometres from the Bruce Site. The site has an approximate footprint of 16.66 hectares and houses one building with an approximate footprint of 3440 square metres. The facility functions as a radioactive workspace to decontaminate and refurbish large nuclear reactor tools and equipment used during reactor maintenance activities during outages [R-35].

Kinectrics carries out effluent monitoring activities on both airborne tritium releases through exhaust stacks and on liquid releases to sewer, following Kinectrics’ effluent monitoring procedures. Specifically:

- Kinectrics’ Waste Nuclear Substance Licence requires releases to air to be monitored for tritium only at Kinectrics’ Ontario Nuclear Services Facility, since particulates are caught in pre-filters and High Efficiency Particulate Air filters prior to exhaust. Tritium releases through exhaust stacks are continuously sampled, and analysis of the samples is conducted weekly [R-36].

- Potentially active wastewater is temporarily stored in collection tanks and sampled and analyzed prior to release. If any radiological or chemical contaminant is found to be above administrative control levels, which are set below the Waste Nuclear Substance Licence limits, then the tank contents are filtered through two charcoal filters and then re-analyzed. All releases are maintained below the Waste Nuclear Substance Licence limits [R-36]. The processes at Kinectrics' Ontario Nuclear Services Facility produce very small volumes of liquid waste, hence discharge to the environment is not required often (less than once per year).

2.2.2 Laurentis' Western Clean-Energy Sorting and Recycling Facility

The Western Clean-Energy Sorting and Recycling Facility is owned by Laurentis Energy Partners, a subsidiary of Ontario Power Generation, and is located near Tiverton, Ontario, approximately 3 kilometres from the Bruce Power Site. The site has a footprint of approximately 1.32 hectares and houses one building with an approximate footprint of 3800 square metres. The facility function is the sorting and segregation of Utilities Low Level Radioactive Waste for the purposes of volume reduction. All radioactive waste received at the facility is subject to waste acceptance screening, to ensure only low level radioactive waste is accepted. [R-37]

EnergySolutions carries out effluent monitoring of the high efficiency particulate air filtered, facility stack exhausts, as per their Waste Nuclear Substance License requirements. Contaminants in the stack emissions consist of tritium only since particulates are caught in pre-filters and high efficiency particulate air filters prior to exhaust. Tritium releases through exhaust stacks are continuously sampled, and analysis of the samples is conducted bi-weekly. There is no liquid effluent release from the facility. [R-37]

2.3 Canadian Nuclear Safety Commission, Independent Environmental Monitoring Program

The Canadian Nuclear Safety Commission has implemented its Independent Environmental Monitoring Program to verify that the public and the environment around licensed nuclear facilities are safe. It is separate from, but complementary to, the Canadian Nuclear Safety Commission's ongoing compliance verification program. The Independent Environmental Monitoring Program involves taking samples from publicly accessible areas around the facilities and measuring and analyzing the amount of radiological (nuclear) and hazardous substances in those samples. Canadian Nuclear Safety Commission staff collect the samples and send them to the Canadian Nuclear Safety Commission's state-of-the-art laboratory for testing and analysis. [R-38] Since the implementation of the Independent Environmental Monitoring Program, the area outside of the Bruce Nuclear Generating Station perimeter was sampled in 2013, 2015, 2016, 2019 and 2022. [R-39] [R-40]

The sampling plans focus on measuring concentrations of contaminants in the environment at publicly accessible locations such as parks, residential communities and beaches, and in areas of interest identified in Environmental Risk Assessments. Samples of air, water, soil, sediment, sand, vegetation, and some local food may be taken. [R-38]

The Canadian Nuclear Safety Commission has also conducted a large study to look at radiation exposure and the incidence of cancer around Ontario nuclear generating sites, including the Bruce Power site. This study concluded that doses to the public were well below levels of natural background radiation and that people who live near nuclear generating sites have no excess cancer risk and are as healthy as the rest of Canada's general population [R-41].

2.3.1 2022 Independent Environmental Monitoring Program Results

The 2022 Independent Environmental Monitoring Program sampling plan for the Bruce A and B nuclear generating stations site focused on radiological and hazardous substances. A site-specific sampling plan was developed based on the licensee's approved environmental monitoring program and the Canadian Nuclear Safety Commission's regulatory experience with the site. The Canadian Nuclear Safety Commission endeavors to incorporate traditional Indigenous land use, values and knowledge by engaging with Indigenous Nations and communities on the sampling plan.

In advance of the 2022 sampling campaign, Indigenous Nations and communities near the facility were invited to review the plan and provide input on species of interest, valued components, and potential sampling locations where traditional practices and activities may take place. In addition, representatives joined the field team to participate in sampling and learn about the equipment and procedures used. Continuing the work completed during the 2019 Bruce Power site Independent Environmental Monitoring Program, plantain, eastern white cedar, cat tails (roots and leaves/flowers), and balsam fir were sampled again at the same locations as in 2019. Milkweed and creeping juniper were added to the sample plan for 2022 at the request of the Saugeen Ojibway Nation. Community members also provided samples of whitefish and trout from Lake Huron.

In July 2022, the Canadian Nuclear Safety Commission collected air, water, soil, sand, sediment, vegetation, and food samples in publicly accessible areas outside the facility perimeter. The levels of radiological and hazardous substances measured in air, water, soil, sediment, vegetation, food were below available guidelines and the Canadian Nuclear Safety Commission screening levels. These screening levels are based on conservative assumptions about the exposure that would result in a dose of 0.1 millisieverts per year (one-tenth of the regulatory public dose limit of 1 millisieverts per year).

Measurements conducted by the Independent Environmental Monitoring Program to date have consistently found levels of radioactivity in the environment to be low, and well within the range of natural background radiation levels. As a result, no effects on human health are expected.

2.3.2 Independent Environmental Monitoring Program Conclusions

Independent Environmental Monitoring Program results from 2013, 2015, 2016, 2019, and 2022 are consistent with the results submitted by Bruce Power and Ontario Power Generation, supporting the assessment that the licensee's environmental protection program is effective. The results add to the body of evidence that people and the environment in the vicinity of the Bruce A and B nuclear generating stations site are protected and that there are no anticipated health impacts from the operation of the facilities on the site.

2.4 Local Indigenous Nations

The Bruce Power site is located within the Saugeen Ojibway Nation Territory, the shared treaty and traditional Territory of the Chippewas of Saugeen First Nation and Chippewas of Nawash Unceded First Nation (Neyaashiinigmiing).

Bruce Power is dedicated to honoring Indigenous history and culture and is committed to moving forward in the spirit of reconciliation and respect with the Indigenous Nations we work with. We are committed to strong and respectful relationships with the Saugeen Ojibway Nation (SON), the Métis Nation of Ontario Region 7, and Historic Saugeen Métis.

Bruce Power realizes each community has a unique set of interests which best suits their communities and continues to make progress on the commitments presented during the 2018 licence renewal hearing. In 2023, collaboration to better understand Bruce Power's impact on the natural environment included:

- Saugeen Ojibway Nation's Coastal Waters Monitoring Program continued for the fifth consecutive year. Results from this program are used in conjunction with environmental monitoring results in the Environmental Risk Assessment to better understand the near shore environment of Lake Huron over a larger spatial scale.

- Bruce Power engaged the Indigenous Nations on the thermal risk assessment which was part of the Bruce A thermal flexibility Environmental Compliance Approval (ECA) application. Discussions on thermal effluent and changing environmental conditions contributed to the request for a five-year thermal flexibility within the Bruce A ECA.

- Bruce Power also engaged the Indigenous Nations and communities on a higher-than-expected amount of Gizzard Shad which were impinged between February and April 2023. This event is discussed further in Section 6.2.2.

Bruce Power continues to build and develop dialogue on environmental items of interest with Indigenous Nations and communities. Sharing and insights have strengthened our approach and have led to synergies for growth and partnership for continued environmental protections.

2.4.1 Saugeen Ojibway Nation

The Saugeen Ojibway Nation is comprised of the Chippewas of Nawash Unceded First Nation and the Chippewas of Saugeen First Nation. They are Indigenous Peoples of the Grey and Bruce region, which they know as Anishnaabekiing. Their Territory includes the lands and waters that surround the Site. The Saugeen Ojibway Nation has two main on-reserve communities which are located approximately 30 kilometres (Chippewas of Saugeen First Nation Reserve Number 29) and 80 kilometres north of the Site (Cape Croker Reserve Number 27). The Saugeen Ojibway Nation also has two hunting ground reserves that are located approximately 115 kilometres north of the Site. The Saugeen Ojibway Nation's Territory is identified in Figure 1.

Figure 1 - Saugeen Ojibway Traditional Territory [R-42]

The Saugeen Ojibway Nation describes their asserted and established Aboriginal and treaty rights as follows:

"Saugeen Ojibway Nation has asserted and proven Aboriginal and Treaty rights throughout its Traditional Territory and continues to rely on this Territory for its economic, cultural, and spiritual survival. The Saugeen Ojibway Nation Territory, including its large reserves, is also the basis of significant and growing commercial fishing and tourism economies. Saugeen Ojibway Nation asserts its Aboriginal and Treaty rights entitle its members to be sustained by the lands, waters and resources of their Traditional Territory. Saugeen Ojibway Nation has the right to protect and preserve its Traditional Territory to ensure that it will be able to sustain its future generations. Saugeen Ojibway Nation asserts that its rights include, but are not limited to:

- The right to continue to be a distinct people living within their Traditional Territory;
- The right to maintain their culture, language and way of life;
- The right to be sustained by the lands, waters and resources of their Traditional Territory;
- The right to the exclusive use and occupation of their communal lands;
- The right to continued use of all of their Traditional Territory;
- The right to harvest for sustenance, cultural and livelihood purposes;
- The right to be meaningfully involved in decisions that will affect their Traditional
- Territory so that they can protect their way of life for many generations to come; and
- The right to be the stewards of their Traditional Territory.

Saugeen Ojibway Nation has a proven an exclusive Aboriginal and Treaty Right to a commercial fishery in the waters of Georgian Bay and Lake Huron, within Saugeen Ojibway Nation Territory. Members of Saugeen Ojibway Nation and their ancestors have been fishing these waters for sustenance and as the basis of trade and commerce for many hundreds of generations, and they continue to do so today. This fact has been recognized by the courts and by the Crown. While Lake Whitefish have significant cultural and economic significance to Saugeen Ojibway Nation - and have consequently been discussed at length in past proceedings and in these submissions - Saugeen Ojibway Nation's fishing rights are not species specific and include the right to harvest all species of fish" [R-43] [R-44].

2.4.2 Historic Saugeen Métis

The Historic Saugeen Métis is a self-governing Métis community at the mouth of the Saugeen River in Southampton, Ontario. The Historic Saugeen Métis are an independent community that began with the arrival of trader Pierre Piché in the Saugeen territory in 1818. Its members have historically hunted, fished, traded and lived in the Saugeen territory since the early 1800s and assert harvesting rights based on the R. v. Powley decision of the Supreme Court of Canada. The Historic Saugeen Métis became independent and self-governing in 2008 and left the Métis Nation of Ontario in or around 2009. This Métis community is one of the formally organized Métis communities in Ontario that is not represented by the Métis Nation of Ontario. Its office is found in Southampton. According to the Historic Saugeen Métis website, the Historic Saugeen Métis [R-45]: "…*are a distinctive Aboriginal community descended from unions between our European traders and Indian women. We are the Lake Huron watershed*

Métis with a unique Métis history and culture that lived, fished, hunted, trapped, and harvested the lands and waters of the Bruce Peninsula, the Lake Huron proper shoreline and its watersheds, their traditional Métis territory."

The Historic Saugeen Métis traded in a regional network since the early 1800s as far as the north shore of Lake Huron and have kinship with the Wikwemikong First Nations community and Killarney Métis community. The geographic scope of the contemporary community is described as covering over 275 kilometres of shoreline from Tobermory and south of Goderich, and includes the counties of Bruce, Grey and Huron. Upon the decline of the fur trade in the early 1820s, Métis families from the Northwest joined these early Métis at Goderich. The community traded in a cohesive regional trading network that extended from the Upper Detroit River system to the northern shoreline of Lake Huron, to the historic Métis community of Killarney, creating kinship along the network from Detroit to Killarney."

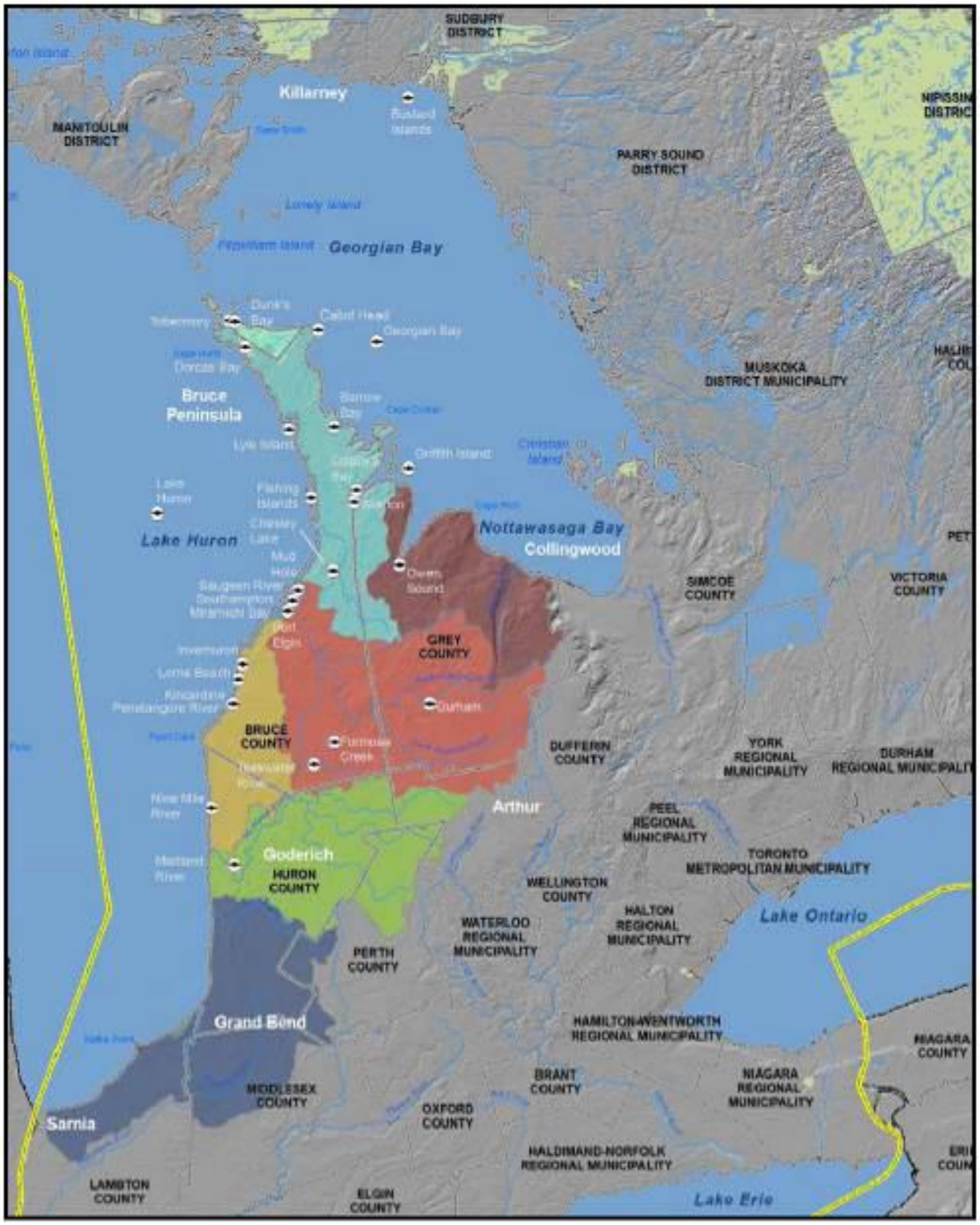


Figure 2 - Fish Harvesting Locations of the Historic Saugeen Métis [R-46]

2.4.3 Métis Nation of Ontario

The Métis Nation of Ontario was established in 1993 "as a representative organization with the objective to protect, assert, and support the distinct culture, traditions, economic wellbeing, and Métis constitutional rights embodied in the *Constitution Act*, 1982, Section 35, within the Métis Homelands of Ontario" [R-47]. The Métis Nation of Ontario has 29 community councils across Ontario, which represents regional rights bearing Métis communities. Four of these councils (Moon River Métis Council, Georgian Bay Métis Council, Great Lakes Métis Council and Barrie South-Simcoe Métis) represent a regional right bearing community. These four councils (collectively known as "Georgian Bay Regional Consultation Committee") are distinct from the Historic Saugeen Métis which are no longer part of the Métis Nation of Ontario. The Métis Nation of Ontario and the Georgian Bay Regional Consultation Committee assert that their people exercise Aboriginal rights across the Georgian Bay Traditional Harvest Territory (Figure 3). This includes hunting, fishing, trapping, gathering, sugaring, wood harvesting, use of sacred and communal sites, and use of water as described in the Métis Nation of Ontario's Oral Presentation to the Canadian Nuclear Safety Commission in the public hearing for Bruce Power's application to renew its operating licence in 2015: "*The Métis Nation of Ontario and their Regional Consultation Committee assert that their people exercise Aboriginal rights throughout the territory surrounding the Bruce site, including, among other things, hunting, fishing (food and commercial), trapping (food and commercial), gathering, sugaring, wood harvesting, use of sacred and communal sites (i.e., incidental cabins, family group assembly locations etc.) and use of water. These rights are protected under the Constitution Act, 1982, section 35, as existing Aboriginal rights that have not been extinguished by the Crown by way of treaty or other means. Métis peoples live in, harvest throughout and extensively rely on their traditional territories for their individual and community's wellbeing*" [R-47].

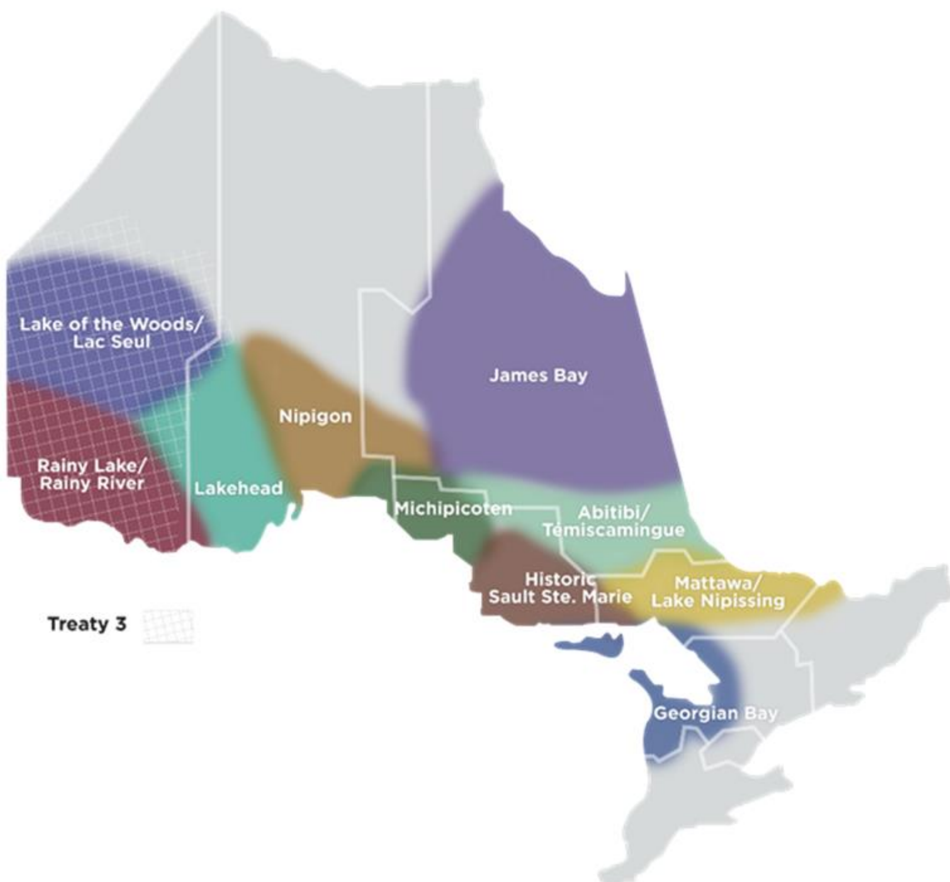


Figure 3 - Métis Nation of Ontario Traditional Harvesting Map [R-47]

2.5 Bruce Power's Community Engagement

2.5.1 Community Investment and Sustainability

Social responsibility is a core value at Bruce Power. We are dedicated to strengthening our communities and protecting the environment to secure tomorrow. Bruce Power invests upwards of $2 million annually to support initiatives that focus on health and wellness, youth development, minimizing environmental impacts, community engagement, and Indigenous youth development and cultural, recreational, and educational programming. This is executed through five funding streams: Community Investment and Sponsorship, Environment & Sustainability, Indigenous Community Investment, Gifts in Kind, and Tripartite.

Bruce Power's Environment and Sustainability Fund is responsible for the continued support of environment and sustainability-related projects and initiatives. Established in 2015, the

Environment and Sustainability Fund seeks opportunities to partner with organizations on initiatives related to:

- Environmental conservation and restoration,
- Energy efficiency and carbon emission reduction,
- Climate change mitigation and resilience, and/or
- Environmental education, awareness, and research

Initiatives local to Bruce, Grey, and Huron counties are prioritized for funding given their proximity to the Bruce Power site. In 2023, The Environment and Sustainability Fund provided support to various groups and environmental initiatives, including:

- **Bruce County Museum & Cultural Centre**: This partnership allowed for a virtual Earth Week program to be offered, including presentations from local experts on biodiversity and species at risk. The digital format provided the opportunity to reach students and families from across the Bluewater and Bruce Grey Catholic District School boards, and beyond.
- **The Lake Huron Coastal Centre's Coast Watchers Program**: A citizen scientist program where local volunteers are trained to observe the coast, record qualitative and quantitative shoreline conditions, and take steps to initiate action when necessary, including beach clean-ups and habitat preservation.
- **The Maitland Valley Conservation Authority**: This project supported stream restoration, dam removal, and tree planting projects with local landowners and community groups to improve water quality in cold-water tributaries and nearshore waters.
- **The Nature Conservancy of Canada's Baptist Harbour Alvar Project**: This project site is located on a 24-hectare property near Tobermory and supports some of the rarest alvars in the world. The project supports the protection of an ecologically important habitat that is home to at-risk species such as Hill's thistle, dwarf lake iris, and eastern Massasauga rattlesnake, and serves as an important wildlife corridor for larger animals (e.g., black bears and deer).

Bruce Power is committed to prioritizing environmental protection and minimizing environmental impact across the business operations and supporting provincial, national, and global sustainability goals. We continue to make strides towards our ambitious target of achieving net zero greenhouse gas emissions by 2027. Through our 2027 Net Zero Strategy, which was released in 2022, we have identified and implemented energy and emission reduction, substitutions, and offsetting actions to achieve these targets. Bruce Power met its emission reduction target of 25% from baseline in 2023. Two initiatives significantly contributed to this:

- The frequency and duration of the Bruce A standby diesel generator safety system tests were reduced starting in fall of 2022. This reduced fuel consumption and resulted in a reduction of 650 tonnes of Scope 1 emissions.

- In November 2022, the Condensate Plant (building B13) was vacated. This contributed to reduced Site steam consumption and resulted in a reduction of 1,030 tonnes of Scope 2 emissions.

To continue to drive towards emission-reduction goals, Bruce Power, through a partnership with the Nuclear Innovation Institute, is supporting the Alternative Land Use Services New Acre Project. This local carbon-offset project, funded by the Carbon Offset Accelerator Fund, supports carbon sequestering opportunities and the protection and enhancement of local ecosystem across 600 acres of nature-based projects on agricultural land across Bruce and Grey counties.

In June 2023, the Alternative Land Use Services New Acre Project released the first annual progress report on Bruce Power's nearly $1 million, three-year investment in farmer-delivered nature-based climate solutions. The first year of involvement saw support distributed to 20 local farmers to create 200 acres of nature-based projects which were expected to sequester 2,737 tonnes of carbon dioxide emissions over five years. Farmers in Bruce and Grey Counties again met the 200-acre annual target in Year 2, with 22 participants enrolling projects. Preliminary estimates of 2023 projects forecast 860 tonnes of carbon dioxide emissions removed over five years, subject to site visits and satellite review in 2024. During detailed reviews, 79.4 acres and 73.94 acres of projects created in 2022 and 2023, respectively, were identified as not eligible under the Alternative Land Use Services Methodology (pending validation and verification). As such, these projects were excluded from the 2023 estimate (860 tonnes of carbon dioxide) and were reflected in the 2022 preliminary estimate (2,737 tonnes of carbon dioxide). This finding has resulted in a corrected carbon estimate of 873 tonnes of carbon dioxide emissions over five years being issued for projects created in 2022.

Innovative technology pilots, such as deploying Albo Climate's remote sensing and machine learning solution to estimate carbon sequestration from trees and shrubs in Bruce and Grey Counties, will ensure future targets are met. In addition to providing carbon sequestration, these projects will also enhance local climate resilience, increase farm productivity, and generate additional ecosystem benefits, including:

- 25% more bird species than non- Alternative Land Use Services farms

- 200% increase in native pollinator diversity and 300% increase in pollinator abundance

In addition to innovative operational initiatives and partnerships, Bruce Power employs green financing initiatives towards eligible investments associated with life extension and increasing output of existing units, further supporting provincial and federal reduction targets through the production of emissions-free power. In March 2023, $600 million in additional green bonds were issued by Bruce Power to further help the province achieve its net zero goals through clean energy projects. More information on the allocation and impact of green bond proceeds can be found in the 2022 Green Bond Impact Report.

In 2023, Bruce Power continued to optimize our assets through our Project 2030 initiative, targeting a site net peak output of more than 7,000 megawatts by the early 2030s. Project 2030 focuses on continued asset optimization, innovations, and leveraging new technology to increase the site peak at Bruce Power, helping to support a low-carbon electricity grid for decades to come.

Based on investment in new and incremental nuclear generation output resulting from Project 2030 and the Life Extension program, Bruce Power now offers clean energy credits to help Ontario corporate electricity customers reach their environmental and sustainability goals. Clean energy credits are electronic certificates that businesses can purchase from Ontario clean energy generators, including nuclear operators, to offset Scope 2 emissions to achieve voluntary environmental targets.

Bruce Power, working with GHD, is also developing a Nuclear Carbon Offset Protocol, with plans to register the project on the Canadian Standards Association, Greenhouse Gas CleanProjects® Registry. The protocol is based on the replacement of fossil-fuel generated electricity and offsetting carbon-intensive generation through additional incremental output of existing nuclear power generation facilities and potential new nuclear.

On an annual basis, an Environment Social Governance Risk Rating is undertaken for Bruce Power by Morningstar Sustainalytics, a leading third-party Environment Social Governance rating agency. This Risk Rating combines an assessment of the company's exposure to industry specific sustainability issues and how these risks are being managed. In 2023, Bruce Power was recognized as "Environment Social Governance Industry Top Rated" and "Environment Social Governance Regional Top Rated" by Morningstar Sustainalytics. Bruce Power continues the trend of year-over-year improvement and maintaining a "Low Risk" rating, with 2023 being our lowest, and most favourable, Environment Social Governance Risk Rating of 12.6. Bruce Power was recognized for strong performance in Community Involvement, Emergency Response, Diversity Programs, Waste Management, and Environmental Programs and Policies. This placed Bruce Power third globally in its sub-industry category of "Independent Power Production and Traders" and in the top four per cent in the "Utilities" industry covered by Morningstar Sustainalytics.

More information on our Sustainability Program can be found in Bruce Power's 2023 Sustainability Report, which highlights our ongoing commitment to having a positive impact in our local community and supporting provincial and federal carbon-reduction goals. The report provides clear, relevant disclosure of our sustainability commitments, focusing on our 2022 sustainability performance across 28 key performance indicators which are monitored annually. Our next report, including our 2023 performance metrics, will be published in June 2024.

3.0 DOSE TO PUBLIC

Canadians are regularly exposed to ionizing radiation as part of their everyday lives [R-48] [R-49] [R-50]. This is partly due to exposure to naturally occurring cosmic radiation from the sun and stars and from terrestrial radiation from radioactive materials (e.g., uranium, thorium, and radium) that naturally exist in soil and rocks. Radon is a naturally occurring radioactive gas that is produced by the earth's crust and is present in the air. A variety of foods contain natural sources of radiation including potatoes, carrots, bananas, milk and red meats. The effective dose from natural radiation in Canada is estimated to be 1,800 microsieverts per year [R-49]. Other locations in the world have higher exposure rates, for example, the Kerala Coast in India has an annual effective dose of 12,500 microsieverts per year [R-49].

In addition to these sources, human activities also contribute to overall radiation exposure, such as air travel, smoking and medical or clinical services such as x-ray machines and CT scanners. For example, a cross country flight (20 microsieverts), tobacco and smoke detectors (100 microsieverts), a dental (5 microsieverts) or chest (100 microsieverts) x-ray, or a CT scan (7,000 microsieverts) adds to a person's overall radiation dose [R-51].

Living near a nuclear power plant also contributes to annual dose as radionuclides associated with CANDU reactors are released to the environment as part of normal operation. These discharges to air and water are heavily regulated in Canada and limits are imposed to ensure levels are safe to workers, the public and the environment. The annual dose limit for a member of the public is 1,000 microsieverts per year [R-52]. As part of the regulatory requirements, Bruce Power must calculate and report its contribution to radiological exposure dose to members of the public on an annual basis.

The annual doses are calculated using the computer software IMPACT following the methodology described in Canadian Standards Association N288.1 [R-15]. The approach uses a radionuclide transport and exposure pathways model that incorporates concentrations of radionuclides measured in environmental media, human characteristics specific to local behaviors and lifestyles, site specific meteorological data, as well as facility characteristics and radiological release information. The details are described in the sections below, however the overall outcome for 2023 is provided here.

For the thirty-second consecutive year, Bruce Power's contribution to the annual dose of a member of the public is less than the lower threshold for significance (<10 microsieverts per year or <1% of the legal dose limit) and is considered *de minimus* [R-53]. The representative person's dose associated with Bruce Power operations in 2023, who is calculated to have the maximum, is the BSF2 Child who received 1.4 microsieverts per year (Table 1). All other representative persons have a lower dose. This maximum dose is a fraction of a percent of the legal dose limit of 1,000 microsieverts per year.

Table 1 - 2023 Maximum Representative Person's Dose

Maximum Representative Person	Committed Effective Dose	Percentage of Legal Limit
BSF2 Child	1.4 microsieverts per year	0.14%

The contribution of each radionuclide or radionuclide group to the 2023 radiological dose for the maximally exposed representative person is shown in Table 2 and Figure 4. Consistent with previous years, most of the radiological dose is from two radionuclides (carbon-14 = 53%, tritium oxide = 40%). Exposure pathways to these radionuclides are predominantly ingestion of local food sources as well as air inhalation and immersion.

Table 2 - 2023 Radiological Dose by Contaminant for Representative Persons Group BSF2 Child

	Carbon-14	Cobalt-60	Cesium-134	Cesium-137	Tritium Oxide	Iodine, mixed fission products	Noble Gases	Total
Dose (μSv/y)	7.4E-01	6.2E-03	0.0E+00	9.9E-03	5.7E-01	6.0E-06	8.3E-02	1.4E+00
Percentage	53%	0%	0%	1%	40%	0%	6%	100%

Note:

1. BSF2 is Subsistence Farmer 2.
2. Tritium oxide includes dose incurred via ingestion of organically bound tritium in fish, plant produce, and animal products.

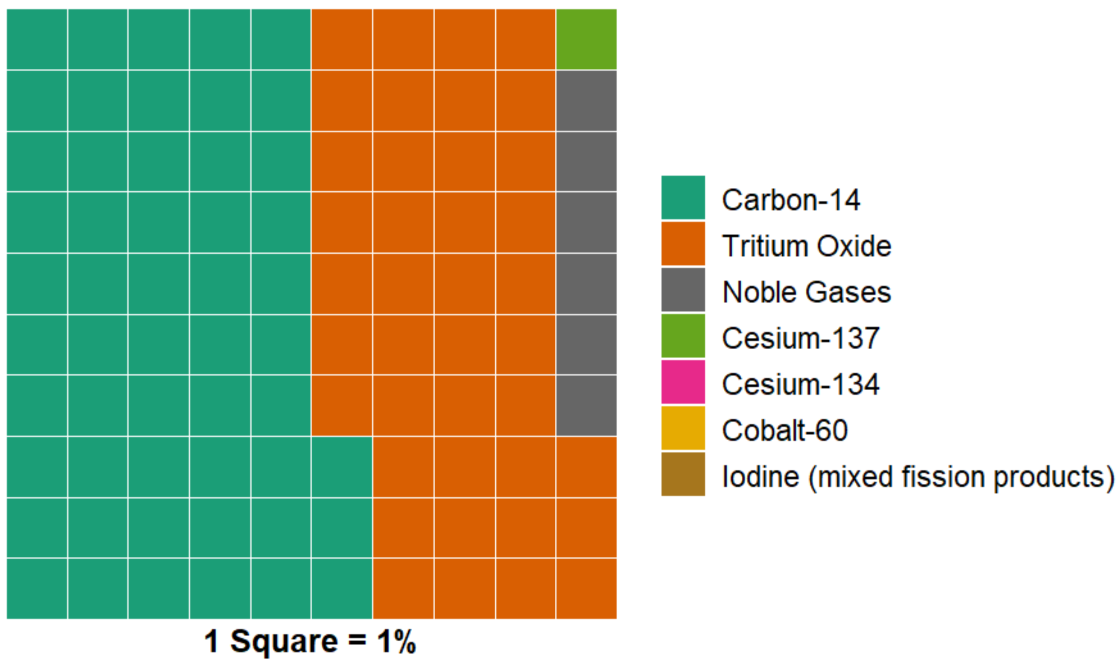


Figure 4 - 2023 Radiological Dose by Contaminant for Representative Persons Group BSF2 Child

3.1 Historical Dose to Public

The additional contribution on the annual radiation dose to members of the public from Bruce Power Site activities has been below the level of significance (less than 10 microsieverts per year) for 32 consecutive years. The annual maximum dose for the last ten years is shown in Figure 5. Although the value fluctuates based on operational or maintenance activities that occur (e.g., preparations in advance of the vacuum building outage in 2015), the outcome is only a small fraction of a percent of the legal limit of 1,000 microsieverts per year. It is also a small contribution to the annual dose experienced from natural radiation in Canada (1,800 microsieverts per year) [R-49]. The calculation of public dose demonstrates that the radiological releases from the Bruce Power Site have an extremely small impact on public dose.

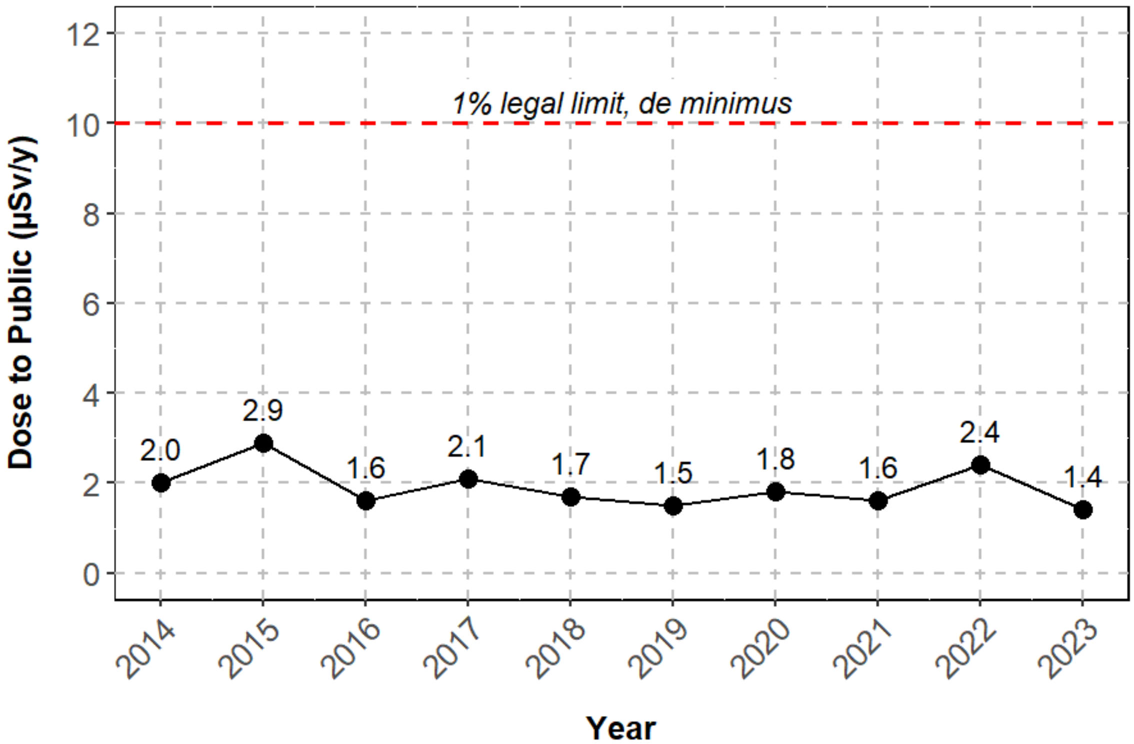


Figure 5 - Historical Dose to Public Over Time (Dose Limit 1000 microsieverts per year)

3.2 2023 Dose to Public

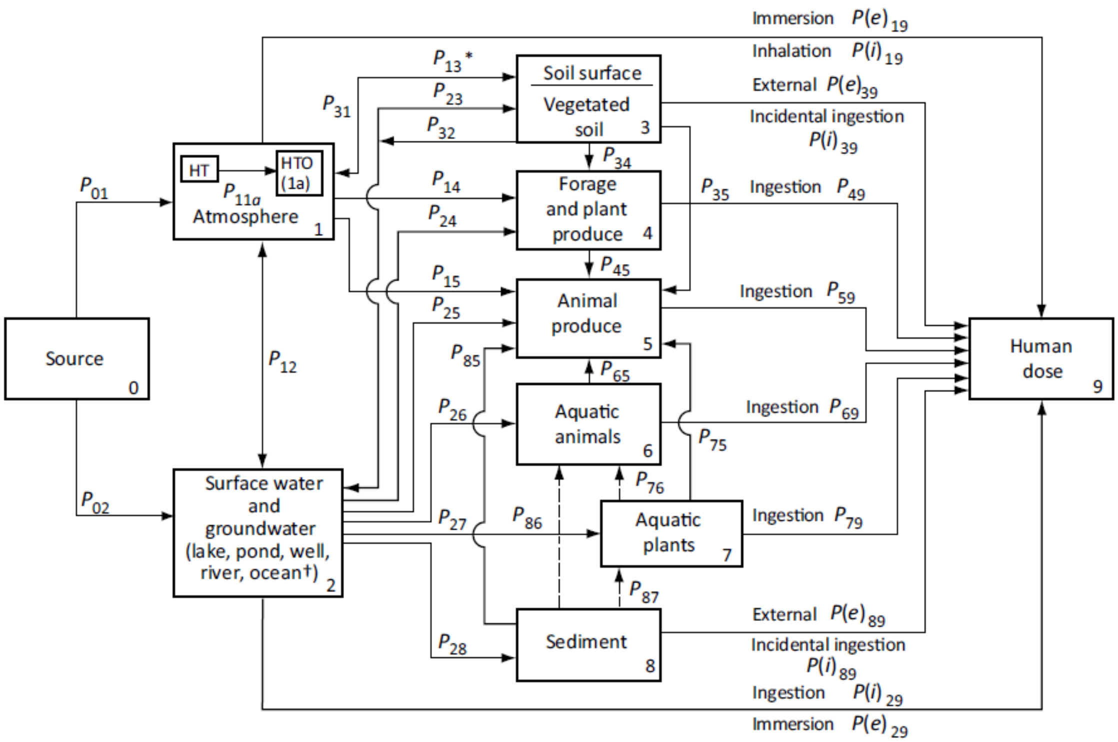
3.2.1 Methodology

Living near the Bruce Power Site results in an additional radiation dose to members of the public due to radiological releases to the environment as part of normal operation. The additional contribution to a person's overall dose is calculated each year and provided in this report.

The following information is required for calculating the public dose:

- Annual radiological airborne emission and waterborne effluent data from all licensed activities on or adjacent to the Bruce Power Site (Section 5.1)
- Annual Radiological Environmental Monitoring data (Section 6.1)
- Annual meteorological data (Section 3.2.2)
- Characteristics of the Representative Persons (Section 3.2.4)

The methodology used to calculate annual public dose from normal operations at CANDU nuclear power stations is described in Canadian Standards Association N288.1 [R-15]. A radionuclide transport and exposure pathways model is used which relies on an array of mathematical equations that describe the transfer of radioactive materials through the environment, as depicted in Figure 6 [R-15]. This pathways model may be likened to a food web that is specific to the local area and population. For example, one pathway could be of a radiological contaminant (e.g., tritiated water) released to the air that is deposited on a field and taken up by the plants. Dairy cattle may eat these plants, which may impact the cow's milk that is ingested by a child. These elaborate networks are set up in computer software called IMPACT, which is the acronym for Integrated Model for the Probabilistic Assessment of Contaminant Transport. IMPACT is a customizable tool that allows the user to assess the transport and fate of a contaminant through a user-specified environment. All of these exposure pathways are summed together in order to quantify the overall human exposure (i.e., dose). Canadian Standards Association N288.1 provides the transport and exposure factors for each step, as well as default values for human and site characteristics, which are refined for the local area based on the Site Specific Survey and annual meteorological data [R-15].



* *Includes transfer factors P_{13area}, P_{13mass}, and P_{13spw}.*
† *For ocean water, pathways P_{23}, P_{24}, P_{25}, and $P(i)_{29}$ are not used.*

Notes:

1) *The broken lines represent pathways that are not explicitly considered in the model or are considered only in special circumstances.*
2) *Factors include multiple transfers where appropriate.*

Figure 6 - Environmental Transfer Model (Extracted from Canadian Standards Association N288.1)

Measured concentrations of radionuclides in environmental media such as air, water and food are used in calculating dose. The data is verified, and the background is subtracted before being entered into the IMPACT model by a third-party independent contractor. All data undergoes a quality assurance and quality control review prior to the dose calculation. For some radionuclide and media combinations, concentrations are below the limit of detection of the measuring equipment and thus may inhibit the ability to measure the desired radionuclide. In cases where monitoring data are not available for a particular exposure media, the available environmental monitoring data are used to calculate or define the missing radionuclide concentrations in the intermediate media as far along the exposure pathway (i.e., food chain) as possible. If no data is available for any media along a specified exposure pathway, transport modelling and emissions or effluent data are used to define the radionuclide concentrations in the exposure media.

The exposure pathways used in the model for each of the radionuclides that contribute significantly to dose, based on sample medium, are shown in Table 3. The dose contributions from each of these exposure pathways are summed to give a total overall dose for each of the representative persons and age groups (i.e., infant, child, and adult). These three age groups are used to refine exposure based on diet and lifestyle differences. The maximum result is taken as the “dose to public” for the year, with all others having a lower dose. As per the *Radiation Protection Regulations SOR/2000-203*, the public radiation dose limit for a year is 1000 microsieverts (100 millirem) [R-52].

Table 3 - Radionuclides Measured as Part of Radiological Environmental Monitoring

Radionuclide	Sample Medium	Exposure Pathway
Tritium oxide	Air	Inhalation (includes skin absorption)
Tritium oxide	Water (drinking water, surface water, well water)	Ingestion
Tritium oxide	Water (precipitation, groundwater)	Ingestion
Tritium oxide	Plants (fruits, vegetables, grains)	Ingestion
Tritium oxide	Animals (meat, milk, honey)	Ingestion
Tritium oxide	Fish	Ingestion
Carbon-14	Air	Inhalation, External
Carbon-14	Plants (fruits, vegetables, grains)	Ingestion
Carbon-14	Animals (meat, milk, honey, eggs)	Ingestion
Carbon-14	Fish	Ingestion
Gamma	Air	Inhalation, External
Gamma	Water (surface water)	Ingestion
Gamma	Animals (meat, honey)	Ingestion
Gamma	Fish	Ingestion
Gamma	Sediment	External
Gamma	Soil	External
Gross Beta	Water (drinking water, surface water, well water, precipitation)	Ingestion
Iodine-131	Site emissions	Air inhalation, Air external Terrestrial animals (ingestion)
Iodine-131	Milk	Ingestion
Noble Gases (half-life of days)	Air	Air External
Organic bound tritium	Fish	Ingestion

There are uncertainties inherent in radiological effluent and emissions monitoring, Radiological Environmental Monitoring, and the dose estimates derived from them. The uncertainty of Bruce Power radiological releases has been estimated, and minimum uncertainties have been characterized as a percentage of weekly airborne emissions or per-batch or monthly waterborne emissions, as applicable. Uncertainty estimates vary for each stack and radionuclide but are generally about 5 – 25% for stacks that contribute most significantly to total airborne emissions. The uncertainty estimates for radiological liquid effluents range from about 5% to 50% for each active liquid waste batch release of tritium and gross gamma respectively, and around 5 to 15% for monthly releases of carbon-14 and gross alpha. While these uncertainties in radiological effluent and emissions reporting are noted, they have a limited effect on uncertainties in the dose results. Data from the Radiological Environmental Monitoring program is used wherever available to provide actual concentrations of radionuclides in environmental media, which reduces the dependence on effluent and emissions data and its associated uncertainty. This approach is in alignment with recommendations of Canadian Standards Association N288.4 to use measured versus modelled concentrations where possible to achieve more precise dose estimates [R-5]. The uncertainties associated with radiological environmental monitoring data are dependent on each specific analysis method and measurement result.

The overall uncertainties associated with public dose estimates have been characterized by a CANDU Owners Group study [R-54]. This study concluded that dose estimates based on environmental measures for important exposure pathways, such as Bruce Power's annual dose calculation, tend to have uncertainties on the order of ± 30%. Bruce Power's annual radiological emissions and effluent continue to remain well below Derived Release Limits with annual dose to public remaining negligible *(de minimus)*.

3.2.1.1 2023 Dose Calculations

For 2023, the basic set-up of the IMPACT model, in terms of transfer parameters and environmental variables, is identical to that used in 2022, as well as in the most recent Environmental Risk Assessment and Derived Release Limit updates. The general physiological characteristics of the representative persons (e.g., inhalation rates, water ingestion rates, food intake rates) were the mean values taken from Canadian Standards Association N288.1 [R-15].

The fractions of ingested food that originate from local sources (e.g., backyard gardens or local farm markets) are based in part on the results of the most recent Site-Specific Survey (Section 3.2.3). The net percentage contribution of each specific food type (e.g., fruits or beef) to each major category of consumption (i.e., total plant product or animal product) is based on both the local fraction and the generic intake rates. The percentage of food intake from local sources and rates of intake used are provided in APPENDIX A.

The radiological emissions and effluents that were directly considered in the dose calculation process include tritium oxide, carbon-14, noble gases, and radio-iodines. For the purpose of public dose calculations, it is assumed that iodine emissions are in the form of mixed fission products, assumed to be present in a ratio associated with a state of secular equilibrium (i.e., other radionuclides from iodine-131 to iodine-135 are assumed to be present). The dose calculation process assumes that all iodine is iodine-131 for longer duration pathways (i.e., anything related to sediment or soil partitioning, or bio-uptake), but for shorter duration pathways (i.e., air inhalation or immersion, lake water immersion or ingestion) the full release is equivalent to iodine-mixed fission products. In modeling the environmental transport and partitioning of radio-iodines, there is assumed to be no isotopic discrimination, and that iodine-mixed fission products behave the same as iodine-131.

In 2018, it was decided *a priori* to assume that all reported beta/gamma emissions and effluents were cobalt-60, consistent with the approach applied in the Environmental Risk Assessment [R-4]. This assumption has been shown to be conservative, very likely over-stating the actual dose that could be associated with Bruce Power emissions and effluents. It should be noted that doses for cesium-134 and cesium-137 are still calculated where direct environmental measures of those radionuclides are available through the Radiological Environmental Monitoring program. For alpha emitters, it has been determined in past analysis, including the most recent Environmental Risk Assessment, that alpha emitters are released at rates which lead to public doses that are negligible. For this reason, alpha emissions are not included in the dose calculation process.

In 2023, the approach taken when Radiological Environmental Monitoring data included values that were less than the associated detection limit or critical level, those values were taken as reported. For example, in the calculation of local or background averages where some measured values were reported as less than the critical level or the detection limit, the uncensored analytical results were used in the calculation. The implications of this approach to the reported doses are very minor, and typically conservative.

For 2023 dose calculations [R-55], the following conservative measures were taken to address unavailable data or measured values being lower than background:

- No milk sample was available for locations BDF12, BDF13 and BDF14. The average results for the milk samples collected from the nearest dairy farm that is closer to the sources of emissions (i.e., BDF1 for BDF12, BDF15 for BDF13 and BDF14) was applied for these locations.

- For deep residential wells, the activity level of tritium oxide in all samples collected in 2023 was reported to be less than the critical level. In this specific case, the critical level itself was assigned, with adjustment for background, as the representative value for tritium oxide in all deep residential wells. The public dose associated with tritium oxide in deep residential wells is in the order of 0.01 microsieverts per year or less.

- The activity level of carbon-14 in local samples of food products (both animal-based and plant-based) was lower than the corresponding activity in background samples. To quantify the carbon-14 activity in these media, the environmental transport models in IMPACT were invoked. Honey was the only food product for which measured carbon-14 activity at the area near location was above background activity.

- The measured activity of beta/gamma emitters (i.e., cobalt-60, cesium-134 and cesium-137) in local samples of some media was lower than background. As in the case of carbon-14, the environmental transport models in IMPACT were invoked.

- Drinking water samples were not available for well BF6 in 2023. This well has been selected as representative of the drinking water supply for 11 of 19 representative group locations. In absence of a measure for 2023, the average tritium oxide activity from 2022 was applied.

3.2.2 Meteorological Data

Meteorological data are required in order to calculate doses to the public resulting from the operation of nuclear facilities on the Bruce Power site. Specifically, the processed meteorological data in the format of Triple Joint Frequency are required as inputs to the computer code IMPACT for public dose calculations. The calculation of joint frequency data used by Bruce Power meets the requirements described in Clause 6.1.4 of Canadian Standards Association N288.1 [R-15].

There are two meteorological towers at the Bruce Power site: one 50-metre on-site tower and one 10-metre off-site tower. These towers were installed in 1990 at specific locations to ensure that the meteorological measurements are representative of local atmospheric conditions experienced, and to better account for how emissions are conveyed inland.

In order to be used for calculating the Triple Joint Frequency, the annual data collection must be 90% complete as per Clause 4.3.2.6 of Canadian Standards Association N288.2 [R-56]. In 2020, both the on-site and off-site meteorological towers were upgraded to improve data availability. At both locations the monitoring equipment were replaced and have battery back-up capabilities, and the dataloggers and software were upgraded. The data availability analysis results for the two meteorological towers for 2023 is shown in Table 4. There was a brief gap in hourly data for the 10-metre tower for the period of July 7-9, 2023 for unknown reasons, however the 15 minute data were available during this time period.

Table 4 - Summary of Data Availability for 2023

Data Source	Available Records	Total Records Planned	Record Availability (%)
10-metre Tower	8732	8760	99.7%
50-metre Tower	8760	8760	100%

The data availability in the 2023 raw meteorological data met the 90% data availability requirement and were used to calculate the Double Joint Frequency and Triple Joint Frequency for the Site [R-57]. The methodology for obtaining the Double Joint Frequency and Triple Joint Frequency, as well as the results for the 50-metre tower is provided in APPENDIX B.

3.2.3 Site Survey

The Site Specific Survey Report includes a collection of information on the local population and the environment surrounding Bruce Power. The report is used to support a number of site programs, such as the Radiological Emissions and Effluent Monitoring Program and calculation of Derived Release Limits, the Radiological Environmental Monitoring Program, Emergency Preparedness, Safety Reports and licence renewal. The Site Specific Survey is updated typically every five years to reflect recent changes to the area surrounding the Bruce Power site.

The survey report includes meteorology, land usage, population distribution, water usage, agriculture, recreational activities and food sources in the area. In addition, information on daycare centres, before and after school programs, long term care homes, school boards, and recreational parks located within 20 kilometres of the Bruce Power site are documented. The diet and lifestyle data collected is used to identify groups of people with similar characteristics to develop or refine the "representative persons" (see Section 3.2.4). These unique groups are used for dose to public calculations as per Canadian Standards Association N288.1 [R-15].

The Site Specific Survey Report was updated in 2021 and focused on refining the characteristics of the hunter/fisher receptor to better reflect the behaviours and practices of local First Nations and Métis groups. Diet surveys were co-developed and completed in 2019-2021 by members of Saugeen Ojibway Nation, Metis Nation of Ontario and Historic Saugeen Metis. An independent third party reviewed and then consolidated the individual results to update the hunter/fisher receptor characteristics with the most conservative parameters. This ensures that the dose calculation is representative of the local population. The updated hunter/fisher receptor has been used for all dose calculations since 2021, including the 2022 Environmental Risk Assessment.

The 2021 Site Specific Survey was revised in 2023 to incorporate the 2021 Census data from Statistics Canada. The census includes population, including the Indigenous population, and agricultural data specific to the local area.

3.2.4 Representative Persons

Doses received by individual members of the public as a result of a given radionuclide release vary depending on factors such as proximity to the release, dietary and behavioral habits, age and metabolism, and variations in the environment [R-15]. A homogenous group of individuals with the same exposure factors may be grouped together, where the individual that receives the highest dose within that group is considered the representative person of that group. Each representative person is broken down into three age classes (i.e. infant, child, adult) in order to account for different diets, breathing rates and dose coefficients.

The Site Specific Survey Report provides the information needed to refine the standard human characteristics provided in Canadian Standards Association N288.1 [R-15] to include local environmental and lifestyle information. This includes details like where people live in relation to Bruce Power, where a person's drinking water comes from, how much local food a person consumes and how much time is spent outdoors.

The following categories of representative persons have been identified based on distinct lifestyle and proximity to the Site:

- **Non-farm resident** - The non-farm resident is considered the typical, full-time resident in the area surrounding the Site. They get a large portion of their food from grocery stores.

- **Farm resident** - The farm resident is more likely to consume their own crop or livestock, but still use grocery stores for a portion of their food intake.

- **Subsistence farm resident** - The subsistence farm resident gets a larger portion of their food, milk and water from local sources, and over half of their diet is self-produced.

- **Dairy farm resident** - The dairy farm resident is assumed to consume some fresh milk from their own farm and a slightly higher fraction of locally grown produce and livestock.

- **Bruce Eco Industrial Park worker** - For consistency with previous studies, the Bruce Eco Industrial Park worker is referred to as a Bruce Energy Centre worker, which corresponds to the former name of the facility. The assessment for a Bruce Energy Centre worker represents occupational exposures at a location near the facility. It is assumed that the Bruce Energy Centre worker does not also live at one of the other selected receptor locations, i.e., the Bruce Energy Centre worker dose is independent of the other representative person doses.

- **Hunter/Fisher** - The hunter/fisher resident represents individuals who may catch and consume wild game and fish in significantly greater quantities than other residents. They are assumed to obtain all of their fish and wild game from local sources and consume greater quantities of these foods than the average Canadian diet. For other food categories, some is sourced locally while the remainder is from grocery stores. The characteristics of this resident have been developed based on surveys of the Saugeen Ojibway Nation, Historic Saugeen Métis, and the Métis Nation of Ontario undertaken from 2019 to 2021.

A total of 19 representative persons were selected, each comprised of an adult (16 to 70 years old), child (6 to 15 years old), and infant (0 to 5 years old) [R-15], except for the Bruce Eco Industrial park worker, who is assumed to be an adult. All representative persons were chosen based on proximity to the Site (i.e., all locations are within 15 kilometres from the Site), with the exception of the hunter/fisher resident, who is located approximately 20 kilometres north of the site. A description of the representative persons by group name is provided in Table 5 and the locations are shown on Figure 7.

Table 5 - Description of Representative Persons

Group Name	General Characteristics and Location of Group
BR1	Non-farm resident, lakeshore at Scott Point (Located to the northeast of Bruce A at a distance of approximately 2 kilometres and northeast of Bruce B at a distance of approximately 5 kilometres)
BR17	Non-farm resident, inland (Located to the southeast of Bruce A at a distance of approximately 4 kilometres and east of Bruce B at a distance of approximately 5 kilometres)
BR25	Non-farm resident, inland (Located to the south of Bruce A at a distance of approximately 5 kilometres and to the southeast of Bruce B at a distance of approximately 4 kilometres)
BR27	Non-farm resident, inland, trailer park (Located to the south of Bruce A at a distance of approximately 5 kilometres and to the southeast of Bruce B at a distance of approximately 3 kilometres)
BR32	Non-farm resident, lakeshore (Located to the south of Bruce A in Inverhuron at a distance of approximately 6 kilometres and to the south of Bruce B in Inverhuron at a distance of approximately 3 kilometres)
BR48	Non-farm resident, inland (Located to the southeast of Bruce A near Baie du Doré at a distance of approximately 2 kilometres and to the east of Bruce B near Baie du Doré at a distance of approximately 3 kilometres)
BF8	Agricultural, farm resident (Located to the south of Bruce A at a distance of approximately 8 kilometres and to the southeast of Bruce B at a distance of approximately 7 kilometres)
BF14	Agricultural, farm resident (Located to the south of Bruce A at a distance of approximately 5 kilometres and to the southeast of Bruce B at a distance of approximately 3 kilometres)
BF16	Agricultural, farm resident (Located to the southeast of Bruce A at a distance of approximately 7 kilometres and to the east of Bruce B at a distance of approximately 8 kilometres)
BSF2	Agricultural, subsistence farm resident (Located to the southeast of Bruce A at a distance of approximately 9 kilometres and to the southeast of Bruce B at a distance of approximately 9 kilometres)
BSF3	Agricultural, subsistence farm resident (Located to the southeast of Bruce A at a distance of approximately 8 kilometres and to the southeast of Bruce B at a distance of approximately 8 kilometres)
BHF1	Generic hunter/fisher resident (Located approximately 20 kilometres north of the Site in Southampton)
BDF1	Agricultural, dairy farm resident (Located to the northeast of Bruce A at a distance of approximately 11 kilometres and to the northeast of Bruce B at a distance of approximately 14 kilometres)

Group Name	General Characteristics and Location of Group
BDF9	Agricultural, dairy farm resident (Located to the southeast of Bruce A at a distance of approximately 13 kilometres and to the southeast of Bruce B at a distance of approximately 12 kilometres)
BDF12	Agricultural, dairy farm resident (Located to the east of Bruce A at a distance of approximately 13 kilometres and to the northeast of Bruce B at a distance of approximately 15 kilometres)
BDF13	Agricultural, dairy farm resident (Located to the southeast of Bruce A at a distance of approximately 13 kilometres and to the southeast of Bruce B at a distance of approximately 12 kilometres)
BDF14	Agricultural, dairy farm resident (Located to the southeast of Bruce A at a distance of approximately 14 kilometres and to the southeast of Bruce B at a distance of approximately 13 kilometres)
BDF15	Agricultural, dairy farm resident (Located to the southeast of Bruce A at a distance of approximately 13 kilometres and to the southeast of Bruce B at a distance of approximately 12 kilometres)
BEC	Worker in Bruce Energy Centre (Located to the southeast of Bruce A at a distance of approximately 4 kilometres and to the east of Bruce B at a distance of approximately 4 kilometres)

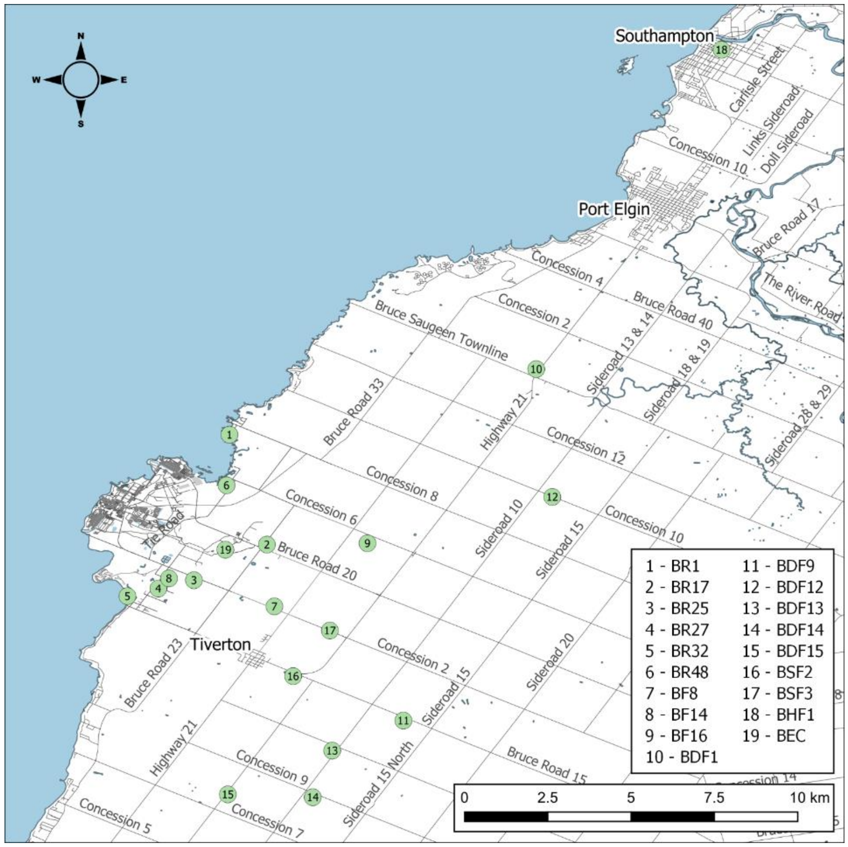


Figure 7 - Representative Person Locations

3.2.5 Dose Results and Interpretation

The maximum dose to a member of the public in 2023 was obtained for the subsistence farmer BSF2 child with a value of 1.4 microsieverts per year [R-55] and remains well below the public dose limit of 1000 microsieverts per year [R-52]. This is a decrease of about 40% compared to the maximum dose calculated in 2022 (2.4 microsieverts per year) for the same representative group (i.e., subsistence farmer). The calculated dose for this BSF group has been the highest of all groups for all but one year (2019) since this group was added in 2012.

In 2023, the doses calculated for all age classes of the subsistence farmer group at both locations (BSF2 and BSF3) were in the range of 1.3 to 1.4 microsieverts per year. The average dose for the subsistence farmer group was 60% higher than the average dose for all other groups. Doses to the various representative locations and age classes of the farmer (BF) and dairy farmer (BDF) groups range from 0.6 to 1.0 microsieverts per year. The doses calculated for the non-farming resident (BR) group range from about 0.6 to 1.2 microsieverts per year. The total dose for all age classes at location BR48 (i.e., 1.1 to 1.2 microsieverts per year) are higher than all other receptors except the subsistence farmer group. This is primarily a function of the proximity and orientation of BR48 relative to the Bruce Power site and the wind patterns experienced in 2023. The doses calculated for members of the hunter/fisher (BHF) group near Southampton were between 0.3 and 0.4 microsieverts per year, which is the same range of doses calculated for the previous year. Other than the Bruce Energy Centre (BEC) group, the hunter/fisher group is the only representative group for which doses do not exceed 0.5 microsieverts per year. Annual doses calculated for 2023 for all representative groups and age classes are provided in APPENDIX C [R-55].

A substantial majority (66 to 74%) of the total dose to the subsistence farmer (BSF) group is associated with food ingestion, which simply reflects the relatively high rate of local food consumption by members of this group. For other farm-based groups (BF and BDF), local food consumption also accounts for a significant percentage (an average of 48% and 56%, respectively) of total dose for the same reason. For non-farm residential groups (excluding hunter/fisher (BHF) and Bruce Energy Centre (BEC) groups), the dose associated with food ingestion averages 30% of total dose, which is notably lower than doses for farm-associated groups.

Aside from food consumption, direct exposure to radionuclides in air via inhalation and immersion is the only other significant contributor to total dose, accounting for about 38% of total dose for farm-based groups (farm (BF), dairy farm (BDF), and subsistence farm (BSF) groups) and 65% for the residential (BR) group. Overall, exposure pathways associated with emissions to atmosphere accounted for an average of 95% of total public dose. These general patterns are consistent with the patterns observed for the past decade.

The main contributing radionuclides to the limiting dose (subsistence farmer BSF2 child) are carbon-14 at about 53% of total dose and tritium oxide at about 40% of total dose. Overall, carbon-14 and tritium oxide (including organically bound tritium) combined account for an average of about 84% of the total dose for all groups of representative persons that have been considered in 2023. This dominance of carbon-14 and tritium oxide as contributors to total dose in 2023 is consistent with the findings of public dose calculations over the past decade. Noble gases and cesium-137 were the only other radionuclide group to consistently contribute more than 1% of public dose, with noble gases accounting for an average of about 14% of total dose for all groups considered. The remaining radionuclides combined (iodine mixed fission products, cobalt-60, cesium-134, and cesium-137) account for only about 2% of total public dose on average.

The decrease in public dose in 2023 relative to 2022 is associated almost entirely with decreases in dose from carbon-14 and tritium oxide. For both radionuclides, the trend in dose reflects the trend in emissions. Compared to 2022, carbon-14 emissions to air decreased by about 20% in 2023 while dose associated with carbon-14 decreased by an average of about 37%. For tritium oxide, atmospheric emissions decreased by 36% while doses decreased by an average of 31%.

Relative to 2022, measures of carbon-14 and tritium oxide in the environment exhibited trends in 2023 that were largely in parallel to their respective dose and emission trends. Measures of both tritium oxide and carbon-14 in air and food products were notably lower in 2023 at most representative locations.

Overall, the calculation of public dose demonstrates that the radiological emissions and effluents from Bruce Power facilities have an extremely small public dose impact. The maximum public dose associated with Bruce Power operations in 2023 (i.e., 1.4 microsieverts per year for the subsistence farmer BSF2 child) is still only a fraction of a percent of the legal limit (i.e., 1,000 microsieverts per year) [R-52] and of the average Canadian background dose (i.e., 1,800 microsieverts per year) [R-58]. It is also well below the *de minimus* threshold of 10 microsieverts per year and is considered negligible [R-53].

4.0 ENVIRONMENTAL RISK ASSESSMENT

The Environmental Risk Assessment fulfills the environmental protection requirements under the *Nuclear Safety and Control Act* [R-59]. The *Canadian Impact Assessment Act* [R-60] does not apply. An important area of focus related to the Environmental Risk Assessment is public and Indigenous engagement. The Environmental Risk Assessment process is meant to provide an on-going analysis of a company's interaction with the environment. Completion of an update to the Environmental Risk Assessment on a 5-year cycle is supported by annual environmental protection reports and both documents are subject to in-depth regulatory review.

One of the benefits of updating the Environmental Risk Assessment is the regular check in points with regulators and the public every 5 years on an ongoing basis. This gives all parties an opportunity to contribute, identify concerns and incorporate new studies or advances in science as per N288.6 guidance [R-29]. This process allows for the identification of emerging trends and identifies any new risks that may arise, which is an enhancement from past assessment processes. Indigenous Nations and other members of the public will continue to participate in and provide feedback on the Environmental Risk Assessment.

4.1 Results of the 2022 Environmental Risk Assessment

An updated retrospective and predictive Environmental Risk Assessment was prepared following the guidance of Canadian Standards Association N288.6-12 in 2022 [R-4] [R-61]. Review of the 2022 Environmental Risk Assessment by the Canadian Nuclear Safety Commission and Environment and Climate Change Canada concluded that the report is consistent with the overall methodology and complies with all the applicable requirements of Canadian Standards Association N288.6-12 [R-62]. The potential risk from physical stressors and from radiological and non-radiological releases to the environment were found to be generally low to negligible.

The cumulative environmental effects of multiple stressors are not directly assessed in the 2022 Environmental Risk Assessment. Bruce Power acknowledges the need to address the cumulative environmental effect of multiple stressors when and where it is warranted. The science behind the determination of cumulative effects is at its infancy: there is no consensus on a definition of "cumulative impact" and assessment methods are largely absent. Understanding cumulative impacts to a system first begins by evaluating its individual stressors. Bruce Power has done this and none of the individual stressors poses an unreasonable risk to the environment. As a result, it is unlikely that the combination of single stressors with low to no risk will result in a cumulative impact or approach an unreasonable risk. Over forty years of operations of the Bruce site and continued monitoring and assessment has provided empirical evidence of little to no risk to the local environment.

4.1.1 Indigenous Engagement

The results of the 2022 Environmental Risk Assessment were shared with Saugeen Ojibway Nation, Métis Nation of Ontario, and Historic Saugeen Métis prior to the submission of the Environmental Risk Assessment to the Canadian Nuclear Safety Commission. Based on the review of the past Bruce Power-specific concerns raised by Indigenous Nations, all technical considerations within the construct of the Canadian Standards Association N288.6 framework have been dispositioned and those related to the Environmental Risk Assessment have been highlighted within the text. Bruce Power is committed to ongoing engagement, consultation, and communication with Saugeen Ojibway Nation, Métis Nation of Ontario, and Historic Saugeen Métis in accordance with Bruce Power's Indigenous Relations Policy, Protocol, and Relationship Agreements with the communities and regulatory requirements.

4.1.2 Conventional Risk Assessment

The non-radiological human health risk assessment evaluated the potential for health risks for members of the public residing in the area surrounding the Site, including recreational users. The potential for health risks due to non-radiological chemicals and physical stressors were negligible considering normal operations at the Site.

Data considered in the conventional ecological risk assessment is available for review at: https://wsp-shinyapps.shinyapps.io/ERA_screening_tables/ and included groundwater, soil, surface water and sediment data from locations on the Bruce Power site as shown in Figure 8.

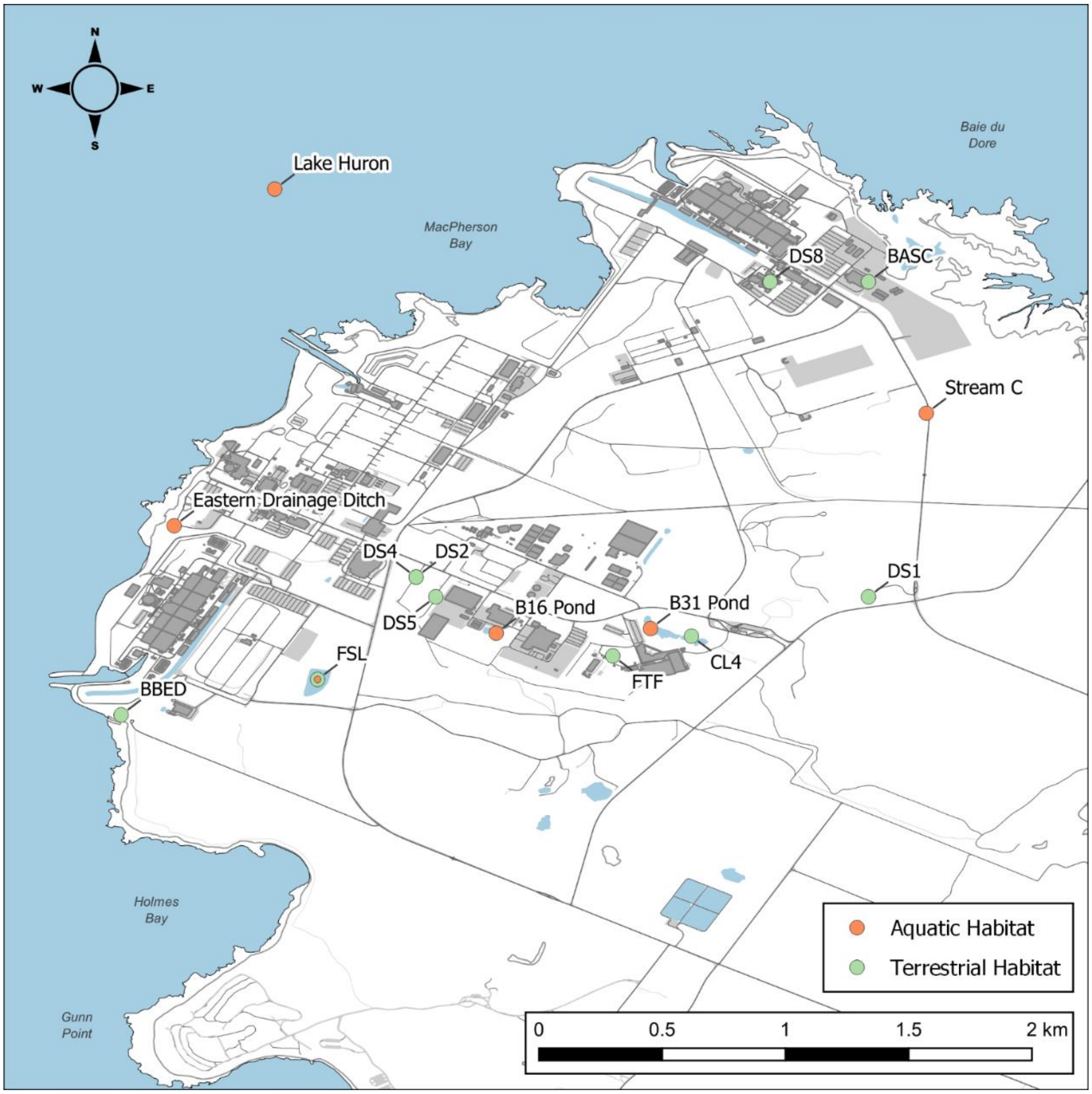


Figure 8 - Areas Assessed in the Conventional Ecological Risk Assessment

The conventional ecological risk assessment identified potential risks to terrestrial ecological receptors at Construction Landfill #4, Fire Training Facility, Distribution Station #1 and at five general soil sampling sites, to semi-aquatic receptors at Eastern Drainage Ditch and to aquatic receptors in Lake Huron, Former Sewage Lagoon, B31 Pond and Eastern Drainage Ditch (Table 6). The conservative nature of the methodology used to assess risks due to conventional contaminants in the ecological risk assessment results in the identification of areas of potential risk but does not necessarily indicate a current risk to receptors. Additional follow-up monitoring is required to refine the risk assessment.

Table 6 - Summary of Conventional Ecological Risk Assessment Conclusions and Recommendations

Area	Media Assessed	Conclusions	Recommendations
Terrestrial			
Construction Landfill #4	Soil	Hazard Quotients above 1 for terrestrial wildlife from zinc and high molecular weight polycyclic aromatic hydrocarbons.	Further work should characterize the extent of zinc impacts around Construction Landfill #4 collected in 2016 and polycyclic aromatic hydrocarbons impacts around site CL4-9 collected in 2000 to affirm potential risks because these were the only locations that exceeded the Construction Landfill #4. Further work should characterize the current acid base extractable concentrations at site CL4-9 collected in 2000 to confirm if they remain chemicals of potential concern in the absence of risk-based criteria.
Fire Training Facility	Soil	Hazard Quotients above 1 for plants and soil invertebrates from light total petroleum hydrocarbons.	Further work should characterize the current Petroleum Hydrocarbon (PHC) concentrations around historically contaminated areas within surface soil to affirm potential risks. Further work should characterize the current acetone and acid base extractable concentrations at site FTF-12 collected in 2000 to confirm if they remain chemicals of potential concern in absence of risk-based criteria.
Distribution Station #1	Soil	Hazard Quotients above 1 for plants and soil invertebrates from light total petroleum hydrocarbons.	Further work should characterize the current petroleum hydrocarbons concentrations around historically contaminated areas within surface soil to affirm potential risks.
General Surface Soil Samples (BPS and SS series)	Soil	Hazard Quotients above 1 for plans and soil invertebrates from boron (hot water soluble), selenium and petroleum hydrocarbons (fraction 2 and 3). Hazard Quotients above 1 for terrestrial wildlife from lead and selenium.	Further work should delineate the extent of metal impacts in surface soil around sites BPS-04-07 and SS6 and the extent of petroleum hydrocarbons impacts around sites BPS-07-07 and BPS-01-07 to affirm potential risks because these were the only locations that exceeded the site-specific target level. Further work should delineate strontium impacts around sites BPS-01-07 and BPS-02-07 to confirm if strontium remains a chemical of potential concern in absence of risk-based criteria.

Area	Media Assessed	Conclusions	Recommendations
Aquatic			
Lake Huron shoreline and nearshore habitat	Surface Water	Hazard Quotients above 1 for aquatic communities from zinc.	Additional sampling events required to affirm potential risks as per updates to the environmental monitoring program. Analysis of dissolved organic carbon required to derive site-specific toxicological benchmark for zinc.
Former Sewage Lagoon	Sediment	Hazard Quotients above 1 for aquatic communities from petroleum hydrocarbon.	Further work should delineate petroleum hydrocarbon impacts; total organic carbon should be assessed to derive a site-specific toxicological benchmark.
Former Sewage Lagoon	Surface Water	Hazard Quotients above 1 for aquatic communities from copper and zinc.	Additional sampling events required to affirm potential risks as per updates to the environmental monitoring program. Analysis of dissolved organic carbon required to derive site-specific toxicological benchmark for zinc.
B31 Pond	Surface Water	Hazard Quotients above 1 for aquatic communities from copper.	Additional sampling events required to affirm potential risks as per updates to the environmental monitoring program.
Distal Eastern Drainage Ditch	Sediment	Hazard Quotients above 1 for aquatic communities from petroleum hydrocarbon fraction 3. Hazard Quotients above 1 for insectivorous, semi-aquatic wildlife from vanadium.	Further work should delineate petroleum hydrocarbon impacts; total organic carbon should be assessed to derive a site-specific toxicological benchmark. Further work should delineate vanadium impacts and measure chemical of potential concern concentration in benthos.

4.1.3 Radiological Risk Assessment

The radiation doses to members of the public residing in the area surrounding the Site are less than 1% of the Canadian Nuclear Safety Commission effective dose limit for a member of the public (1 millisievert per year) [R-63]. With a hazard quotient of less than 0.01, and with many of the uncertainties in the assessment (e.g., concentrations reported as less than a detection limit) addressed in a conservative manner, there is no radiological risk to human health for members of the public resulting from normal operations on the Site.

The radiation dose rates to non-human biota residing on or near the Site are less than 1% of the applicable United Nations Scientific Committee on the Effects of Atomic Radiation benchmark value [R-64]. With a hazard quotient of less than 0.01, and with many of the uncertainties in the assessment (e.g., occupancy factors and ingestion parameters) addressed in a conservative manner, there is no radiological risk to non-human biota resulting from normal operations on the Site.

In addition to assessing the overall risk to humans and non-human biota, this report examined the specific contributions of each radionuclide and exposure pathway to the total radiation dose. This analysis of relative risk provides information for the design of the radiological environmental monitoring program.

4.1.4 Physical Stressor Assessment

The assessment of the physical effects of the noise, cooling water intake and discharge, and habitat alteration has shown no unreasonable risk to human or ecological receptors.

Bruce Power has completed a comprehensive quantitative thermal risk assessment with substantial methodological improvements over past thermal risk assessments. These improvements have included the full incorporation of thermal modelling data, modelled thermal benchmarks for cold water fish species and assessment of all species and life stages present in the nearshore area. A pilot method of presenting daily maximum temperature data and overlays of fish species and life stage benchmark exceedances for improved visualization can be accessed at: https://wsp-shinyapps.shinyapps.io/ERA_temperature/. The thermal risk assessment assessed a low risk to several mainly cold and cool water species and life stages located in the Local Study Area:

1. Lake Trout, Lake Whitefish, Round Whitefish, Walleye and Brown Bullhead eggs
2. Larval Deepwater Sculpin, Lake Whitefish and Walleye
3. Growth stage for Rainbow Trout, Chinook Salmon, Lake Whitefish, Walleye, Gizzard Shad and Yellow Perch
4. Parent Smallmouth Bass and Brown Bullhead.

Given the similar habitat available along the length of the Lake Huron coast and the mobility of older life stages, no population level effects are expected.

No benchmarks for fish impingement or entrainment are available from federal or provincial authorities that can be used to assess the environmental risk. Effect thresholds are dependent on sufficient knowledge of the population including natural variability. Bruce Power obtained a *Fisheries Act Authorization* from Fisheries and Oceans Canada in 2019 [R-65] that permits continued operation with the requirement to meet specific conditions related to impingement and entrainment, including offsetting that is intended to provide complete compensation for the fish losses incurred through impingement and entrainment. Using this construct, fish losses from impingement and entrainment are compensated for by fisheries offsets, resulting in a no net loss over time.

Monitoring and assessment of impingement and entrainment and thermal effluents over time (in prior environmental assessments and environmental risk assessments) continues to verify no unreasonable risk to the natural environment because of these physical stressors. Extensive monitoring to verify these conclusions, coupled with comprehensive assessments that utilize best practices to characterize risk, have resulted in the conclusion that further mitigation is not warranted at this time. This conclusion is substantiated by the measured fish loss (non-significant) and lack of change in the predicted temperature differential from operations.

The design and use of existing mitigation technologies has been implemented to minimize impingement and entrainment and thermal impacts to the greatest extent possible. The Bruce Power site location, situated on the Douglas Point headland, was strategically picked because of its high energy zone with access to cold, deep water. The headland juts into Lake Huron providing a natural feature for dispersion of thermal effluent and the shoreline location itself is naturally low in diversity of fish species due to high wave action and winter ice movement. In 2020, Bruce Power submitted an assessment of feasible mitigation measures for thermal effluent and impingement and entrainment effects at the Bruce Power site [R-66]. This assessment of feasible mitigation measures for reduction of impingement and entrainment and thermal effluents identified the most feasible options for reduction of Impingement and Entrainment and thermal effluent as Variable Speed Drives and velocity cap modifications (i.e., light or sound deterrents). The results of the 2020 assessment of feasible mitigation measures are integrated into the 2022 Environmental Risk Assessment and any changes to mitigation technologies will be integrated into future Environmental Risk Assessments. Given the overall low impact of thermal effluent, impingement and entrainment on aquatic biota in Lake Huron, no additional mitigation measures will be actively implemented at the present time [R-67]. The update of the assessment of feasible mitigation measures within the Environmental Risk Assessment on a 5-year cycle provides a continual surveillance of potential mitigation measures in the event of operational changes or that continued monitoring of thermal effluent, impingement and entrainment show a significant increase in environmental impact to aquatic biota.

Bruce Power continues to be engaged in understanding the impacts from climate change predictions and considering how they may affect future operations and the local environment. Bruce Power has prepared an assessment of the potential effects of climate change on water temperatures by 2054 to 2074 [R-68]. The impact of Bruce Power operations in terms of thermal effluent will remain unchanged under all climate change scenarios. This means that the temperature changes driven by thermal effluent from Bruce Power operations in the local study area will not change as Lake Huron temperatures increase. The absolute temperature in the local study area is predicted to increase proportionately to the temperature increase in other nearshore areas of Lake Huron by 1-2 degrees Celsius. As climate change prediction models become more advanced and/or the ambient conditions change, the Environmental Risk Assessment will be updated to determine if and how such changes impact the operation of Bruce Power’s facilities and, if required, assess the feasibility of mitigation measures.

4.1.5 Predictive Effects Assessment

Over the past 20 years Bruce Power has gained a significant amount of experience in the restart and refurbishment of its CANDU reactors. Overall, as outlined in Appendix D [R-61] of the 2022 Environmental Risk Assessment report, potential environmental effects of planned future activities are anticipated to be similar to those associated with the existing operations. Therefore, the existing environmental monitoring programs will be retained as required to confirm predictions and be reported through the annual environmental monitoring program findings. During life extension and major component replacement activities, Bruce Power's environmental management programs will be maintained.

Future site activities including Lutetium-177 production, life extension and major component replacement activities were evaluated for potential interactions with the environment. The preliminary assessment screened these interactions to assess whether the current operational conditions were bounding. Where this was not considered to be the case, a predicted bounding condition was developed and screened against accepted values for the protection of human health and the environment. In all cases, the current conditions were considered bounding, or the predicted conditions were screened as being acceptable.

The environmental effects and interactions that were discussed in this report are continually evaluated throughout the major component replacement planning stages through involvement of the Environment Department as a stakeholder in the design process and planning of major component replacement activities. Environmental management plans are implemented and executed as required for major component replacement activities.

All activities at the Bruce Power site, including major component replacement activities, will continue to be executed in a manner that ensures continual protection of human health and the environment, in accordance with applicable operating licences, codes and standards.

4.1.6 Conclusions

The Environmental Risk Assessment demonstrates that the operation of the Bruce Nuclear Facility has not resulted in adverse effects on human health of nearby residents or visitors due to exposure to radiological or conventional substances and physical stressors. For non-human biota exposure to radiological or conventional substances also resulted in no adverse effects and no unreasonable risk to the environment is evident due to exposure to physical stressors.

The baseline radiation doses to members of the public residing in the area surrounding the Site as calculated based on current operational conditions are less than 1% of the Canadian Nuclear Safety Commission effective dose limit for a member of the public of 1 millisieverts per year. There is no radiological risk to human health for members of the public resulting from normal operations on the Site. The human health risk assessment for conventional contaminants identified no unreasonable risk for people using the land around the Site for recreational or residential/agricultural uses.

The radiation doses to non-human biota residing on or near the Site are less than 1% of the applicable United Nations Scientific Committee on the Effects of Atomic Radiation benchmark value. There is no radiological risk to non-human biota resulting from normal operations on the Site. The conventional ecological risk assessment identified potential risks to terrestrial ecological receptors at Construction Landfill #4, Fire Training Facility, Distribution Station #1 and at five general soil sampling sites, to semi-aquatic receptors at Eastern Drainage Ditch and to aquatic receptors in Lake Huron, Former Sewage Lagoon, B31 Pond and Eastern Drainage Ditch. Additional follow-up monitoring will be completed to refine these potential risks.

For thermal effluent, a low risk to some mainly cold and cool water species and life stages located in the Local Study Area was assessed during the thermal risk assessment process. Given the similar habitat available along the length of the Lake Huron coast and the mobility of older life stages, no population level effects are expected. For impingement and entrainment, Bruce Power has a *Fisheries Act Authorization* from Fisheries and Oceans Canada that permits continued operation with the requirement to meet specific conditions related to impingement and entrainment, including offsetting that is intended to provide complete compensation for the fish losses incurred through impingement and entrainment. Using this construct, fish losses from impingement and entrainment are compensated for by fisheries offsets, resulting in a no net loss over time. For other physical stressors, the assessment of the physical effects of noise, cooling water discharge and habitat alteration has shown no unreasonable risk to human or ecological receptors.

As the current operational conditions are demonstrated to be bounding of future activities, the 2022 Environmental Risk Assessment is, therefore, shown to be bounding of proposed future activities. There is no additional radiological or non-radiological risk to human or non-human biota resulting from anticipated future activities.

4.1.7 Preparation of the 2027 Environmental Risk Assessment

Table 7 described the progress on the recommendations listed in the conclusion of the 2022 Environmental Risk Assessment. The plan and progress towards the recommendations will be updated annually in this report.

Table 7 - Plan and Progress of Recommendations in the 2022 Environmental Risk Assessment

Recommendation in the 2022 Environmental Risk Assessment	Plan and Progress
Bruce Power will continue to engage with Saugeen Ojibway Nation, Métis Nation of Ontario and Historic Saugeen Métis to support climate change research that is relevant to each community.	This engagement is ongoing through regular and ad hoc meetings.
Bruce Power will continue to support the Coastal Waters Environmental Monitoring Program. This	Bruce Power is continuing to support the Coastal Waters Environmental Monitoring Program and

Recommendation in the 2022 Environmental Risk Assessment	Plan and Progress
program was jointly developed between Bruce Power and Saugeen Ojibway Nation and aims to enhance the existing body of knowledge being compiled through Bruce Power's routine Environmental Monitoring.	Bruce Power will continue to integrate results into relevant environmental assessments.
As a follow up to the submission of the Assessment of Feasible Mitigation Measures report [R-67], updates to the risk assessment for Impingement and Entrainment and thermal effluent will continue to include an assessment of the need for mitigation measures and an update on any progress to mitigation measure implementation, if applicable.	Assessment of feasible mitigation measures continues and results will be incorporated as needed into: • Bruce A and B environmental compliance approvals; • *Fisheries Act Authorization* application; • Thermal risk assessments; and, • Projects on site that impacts thermal effluent and water taking, including Project 2030.
Bruce Power is required to complete entrainment monitoring and offset projects as part of the conditions of the *Fisheries Act Authorization* [R-65] and will continue to engage with Saugeen Ojibway Nation, Métis Nation of Ontario and Historic Saugeen Métis to communicate the results of the entrainment monitoring and to select and complete these offset projects.	Implementation of the *Fisheries Act Authorization* is ongoing. A pilot entrainment monitoring program was planned in 2023 and has been delayed until 2024. Engagement with all three of the local Indigenous Nations and communities is ongoing through regular and ad hoc meetings
For the conventional ecological risk assessment, Bruce Power will complete follow up monitoring as recommended in Table 6 to refine the assessment of risk in the 2027 Environmental Risk Assessment. Results of follow up monitoring will be reported annually in the environmental protection reports and compared to the site-specific target levels calculated in the 2022 Environmental Risk Assessment.	Follow-up monitoring is ongoing, and results are compared to the site-specific target levels calculated in the 2022 Environmental Risk Assessment. Monitoring of lake water and stream water quality were completed in the 2023 calendar year with results reported in Section 6.2.1 of this report.
Effluent and environmental data reported as less than a detection limit is a source of uncertainty in the radiological Environmental Risk Assessment. Uncensored data below the detection limit is now recorded and used where possible for environmental monitoring data. In some cases, the critical level is conservatively used as an upper bound of contaminant concentration. For effluent/emissions monitoring data, Bruce Power is in the process of completing the required work to	Changes to the management of uncensored data are in progress. Once available, this information will be integrated into the 2027 Environmental Risk Assessment.

Recommendation in the 2022 Environmental Risk Assessment	Plan and Progress
report uncensored data and critical level information for all radiological analyses. This uncensored data and critical level information will then be used in routine reporting. The use of uncensored data and critical level information for effluent and emissions data will represent a refinement of the Environmental Risk Assessment dose calculations. However, most of the Human Health Risk Assessment dose calculations are based on measurements in environmental media and are not dependent on effluent/emissions data. As a result, increasing the accuracy of reported emissions will have a small effect on reported doses and on the outcomes of the radiological Human and Ecological Risk Assessments.	
From the Ecological Risk Assessment, additional measurements of radionuclides in on site waterbodies have confirmed that the Former Sewage Lagoon is the bounding exposure location. Doses to non-human biota remain far below benchmark values, therefore additional refinement of dose calculations is not required. Continued monitoring of radionuclides in water and sediment at the Former Sewage Lagoon is recommended. This may include characterization of Carbon-14 in surface water to refine concentrations that were calculated based on modelling.	Follow-up monitoring is planned and results of completed monitoring will be reported annually in this report. No follow-up monitoring was completed during the 2023 calendar year.
Monitoring for impingement will continue. Bruce Power will also complete entrainment monitoring and offset projects as part of the conditions of the *Fisheries Act Authorization* [R-65].	Impingement monitoring continues and is reported in Section 6.2.2.1. A pilot entrainment monitoring program was planned for 2023 and has been delayed until 2024. Offset projects are ongoing and are reported in Section 6.2.2.
In response to the low risk posed by thermal effluent to several fish species, Bruce Power will continue to execute year-round thermal monitoring through logger deployments and thermal modelling work to monitor the risk posed by thermal effluent in the Local Study Area. Thermal logger deployments at depths over 10 metres will be discontinued during the winter period starting in the fall of 2022. Deployments at 3 metres, 5 metres and 10 metres depths will continue. Bluetooth technology for data loggers is being trialed to help improve retrieval of temperature loggers at shallow depths (≤10	Thermal monitoring continued in 2023. Over the summer of 2023, a brief trial of a Spotter Buoy and Smart Mooring, equipped with cellular transmission capability was successful. Data from the Spotter Buoy can be publicly available on the Seagull platform (Seagull (glos.org)) run by the Great Lakes Observing System. Up to three Spotter Buoys are planned to be deployed in 2024. Bluetooth technology for data loggers was trialed in 2022 to help improve retrieval of temperature loggers at shallow depths (≤10m). There was no

Recommendation in the 2022 Environmental Risk Assessment	Plan and Progress
metres). Deep locations (>10 metres) are difficult to retrieve in the spring, resulting in more field days and additional exposure of field personnel to health and safety concerns because of searching for and pulling these deep locations from the lake bottom. Over the winter period, the Thermal Risk Assessment considers only Lake Whitefish and Round Whitefish eggs at depths of 4 to 10 metres and Lake Trout eggs at depths of over 12 metres. For Lake Trout eggs, the only species and life stage assessed over the winter period at depths greater than 10 metres, thermal exceedances occur equitably at both reference and Local Study Area sites early in the incubation period; therefore, deployment and retrieval of temperature loggers over the winter period at depths greater than 10 metres is not contributing to the assessment of thermal effects. The Local Study Area Remapping Tool generates daily temperatures for 8,815 nodes at the surface and 8,815 nodes at the bottom over the entire Thermal Risk Assessment period. Daily average and daily maximum temperatures from the Local Study Area Remapping Tool can be used in the same manner as measured temperature values in the Thermal Risk Assessment process. For the 2022 Thermal Risk Assessment, the tool was used to increase the spatial assessment of the extent of thermal exceedances for Lake Whitefish eggs, Round Whitefish eggs and Lake Trout eggs. In the 2027 Thermal Risk Assessment, temperatures used for Hazard Quotient calculations for Lake Trout eggs will be generated using the Local Study Area Remapping Tool. Temperatures used for Hazard Quotient calculations for Lake and Round Whitefish eggs will also be completed using the Local Study Area Remapping Tool and available measured data.	effective transmission through water to aid in retrieval and therefore did not improve data retrieval. These loggers continue to be deployed and downloaded as part of the routine program. The thermal risk assessment was updated in 2023 for the Bruce A Environmental Compliance Approval Application. See Section 6.2.3.
Continued monitoring and assessment of impingement and entrainment and thermal effects will occur as per the established regulatory framework. This iterative assessment will also include ongoing Indigenous engagement and working to embed Indigenous values as was done throughout the mitigation measures assessment report. A reevaluation of risks and basis for	Assessment of impingement and entrainment and thermal effluent continues and results will be incorporated as needed into: • Bruce A and B environmental compliance approvals;

Recommendation in the 2022 Environmental Risk Assessment	**Plan and Progress**
decisions surrounding mitigation measure will be reported in subsequent Environmental Risk Assessments. Bruce Power will provide an update on the progress of the use of intake water flow flexibility (i.e., variable speed drives) engineering work and on current research related to the effects of sound and light on fish species relevant to the Local Study Area in the 2027 Environmental Risk Assessment.	• *Fisheries Act Authorization* application; • Thermal risk assessments; and, • Projects on site that impacts thermal effluent and water taking, including Project 2030
Although no significant impact on the environment is expected from Lutetium-177 production, Bruce Power will collect data to verify and confirm that changes in atmospheric emissions are negligible. During commissioning of the Isotope Production System and for a limited period thereafter, the particulate filters from the stack monitor will be analyzed for the presence of Ytterbium-175, Ytterbium -177 and Lutetium -177 in the gaseous effluents. Bruce Power will review the additional monitoring data to validate the assumptions presented in the predictive Environmental Risk Assessment.	Radiological emissions on site are reported in Section 5.1.
With the successful execution of a large portion of the higher risk Life Extension and Major Component Replacement activities for Unit 6, including the draining of systems and the removal of components, no substantial changes to baseline radiological and conventional emissions and effluents are expected to occur during Life Extension and Major Component Replacement. As the current operational conditions are demonstrated to be bounding of future activities, including Major Component Replacement activities, the 2022 Environmental Risk Assessment is, therefore, shown to be bounding of the proposed activities. The need to evaluate for monitoring related to Gas Bubble Trauma at the completion of the Life Extension Program will be carried to the 2027 Environmental Risk Assessment. No specific recommendations are required.	The impacts of Project 2030 are being evaluated and will be incorporated into the 2027 Environmental Risk Assessment and into a gap analysis, if deemed necessary. An Environmental Management Plan will be used to evaluate the impacts of Project 2030 on all environmental aspects. Incorporation of an efficiency gains scenario was included in the updated thermal risk assessment. See Section 6.2.3.

In addition to the recommendations listed in Table 7 above, the Canadian Nuclear Safety Commission and Environment and Climate Change Canada have reviewed the 2022 Environmental Risk Assessment. Preparation of formal correspondence to respond to technical comments is underway. At the present time, the following recommendations will be implemented for the 2027 Environmental Risk Assessment:

- Regular wildlife turtle and bird surveys of on-site permanent drainage features will continue at the frequency dictated by the environmental monitoring program. Bruce Power will consider follow-up monitoring of benthic invertebrate communities in the nearshore area of Lake Huron, the discharge channels, and the addition of a reference site location if such monitoring is deemed necessary through the environmental monitoring program. Results will be included in future iterations of the annual Environmental Protection Report and in the 2027 Environmental Risk Assessment to provide additional context for risk characterization. An enhanced description of the permanent drainage features on site will be added to the 2027 Environmental Risk Assessment.

- Analysis of selenium and vanadium in sediment samples collected from the Eastern Drainage Ditch and the Former Sewage Lagoon and of pH from surface water at the Former Sewage Lagoon will continue during routine monitoring. Lake Huron surface water sampling will include antimony, barium, molybdenum, selenium, uranium, and vanadium as part of routine sampling. A discussion of the potential cumulative effects from project activities on phosphorus in effluent will be included in the 2027 environmental risk assessment. All sampling will be included in future iterations of the Annual Environmental Protection Report and assessed in the 2027 Environmental Risk Assessment.

- As completed for the 2022 Environmental Risk Assessment, future Environmental Risk Assessments will include a review of available Toxicity Reference Values for all Chemicals of Potential Concern. An interactive interface will be considered to facilitate regulator and stakeholder review of the screening process, similar to the one piloted for the 2022 Environmental Risk Assessment (https://wsp-shinyapps.shinyapps.io/ERA_screening_tables/).

- A map of the Lake Huron fishing Zone 1 will be included in the Impingement and Entrainment section.

- In the 2027 Thermal Risk Assessment, several changes will be made:

    - All available thermal monitoring data from April 1, 2021 to March 31, 2026 will be incorporated.

    - Validation results for the MIKE3 Huron Hydrothermal model will be presented for two years.

- The Local Study Area Remapping Tool, thermal modelling improvements, calibration and validation efforts will be briefly discussed within the methodology section of the 2027 thermal risk assessment.

- The spatial extent of thermal benchmark exceedances and hatch advance for Lake Whitefish eggs will be compared between operational and non-operational scenarios and with reference sites to enhance the risk characterization. This will provide additional context as to the spatial extent of exceedances within the Local Study Area.

- Reference site selection criteria will be explicitly stated for all reference sites.

- An interactive interface for thermal risk assessment data will be considered, similar to the one prepared as a pilot for regulators and stakeholders for the 2022 Thermal Risk Assessment (https://wsp-shinyapps.shinyapps.io/ERA_temperature/).

- A discussion of the potential cumulative effects from project activities on phosphorus levels in Lake Huron will be included.

- Bruce Power will consider contributing funding and/or in-kind contributions to future projects to characterize the Habitat Productivity Index for Lake Huron run by external organizations. Bruce Power will not be initiating projects to characterize Habitat Productivity Index in Lake Huron based on the current *Fisheries Act Authorization* conditions.

- Bruce Power will consider posting a public plain language summary in addition to the posting of an accessible version of the report. Information will be provided regarding risk terminology, the quality assurance processes for the site-specific survey, and the periodic review process for the Environmental Risk Assessment. Bruce Power will also continue to list the changes made with each Environmental Risk Assessment update, including changes made to reach compliance with Canadian Standards Association N288.6-22.

4.2 Thermal Risk Assessment

As climate change gradually affects lake-wide temperature, a temporary flexibility amendment of the Bruce A environmental compliance approval is in place to allow a maximum effluent temperature of 34.5 degrees Celsius (an increase of 2.3 degrees Celsius) between June 15th and September 30th each year. This provides operational flexibility for a maximum of 30 aggregate days within this period, and for no more than a maximum of 15 consecutive days at a time. This operational flexibility was not invoked in 2023 because the maximum daily average effluent temperature at Bruce A did not exceed 32.2 degrees Celsius. In the Thermal Environmental Compliance Approval renewal application submitted to the Ministry of Environment, Conservation and Parks in 2023, Bruce Power proposed that where the use of the Bruce A flexibility occurs for 11 or more consecutive days or 23 or more aggregate days June 15 and September 30, this would trigger additional consultation with Ministry of

Environment, Conservation and Parks, Saugeen Ojibway Nation, Historic Saugeen Métis and Métis Nation of Ontario. This trigger for additional engagement once 75 percent of the thermal flexibility days were utilized in each season will allow for early dialogue about the thermal conditions in Lake Huron, including ambient conditions and the effects of Bruce Power operations.

For future consideration, to fully assess the potential effects of post Major Component Replacement operations with the effects of climate change, a bounding scenario was included in the renewal application under a 2030 climate scenario, titled Efficiency Gains. The Efficiency Gains scenario includes Project 2030. Project 2030 is an incremental investment program that will build on the existing life extension program (Major Component Replacement and Asset Management) that enables additional targeted investments to increase power output from 6,300 Megawatts (in 2016) to up to 7,000 Megawatts. The results show a generally unchanged level of risk between current operational conditions from 2017 to 2022, under both operational warm and median 2030 climate scenarios.

Bruce Power will continue to pursue the conceptual engineering projects on additional Condenser Cooling Water pumping capacity and modifying the Bruce A discharge, with results available at the end of 2024. Bruce Power will also work with Electric Power Research Institute to kick off a Technical Advisory Committee to identify innovative means to minimize the impact of operating Nuclear Power Plants on lake temperature and local ecology (fish species, biota). Outcomes from these two conceptual engineering projects and Electric Power Research Technical Advisory Committee initiative will be reported in the 2027 Environmental Risk Assessment. Bruce Power will continue working with the Electric Power Research Institute on Climate READi and Climate Hazard Information and Projection initiatives.
Bruce Power will also continue to continue to monitor current research on feasible mitigation measures for thermal effluent and fish impingement. This iterative assessment will also include ongoing Indigenous engagement and will continue to embed Indigenous values as was done throughout the mitigation measures assessment report [R-67]. A re-evaluation of risks and basis for decision will continue in the future through existing regulatory processes.

To address other climate change related concerns identified by the Historic Saugeen Métis, including invasive species and extreme weather events that are not applicable to the Bruce A thermal flexibility, Bruce Power is developing a Climate Hub with the Nuclear Innovation Institute in Port Elgin, Ontario. The Climate Hub is in the initial development phase and Bruce Power welcomes contributions from the Saugeen Ojibway Nation, Historic Saugeen Métis and Métis Nation of Ontario to the structure and function of the hub. Bruce Power shares the concerns of the Saugeen Ojibway Nation, Historic Saugeen Métis and Métis Nation of Ontario about the effects of climate change on the impact of thermal effluent in Lake Huron and will include a modelling projection for warm and median climate conditions and known operational conditions in the 2040s in the 2027 and 2032 updates to the Thermal Risk Assessment. As a result, the potential near-term impacts of climate change will be integrated into the thermal risk assessment on an ongoing, iterative basis.

The results of the five-year update to the Thermal Risk Assessment will embed any traditional knowledge provided by Saugeen Ojibway Nation, Historic Saugeen Métis and Métis Nation of Ontario and projections for the following decade with the current knowledge of potential future operational conditions. Bruce Power strives to not only assess the current effects of thermal effluent, but to provide a look ahead into the combination of future climate scenarios and future operational scenarios. Climate projections used in these future hydrodynamic modelling efforts will be updated to remain with the ever-evolving state of climate science.

Further details on thermal monitoring results can be found in the 2022 Environmental Quantitative Risk Assessment [R-4]. In addition, an interactive tool has been developed to present these data and can be accessed through the following link:

https://wsp-shinyapps.shinyapps.io/ERA_temperature/

5.0 EMISSIONS AND EFFLUENT MONITORING

To demonstrate environmental protection, Bruce Power performs extensive monitoring and modelling of radiological and conventional contaminants.

Air emissions and water/land effluents are controlled and regulated. Releases occur in a manner that minimizes environmental impact. Bruce Power's radiological and conventional environmental monitoring programs are designed to continuously verify that environmental protection is being maintained and that these releases minimal impact on the surroundings. The effluent and emissions monitoring programs are based on Canadian Standards Association N288.5 [R-27], Canadian Nuclear Safety Commission REGDOC-2.9.1 [R-12], reporting requirements in Canadian Nuclear Safety Commission REGDOC-3.1.1 [R-2] and the framework laid out in internal procedures.

The key goal of the emissions and effluent monitoring program is to:

- Ensure that physical stressors and radiological and conventional contaminants released through controlled pathways or spills do not cause undue risk to living organisms.

This is achieved by fulfilling key program objectives:

- Demonstrate compliance with limits on the concentration/activity of radiological and hazardous contaminants and intensity of physical stressors in the environment and/or their effect on the environment;
- Provide data to verify predictions, refine models, and/or reduce uncertainty in predictions as required for the Environmental Risk Assessment [R-4], and incorporate any recommendations into the program design; and,
- Maintain transparency and trust and demonstrate due diligence and meet stakeholder commitment.

5.1 Radiological Emissions and Effluent Monitoring Programs

Bruce Power monitors its radiological airborne emissions and waterborne effluent to ensure that releases are occurring within acceptable limits and remain as low as reasonably achievable. Radiological emissions and effluent monitoring data is reported to the Canadian Nuclear Safety Commission quarterly and is compared to internal administrative levels in addition to reportable regulatory levels and limits. If abnormal conditions are identified, investigations are undertaken, and appropriate corrective actions are applied.

Radiological emissions and effluent monitoring results feed into the larger Environmental Protection framework to ensure the public and the environment are protected at all times. Data from the radiological emissions and effluent monitoring program are utilized in conjunction with Radiological Environmental Monitoring measurements to support radiation dose assessments and complete a comprehensive Environmental Risk Assessment in accordance with Canadian Standards Association N288.6 [R-17].

The objectives of the Bruce Power radiological emission and effluent monitoring program are to:

a) demonstrate compliance with authorized release limits (Derived Release Limits) and other regulatory requirements;

b) demonstrate adherence to internal objectives and targets set on release amounts, for the purposes of emissions and effluent control;

c) confirm the adequacy of controls on releases from the source;

d) provide an indication of unusual or unforeseen conditions that might require corrective action or additional monitoring;

e) provide data to assess the level of risk on human health and safety, and the potential biological effects in the environment of the nuclear substances released from the facility; and,

f) provide data which, when combined with the results of environmental monitoring, can be used to test, verify or refine models used in Environmental Risk Assessments and dose assessments, and incorporate recommendations into program design.

Radionuclides in airborne emissions and waterborne effluents are monitored, as applicable, at Bruce Power facilities including Bruce A, Bruce B, Central Maintenance Facility, and the Central Storage Facility. Other facilities located on or near site that monitor for airborne and waterborne radionuclides, as applicable, include Canadian Nuclear Laboratories, Ontario Power Generation's Western Waste Management Facility, Kinectrics' Ontario Nuclear Services Facility, and Laurentis' Western Clean-Energy Sorting and Recycling Facility. Descriptions of the radiological emissions and effluent programs for these facilities can be found in Section 2.0

5.1.1 Bruce Power Facilities (Bruce A, Bruce B, Central Maintenance Facility, Central Storage Facility)

Monitoring of radiological emissions and effluents from Bruce A, Bruce B, the Central Maintenance Facility, and the Central Storage Facility occurs within the Bruce Power framework for control of radioactive emissions and effluents and includes the monitoring systems operating and quality assurance requirements. Airborne radiological emissions are monitored from applicable stacks within each facility for tritium, carbon-14, radioiodine (^{131}I), noble gasses, gross beta/gamma, and gross alpha. Waterborne radiological effluents are monitored at applicable release points for tritium, carbon-14, gross alpha, and gross beta/gamma.

All airborne emissions and waterborne effluents at Bruce Power remain well below the Derived Release Limits, which are regulatory limits developed using Canadian Standards Association Standard N288.1 [R-69], and based on a public dose limit of 1 millisievert per year as mandated by the Canadian Nuclear Safety Commission (*Radiation Protection Regulations*, SOR/2000-203) [R-70]. Bruce Power operates well below Derived Release Limits to ensure that members of the public and the environment are protected. Environmental Action Levels, developed in accordance with Canadian Standards Association Standard N288.8, are established at Bruce Power and are used as a precautionary measure to provide early warning of any actual or potential loss(es) of control of the Environmental Protection Program [R-71]. These levels are not an indication of risk to the public or environment as they represent a very small fraction of the Derived Release Limit (typically less than 1% of the Derived Release Limit) with annual dose to public remaining low (*de minimus)*. Bruce Power controls radiological emissions as low as reasonably achievable by taking action to investigate causes of elevated emissions and effluents and initiating mitigating actions, when necessary.

On December 31, 2021, Bruce Power implemented new Environmental Action Levels in accordance with Canadian Standards Association N288.8-17. The revised Environmental Action Levels are much lower than previous ones. In the past, Environmental Action Levels were applied to the whole station and were equivalent to 10% of the Derived Release Limit. The updated Environmental Action Levels are specific to each radionuclide and pathway of release and are based on the upper bound of historical normal releases.

5.1.2 Air

5.1.2.1 2023 Radiological Airborne Emissions Results

Through Bruce Power’s normal operation and outage maintenance activities, airborne radiological emissions are released to the environment. These airborne emissions are primarily monitored through exhaust stacks and are well below regulatory limits (Derived Release Limits). Radiological airborne emissions typically originate from reactor systems such as the main moderator and heat transport systems and their auxiliary systems. Airborne emissions can fluctuate during planned and unplanned activities; however, monitoring systems are in place to capture this variability. Planned activities that may result in temporary elevated emissions include controlled removal of defect fuel bundles from the reactor core, moderator cover gas purges to keep chemistry parameters within specifications, and planned outage days where maintenance work is performed on reactor systems to support equipment health and continued safe operation. Other causes of elevated emissions can include equipment deficiencies such as stack filter by-pass, resin exhaustion in ion-exchange purification systems, and boiler tube leaks that may cause increased emissions through feedwater venting.

Bruce Power has several engineered barriers in place to minimize the release of radionuclides to the environment and keep releases as low as reasonably achievable. These barriers include high efficiency particulate air filters and high efficiency carbon air filters to remove airborne particulates and radioiodine. Testing of Bruce Power's stack filters is conducted annually by a third-party vendor to assess and assure their removal efficiency. Additional barriers include moderator and heat transport purification systems designed to remove radionuclides, and moderator confinement and vault vapour recovery systems which reduce airborne tritium releases. Together, these engineered barriers along with systematic monitoring and investigation of emissions above normal operating levels ensures Bruce Power maintains emissions to levels that are as low as reasonably achievable. At all times, Bruce Power operations are designed to minimize emissions below internal administrative levels and Environmental Action Levels (Canadian Nuclear Safety Commission reportable levels), which ensures emissions remain well below regulatory Derived Release Limits.

The 2023 radiological airborne emission results for all licensed facilities located on or near site are shown in Table 8 [R-37][R-72]–[R-74]. This includes annual results of tritium, noble gases, radioiodine (^{131}I), carbon-14, particulate alpha, and particulate beta/ gamma. Bruce Power provides emission results to the Canadian Nuclear Safety Commission in quarterly reports in accordance with the Power Reactor Operating Licence. Bruce Power's radiological airborne emissions continue to remain well below regulatory limits (Derived Release Limits) as shown in Table 9 which displays Bruce Power's annual emissions as a percentage of the Derived Release Limit. In 2023, airborne radiological emissions at Bruce A, Bruce B, the Central Maintenance Facility, and the Central Storage Facility were well below Derived Release Limits and below reportable Environmental Action Levels.

Table 8 - Annual Radiological Airborne Emissions for 2023

Facility & Radionuclide/ Radionuclide Group	Bruce A	Bruce B	Central Maintenance Facility	Central Storage Facility	Ontario Power Generation Western Waste Management Facility	Canadian Nuclear Laboratories Douglas Point Waste Facility	Kinectrics' Ontario Nuclear Services Facility	Laurentis EnergySolutions Western Clean-Energy Sorting and Recycling Facility	Total
Tritium Oxide (becquerels per year)	8.8E+14	4.4E+14	3.7E+09	1.8E+11	1.5E+13	2.72E+11	1.25E+11	<1E+11	1.3E+15
Noble Gas (becquerels-mega electron volts per year)	7.4E+13	2.2E+13	N/A	N/A	N/A	N/A	N/A	N/A	9.6E+13
Iodine-131 (becquerels per year)	1.4E+07	4.9E+05	0.0E+00	N/A	1.2E+05	N/A	N/A	N/A	1.5E+07
Particulate Beta/ Gamma (becquerels per year)	2.5E+06	6.8E+06	0.0E+00	0.0E+00	5.1E+05	1.34E+05	N/A	N/A	9.9E+06
Particulate Gross Alpha (becquerels per year)	4.3E+04	1.2E+05	2.2E+03	N/A	N/A	N/A	N/A	N/A	1.7E+05
Carbon-14 (becquerels per year)	1.8E+12	8.7E+11	N/A	N/A	2.1E+10	N/A	N/A	N/A	2.7E+12

Note:

1. Beta/Gamma Results: Bruce A, Bruce B, and the Canadian Nuclear Laboratories Douglas Point Waste Facility perform beta analysis, and the Central Maintenance Facility, Central Storage Facility, and Ontario Power Generation Western Waste Management Facility utilize gamma scan results. Naturally occurring radionuclide material detected in the gamma scan analysis is not included in the summation of releases and are not reported.

2. Airborne radiological emissions from Bruce Power facilities are monitored continuously via stack monitoring systems with weekly analysis performed.

Table 9 - Annual Radiological Airborne Emissions for 2023 as a Percentage of the Derived Release Limit

Facility & Radionuclide/ Radionuclide Group	Bruce A	Bruce B	Central Maintenance Facility	Central Storage Facility
Tritium Oxide (% Derived Release Limit)	2.6E-01	5.6E-02	1.2E-06	4.3E-05
Noble Gas (% Derived Release Limit)	4.8E-02	5.8E-03	N/A	N/A
Iodine-131 (% Derived Release Limit)	4.0E-04	1.3E-05	0.0E+00	N/A
Particulate Beta/ Gamma (% Derived Release Limit)	3.9E-04	5.0E-04	0.0E+00	0.0E+00
Particulate Gross Alpha (% Derived Release Limit)	1.7E-05	1.7E-05	6.3E-07	N/A
Carbon-14 (% Derived Release Limit)	8.0E-02	2.1E-02	N/A	N/A

5.1.2.2 Air Emission Monitoring of Lutetium-177 Production

In January 2022, Bruce Power began production of lutetium-177, a medical isotope used in targeted radionuclide therapy to treat neuroendocrine tumours and prostate cancer. The lutetium-177 produced at Bruce B is used in cancer treatments around the world to precisely target malignant cancer cells without damaging surrounding healthy tissues.

Commissioning of the isotope production system in Unit 7 began in January 2022 and became operational on October 24, 2022. Although no changes to radiological emission levels were expected from this isotope production system, temporary monitoring of lutetium-177, ytterbium-175 and ytterbium-177 occurred at Bruce B since commissioning and was completed at the end of 2023. No airborne emissions from these radionuclides were identified throughout the entire temporary monitoring study. Due to the nature of the decay products associated with the production of lutetium-177, particles will either quickly decay to negligible activity or be filtered out by high efficiency particulate air filters prior to release resulting in negligible emissions. Although it is expected to have a negligible impact on emissions, any measurable radiological emissions produced from the lutetium-177 isotope production system would be detected by the existing stack monitoring systems already in place and reported to the Canadian Nuclear Safety Commission via routine quarterly reporting. No waterborne effluent is produced from the lutetium-177 isotope production system.

5.1.2.3 Historical Radiological Airborne Emission Results

Figure 9 through Figure 11 below provide an overview of the ten-year historical trend of annual airborne radiological emissions at Bruce A and Bruce B.

Historical airborne tritium emissions are provided in Figure 9. Airborne tritium is a principal radionuclide associated with dose to the public. Tritium emissions from Bruce B in 2023 were similar to previous years; however airborne tritium emissions from Bruce A decreased in 2023 compared to 2022. This decrease was a result of a continued emphasis on improving equipment reliability and performance of the confinement vapour recovery and vault vapour recovery systems. In December 2021 and January 2022, tritium emission increases were experienced at Bruce A due to a moderator pump seal leak within confinement rooms in Unit 1. In order to maintain radiological safety and minimize dos impact to workers, purging moderator pump room air to contaminated exhaust was required to execute repair and 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. In 2023, Bruce A experienced a Unit 4 Heat Transport System leak outside containment (within the powerhouse) due to a heat transport purification filter hose rupture that occurred in April. 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. All airborne tritium emissions remain below Environmental Action Levels and Derived Release Limits with dose to public remaining *de minimus*.

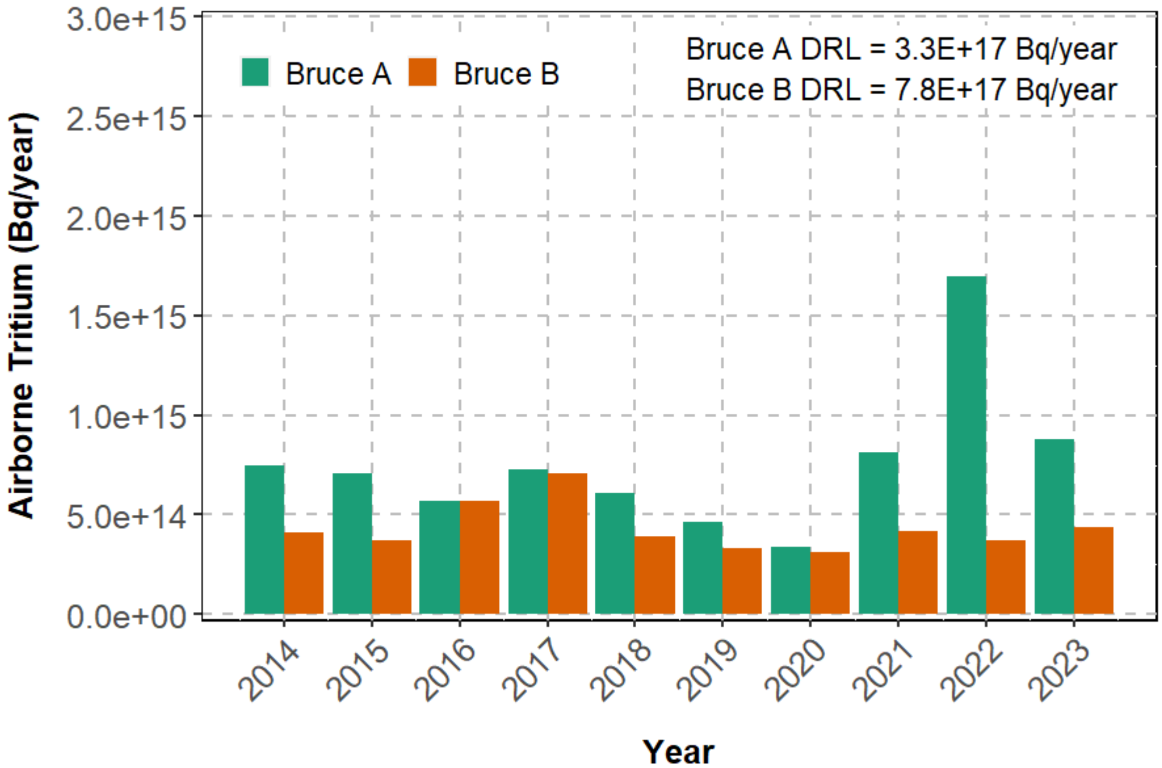


Figure 9 - Historical Airborne Tritium Emissions

Figure 10 displays the historical trend of airborne carbon-14 emissions. In 2023, carbon-14 emissions remained low at Bruce B with a decrease at Bruce A compared to 2022. The elevated 2022 carbon-14 emissions were attributed to 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. All carbon-14 emissions are below Environmental Action Levels and well below regulatory limits with dose to public remaining *de minimus*.

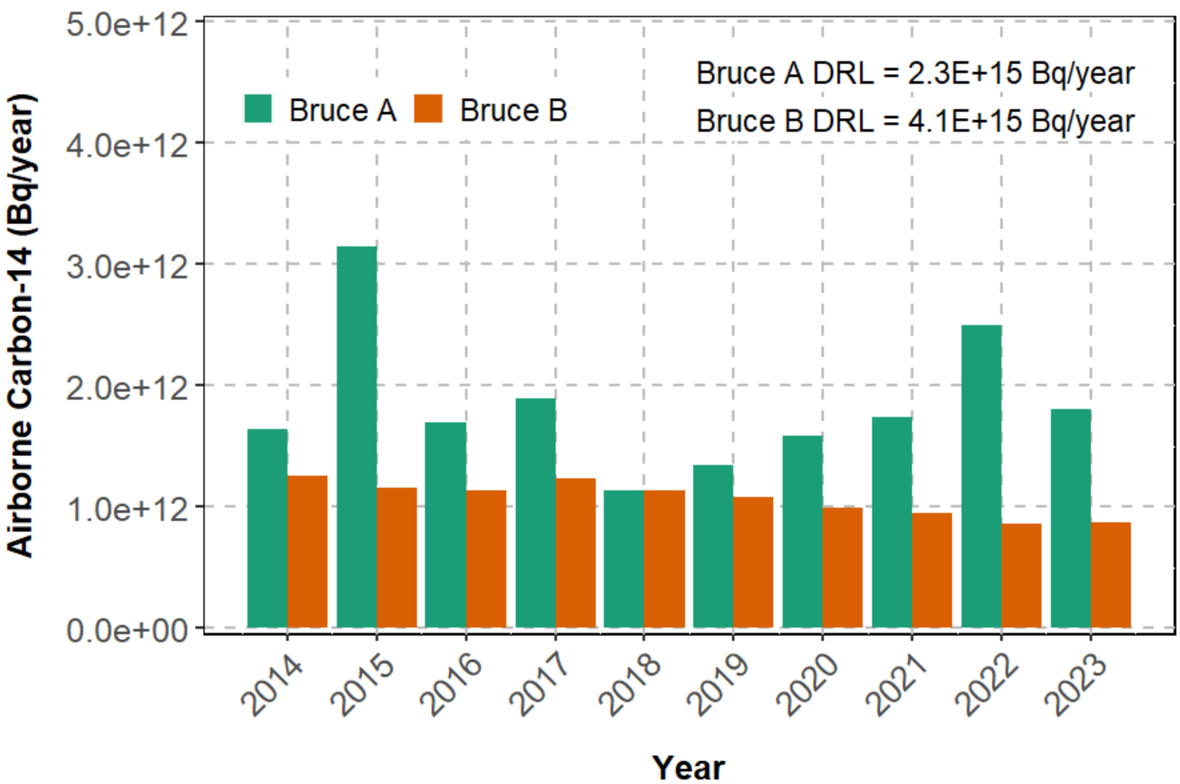


Figure 10 - Historical Airborne Carbon-14 Emissions

The majority of airborne iodine emissions are captured by the High Efficiency Carbon Air filters, which are tested on an annual basis to determine efficiency and maintain equipment reliability. Most Bruce A and B stack monitoring results for iodine are less than the Limit of Detection. To prevent producing an over-conservative number, as of 2016, results that were below the Limit of Detection were stated as such during routine reporting and results greater than Limit of Detection were included in the summation of iodine to provide a more representative value.

Figure 11 details the historical trend in radioiodine airborne emissions over the last 10 years. Iodine in air is a radiological emission associated with dose to the public. Radioiodine emissions from Bruce A in 2023 returned to low historical levels compared to 2022 and in 2023 Bruce B radioiodine emissions continued to remain low. Elevated iodine emissions at Bruce A in 2014 was caused by debris in the heat transport system following return to service of Units 1 and 2, which resulted in fuel defects and associated releases of iodine when the defect fuel was removed from the reactor. Similarly, Bruce A experienced increased iodine emissions for two weeks in 2022 caused by the removal of defect fuel on February 2nd, 2022. The radioiodine emissions during this period were above Bruce A's Environmental Action Level. Corrective actions were put in place to reduce the risk of re-occurrence including replacement of the High Efficiency Carbon Air filter beds and an increased focus placed on the filter maintenance and testing program. Although the iodine 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*.

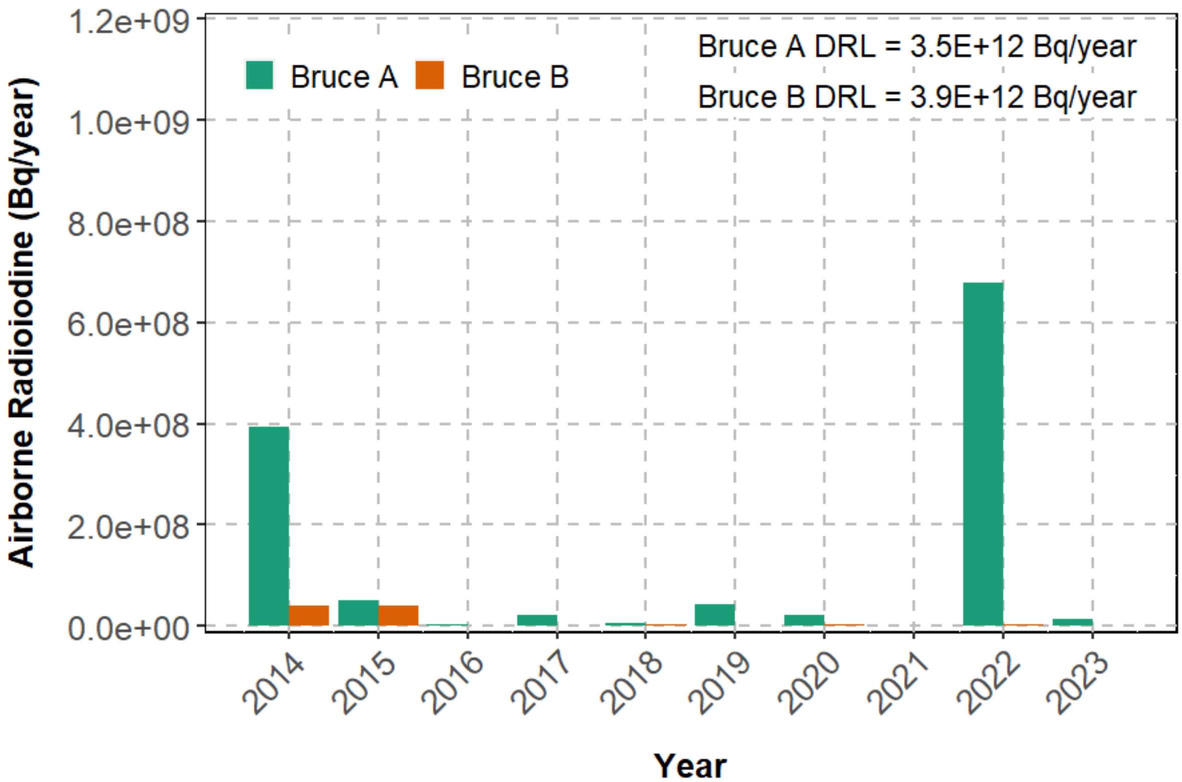


Figure 11 - Historical Radioiodine Emissions in Air

5.1.3 Water

5.1.3.1 2023 Radiological Waterborne Effluent Results

Waterborne radiological effluent, produced during Bruce Power's normal operation and outage activities, remained well below regulatory limits in 2023. Waterborne effluent is monitored through release pathways that include Active Liquid Waste, feedwater discharges and foundation drainage. Ultimately, these effluent streams are discharged to Lake Huron via the Condenser Cooling Water Duct. Sources for radiological waterborne effluent typically originates within reactor systems such as the moderator and heat transport systems and their auxiliary systems, where minor amounts are collected via systems such as vault vapour recovery systems and directed to the Active Liquid Waste treatment system prior to discharge.

The largest contributor to waterborne radiological effluent is the Active Liquid Waste system. Water in this system is collected in tanks and re-circulated to allow time for short-lived radionuclides to decay. Reverse osmosis and filtration systems are also used to remove radioactive particulate, where available. Prior to release, the contents of each tank are analyzed to ensure established discharge criteria are met.

Waterborne effluent loading can fluctuate depending on planned and unplanned activities that take place. Unplanned events that may result in higher radionuclide concentrations in effluent include equipment challenges such as moderator or primary heat transport upgraders being out of service, delays in offsite processing (de-tritiation) of heavy water (D_2O), purification resin exhaustion, and boiler tube leaks. Planned activities for which effluent fluctuations may occur include increased spent resin transfer activities, controlled discharges from collection and recovery systems, and planned outage days where maintenance work is performed on reactor systems to support equipment health and continued safe operation.

Bruce Power has several barriers in place to minimize waterborne radionuclides from being released to the environment. These barriers include moderator and heat transport purification to remove waterborne radionuclides from reactor systems, heavy water in light water (D_2O in H_2O) leak detection to provide indication of a heavy water leak or boiler tube leak, and heavy water (D_2O) supply and inventory systems to maximize the capture of heavy water (D_2O) for re-use. These barriers, in conjunction with applying the As Low As Reasonably Achievable principle, routine monitoring, and initiating investigations when effluent levels are above normal operating levels, assists Bruce Power in minimizing effluent and ensuring effluent remains well below regulatory limits.

Bruce A, Bruce B, Canadian Nuclear Laboratories, and Kinectrics' Ontario Nuclear Services Facility monitor for waterborne radionuclides (as applicable). Annual results of waterborne radionuclides including tritium, carbon-14, particulate alpha, and beta/gamma from these facilities are presented in Table 10 [R-72]–[R-74]. Bruce Power reports quarterly to the Canadian Nuclear Safety Commission results of radiological waterborne effluents in accordance with the Power Reactor Operating Licence. In 2023, Bruce Power's radiological waterborne effluents were well below regulatory limits as shown in Table 11 as well as below applicable reportable Environmental Action Levels.

There are no direct waterborne radiological effluent releases to the environment from the Central Maintenance Facility or Central Storage Facility. All radiological waterborne releases from these buildings are directed to Bruce A's Active Liquid Waste management system for processing and are included in the waterborne effluent total for that facility.

Starting January 2021, monitoring of discharge from the Western Waste Management Facility's Sample Stations system surface (stormwater) and subsurface (groundwater) streams was transitioned from the effluent monitoring program to Canadian Standards Association N288.6, *Environmental risk assessments at Class I nuclear facilities and uranium mines and mills*, and CSA N288.7, *Groundwater protection programs at Class I nuclear facilities and uranium mines and mills*, respectively [R-29], [R-75]. This change was based on the absence of releases of effluent into the stormwater system—other than the deposition of airborne emissions via precipitation. The monitoring and reporting of these airborne emissions are already managed under the airborne effluent monitoring programs and not reported separately as waterborne effluent [R-76].

Table 10 - Annual Waterborne (Aqueous) Radiological Effluent Results for 2023

Facility & Radionuclide/ Radionuclide Group	Bruce A	Bruce B	Canadian Nuclear Laboratories Douglas Point Waste Facility	Total
Tritium Oxide (becquerels per year)	2.6E+14	7.2E+14	2.44E+10	9.8E+14
Carbon-14 (becquerels per year)	8.4E+09	4.7E+09	N/A	1.3E+10
Gross Gamma (becquerels per year)	1.5E+09	3.2E+09	N/A	4.7E+09
Gross Beta (becquerels per year)	N/A	N/A	8.18E+06	8.2E+06
Gross Alpha (becquerels per year)	1.6E+05	3.7E+05	8.02E+06	8.6E+06

Note:

1. There were no waterborne effluents in 2023 for Kinectrics' Ontario Nuclear Services Facility.

2. Radiological waterborne effluents from Bruce Power facilities are primarily processed through the active liquid waste system. Tritium and gross gamma samples are analyzed on a per batch discharge frequency (grab and composite sampling) and gross alpha and carbon-14 samples are analyzed via monthly composite samples.

Table 11 - Annual Radiological Waterborne Effluent Results for 2023 as a Percentage of the Derived Release Limit

Facility & Radionuclide/ Radionuclide Group	Bruce A	Bruce B
Tritium Oxide (% Derived Release Limit)	3.0E-02	9.6E-02
Carbon-14 (% Derived Release Limit)	8.4E-03	2.2E-03
Gross Gamma (% Derived Release Limit)	5.1E-02	5.0E-02
Gross Alpha (% Derived Release Limit)	1.0E-05	1.1E-05

5.1.3.2 Historical Radiological Waterborne Effluent Results

Figure 12 through Figure 14 provide an overview of the ten-year historical trend of annual releases of waterborne radiological effluent at Bruce A and Bruce B.

Figure 12 details the historical trend in waterborne tritium. Tritium waterborne releases are a minor contributor to the overall dose to the public. Waterborne tritium effluent at Bruce B has a consistently higher baseline compared to Bruce A due to a design configuration with the Moderator Confinement Vapour Recovery condensate being directed to the Active Liquid Waste System. Bruce A and Bruce B waterborne tritium effluent in 2023 remained relatively stable compared to historical trends. In 2021, an increase in effluent was primarily attributed to a leaking motorized valve in the Bruce B Unit 8 Emergency Coolant Injection 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*.

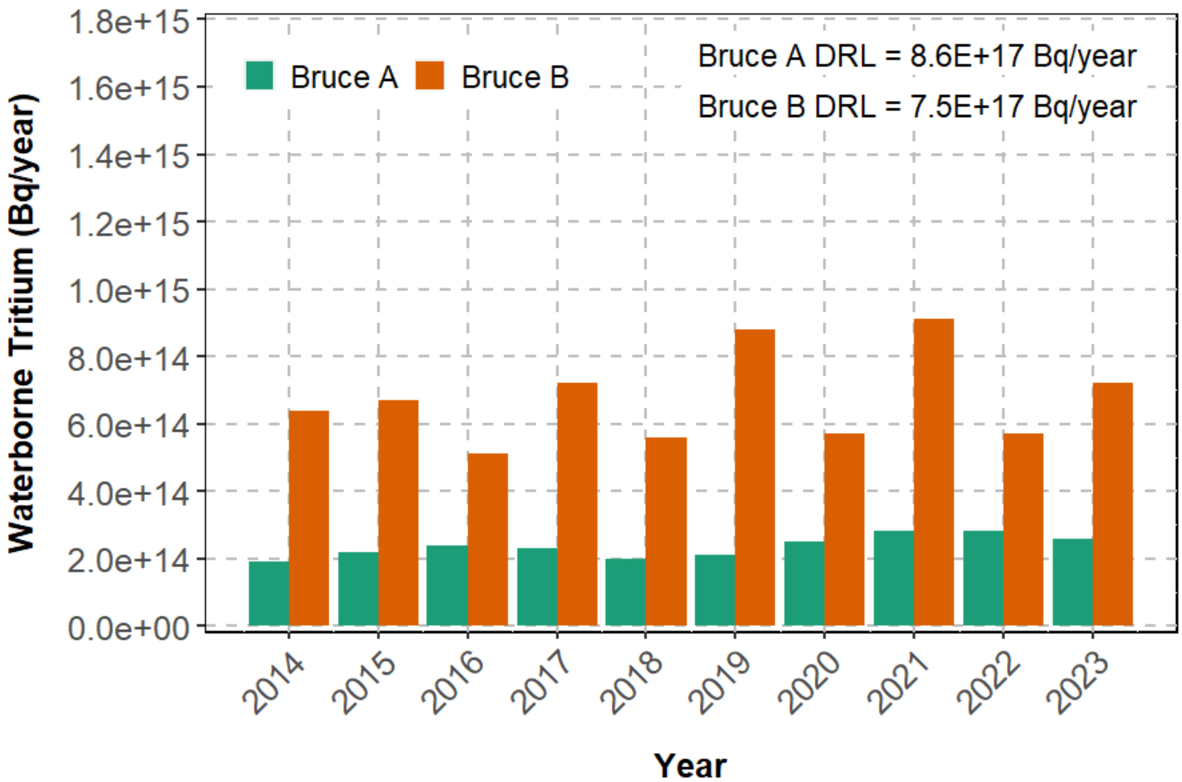


Figure 12 - Historical Tritium Waterborne Effluent

Figure 13 details the historical trend of waterborne carbon-14 effluent. Carbon-14 in water is a radiological effluent associated with dose to public and control/oversight is provided through Bruce Power's resin management program. Carbon-14 in waterborne effluent can fluctuate due to variations in the volume of spent ion exchange resins that are processed for waste each year. In 2022, Bruce A and Bruce B carbon-14 waterborne effluent remained low; however, carbon-14 effluent increases experienced in 2023 at Bruce A were a result of spent resin dewatering activities that were planned and required to support outages including Major Component Replacement heat transport chemical decontamination activities. In 2014, 2015, and 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. 2019 carbon-14 effluent at Bruce B is associated with increased spent resin dewatering activities in preparation for the Major Component Replacement in Unit 6. Carbon-14 effluent remained well below regulatory limits with dose to public remaining *de minimus*.

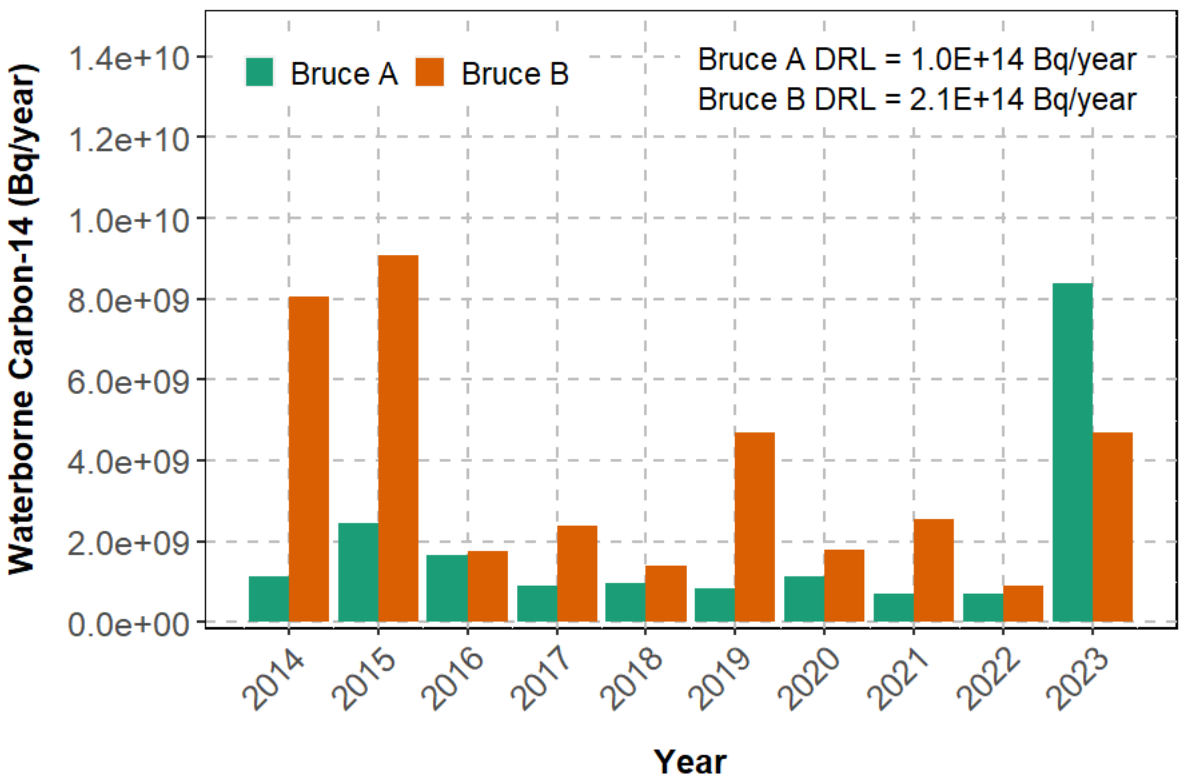


Figure 13 - Historical Carbon-14 Waterborne Effluent

Historical waterborne gamma effluent is shown in Figure 14. Bruce A and Bruce B waterborne gamma effluent in 2023 remained low and well within regulatory limits. 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*.

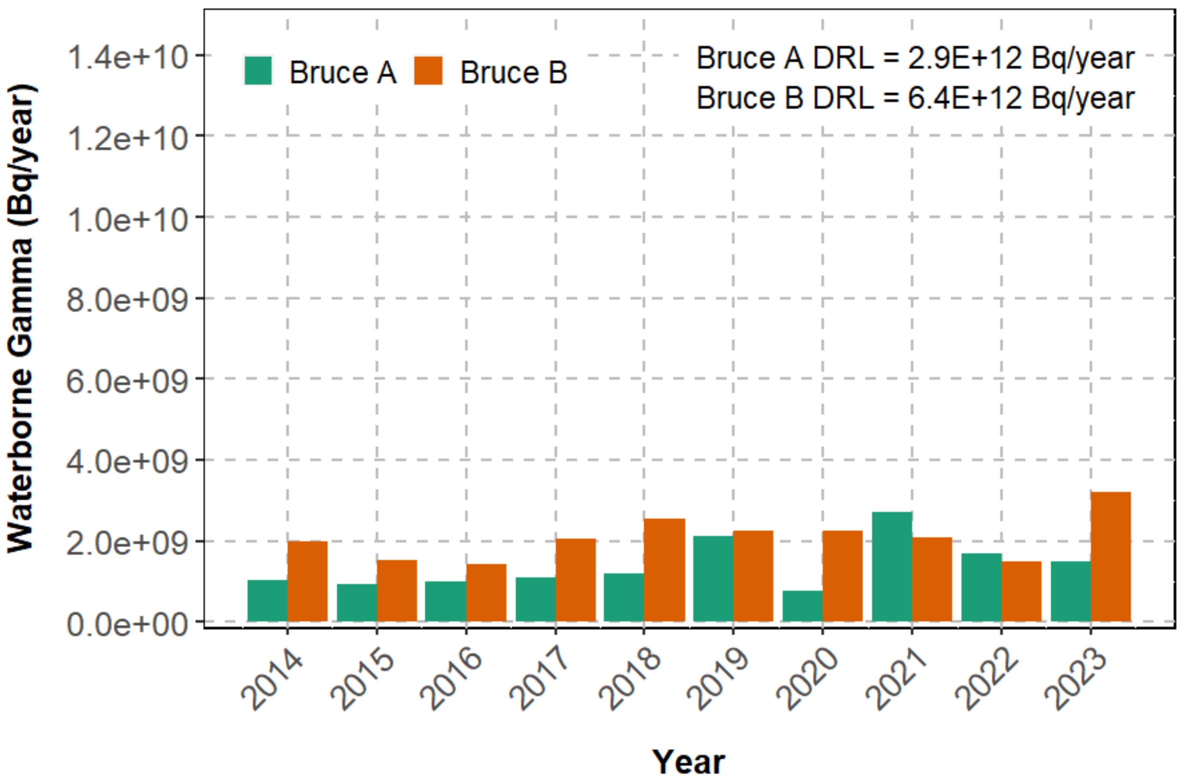


Figure 14 - Historical Waterborne Gamma Effluent

5.1.3.3 Sewage

Domestic wastewater (sanitary sewage) is collected from all facilities at the Bruce Power site including Bruce A and Bruce B, Central Maintenance Facility, Central Storage Facility, Canadian Nuclear Laboratories (Douglas Point), Ontario Power Generation (Western Waste Management Facility) and Centre of Site buildings. This wastewater is treated onsite at the Bruce Power Sewage Processing Plant. The sanitary sewage collection system is a 10 kilometre network of gravity sewers and force mains.

The sewage processing plant has an average design flow capacity of 1,590 cubic metres per day and a maximum design flow capacity of 4,700 cubic metres per day. The plant consists of an inlet chamber, aerated equalization tank, screening and grinding equipment, liquid chemical injection, and two parallel biological treatment trains consisting of aeration tanks, settling tanks, and aerobic sludge digesters, followed by ultraviolet disinfection, and two onsite lagoons for sludge storage. Final effluent from the plant is discharged to Lake Huron via a gravity pipe to the Lake Huron outfall located near Douglas Point.

Sewage processing plant effluent monitoring data includes radiological analytical results from the treated liquid effluent routed to the lake and the sludge digester tanks routed to onsite lagoons.

As shown in Table 12 and Table 13, quarterly and annual averages for radiological parameters in sludge and sewage effluent in 2023 were low and remained well below Bruce Power's internal acceptance criteria of 5,956 becquerels per litre for tritium, 4.3 becquerels per litre for gross beta, and 9.0 becquerels per litre for gross gamma. Additionally, the annual averages are well below the Ontario Drinking Water Quality Objective for tritium (7,000 becquerels per litre) [R-77].

Table 12 - 2023 Sewage Processing Plant Monitoring - Sewage Digester Sludge

Sample Source	Tritium (becquerels per litre)	Gamma (becquerels per litre)
Quarter 1	450	None detected
Quarter 2	520	None detected
Quarter 3	350	0.21
Quarter 4	330	None detected
Annual Average	410	0.05

Note:

1. Beta analyses are not done on sludge samples due to sample beta-self absorption.
2. Sewage processing plant sewage digester sludge is sampled and analyzed via grab samples when digester sludge is transferred to the sewage lagoon.

Table 13 - 2023 Sewage Processing Plant Monitoring - Sewage Effluent

Sample Source	Tritium (becquerels per litre)	Gross Beta (becquerels per litre)
Quarter 1	440	0.51
Quarter 2	410	0.54
Quarter 3	300	0.55
Quarter 4	280	0.56
Annual Average	360	0.54

Note:

1. Gamma analyses are not done on effluent samples since beta analysis is the most sensitive analysis for liquids.
2. Sewage processing plant sewage effluent is sampled and analyzed weekly via a 24-hour composite sample.

5.2 Conventional (Non-Radiological) Emissions and Effluent Monitoring

Bruce Power performs extensive modelling and monitoring of its emissions and effluent for conventional/hazardous contaminants to ensure that releases occur within acceptable limits and environmental impact is minimized.

The objectives of the conventional emission and effluent monitoring program are to:

- Demonstrate compliance with authorized release limits and any other regulatory requirements concerning the release of hazardous substances from the source;
- Demonstrate adherence to internal objectives and targets set on release amounts, for purposes of effluent control;
- Confirm the adequacy of control on releases from the source and ensure that appropriate measures are taken if new or existing activities will increase or change air or water emissions;
- Inform continual improvement strategies;
- Provide an indication of unusual or unforeseen conditions that might require corrective action or additional monitoring;
- Provide data to assess the level of risk on human health and safety, and the potential biological effects in the environment of the hazardous substances of concern released from the facility;
- Assist with determining whether a discharge/release event is reportable to external regulators; and
- Provide data which, when combined with the results of environmental monitoring, can be used to test, verify or refine models used in Environmental Risk Assessments, and incorporate recommendations into program design.

The results of monitoring events are submitted to the appropriate environmental Authorities Having Jurisdiction at various times throughout the year. Table 14 provides a summary of the monitoring reports that Bruce Power submits throughout the year as well as identifies the time of submission and the lead regulatory agency. The reports provide details and information necessary to meet regulatory reporting requirements. The following sections describe some of the regulatory context for each report.

5.2.1 Conventional (Non-Radiological) Emissions and Effluent Monitoring Program Methodologies

Effluent sampling and monitoring is conducted in compliance with limits set forth in the following:

- *Ontario Regulation 419/05: Air Pollution - Local Air Quality* [R-78], the *Environmental Protection A*ct (R.S.O. 1990, c. E. 19) [R-12]
- *Ontario Water Resources Act* (R.S.O. 1990, c.O.40) [R-79]
- Environmental Compliance Approvals issued by the Ministry of the Environment Conservation and Parks [R-80] [R-81] [R-82]
- Permits to Take Water issued by Ministry of the Environment Conservation and Parks and with Internal Administrative Levels [R-83] [R-84] [R-85]*Ontario Regulation 390/18: Greenhouse Gas Emissions: Quantification, Reporting and Verification* [R-86]
- *Federal Halocarbon Regulations, 2022, SOR/2022-210* [R-87]
- Notice to Report: Under the authority of Section 46 of the *Canadian Environmental Protection Act*, operators of facilities that meet the criteria specified in the annual notice with respect to reporting of greenhouse gases, published in the Canada Gazette, are required to report facility Greenhouse Gas emissions to Environment and Climate Change Canada by the annual June 1st reporting deadline [R-88].
- Notice to Report: Under the authority of the *Canadian Environmental Protection Act*, 1999 (CEPA 1999), owners or operators of facilities that meet published reporting requirements are required to report to the National Pollutant Release Inventory [R-89]
- *Ontario Regulation 463/10: Ozone Depleting Substances and other Halocarbons* [R-90]
- *Ozone-Depleting Substances and Halocarbon Alternatives Regulations (SOR/2016-137)* [R-91]

Table 14 – 2023 Bruce Power Regulator Reporting for Conventional Parameters

Regulatory Instrument	Report Title (Document Control Number)	Regulatory Agency	Submission Date (Frequency)
Air – Environmental Compliance Approval	Written Summary for Reporting Year 2023 Environmental Compliance Approval – Air 7747-8PGMTZ (BP-CORR-00541-00235)	Ministry of the Environment, Conservation and Parks	15JUN2024 (Annual)
Air - Halocarbon	Halocarbon Release Report Pursuant to the *Federal Halocarbon Regulations (SOR/2022-210)* Section 25 January to June 2023 (BP-CORR-00521-00065)	Environment and Climate Change Canada	31JUL2023 (Semi-annual)
Air - Halocarbon	Halocarbon Release Report Pursuant to the *Federal Halocarbon Regulations (SOR/2022-210)* Section 25 July to December 2023 (BP-CORR-00521-00066)	Environment and Climate Change Canada	31JAN2024 (Semi-annual)
Air – Greenhouse Gas	Not required to report 2023 Federal and Provincial Greenhouse gas Reporting	Internal Report	Quantify Greenhouse Gas emissions by 01JUN2024 (Annual) Not required to report
Air – National Pollutant Release Inventory	2023 National Pollutant Release Inventory for Bruce Power NPRI ID #7041 (BP-CORR-00521-00074)	Environment and Climate Change Canada	01JUN2024 (Annual)
Water – Annual Effluent	2023 Annual Effluent Discharge Report (BP-CORR-00541-00232)	Ministry of Environment, Conservation and Parks	01JUN2024 (Annual)
Water – Quarterly Effluent and Environmental Compliance Approval Report	Q1 2023 Effluent Discharge Report (BP-CORR-00541-00200)	Ministry of Environment, Conservation and Parks	15MAY2023(Quarterly)
Water – Quarterly Effluent and Environmental Compliance Approval Report	Q2 2023 Effluent Discharge Report (BP-CORR-00541-00208)	Ministry of Environment, Conservation and Parks	14AUG2023 (Quarterly)
Water – Quarterly Effluent and Environmental Compliance Approval Report	Q3 2023 Effluent Discharge Report (BP-CORR-00541-00214)	Ministry of Environment, Conservation and Parks	14NOV2023 (Quarterly)

Regulatory Instrument	Report Title (Document Control Number)	Regulatory Agency	Submission Date (Frequency)
Water – Quarterly Effluent and Environmental Compliance Approval Report	Q4 2023 Effluent Discharge Report (BP-CORR-00541-00219)	Ministry of Environment, Conservation and Parks	14FEB2024 (Quarterly)
Water – Environmental Compliance Approval	2023 Environmental Compliance Approval (Water) Annual Compliance Report for Bruce A (BP-CORR-00541-00226)	Ministry of Environment, Conservation and Parks	31MAR2024(Annual)
Water – Environmental Compliance Approval	2023 Environmental Compliance Approval (Water) Annual Compliance Report for Bruce B (BP-CORR-00541-00227)	Ministry of Environment, Conservation and Parks	31MAR2024 (Annual)
Water – Environmental Compliance Approval	2023 Environmental Compliance Approval (Water) Annual Compliance Report for Centre-of-Site (BP-CORR-00541-00228)	Ministry of Environment, Conservation and Parks	31MAR2024 (Annual)
Water – Permit to Take Water	2023 BA Water Taking Data - Permit to Take Water # P-300-2114648110 (BP-CORR-00541-00229)	Ministry of Environment, Conservation and Parks	31MAR2024 (Annual)
Water – Permit to Take Water	2023 BB Water Taking Data - Permit to Take Water # P-300-4114675736 (BP-CORR-00541-00230)	Ministry of Environment, Conservation and Parks	31MAR2024 (Annual)
Water – Permit to Take Water	2023 CS Water Taking Data - Permit to Take Water # P-300-7116089842 (BP-CORR-00541-00231)	Ministry of Environment, Conservation and Parks	31MAR2024 (Annual)
Water – *Wastewater Systems Effluent Regulation*	2023 Q1 Wastewater Systems Effluent Regulation Report (BP-CORR-00521-00064)	Environment Climate Change Canada	15MAY2023 (Quarterly)
Water – *Wastewater Systems Effluent Regulation*	2023 Q2 Wastewater Systems Effluent Regulation Report (BP-CORR-00521-00067)	Environment Climate Change Canada	14AUG2023 (Quarterly)
Water – *Wastewater Systems Effluent Regulation*	2023 Q3 Wastewater Systems Effluent Regulation Report (BP-CORR-00521-00069)	Environment Climate Change Canada	14NOV2023 (Quarterly)

Regulatory Instrument	Report Title (Document Control Number)	Regulatory Agency	Submission Date (Frequency)
Water – *Wastewater Systems Effluent Regulation*	2023 Q4 Wastewater Systems Effluent Regulation Report (BP-CORR-00521-00073)	Environment Climate Change Canada	14FEB2024 (Quarterly)

5.2.2 Conventional Air Emissions

5.2.2.1 Environmental Compliance Approval

Conventional air emissions are held to performance standards stipulated in Environmental Compliance Approval for Air Number 7477-8PGMTZ [R-92] which incorporates all non-radiological air emission sources on site. The Environmental Compliance Approval for Air allows flexibility to release contaminants up to a maximum Point of Impingement concentration limit at its property boundary. These limits are typically Ministry of the Environment, Conservation and Parks limits (as per *Ontario Regulation 419/05*) [R-78], and for cases where there is no pre-defined Ministry of the Environment, Conservation and Parks Point of Impingement limit, Bruce Power is bound by a Maximum Ground Level Concentration accepted by the Ministry of the Environment, Conservation and Parks upon its Environmental Compliance Approval for Air application submission.

Bruce Power's Environmental Compliance Approval for Air Limited Operational Flexibility expired December 31, 2021. An application to renew the Limited Operational Flexibility was submitted to the Ministry of the Environment, Conservation and Parks on January 1, 2021. The application to renew the Limited Operational Flexibility is currently under review by the Ministry of the Environment, Conservation and Parks. The Ministry of the Environment, Conservation and Parks Director issued a letter indicating that Condition 2.1 of the Environmental Compliance Approval for Air allows the Limited Operational Flexibility to remain in effect until the Environmental Compliance Approval for Air has been revoked with the issuance of the new Limited Operational Flexibility. All other Terms and Conditions of the Environmental Compliance Approval for Air remain in effect [R-93].

Air contaminants of concern are modelled for all non-negligible sources in worst-case scenarios. Estimated emission rates are then analyzed to ensure regulatory limits at the Point of Impingement are met. While Bruce Power is bound by Environmental Compliance Approval for Air performance limits, the company has operational flexibility to do things like modify the location of emissions sources or add new buildings and exhaust stacks, once it can be demonstrated that it will remain within these limits.

Specific contaminants emitted from non-negligible air emission source on site are identified in the Emission Summary and Dispersion Modelling report that reflects the actual operation of the facility [R-78]:

Bruce Power maintains an up-to-date Emission Summary and Dispersion Modelling report that reflects current operations. Upon making any modifications (within the bounds of the operational flexibility prescribed in the Environmental Compliance Approval for Air [R-92]), the modification log and Emission Summary and Dispersion Modelling report are updated to document that the facility is in compliance. The Emission Summary and Dispersion Modelling Report shows that:

1. The nature of the operations of the facility continues to be consistent with the description section of the Environmental Compliance Approval for Air;

2. The production at the facility continues to be below the facility production limit specified in the Environmental Compliance Approval for Air; and

3. The performance limits are met.

During 2023, two modifications were made for the use of diesel burning equipment as follows:

- Two 1,500 kilowatt diesel generators were required for the Bruce A Unit 3 Major Component Replacement Primary Heat Transport Chemical Decontamination; and

- Three 1600 cubic feet per minute low pressure diesel compressors were required for Unit 3 and Unit 6 Major Component Replacement Vault Pressure Tests.

The modifications demonstrated compliance with the Point of Impingement limits (as per *Ontario Regulation 419/05*) and the conditions of Bruce Power's Environmental Compliance Approval for Air.

5.2.2.2 Noise

The Environmental Compliance Approval for Air [R-92] requires that Bruce Power is within the noise limits of Noise Pollution Clearinghouse-232 Sound Level Limits for Stationary Sources in Class 3 Areas (Rural).

Two noise complaints were received in 2023 from Inverhuron residents. One of the complaints was likely the result of vacuum truck use for a buried piping project at Bruce B while no unusual activities were identified at the time of the second complaint. The noise complaints were reported to the Ministry of the Environment, Conservation and Parks District Office as per the conditions of Bruce Power's Environmental Compliance Approval for Air.

5.2.2.3 Halocarbons

In Canada, the federal, provincial, and territorial governments have legislation to protect the ozone layer and manage ozone-depleting substances and their halocarbon alternatives. The use and handling of these substances are regulated by the provinces and territories in their respective jurisdictions, and through the *Federal Halocarbon Regulations*, 2022 [R-94] for refrigeration, air-conditioning, fire extinguishing, and solvent systems under Federal jurisdiction. Bruce Power is governed by both the provincial and federal regulations.

Figure 15 below provides the number of reportable halocarbon releases across site for the 2023 calendar year. These releases are broken down by magnitude. Halocarbon releases of 10 and 100 kilograms are reported to Environment and Climate Change Canada in semi-annual release reports. Halocarbon releases greater than 100 kilograms are immediately reportable to Environment and Climate Change Canada and Ministry of the Environment, Conservation and Parks.

There were nine releases between 10 and 100 kilograms from site reported in the semi-annual release reports in 2023. There were no releases greater than 100 kilograms in 2023.

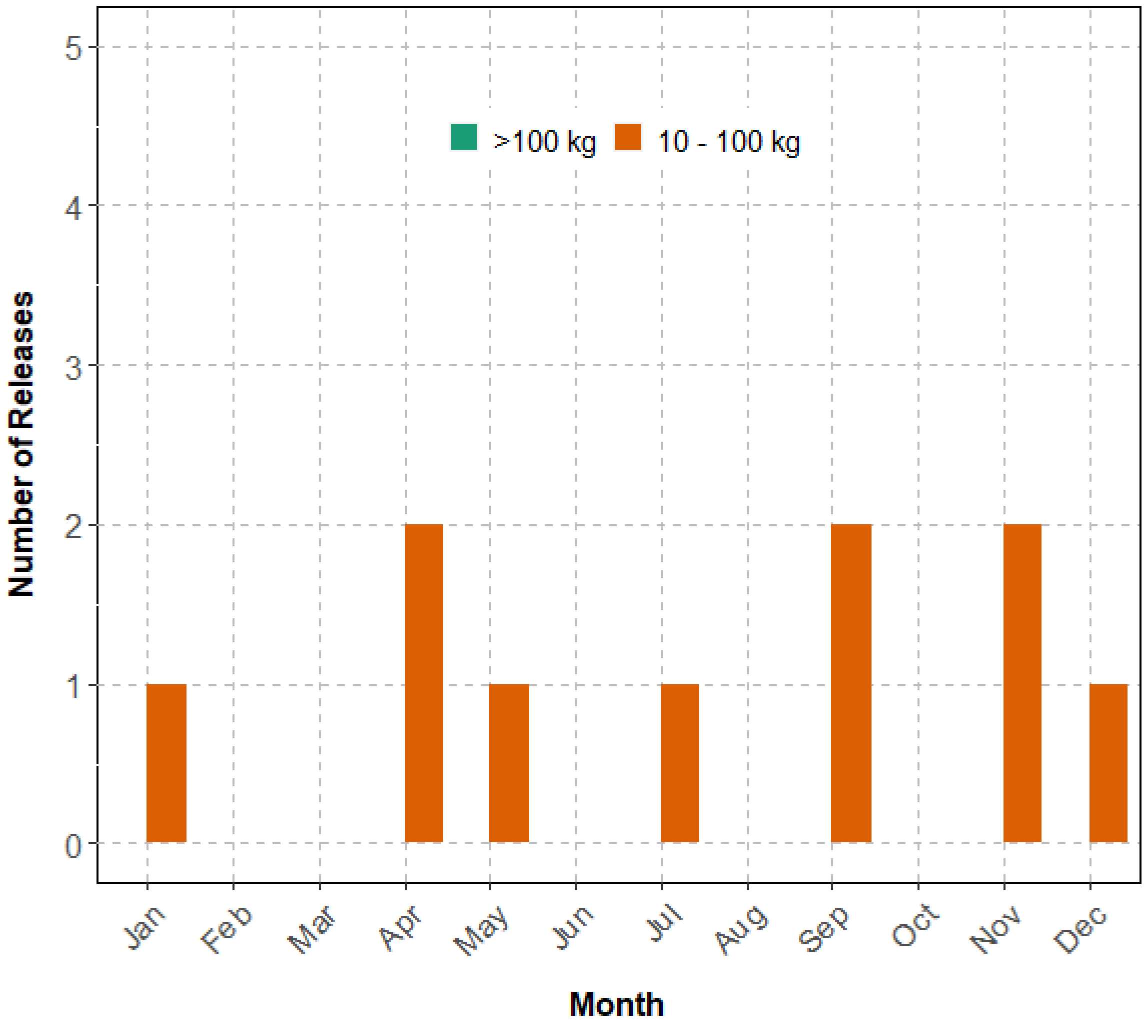


Figure 15 - 2023 Bruce Power Halocarbon Release Occurrences

Historical Halocarbons Releases

The environmental impact of these halocarbon discharges is reduced as a result of the older ozone depleting refrigerants (chlorofluorocarbon and hydrochlorofluorocarbons) being replaced by hydrofluorocarbons with negligible impact on the ozone layer (examples include R134a and R410). Hydrofluorocarbons however have high global warming potential and pose a threat as a greenhouse gas [R-94].

Figure 16 below provides the historical trend of the total number of halocarbon releases since 2014. Between 2017 and 2020, no halocarbon releases greater than 100 kilograms were occurred. However, three halocarbon releases greater than 100 kilograms were reported to Environment and Climate Change Canada in 2021 (Bruce B – 317 kilograms, Bruce B - 209 kilograms and Centre of Site – 99 kilograms), and two releases were reported in 2022 (Centre of Site – 215 kilograms and Bruce A – 274 kilograms). The 99 kilograms release at Centre of Site in 2021 was conservatively reported given that the exact volume of halocarbon release cannot be determined due to the accuracy of instrumentation.

The number of reportable releases increased in 2023, the releases were smaller in volume and attributed to increased leak checks on equipment containing greater than 100 kilograms of halocarbons. The increased leak checks prevented a number of the releases becoming a more significant release.

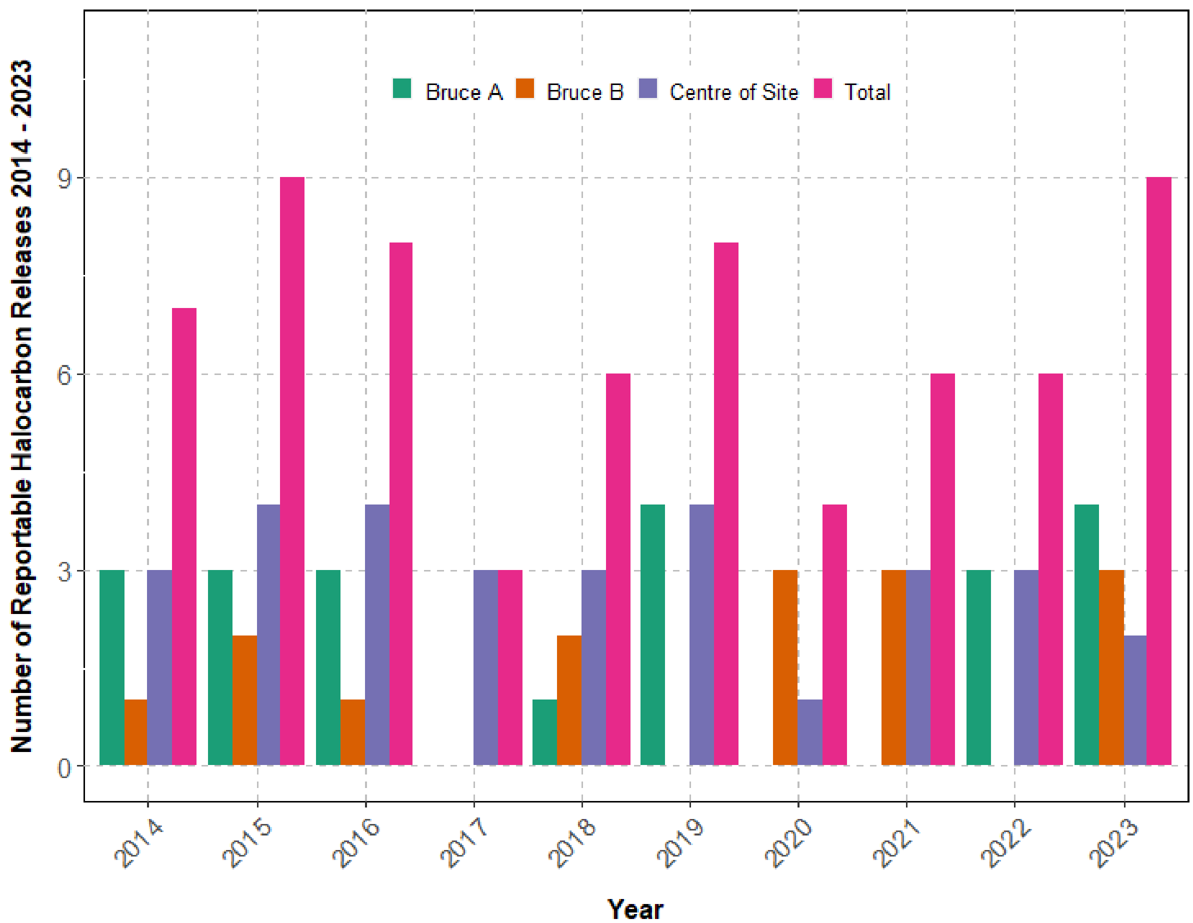


Figure 16 - Historical Bruce Power Halocarbon Releases

5.2.2.4 Greenhouse Gas Emissions

The provincial threshold for reporting greenhouse gas emissions dropped from 25,000 tonnes of carbon dioxide equivalent to 10,000 tonnes of carbon dioxide equivalent in 2015.
Bruce Power was below the 25,000 tonnes of carbon dioxide equivalent threshold in 2013 and 2014 and below the 10,000 tonnes of carbon dioxide equivalent threshold from 2015 to 2022.

In order to cease reporting, there must be three consecutive years reported under the threshold. Therefore, 2015 was the last year of reporting greenhouse gas emissions.

Greenhouse gas emissions will continue to be calculated for 2023 and onwards to confirm they remain below threshold values. The calculation of 2023 emissions will be completed by June 1, 2024.

Historical Greenhouse Gas Emissions

Figure 17 shows greenhouse gas emissions from 2013 to 2022. Greenhouse gas emissions on site have been consistent since the Bruce Steam Plant shut down strategy. The Steam Plant last operated in 2015 to supplement the Vacuum Building Outage at Bruce B and was officially shut down in December of 2015 when the stack was removed. Since 2012, greenhouse gas emissions from Bruce Power included combustion of stove oil and diesel by boilers at the steam plant and combustion of stove oil and diesel from stationary equipment (examples include: standby generators, temporary generators, heaters).

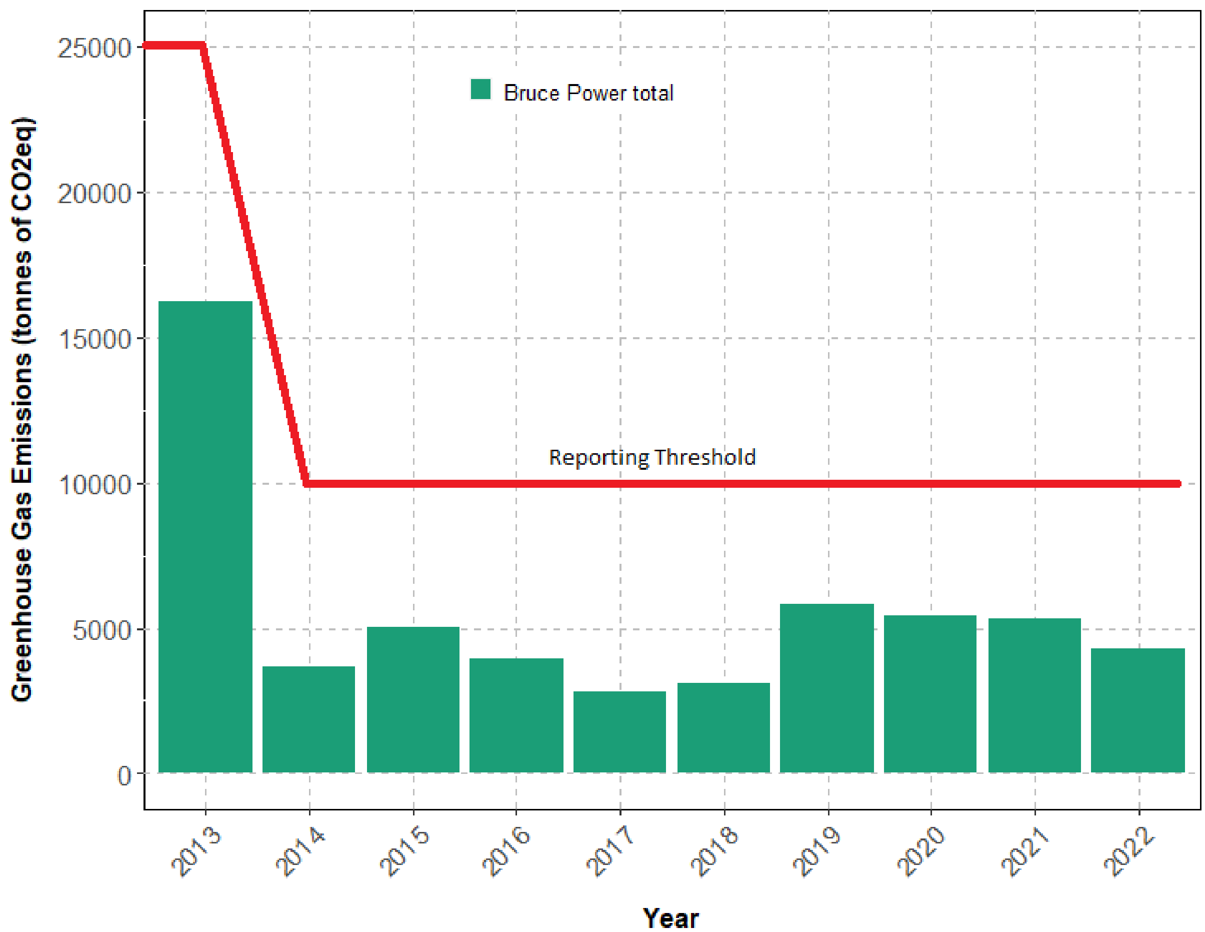


Figure 17 - Provincial Greenhouse Gas Reporting Tonnes Carbon Dioxide Equivalent - Conventional Air

In March of 2021, Bruce Power made a commitment to achieving Net Zero greenhouse gas emissions from site operations by 2027. The Net Zero 2027 Strategy outlines how emissions reductions targets will be achieved and our structured approach to supporting both Provincial and Federal Climate Change goals. Bruce Power met emissions reduction targets in 2023 and continues to work on the implementation of operational initiatives, local carbon sequestration and offset projects, as well as registering with the Ontario Clean Energy Program. Details of Bruce Power's Net Zero 2027 goals and progress are included in Section 2.5.1 and the 2023 Sustainability Report.

5.2.2.5 National Pollutant Release Inventory

The National Pollutant Release Inventory is Canada's legislated, publicly accessible inventory of pollutant releases, disposals and recycling. National Pollutant Release Inventory information is a major starting point for identifying and monitoring sources of pollution in Canada, and in developing indicators for the quality of air, land, and water. The National

Pollutant Release Inventory provides Canadians with annual information on industrial, institutional, commercial, and other releases and transfers in Canadian communities [R-95].

Bruce Power complies with reporting requirements and regulatory limits, as shown in Section 5.2. Bruce Power's National Pollutant Release Inventory contaminants reported for the 2022 calendar year are presented in Table 15. Calculations and reporting for the 2023 calendar year will be completed by June 1, 2024.

Table 15 - National Pollutant Release Inventory Contaminants Reported for 2022

Contaminant	**Volume to Air (kilograms)**	**Volume to Water (kilograms)**	**Volume to Land (kilograms)**
Ammonia (total)	8,362	2,874.4	-
Hydrazine	19.3	474.1	453
Lead	10.4	-	162.1
Oxides of nitrogen	26,198	-	-
Particulate Matter 10	648.3	-	-
Particulate Matter 2.5	561.7	-	-
Volatile organic compounds	14,566.7	-	-

A graphical comparison of releases reported under National Pollutant Release Inventory to air, water and land is shown in Figure 18.

Changes to reporting requirements and refinements to calculations over the years has resulted in changes to ammonia, hydrazine and volatile organic compound releases to air. Refinements to construction dust calculations were made in 2020 resulting in changes to emissions of particulate matter and hence the step change in emissions. In addition, parking lot construction during 2020 resulted in an increase in particulate matter emissions. The volume of ammonia released to water has decreased since 2018 due to refinements in calculations for system drains during outages. The volume of hydrazine released to water has remained consistent with a slight decrease in 2022.

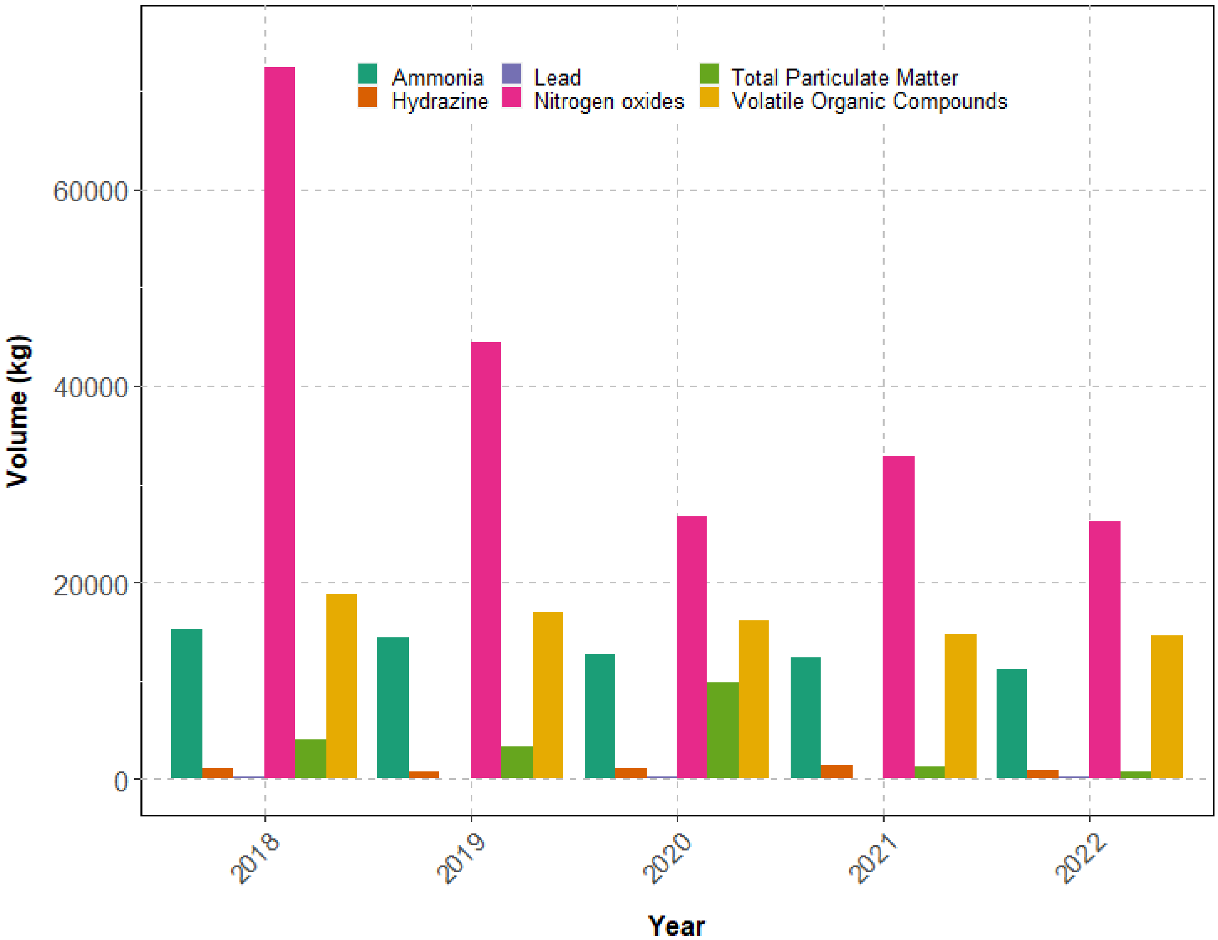


Figure 18 - 2018 to 2022 Releases to Air, Water and Land (kilograms)

Quality Assurance/Quality Control

Quality assurance activities for conventional air emissions are outlined in the Emission Summary and Dispersion Modelling report [R-96]. The Emission Summary and Dispersion Modelling report includes the operating conditions, emission estimating, data quality and sample calculations. Modelling is conducted in accordance with the Air Dispersion Modelling Guideline for Ontario, Version 3.0 [R-97].

Data included in the National Pollutant Release Inventory reporting follows the guideline released by Environment and Climate Change Canada [R-98]. Hydrazine, Ammonia and Morpholine Calculation Methodology for National Pollutant Release Inventory Reporting [R-99], describes the process for obtaining continuous emissions monitoring data, plant information, drain data for the calculation of air and water emissions for hydrazine, morpholine and ammonia.

Data included in the greenhouse gas calculations follows Canada's Greenhouse Gas Quantification Requirements [R-100].

5.2.3 Conventional Water Effluent

Site conventional water effluents are controlled to meet regulatory requirements and to minimize environmental impacts to protect the environment. Conventional water effluents at Bruce Power are discharged according to specific licenses, permits, and regulations under (but not limited to) the *Environmental Protection Act* [R-101] and the *Ontario Water Resources Act* [R-79].

5.2.3.1 Environmental Compliance Approvals

The *Ontario Water Resources Act* states that no person shall use, operate, establish, alter, extend, or replace new or existing sewage works except under, and in accordance with, an Environmental Compliance Approval. Bruce Power operates according to three Environmental Compliance Approvals regulating conventional water effluents across site; Bruce A, Bruce B, and Centre of Site [R-102], [R-103], [R-104]. These Environmental Compliance Approvals impose site-specific effluent limits and monitoring and reporting requirements for the operation of the facility. Non-compliances of Environmental Compliance Approval limits are reportable to the Ministry of Environment, Conservation and Parks and are subject to Environmental Penalties under *Ontario Regulation 223/07* [R-105]. Table 16, Table 17, Table 18 and Table 19 show summaries of the measured effluent concentrations in the Bruce A and Bruce B cooling water discharge ducts, and the Centre of Site sewage processing plant between 2019 and 2023. The maximum measured values for all regulated parameters were all below the approved limits, with the exception of a Total Suspended Solids limit exceedance at the Centre of Site Sewage Processing Plant in June 2023, demonstrating continuous compliance over the last 5 years.

Table 16 - The Range of Monthly Effluent Concentrations Measured in The Bruce A Cooling Water Discharge Duct (2019-2023)

Parameter	Units	Method Detection Limit (2023)	Environmental Compliance Approval Limit (or Objective)	Minimum	Maximum
Ammonia (unionized)	Micrograms per litre	Varies based on pH and temperature but does not exceed 3.5 micrograms per litre	<20	< Method Detection Limit	< Method Detection Limit

Parameter	Units	Method Detection Limit (2023)	Environmental Compliance Approval Limit (or Objective)	Minimum	Maximum
Boron	Micrograms per litre	4	5,000	< Method Detection Limit	21
Hydrazine	Micrograms per litre	3	100	< Method Detection Limit	12
Morpholine	Micrograms per litre	15	2,500	< Method Detection Limit	770
Total Residual Chlorine	Micrograms per litre	1	<10	< Method Detection Limit	< Method Detection Limit
pH	Not Applicable	Not Applicable	6.0 to 9.5	7.0	8.5
Phosphorus	Micrograms per litre	5	1,000 (objective)	< Method Detection Limit	62

Table 17 - The Range of Monthly Effluent Concentrations Measured in the Bruce B Cooling Water Discharge Duct (2019-2023)

Parameter	Units	Method Detection Limit (2023)	Environmental Compliance Approval Limit or (Objective)	Minimum	Maximum
Ammonia (unionized)	Micrograms per litre	Varies based on pH and temperature, but does not exceed 3.5 micrograms per litre	<20	< Method Detection Limit	< Method Detection Limit
Hydrazine	Micrograms per litre	3	100	< Method Detection Limit	73

Parameter	Units	Method Detection Limit (2023)	Environmental Compliance Approval Limit or (Objective)	Minimum	Maximum
Morpholine	Micrograms per litre	15	2,500	< Method Detection Limit	15
Total Residual Chlorine	Micrograms per litre	1	<10	< Method Detection Limit	< Method Detection Limit
pH	Not Applicable	Not Applicable	6.0 to 9.5	6.7	8.7
Phosphorus	Micrograms per litre	*5*	1,000 (objective)	< Method Detection Limit	64

Table 18 - The Maximum Daily and Monthly Average (measured weekly) Environmental Compliance Approval Effluent Concentrations at the Centre of Site Sewage Processing Plant (2019-2023)

Parameter	Units	Method Detection Limit	Daily Limit	Maximum Daily (range)	Monthly Average Limit	Maximum Monthly Average
Biochemical Oxygen Demand (5-day)	Milligrams per litre	Not Applicable	Not Applicable	Not Applicable	25.0	5.8
Nitrogen (Ammonia + Ammonium)	Milligrams per litre	0.006	Not Applicable	Not Applicable	7.000	5.420
Total Phosphorus	Milligrams per litre	0.014	Not Applicable	Not Applicable	1.000	0.361
Total Suspended Solids	Milligrams per litre	0.4	44.0	78.0	18.0	17.63
Oil and Grease	Milligrams per litre	1.0	38.0	6.6	12.0	2.1
pH	Not Applicable	Not Applicable	6.0-9.5	(6.1-8.9)	Not Applicable	Not Applicable
Escherichia coli	Colony Forming Unit per 100 millilitres	Not Applicable	Not Applicable	Not Applicable	200	3.17

Parameter	Units	Method Detection Limit	Daily Limit	Maximum Daily (range)	Monthly Average Limit	Maximum Monthly Average
	(rolling geometric mean)					

Table 19 - The Range of Quarterly Average (measured monthly) Wastewater Systems Effluent Regulation Effluent Concentrations at the Centre of Site Sewage Processing Plant (2019-2023)

Parameter	Units	Method Detection Limit	Quarterly Average Limit	Minimum Quarterly Average	Maximum Quarterly Average
Carbonaceous Biochemical Oxygen Demand	Milligrams per litre	2.0	25.0	2.0	17.4
Total Suspended Solids	Milligrams per litre	2.0	25.0	2.9	9.4

The 10-year trend of the annual average effluent concentrations in the Bruce A and Bruce B cooling water discharge ducts is shown in Figure 19 for ammonia, hydrazine and morpholine. The annual average values for these parameters have been well below the limits over the last 10 years, demonstrating continued compliance and protection of the receiving environment.

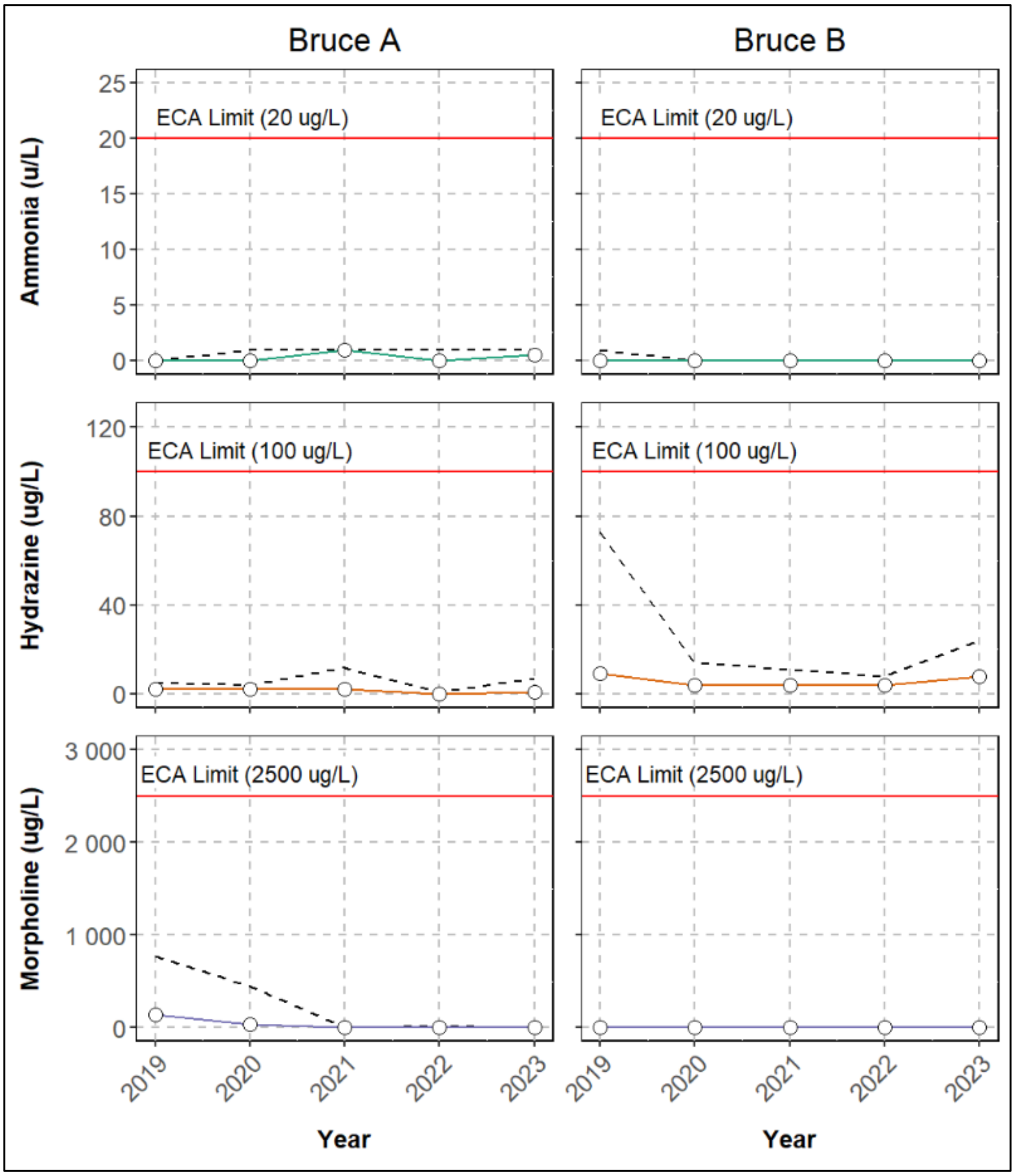


Figure 19 - Bruce A and Bruce B Cooling Water Discharge Duct Discharge Annual Average Concentrations from 2019 through 2023. The solid line indicates the average annual value; the dashed line indicates the maximum annual value.

In 2021, Environmental Compliance Approval amendment applications were submitted to the Ministry of Environment, Conservation and Parks for all three Environmental Compliance Approvals. In January 2023 the amended Centre of Site Environmental Compliance Approval was issued as 4640-CEGKDU [R-106]. In June 2023, the amended Bruce B Environmental Compliance Approval was issued as A-500-7141062184 [R-103]. In July 2023, the amended Bruce A Environmental Compliance Approval was issued as A-500-3151105259 [R-102]. The

Bruce A and Bruce B amendments focused on the use and discharge of Film Forming Amines used for protecting the feedwater system from corrosion, as well as other changes and updates to the Environmental Compliance Approval language and the supporting documents. The Centre of Site Environmental Compliance Approval amendment approved a third treatment train for the Sewage Processing Plant, removal of the Bruce Steam plant, and incorporation of requirements of the former *Effluent Monitoring Effluent Limits Regulation*. Although the Sewage Processing Plant third train was approved, the expansion project is not currently active.

In 2023, there were two reportable events related to the site Environmental Compliance Approvals; each event is discussed in quarterly reports submitted to the Ministry of Environment, Conservation and Parks [R-107] [R-108].

Environmental Compliance Approval Notice 1

Prior to July 2021, the electric power generating sector was regulated under *Ontario Regulation 215/95 Effluent Monitoring Effluent Limits* [R-109]. When this regulation was revoked in 2021 the requirements formerly captured in this legislation were incorporated into Notices which accompanied Bruce Power's three Environmental Compliance Approvals [R-102] [R-110] [R-111]. These notices have now been incorporated into the amended Bruce A, Bruce B, and Centre of Site Environmental Compliance Approvals noted above.

5.2.3.2 Wastewater Systems Effluent Regulations

The *Wastewater Systems Effluent Regulations* [R-112] is a Federal wastewater regulation under the *Fisheries Act* that came into effect in 2012. The regulation applies to wastewater treatment systems like Bruce Power's Sewage Processing Plant because it discharges wastewater effluent at a flowrate that exceeds 100 cubic metres a day. Table 18 shows a summary of the measured Sewage Processing Plant effluent concentrations from 2019 to 2023. There were no exceedances reported in 2023.

5.2.3.3 Permit to Take Water

Most operations in Ontario that take more than 50,000 litres of water per day from a lake, river, stream, or groundwater source must obtain a Permit to Take Water from the Ministry of Environment, Conservation and Parks [R-79]. These permits help ensure Ontario's water is conserved, protected, managed, and used sustainably. Ontario's Water Taking Regulation (*Ontario Regulation 387/04*) [R-113] helps ensure fair sharing of water resources and it prevents interferences among water users. Permits are not issued to assign rights to water or to establish priorities on water use. *Ontario Regulation 387/04* [R-113] sets out criteria that the Ministry must consider when assessing an application for a Permit to Take Water. A permit will not be issued if the Ministry determines that the proposed water taking will adversely impact existing users or the environment [R-113].

Bruce Power has a separate permit for each station Bruce A P-300-2114648110 [R-83], Bruce B P-300-4114675736 [R-84] and Centre of Site P-300-7116089842 [R-85]. The Bruce A and Bruce B permits include flexibility throughout the year to allow for optimized efficiency in unit output as well as upgrades to Condenser Cooling Water pumps. Bruce Power remained in compliance with all Permit to Take Water requirements in 2023.

Bruce Power recognizes the value and importance of its interactions with Lake Huron. Bruce Power uses the cold, deep Lake Huron water in a once-through cooling process to supply operational needs including consumption for boiler feedwater and domestic water. We greatly value this resource and return more than 99.9 per cent of the water used for once through cooling. This process is highly regulated, including provincial permits for water taking and reporting and imposing protective limits on water quality for waters returned to the lake. This ensures the conservation, protection, management and sustainable use of Ontario's freshwater resources.

In our effort to uphold and support these goals, we monitor our usage, including the amounts returned directly to the lake with no chemical changes, and report on daily amounts drawn. Beyond considerations of water quantity management, we are committed to monitoring and ensuring the protection of the quality of water, and our fish habitats in and around our shores and the greater region.

5.2.3.4 Quality Assurance/Quality Control

Quality Assurance, quality control for the conventional water emissions program has been developed by applying the requirements of both the Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater [R-114] for Environmental Compliance Approvals [R-102], [R-103], [R-104] which also meets the requirements of Canadian Standards Association Standard N288.5-11, Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills [R-27]. The Quality Assurance Quality Control program also includes requirements of the Environment and Climate Change Canada *Wastewater Systems Effluent Regulation* [R-112].

The Quality Assurance Quality Control requirements for conventional water include field quality control, lab quality control, tracking of quality control data. The Quality Assurance Quality Control program documentation further defines when lab accreditation is required for specific sampling parameters, and at times defines actions and how to report data depending on the Quality Assurance Quality Control results.

5.3 Chemical Management Plans

Environment and Climate Change Canada routinely collects information from industry to assist in managing toxic and priority substances identified under the *Canadian Environmental Protection Act*, 1999 Part 5 [R-115] in order to protect the environment and human health. Bruce Power participates in the information collection. Environment Canada issued a notice to identify information on commercial status, use and releases of 850 chemicals under section 71, Chemicals Management Plan. Bruce Power identified two substances in use at Bruce Power, one is used as a scintillation reagent, and one is used as a corrosion inhibitor.

5.4 Pollution Prevention

Under Part 4 of *Canadian Environmental Protection Act* [R-116], Environment and Climate Change Canada has the authority to require preparation and implementation of pollution prevention plans for toxic substances. Pollution prevention planning is a method of identifying and implementing pollution prevention options to minimize or avoid the creation of pollutants or waste. Environment and Climate Change Canada issued a pollution prevention planning notice for any person who operates a facility in the electricity sector that has a concentration of hydrazine that is higher than the specified target levels under normal operating conditions and at any final discharge point. Bruce Power reviewed the notice and determined that it does not apply and as such, submitted a Notification of Non-Engagement [R-117]. In 2023, all Bruce A and Bruce B Cooling Water Discharge Duct hydrazine results we below the P2 threshold.

5.5 Environmental Emergency Regulations

The aim of the Federal *Environmental Emergencies Regulations, 2019* [R-118] (under *Canadian Environmental Protection Act*) is to help reduce the frequency and severity of accidental releases of hazardous substances into the environment. Two hundred and forty-nine hazardous substances are included in the regulations, identified for their emergency hazard characteristics (oxidizer that may explode, inhalation, aquatically toxic, explosion, combustible, pool fire). The *Environmental Emergencies Regulations* identify minimum threshold quantities for these substances, above which there are requirements for submitting notices, developing Environmental Emergency Plans, and completing drills. These are based on both the total volume on site and the size of the largest container system for the substance(s). There are additional reporting requirements for Environmental Emergencies. To date, Bruce Power has not had a reportable Environmental Emergency under this regulation. Bruce Power currently meets the reporting threshold on site for diesel (Chemical Abstract Service Number 68334-30-5). Diesel volumes on site are above the total volume on site threshold; this requires submitting Schedule 2 notices to Environment and Climate Change Canada. Following the removal of the Central Storage Facility propane tanks in July 2022, Bruce Power is below the threshold for propane and the requirement for emergency plans and drills for propane was revoked in July 2023.

6.0 ENVIRONMENTAL MONITORING

Bruce Power’s Environmental Monitoring program is built upon an integrated monitoring approach that strives to understand environmental impact, verify environmental protection, and continuously improve by driving strategic research and innovation through collaborations with industry and community. Environmental safety and responsibility are woven into all aspects of the company’s nuclear safety culture, and Bruce Power commits to meet or exceed all relevant legal and voluntary environmental requirements. The company holds itself accountable to prevent pollution through strong management of emissions, effluents, and waste, and it implements robust spill mitigation measures in order to provide effective containment and control of contaminants.

To demonstrate environmental protection, Bruce Power performs extensive monitoring and modelling of radiological and conventional contaminants in the Earth's Critical Zone [R-119]. The Critical Zone is comprised of the permeable zones near the Earth's surface where living organisms, air, water, soil, sediment, and groundwater interact, Figure 20.

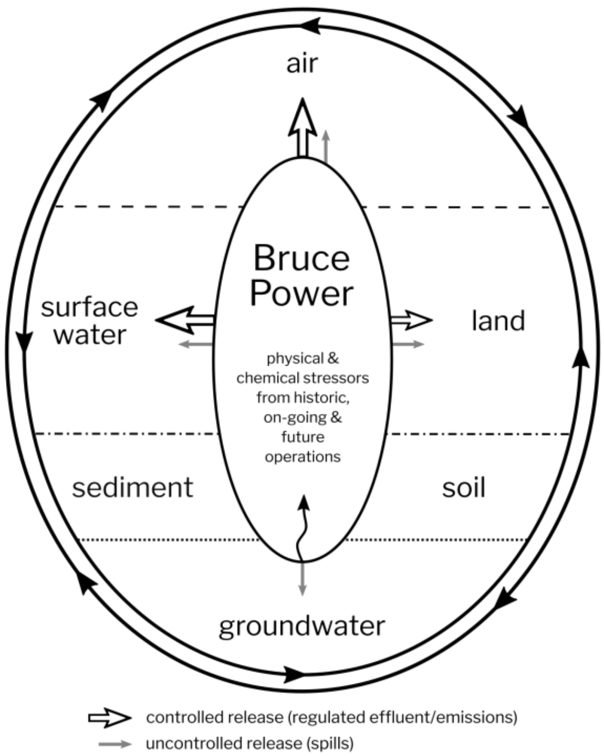


Figure 20 - Bruce Power has multiple layers of protection in place to minimize emissions and effluents released during facility operations. The Environmental Monitoring program monitors and models physical, radiological and chemical stressors released to the environment and continuously assesses their risk and impact.

Air emissions and water/land effluents are controlled, and regulated releases occur in a manner that minimizes environmental impact. Bruce Power's Radiological and Conventional Environmental Monitoring programs are designed to continuously verify that environmental protection is being maintained and that these releases have a minimal impact on the surroundings. The programs are based on Canadian Standards Association N288.4-10 Environmental monitoring programs at nuclear facilities and uranium mines and mills [R-5], Canadian Nuclear Safety Commission REGDOC-2.9.1 Environmental Protection: Environmental Principals, Assessments and Protection Measures [R-12], and reporting requirements in Canadian Nuclear Safety Commission REGDOC-3.1.1 Reporting Requirements for Nuclear Power Plants [R-2].

The primary objectives of the Environmental Monitoring program are to:

- Demonstrate compliance with all applicable environmental compliance obligations, Licence conditions and the Environmental & Sustainability Policy.
- To have in place environmental monitoring to provide timely data confirming that uncontrolled releases are not occurring and, if uncontrolled releases do occur, to identify when and where.
- To protect human and ecological health that may be affected by the release of contaminants or physical stressors into the environment arising from the facility.
- Support business decisions to drive environmental protection, sustainability principles and Environment Social Governance (ESG) strategy.
- Maintain strong engagement and collaboration with stakeholders, community members and Indigenous Nations.

Additionally, the Canadian Standards Association standard N288.4, Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills outlines the following objectives for Environmental Monitoring programs [R-5]:

- Collect environmental monitoring data to assess the level of risk to human health and safety, and the potential biological effects in the environment of the contaminants and physical stressors of concern arising from the facility.
- Demonstrate compliance with limits on the concentration and/or intensity of contaminants and physical stressors in the environment and their effect on the environment; and
- Verify that the facility has effective containment and effluent control measures in place.

Bruce Power has well-established environmental monitoring programs that focus on the local area around the facility, including neighboring communities and Lake Huron. Together, the results build an overall understanding of the risk to human health and impact on the environment. The company's strong commitment to excellence has yielded excellent environmental performance, and Environmental Risk Assessments continually show the operation of the facility has little-to-no impact on human and ecological health. This conclusion is supported by evidence independently collected by the Federal and Provincial governments who monitor and measure concentrations of contaminants in the environment near Bruce Power.

Bruce Power continues to engage with Saugeen Ojibway Nation, Métis Nation of Ontario and Historic Saugeen Métis and make progress on all commitments made at the 2018 licence renewal. Regular meetings are held with the Saugeen Ojibway Nation, Métis Nation of Ontario, and Historic Saugeen Métis to discuss key concerns, regulatory items, and other items of interest. This continued dialogue results in improved understanding and opportunities for feedback and collaboration. Over the last six years, topics of focus have included thermal effluent, fish impingement and entrainment, environmental monitoring and assessment, and dietary surveys. In 2023 progress on commitments are as follows:

- Preliminary discussions on the Impact Assessment process, following the Ontario Government's announcement of support for Bruce Power to commence the long-term planning and consultation work required to explore nuclear expansion options on the Bruce Power site (Bruce C Project). Although no decision has been made to advance with a project, the process has been initiated to begin early dialogue and engagement to ensure all voices are heard.

- Sustained support for the joint environmental monitoring and stewardship program, between Bruce Power and the Saugeen Ojibway Nation, called the Coastal Waters Monitoring Program, currently in year 6. This project enhances the existing body of knowledge compiled through Bruce Power's environmental monitoring program and was integrated throughout the 2022 Environmental Risk Assessment.

- Continued sharing of impingement and entrainment and thermal effluent information.

- Ongoing discussions with the Saugeen Ojibway Nation to identify a meaningful offset project that is supported by the community. Bruce Power's *Fisheries Act* Authorization was amended in December 2023 and the project plan is now due to Fisheries and Oceans Canada by December 31, 2024.

- Completion of the fish offset project to remove invasive Phragmites from the Fishing Islands wetland complex, an area important to the Historic Saugeen Métis community. This project has helped to restore fish habitat and encourage naturalization of the area by removing high density Phragmites. The final report on the offset project was submitted to Fisheries and Oceans Canada in March 2024.

- Through consultation with the Métis Nation of Ontario, an offset project plan to improve fish habitat and restore connectivity in Bothwell's Creek, near Leith, Ontario was submitted to and approved by Fisheries and Oceans Canada in December 2023. Bothwell's Creek has been used by the Métis Nation of Ontario community for fishing and recreation, however a decline in fish has been noticed over the past decade. Erosion, leading to high sedimentation, and large debris may be the leading causes of the observed decline in fish in the creek. In addition to the offset project, Bruce Power is working with the Métis Nation of Ontario and Trout Unlimited Canada to perform temperature monitoring and redd surveys in Bothwell's Creek, to better understand the condition of the creek and guide future rehabilitation or enhancement activities.

- Ongoing monitoring and mitigation of Fairy Lake to improve wetland quality as this location is of historic significance to the local métis community. This is a joint project between the Historic Saugeen Métis, Town of Saugeen Shores, University of Waterloo, the Nuclear Innovation Institute and Bruce Power.

In 2024 Bruce Power will continue to engage with each community on thermal effluent monitoring, fish impingement and entrainment including the pilot study to occur in 2024 and the full study scheduled for 2025 and 2026, as well as continue work on community specific offset plans as required by the *Fisheries Act* Authorization. Engagement on the Impact Assessment for the Bruce C Project will remain a top priority.

6.1 Radiological Environmental Monitoring

The Radiological Environmental Monitoring Program establishes a database of radiological activity measured in the environment near Bruce Power and determines the contribution of overall radiation dose to members of the public as a result of the radiological releases from normal operations on Site. The Radiological Environmental Monitoring Program is conducted in accordance with Canadian Standards Association N288.4-10 [R-5] and is integrated into the Environmental Management System framework which requires a regular review, assessment and refinement of the program to ensure the environment and the public are adequately protected.

The Radiological Environmental Monitoring data implicitly reflects the influence of releases from all licensed activities carried out at Bruce Power licensed facilities (i.e., Bruce A, Bruce B, Central Maintenance Facility and Central Storage Facility) as well as from facilities within or adjacent to the Bruce Power site boundary that are owned and operated by other parties. This includes the Western Waste Management Facility (owned and operated by Ontario Power Generation) and the Douglas Point Waste Facility (owned and operated by Canadian Nuclear Laboratories), both of which are located inside the Site perimeter, as well as the Ontario Nuclear Services Facility (owned and operated by Kinectrics) and the Western Clean – Energy Sorting and Recycling Facility (owned by Laurentis Energy Partners and operated by EnergySolutions) which are located outside the Site perimeter.

The Radiological Environmental Monitoring Program involves the annual collection and analysis of environmental media for radionuclides specific to nuclear power generation. Background levels due to naturally occurring sources are subtracted from the totals in order to determine the impact specific to Bruce Power operations. The data gathered each year is used in the annual dose to public calculation, which is described in Section 3.0.

The design of the Radiological Environmental Monitoring Program is based on risk and is informed by a radionuclide and exposure pathways analysis. This analysis outlines which radionuclides and environmental media should be monitored due to their contribution to human or non-human radiological dose. For radionuclide-media pairs contributing >10% to the total dose of any human receptor, Bruce Power attempts to obtain samples at a minimum of one location per 22.5° wind sector over land to provide spatial resolution at the cardinal points of the compass and align with standard partitioning of meteorological data. The media contributing greater than 10% to receptor dose are air, soil, milk, meat, and terrestrial plants such as grains, fruit and vegetables. For radionuclide-media contributing <10% to the total dose, a total of three locations over land within the Radiological Environmental Monitoring boundary are required.

The following environmental media are collected and analyzed by the Bruce Power Health Physics Laboratory as part of the annual Radiological Environmental Monitoring Program:

- Air
- Precipitation
- Water
    - Drinking water (e.g., water supply plants, residential wells)
    - Lake and stream water
- Terrestrial Samples
    - Animal products (e.g., milk, eggs, honey, animal meat)
    - Agricultural products (e.g., fruits, vegetables, farm crops, animal feed)
    - Soil
- Aquatic Samples
    - Fish
    - Sediment and beach sand

The radionuclides that are measured in the environmental media collected include tritiated water (tritium oxide), carbon-14, iodine-131, beta and gamma emitting radionuclides.

Bruce Power relies on the Ontario Power Generation Health Physics Laboratory in Whitby, Ontario for provincial background radiation levels measured in a variety of environmental media collected at locations outside the influence of Bruce Power or other nuclear power plants. Background radiation comes from naturally occurring radioactive materials present in the environment (see Section 3.0), and these levels are subtracted from Bruce Power environmental monitoring results for dose calculations each year. The provincial background sampling locations are shown in Figure 21.

For the Bruce Power Radiological Environmental Monitoring Program, monitoring locations for aquatic media such as lake water, fish and sediment are downstream of the site, at locations where radionuclides are expected to accumulate. For air sampling, monitors are situated at varying distances from Bruce Power, at locations covering all landward wind directions. For terrestrial foodstuffs (e.g., milk, meat, fruit, vegetables, grains, eggs, honey), sampling is performed at nearby areas or at local farms and residences, as applicable. Monitoring locations are based on practical considerations, including the availability of samples and participation of local residents and farmers. Wild animals are sampled only when available (e.g., subject to on-site vehicle collisions or samples provided by local hunters). Milk is monitored from several local dairy farms through an agreement with the Dairy Farmers of Ontario.

Bruce Power groups the sampling locations by proximity to site and these groups include indicator, area near and area far locations. Indicator locations are used to assess the potential dose to the public. These locations are on or outside the facility perimeter and represent the highest risk of public exposure as they are closest to the source. Indicator locations are within 20 kilometres of the facility and take into consideration the locations of representative persons and where they get their food/water for consumption, as well as prevailing wind directions. Area Near locations are used in conjunction with indicator locations to provide confirmation of the validity of the computing models used to assign dose to the public. Area Near location data is used to estimate atmospheric dispersion and doses to people in local population centres located further away from the site than the indicator locations, but less than 20 kilometres from the facility. Data from the Area Near location may be used to calculate the average dilution available as a function of distance for a given monitoring period. Area Far locations are located further away but potentially still under the influence of Bruce Power. Area Far locations include the towns of Port Elgin, Paisley and Kincardine. Control locations are located outside the influence of Bruce Power but close enough to have similar background levels to Site. These samples are collected by Bruce Power when equivalent samples or analyses are not available through the Provincial background monitoring program.

Bruce Power area near and area far sampling locations are provided in Figure 22 and Figure 23, Residential sampling locations (labelled Other) where fruit, vegetable and milk samples are collected are included on Figure 24, alongside the locations of representative persons/groups.

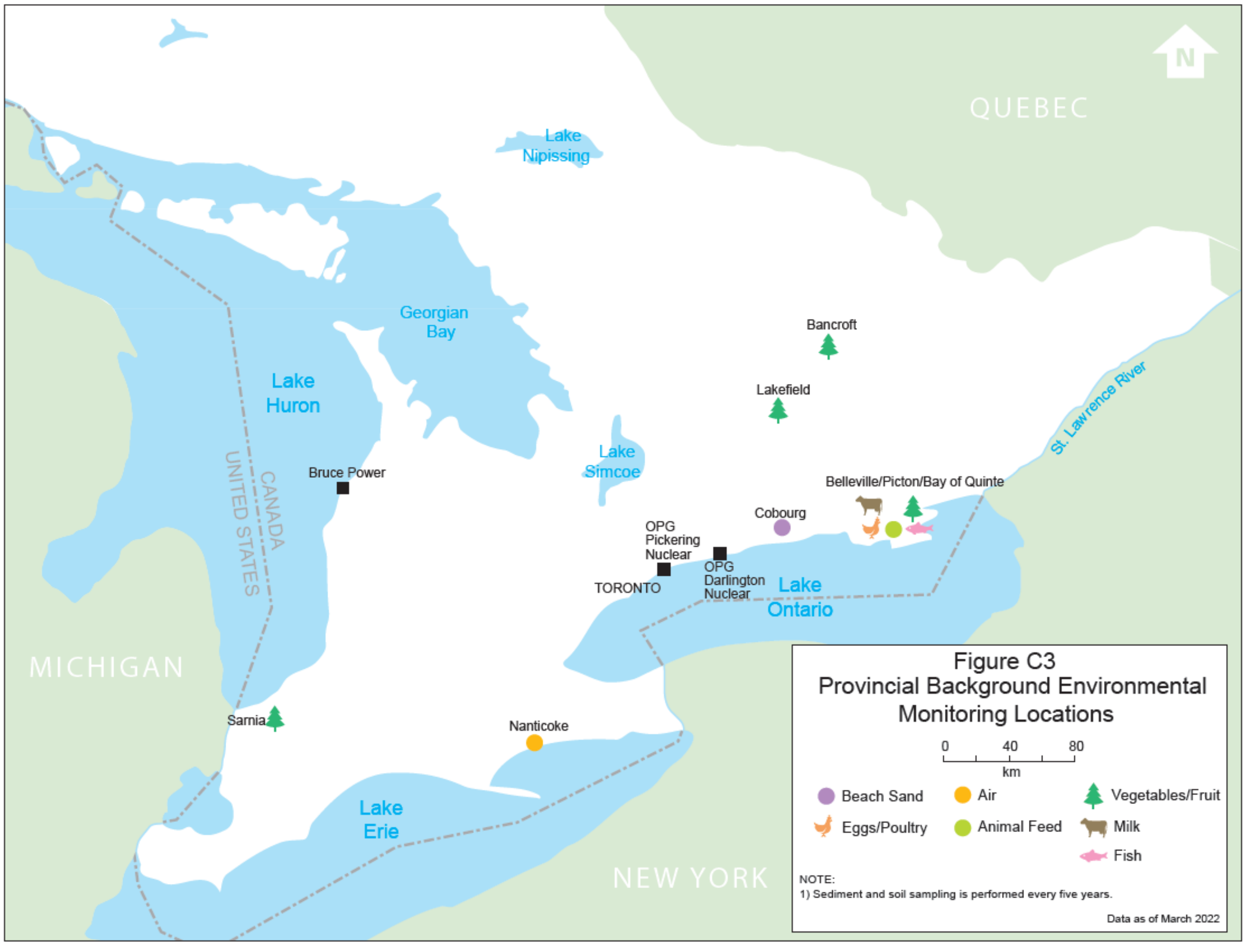


Figure 21 - Provincial Background Radiological Environmental Monitoring Locations

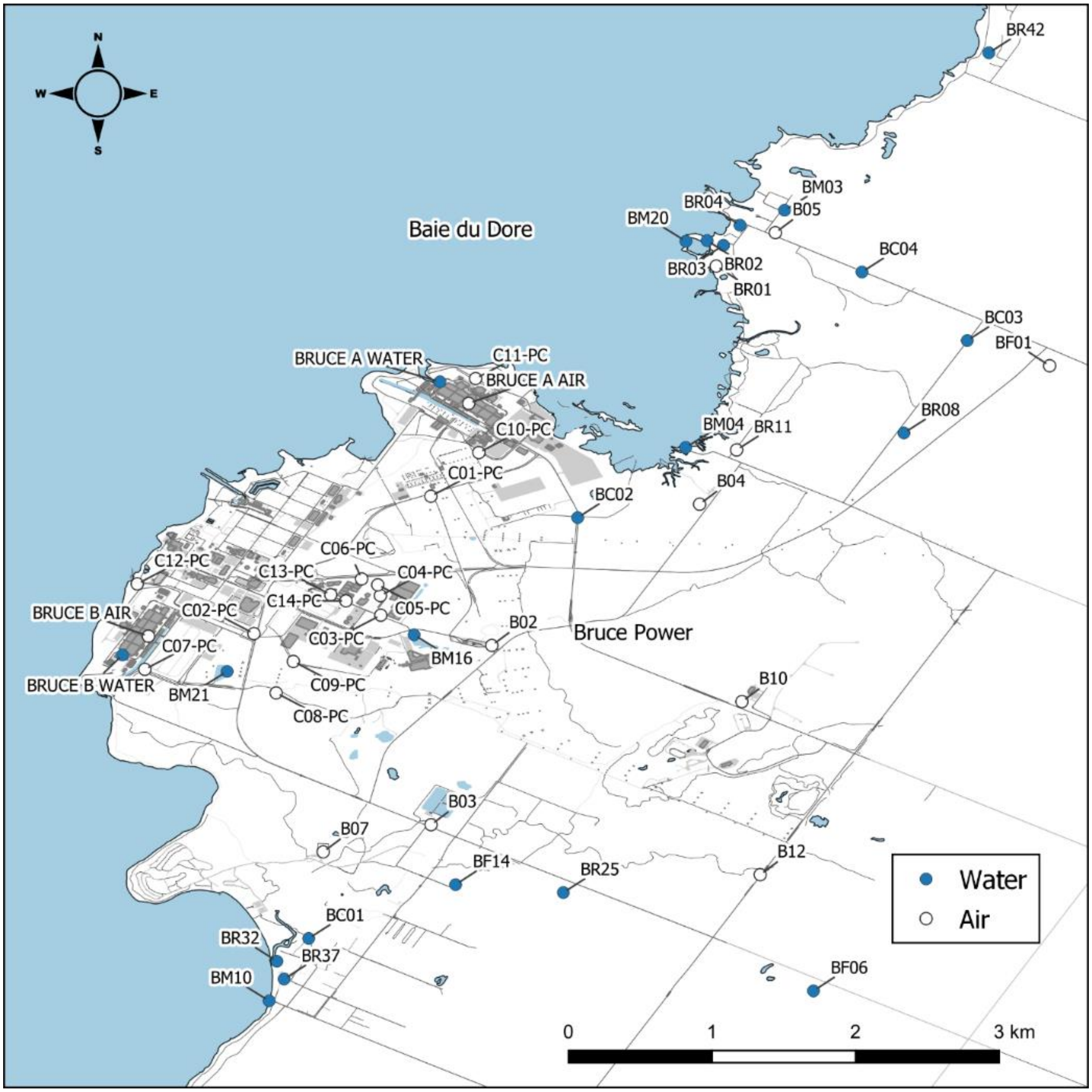


Figure 22 - Bruce Power On-Site and Area Near Radiological Environmental Monitoring Locations

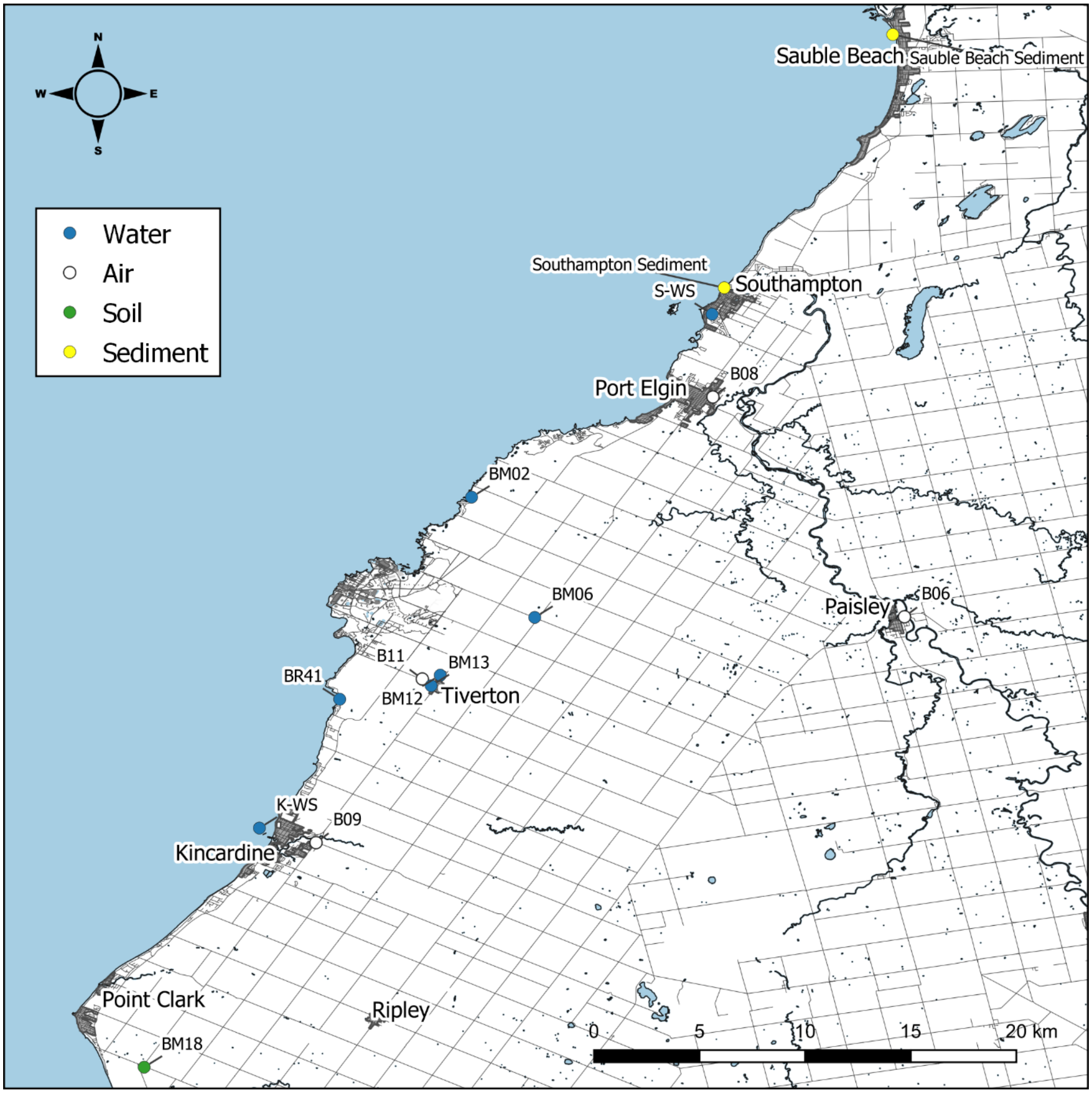


Figure 23 - Bruce Power Area Near and Far Radiological Environmental Monitoring Locations

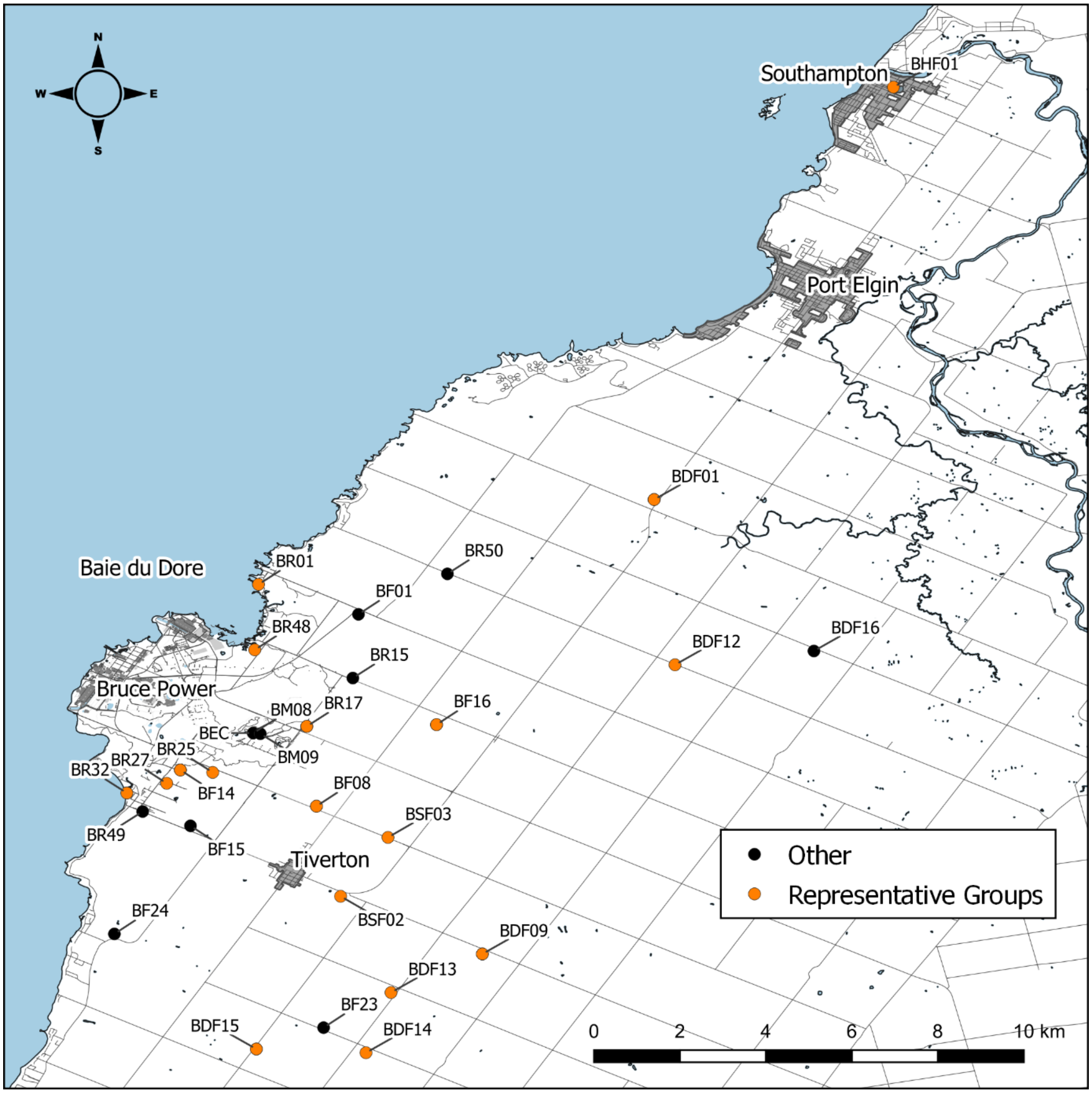


Figure 24 - Bruce Power Radiological Environmental Monitoring Residential Locations (Other) and Representative Groups

For Radiological Environmental Monitoring data analysis, the actual measured value, uncertainty, critical level and detection limit are recorded in a data management system. The critical level or decision threshold (Lc) is the calculated value based on background measurements, below which the net counts measured from the sample are indistinguishable from the background at the 95% probability level. The detection limit (Ld) is the calculated value based on the decision threshold and the measurement system parameters (e.g., count time) above which the net counts measured from the sample are expected to exceed the decision threshold at the 95% confidence level. These definitions of critical level and detection limit are consistent with Canadian Standards Association N288.4-10 Annex D [R-5].

For Bruce Power Radiological Environmental Monitoring data, when the actual measured value is less than the associated critical level (<Lc), those values were taken as reported (i.e., not censored). In the calculation of averages where some measured values were reported as less than the critical level, the uncensored analytical results were used in the calculation. For instances where the annual *average* value is negative or where all individual analytical results were less than the critical level, the result is stated as "<Lc" for simplification. For provincial background data where the result was less than the detection limit (<Ld), the detection limit value was used in the annual average. When all of the results for a particular radionuclide-media pair were less than the detection limit, or where the annual average was negative, then "<Ld" was stated for the annual average.

The following sections provide the results of Radiological Environmental Monitoring carried out by Bruce Power in 2023 and previous years. The provincial background results are also provided where appropriate. The Canadian Nuclear Safety Commission completed the Independent Environmental Monitoring Program in the Bruce County area most recently in 2022 and the results are presented for comparison, as applicable, for additional demonstration that there is low radiological risk from Bruce Power operations to people and the environment.

Radiological Environmental Monitoring results are presented as monthly, quarterly or annual averages by location or location type (e.g., indicator, area near, area far, or background). The variance from the mean is presented as standard error bars on the figures. Where individual results are presented (e.g., animal products) the analytical uncertainty (±2σ) is provided along with the critical level (Lc).

6.1.1 Air Monitoring

Bruce Power monitors for external gamma radiation, tritium oxide and carbon-14 concentrations in air on a continuous basis at a variety of locations near and far from site. The results are used in the annual dose to public calculation for each of the representative persons that live near Bruce Power. In addition, the results inform the environmental monitoring and Environmental Risk Assessment programs to ensure that Bruce Power is appropriately monitoring and understanding its impact on the environment.

6.1.1.1 External Gamma in Air

Ambient external gamma radiation in air was measured using Harshaw Environmental Thermoluminescent Dosimeters at 10 air monitoring stations near and far from Bruce Power (Figure 22 and Figure 23). The dosimeters are exposed for three-month periods, collected quarterly and measured by the Ontario Power Generation's Whitby Health Physics Laboratory. The annual dose rates are calculated as the sum of the quarterly results.

Provincial background dosimeters are located at various locations around Ontario (Figure 21) and are also collected quarterly and measured by the Whitby Health Physics Laboratory. The thermoluminescent dosimeters at the Ottawa location was not available for the fourth quarter of 2023 due to construction issues and will be permanently discontinued starting in 2024. The dosimeter locations throughout the province show the range of background radiation levels experienced by Ontario residents during the year. Bruce Power and provincial background results are detailed in Table 20.

The Bruce Power indicator sites B02, B03, and B04 are located closest to the Bruce Power site and the average external gamma dose in air was 54 nanogray per hour for 2023, with the maximum occurring at B02 with a result of 58 nanogray per hour, as shown below in Table 20. For comparison, the average of the seven provincial background sites (excluding Ottawa) was slightly higher at 60 nanogray per hour.

Thermoluminescent dosimeter measurements alone cannot resolve the very low gamma doses in air associated with radiological emissions from the Bruce Power site or those observed provincially. This includes radioactive noble gases such as argon-41, xenon-133 and xenon-135. As a result, a conservative modelling method of estimating noble gas activity in the environment using emissions data and atmospheric dilution factors is used in the annual dose estimates. This demonstrates that the impact of Bruce Power on the surrounding environment, with regards to gamma radiation in air, is *de minimus* or negligible.

Table 20 - 2023 Annual External Gamma Dose Rate Measurements

Location Type	Sample Location	Total Exposure Time (days)	Total Measured Dose in Air (microgray)	Annual Average Dose Rate in Air (nanogray per hour)	Annualized Exposure (microgray)
Indicator	B02-TLD	351	490	58	510
Indicator	B03-TLD	352	471	56	489
Indicator	B04-TLD	351	405	48	421
Indicator	**Average**	**351**	**455**	**54**	**473**
Area Near	B05-TLD	352	401	47	416
Area Near	B07-TLD	352	408	48	423
Area Near	B10-TLD	351	543	64	565
Area Near	B11-TLD	352	497	59	516
Area Near	**Average**	**352**	**462**	**55**	**480**
Area Far	B06-TLD	352	409	48	424
Area Far	B08-TLD	352	397	47	412
Area Far	B09-TLD	352	415	49	431
Area Far	**Average**	**352**	**407**	**48**	**422**
Background	Bancroft	366	607	69	606
Background	Barrie	364	527	60	529
Background	Lakefield	366	562	64	561
Background	Niagara Falls	350	403	48	421
Background	North Bay	369	539	61	534
Background	Ottawa	282	337	Not applicable	Not applicable
Background	Thunder Bay	363	518	59	521
Background	Windsor	361	523	60	529
Background	**Average**	**353**	**502**	**60**	**529**

The annual average external gamma dose rates for Bruce Power indicator, area near and area far sites over time are shown in Figure 25, along with the annual average provincial background dose rate. External gamma values have remained relatively constant over the past ten years. Both Bruce Power and provincial measurements show similar trends, although Bruce Power is consistently below the provincial background. A general linear model (α=0.05) was performed by site over the last 10 years and identified that there is a statistically significant change over time ($p<0.05$), but no significant difference by site over time. An analysis of variance ($\alpha=0.05$) shows a statistically significant difference in the means by site ($p<0.001$). The results showed that the provincial site had the highest mean gamma in air, that the indicator and area near sites had no significant difference from each other and that the area far site had the lowest mean gamma in air.

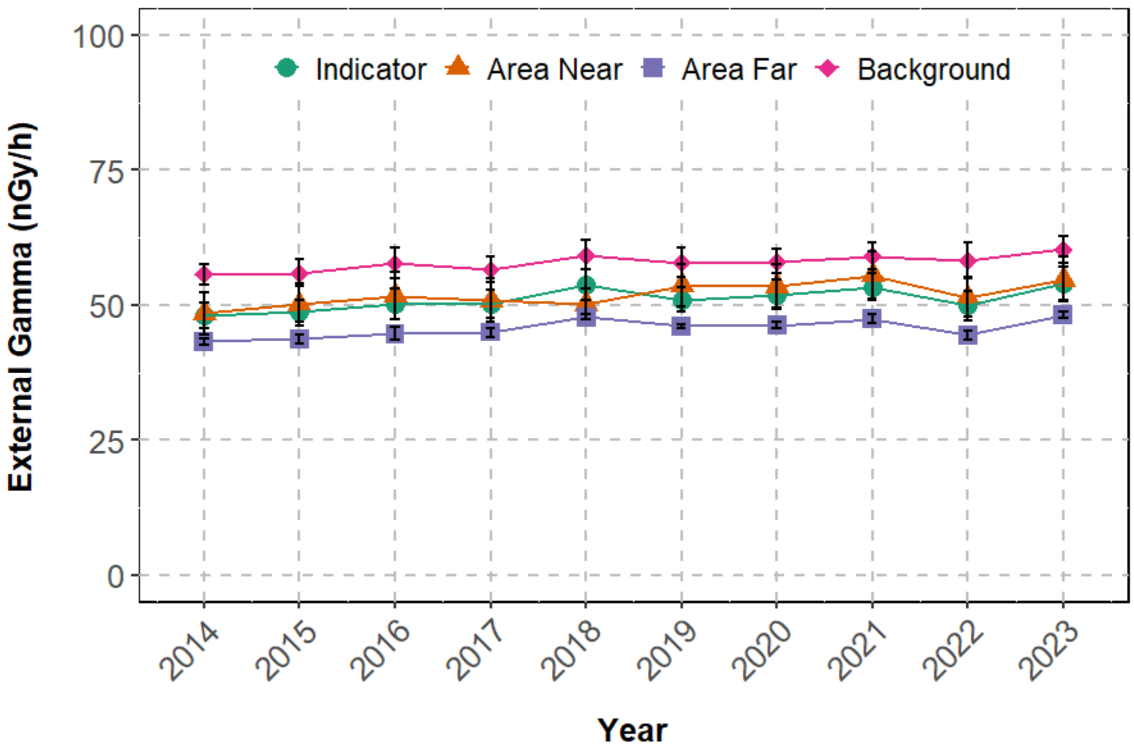


Figure 25 – 2023 Annual Average External Gamma Dose Rates (nanogray per hour) at Bruce Power Indicator, Near, Far and Provincial Background Locations Over Time (± Standard Error)

Health Canada also monitors total external gamma dose in the local area [R-120]. The Fixed Point Surveillance network monitors radiation dose to the public in real-time due to radioactive materials (natural and manmade) in the terrestrial environment, whether they are airborne or on the ground. The radiation dose from all external gamma sources, which includes natural background from mineral deposits in the ground or radon gas in the air, is provided as Total Air Kinetic Energy Released in Matter. The contributions to external dose from three radioactive noble gases argon-41, xenon-133 and xenon-135 are reported in nanogray per month (1 nanogray = 1×10^{-6} millisieverts). There are eight Fixed Point Surveillance network monitors in the area near Bruce Power, including at the site boundary, the Visitor's Centre (Infocentre), Scott Point, Kincardine, Inverhuron, Port Elgin, Tiverton, and Shore Road. In 2023, the results for xenon-133 and xenon-135 were less than the limit of detection for all months at all 8 locations. At most locations and months the results for argon-41 were less than the limit of detection, although there were 1-3 months at Scott Point, Infocentre, and

Shore Rd that detected argon-41 at or above the limit of detection of 6 nanogray per month, but were very low (less than 10 nanogray per month) [R-121]. Doses at these levels are considered negligible.

The Canadian Nuclear Safety Commission Independent Environmental Monitoring Program does not monitor for external gamma using the same approach used by Bruce Power, the Province or Health Canada, but instead measures individual gamma emitting radionuclides in air. Therefore, the results are not comparable; however, they are presented to show all of the monitoring results in the Bruce area. The 2022 Canadian Nuclear Safety Commission Independent Environmental Monitoring Program monitored for cesium-137 in air at Baie du Doré, Inverhuron, Tiverton and Neyaashiinigmiing locations. All results were < 0.000052 becquerels per cubic metre, which are well below the guideline/reference level of 2.56 becquerels per cubic metre. The Canadian Nuclear Safety Commission also measured iodine-131 at these locations in 2022, and all results were < 0.00086 becquerels per cubic metre, much lower than the guideline/reference level of 0.228 becquerels per cubic metre [R-39] [R-40].

6.1.1.2 Tritium Oxide in Air

Tritium oxide in air is measured at 10 locations near Bruce Power (Figure 22and Figure 23) using active air samplers that pass air at a continuous rate through molecular sieves, where water vapour from the atmosphere is absorbed. The molecular sieves are changed out on a monthly basis and the water is extracted and analyzed for tritium by liquid scintillation counting. The results are obtained by multiplying the specific activity of tritium in the extracted water by the average absolute humidity measured for the sampling period. The average absolute humidity is determined by dividing the mass of water collected on the molecular sieve by the volume of air sampled as measured by an integrated flow metre.

Monthly samples are averaged by location for the year and are shown in Table 21, along with the provincial background value measured in Nanticoke (Figure 21). The results for 2023 are shown on a monthly basis in Figure 26. At one location, B11-ST, the totalizer failed due to extreme cold in January, which resulted in no result for this month.

Table 21 - 2023 Annual Average Tritium Oxide in Air

Location Type	Sample Location	Tritium Oxide (becquerels per cubic metre)
Indicator	B02-ST	3.47E+00
Indicator	B03-ST	2.66E+00
Indicator	B04-ST	2.69E+00
Indicator	**Average**	**2.94E+00**
Area Near	B05-ST	2.28E+00
Area Near	B07-ST	2.63E+00
Area Near	B10-ST	1.48E+00
Area Near	B11-ST	1.23E+00
Area Near	**Average**	**1.91E+00**
Area Far	B06-ST	1.98E-01
Area Far	B08-ST	3.82E-01
Area Far	B09-ST	4.26E-01
Area Far	**Average**	**3.35E-01**
Background	Nanticoke	4.20E-02

Note:

1. E+00 represents scientific notation, E+03 = $x10^3$.
2. Sample count = 12 in all cases, except B11-ST sample count = 11.
3. For calculation of averages the uncensored analytical result was used.

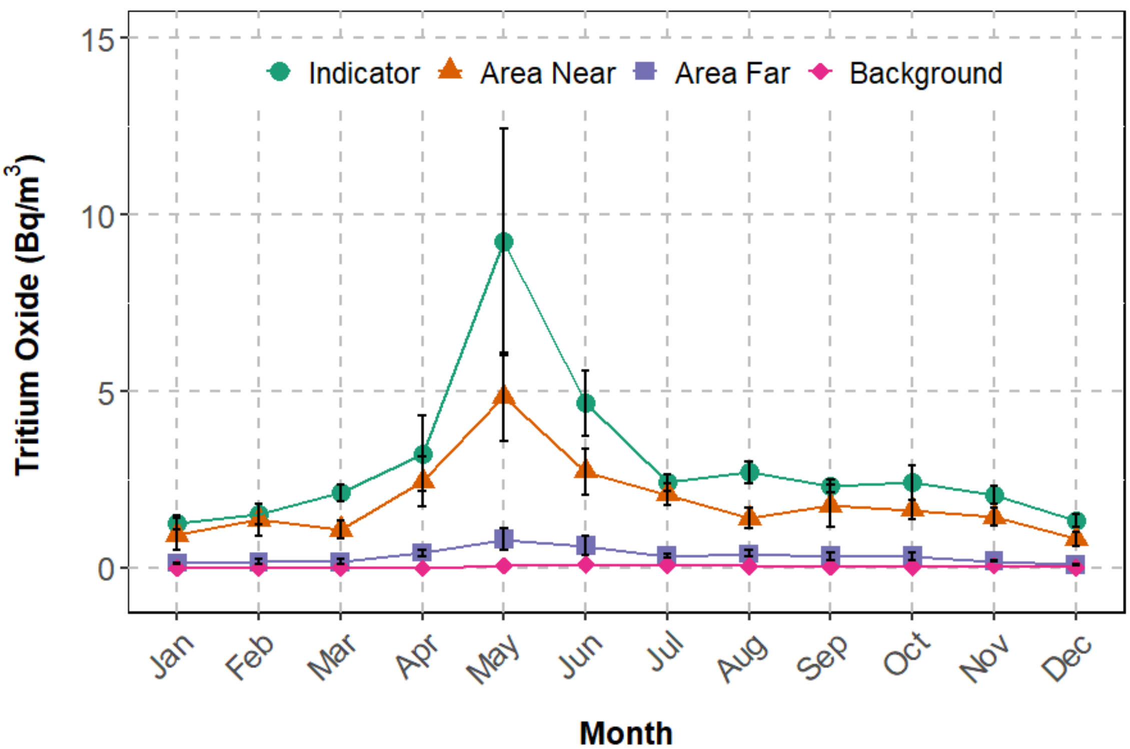


Figure 26 – 2023 Monthly Tritium Oxide in Air Concentrations (becquerels per cubic metre) at Bruce Power Indicator, Near, Far and Provincial Background Locations (± Standard Error); reference level = 340 becquerels per cubic metre

As illustrated in Figure 26, the monthly average tritium oxide levels in air for 2023 were higher at indicator sites closest to Bruce Power (B02, B03, B04), with sites further away (area near and area far) being progressively lower. The average for the area far location was close to the provincial background value each month, which was consistently lower than all Bruce Power results. In 2023 tritium oxide levels at indicator and area near locations were higher in April through June compared to other months, with the peak in May. These results may be attributed to elevated tritium releases to air from Bruce A, due to a primary heat transport water leak within the powerhouse and purging required to support subsequent clean-up activities that occurred late April/early May, as described in Section 5.1.2.1. The tritium oxide concentrations measured in air near Bruce Power were well below the Canadian Nuclear Safety Commission reference level of 340 becquerels per cubic metre.

The historical trend of the annual average tritium oxide in air is shown in Figure 27 for indicator, area near, area far and provincial background locations. Concentrations of tritium oxide in air are higher closer to site and decrease with distance. The annual averages fluctuate with changes to airborne tritium emissions from the site each year, which are related to maintenance work on reactor systems or equipment deficiencies. For example, in 2014 and 2017 airborne tritium emissions were impacted by maintenance work on components of the heat transport and moderator systems, whereas in 2022 there was the combination of equipment deficiencies in the vapour recovery systems at Bruce A, as well as the work involved in the preparation and completion of the planned vacuum building outage at Bruce A. As previously mentioned, in 2023 there was a heat transport water leak at Bruce A that impacted airborne emissions and the tritium oxide concentrations measured off-site. All historical airborne tritium releases have been well below any reportable or regulatory limits and have consistently been a small fraction of the Canadian Nuclear Safety Commission reference level of 340 becquerels per cubic metre. These levels are not harmful to people or the environment. Provincial background tritium in air is typically lower than near Bruce Power. It is not known why the 2018 provincial value is higher than other years.

A general linear model (α=0.05) was performed by site over the last 10 years and identified that there is not a statistically significant change over time, or a significant difference by site ($p>0.05$). An analysis of variance (α=0.05) shows that there is a significant difference in the means by site between the indicator, area near and area far sites, and the mean for area far site is not significantly different to provincial background ($p<0.001$).

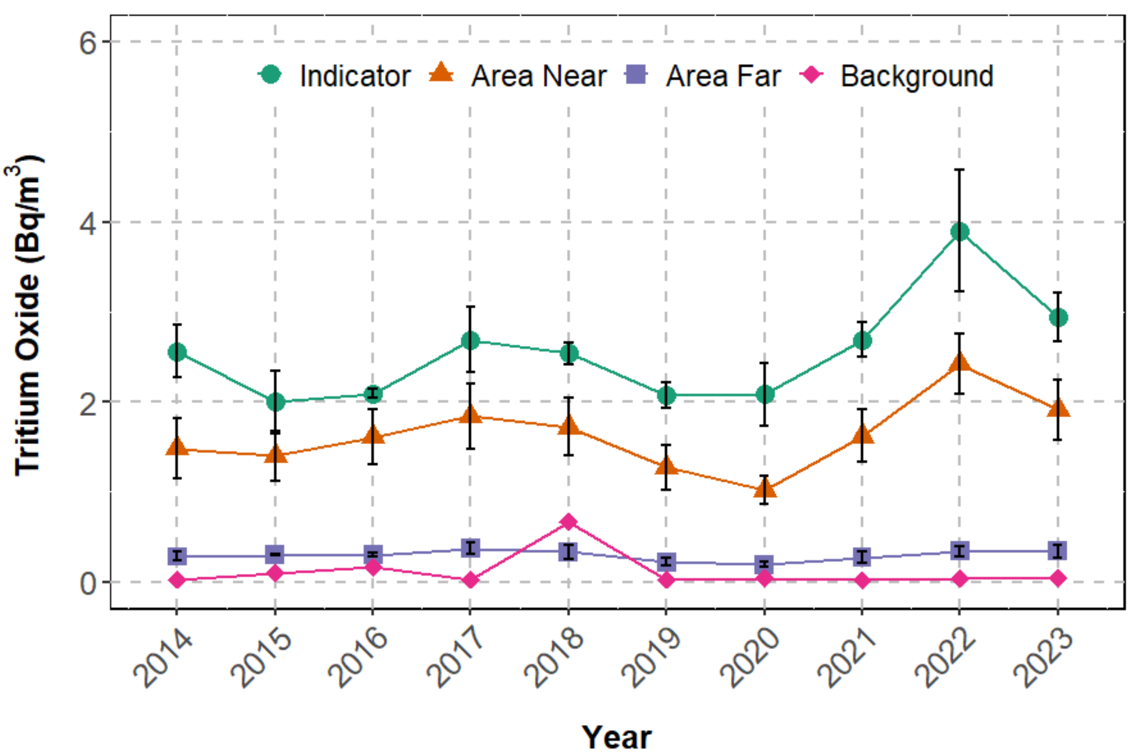


Figure 27 - 2023 Annual Average Tritium Oxide in Air Concentrations (becquerels per cubic metre) at Bruce Power Indicator, Near, Far and Provincial Background Locations Over Time (± Standard Error); reference level = 340 becquerels per cubic metre

The Canadian Nuclear Safety Commission Independent Environmental Monitoring Program measured air samples for tritiated water (tritium oxide) and elemental tritium at four locations near Bruce Power in 2022 including Inverhuron, Baie du Doré, Tiverton and

Neyaashiinigmiing [R-39][R-40]. All results for elemental tritium were less than the limit of detection value of 2.0 becquerels per cubic metre. Two locations had values greater than the detection limit of tritiated water measured in air. These include Baie du Doré at 8.5 becquerels per cubic metre and Tiverton at 6.1 becquerels per cubic metre. All results were well below the guideline/reference level of 340 becquerels per cubic metre for tritiated water and were not expected to cause a human health impact.

6.1.1.3 Carbon-14 in Air

Carbon-14 in air is monitored using passive air samplers that contain mixed soda lime pellets that absorb carbon dioxide from the atmosphere at a controlled rate. The absorbent material is collected on a quarterly basis. The carbon dioxide is released from the pellets by titration with acid and then analyzed by liquid scintillation counting for carbon-14 content. There are eight sampling locations near Bruce Power (Figure 22), with a duplicate sampler at B05 at Scott Point. There are 14 passive samplers on-site situated around Bruce A, Bruce B and Ontario Power Generation Western Waste Management Facility. The Provincial Environmental Monitoring Program has five carbon-14 samplers, shown in Figure 21, to measure background levels.

The average carbon-14 in air results are shown for each quarter of 2023 in Figure 28. For all quarters, carbon-14 concentrations measured at indicator, area near and background locations were very similar, with minor differences in the first and fourth quarter.

The 2023 annual average carbon-14 concentrations are provided in Table 22 for the off-site locations and in Table 23 for the on-site locations. The average carbon-14 concentration at the indicator location in 2023 was very similar to the average provincial background value (Table 22). Most of the individual area near locations are comparable to background locations, with BR01 and BR11 slightly higher. These locations are located closest to Bruce A, which typically has higher airborne carbon-14 emissions than Bruce B (see Section 5.1.2).

The 2023 carbon-14 results from the on-site passive samplers circling the Ontario Power Generation Western Waste Management Facility are typically higher than other areas on-site, including monitors near the Bruce A and Bruce B stations. In late summer 2022, Ontario Power Generation installed carbon dioxide scrubbers in select spent resin storage containers to reduce carbon-14 emissions released from this area.

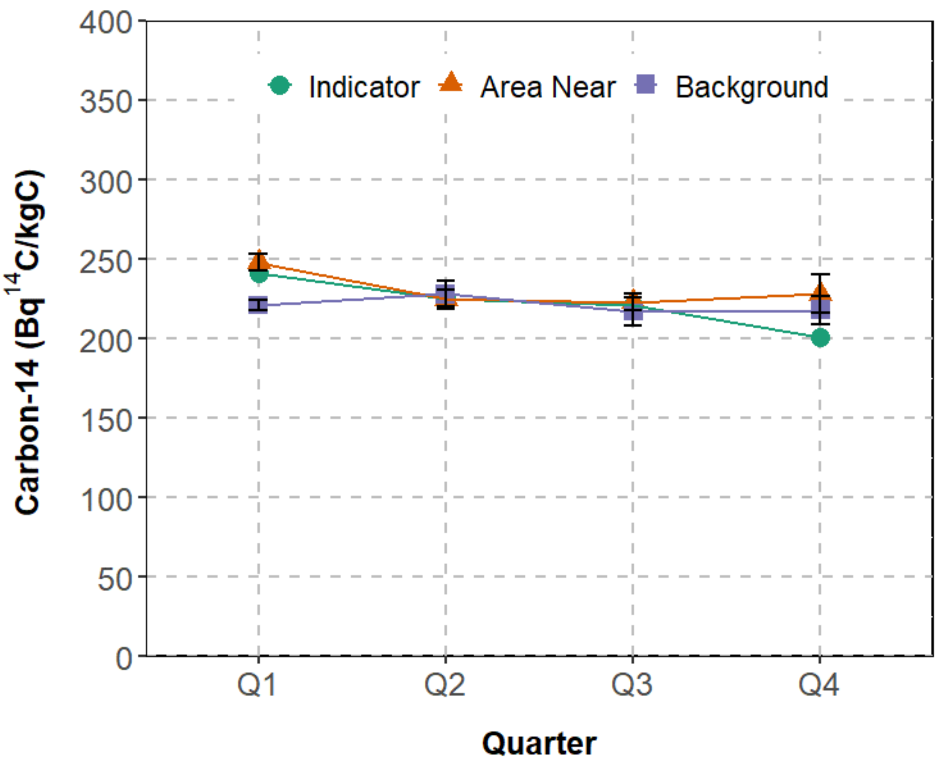


Figure 28 - 2023 Quarterly Average Carbon-14 in Air Concentrations (becquerels carbon-14 per kilogram carbon) at Bruce Power Indicator, Area Near and Provincial Background Locations (± Standard Error)

Table 22 – 2023 Annual Average Carbon-14 in Air from Passive Samplers Off-Site

Location Type	Sample Location	Carbon-14 (becquerels carbon-14 per kilogram carbon)
Indicator	B03-PC	2.22E+02
Area Near	B05-PC (#1)	2.27E+02
Area Near	B05-PC (#2)	2.29E+02
Area Near	B11-PC	2.18E+02
Area Near	BF01-PC	2.35E+02
Area Near	BF14-PC	2.33E+02
Area Near	BF23-PC	2.10E+02
Area Near	BR01-PC	2.48E+02
Area Near	BR11-PC	2.50E+02
Area Near	**Average**	**2.31E+02**
Background	Bancroft	2.16E+02
Background	Barrie	2.25E+02
Background	Lakefield	2.18E+02
Background	Nanticoke	2.17E+02
Background	Picton	2.30E+02
Background	**Average**	**2.21E+02**

Note:

1. E+00 represents scientific notation, E+03 = $x10^3$.
2. Sample count = 4.
3. For calculation of averages the uncensored analytical result was used.

Table 23 – 2023 Annual Average Carbon-14 in Air from Passive Samplers On-Site

Location Type	Sample Location	Carbon-14 (becquerels carbon-14 per kilogram carbon)
On-Site	C01-PC	3.78E+02
On-Site	C02-PC	3.16E+02
On-Site	C03-PC	6.94E+03
On-Site	C04-PC	1.42E+03
On-Site	C05-PC	1.16E+03
On-Site	C06-PC	2.19E+03
On-Site	C07-PC	5.02E+02
On-Site	C08-PC	4.03E+02
On-Site	C09-PC	2.94E+02
On-Site	C10-PC	4.42E+02
On-Site	C11-PC	9.26E+02
On-Site	C12-PC	3.59E+02
On-Site	C13-PC	9.01E+02
On-Site	C14-PC	1.07E+03

Note:

1. E+00 represents scientific notation, E+03 = $x10^3$.

2. Sample count = 4.

3. For calculation of averages the uncensored analytical result was used.

The annual average carbon-14 in air concentrations for the last ten years are shown in Figure 29. The Bruce Power annual average is consistently just above the provincial annual average, with trends in both being relatively stable. There is a slight decrease for indicator and area near locations for 2023 compared to the previous year. A general linear model (α=0.05) was performed by site over the last 10 years and identified a statistically significant decrease by site and by year ($p<0.001$). An analysis of variance (α=0.05) by site shows that the means for indicator and area near sites are not significantly different from one another, with both means being significantly higher than provincial background ($p<0.001$). An analysis of variance (α=0.05) by year shows that the means decrease over time ($p<0.05$).

The Canadian Nuclear Safety Commission Independent Environmental Monitoring Program carried out near Bruce Power in 2022 did not monitor for carbon-14 in air.

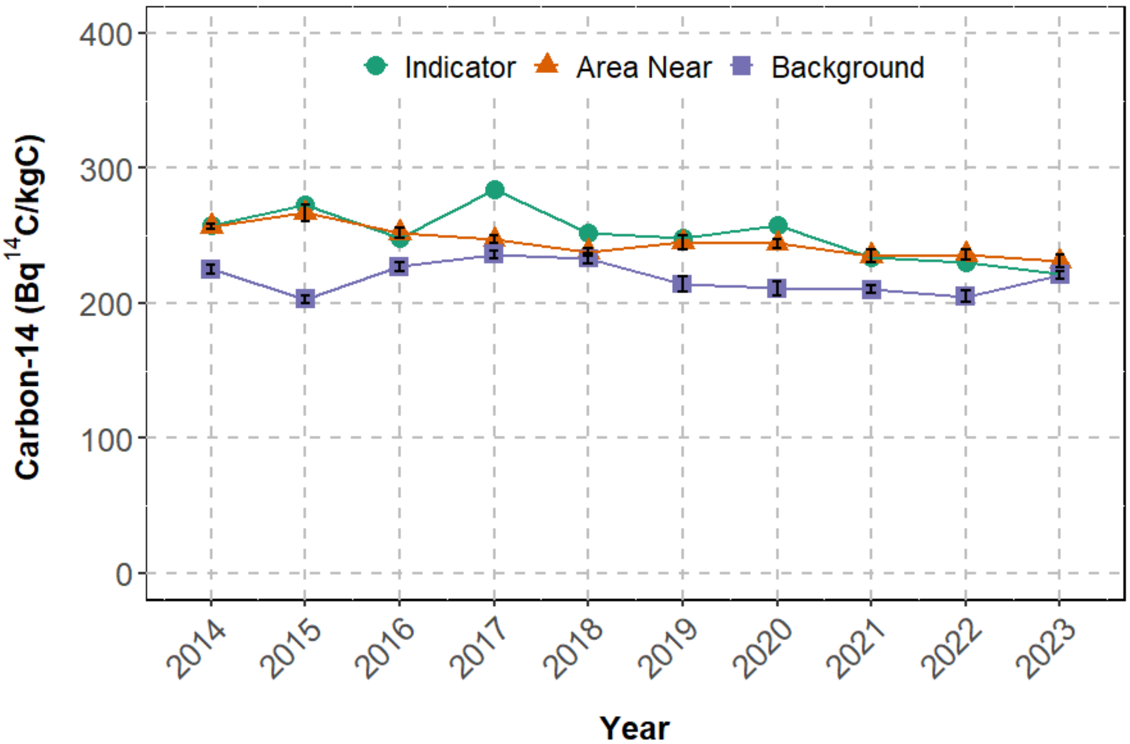


Figure 29 - Annual Average Carbon-14 in Air Concentrations (becquerels carbon-14 per kilogram carbon) at Bruce Power Indicator, Area Near and Provincial Background Locations Over Time (± Standard Error)

6.1.1.4 Air Monitoring Summary

Bruce Power monitors external gamma radiation and tritium oxide and carbon-14 concentrations in air on a continuous basis at locations near Site. All results for 2023 were within normal ranges and similar to historical values. No human health impacts are expected from these levels in the environment.

A summary of each radionuclide group is provided here:

- External gamma results for 2023 were less than provincial background and have remained relatively constant over the last decade. The external radiation levels measured in the area by the Canadian Nuclear Safety Commission and Health Canada were negligible.

- Tritium levels in air for 2023 were lower than the previous year, and the annual averages were well below the Canadian Nuclear Safety Commission reference level.

- For 2023, carbon-14 levels in air were similar to previous years and nearly indistinguishable from background levels.

6.1.2 Precipitation

Precipitation is collected in a bucket at 10 locations near and far from Bruce Power (Figure 22 and Figure 23). The water that has accumulated is collected each month and analyzed for tritium oxide by liquid scintillation counting and for gross beta radiation by proportional counting.

The precipitation data are not used in the dose calculations for members of the public. The results are not representative due to the infrequent nature of precipitation and changes in radiological emissions between precipitation events. The results are used only as a gross indication of other more direct measurements such as tritium oxide in air, agricultural products and drinking water. Since precipitation will invariably become surface water and ground water, and potentially a source of drinking water via shallow wells or surface water, precipitation is collected each month to assist in understanding the movement of radionuclides through the environment.

The volume of water collected is highly variable and depending on the year and season the pail may be empty or filled with snow or ice. In 2023 the months of May, June and September were drier than other months and several (4 to 8) collection buckets were found to be empty or nearly empty (< 0.5 litres). This affected the analysis as there was not enough volume to perform all of the planned measurements (e.g., tritium or gross beta). In May there were 6 locations (60%), and in June and September there were 2 locations (20%), that did not have enough volume for the tritium analysis. In February the pail at B06 was cracked and some sample was lost, therefore there was not enough volume for beta analysis.

The annual average results for tritium oxide and gross beta in precipitation are presented in Table 24. The province does not collect precipitation as part of their Environmental Monitoring Program. As seen in previous years, the average tritium oxide results decrease with distance from Bruce Power (indicator > area near > area far locations), while gross beta remains consistent regardless of proximity to site. The annual average for tritium in precipitation at indicator locations was 182 becquerels per litre, while the annual average for area near locations was 160 becquerels per litre and area far locations was 31 becquerels per litre. By contrast the annual average gross beta deposition rate at indicator locations was 21 becquerels per metre squared per month, while area near and far locations had an annual average of 21 and 20 becquerels per metre squared per month, respectively. This suggests that Bruce Power operations are not a significant contributor to beta radiation measured in precipitation.

Table 24 - 2023 Annual Average Precipitation Data

Location Type	Sample Location	Tritium Oxide (becquerels per litre)	Gross Beta (becquerels per cubic metre per month)
Indicator	B02-WP	1.96E+02	2.01E+01
Indicator	B03-WP	1.56E+02	2.26E+01
Indicator	B04-WP	2.03E+02	1.96E+01
Indicator	**Average**	**1.82E+02**	**2.08E+01**
Area Near	B05-WP	1.90E+02	1.96E+01
Area Near	B07-WP	2.06E+02	2.21E+01
Area Near	B10-WP	1.24E+02	2.06E+01
Area Near	B11-WP	8.87E+01	2.06E+01
Area Near	**Average**	**1.60E+02**	**2.07E+01**
Area Far	B06-WP	3.32E+01	1.88E+01
Area Far	B08-WP	3.54E+01	2.05E+01
Area Far	B09-WP	1.39E+01	1.94E+01
Area Far	**Average**	**3.12E+01**	**1.95E+01**

Note:

1. E+00 represents scientific notation, E+03 = $x10^3$.

2. For tritium analysis, sample count = 12 in all cases, except at B03-WP, B06-WP, B08-WP, B11-WP with sample count = 11, and B02-WP, B09-WP with sample count = 9. For beta analysis, sample count = 12 in all cases, except B11-WP with sample count = 11.

3. For calculation of averages where result was less than critical level (Lc) the uncensored analytical result was used.

Tritium oxide in precipitation measured at Bruce Power monitoring locations are shown for the last ten years in Figure 30. Consistently the tritium concentration decreases with distance from Bruce Power. Averages vary from year to year mirroring the airborne tritium emissions from Site. The annual averages at the indicator and area near locations for 2023 were lower than the previous year, similar to the trends observed for tritium oxide in air (Section 6.1.1.2).

A general linear model ($\alpha=0.05$) was performed by site over the last 10 years and identified that there is no statistically significant change by site over time ($p>0.05$). An analysis of variance ($\alpha=0.05$) shows that there is a significant difference in the means between the indicator, area near and area far sites ($p<0.001$).

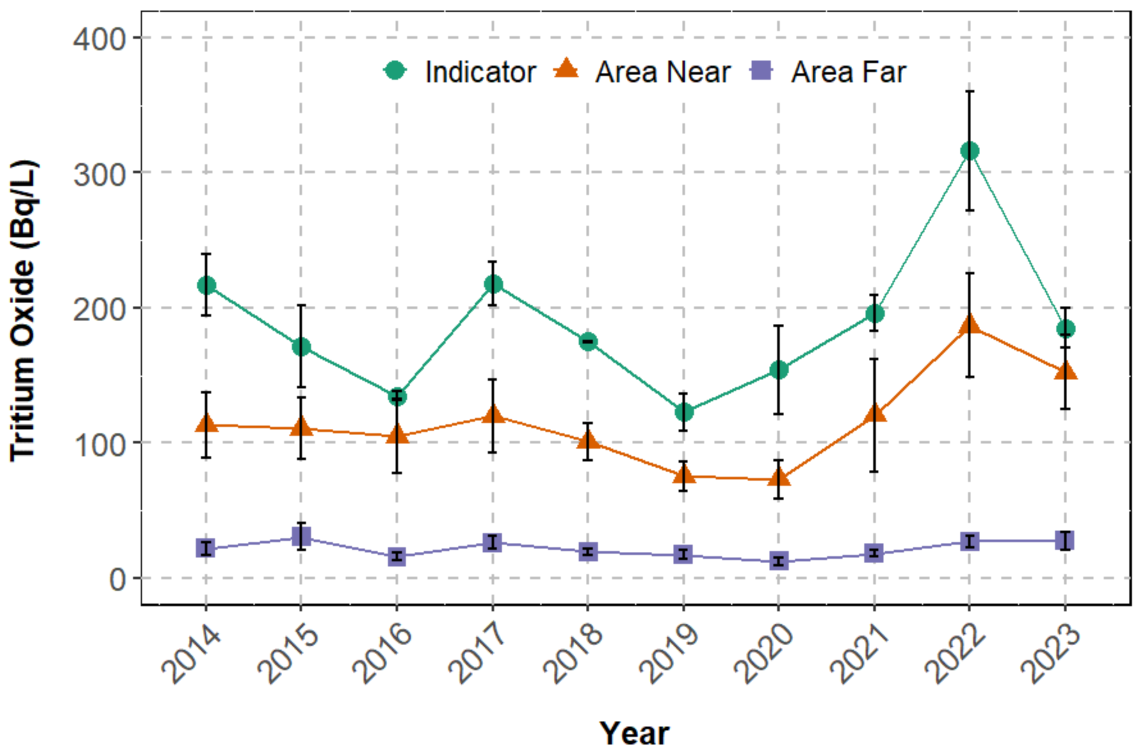


Figure 30 - Annual Average Tritium Oxide Concentrations in Precipitation (becquerels per litre) at Bruce Power Indicator, Area Near, Area Far Locations over Time (± Standard Error)

6.1.3 Water Monitoring

Bruce Power regularly collects drinking water samples from the local municipal water supply plants and municipal and residential wells near Site for use in calculating dose to members of the public each year. Surface water samples are also collected from Lake Huron and local streams off-site, as well as at locations within the Bruce Power Site boundary. Both drinking water and surface water are monitored for tritium oxide, gross beta and gross gamma radiation. Bruce Power water sampling locations are shown in Figure 22 and Figure 23.

Background levels of tritium oxide in lake water are a combination of natural cosmogenic sources (produced by the action of cosmic rays) and residual fallout from historical nuclear weapons testing. The Atomic Energy Canada Limited developed a mathematical model for estimating background tritium activity in Lake Huron from cosmogenic sources and fallout from nuclear weapons testing [R-122]. Natural Lake Huron tritium levels in the absence of CANDU tritium releases are estimated to be 1.5 becquerels per litre.

The provincial environmental monitoring program monitors for tritium oxide and gross beta in samples collected at water supply plants, municipal drinking water locations and lakes within

Ontario that are outside the influence of nuclear power plants. Provincial background sampling locations are shown in Figure 21.

The routine monitoring of the on and off-site waterbodies informs the environmental monitoring and Environmental Risk Assessment programs to ensure that Bruce Power is appropriately monitoring and understanding its impact on the environment.

6.1.3.1 Municipal Water Supply Plants

Municipal drinking water is sampled at two municipal water supply plants on Lake Huron – one in Southampton (22 kilometres northeast of Bruce A) and one in Kincardine (15 kilometres south-southwest of Bruce B). Water samples are collected twice per day during regular business hours and weekly composite samples are analyzed for tritium oxide by liquid scintillation counting. Monthly composite samples are analyzed for gross beta radiation by proportional counting. The Ontario Drinking Water Standard for tritium is 7,000 becquerels per litre (annual average), however Bruce Power has a long standing commitment with the municipalities to maintain an annual and monthly average tritium concentration at the water supply plants below 100 becquerels per litre [R-123].

The 2023 annual average tritium and gross beta results for drinking water samples collected by Bruce Power and the province are listed in Table 25. The 2023 annual weekly average for tritium at the Kincardine water supply plant was 2.8 becquerels per litre and at the Southampton water supply plant was 10.2 becquerels per litre. These values are well below the Ontario Drinking Water Standard and Canadian Nuclear Safety Commission reference level (7,000 becquerels per litre), as well as the committed administrative level of 100 becquerels per litre. The average annual tritium concentration at the provincial water supply locations ranged between 0.3 and 3.2 becquerels per litre.

The gross beta results at the local water supply plants for 2023 (0.07 becquerels per litre) were similar to historical and provincial background results (0.05 – 0.13 becquerels per litre) and were well below the Canadian Nuclear Safety Commission reference level of 1 becquerels per litre.

Table 25 - 2023 Annual Average Tritium Oxide and Gross Beta Concentrations in Drinking Water at Municipal Water Supply Locations

Location Type	Sample Location	Tritium Oxide (becquerels per litre)	Gross Beta (becquerels per litre)
Bruce Power	Kincardine	2.81E+00	7.45E-02
Bruce Power	Southampton	1.02E+01	6.83E-02
Background	Brockville	2.65E+00	1.24E-01
Background	Burlington	3.13E+00	1.29E-01
Background	Goderich	2.45E+00	9.00E-02
Background	Kingston	3.23E+00	1.16E-01
Background	Niagara Falls	2.68E+00	9.03E-02
Background	Windsor	1.98E+00	1.07E-01
Background	St. Catherine's	2.40E+00	1.12E-01
Background	Thunder Bay	<Ld	5.23E-02
Background	North Bay	8.25E-01	7.60E-02
Background	Parry Sound	2.67E+00	6.13E-02

Note:

1. E+00 represents scientific notation, E+03 = $x10^3$.
2. Bruce Power: For calculation of averages where the result was less than critical level (Lc), the uncensored analytical result was used.
3. Provincial background: For calculation of averages where the result was less than the minimum detection level (Ld), the uncensored analytical result was used. '<Ld' stated in table when all results were <Ld.

The impact of Bruce Power discharges to Lake Huron on the local water supply plants varies from year to year and is dependent on the distance from the stations, lake current direction and general dispersion conditions in the lake. The Southampton water supply plant has marginally higher annual average tritium oxide concentrations each year compared to Kincardine due to the predominant lake currents near Bruce Power travelling northward.

The tritium concentrations at the water supply plants over the last ten years are shown in Figure 31. Tritium oxide concentrations are consistently low and stable from 2014 through 2023, with Southampton being slightly higher than Kincardine and provincial averages. All results are below 15% of the administrative level of 100 becquerels per litre. These values are very low and no impacts to human health are expected from these levels.

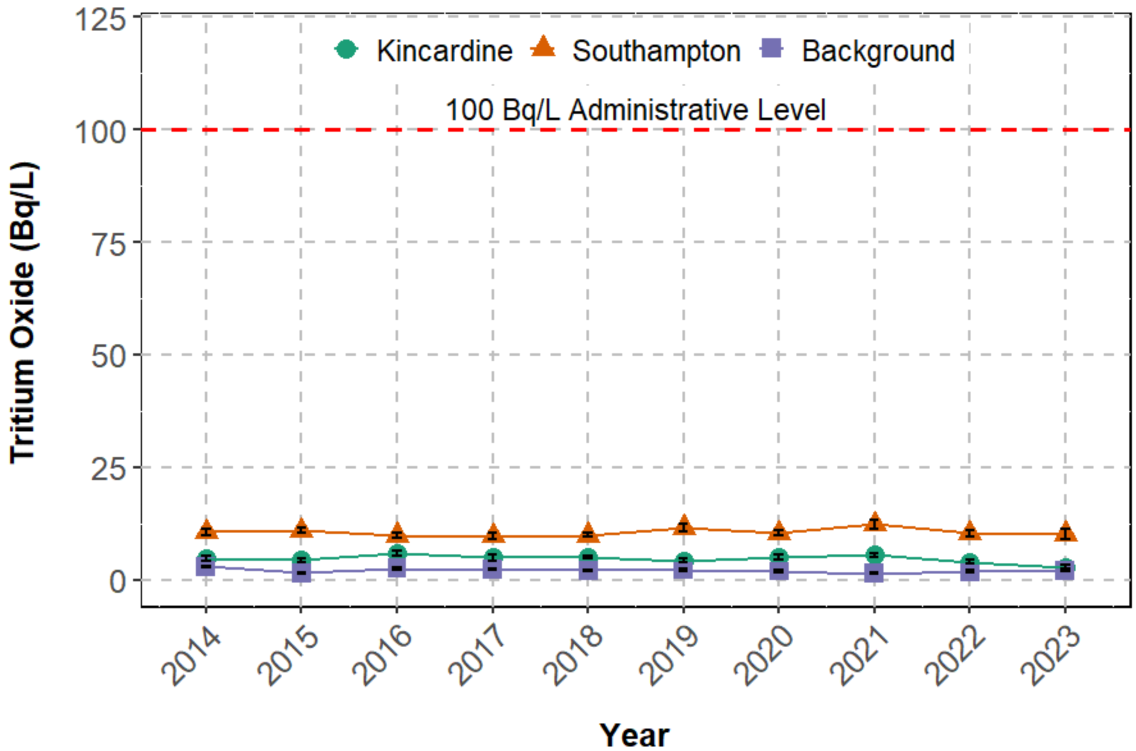


Figure 31 - Annual Average Tritium Oxide Concentrations (becquerels per litre) at the Municipal Water Supply Plants near Bruce Power and Provincial Background Locations Over Time. reference level = 7000 becquerels per litre; Administrative level = 100 becquerels

6.1.3.2 Municipal and Residential Wells

In addition to the water supply plants in Southampton and Kincardine, drinking water is also collected at a number of municipal and local residential wells. Four municipal wells, located at Scott Point (BM03-WW), Underwood (BM06-WW) and Tiverton (BM12-WW, BM13-WW), are sampled semiannually. Seven deep residential wells are also sampled semiannually, while six shallow residential wells are sampled bimonthly, based on occupant availability. Water samples are analyzed for tritium oxide by liquid scintillation counting. Two representative locations, one to the north of Bruce Power at Scott Point (BR02-WW) and one to the south at Inverhuron (BR32-WW), are also analyzed semiannually for gross beta and gross gamma radiation. Annual average tritium oxide and gross beta results are shown in Table 26. Results for CANDU related gamma-emitting radionuclides cobalt-60, cesium-134 and cesium-137 from the gamma scan completed on semi-annual samples taken from shallow wells at Scott Point (BR02-WW) and Inverhuron (BR32-WW) are not shown as the results were indistinguishable from background (i.e., less than the critical level or not identified).

Table 26 - 2023 Annual Average Tritium Oxide and Gross Beta Concentrations in Drinking Water at Bruce Power Well Locations

Location Type	Sample Location	Tritium Oxide (becquerels per litre)	Gross Beta (becquerels per litre)
Municipal Well	BM03-WW	<Lc	Not Applicable
Municipal Well	BM06-WW	<Lc	Not Applicable
Municipal Well	BM12-WW	<Lc	Not Applicable
Municipal Well	BM13-WW	<Lc	Not Applicable
Residential Deep Well	BR01-WW	<Lc	Not Applicable
Residential Deep Well	BR08-WW	<Lc	Not Applicable
Residential Deep Well	BR25-WW	<Lc	Not Applicable
Residential Deep Well	BF01-WW	<Lc	Not Applicable
Residential Deep Well	BF14-WW	<Lc	Not Applicable
Residential Deep Well	BF23-WW	<Lc	Not Applicable
Residential Deep Well	BM02-WW	<Lc	Not Applicable
Residential Shallow Well	BR02-WW	<Lc	1.38E-01
Residential Shallow Well	BR03-WW	1.57E+02	Not Applicable
Residential Shallow Well	BR04-WW	<Lc	Not Applicable
Residential Shallow Well	BR41-WW	2.63E+01	Not Applicable
Residential Shallow Well	BR42-WW	5.04E+01	Not Applicable
Residential Shallow Well	BF06-WW	No sample	Not Applicable
Residential Shallow Well	BR32-WW	1.76E+01	2.76E-01

Note:

1. E+00 represents scientific notation, E+03 = $x10^3$.
2. For calculation of averages where the result was less than critical level (Lc), the uncensored analytical result was used. ‘<Lc’ stated in table when all results were <Lc.

For shallow wells, the source of tritium oxide may be attributed to deposition of airborne tritium emissions from Bruce Power or precipitation washout migrating into the shallow wells. The deep wells are less likely to be affected by airborne deposition. Tritium oxide concentrations for all municipal and deep residential wells were less than the critical level for detection and indistinguishable from background. For the shallow wells the tritium oxide results were slightly higher, although 2 out of 6 available wells had results less than the critical level. The other four wells had annual averages ranging between 26 and 157 becquerels per litre and well below the Ontario Drinking Water Standard of 7000 becquerels per litre. One shallow well location (BF06-WW) was unoccupied in 2023 and no samples were available. The average gross beta result for BR02 and BR32 were slightly higher than the background locations (Table 25) but were only a fraction of the Canadian Nuclear Safety Commission reference level of 1 becquerels per litre.

The Canadian Nuclear Safety Commission Independent Environmental Monitoring Program that collected samples near Bruce Power in 2022 did not include drinking water from the municipal water supply plants or residential wells. However, samples of lake water were collected, and these results are discussed in the appropriate section below.

6.1.3.3 Lakes and Streams

Water samples are collected bimonthly from Lake Huron, ponds and streams in the vicinity of Bruce Power. Bruce Power sampling locations are shown on Figure 22. On-site sample locations within the Bruce Power perimeter fence include two ponds and one stream (B31 Pond – BM16, Former Sewage Lagoon – BM21 and Stream C – BC02). Off-site samples are collected from three stream locations near Bruce Power, which include Little Sauble (BC01) to the south and two locations on Underwood Creek (BC03 and BC04) to the north. Streams may be impacted by deposition of airborne radiological emissions from the Site or by precipitation washout migrating into waterways. Lake water is sampled at Baie du Doré (BM04) to the northeast, Inverhuron (BM10) to the south and Scott Point (BM20) to the north. Lake water may be impacted from waterborne effluent from discharge points on site, where as Baie du Doré may also be influenced by Stream C and atmospheric downwash. The stream indicator location is Stream C (BC-02) located on the north side of the Bruce Power boundary and flows into Baie du Doré. The lake indicator location (BM04) is sampled from the eastern shore of Baie du Doré at the end of Concession Road 6.

Samples of lake and stream water are collected on a bi-monthly basis when free of ice. Lake water is analyzed for tritium oxide by liquid scintillation counting and gross beta by proportional counting. The stream water samples are composited semi-annually and measured for tritium oxide and gross beta radiation. Composites of lake water samples are also analyzed for gross gamma twice per year using gamma spectroscopy. The 2023 annual average tritium oxide and gross beta results are shown in Table 27. Gamma results for 2023 are not shown as all results for CANDU related radionuclides cobalt-60, cesium-134 and cesium-137 were indistinguishable from background (i.e., less than the critical level or not identified in the gamma scan).

In January 2023, lake water samples were not collected at the Baie du Doré location (BM04) or the B31 on-site pond (BM16) due to the waterbody being frozen or inaccessible due to ice. Also in 2023, the second semiannual composite sample for Underwood Creek (BC04) was impacted by high crud content in one of the three bi-monthly samples. Therefore, the gross beta result for that timeframe includes only two out of the three bi-monthly samples taken.

Background lake water is collected by Ontario Power Generation on a quarterly basis at three locations (Bancroft, Belleville and Cobourg) as shown in Figure 21 and analyzed for tritium oxide and gross beta radiation. Samples are not collected when the lake is frozen (typically the first and fourth quarters). The 2023 annual average results are presented in Table 27.

Table 27 - 2023 Annual Average Tritium Oxide and Gross Beta Concentrations in Ponds, Lakes and Streams

Location Type	Sample Location	Tritium Oxide (becquerels per litre)	Gross Beta (becquerels per litre)
On Site Pond	BM16-WL (B31 Pond)	1.74E+02	Not applicable
On Site Pond	BM21-WL (Former Sewage Lagoon)	5.64E+02	Not applicable
Indicator Stream	BC02-WC	8.86E+01	1.23E-01
Area Near Stream	BC01-WC	3.39E+01	1.94E-01
Area Near Stream	BC03-WC	4.45E+01	1.56E-01
Area Near Stream	BC04-WC	1.46E+02	1.13E-01
Indicator Lake	BM04-WL	6.55E+01	9.68E-02
Indicator Lake	BM04-WL duplicate	6.49E+01	9.57E-02
Area Near Lake	BM10-WL	1.26E+01	8.85E-02
Area Near Lake	BM20-WL	4.88E+01	8.17E-02
Background Lake	Bancroft (Clark Lake)	<Ld	4.9E-02
Background Lake	Belleville (Bay of Quinte)	1.3E+00	7.5E-02
Background Lake	Cobourg (Lake Ontario)	3.9E+00	9.9E-02

Note:

1. E+00 represents scientific notation, E+03 = $x10^3$.
2. Bruce Power: For calculation of averages where result was less than critical level (Lc) the uncensored analytical result was used.
3. Provincial background: For calculation of averages where the result was less than the minimum detection level (Ld), the minimum detection level was used. ‘<Ld’ stated in table when all results were <Ld.
4. Bancroft, Belleville, and Cobourg are not sampled during winter months (Quarter 1 and 4).

The 2023 Bruce Power results for lake and stream water show similar trends as those observed for shallow wells and air monitoring; tritium oxide values decrease with increasing distance from Bruce Power. All values are well below the Ontario Drinking Water Standard and Canadian Nuclear Safety Commission reference level for tritium oxide in drinking water (7000 becquerels per litre). The gross beta results are consistently low and show little variation with proximity to Bruce Power. The indicator lake results are similar to what is measured at Cobourg (Lake Ontario). The gross beta concentrations in surface water are well below the Canadian Nuclear Safety Commission reference level of 1 becquerel per litre.

Annual average tritium oxide concentrations in lake and stream water samples measured at Bruce Power indicator and area near locations over time are shown in Figure 32. In 2023, both the indicator stream and indicator lake annual averages returned to historical levels. The higher tritium oxide concentrations observed in 2022 were attributed to the higher airborne tritium releases that year due to equipment deficiencies and planned maintenance activities at Bruce A. The challenges associated with the vapour recovery drier systems were addressed, resulting in improved performance in 2023 (see Section 5.1.2.1).

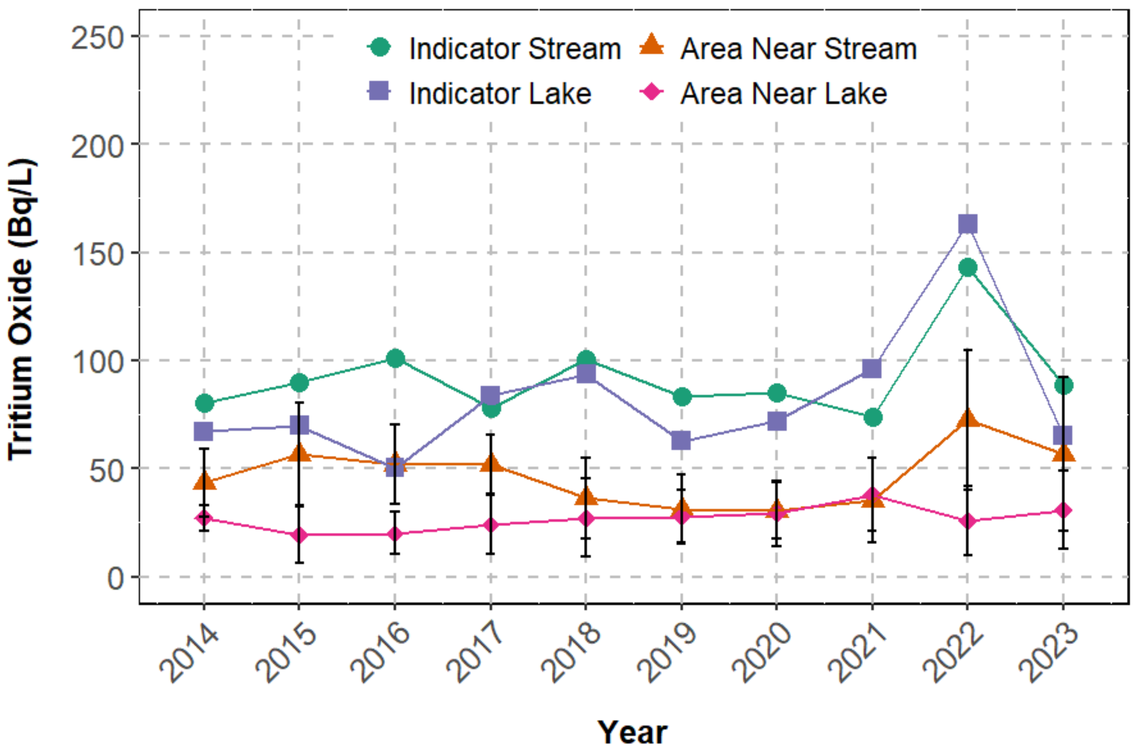


Figure 32 - 2023 Annual Average Tritium Oxide Concentrations (becquerels per litre) in Lake Huron and Streams Near Bruce Power Over Time (± Standard Error). Canadian Nuclear Safety Commission reference level = 7000 becquerels per litre

The Canadian Nuclear Safety Commission Independent Environmental Monitoring Program for 2022 included surface water sampling at five locations near Bruce Power including the Saugeen River in Southampton and the shores of Southampton beach, Port Elgin beach, Baie du Doré and Kincardine beach. The following radionuclides or radionuclide groups were measured in the surface water samples: tritiated water (tritium oxide), gross alpha, gross beta, cobalt-60 and cesium-137. The Canadian Nuclear Safety Commission found that tritiated water concentrations were in the range of 3.6 becquerel per litre to 68.2 becquerel per litre and below the guideline/reference level of 7000 becquerel per litre. All gross alpha, gross beta, cobalt-60 and cesium-137 results were less than the limit of detection. These results are consistent with what Bruce Power reports and indicate that no human health impacts are expected from radionuclides in surface water from the local area [R-39] [R-40].

6.1.3.4 Water Monitoring Summary

Bruce Power regularly monitors tritium oxide, beta and/or gamma emitters in drinking water and surface water at a variety of locations on and off site, including from municipal water supply plants and residential wells, from Lake Huron, streams and ponds. All results were well below the Canadian Nuclear Safety Commission reference levels, indicating that there is no risk to members of the public or the environment.

A summary is provided here:

- Concentrations of tritium oxide in drinking water at the municipal water supply plants in Kincardine and Southampton are similar to previous years and well below the Ontario Drinking Water Standard and the commitment with the municipalities.
- Radionuclide concentrations in drinking water from local municipal and residential wells are well below the Canadian Nuclear Safety Commission reference levels for tritium oxide and gross beta radiation.

Annual average tritium concentrations in Lake Huron and local streams in areas closest to Site are lower than the previous year, and quickly decrease with distance from Bruce Power.

6.1.4 Agricultural and Animal Products Monitoring

Bruce Power collects a variety of foodstuffs each year, including milk, fish, animal products (e.g., eggs, honey, meat) and agricultural products (e.g., fruit, vegetables, grains) and measures for radioactivity. Sample type and location may vary from year to year depending on sample availability and participation from local farmers and residents. The results are used in the annual dose to public calculation for the representative persons that live near Bruce Power. Additionally, the results inform the Environmental Monitoring and Environmental Risk Assessment programs to ensure that Bruce Power is appropriately monitoring and understanding its impact on the environment.

6.1.4.1 Fish

Bruce Power monitors fish in Lake Huron for radionuclide concentrations as part of the Radiological Environmental Monitoring program. Samples of benthic forager (bottom feeders) and pelagic forager (open water) fish species are collected near Bruce Power and further afield at locations along the western shore of Lake Huron well away from Bruce Power for use as a control. The control sampling locations were updated in 2017 due to importation policies that came into effect that year. Starting in 2017, control fish are collected on the Canadian side of Lake Huron north of Tobermory or within Georgian Bay, by a contractor assisted by local Indigenous members. In 2023, due to availability, the near area fish samples were obtained at a location near Oliphant.

The analysis of two types of fish species provides some insight into potential radiological impacts from Bruce Power operations on the lakebed where benthic species inhabit, and through open water ecosystems where pelagic fish inhabit. The target fish species representing benthic and pelagic foragers are as follows:

- White Sucker (*Catostomus commersoni*) represents a benthic forager species. Brown Bullhead (*Ictalurus nebulosus*) is the alternate benthic species. Sample collection is conducted in the spring when adults are near shore to spawn.

- Lake Whitefish (*Coregonus clupeaformis*) represents a predominantly pelagic forager that feeds on a wide variety of organisms from invertebrates to small fish, to plankton. Round Whitefish (*Prosopium cylindraceum*) is the alternate pelagic species. Collection is conducted in the fall when adults are near shore to spawn. The secondary alternative is Lake Trout (*Salvelinus namaycush*).

Eight composite fish samples for each species and location are analyzed for tritium oxide and carbon-14 by liquid scintillation counting and for cobalt-60, cesium-134, cesium-137 by gamma spectrometry. A composite of the eight fish samples for each species and location is measured for organically bound tritium by liquid scintillation counting. The fish flesh ventral to the lateral line is included in the samples prepared for analysis. The sample preparation and analysis method for each radionuclide group is outlined in Table 28.

Table 28 - Fish Preparation and Methods

Analyte	Sample	Preparation	Method
Cobalt-60, Cesium-134, Cesium-137	Individual fish	Skinned, filleted, and flesh sliced	Gamma spectrometry
Carbon-14	Two counts of a single sample per individual fish	Freeze-dried flesh combusted	Liquid scintillation counting
Tritium oxide	Average of two samples per individual fish	Water from freeze dried flesh	Liquid scintillation counting
Organically Bound Tritium	Single composite by fish type	Solid residue (washed to remove free tritium oxide) combusted	Liquid scintillation counting

The 2023 annual average results for benthic and pelagic fish are provided in Table 29 and Table 30 for Bruce Power area near and control fish. Also shown are the provincial background annual average results for benthic and pelagic fish from Lake Huron and benthic fish from Lake Ontario for comparison. Provincial background results for organically bound tritium in fish were not available in 2023 due to potential contamination of labware used for sample preparation.

Table 29 - 2023 Annual Average Radionuclide Concentrations for Fish

Location Type	Sample Type, Location	Tritium Oxide (becquerels per litre)	Carbon-14 (becquerels carbon-14 per kilogram carbon)	Organically Bound Tritium (becquerels per litre)	Organically Bound Tritium Uncertainty (±2σ) (becquerels per litre)
Bruce Power Area Near	Benthic, Lake Huron	3.76E+00	2.39E+02	1.6E+01	4.0E+00
Bruce Power Area Near	Pelagic, Lake Huron	<Lc	2.11E+02	5.6E+00	3.7E+00
Bruce Power Control	Benthic, Lake Huron	<Lc	2.22E+02	8.4E+00	3.8E+00
Bruce Power Control	Pelagic, Lake Huron	<Lc	2.13E+02	4.6E+00	3.7E+00
Background	Benthic, Lake Ontario	<Ld	2.21E+02	Not available	Not available
Background	Benthic, Lake Huron	7.23E+00	2.53E+02	Not available	Not available
Background	Pelagic, Lake Huron	5.81E+00	2.31E+02	Not available	Not available

Note:

1. E+00 represents scientific notation, E+03 = $x10^3$.
2. Sample count = 8 in all cases, except for organically bound tritium, which includes one composite and raw data is provided.
3. For organically bound tritium results: ±2σ is the uncertainty associated with the analytical measurement, the detection limit was 8.4 becquerel per litre and the critical level was 4.2 becquerel per litre. Provincial background results were not available.
4. Bruce Power: For calculation of averages where result was less than critical level (Lc), the uncensored analytical result was used. ‘<Lc’ is stated in table when all results were <Lc.
5. Provincial background: For calculation of averages where the result was less than the minimum detection level (Ld), the minimum detection level was used. ‘<Ld’ is stated in table when all results were <Ld.

Table 30 - 2023 Annual Average Gamma Spectroscopy Results for Fish

Location Type	Sample Type, Location	Cobalt-60 (becquerels per kilogram)	Cesium-134 (becquerels per kilogram)	Cesium-137 (becquerels per kilogram)
Bruce Power Area Near	Benthic, Lake Huron	<Lc	<Lc	2.29E-01
Bruce Power Area Near	Pelagic, Lake Huron	<Lc	<Lc	3.46E-01
Bruce Power Control	Benthic, Lake Huron	<Lc	<Lc	2.51E-01
Bruce Power Control	Pelagic, Lake Huron	<Lc	<Lc	5.77E-01
Background	Benthic, Lake Ontario	<Ld	<Ld	3.08E-01
Background	Benthic, Lake Huron	<Ld	<Ld	1.80E-01
Background	Pelagic, Lake Huron	<Ld	<Ld	3.33E-01

Note:

1. E+00 represents scientific notation, E+03 = $x10^3$.
2. Sample count = 8 in all cases.
3. Bruce Power: For calculation of averages where result was less than critical level (Lc), the uncensored analytical result was used. '<Lc' stated in table when all results were <Lc or not identified on the gamma scan.
4. Provincial background: For calculation of averages where the result was less than the minimum detection level (Ld), the minimum detection level was used. '<Ld' stated in table when all results were <Ld.

Tritium Oxide in Fish

The 2023 annual average concentration of tritium oxide in benthic fish was 4 becquerels per litre for area near, 7 becquerels per litre for the Lake Huron provincial background group, and less than the critical level (and indistinguishable from background) for the control group. For pelagic fish, both the area near and control group average was less than the critical level, whereas the Lake Huron background value was 6 becquerels per litre. For both sample types, the tritium oxide concentrations in fish caught near Bruce Power were low and less than background.

The annual average tritium oxide concentrations in fish for the past 10 years are shown in Figure 33 for pelagic fish and Figure 34 for benthic fish. There has been little variation in tritium oxide levels in pelagic fish over the years, except for the higher result for the control group in 2018 for reasons unknown. In 2022, samples of pelagic fish were not available from the supplier. The annual average tritium oxide concentration for benthic fish collected near Bruce Power was very low in 2023. The higher annual average in 2021 was attributed to elevated waterborne releases from Bruce B during the sample collection period of May/June.

A general linear model could not be used for tritium oxide results in fish as the variance was not homogenous. A Kruskal Wallis analysis of variance (α=0.05) showed a statistically significant difference in the medians for benthic fish ($p<0.001$) and pelagic fish ($p<0.05$) by site. The benthic area near fish had a higher median than the control and provincial fish. The pelagic area near and control fish had a higher median than the provincial fish.

The Canadian Nuclear Safety Commission Independent Environmental Monitoring Program for 2022 included fish samples collected from the Saugeen River in Southampton [R-39] [R-40]. Fish species included Lake Trout and Lake Whitefish. The tritiated water (tritium oxide) results ranged from 2.5 to 8.2 becquerels per kilogram fresh weight, which are well below the guideline/reference level of 488,000 becquerels per kilogram fresh weight. No human health impacts are expected from these measured values.

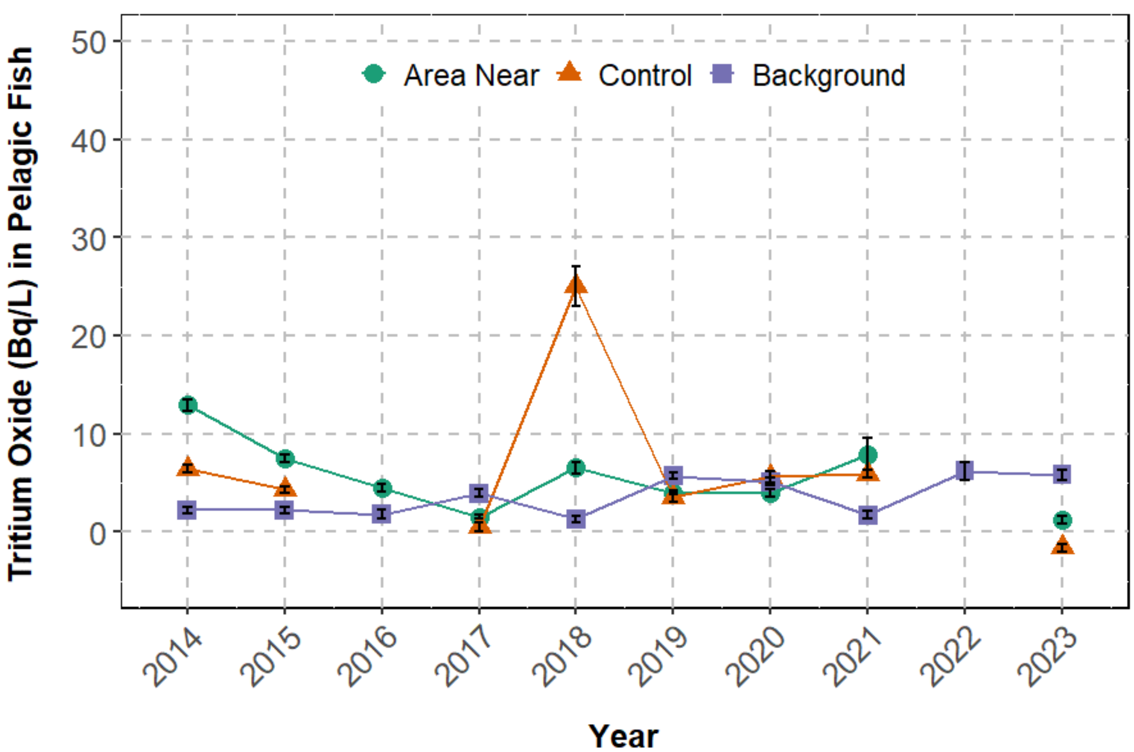


Figure 33 - Annual Average Tritium Oxide (becquerels per litre) in Pelagic Fish Tissue by Year Over Time (± Standard Error).

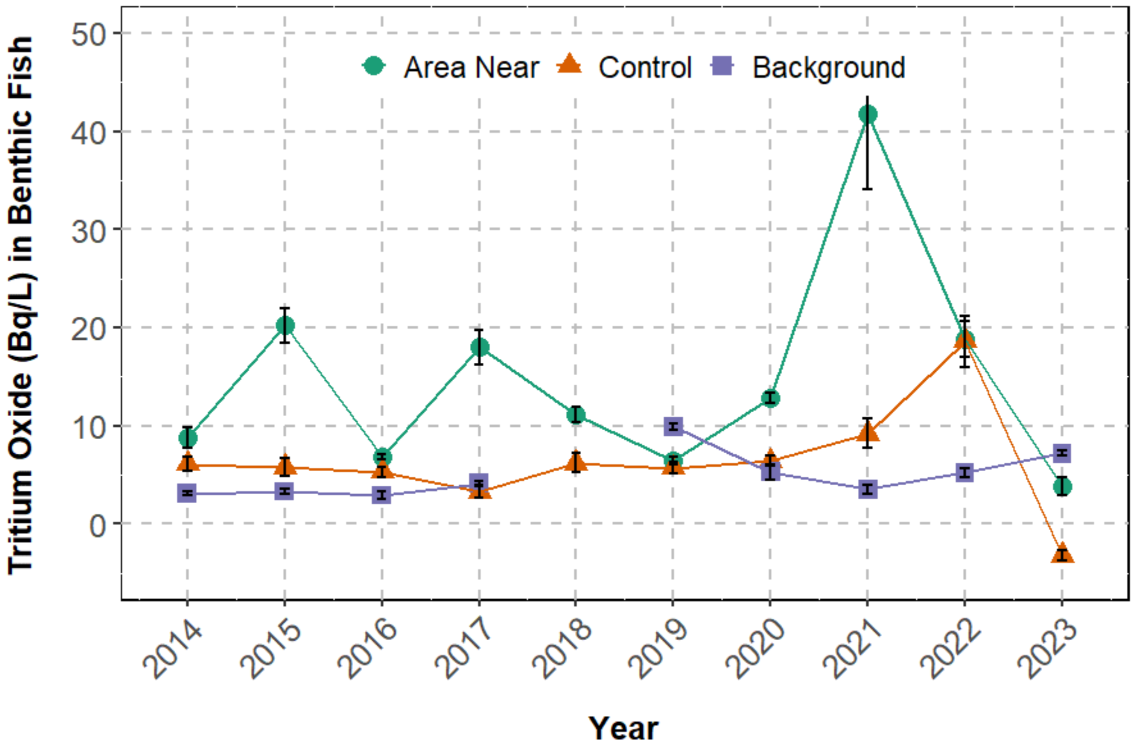


Figure 34 - Annual Average Tritium Oxide (becquerels per litre) in Benthic Fish Tissue by Year Over Time (± Standard Error)

Carbon-14 in Fish

The 2023 annual average concentration of carbon-14 in benthic fish collected near Bruce Power was 239 becquerels carbon-14 per kilogram carbon and for control fish was 222 becquerels carbon-14 per kilogram carbon. The average provincial results for Lake Huron benthic fish was slightly higher at 253 becquerels carbon-14 per kilogram carbon. For pelagic fish, the annual average carbon-14 concentration was 211 and 213 becquerels carbon-14 per kilogram carbon for area near and control locations, respectively. The average Lake Huron provincial background value for pelagic fish was higher at 231 becquerels carbon-14 per kilogram carbon. For 2023, the carbon-14 levels in fish collected near Bruce Power were lower than background values.

The annual average carbon-14 concentrations over time are shown in Figure 35 for pelagic fish and Figure 36 for benthic fish. The carbon-14 levels measured in fish tissue of both species' types collected from Lake Huron have remained steady over time and very similar to background values.

A general linear model (α=0.05) was performed over the last 10 years and identified that there is a statistically significant change by site over time for both benthic fish ($p<0.05$) and pelagic fish ($p<0.05$). An analysis of variance (α=0.05) shows that there is not a significant difference in the means between the area near, control or provincial sites for either fish type.

The Canadian Nuclear Safety Commission Independent Environmental Monitoring Program near Bruce Power did not analyze for carbon-14 in fish.

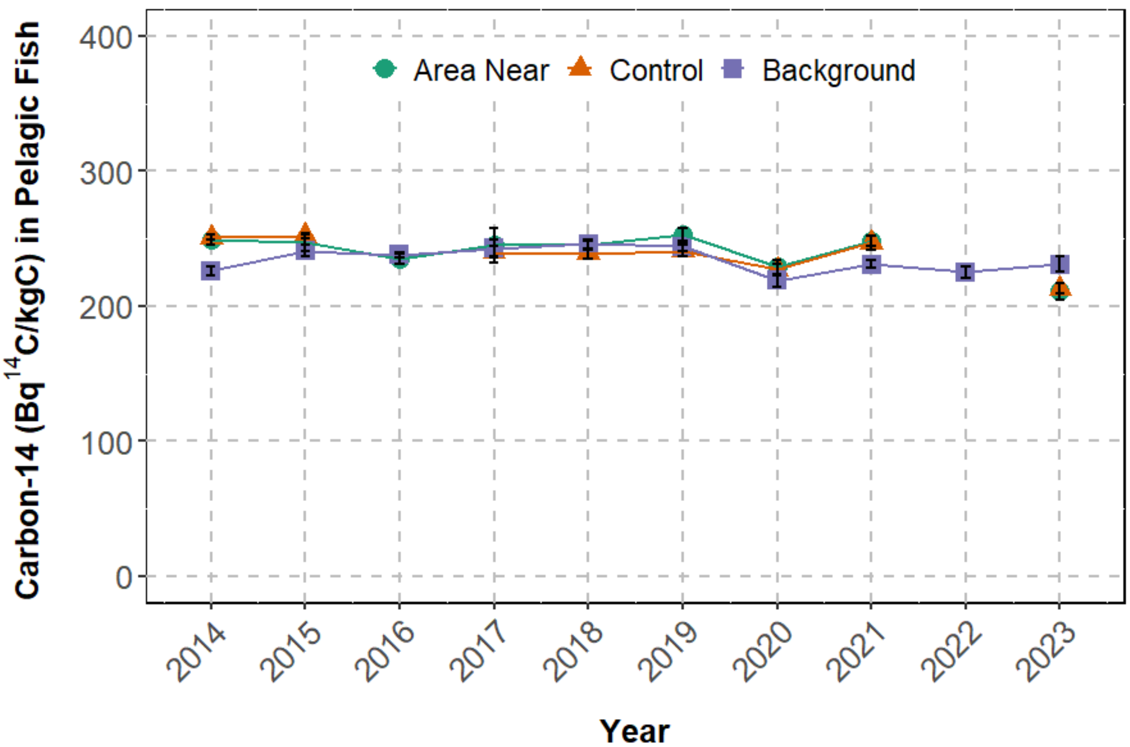


Figure 35 - Annual Average Carbon-14 (becquerels carbon-14 per kilogram carbon) in Pelagic Fish Tissue by Year Over Time (± Standard Error).

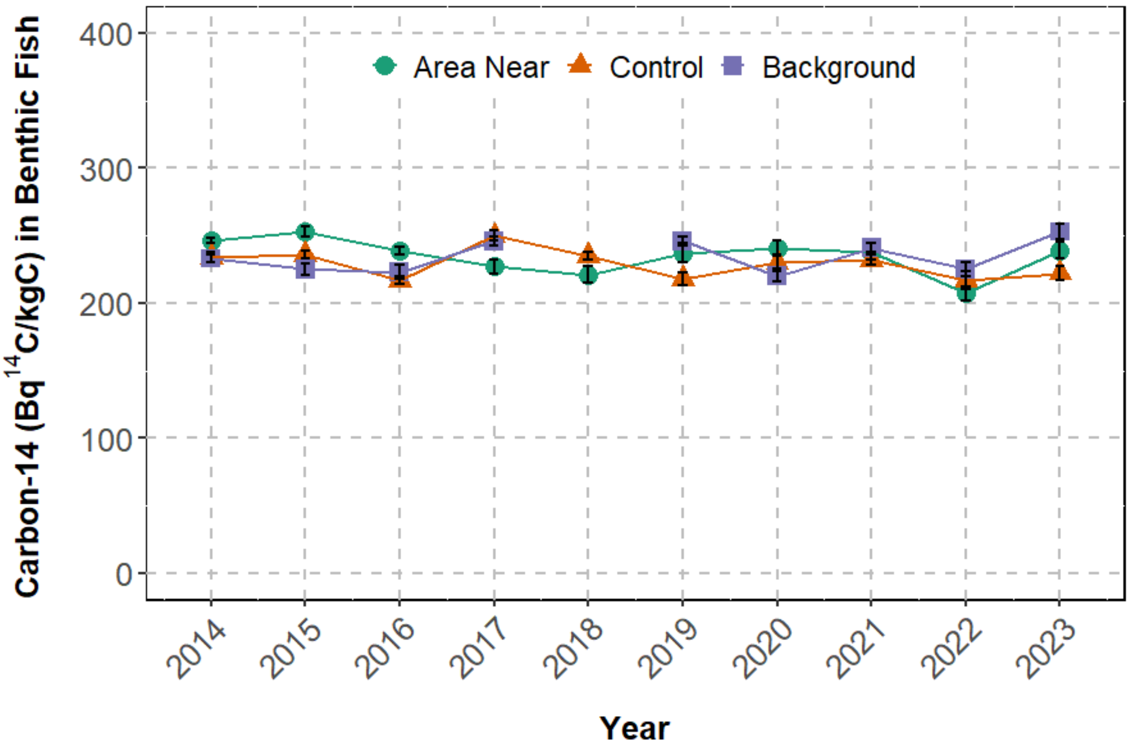


Figure 36 - Annual Average Carbon-14 (becquerels carbon-14 per kilogram carbon) in Benthic Fish Tissue by Year Over Time (± Standard Error)

Cobalt-60 and Cesium-134 in Fish

The cobalt-60 and cesium-134 concentrations in fish samples measured by Bruce Power in 2023 were all less than the critical level or not identified on the gamma scan, indicating that these concentrations are indistinguishable from background and considered negligible. All fish measured by the province had cobalt-60 and cesium-134 concentrations less than the minimum detection limit (<Ld) and annual averages were stated as <Ld.

Cesium-137 in Fish

The 2023 annual average concentration of cesium-137 in benthic fish collected near Bruce Power was 0.2 becquerel per kilogram and the control was 0.3 becquerels per kilogram. The provincial average cesium-137 results for Lake Huron benthic fish were similar to Bruce Power at 0.2 becquerel per kilogram. For pelagic fish, the annual average was 0.3 and 0.6 becquerels per kilogram for area near and control locations respectively, with the Lake Huron provincial background average of 0.3 becquerels per kilogram. These values are well below the Canadian Nuclear Safety Commission reference level of 1040 becquerels per kilogram.

The annual average cesium-137 results for the last ten years for Bruce Power area near, control and provincial background pelagic and benthic fish are shown in Figure 37 and Figure 38, respectively. Generally, the cesium-137 concentrations in fish tissue of pelagic and benthic fish collected in Lake Huron are very low and have remained steady over time.

A general linear model could not be used for benthic fish as the variance was not homogenous. A Kruskal Wallis analysis of variance (α= 0.05) showed no significant difference in the medians for benthic fish by site. A general linear model (α=0.05) was performed for pelagic fish over the last 10 years and identified that there is not a statistically significant change by site over time ($p<0.05$). An analysis of variance (α=0.05) shows that there is not a significant difference in the means between the area near, control or provincial sites.

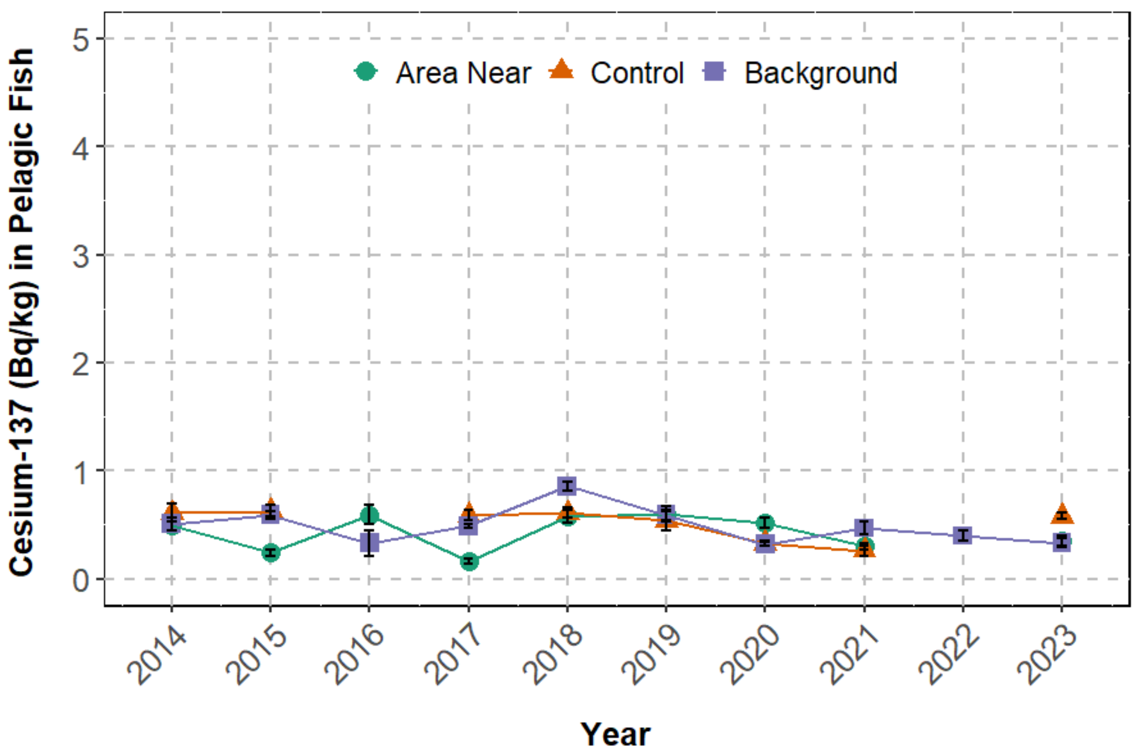


Figure 37 - Annual Average Cesium-137 (becquerels per kilogram) in Pelagic Fish Tissue by Year Over Time (± Standard Error). reference level = 1040 becquerels per kilogram

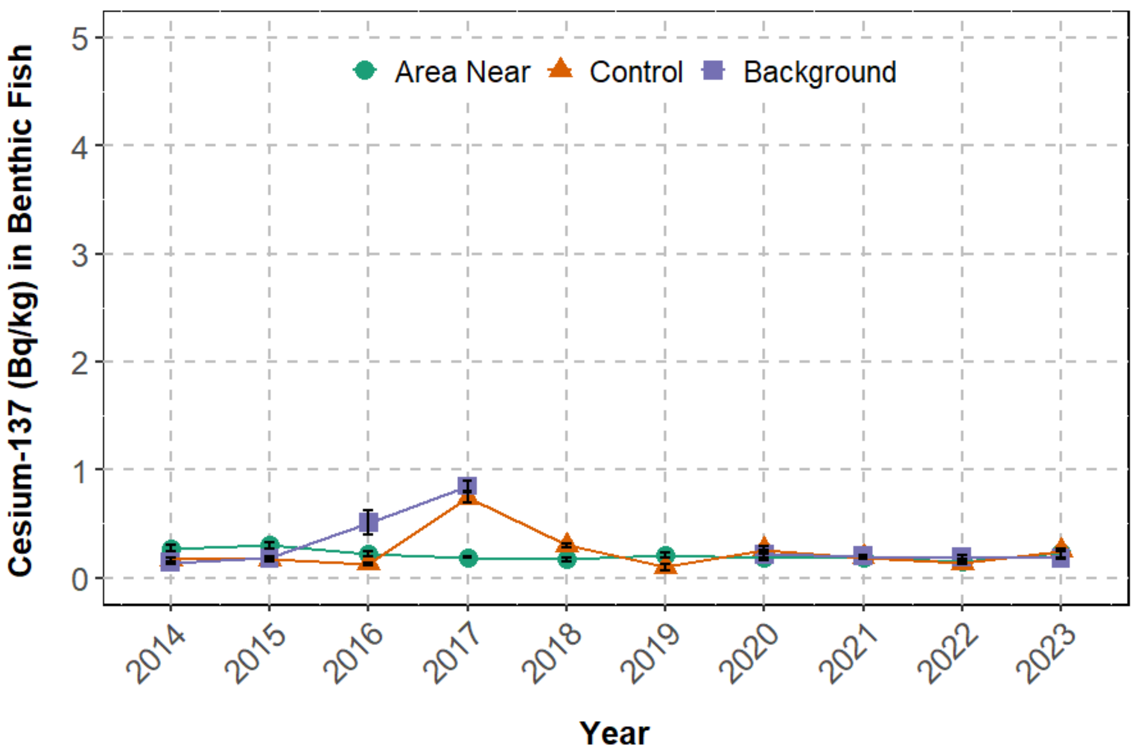


Figure 38 - Annual Average Cesium-137 (becquerels per kilogram) in Benthic Fish Tissue by Year Over Time (± Standard Error). reference level = 1040 becquerels per kilogram

The Canadian Nuclear Safety Commission Independent Environmental Monitoring Program for 2022 measured cesium-137 concentrations in 3 fish samples collected from the Saugeen River in Southampton [R-39] [R-40]. Fish species included Lake Trout and Lake Whitefish. All results were below the detection limit value of 0.8 becquerels per kilogram fresh weight, and well below the guideline/reference level of 1,040 becquerels per kilogram fresh weight.

Organically Bound Tritium in Fish

Tritium is present in two forms within the tissue of plants and animals. These forms include tritiated water present in tissue as free water, and organically bound tritium present in the organic molecules within the tissue. The biological half-life (i.e., the amount of time the radionuclide stays within the body of the plant or animal) is longer for organically bound tritium, and therefore poses a higher exposure risk to the plant or animal. Both free tritium and organically bound tritium are measured in fish samples as part of the Radiological Environmental Monitoring program.

Organically bound tritium is measured on a composite sample of the eight fish samples collected for each type (pelagic and benthic) and location (area near and control) by Bruce Power. The result is based on the arithmetic mean of the activity of the single composite sample counted twice. In 2023, for benthic fish, the area near organically bound tritium results were slightly higher than the control, at 16 and 8 becquerels per litre, respectively. For pelagic fish, the area near and control results were very similar at 6 and 5 becquerels per litre, respectively. These values are very low and near the limits of the analytical method.

In 2023, no organically bound tritium results were available from the provincial environmental monitoring program for either pelagic or benthic fish. Historically, background organically bound tritium results for fish have been higher than the Bruce Power results. The methodology used to prepare fish samples for measurement of organically bound tritium is not standardized, and Bruce Power uses a different methodology than Ontario Power Generation. It was established in 2022 that the provincial results include both exchangeable and non-exchangeable tritium, whereas Bruce Power results include only the non-exchangeable organically bound tritium. Therefore, the annual results cannot be directly compared, and are not included on graphs showing long term trends.

The organically bound tritium results for the past 10 years are presented in Figure 39 for pelagic fish and Figure 40 for benthic fish. The 2017 results for Bruce Power (area near and control) pelagic and benthic fish were not available due to several factors including sample delivery, equipment reliability and QC failure. In 2022 there were no results for pelagic fish as the contractor was not able to secure whitefish for this year. For pelagic fish over time, the trends show that there is little difference between the area near and control fish and that organically bound tritium levels have remained stable over time. The results for benthic fish are similar, but a little more variable from year to year. This demonstrates that fish residing closer to Bruce Power do not have a higher concentration of organically bound tritium compared to fish collected further away.

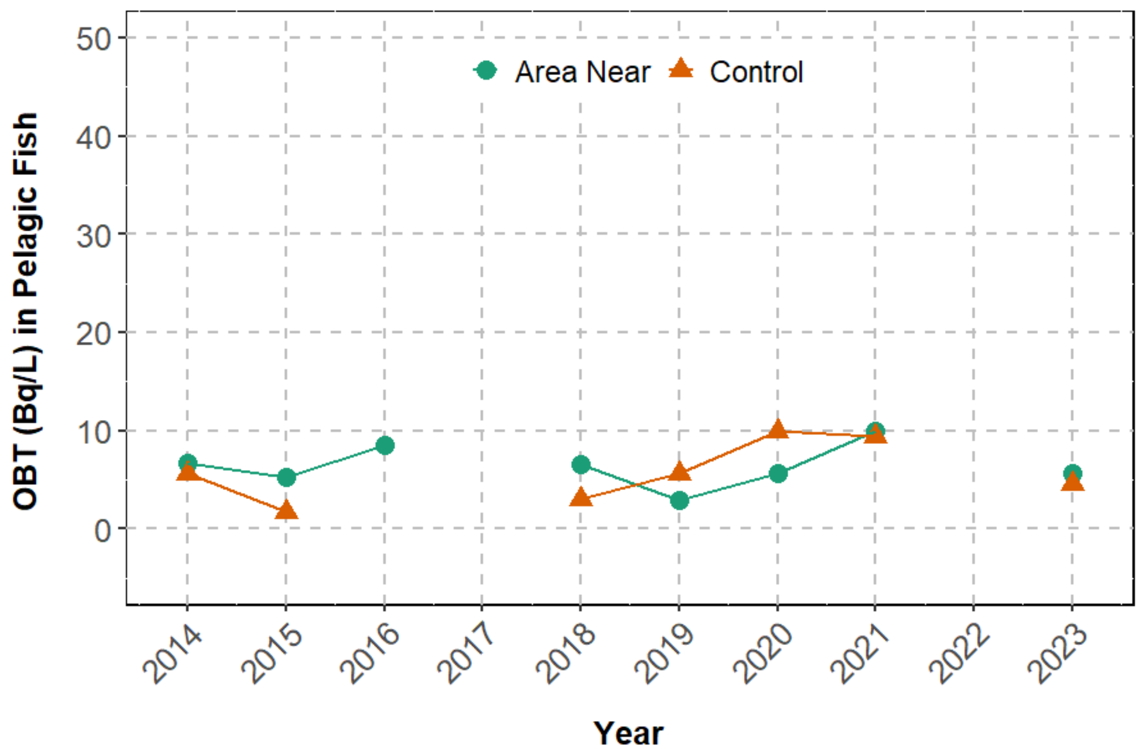


Figure 39 - Organically Bound Tritium (becquerels per litre) for Pelagic Fish Tissue from Area Near and Control Locations

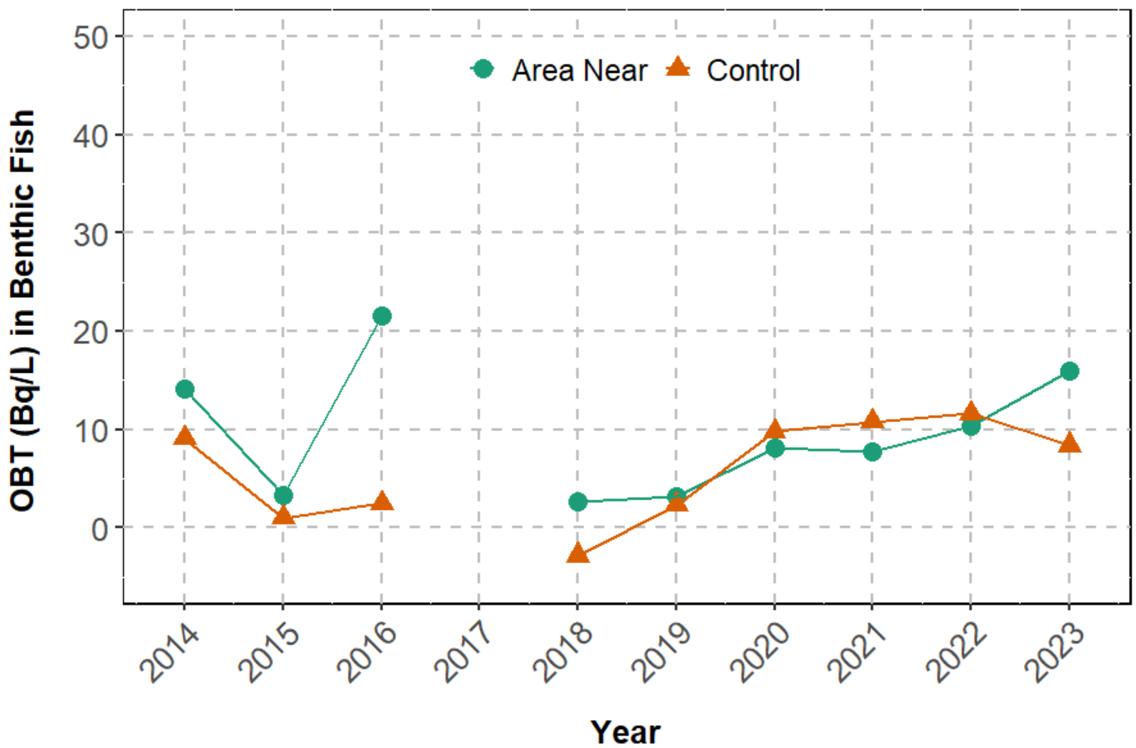


Figure 40 - Organically Bound Tritium (becquerels per litre) for Benthic Fish Tissue from Area Near and Control Locations

The Canadian Nuclear Safety Commission Independent Environmental Monitoring Program for 2022 included fish samples collected from the Saugeen River in Southampton [R-39] [R-40]. . The fish types included Lake Trout and Lake Whitefish. One of the three samples had an organically bound tritium result greater than the detection limit at 2.8 becquerels per kilogram fresh weight, a value well below the guideline/ reference level of 1,040 becquerels per kilogram fresh weight. No health impacts are expected at these low levels.

<u>Fish Monitoring Summary</u>

Bruce Power regularly monitors tritium oxide, organically bound tritium, carbon-14 and CANDU related gamma emitters in samples of pelagic (whitefish) and benthic (suckers) fish collected in the near shore by Bruce Power and farther afield at a control location. Measured radionuclide levels were similar to background samples and all results were well below the Canadian Nuclear Safety Commission reference levels, indicating that there is no risk to members of the public or the environment.

A summary is provided here:

- Samples of whitefish and suckers collected near Bruce Power had levels of tritium oxide, carbon-14 and cesium-137 that were very similar to provincial background values, indicating that fish caught near Bruce Power are not different to those caught elsewhere in Lake Huron.
- Tritium oxide levels in suckers collected near Bruce Power show more interannual variability than whitefish, however the values remain low and were below background levels in 2023.

6.1.4.2 Animal Products

Bruce Power samples animal products including honey, eggs, beef and poultry. Sampling locations are shown in Figure 24. Honey (harvested in area near and area far locations) is collected on an annual basis, while eggs are collected twice each year (spring and fall). Samples of animal meat are collected once per year from local farms, as available. In 2023 samples included beef, chicken, and rabbit meat. New farms were established in 2023 to regularly supply beef and rabbit meat for the program.

On occasion, Bruce Power collects samples from wild animal fatalities that occur on-site (i.e., vehicular collisions) or from donations made by local hunters. In 2023, deer meat was provided by a local hunter, obtained from a location near MacGregor Park.

Animal products are analyzed for tritium oxide and carbon-14 by liquid scintillation counting, and the 2023 results are listed in Table 31. Some samples are also analyzed by gamma spectroscopy and the 2023 results for cobalt-60, cesium-134 and cesium-137 are shown in Table 32. The tritium oxide results are an average of two subsamples, the carbon-14 results are an average of two counts of a single sample, and the gamma results represent a single count of a single sample. As there is only one sample of each type measured, the analytical (uncensored) result is provided.

The province measures for background tritium oxide and carbon-14 concentrations in eggs (3 locations sampled quarterly) and poultry (8 samples) obtained from Picton, Ontario. The sampling location is shown in Figure 21, and the annual average values for 2023 are provided in Table 31. For 2023, no egg samples were available in the fourth quarter. Annual averages are shown in Table 31 and Table 32.

In 2023, honey collected from a hive located near Bruce Power had a higher concentration of tritium oxide compared to the honey sample collected farther afield (81 and 18 becquerels per litre, respectively), which is in line with historical levels. Similarly, the 2023 carbon-14 concentrations at the area near location was marginally higher than the area far location (232 and 220 becquerels carbon-14 per kilogram carbon, respectively) and was similar to previous years. The CANDU radionuclides cobalt-60, cesium-134 and cesium-137 were less than the critical level and indistinguishable from background, which is consistent with historical samples.

The 2023 average tritium oxide result measured in eggs obtained from a farm located near Bruce Power was higher than the provincial background average (33 and 4 becquerels per litre, respectively), although the average carbon-14 result was lower (229 and 240 becquerels carbon-14 per kilogram carbon, respectively). For chicken sampled from the same local farm, the tritium oxide concentration was comparable to the provincial background average (7 and 5 becquerels per litre, respectively), and the carbon-14 concentration was lower (184 and 226 becquerels carbon-14 per kilogram carbon, respectively). Concentrations of tritium oxide and carbon-14 in eggs and chicken were similar to previous years.

In 2023 a local hunter provided deer meat from a deer caught near MacGregor Park. The tritium oxide (53 becquerels per litre) and carbon-14 (196 becquerels carbon-14 per kilogram carbon) concentrations were similar to or lower than what has been measured in previous years (e.g., in 2022, tritium oxide was 53 becquerels per litre; carbon-14 was 248 becquerels carbon-14 per kilogram carbon). As observed historically, the gamma scan results for cobalt-60, cesium-134 and cesium-137 were very close to or below the critical level and considered negligible. Low levels of cesium-137 occur in the environment due to historical weapons testing and other anthropogenic sources separate from Bruce Power.

The 2022 Canadian Nuclear Safety Commission Independent Environmental Monitoring Program included locally sourced ground beef from two locations that were analyzed for tritiated water (tritium oxide) and organically bound tritium [R-39] [R-40]. The tritiated water results were 9.1 and 12.5 becquerels per kilogram fresh weight, which are well below the guideline/reference level of 159,000 becquerels per kilogram fresh weight. The results for organically bound tritium were below the limit of detection (<2.0 becquerels per kilogram fresh weight), and much lower than the guideline/reference level of 69,300 becquerels per kilogram fresh weight.

Table 31 - 2023 Annual Tritium Oxide and Carbon-14 Concentrations in Animal Products

Location Type	Sample Label	Sample Type	Tritium Oxide (becquerels per litre)	Tritium Oxide Uncertainty (± 2σ) (becquerels per litre)	Tritium Oxide Critical Level (Lc) (becquerels per litre)	Carbon-14 (becquerels carbon-14 per kilogram carbon)	Carbon-14 Uncertainty (± 2σ) (becquerels carbon-14 per kilogram carbon)	Carbon-14 Critical Level (Lc) (becquerels carbon-14 per kilogram carbon)
Bruce Power	Near-Deer-AM	Deer	5.27E+01	4.64E+00	3.17E+00	1.96E+02	2.43E+01	1.37E+01
Bruce Power	Near-Beef-AM	Beef	1.41E+01	3.01E+00	2.74E+00	2.22E+02	2.62E+01	1.43E+01
Bruce Power	BF25-AM	Chicken	7.29E+00	2.69E+00	2.74E+00	2.16E+02	2.57E+01	1.41E+01
Bruce Power	BF26-AM	Rabbit	1.11E+01	2.88E+00	2.74E+00	2.28E+02	2.56E+01	1.37E+01
Bruce Power	BF25-EG (spring)	Eggs	5.51E+01	4.74E+00	3.17E+00	2.16E+02	2.50E+01	1.37E+01
Bruce Power	BF25-EG (fall)	Eggs	1.10E+01	2.88E+00	2.76E+00	2.41E+02	2.64E+01	1.40E+01
Bruce Power	Near-BR22-HO	Honey	8.12E+01	5.20E+00	2.76E+00	2.32E+02	2.59E+01	1.38E+01
Bruce Power	Far-BR22-HO	Honey	1.81E+01	3.19E+00	2.76E+00	2.20E+02	2.61E+01	1.43E+01
Background	Picton - Average	Eggs	4.4E+00	-	-	2.4E+02	-	-
Background	Picton - Average	Poultry	4.9E+00	-	-	2.4E+02	-	-

Note:

1. E+00 represents scientific notation, E+03 = x10^3. 2σ is uncertainty in the analytical result.
2. Provincial background: Sample count = 9 for eggs and 8 for poultry (turkey).
3. Provincial background: For calculation of averages where result was less than detection limit (<Ld), the uncensored analytical result was used.

Table 32 - 2023 Annual Gamma Radionuclide Concentrations in Animal Products Near Bruce Power

Location Type	Sample Label	Sample Type	Cobalt-60 (becquerels per kilogram)	Cobalt -60 Uncertainty (± 2σ) (becquerels per kilogram)	Cobalt -60 Critical Level (Lc) (becquerels per kilogram)	Cesium-134 (becquerels per kilogram)	Cesium - 134 Uncertainty (± 2σ) (becquerels per kilogram)	Cesium - 134 Critical Level (Lc) (becquerels per kilogram)	Cesium - 137 (becquerels per kilogram)	Cesium - 137 Uncertainty (± 2σ) (becquerels per kilogram)	Cesium - 137 Critical Level (Lc) (becquerels per kilogram)
Bruce Power	Near-Deer-AM	Deer	<Lc	-	-	<Lc	-	-	1.56E-01	7.10E-02	5.38E-02
Bruce Power	Near-Beef-AM	Beef	<Lc	-	-	<Lc	-	-	<Lc	-	-
Bruce Power	BF25-AM	Chicken	<Lc	-	-	<Lc	-	-	<Lc	-	-
Bruce Power	BF26-AM	Rabbit	<Lc	-	-	<Lc	-	-	<Lc	-	-
Bruce Power	Far-BR22-HO	Honey	<Lc	-	-	<Lc	-	-	<Lc	-	-
Bruce Power	Near-BR22-HO	Honey	<Lc	-	-	<Lc	-	-	<Lc	-	-

Note:

1. E+00 represents scientific notation, E+03 = $x10^3$. Lc is critical level. 2σ is uncertainty in the analytical result.
2. For honey, gamma results in becquerels per litre.
3. When activity value was a negative number or less than the critical level, ‘<Lc’ is stated in the table.

6.1.4.3 Milk

Since 2016 Bruce Power has worked with the Dairy Farmers of Ontario to ensure that milk samples may be collected from local dairy farmers on a weekly basis for use in the Radiological Environmental Monitoring program. One weekly sample from all farm locations are composited together and analyzed for iodine-131 by gamma spectrometry. Samples are analyzed for iodine-131 more frequently than other radionuclides because of its shorter half-life. A second sample is collected from each farm each week and a monthly composite is analyzed for each individual farm for tritium oxide and carbon-14 by liquid scintillation counting. These radionuclides may be present in milk from the ingestion of feed and water and the inhalation of air by dairy cattle. For 2023 there were four farms participating in the Radiological Environmental Monitoring program.

The milk sampling locations for Bruce Power are shown in Figure 24 and the provincial background locations (Belleville and London) are shown in Figure 21. Quarterly samples of milk from the London location were not available after the second quarter of 2023, and therefore no results were available. The 2023 results for tritium oxide, iodine-131 and carbon-14 are shown in Table 33.

Table 33 - 2023 Annual Average Tritium Oxide, Iodine-131, Carbon-14 Concentrations in Milk

Location Type	Sample Location	Tritium Oxide (becquerels per litre)	Iodine-131 (becquerels per litre)	Carbon-14 (becquerels per litre)
Area Near	BDF01-MK	1.02E+01	Not applicable	2.20E+02
Area Near	BDF09-MK	8.41E+00	Not applicable	2.19E+02
Area Near	BDF15-MK	6.00E+00	Not applicable	2.25E+02
Area Near	BDF16-MK	6.02E+00	Not applicable	2.18E+02
Area Near	BDF-MK Composite	Not applicable	2.15E-02	Not applicable
Area Near	**Average**	**7.65E+00**	**2.15E-02**	**2.21E+02**
Background	DF1 Belleville D	<Ld	<Ld	2.3E+02
Background	DF1 Belleville E	<Ld	<Ld	2.3E+02
Background	DF1 Belleville F	<Ld	<Ld	2.3E+02
Background	DF2 London	No sample	No sample	No sample

Note:

1. E+00 represents scientific notation, E+03 = $x10^3$.

2. Bruce Power: For calculation of averages where result was less than critical level (Lc) the uncensored analytical result was used.

3. Provincial background: For calculation of averages where result was less than detection limit (<Ld), the uncensored analytical result was used. '<Ld' stated in table when all values were <Ld.

4. Sample count for Bruce Power is 12, except for I-131 which is 52. For provincial background sample count is 4 for each Belleville location.

For 2023, the average annual tritium oxide concentration in milk at local dairy farms was 8 becquerels per litre. Although this value was higher than the provincial background values (less than the minimum detection limit), this is well below the Ontario Drinking Water Standard for tritium (7000 becquerels per litre) [R-124]. Bruce Power and provincial annual average tritium concentrations in milk for the last eight years are shown in Figure 41. For 2023 there was a slight decrease from the previous year but remains within the range of historical values. A general linear model could not be used for tritium oxide in milk as the variance was not homogenous. A Kruskal Wallis analysis of variance (α=0.05) showed a statistically significant difference in the medians by site (p<0.001). The area near site had a higher median than the provincial location.

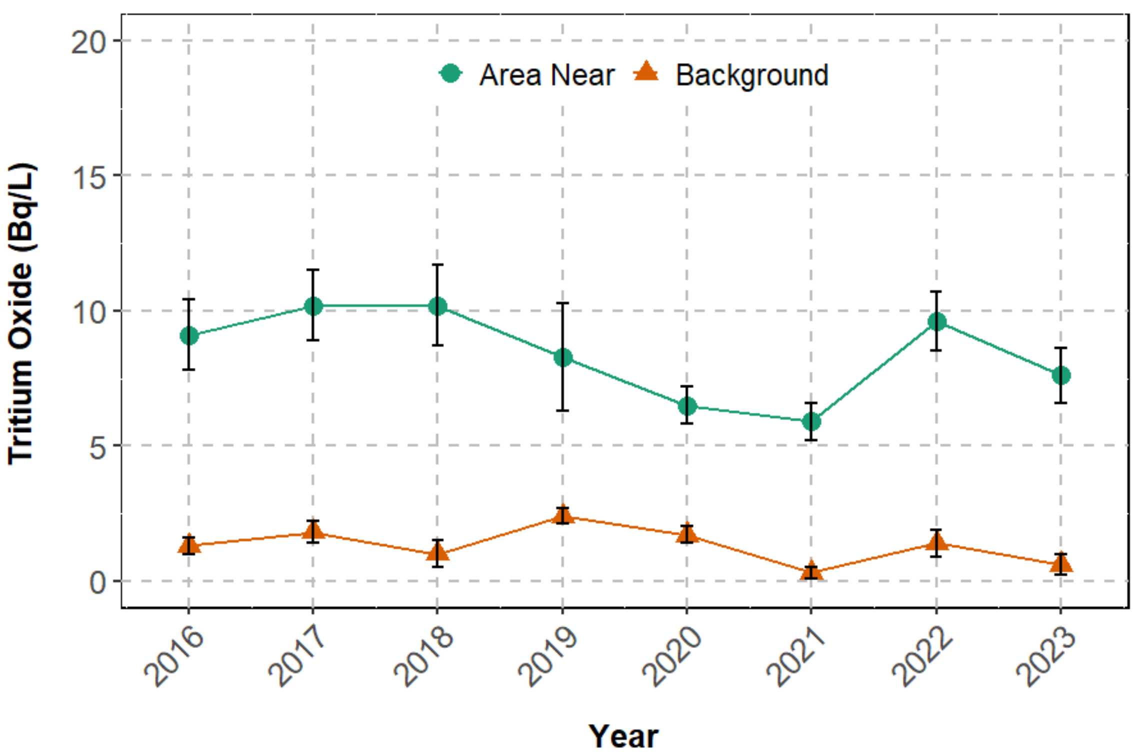


Figure 41 - Annual Average Tritium Oxide Concentration (becquerels per litre) in Milk Samples Collected Near Bruce Power and Provincial Background Locations Over Time (± Standard Error)

The annual average carbon-14 result for area near milk samples was 221 becquerels carbon-14 per kilogram carbon, which was lower than the provincial background average of 233 becquerels carbon-14 per kilogram carbon. There is little variability in carbon-14 in milk at both locations, and the area near and background averages for 2023 were similar to previous years (e.g., for 2022, 219 and 221 becquerels carbon-14 per kilogram carbon for area near and background, respectively). Annual iodine-131 concentrations in milk for both Bruce Power and provincial samples are consistently negligible. For area near milk, all weeks were below or just above the critical level and therefore indistinguishable from background.

For the 2022 Canadian Nuclear Safety Commission Independent Environmental Monitoring Program, milk was collected at a location near Tiverton and analyzed for tritiated water (tritium oxide), iodine-131, cesium-137 and organically bound tritium [R-39] [R-40]. The result for tritiated water was 9.6 becquerels per kilogram fresh weight, which is well below the guideline/reference level of 5,560 becquerels per kilogram fresh weight. For organically bound tritium the result was 5.7 becquerels per kilogram fresh weight, much less than the guideline/reference level of 2,260 becquerels per kilogram fresh weight. The results for iodine-131 and cesium-137 were less than the limit of detection. These results are consistent with what Bruce Power reports and are not expected to have an impact on human health.

6.1.4.4 Agricultural Products

Local farms and residents supply Bruce Power with samples of various grains, fruits and vegetables grown on lands in the vicinity of Bruce Power. Sample locations are shown on Figure 24. These agricultural products are collected annually in specific wind sectors around the Bruce Power site and are analyzed for tritium oxide and carbon-14 by liquid scintillation counting. The commercial alcohol plant at the Bruce Eco-Industrial Park, formerly the Bruce Energy Centre, also provides Bruce Power with samples of corn mash (used for animal feed) for tritium oxide analysis on a quarterly basis.

The annual average tritium oxide and carbon-14 results for agricultural products measured by Bruce Power are provided in Table 34. For 2023, the types of grains collected were corn and soybeans and fruit samples consisted of apples. Bruce Power collects a variety of vegetable types to include above ground, leafy and below ground vegetables. In 2023 the above ground variety included cucumbers and tomatoes, the leafy group included rhubarb, asparagus, bok choy, sorrel and foraged wild plants, and the below ground vegetables were horseradish, potato, parsnips and beets. Where multiple samples within a group (i.e., above ground) were found at the same location, the samples were combined into a composite sample for analysis.

Provincial background samples for fruits and vegetables typically include two sets of composite samples at four locations, however for 2023 there were only two fruit locations and 3 vegetable locations available. For animal feed, sampling consists of semiannual collection at four locations. Sampling locations are provided in Figure 21 and the annual averages are provided in Table 34. The provincial results for animal feed, fruit and vegetables are not equivalent to Bruce Power as the items are different and analysis is done on composites. However, the results may be broadly compared.

Table 34 - 2023 Annual Average Data for Agricultural Products

Location Type	Sample Type	Tritium Oxide (becquerels per litre)	Carbon-14 (becquerels carbon-14 per kilogram carbon)
Area Near	Grains	3.19E+01	2.14E+02
Area Near	Corn Mash	2.43E+01	Not applicable
Area Near	Fruit	8.05E+01	2.30E+02
Area Near	Vegetables - Above Ground	4.40E+01	2.30E+02
Area Near	Vegetables – Leafy	1.90E+01	2.23E+02
Area Near	Vegetables - Below Ground	3.71E+01	2.21E+02
Background	Animal Feed	2.70E+00	2.29E+02
Background	Fruit Composite	2.80E+00	2.25E+02
Background	Vegetable Composite	1.08E+00	2.28E+02

Note:

1. E+00 represents scientific notation, E+03 = $x10^3$.
2. Bruce Power - For calculation of averages where result was less than critical level the uncensored analytical result was used.
3. Provincial background – For calculation of averages where the result was less than the minimum detection level, the uncensored analytical result was used.

Tritium oxide and carbon-14 content in agricultural products may vary each year based on the operational activities (i.e., radiological airborne emissions) that occur during the growing season. The annual average trend of tritium oxide in fruits and vegetables over time are shown in Figure 42 and Figure 43, respectively. Consistently fruit and vegetables near Bruce Power have higher tritium oxide concentrations than at provincial background locations. The 2023 annual average for fruit harvested near Bruce Power decreased in comparison to the previous year (81 versus 108 becquerels per litre in 2022) and was similar to what has been observed in previous years. There was also a decrease in the annual average tritium oxide concentration for vegetables in 2023 compared to the previous year (34 versus 76 becquerels per litre for 2022). Average tritium oxide concentrations in grains follow similar trends to those observed in vegetables, with the 2023 average lower than the previous year. Tritium oxide results in 2022 for fruit, vegetables and grains were impacted by elevated airborne tritium releases at Bruce A (see Section 5.1.2.1). The annual average trend of carbon-14 in fruit and vegetables over time is shown in Figure 44 and Figure 45. Carbon-14 average values in fruit and vegetables remain consistent with historic trends and were very similar to the provincial background values in 2023.

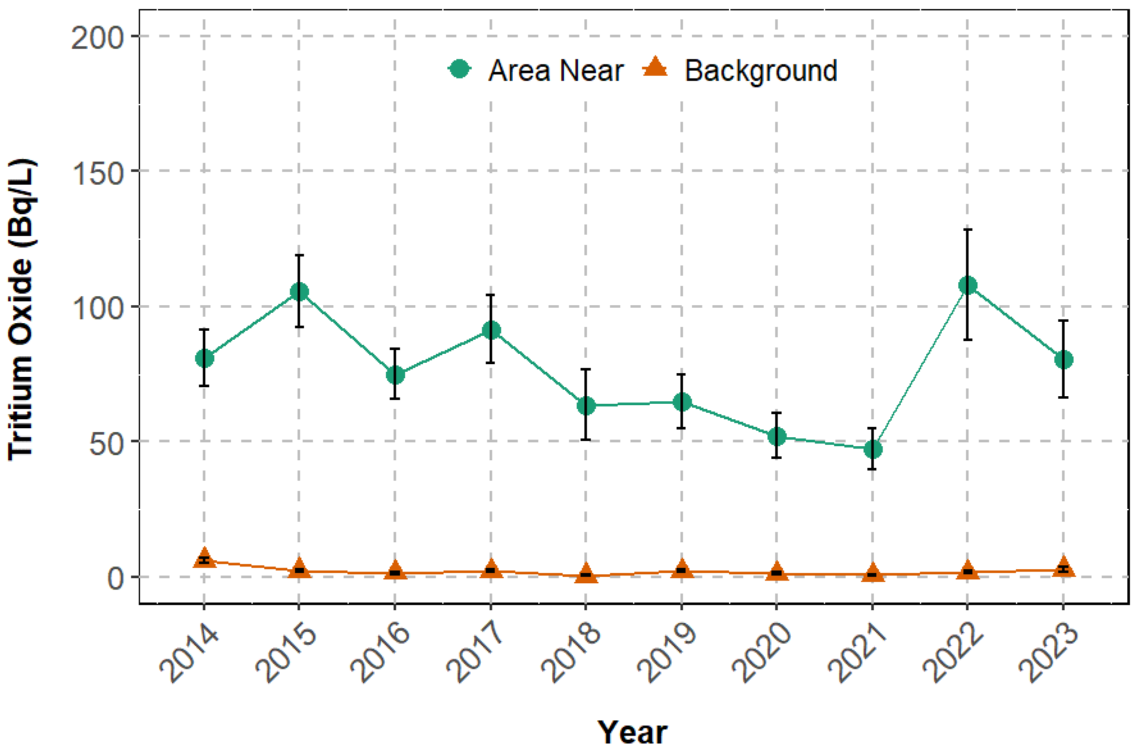


Figure 42 - Annual Average Tritium Oxide (becquerels per litre) in Fruit at Bruce Power and Provincial Background Locations Over Time (± Standard Error)

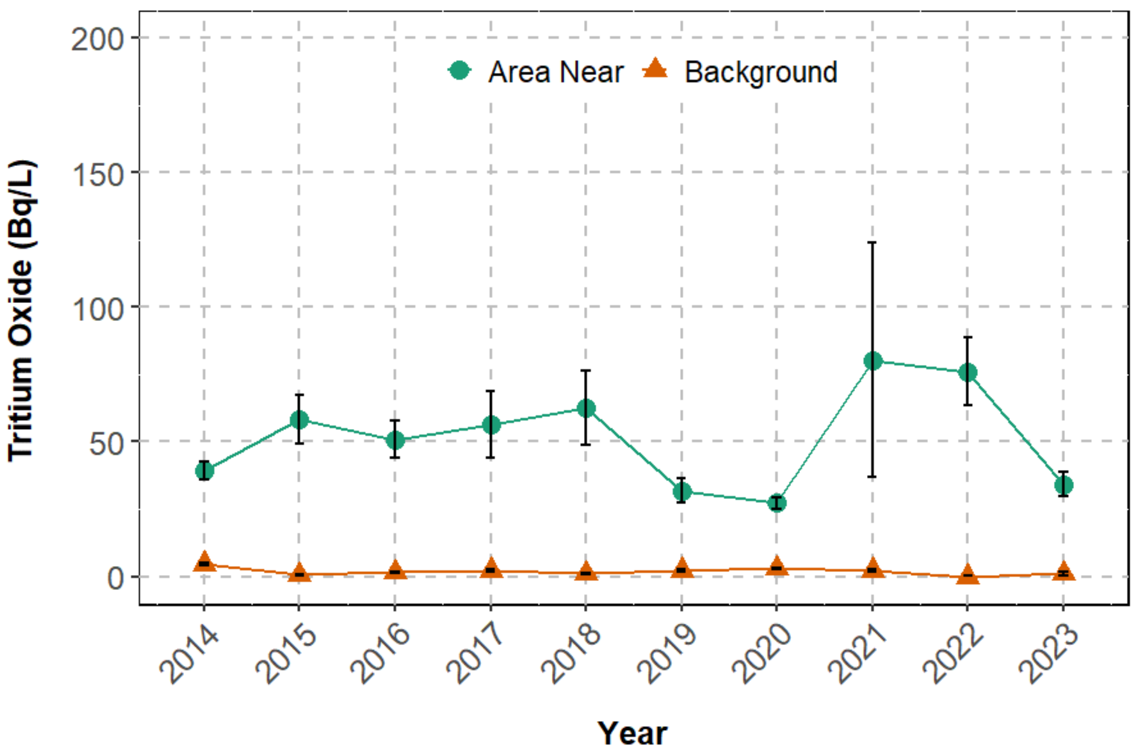


Figure 43 - Annual Average Tritium Oxide (becquerels per litre) in Vegetables at Bruce Power and Provincial Background Locations Over Time (± Standard Error)

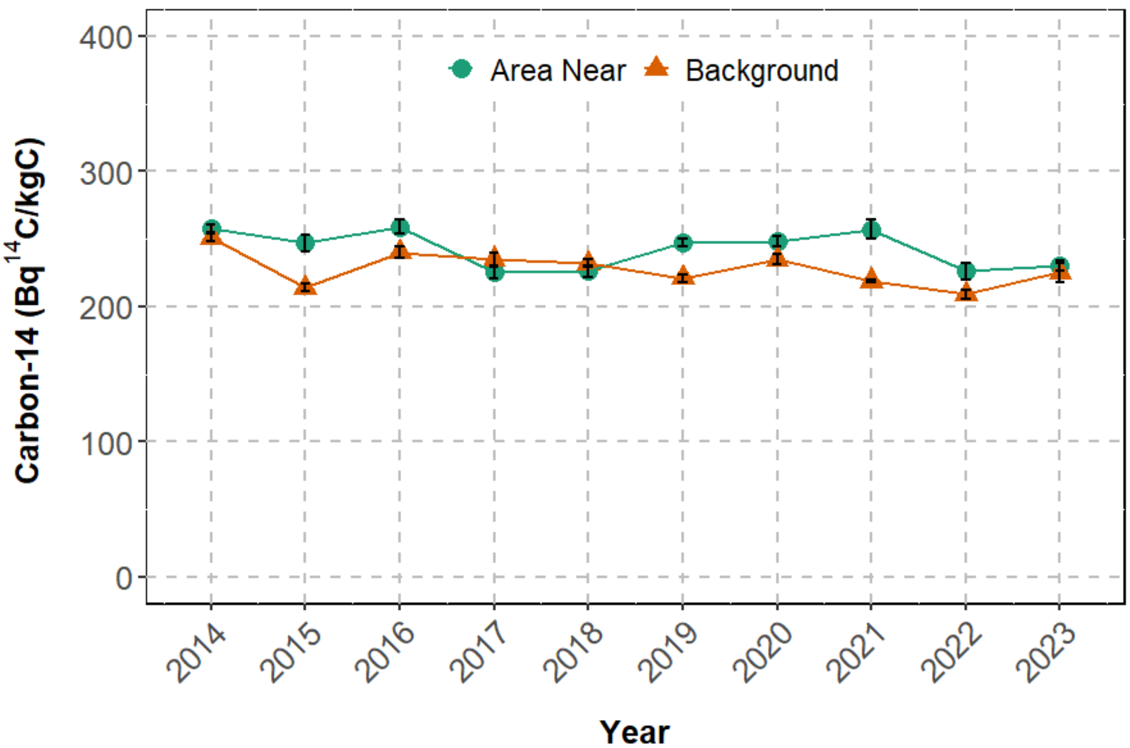


Figure 44 - Annual Average Carbon-14 (becquerels carbon-14 per kilogram carbon) in Fruit at Bruce Power and Provincial Background Locations Over Time (± Standard Error)

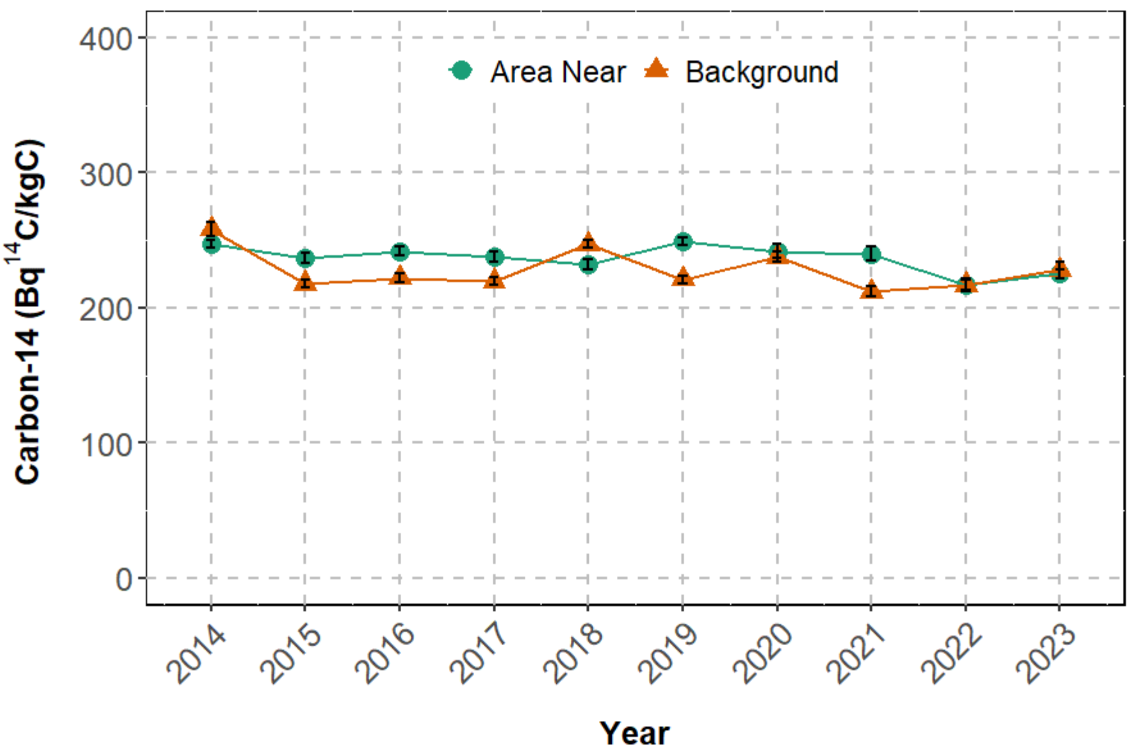


Figure 45 - Annual Average Carbon-14 (becquerels carbon-14 per kilogram carbon) in Vegetables at Bruce Power and Provincial Background Locations Over Time (± Standard Error)

As part of the 2022 Canadian Nuclear Safety Commission Independent Environmental Monitoring Program a variety of agricultural products were sampled including fruits, vegetables and vegetation [R-39] [R-40]. A fruit sample was collected at Saugeen Shores (strawberries) and was analyzed for cesium-137, tritiated water (tritium oxide) and organically bound tritium. The results for cesium-137 and organically bound tritium were below the limits of detection, and the tritiated water result was 14.7 becquerels per kilogram fresh weight, which is well below the guideline/reference level of 123,000 becquerels per kilogram fresh weight.

Samples of above ground (kale) and below ground (carrot) vegetables grown in Saugeen Shores were analyzed for tritiated water (tritium oxide) and organically bound tritium. The results for tritiated water ranged from 5.1 to 18.8 becquerels per kilogram fresh weight and were well below the guideline/reference levels of 104,000 (for kale) or 279,000 (for carrots) becquerels per kilogram fresh weight. The organically bound tritium results were less than detection for carrots and 11.3 becquerels per kilogram for kale and were also below the guideline/reference level (45,200 or 121,000 becquerels per kilogram for kale and carrots, respectively). These results indicate that the tritium levels in fruits and vegetables sampled near Bruce Power are very low.

Locations where vegetation was collected included Baie du Doré, Inverhuron, Kincardine, Southampton and Neyaashiinigmiing (also known as Cape Croker). Samples included plantain, Eastern white cedar, cat tails (roots and leaves), milkweed, creeping juniper and Balsam fir and were analyzed for cesium-137. All results, for all sample types and locations, had cesium-137 values that were less than the limit of detection (<1.8 becquerel per kilogram fresh weight).

6.1.4.5 Agricultural and Animal Products Summary

Bruce Power regularly monitors tritium oxide, carbon-14 and gamma emitters in fish, animal meat, honey, eggs, milk, fruit and vegetables, grains, and animal feed at a variety of locations near Bruce Power. All results in 2023 were within historical levels and where applicable were well below the Canadian Nuclear Safety Commission reference levels, indicating that there is no impact to members of the public from ingesting foods grown locally to Bruce Power.

A summary is provided here:

- Tritium oxide levels in benthic and pelagic fish were below background values in 2023. Other radionuclide concentrations, including carbon-14, cesium-137 and organically bound tritium, were very similar to background levels. No human health impacts are expected from these low levels.

- Levels of tritium oxide in milk are typically just above background concentrations. The annual average decreased in 2023 compared to the previous year. As observed in other years, all other radionuclides measured in milk (i.e., carbon-14, iodine-131) were indistinguishable from background.

- Concentrations of tritium oxide are slightly higher in fruits and vegetables grown near Bruce Power compared to provincial background locations, varying with operational activities that occur during harvest time. Regardless of the small fluctuations from year to year, the values are small and the dose to public remains negligible. Annual averages in 2023 were lower than the previous year.

6.1.5 Beach Sand, Soil and Sediment Monitoring

Samples of garden soil and sediment are collected once every five years, while beach sand is collected annually. This is aligned with the sampling frequency carried out by the province. Samples are dried, sieved and analyzed for gamma-emitting radionuclides using gamma spectroscopy. The results are used in the annual dose to public calculation and inform the Environmental Monitoring and Environmental Risk Assessment programs to ensure that Bruce Power is appropriately monitoring and understanding its impact on the environment.

Sampling locations in the vicinity of Bruce Power and further afield along the shore of Lake Huron are shown in Figure 22, Figure 23 and Figure 24. Off-site samples of sediment and garden soil were last collected in 2019, as were the on-site soil samples for the Environmental Risk Assessment [R-125]. In 2023, samples of Lake Huron beach sand were collected.

6.1.5.1 Beach Sand

Beach sand was collected in 2023 at Baie du Doré, Inverhuron (duplicate samples) and Scott Point. The annual average results for CANDU related radionuclides cobalt-60, cesium-134 and cesium-137 are shown in Table 35, along with the provincial background results. The provincial radiological environmental monitoring program collects 8 beach sand samples from Cobourg and 2 samples from Goderich.

Table 35 - 2023 Annual Average Beach Sand Data

Location Type	Location	Cobalt-60 (becquerels per kilogram)	Cesium-134 (becquerels per kilogram)	Cesium-137 (becquerels per kilogram)
Bruce Power	Area Near	<Lc	<Lc	9.16E-01
Background	Cobourg	<Ld	2.0E-01	2.9E-01
Background	Goderich	<Ld	1.9E-01	<Ld

Note:

1. E+00 represents scientific notation, E+03 = $x10^3$.

2. Bruce Power - For calculation of averages where result was less than critical level (Lc) the uncensored analytical result was used. '<Lc' stated in table when the average was negative.

3. Provincial background – For calculation of averages where the result was less than the minimum detection level (Ld), the minimum detection level was used. '<Ld' stated in table when all values were less than the detection level.

As in other years, the annual average cobalt-60 and cesium-134 values in beach sand at the area near location was less than the critical level and indistinguishable from background. The area near average for cesium-137 is consistently very low. Although it was slightly higher than the provincial background averages for Cobourg and Goderich, it was well below the Canadian Nuclear Safety Commission reference level for soil (58.6 becquerels per kilogram dry weight) or sediment (37,300 becquerels per kilogram dry weight). Low levels of cesium-137 occur in the environment due to historical weapons testing and other anthropogenic sources separate from Bruce Power. As observed in previous years, cesium-137 levels are marginally higher to the north at Scott Point and Baie du Doré, which is consistent with the predominant lake current direction moving in the northerly direction and the position of the point in relation to the sill at the mouth of Baie du Doré.

The Canadian Nuclear Safety Commission Independent Environmental Monitoring Program included both soil and sediment samples in 2022 that were analyzed for cesium-137 [R-39] [R-40]. Soil was sampled at 3 locations, including Neyaashiinigmiing, Chippawa Hill and Tiverton, and the results were in the range of 2.5 to 13.5 becquerels per kilogram dry weight. These values were well below the guideline/reference level of 58.6 becquerels per kilogram dry weight. Sediment samples were collected from Baie du Doré and the Kincardine beach and the results ranged from 0.6 to 1.2 becquerels per kilogram dry weight, which are much lower than the guideline/reference level of 37,300 becquerels per kilogram dry weight. The cesium-137 levels in soil and sediment are consistent with what is reported by Bruce Power and are not expected to have any impact on human health.

6.1.5.2 Sediment

Samples of sediment are typically collected on a five-year frequency. The off-site monitoring locations were last sampled in 2019 and will be sampled again in 2024. The on-site waterbodies were last sampled in 2021. No sediment samples were collected in 2023.

6.1.5.3 Garden Soil

Samples of garden soil from local resident locations are collected on a five-year frequency. Garden soil was last sampled in 2019 and is planned for 2024. No garden soil samples were collected in 2023.

6.1.6 Radiological Environmental Monitoring Program Summary

The main objectives of the Radiological Environmental Monitoring program, which are listed in Section 6.0, are to (i) obtain concentrations of radioactivity in environmental media each year, (ii) calculate radiation exposure doses to representative persons and demonstrate they are below the legal limit, and (iii) check the effectiveness of emission and effluent controls in place and provide public assurance of the efficacy of these measures. The Radiological Environmental Monitoring data collected in 2023 is provided in Section 6.1 and the dose calculated from this information is described and compared to the legal dose limit in Section 3.0. The results demonstrate that radionuclide concentrations in the environment remain very low and that the emissions and effluent controls in place are effective and adequate. For 2023, the environmental monitoring results obtained were effective in meeting the Radiological Environmental Monitoring program objectives.

Following the 2022 Environmental Risk Assessment, the Radiological Environmental Monitoring program was reviewed in 2023. This process was used to evaluate the data collected, to reassess environmental risks and to determine whether the objectives of the program have been achieved. In addition, the need for and adequacy of the Radiological Environmental Monitoring program was reviewed. Through this process it was determined that the program objectives were met by the current design, that environmental risks were found to be negligible, and that there were no changes in requirements to measure radionuclides in the environment. In conclusion, the design of Radiological Environmental Monitoring was confirmed to be adequate, and no changes were required.

6.1.7 Quality Assurance/Quality Control

6.1.7.1 Meteorological Data Analysis

The meteorological data analysis was conducted in accordance with the Kinectrics Quality Assurance program [R-126]. The Kinectrics Quality Assurance program is registered to the 2015 International Organization for Standardization 9001 standard and the scope of the registration covers "consulting, scientific and engineering services to nuclear and other industries to support siting, safety, licensing, design and operations by providing specialized: asset management, project management, procurement, software, environmental, integrated analytical and engineering solutions and services". The Kinectrics Quality Assurance program is regularly audited by organizations such as CANDU Procurement Audit Committee (CANPAC) and has consistently been assessed as compliant with requirements of Canadian Standards Association N299.1-16 [R-127] and Canadian Standards Association N286-12 [R-23].

6.1.7.2 Public Dose Calculations

The Public Dose calculations for 2023 were conducted in accordance with the Calian Engineering and Technical Services Quality Assurance program. Calian has implemented and maintains a Quality Management System that is certified to the International Organization for Standardization 9001:2015 Standard [R-128].

The 2023 public dose calculations were conducted using the IMPACT 5.5.2 software. All inputs to the IMPACT model were verified based on Bruce Power environmental and emissions and effluents data. A verification tool was utilized to ensure that all numerical entries to the IMPACT model were inputted correctly, and the results of this IMPACT model verification were recorded. The results of the IMPACT calculation were independently verified.

The development of IMPACT 5.5.2 has been guided by, and subject to, an overall Tool Qualification program, which follows the Canadian Standards Association N286.7-99 guidelines for quality assurance in software development for nuclear power plants [R-129].

6.1.7.3 Provincial Background – Ontario Power Generation Whitby Laboratory

The Ontario Power Generation Whitby Laboratory performed the thermoluminescent dosimeter gamma analyses and the provincial sample analyses. Details regarding the Ontario Power Generation Quality Assurance and Quality Control program are described in the Ontario Power Generation report *2023 Results of Environmental Monitoring Programs for Darlington and Pickering Nuclear* [R-130].

6.1.7.4 Bruce Power Health Physics lab

The Bruce Power Health Physics Lab operates a comprehensive Quality Assurance program, which includes quality control samples, blank/background samples, process control samples, and externally generated proficiency testing samples.

Sample Availability

The Bruce Power Health Physics Lab collected 955 environmental samples in 2023 against a target of 979 for an overall sample availability of 98%. This meets the sampling criteria of greater than 90% for the Radiological Environmental Monitoring Program. Typically, sample unavailability is due to seasonal conditions (such as variations in agricultural yields or frozen streams/ponds) or due to the nature of seasonal residences closed for certain months of the year, making some samples such as wells, unavailable for sampling. Details of the sample availability for 2023 are presented in Table 36 below.

Table 36 – 2023 Sample Availability Data

Sample Types	Collection Frequency	Planned	Actual	% Complete
Air Emissions	Monthly (tritium)	120	119	99%
Air Emissions	Quarterly (carbon-14)	172	172	100%
Environmental Gamma	Quarterly (gamma)	44	44	100%
Precipitation	Monthly (tritium, beta)	120	120	100%
Water Supply Plants	Weekly Composite (tritium)	96	96	100%
Water Supply Plants	Monthly Composite (beta)	24	24	100%
Resident Well & Lake Water	Bi-Monthly (tritium, beta)	66	55	83%
Resident Well & Lake Water	Semi-Annually (tritium, beta, gamma)	32	31	97%
Local Streams	Bi-Monthly (tritium)	36	35	97%
Local Streams	Semi-Annually (beta)	8	8	100%
Site Ground Water	Semi-Annually (tritium)	80	75	94%
Fish	Annually (tritium, carbon-14, gamma, organically bound tritium)	32	32	100%
Milk	Weekly Composite (gamma)	52	52	100%
Milk	Monthly Composite (tritium, carbon-14)	48	48	100%
Fruits & Vegetables	Annually (tritium, carbon-14)	27	21	78%
Honey	Annually (tritium, carbon-14, gamma)	2	2	100%
Eggs	Annually (tritium, carbon-14)	2	2	100%

Sample Types	Collection Frequency	Planned	Actual	% Complete
Grains	Annually (tritium, carbon-14)	6	7	117%
Grains	Quarterly (tritium)	4	4	100%
Animal Meat	Annually (tritium, carbon-14, gamma)	4	4	100%
Soil & Sand	Annually (gamma)	4	4	100%
Overall Site Sample Availability		979	956	98%

Note: Samples may have been unavailable because of seasonal conditions (e.g., freezing of water samples and seasonal residences that are closed for certain months of the year).

Laboratory Analysis Summary

A total of 1250 laboratory analyses were conducted in support of the Bruce Power Radiological Environmental Monitoring Program in 2023, with a completion rate of 97%. This meets the analysis criteria of greater than 90%. The analyses included tritium, gross beta, carbon-14, iodine-131, thermoluminescent dosimeter gamma (under contract to Ontario Power Generation), gamma spectrometry and organically bound tritium. Table 37 provides a summary of the number of samples analyzed for each analysis method.

Table 37 - 2023 Laboratory Analysis Summery

Laboratory Analysis	Planned	Actual	% Complete
Tritium oxide	665	631	95%
Gross Beta	184	179	97%
Carbon-14	293	288	98%
Iodine-131	52	52	100%
Thermoluminescent Dosimeter Gamma	44	44	100%
Gamma Spectrometry	52	52	100%
Organically Bound Tritium	4	4	100%
Total	1294	1250	97%

Note: Thermoluminescent dosimeter gamma analysis was completed by Ontario Power Generation, Whitby.

Laboratory Quality Assurance and Quality Control

The purpose of inter-laboratory proficiency testing is to provide independent assurance to Bruce Power, the Canadian Nuclear Safety Commission, and external stakeholders that the laboratory's analytical performance is adequate, and the accuracy of the measurements meets required standards. Table 38 presents a summary of the Bruce Power Radiological Environmental Monitoring Quality Assurance and Quality Control Program.

Table 38 - Summary of the Quality Assurance and Quality Control Program

Analyses	**Tritium**	**Tritium**	**Tritium**	**Gross Beta**	**Carbon-14**	**Gamma Spec**	**Gamma Spec**	**Gamma Spec**
Medium	**Organically bound**	**Water**	**Air**	**Water**	**Produce**	**Water**	**Sediment**	**Soil**
Historical	X	X	X	X	X		X	X
Relative	X	X	X		X		X	X
Proficiency Testing	-	Eckert & Ziegler Analytics	-	Eckert & Ziegler Analytics	-	Eckert & Ziegler Analytics	Eckert & Ziegler Analytics	Eckert & Ziegler Analytics
Bias	QC Sample	QC Sample	QC Sample	QC Sample (^{137}Cs)	QC Sample (Sawdust)	Mixed Gamma QC Sample	Mixed Gamma QC Sample	Mixed Gamma QC Sample
Precision	QC Sample	QC Sample	QC Sample	QC Sample (^{137}Cs)	QC Sample (Sawdust)	Mixed Gamma QC Sample	Mixed Gamma QC Sample	Mixed Gamma QC Sample
Background	Low Tritium Water	Low Tritium Water	Low Tritium Water	Blank	Limestone	Blank	Blank	Blank
Process Controls	Contamination	Contamination	Contamination	Contamination (de-min water)	Contamination (Coal)	-	-	-

Laboratory Quality Control

Various quality control samples are utilized to estimate the precision and accuracy of analytical results and to indicate errors introduced by laboratory practices. There are two types of quality control samples used to accompany the analyses of the environmental samples collected for the Radiological Environmental Monitoring Program: process control samples and quality control samples.

1. Process Control Samples

Process Control samples are low analyte samples that are treated as actual samples and go through the same handling process. These are intended to detect contamination and specific sources of error. The following main process control samples are used for Radiological Environmental Monitoring samples:

- Low tritium reference water samples kept open to the air during sample handling to detect contamination from tritium in ambient air
- Coal (low carbon-14) samples to detect anomalies with carbon-14 analyses
- Demineralized water samples run as low gross beta samples to detect contamination
- Blank thermoluminescent dosimeters to detect radiation exposure during shipping to and from the Ontario Power Generation Whitby laboratory

2. Quality Control Samples

Quality control samples are samples which contain known values of the analyte (usually derived from traceable standards), which are included for analysis. Statistically based quality control charts are used to evaluate validity of environmental sample results; results are considered valid when the values for the accompanying quality control samples are within ± 3 standard deviations of the known or expected value for the respective control chart.

Proficiency Testing and Inter-laboratory Comparisons

The main purpose of inter-laboratory comparison programs is to provide independent assurance to Bruce Power, the Canadian Nuclear Safety Commission, and external stakeholders that the laboratory's analytical proficiency is adequate, and the accuracy of the measurements meets required standards. The comparison program forms a crucial part of the overall laboratory Quality Assurance program and demonstrates that the laboratory is performing within acceptable limits as measured against external unbiased standards.

The proficiency testing service is operated by Eckert & Ziegler Analytics Inc. of Atlanta, Georgia. On a quarterly basis Eckert & Ziegler Analytics provides samples containing known quantities of radionuclides to the Bruce Power Health Physics Laboratory. The samples are environmental matrices which are analogous to the samples collected for the Radiological Environmental Monitoring Program.

These samples include:

- Tritium in water
- Beta emitters in water
- Iodine in milk
- Gamma emitters in water
- Gamma emitters in soil
- Iodine-131 in iodine cartridge (annually)
- Gamma emitters on particulate filter (annually)

Upon completion of analysis, the Bruce Power analytical values are submitted to Eckert & Ziegler Analytics, which subsequently provides a final report for Bruce Power, detailing the expected values and the ratio of the laboratory value to the expected value.

All results obtained from Eckert & Ziegler Analytics shall meet the following self-imposed pass/fail investigation criteria:

$$\frac{(V_L + 1\sigma_L)}{V_A} \geq 0.75 \text{ AND } \frac{(V_L - 1\sigma_L)}{V_A} \leq 1.2$$

Where:

V_L = Bruce Power HPL value
σ_L = Bruce Power HPL one sigma uncertainty value
V_A = Analytics Supplier value

The results for the proficiency testing are presented in APPENDIX D. All results for 2023 met the acceptance criteria and were acceptable.

6.1.8 Updates to Radiological Environmental Monitoring

The following changes were made to Radiological Environmental Monitoring in 2023:

- A new farm location was established in the SSE wind sector that may supply samples of rabbit meat, garden vegetables and garden soil to the program.
- A new farm location was established to supply near-field beef samples on a regular basis.

Planning began in 2023 for the upgrade of environmental monitoring sheds that house tritium in air monitoring equipment at various locations off-site. To allow for ease of access and improve safety for the Health Physics Technicians, there is potential for four sheds at locations within neighboring towns to be moved to new locations within the town boundaries. The shed upgrades are expected to occur in 2024 to 2025.

6.2 Conventional Environmental Monitoring

The Canadian Standards Association standard N288.4, Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills outlines the following objectives for environmental monitoring programs [R-131]:

- measure the concentration of hazardous substances and physical stressors in the environment to allow for the assessment of potential biological effects from stressors arising from the facility;
- demonstrate compliance with limits on hazardous substances and physical stressors in the environment; and
- verify that the facility has effective containment and effluent control measures in place.

The Bruce Power Conventional Environmental Monitoring program monitors for conventional contaminants, physical stressors, potential biological effects, and pathways for both human and non-human biota. Non-radiological chemical stressors from historic and current operations are monitored (with future effects predicted using models as needed) in local surface waters, sediments, soil, and/or air using an activity-centered, risk-based approach. Effects on wildlife from physical stressors are documented using numerous Biological Effects Monitoring approaches.

Chemical stressors that have the *potential* for environmental impact are referred as Chemicals of Potential Concern. Chemicals of Potential Concern are routinely monitored at Bruce Power, and they are chosen based on known controlled releases from the facility. Controlled effluents and emissions are regulated and are described in Bruce Power's Conventional Effluents and Emissions Monitoring program (see Section 5.2). A second pathway to the environment is through an uncontrolled release (i.e., spill). If a spill was to occur and a contaminant reached the environment, the location and frequency of Chemicals of Potential Concern monitoring may change on a case-by-case basis, as dictated by remediation activities and/or follow-up monitoring.

Routine monitoring for conventional Chemicals of Potential Concern occurs in surface waters (annually) and sediments (every 5 years) because they have the highest probability of impact from facility operations such as station effluents, storm water discharges, and Centre of Site operations (e.g., sewage treatment and discharges). Soil has a low probability of being impacted by chemical stressors at Bruce Power, primarily because Chemicals of Potential Concern are not discharged directly to soil under normal operations. This has been repeatedly demonstrated in past Environmental Risk Assessments [R-4]. Sediments and soils were sampled in 2021 to inform an updated Environmental Risk Assessment. For a detailed assessment of risk to potential receptors please refer to the 2022 Environmental Risk Assessment [R-4].

The impact of air emissions on the surrounding environment is assessed annually in the Conventional Environmental Monitoring Program and in recurring Environmental Risk Assessments which have demonstrated that these impacts are very low [R-4]. The transport of Chemicals of Potential Concern through the air to surface water (and potentially sediment, soil or groundwater) occurs via deposition, runoff and percolation processes. Transport through air is short-lived and thus there is minimal interaction between Chemicals of Potential Concern and potential receptors.

6.2.1 Routine Lake Water Quality and Stream Water Quality Assessment

6.2.1.1 Lake Water Quality

Lake Huron surface water quality samples were taken from 1 metre below the lake surface at three long-term monitoring locations in the Bruce A and Bruce B discharges (LWQ1 and LWQ2, respectively) and Baie du Doré (LWQ5) on December 19, 2023 (Figure 46). These locations are representative of near field conditions and wildlife habitat. Samples were not collected from reference areas in Inverhuron Bay (LWQ8) and MacGregor Point (LWQ7) due to difficulties in chartering a boat for these locations. Bruce A and Bruce B discharges were sampled to sufficiently characterize the effluent from facility operations. Baie du Doré was sampled as it is a wildlife habitat area. The results of these water quality analyses are presented in APPENDIX E Table 88 alongside the historical trend observed between 2019 and 2023 (Table 89). These data continue to show that Bruce Power has effective containment and effluent control measures in place, and that facility operations have little-to-no effect on the water quality in Lake Huron [R-4].

Sample results are compared to several criteria including:

- Provincial Water Quality Objectives as established by the Ontario Ministry of Environment, Conservation and Parks [R-132];
- The Canadian Council of Ministers of the Environment freshwater, long-term water quality guidelines for the protection of aquatic life [R-133];
- Ontario Drinking Water Standards as listed in *Ontario Regulation 169/03* [R-77];
- Health Canada Guidelines for Canadian Drinking Water Quality [R-134]; and
- Site-specific target levels, as developed in the 2022 Environmental Risk Assessment (Table 7) [R-4].

All lake water quality parameters in 2023 were below the screening criteria, except for pH, unionized ammonia, phosphorous, phenolics, aluminum and iron in some locations.

Samples from all three locations had a pH greater than the screening criteria set by the Ministry of the Environment, Conservation and Parks (6.5 to 8.5), with the highest result of 9.4 at the Bruce A Discharge LWQ1, however the sample from Baie du Doré (LWQ5) fell within the Canadian Council of Ministers of the Environment acceptable pH range for freshwater, which is between 6.5 and 9.0 [R-135], with a result of 8.7. This range is considered to be protective of fish and benthic invertebrate toxicity [R-136].

For unionized ammonia and phosphorous, it is not unusual to see elevated levels. Ammonia inputs into Lake Huron from sewage, agriculture and/or nearby industry have been shown to impact water quality, as documented in nearby Provincial Water Quality Monitoring Network monitoring sites and off-site samples collected from within Stream C (upstream) [R-4]. Studies along the Lake Huron shoreline have identified that agricultural land uses are a significant source of phosphorous to Lake Huron [R-137]. The Ontario Provincial Water Quality Monitoring Network (https://data.ontario.ca/dataset/provincial-stream-water-quality-monitoring-network) has active monitoring stations near Bruce Power to the north (Mill Creek) and south (Pine River). Data from these stations demonstrates that these local rivers are impacted by agriculture as phosphorus concentrations are almost always above the preliminary benchmark concentration of 20 micrograms per litre. Phosphorus inputs to Lake Huron from across the lake fringe watersheds can reasonably account for the elevated phosphorus concentrations observed in surface water samples collected within Lake Huron in 2023. Although Bruce Power contributes to these Chemicals of Potential Concern, all releases in 2023 were within environmental compliance approval limits.

Prior to 2022, phenolics were not routinely analyzed in Lake Huron water quality samples because they were not part of the analysis package offered by the external laboratory. In 2022 this parameter was added to the analysis package and in 2023 all three samples collected showed elevated levels of phenolics. This Chemical of Potential Concern occurs naturally in aquatic environments due to the decomposition of aquatic vegetation or can originate from industrial effluent, domestic sewage or pesticides [R-135]. Given the prevalence of phosphorous in Lake Huron from agricultural sources, it is possible that a similar situation may exist for phenolics.

Samples collected at the Bruce A discharge (LWQ1), Bruce B discharge (LWQ2) and Baie du Doré (LWQ5) showed aluminum concentrations above the screening criteria. This is an unusual occurrence, as all other Lake Huron samples obtained by Bruce Power since 2017 have been below the screening criteria. Aluminum occurs naturally in surface water and groundwater due to weathering of minerals. It can also be released to the environment from construction materials, vehicles, electronics, pharmaceuticals and personal care products [R-135].

Iron was found to be above the screening criteria in Baie du Doré (LWQ5). This is the first instance of elevated iron in Bruce Power’s history of monitoring Lake Huron. Of note, elevated iron was also found in Stream C in 2023. Stream C discharges into Baie du Doré and may have contributed to the Baie du Doré results. According to Environment and Climate Change Canada, the concentrations of iron in Canadian surface waters are generally below

10 milligrams per litre, with Lake Huron measured as 0.7 milligrams per litre [R-139]. The concentration in Baie du Doré (LWQ5) was 1.9 milligrams per litre.

Historical lake water quality data collected between 2017 and 2021 are presented in the 2022 Environmental Risk Assessment [R-4], including a discussion of any exceedances of the screening criteria and characterization of the risk to potential receptors. These data were collected from the locations shown in Figure 46 retired monitoring locations, and from the Coastal Waters Monitoring Program stations in Baie du Doré and Inverhuron Bay. A similar discussion of exceedances from 2022 to 2026 and characterization of the risk to potential receptors will be included in the 2027 Environmental Risk Assessment.

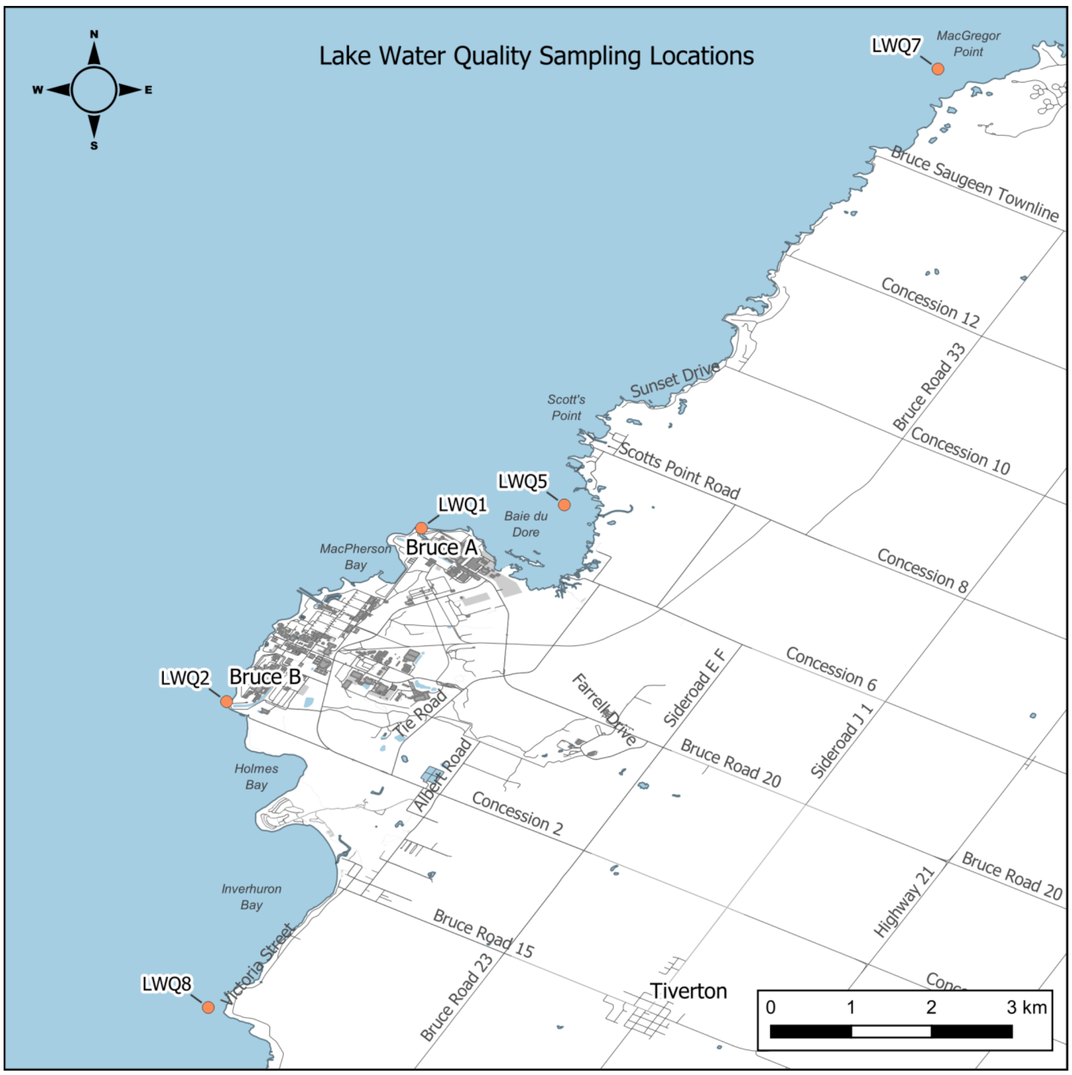


Figure 46 - Long-term Water Quality Monitoring Locations in Lake Huron. LWQ7 and LWQ8 were not sampled in 2023 due to challenges in chartering a boat for those locations.

6.2.1.1 Water Quality in Stream C and On-site Drainage Features

Surface water quality samples were collected in the spring, summer and fall of 2023 at several locations across the Bruce Power site, including the long-term monitoring locations in 'Stream C' (Figure 47). Stream C is a small stream that originates off-site (headwaters on the Nipissing Bluff just east of site), flows through site including Hydro One and Ontario Power Generation lands, and discharges to Baie du Doré. Two long-term monitoring locations exist in Stream C; one at the upstream boundary of the facility (SW1), and one at a downstream location near the discharge to Lake Huron (SW2). Additional on-site surface water monitoring locations include: Eastern Drainage Ditch (SW3), the pond adjacent to building B31 and the former Ontario Power Generation Construction Landfill #4, the pond beside building B16 and the pond at the 'Former Sewage Lagoon'. One sample taken by Ontario Power Generation in 2020 for their Western Waste Management Facility Environmental Risk Assessment ('Stream C Confluence') is shown for reference only and was not sampled by Bruce Power in 2023 (Figure 47).

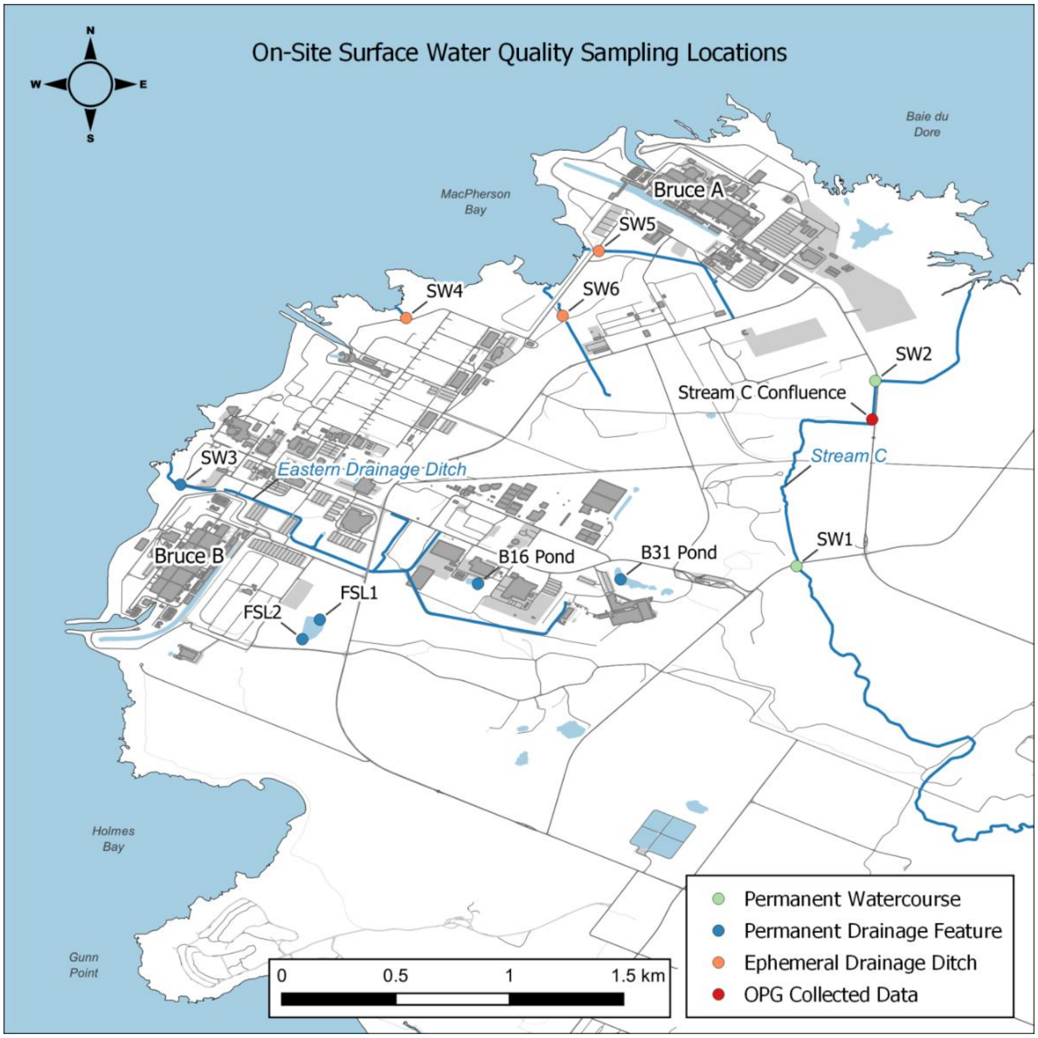


Figure 47 - Water quality monitoring locations sampled in 2023 from Stream C and other on-site drainage features. The Ontario Power Generation Western Waste Management Facility sampling station 'Stream C Confluence' is shown here for reference only and was not sampled in 2023 by Bruce Power.

Sample results are compared to several criteria including:

- Provincial Water Quality Objectives as established by the Ontario Ministry of Environment, Conservation and Parks [R-132];
- The Canadian Council of Ministers of the Environment freshwater, long-term water quality guidelines for the protection of aquatic life [R-133];
- Ontario Drinking Water Standards as listed in *Ontario Regulation 169/03* [R-77];

- Health Canada Guidelines for Canadian Drinking Water Quality [R-134]; and
- Site-specific target levels, as developed in the 2022 Environmental Risk Assessment (Table 7) [R-4].

In 2023, results above the screening criteria were recorded in some on-site surface water samples for the following Chemicals of Potential Concern: phosphorous, chloride, fluoride, phenolics, aluminum, copper, iron, vanadium, pH and dissolved oxygen.

As mentioned in Section 6.2.1.1, phosphorous has been shown to be elevated in Lake Huron and other local surface water bodies due to run-off from agricultural activities. This is supported by the observation that phosphorous is elevated in the upstream portion of Stream C (SW1), prior to any influence from the Bruce Power site.

According to the 2022 Environmental Risk Assessment, elevated chloride levels are expected due to road salting practices as part of the facility's general maintenance programs and fluoride is naturally elevated in regional groundwater and surface water due to the geology of the region [R-140]. Fluoride is not a chemical constituent used or emitted from Bruce Power operations.

Prior to 2022, phenolics were not routinely analyzed in on-site surface water quality samples because they were not part of the analysis package offered by the external laboratory. In 2022 this parameter was added to the analysis package and in 2023 most of the samples collected in August and November showed elevated levels of phenolics. All samples collected in April were below the screening criteria. This Chemical of Potential Concern occurs naturally in aquatic environments due to the decomposition of aquatic vegetation or can originate from industrial effluent, domestic sewage or pesticides [R-135]. The seasonal trend (summer and fall) in this Chemical of Potential Concern suggests a relationship to growth and decay of aquatic vegetation.

Aluminum occurs naturally in surface water and groundwater due to weathering of minerals. It can also be released to the environment from construction materials, vehicles, electronics, pharmaceuticals and personal care products [R-138]. Samples collected from the upstream section of Stream C (SW1) had elevated aluminum concentrations in April, August and November. The downstream section of Stream C (SW2) was only elevated in April and August. The pond adjacent to building B31 also had aluminum concentrations above the screening criteria in April and August. The Eastern Drainage Ditch had concentrations above the screening criteria in August only.

Iron was above the screening criteria in the upstream portion of Stream C (SW1) in April, August and November. The downstream portion of Stream C (SW2) had an elevated iron concentration in August only. According to Environment and Climate Change Canada, the concentrations of iron in Canadian surface waters are generally below 10 milligrams per litre, with Lake Huron measured as 0.7 milligrams per litre [R-139]. The Eastern Drainage Ditch, pond at building B16 and pond at building B31 also had elevated iron concentrations in August.

Vanadium concentrations in the Eastern Drainage Ditch (SW3) were above the screening criteria in August and November 2023. Routine on-site surface water quality monitoring of this location will continue in 2024 and analysis of benthic invertebrates for vanadium will be carried out in 2024 to determine the uptake factor from water and sediment to benthic invertebrates.

Zinc is an essential element that is widely found in nature. In Ontario streams, zinc concentrations range from less than two micrograms per litre to 537 micrograms per litre [R-140]. Although the concentrations of zinc found in the Eastern Drainage Ditch and the pond at building B31 were above the screening criteria in August, and the Former Sewage Lagoon in August and November, they were well within the range for Ontario streams.

Elevated levels of copper are often found naturally where there are higher concentrations of zinc [R-141]. Therefore, it is not surprising that samples from the Eastern Drainage Ditch and the pond at building B31 (which were above the screening criteria for zinc) were also above the screening criteria for copper. Samples from the pond at building B16 and the Former Sewage Lagoon in April were also just above the screening criteria.

The April 12th sample from the Former Sewage Lagoon had a pH greater than the screening criteria set by the Ministry of the Environment, Conservation and Parks (6.5 to 8.5), but fell within the Canadian Council of Ministers of the Environment acceptable pH range for freshwater, which is between 6.5 and 9.0 [R-135]. This range is considered to be protective of fish and benthic invertebrate toxicity [R-136].

Finally, dissolved oxygen was below the Canadian Council of Ministers water quality long-term concentration guideline for warm water biota (early life stages) in the Eastern Drainage Ditch and the pond at building B16 in April.

The full results of the 2023 water quality analyses are presented in APPENDIX F Table 90 to Table 94, alongside the historical trend observed between 2019 and 2023 (Table 95).

Historical data from 2017 to 2021 is outlined in the 2022 Environmental Risk Assessment [R-62], including a discussion of any exceedances of the screening criteria and characterization of the risk to potential receptors. A similar discussion of exceedances from 2022 to 2026 and characterization of the risk to potential receptors will be included in the 2027 Environmental Risk Assessment.

6.2.1.1 Sediment Sampling in Lake Huron, Stream C and On-site Drainage Features

No sediment sampling was performed by Bruce Power in 2023. Sediment sampling is performed once every five years and was last completed in 2021. Results of these samples are documented in the 2021 Environmental Protection Report [R-142] and the 2022 Environmental Risk Assessment [R-4].

Alternatively, historical sediment data can be viewed using a new interactive tool that has been developed for this purpose. The tool can be accessed through the following link:

https://wsp-shinyapps.shinyapps.io/ERA_screening_tables/

6.2.1.1 On-site Soil Sampling

No on-site soil sampling was performed by Bruce Power in 2023. Soil sampling is performed once every five years and was last completed in 2021. Results of these samples are documented in the 2021 Environmental Protection Report [R-142] and the 2022 Environmental Risk Assessment [R-4].

Alternatively, historical soil data can be viewed using an interactive tool that has been developed for this purpose. The tool can be accessed through the following link:

https://wsp-shinyapps.shinyapps.io/ERA_screening_tables/

6.2.1.1 Quality Assurance and Quality Control

The external laboratory that analyzes samples from the Conventional Environmental Monitoring program is certified under The Canadian Association for Laboratory Accreditation and operates a Quality Assurance and Quality Control program in accordance with International Organization for Standardization 17025 for competence of testing and calibration laboratories.

The internal Bruce Power laboratory also operates a documented, comprehensive Quality Assurance and Quality Control program, which includes the use of blank samples, blind duplicate samples and spike samples.

Performance criteria are specific to each monitoring effort and are outlined in the annual Conventional Environmental Monitoring program plan. Data acceptance criteria are defined for chemical analyses and are analyte-group specific. These criteria are defined in terms of specific data quality metrics such as analyte detection limits, matrix spike recovery, precision and blank results. The detection limit of the method used to measure the concentration, intensity should be less than the benchmark value identified for that contaminant, physical stressor, or effect [R-131].

The minimum detection limits for copper and zinc in surface water were above the screening criteria for samples collected from the Eastern Drainage Ditch SW3 on April 12, 2023 and August 22, 2023. The minimum detection limit was raised due to dilution of the samples to accommodate higher concentrations of these metals in the water.

The water quality instrument became defective during the August 2023 on-site surface water sampling and therefore, temperature, pH, dissolved oxygen and specific conductivity values were not recorded during sample collection. pH and specific conductivity were determined during laboratory analysis of the samples and temperatures were assigned based on temperatures recorded for August 2022 samples. A replacement water quality instrument was purchased and used for the November on-site surface water samples and December lake water quality samples.

6.2.1.1 Achievement of Program Objectives – 2023

As demonstrated in this report, the 2023 Conventional Environmental Monitoring program is effective as the program continued to meet the objectives defined in the Canadian Standards Association standard N288.4, Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills, by:

- measuring the concentration of hazardous substances and physical stressors in the environment to allow for the assessment of potential biological effects from stressors arising from the facility;
- demonstrating compliance with limits on hazardous substances and physical stressors in the environment; and
- verifying that Bruce Power has effective containment and effluent control measures in place [R-130].

6.2.1.1 Future Environmental Monitoring Activities

The Conventional Environmental Monitoring program has a focus on locations with historical activity to monitor for impacts and ensure risk to receptors is sufficiently characterized. Additions or changes to the Environmental Monitoring program in 2024 and subsequent years are guided by the conclusions and recommendations outlined in the 2022 Environmental Risk Assessment [R-4].

Potential risks identified by the conventional Ecological Risk Assessment are listed in Section 4.1 of this report. The conservative nature of the methodology used to assess risks due to conventional contaminants in the Ecological Risk Assessment results in the identification of areas of potential risk but does not necessarily indicate a current risk to receptors.

In 2024, water quality monitoring of Lake Huron, Stream C and other on-site drainage features will continue. Sediment and soil sampling at areas of interest will also be performed. Benthic invertebrates from the Eastern Drainage Ditch (SW3) will be collected and analyzed for vanadium to establish an uptake factor for this metal from sediment to benthic invertebrates and refine the risk to ecological receptors that consume benthic invertebrates in this location.

A study of benthic invertebrates along the shoreline near Bruce Power will be completed in 2024. This is a follow-up to a similar study that was conducted in 2012 [R-143]. The 2012 study included sampling of benthic invertebrates and aquatic macrophytes in 15 locations that were associated with existing temperature loggers and historical benthic invertebrate sampling. Results found a low diversity of benthic invertebrates across all sample locations. Abundance was low in most areas too, except for the Bruce A discharge and Baie du Doré which are more sheltered. Previously common native species were outnumbered by the invasive *E. ischnus*, which aligns with changes seen in the rest of Lake Huron. Finally, there was no evidence of a thermal effect on larval instar development. Macrophyte abundance was low at most sites.

6.2.2 Fish Impingement, Entrainment and Offsetting Activities

Bruce Power uses cold, deep Lake Huron water in a once-through-cooling system to condense steam and supply operational needs. This cooling requirement can cause adult fish and larger juveniles to become trapped against water intake screens (impingement). Smaller aquatic organisms, like fish eggs and larvae, can fit through the intake screens and then be carried through the cooling water system before returning to the lake (entrainment).

Bruce Power received a *Fisheries Act* Authorization from Fisheries and Oceans Canada in December 2019 [R-144]. The Authorization requires Bruce Power to quantify fish losses through continued monitoring of fish impingement and entrainment and to measure fish gains obtained from approved offsetting measures. These monitoring results are reported annually to Fisheries and Oceans Canada. Bruce Power works closely with the Canadian Nuclear Safety Commission, Fisheries and Oceans Canada and local Indigenous Nations and communities to ensure the requirements of the Authorization are met and that all are well-informed of relevant fish impingement, entrainment, and fish offsetting activities.

6.2.2.1 Impingement and Entrainment – 2023

The total loss of fish due to impingement and entrainment at Bruce A and Bruce B Generating Stations in 2023 was 2444 kilograms (Table 39) expressed as a Habitat Productivity Index metric [R-145] [R-146]). This was consistent with losses in prior years (Figure 48), below the administrative threshold of 4,500 kilograms per year, and well below the maximum loss permitted in Bruce Power's *Fisheries Act* Authorization (6,600 kilograms per year). The total nominal weight of fish impinged in 2023 was 1315 kilograms, excluding Round Goby, an invasive species not included in the total impingement loses, and Gizzard Shad impinged between February 6th and April 30th, 2023, as described below. None of the fish impinged in 2023 were listed as Threatened or Endangered on Schedule 1 of the *Species At Risk Act* [R-147]. .

Impingement losses were measured consistently throughout 2023 by Bruce Power Operations who identified and quantified fish impinged in all unit pump houses each day. The impingement monitoring program has several levels of Quality Assurance and Quality Control checks to ensure data integrity. Operators undergo training in fish identification and quantification prior to performing these tasks. The Quality Assurance and Quality Control program for fish impingement requires Operators to freeze Lake Whitefish, Round Whitefish and Deepwater Sculpin so that identification can be confirmed by field biologists who oversee the program. Frozen fish are bagged, labelled, and placed in freezers stored in each pump house until they are inspected by Bruce Power's field biologists. Operations staff will also freeze specimens that they would like the field biologists to perform a confirmatory identification.

Higher-than-Expected Amount of Gizzard Shad Impinged

A higher-than-expected amount of Gizzard Shad was impinged at Bruce Power between February 6, 2023 and April 30, 2023. The start of this event was informally communicated to Fisheries and Oceans Canada on February 7, 2023, with formal follow-up reports submitted on February 24, May 9 and December 6, 2023.The Saugeen Ojibway Nation, Métis Nation of Ontario and Historic Saugeen Métis were initially notified of the higher-than-expected amount of Gizzard Shad impinged at Bruce Power during technical working meetings with them on February 8, February 10 and March 2, 2023, respectively. Formal reports sent to Fisheries and Oceans Canada were also shared with each Indigenous Nation. Further discussions with the communities during routine quarterly meetings occurred at the 2023 quarter one Historic Saugeen Métis meeting on March 17, 2023, the 2023 quarter one Saugeen Ojibway Nation meeting on April 14, 2023 and at the quarter two Métis Nation of Ontario meeting on June 27, 2023 (quarter one meeting was not held). Updates on fish impingement and entrainment losses will continue to be shared with Saugeen Ojibway Nation, Métis Nation of Ontario and Historic Saugeen Métis through future technical working meetings, quarterly meetings and quarterly Environmental Summary Reports.

Gizzard Shad are very sensitive to changing environmental conditions and a sudden decrease in water temperature has been documented to cause large-scale die-offs [R-148]. In addition, “Gizzard Shad are known to become disoriented at cold temperatures and are believed to suffer high mortality at temperatures below 4 degrees Celsius” (Heidinger, 1983; Adams et al., 1985; White et al., 1987, as cited in Fetzer et al., 2011), with the highest mortality rates occurring when water temperatures approach freezing [R-148]. On February 2, 2023, air temperatures in the Bruce County region fell from above zero degrees Celsius to minus 24 degrees Celsius (with windchill) in a short period of time. During the same period, water temperature loggers at MacGregor Point (20 metres below surface) showed a decrease in water temperature from 2.4 degrees Celsius to almost zero degrees Celsius. Lake Huron water temperatures remained below 4 degrees Celsius from January until mid-April, except for three brief time periods. It is believed that the deceased and dying Gizzard Shad that entered the pumphouses at Bruce A and Bruce B succumbed to cold shock and/or Viral Hemorrhagic Septicemia (VHS), as a result of the severe and sudden cold front that covered Southern Ontario in early February, in combination with sustained water temperatures below 4 degrees Celsius. Bruce Power operations during the period of elevated impingement were reviewed, but no unusual conditions or contributing factors were identified.

Canadian Standards Association N288.9 Guideline for design of fish impingement and entrainment programs at nuclear facilities, clause 6.3.7.3 states that “Long dead fish should not be assumed to have been killed by impingement and may be excluded from the loss calculations if scientifically defensible. Note: Scientifically defensible reasons might include species susceptible to natural die-offs (e.g., Gizzard Shad).” Gizzard Shad impinged at Bruce Power between February 6, 2023 and April 30, 2023 were long dead or moribund prior to being impinged and therefore, have been excluded from the annual HPI losses calculation. During a Teams meeting on September 14, 2023, Fisheries and Oceans Canada indicated they are developing a standardized protocol for dealing with these types of impingement events. This protocol may be incorporated into the new edition of Canadian Standards

Association N288.9 which is currently being drafted by a technical committee that includes representatives from the regulator, utilities and consultants.

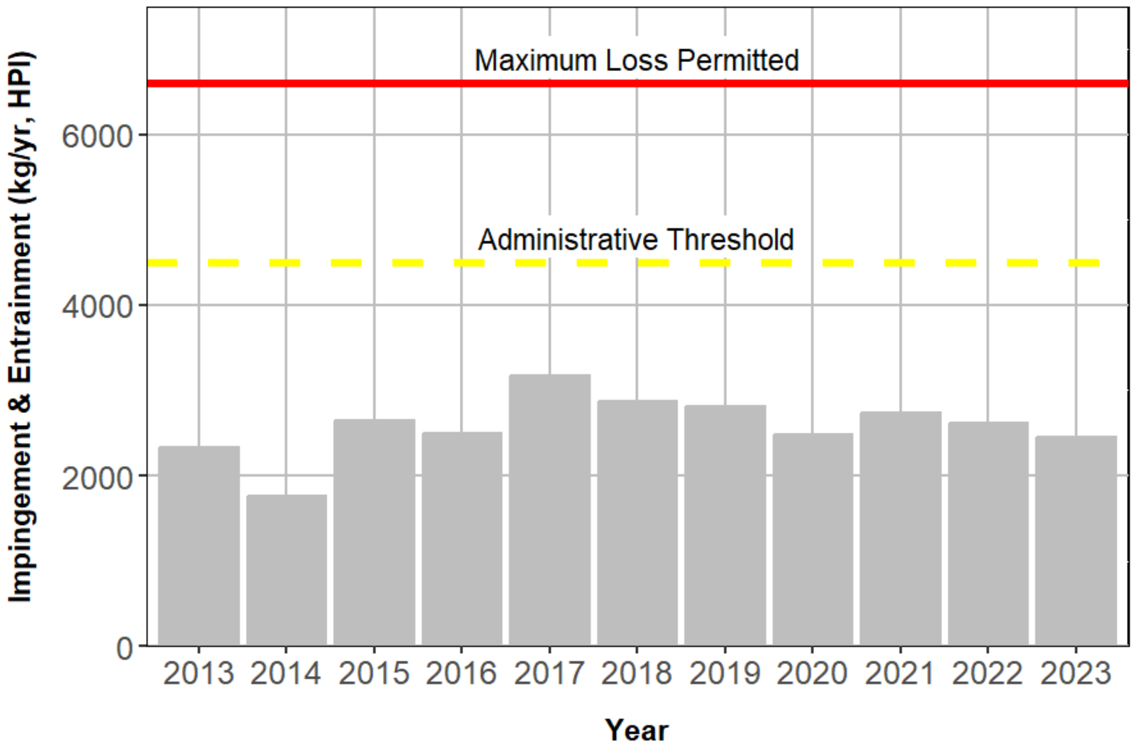


Figure 48 - Total impingement and entrainment losses at Bruce Power (2013-2023), calculated using the Habitat Productivity Index metric [R-17] [R-18]. Impingement was measured in all years. Entrainment was measured in 2013 and 2014 and estimated in 2015 through 2023 using a conservative approach.

Table 39 - Impingement and Entrainment Fish Losses at Bruce A and Bruce B in 2023

Species	2023 Impingement Count (number)	2023 Impingement Nominal Weight (grams)	2013/2014 Entrainment[1] Count (number of age-1 equivalents)	2013/2014 Entrainment[1] Age-1 Weight (grams)	2023 Productivity Loss (HPI, kilograms per year)
Alewife	240	4,793	6	24	4
Bloater	-	-	14,124	790,944	510

Species	2023 Impingement Count (number)	2023 Impingement Nominal Weight (grams)	2013/2014 Entrainment[1] Count (number of age-1 equivalents)	2013/2014 Entrainment[1] Age-1 Weight (grams)	2023 Productivity Loss (HPI, kilograms per year)
Brown Trout	53	15,889	-	-	6
Bullhead	23	9,647	-	-	3
Burbot	213	160,837	9,089	78,165	203
Carp	22	15,050	-	-	4
Channel Catfish	95	77,015	-	-	20
Chinook Salmon	37	26,821	2,208	266,285	141
Cisco	-	-	17,545	538,632	429
Coho Salmon	37	65,973	-	-	13
Cyprinid	-	-	431	259	1
Deepwater Sculpin	-	-	2,610	3,654	9
Emerald Shiner	135	18,479	-	-	9
Freshwater Drum	7	16,725	-	-	3
Gizzard Shad	399	91,967	-	-	36
Lake Trout	86	156,841	-	-	30
Lake Whitefish	24	30,980	8,547	639,316	385
Rainbow Smelt	72	644	16,898	152,082	187

Species	**2023 Impingement Count (number)**	**2023 Impingement Nominal Weight (grams)**	**2013/2014 Entrainment[1] Count (number of age-1 equivalents)**	**2013/2014 Entrainment[1] Age-1 Weight (grams)**	**2023 Productivity Loss (HPI, kilograms per year)**
Rainbow Trout	20	14,667	-	-	4
Rock Bass	34	1,021	-	-	1
Round Goby	60	1,361	2,529	2,529	9
Round Whitefish	60	38,396	-	-	11
Salmonid	-	-	427	8,028	8
Smallmouth Bass	18	9259	-	-	3
Spottail Shiner	506	68,459	-	-	32
Suckers	482	329,112	5,089	26,972	219
Walleye	142	124,867	75	8,730	37
White Bass	2	2	-	-	0
White Perch	125	2,301	-	-	2
Yellow Perch	672	35,557	10,512	81,994	136
Total (kg/year)					2,453
Total (less Round Goby) (kg/year)					2,444

Round Goby are excluded from the annual Habitat Productivity Index calculation because they are a species listed in the *Aquatic Invasive Species Regulations* (SOR/2015-121).

Entrainment losses were not measured in 2023; power generation facilities do not routinely measure entrainment because it is an intensive effort. Instead, entrainment was conservatively estimated in 2023 based on the highest value observed (by species) in either the 2013 or 2014 entrainment monitoring programs that were completed in preparation of the Authorization application. The 2444 kilogram total loss value for 2023 includes this estimate of entrainment losses.

6.2.2.2 Truax Dam Removal Project Offsetting Activities – 2023

In August 2019, the Truax Dam (Saugeen River, Walkerton, Ontario) was successfully removed as part of Bruce Power's *Fisheries Act Authorization* Offsetting Plan. This project was completed in partnership between Bruce Power, the Lake Huron Fishing Club and the Municipality of Brockton, and represents the largest known dam removal to occur in the Province of Ontario in recent times (Figure 49). The successful dam removal in 2019 was a key step forward in Bruce Power's efforts to fully offset its fish losses from impingement and entrainment.

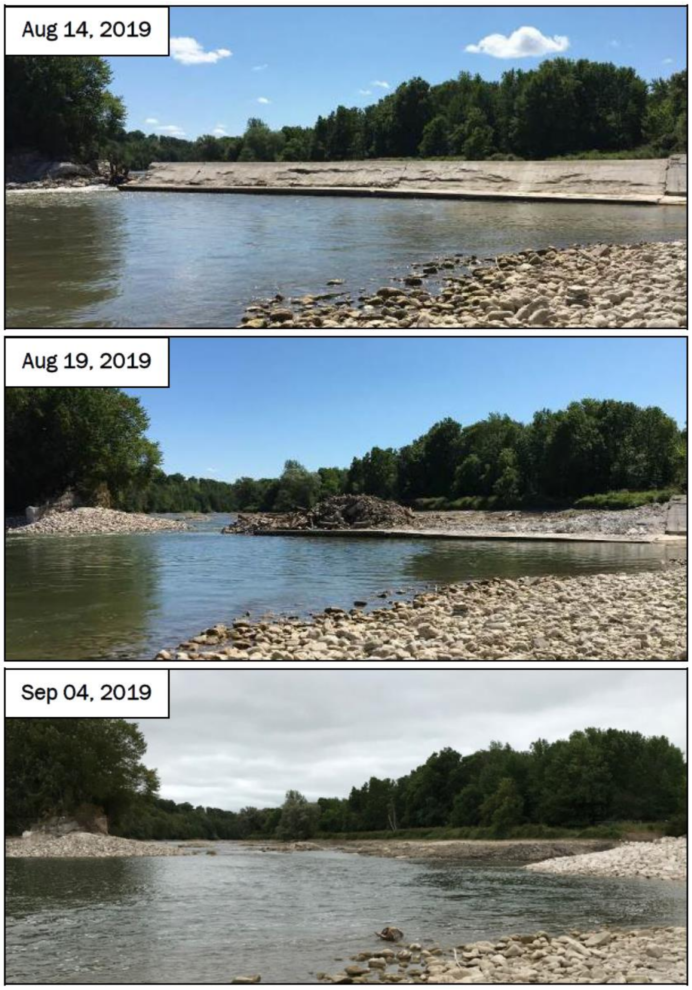


Figure 49 - Truax Dam, Walkerton, Ontario. The original wooden dam was built in 1852 and later replaced by the concrete structure shown above in 1919. The dam posed a significant barrier to fish passage for more than a century before it was removed in the summer of 2019 over the course of 3 weeks.

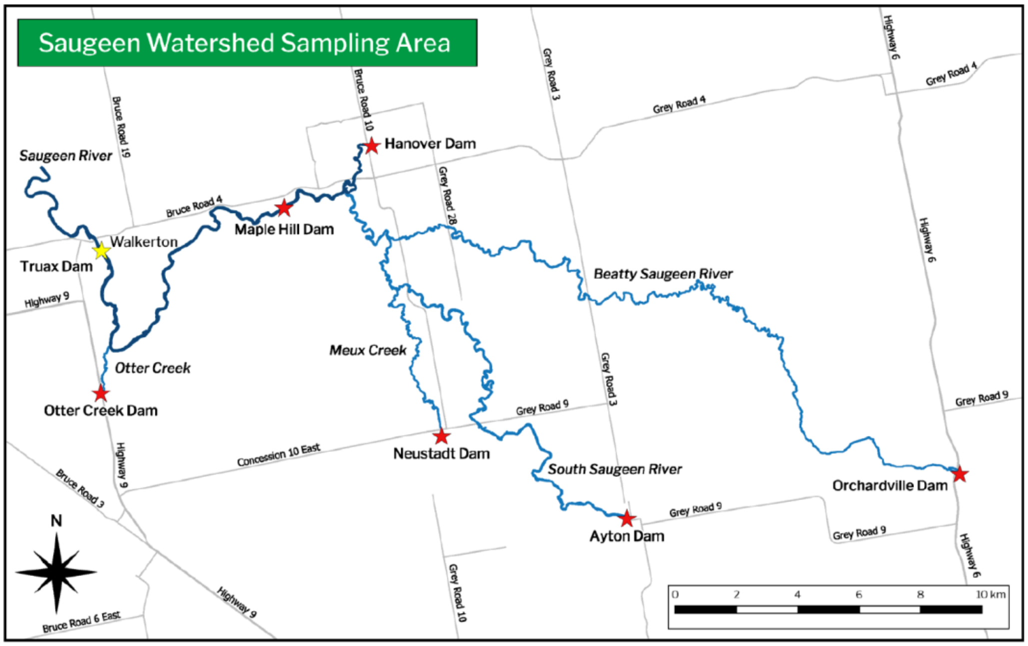


Figure 50 - Twenty-two long-term monitoring sites are located in the Saugeen (upstream & downstream of the former Truax Dam) and within the South Saugeen & Beatty Saugeen Rivers and Otter and Meux Creeks. Dams (red stars) are natural endpoints of the study area as fish cannot pass upstream of these structures. Control sites with independent fish communities are located outside of the study area, upstream of the Hanover and Otter Creek dams.

Fish and fish habitat monitoring upstream and downstream of the former Truax Dam began in 2018 and continued in 2023 in order to quantify the change in fish biomass that has occurred as a result of the dam removal. Twenty-two long-term monitoring locations were established in the study area where biologists carry out electrofishing surveys to measure changes in fish biomass and production (Figure 50). Additionally, habitat assessments and redd surveys are used to monitor changes in fish spawning, and underwater video and radio-telemetry studies are being done to track fish passage throughout the watershed.

In 2023, the largest increases in fish biomass production continued to be found in the sites immediately upstream of the Truax Dam footprint which were previously in the dam impoundment. Productivity increases in sites further upstream also continued to be significant. While tributary sites are showing increases, this year the increases were not statistically significant. Therefore, only increases in production between Truax and Carrick were carried forward to assess offsetting gains for 2023. As a result of the removal of the Truax Dam, increase in Habitat Productivity Index is 843.7 kilograms per year, averaged across four years post removal. These values might change upon review of methodology and discussion with Fisheries and Oceans Canada.

Fish production within the Saugeen River main stem is expected to continue to increase in future years as the warm-water fish community re-distributes across the newly reconnected river system and as additional successful Salmonid spawning occurs within the newly formed habitat upstream of the dam footprint. Indeed, additional observations gathered through radiotelemetry studies of Rainbow Trout, Salmonid redd surveys and videography monitoring have demonstrated an almost instantaneous increase in Salmonid presence in the Saugeen River upstream of the Truax Dam to Carrick Dam and within Otter Creek. Increased fish production of Salmonids in the tributaries is also anticipated in future years.

A photographic collection of the Saugeen River watershed field work is found at [R-149]–[R-152]:

Videographic surveys have confirmed significant increases in Rainbow Trout passage at Maple Hill Dam. Additional information is available at Biotactic's website (www.biotactic.com, [R-153]) or by following these links:

2022 Summary - Saugeen River Telemetry [R-154]

Migratory Patterns of Rainbow Trout [R-155]

Rainbow Trout and Chinook Salmon redd counts continue to be higher than post-removal. An average of 33 Rainbow Trout redds were observed in Otter Creek pre-removal, increasing to 66 redds in 2023. Correspondingly the number of juvenile Rainbow Trout captured increased from an average of 559 individuals pre-removal to 963 individuals in 2023 (Table 40). Similarly, Chinook Salmon redds in Otter Creek increased from 8 counted in fall 2018 to 55 counted in fall 2023 (Table 41). Fewer redds were observed in fall 2022 compared to fall 2021, due to significantly decreased water levels at the mouth and throughout Otter Creek, which precluded the ability of fish to enter the tributary. This is reflected in the 2023 juvenile count, which dropped from 42 in 2022, to 3 in 2023. Importantly, no redds or juvenile Salmonids were found pre-removal in the dam headpond, however post-removal redd counts continue to remain elevated (Table 41). While an increase in redd counts cannot directly be correlated to increases in biomass, this provides additional evidence of the benefit of the removal of Truax Dam to fish communities and will likely lead to further increases in fish biomass and fish biomass production throughout the watershed.

A summary of redd surveys in the Saugeen River near the former Truax Dam site are provided in Table 40 and Table 41, as well as the link below.

Redd Count Surveys [R-156]

Table 40 - Rainbow Trout spring redd and summer juvenile counts in the main-stem and Otter Creek baseline (2018 and 2019) and post-dam removal (2020 - 2023).

	Main stem	Main stem	Otter Creek	Otter Creek
	Redd counts	**Juveniles**	**Redd counts**	**Juveniles**
2018	0	0	45	312
2019	0	0	21	806
2020	31	15	46	488
2021	5	7	71	642
2022	5	63	92	1,128
2023	3	38	66	963

Table 41 - Chinook Salmon fall redd and summer juvenile counts in the main-stem and Otter Creek baseline (2018) and post-dam removal (2019 - 2023).

	Main stem	Main stem	Otter Creek	Otter Creek
	Redd counts	**Juveniles**	**Redd counts**	**Juveniles**
2018	0	0	8	0
2019	3	0	10	13
2020	2	0	15	3
2021	28	0	73	2
2022	19	1	18	42
2023	26	0	55	3

6.2.2.3 Indigenous Nation and Community Offsetting Projects – 2023

In addition to the Truax Dam Removal Project, Bruce Power continues to collaborate with local Indigenous Nations and communities to develop additional offsetting projects. These projects provide an opportunity to work together in meaningful ways to improve fish and fish habitat in areas of the Lake Huron watershed that are of special importance to local Indigenous Nations and communities. These projects are in addition to Bruce Power's support of the Saugeen Ojibway Nation Coastal Waters Monitoring Program, which is a nearshore/coastal monitoring program with the goal of building a comprehensive baseline inventory of aquatic habitat and wildlife in the Saugeen Ojibway Nation Territory [R-157].

Bruce Power and the Historic Saugeen Métis have completed the third and final year of the offsetting project known as "Fisheries Habitat Restoration and Enhancement: Removal of *Phragmites australis* from the Fishing Islands". The combination of western science and

Indigenous knowledge produced an all-encompassing improved formula for dealing with compensating offsets. The Fishing Islands are an important harvest area for the Historic Saugeen Métis Community. Fish, aquatic plants and bird eggs are all part of the Métis way of life. Maintaining ecological integrity in this area is therefore of high importance to the Historic Saugeen Métis Community. The proposed project plan was approved in 2021 and an amended *Fisheries Act Authorization* was issued to Bruce Power. As per the Authorization, an annual report documenting the work completed in 2021 and 2022 was submitted to the Fisheries and Oceans Canada in March 2022, and September 2023, respectively. The goals of this project were to: strengthen the role of the Historic Saugeen Métis community in fisheries related projects; incorporate Historic Saugeen Métis community knowledge of coastal habitats and fish interactions; restore near shore coastal habitats that are important to the Historic Saugeen Métis community; increase shoreline complexity and restore native plant diversity; improve near shore fish habitat; enhance local hydraulic conditions to favour certain functions of fish habitat; and promote restoration of degraded habitats.

This program is also being undertaken by a number of partners including the Oliphant and Fishing Islands Phragmites Community Group, Bruce Power, Grey Sauble Conservation Authority, Township of South Bruce, Oliphant Campers Association, Bruce Peninsula Biosphere Association, Nature Conservancy of Canada and the Invasive Phragmites Control Centre as well many seasonal and fulltime residents. In 2022, the Invasive Phragmites Control Centre undertook Phragmites control efforts over a total of 26 days targeting 44.3 hectares of phragmites. All high density stands remaining in the Fishing Islands were targeted in 2022, and it was confirmed in 2023 that no high density stands remained in the project area. The final project report was submitted to Fisheries and Oceans Canada in March 2024.

Through consultation with the Métis Nation of Ontario, a project plan was submitted and approved by Fisheries and Oceans Canada in December 2023. This work is aimed at improving fish habitat and restoring connectivity in Bothwell’s Creek. Near Leith, Ontario, Bothwell’s Creek has been used by the Métis Nation of Ontario community for fishing and recreation, however a decline in fish has been noticed over the past decade. Erosion, leading to high sedimentation, and large debris may be the leading causes of the observed decline in fish in the creek. The Métis Nation of Ontario assessed and removed debris that they identified as impediments to fish passage in 2022 and 2023. A community riparian tree planting event is currently being planned in collaboration with Bruce Power, Métis Nation of Ontario, and Grey Sauble Conservation Authority for May 2024. Photo-documentation is ongoing and will be provided to Fisheries and Oceans Canada in a final report by March 31, 2027.

Although no projects have been formally proposed to Bruce Power by the Saugeen Ojibway Nation, Bruce Power and Saugeen Ojibway Nation have met on several occasions and a list of potential project ideas has been developed and discussed. Bruce Power’s *Fisheries Act Authorization* was amended December 29, 2023, and a project plan is due to Fisheries and Oceans Canada by December 31, 2024.

Bruce Power continues to engage with Saugeen Ojibway Nation and discuss ideas for meaningful projects that are supported by the community.

As per Sections 4.4.4.1 and 5.3.1 of the *Fisheries Act* Authorization, should the Truax Dam Removal Project not yield the expected production of fish sufficient to offset the calculated serious harm by March 31, 2024, then an offset plan will be developed that includes reporting criteria that will be used to assess the effectiveness of the Indigenous Nation Community Projects. This offset plan will be submitted by March 31, 2025, should this be required.

6.2.3 Thermal Monitoring of Lake Temperatures

As part of nuclear electricity generation, high-pressure steam is produced at Bruce A and Bruce B by means of nuclear fission producing thermal energy in the core, which is transferred to the heavy water heat transport system, which then heats demineralized light water in a closed-loop system. This steam is used to produce the electricity in the turbine-generator systems and is then condensed to liquid water in the Condenser Cooling Water system before travelling back to boilers to be reheated to high-pressure steam again. Steam condensation occurs in the Condenser Cooling Water system using a separate open loop of cool lake water that is drawn from offshore deep-water intakes, and warmer water is discharged back to the lake.

The temperature of water leaving the Bruce A and Bruce B discharge channels is monitored continuously to ensure it meets the specifications outlined in Ministry of Environment, Conservation and Parks environmental compliance approvals, which are established to be protective of the environment and minimize impacts to aquatic organisms and their habitat. Because this warmer discharge water has the potential to be a physical stressor to aquatic organisms, Bruce Power has carried out extensive thermal and current monitoring over several years in order to characterize any potential risk from thermal effluent [R-4]. Temperature and current monitoring in Lake Huron continued in 2023 in order to collect ongoing verification data for the thermal risk assessment. These data will be presented in the 2027 Environmental Risk Assessment. A comprehensive thermal risk assessment was completed in the 2022 Environmental Risk Assessment, using data from the period between April 2016 and March 2021. As part of this Thermal Risk Assessment, a low risk to some cold and cool water fish species and life stages was identified, based on modelled thermal benchmarks [R-4]. Given the similar habitat available along the length of the Lake Huron coast and the mobility of older life stages, no population level effects are expected. Bruce Power will continue to execute thermal monitoring through logger deployments, as described in N288.4-10 [R-131], and thermal modelling work to monitor the risk posed by thermal effluent in the Local Study Area.

Bruce Power's thermal monitoring field program will continue to deploy thermal loggers across the local study area and at reference locations throughout the proposed thermal flexibility period. The number of sites deployed and retrieved across the local study area may change due to safety considerations related to weather and substrate composition, results of the thermal risk assessment and the adoption of advanced thermal monitoring methods. All available thermal monitoring data, including results from CWMP, will continue to be incorporated into the Thermal Risk Assessment (Section 4.2).

6.2.4 Biological Effects Monitoring

Bruce Power has conducted long-term monitoring of local wildlife populations for many years to trend baseline wildlife populations on our site. By doing so, we can understand local population dynamics, detect changes if they occur, and ensure that facility operations have minimal impact on the environment. Each of the following biological effects monitoring programs provides an additional layer of assurance that Bruce Power continues to operate its facility safely and in a manner that is protective of the environment.

Many of the monitoring programs (including snake board studies, turtle nesting, migratory birds, breeding birds and amphibians) are completed in collaboration with Ontario Power Generation Western Waste Management Facility.

6.2.4.1 Amphibians

Amphibians are an excellent indicator of ecosystem health because they have a dual life cycle (water and land) and are sensitive to pollutants during all life stages [R-158].

Targeted nocturnal amphibian vocalization surveys are conducted in the spring and summer , following the Environment Canada Marsh Monitoring Protocol [R-158]. The protocol requires sampling on three separate calm, mild evenings at least 15 days apart to determine species presence and relative abundance. In addition to the targeted vocalization surveys, incidental observations are made throughout the year during other field studies.

Table 42 - Amphibian Call Level Codes used in Survey Protocol [R-154]

Level 1	Calls did not overlap and calling individuals could be discretely counted
Level 2	Calls of individuals occasionally overlap, but numbers of individuals could still reasonably be estimated
Level 3	Numerous individuals were calling, and an overlap of calls seemed continuous, making an estimate of individuals impossible

In 2023, amphibian vocalization surveys revealed a total of five different species calling at varying call levels over the three spring/summer 2023 visits.

By far, the most common and abundant species documented was the Spring Peeper (*Pseudacris crucifer*). This early breeding frog species was heard calling at all 13 stations, with call levels ranging from Level 1 to Level 2. The second most recorded frog species was the Grey Tree Frog (*Dryophtes versicolor*). This species was documented at 10 monitoring stations. In comparison, in 2022 the Green Frog (*Rana clamitans*) was the second most abundant. The Northern Leopard Frog (*Lithobates pipiens*) was found at 7 locations in 2023. No Wood Frogs (*Lithobates sylvaticus*) were found during the 2023 surveys, but Western Chorus Frogs (*Pseudacris triseriata*) were heard at a call level of 1 at the DGR/MMP 3 location, during unrelated early season nocturnal owl surveys. This (Great Lakes/St. Lawrence) species which is listed as Threatened by the Committee on the Status of

Endangered Wildlife in Canada, and the *Species at Risk Act* has not been recorded in any of the amphibian surveys from 2017 to 2022 but has historically been observed on site. The Western Chorus Frog is a very early breeder and quite often will breed while ice is still present. It may begin calling as early as mid-March, but the majority of calling will be heard in April. The fact that this species is such an early breeder makes it more difficult to document. Specific surveys should be completed in advance of the typical starting window for the other local amphibian species.

American Toads have the most diverse breeding habitat requirements and may be found in shallow ponds, shallow streams, river margins and even large puddles and roadside ditches. [R-2]. American Toads were heard at call level 1 at three locations in 2023, having not been recorded in 2022.

No Bullfrog species have been documented during any of the surveys from 2019 to 2023. They are generally not found in this region of Ontario.

Table 43 shows the frog and toad species that have been recorded on site between 2017 and 2023.

Table 43 - Frog and Toad Species Recorded on Site and the Surrounding Area between 2017 and 2023

	2017	2018	2019	2020	2021	2022	2023
American Toad	Yes	Yes	Yes	Yes	Yes	No	Yes
Bullfrog	No	No	No	No	No	No	No
Green Frog	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Grey Tree Frog	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Northern Leopard Frog	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spring Peeper	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Western Chorus Frog	No	No	No	No	No	No	Yes
Wood Frog	Yes	Yes	Yes	No	Yes	Yes	No

Monitoring of local frog and toad populations will continue in 2024, with the addition of an early season survey in an attempt to capture the early breeders, specifically the Western Chorus Frog.

On April 17 and April 23 visual surveys were completed on site for local amphibians, predominantly the local salamander and newt populations. Surveys involved walking wet areas, turning over rocks, logs etc. to search for the hiding spots of these amphibians.

Surveys revealed a total of three Yellow-spotted Salamanders (*Ambystoma maculatum*) and four Red-Spotted Newts (*Notophthalmus viridescens*) along with two large Yellow-spotted Salamanders egg masses, one located near the south of the property and the other located in the proposed Deep Geological Repository wetted areas.

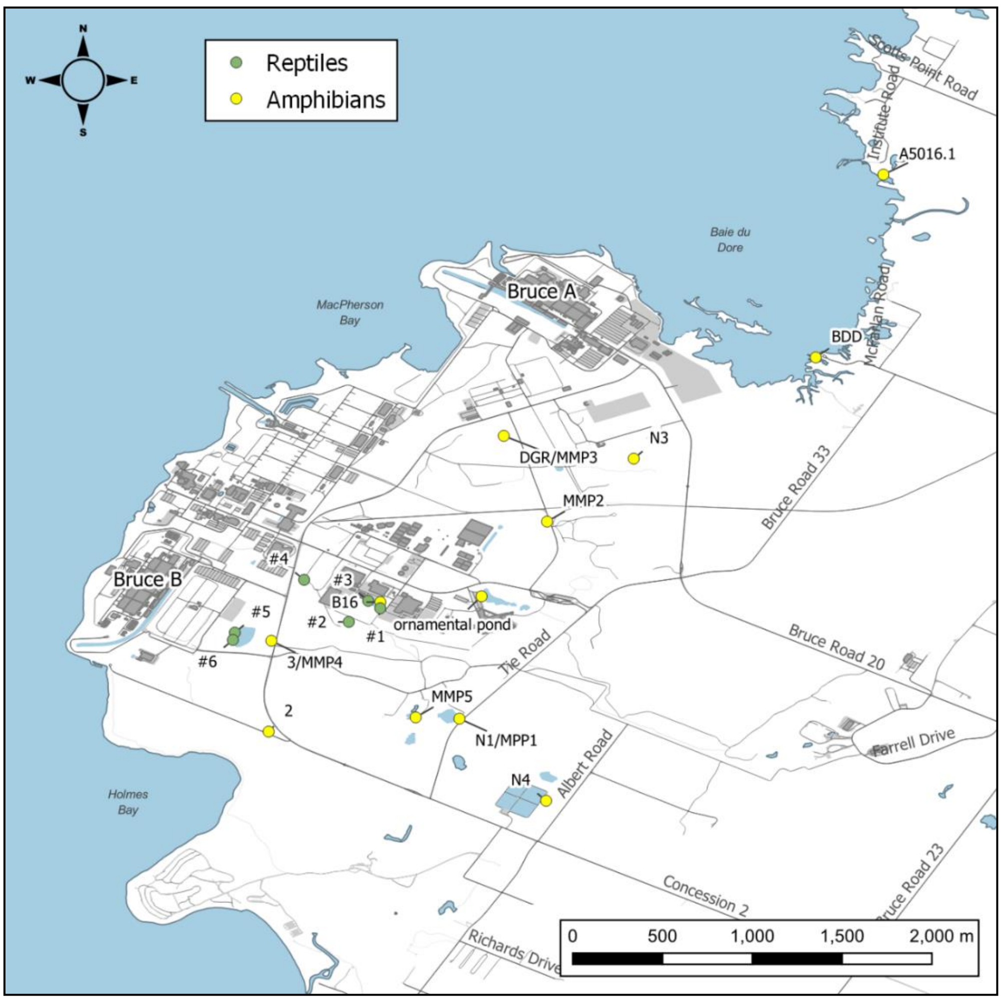


Figure 51 - Amphibian and Reptile Survey Monitoring Locations at Bruce Power

6.2.4.2 Snakes

Several snake species inhabit the Bruce Power site. They are an important component of natural ecosystems for many reasons, one of which is their need for diverse habitats to complete their lifecycles. Habitats include hibernacula areas, grasslands, wetlands, and other surface water features. Due to the decline and sensitivity of certain populations in Ontario, data collected on snake species presence and abundance provides information to make planning decisions and manage property holdings from an ecological perspective. Due to the increasing number of snake Species at Risk in Ontario, it is vital to monitor vulnerable snake populations in our local area. Investigations specific to snakes have been conducted in the form of pedestrian surveys from 2017 to present. These surveys locate and characterize the species assemblage and identify potential habitat within the Bruce Power leased lands. Along with pedestrian surveys, bioinventories focus on identifying and recording snake species classified as Species at Risk. Data is also collected during Vehicle-Wildlife Collision Surveys and incidental observations by Bruce Power employees.

Snake monitoring follows the guidelines outlined in the Ontario Ministry of Natural Resources and Forestry survey protocol [R-159]. Ontario Power Generation Western Waste Management Facility placed 33 snake monitoring boards at various locations throughout the site and Bruce Power monitored 11 additional snake board locations.

<u>Bruce Power Snake Monitoring</u>

A total of two snake species were recorded in 2023 by Bruce Power over the course of 8 monitoring events: Eastern Gartersnake (*Thamnophis sirtalis sirtalis*) and Smooth Green Snake (*Opheodrys vernalis*). A total of four individual snakes were found during the 2023 monitoring. Since snake monitoring began on site, five different species have been observed. Throughout the years, the most common snakes have been the Eastern Gartersnake and the Dekay's Brownsnake (*Storeria dekayi*).

<u>Ontario Power Generation Western Waste Management Facility Snake Monitoring</u>

Deployment of the 33 snake coverboards at the Ontario Power Generation Western Waste Management Facility site has proven to be quite successful since snake monitoring began in 2020. A total of 99 snakes of eight different species have been recorded as part of the coverboard monitoring over the four field seasons. All snake species expected to occur in southern Bruce County have thus been found during coverboard monitoring at Ontario Power Generation Western Waste Management Facility.

The 2023 Ontario Power Generation Western Waste Management Facility coverboard monitoring documented a total of 26 snakes of seven different species. Highlights of the 2023 coverboard surveys included a Northern Ribbonsnake (*Thamnophis sauritus septentrionalis*) (Special Concern), one Eastern Milksnake (*Lampropeltis Triangulum*) (Special Concern, federally only), two Smooth Greensnakes and one Northern Ring-necked Snake (*Diadophis punctatus*). The most commonly found snake under coverboards in 2023 was Eastern Gartersnake (11 observations), followed by Dekay's Brownsnake, with eight observations (compared to six in 2022, three in 2020, and only one in 2021).

Although the Northern Watersnake (*Nerodia sipedon sipedon*) is not generally observed under coverboards, it is sometimes recorded during other, unrelated biological effects monitoring in areas near water. In 2023, the Northern Watersnake was not observed during coverboard surveys, but was seen by Ontario Power Generation Western Waste Management staff during marsh monitoring at location MMP3.

Table 44 - Snake Species Presence Recorded in the Local Area 2017-2023

Species	2017	2018	2019	2020	2021	2022	2023
Dekay's Brownsnake	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Eastern Gartersnake	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Eastern Milksnake	No	No	No	No	Yes	Yes	Yes
Northern Ribbonsnake	Yes	No	Yes	Yes	Yes	Yes	Yes
Red-bellied Snake	Yes	Yes	No	Yes	Yes	Yes	Yes
Northern Ring-necked Snake	No	No	No	No	Yes	Yes	Yes
Smooth Greensnake	No	No	No	Yes	Yes	Yes	Yes
Northern Watersnake	Yes	No	No	No	No	Yes	Yes

Snake surveys will continue in 2024, with the addition of a new transect that will follow the Ontario Nature Long-Term Monitoring Protocol [R-160]. This protocol differs from the Ontario Ministry of Natural Resources and Forestry survey protocol in that more snake boards are used and they are placed closer together.

6.2.4.3 Turtles

In Ontario, turtles generally nest between May and mid-July, depending on the species, location and year [R-161]. Females choose nesting areas in loose, sandy substrate with sunny exposures. In 2023, nesting surveys were performed and found a mix of Midland Painted Turtle (*Chrysemys picta*) and Snapping Turtle (*Chelydra serpentina*) nests. Although many nests had been destroyed by predators, some Snapping Turtle nests showed evidence of successfully hatched eggs.

Basking surveys were conducted at various water features on site, with observations of several Midland Painted Turtles.

Turtle nesting and basking surveys will continue in 2024.

6.2.4.4 Waterfowl and Shorebirds

The purpose of waterfowl and shorebird surveys is to monitor overwintering and stopover migration areas to trend species abundance and distribution over time. The shoreline of Bruce Power is surveyed for waterfowl and shorebirds with both binoculars and a spotting scope from a set of nine viewpoints which were selected to cover most of the shoreline from Gunn Point to Scott Point with very little overlap (Figure 52).

In total, there were three spring and three fall survey days in 2023 completed between March and May and September to November. The total number of birds observed during the 2023 monitoring season was 2678. A total of 32 waterfowl, shorebird and gull species were identified during the waterfowl and shorebird monitoring. Canada Geese (*Branta Canadensis*) was the most abundant bird species observed, second most abundant was the Double-crested Cormorant (*Phalacrocorax auritus*) and the third most abundant was the Herring Gull (*Larus smithsonianus*)

In comparison, a total of 3584 birds across 32 species of waterfowl and shorebirds were observed in 2022. Routine annual surveys continue to demonstrate that there are diverse populations of local and migrant waterfowl and shorebirds inhabiting the lands nearby Bruce Power, with the highest density in Baie du Doré (Figure 53).

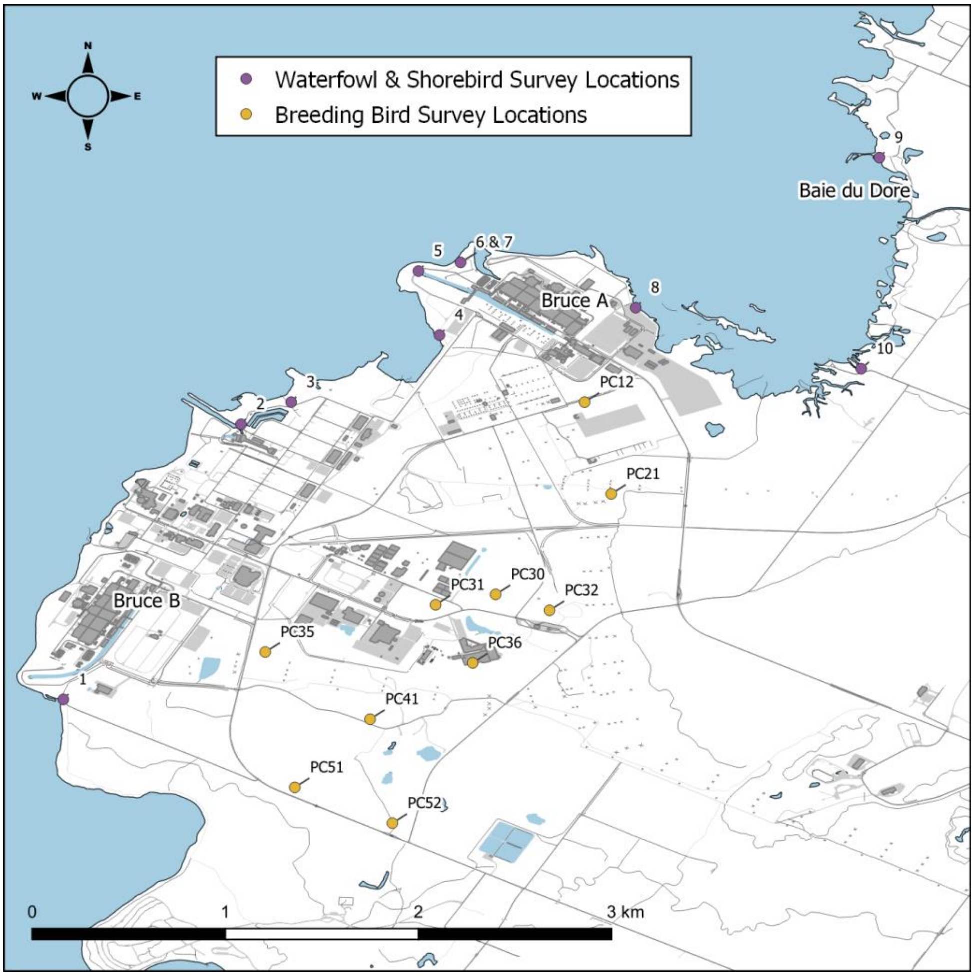


Figure 52 - Waterfowl & Shorebird and Breeding Bird Monitoring Locations at Bruce Power

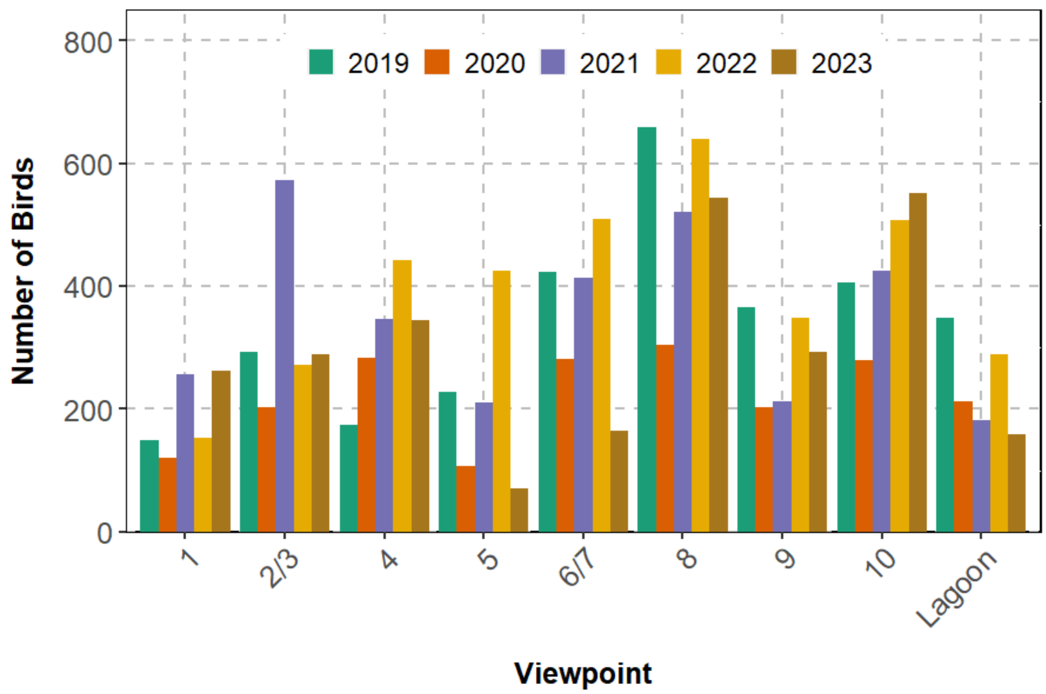


Figure 53 - Counts of Local Waterfowl and Shorebirds Observed 2019 to 2023

Ducks were relatively abundant with a total species count of 16. Mallard (*Anas platyhynchos*) was the most abundant waterfowl species and second was merganser sp. (mergus). Green-winged Teal (*Anas carolinensis*), Blue-winged Teal (*Anas discors*) and Wood Ducks (*Aix sponsa*) were also observed during the 2023 surveys. These small dabbling ducks are early migrants to the area during spring and typically migrate early in the fall. Both Teal species were documented very late in the fall and early winter season this year.

Diversity of gull species was relatively high in 2023 with a total of five species from this family. Gull species included Ring-billed Gull (*Larus delawarensis*), Herring Gull, Great Black-backed Gull (*Larus marinus*), Bonaparte's (*Chroicocephalus Philadelphia*) and Glaucous Gull (*Larus hyperboreus*)

Several Horned Grebes (*Podiceps auritus*) and Pied-billed Grebes (*Podilymbus podiceps*) were counted in 2023 along with one species of scoter, the White-winged Scoter (*Melanitta deglandi*). Scoters are late season migrants and are usually observed during the winter migration period.

There are abundant birds of prey in the areas surveyed for waterfowl. A total of 101 Bald Eagles (*Haliaeetus leucocephalus*), were recorded in 2023. The majority of these observations were made during fall monitoring, likely a result of common feeding and breeding behaviors.

Swans are relatively common in Baie du Doré and are often recorded during waterfowl monitoring. Two species were recorded this year - the Mute Swan (*Cygnus olor*) and Tundra Swan (*Cygnus columbianus*). Tundra Swans were recorded late in the season this year, with several observed in early February. Trumpeter Swans (*Cygnus buccinators*) seen in 2022 were absent this year.

Most of the survey locations are not ideal habitat for shoreline or wading birds, but 2023 had the highest recorded numbers and diversity when compared to the period between 2019 and 2022. Greater and Lesser Yellowlegs (*Tringa melanoleuca*) (*Tringa flavipes*) and Dunlin (*Caldris alpine*) were observed. These wading shorebirds can be seen during the spring and late fall and early winter on or near sandy beaches.

6.2.4.5 Breeding Birds

Ontario Power Generation Western Waste Facility staff conducted nineteen 5-minute breeding bird point counts across the site (Figure 52) on June 14 and 24, 2023. Monitoring protocols followed the standards prescribed by Birds Canada for the Ontario Breeding Bird Atlas [R-162]. A total of 52 breeding bird species were documented. Of these, 42 species were detected on June 14, 2023, and 10 additional species were observed on June 24, 2023. The lower species totals in 2023 may have been due to the later survey dates (June 14 and 24) than in 2022 (June 3 and 9), as territorial vocalizations tend to diminish in frequency for many bird species as the breeding season progresses.

New species not previously recorded included Double-crested Cormorant (*Phalacrocorax auratus*) and the federally and provincially Threatened Chimney Swift (*Chaetura pelagica*), raising the overall total number of species recorded during point counts over the last four years (2020 to 2023) to 77 species.

The most commonly observed species during point counts within the restricted area in 2023 was Red-eyed Vireo (*Sciurus vulgaris*) (detected at 17 stations), while American Crow (*Corvus brachyrhynchos*) (13 stations), Common Yellowthroat (*Geothlypis trichas*) (12 stations each), American Robin (*Turdus migratorius*) (11 stations) and Song Sparrow (*Melospiza melodia*) (11 stations) were also very common and widespread. Interesting observations included four Species at Risk: Eastern Wood-Pewee (*Contopus virens*), Wood Thrush (*Hylocichla mustelina*), Eastern Meadowlark (*Sturnella magna*) and the aforementioned Chimney Swift (Sturnella magna), all of them showing evidence of breeding. The Threatened Bobolink (*Dolichonyx oryzivorus*) was observed in 2021 but not in 2022 or 2023, and Canada Warbler (*Cardellina canadensis*), observed in previous years, was not documented in 2023.

Table 45 is a list of all breeding birds species detected at Bruce Power during the surveys in 2023.

Table 45 - Breeding Birds Species Detected at Bruce Power During Formal Surveys Conducted June 14 and 24, 2023

Wood Duck	Mourning Dove	Chimney Swift	Killdeer
Ring-billed Gull	Herring Gull	Double-crested Cormorant	Turkey Vulture
Bald Eagle	Belted Kingfisher	Hairy Woodpecker	Pileated Woodpecker
Northern Flicker	Eastern Wood-Pewee	Alder Flycatcher	Great Crested Flycatcher
Eastern Kingbird	Red-eyed Vireo	Blue Jay	American Crow
Black-capped Chickadee	Tree Swallow	Barn Swallow	Red-breasted Nuthatch
House Wren	Winter Wren	European Starling	Gray Catbird
Veery	Wood Thrush	American Robin	Purple Finch
American Goldfinch	Chipping Sparrow	Field Sparrow	White-throated Sparrow
Song Sparrow	Swamp Sparrow	Eastern Towhee	Eastern Meadowlark
Red-winged Blackbird	Brown-headed Cowbird	Common Grackle	Ovenbird
Northern Waterthrush	Black-and-white Warbler	Nashville Warbler	Common Yellowthroat
American Redstart	Yellow Warbler	Chestnut-sided Warbler	Black-throated Green Warbler
Rose-breasted Grosbeak	Indigo Bunting		

Breeding bird monitoring surveys will continue in 2024, using the same protocol and viewing stations.

6.2.4.6 Bald Eagles

Bruce Power monitors habitat use by Bald Eagles and other raptors in the vicinity of the Bruce Power Site during the overwintering period (Nov-Mar). Four Bald Eagle monitoring surveys were completed in each of the last five winter monitoring periods. Observations of Bald Eagles continued in 2022-2023 at six monitoring stations, labelled Station 1, and Stations 3 to 7 on Figure 54. Station 2 (not labelled on Figure 54) was abandoned in 2019 due to lack of visibility because of woody shoreline vegetation.

Bald Eagles are frequently observed at Stations 4, 5, 6 and 7 around Baie du Doré and the Bruce A discharge and lower numbers are recorded at Stations 1 and 3, where there are less foraging and perching opportunities. Counts at most of the stations were down slightly in 2023 (Figure 55). Surveys will continue in 2024 to determine if this is anomaly or an adjustment to the local population levels.

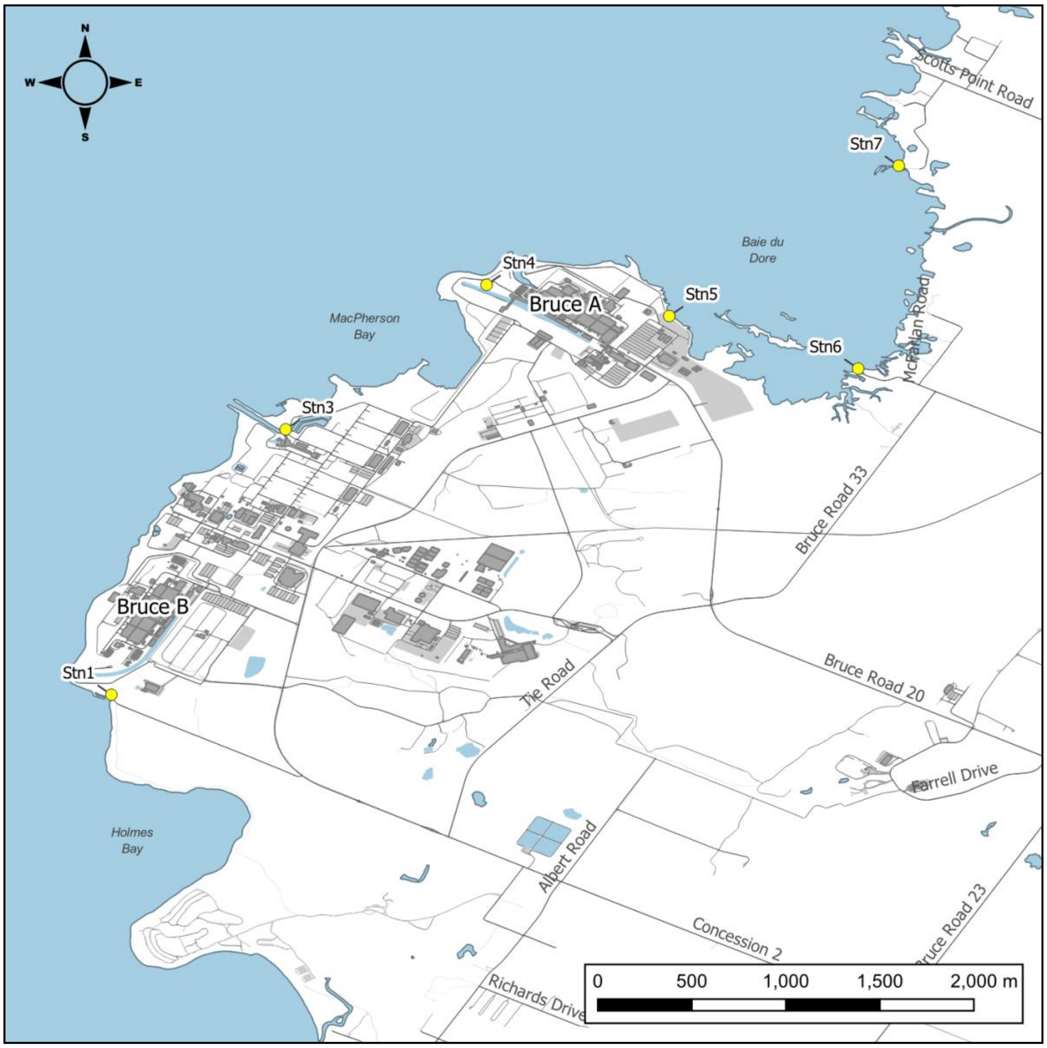


Figure 54 - Bald Eagle Monitoring Locations at Bruce Power

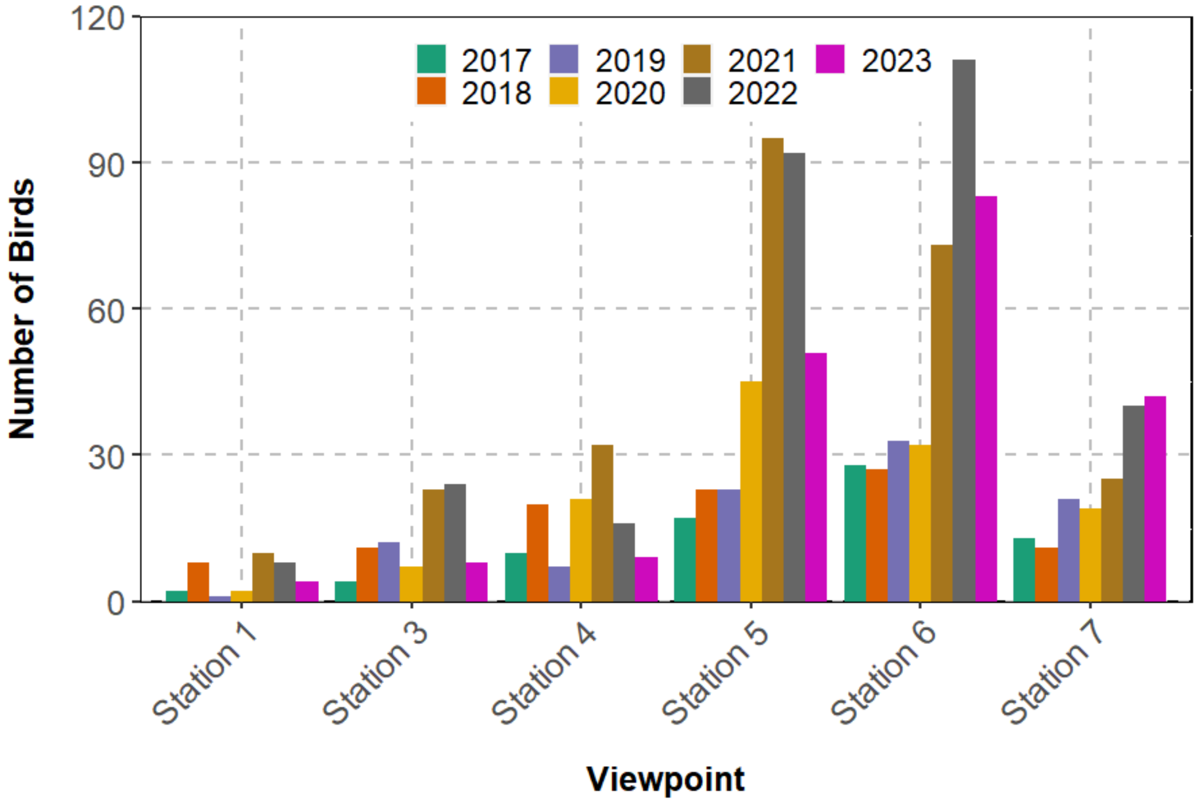


Figure 55 - Counts of Bald Eagles Observed near Bruce Power Between 2017 and 2023

Formal surveys for winter raptor species did not occur in 2021, 2022 or 2023 as none were observed during winter raptor surveys conducted in 2017-2018 and 2019-2020.; however incidental observations made by employees and Bruce Power field biologists are recorded. One Red-tailed Hawk (*Buteo jamaicensis*) was observed in 2018-2019, and one Snowy Owl (*Bubo scandiacus*) and one Northern Harrier (*Circus hudsonius*) were recorded in 2019-2020. In 2021 a Coopers Hawk (*Accipiter cooperii*), Northern Harrier and a Snowy Owl were observed on site. No additional species of winter raptors were observed in 2023.

Bald Eagle surveys will continue in 2024 at the same six monitoring stations. Bald Eagles were formerly listed as an Endangered Species provincially and in May 2023, they were down-listed from Special Concern to Not at Risk in Ontario. Populations have been steadily increasing since the 1970s when the use of DDT pesticide was phased out in Canada. The warm water discharges from Bruce A and Bruce B have created an area of open water in the winter months that allows the opportunity for Bald eagles to forage months when most water bodies are ice covered. There are at least two active Bald Eagle nests on the Bruce Power site, which provides evidence of a healthy local population.

6.2.4.7 Owls

This was the first year of formal owl surveys on the Bruce Power site. A total of seven survey locations were monitored, spanning the site from north to south. Surveys were completed on April 3, 13 and May 10 under the guidance of the Nocturnal Owl Surveys in Central Ontario: A Citizen Scientist's Guide [R-163]. A total of five owls were recorded during the surveys, including Northern Saw-whet Owl (*Aegolius acadicus*), Barred Owl (*Strix varia*) and the Eastern Screech Owl (*Megascops asio*). The Eastern Screech Owl was the most abundant and recorded three times.

Owl surveys will continue in 2024.

6.2.4.8 Nightjars

Nightjars are night-time aerial insectivores and therefore, are great indicators of overall insect abundance.

Nightjars are widespread but very little is known about them. Two common species, Eastern Whippoorwill (*Antrostomus vociferous*) and the Common Nighthawk (*Chordeiles minor*) are listed as Species at Risk and have been recorded historically on the Bruce Power Site.

Three surveys were completed in 2023 on June 20, June 28 and July 24. Seven separate sites located throughout the Bruce Power property were surveyed. Surveys were completed with guidance from the Ontario Nightjar Survey Instruction Manual (Ontario Breeding Bird Atlas, February 2021). A total of 18 Eastern Whippoorwills were recorded, but no Common Nighthawks were heard.

Common Nighthawks have been recorded on site in previous years, with the last observation in 2019 during spring amphibian surveys. Common Nighthawk populations have been decreasing in recent years due to declines in insect populations, habitat loss and pesticides.

Nightjar surveys will continue in 2024.

6.2.4.9 Redd Surveys in Stream C

In the early spring and late fall, salmonids migrate upstream from Lake Huron to reach suitable cool-cold water spawning grounds. The female selects a nest site and begins excavating a pit, referred to as a redd. This redd is where eggs will be deposited for fertilization by one or more males. Redd surveys are a tool for assessing the productivity and health of a watercourse, as presence and success of spawning salmonids indicates the watercourse has the necessary environmental conditions to promote healthy spawning, hatching, and rearing (i.e., substrate, temperature, and flow regimes). Timing of the start for the survey varies depending on conditions like water temperature, rainfall, and stream water levels. Stream C surveys are conducted in the spring to capture the migration of Rainbow Trout (*Onchorynkus mykiss*) and in the fall to observe various salmon species, which include both Chinook Salmon (*Oncorhynchus tshawytscha*) and Coho Salmon (*Oncorhynchus* *kisutch)*. Redd surveys extend from the mouth of Stream C at Baie du Doré (Lake Huron) upstream to the culvert on the west side of Tie Road.

Fourteen surveys were completed in 2023 (six in the spring, eight in the fall). Nine Rainbow Trout redds were observed in 2023, which was less than half the number recorded in 2022 (Figure 56). Of these, five had a Rainbow Trout on or near the nest. Thirty-three Chinook Salmon redds were observed in Stream C in 2023 and a total of 18 Coho Salmon redds were recorded in the 2023 season. Of these fall redds, 22 of them had fish on or near the redd. Increased beaver activity in Stream C over the last few years has caused lower stream flow downstream of the dam structures. Several informal observations of Stream C occurred throughout the fall of 2023 to assess activity. The consistently high number of redds observed in Stream C since 2017 demonstrates there is excellent water quality that supports fish habitat in this stream.

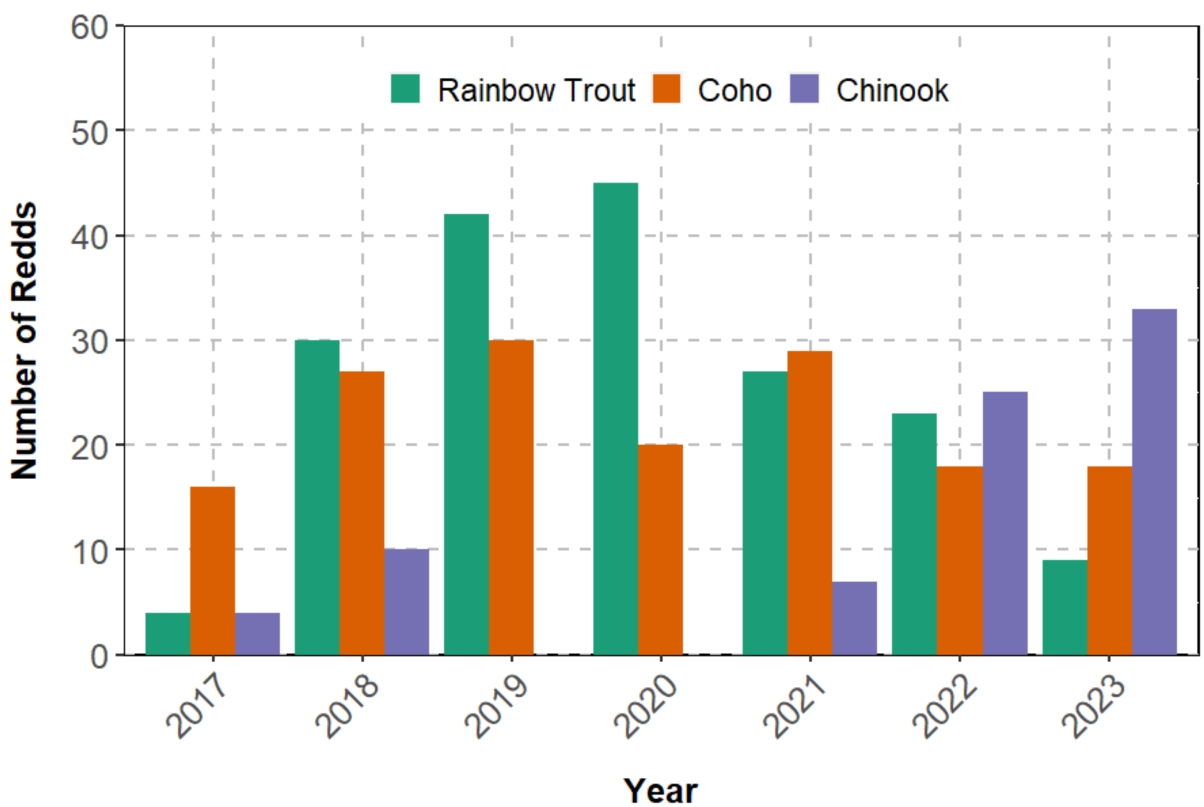


Figure 56 - Counts of Redds Observed in Stream C between 2017 and 2023

Redd surveys of Stream C will continue in the spring and fall of 2024 to confirm the suitability of this waterway for spawning, hatching, and rearing of fish.

6.2.4.10 Vehicle and Wildlife Interaction

Monitoring of vehicle-wildlife collisions on local roadways began in July 2017 to improve our understanding of wildlife mortality caused by vehicle collisions. This monitoring continued in 2023 with 48 formal surveys completed. Surveys occurred up to three times per week and were concentrated during peak wildlife migration periods or times (spring and fall, heavy rainfall events).

Standardized two pass surveys occurred on the main access roads that run between Highway 21 and Bruce Power (Bruce Road 20 – Segment 5; Concession 2 – Segment 4) and on the major on-site roadways that have the most traffic (Segments 1,2 3 and 6). Concession 6 (Segment 7) was added in 2019 because of increased traffic around the Farrell Drive industrial complex (Figure 57). Surveys were completed after 9:00 a.m. on weekdays after the peak morning traffic had subsided. All animals were identified to the species-level (wherever possible), photographed and georeferenced. Incidental observations of wildlife carcasses (outside of the formal surveys) were also recorded throughout the year.

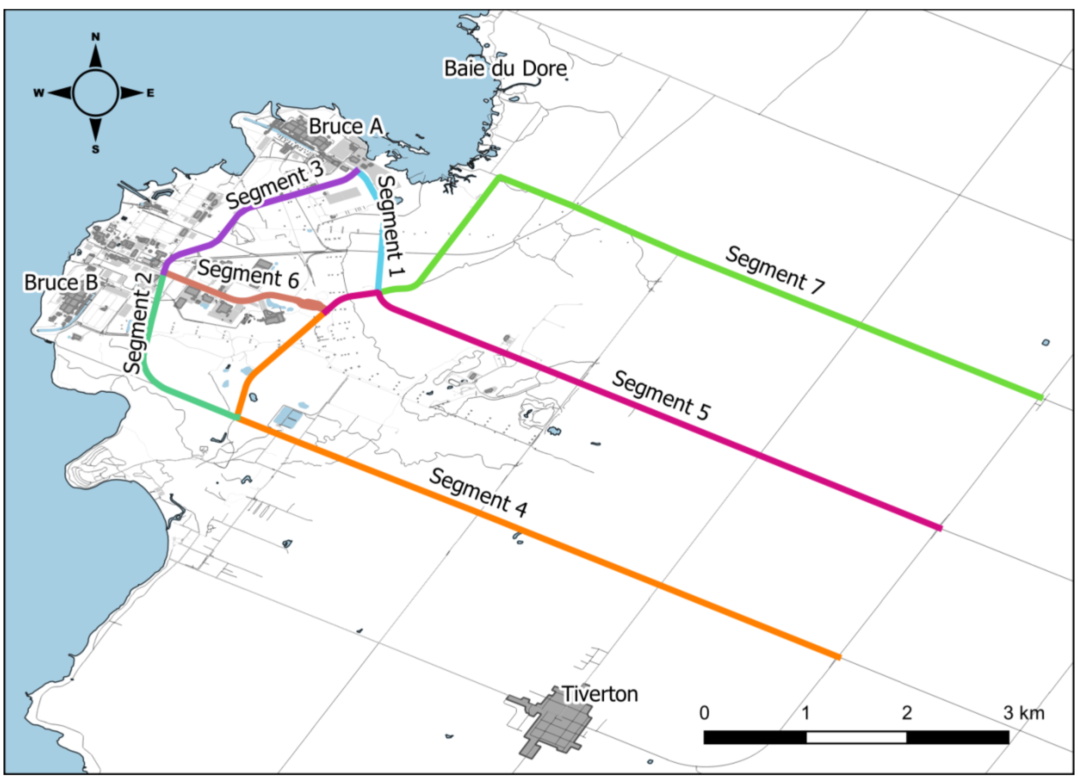


Figure 57 - Vehicle-Wildlife Collision Survey Areas

In total, 75 wildlife carcasses were recorded over the 48 formal surveys conducted in 2023 (1.6 animals per survey day in 2023). This is lower than 2017 and 2022, but consistent with most other years (Table 46).

Table 46 - Results of Vehicle-Wildlife Collision Surveys Conducted in the Local Area (2017-2023)

Year	Number of Surveys Completed	Number of Deceased Animals Observed During Formal Surveys	Mortality Rate (Number of Animals Divided by Number of Surveys)
2017	19	43	2.3
2018	46	60	1.3
2019	46	78	1.7
2020	37	50	1.3
2021	48	83	1.7
2022	48	119	2.5
2023	48	75	1.6

Of all the carcasses recorded, mammals constituted 41%; reptiles 28%, amphibians 15%; birds 11% and insects 5%. The most recorded species were North American Porcupine (*Erethizon dorsatum*), Grey Squirrel (*Sciurus carolinensis*), Raccoon (*Procyon lotor*) and Northern Leopard Frog (*Lithobates pipiens*). A total of 18 Species at Risk were recorded in 2023, including three Barn Swallows (*Hirundo rustica*), four Midland Painted Turtles (*Chrysemys picta*), three Snapping Turtles (*Chelydra serpentina*), three Eastern Ribbonsnakes (*Thamnophis sauritus*), four Monarchs (*Danaus plexippus*) and one other turtle species.

Table 47 - Mortality by Survey Segment as a Proportion (%) of the Annual Total (2017-2023)

Year	**Segment 1**	**Segment 2**	**Segment 3**	**Segment 4**	**Segment 5**	**Segment 6**	**Segment 7**
2017	7	14	5	42	33	0	Not surveyed
2018	13	12	8	37	28	2	Not surveyed
2019	10	19	18	29	13	10	Not surveyed
2020	18	8	8	34	16	0	16
2021	13	19	6	24	12	2	23
2022	20	24	2	18	16	4	17
2023	16	9	3	12	23	9	28
Average Proportion (%)	*14*	*15*	*7*	*28*	*20*	*4*	*21*

Among road segments, Segment 7 experienced the highest collision rates when all wildlife classes were grouped together. This segment accounted for 28% of all recorded mortalities. Segment 5 had the second highest rate at 23%, followed by Segment 1 with 16% of the total mortalities. All three of these road segments have good quality, diverse woodlots with significant water features and provide preferred wildlife habitat. The main entrance to Inverhuron Provincial Park is located on the west end of Concession 2 (Segment 4) and this adds considerable traffic to all the concession roads between the months of June and September. The park sees approximately 120,000 visitors over the course of the season. Segment 7 and Segment 6 are dissected by the Algonquin bluff which remains a vital wildlife corridor within Bruce County.

Bruce Power has installed road signs on Bruce Rd 20 (segment 5) and on Concession 2 (segment 4), warning drivers of turtle and snake crossings. In 2023, the Municipality of Kincardine replaced and lowered the culvert on Tie Road, providing an alternative (and safer) means for wildlife to cross this road.

Increased vehicle presence at the Bruce Eco-Industrial Park and the continuation of Major Component Replacement work has led to an increased use of all concession roads leading to the Bruce Power site. Monitoring of these roadways will continue into 2024.

7.0 GROUNDWATER PROTECTION PROGRAM

The Canadian Standards Association N288.7 Standard entitled: Groundwater protection and monitoring for nuclear facilities and uranium mines and mills ("*the standard*") [R-164] provides requirements and guidance on the elements of a groundwater protection program and detailed guidance on developing groundwater monitoring programs as components of a groundwater protection program. The Bruce Power Groundwater Monitoring program has been in place since the late 1990's. The Groundwater Protection program is part of a wider environmental monitoring program at Bruce Power and has been in alignment with the standard since 2021.

The Groundwater Protection program has established groundwater protection goals and groundwater monitoring objectives. Performance against these objectives are documented annually through a program assessment under separate cover. A review of the annual monitoring and sampling which was carried out in 2023 is provided below and confirms that Bruce Power has in place a program which:

- Prevents or minimizes releases of nuclear or hazardous substances to groundwater,
- Prevents or minimizes the effects of physical stressors on groundwater end-uses, and
- Confirms that adequate measures are in place to stop, contain, control, and monitor any releases and physical stressors that can occur under normal operation.

The results of the 2023 Groundwater Monitoring program demonstrate that groundwater quality on the Bruce Power site is within historical trending. There were no observations of unforeseen conditions which would represent potential adverse impacts to human health or the environment.

7.1 Sampling and Analysis Plan

Water level measurements occurred at approximately 160 groundwater well locations and were used to infer the groundwater flow conditions at the Bruce Power site.

Groundwater sampling was carried out in the spring and fall of 2023. The main contaminants of concern are tritium and petroleum hydrocarbons based on on-going operational activities. Other parameters include anions and nutrients, metals, volatile organic compounds, and perfluoroalkyl and polyfluoroalkyl substances. Groundwater parameters are chosen based on the following:

- Confirm presence or absence of releases from systems, structures and components identified as having potential for impact to groundwater,
- Provide information where potential information gaps exist (environmental risk assessment, conceptual site model, buried piping program)
- Monitor impacted areas to confirm that there is no risk to end-use receptors

Sampling was carried out at nine locations in 2023 (see Figure 58). The Fire Training Facility, the Soil Management Area and the Bruce Heavy Water Lands were sampled in the spring and fall with the remainder only sampled in the fall. Groundwater samples for tritium were collected from monitoring locations within the Bruce A and Bruce B protected areas as shown in Figure 59 and Figure 60 respectively.

Figure 58 - 2023 Bruce Power Conventional Groundwater Sampling Locations

Figure 59 - Bruce A Radiological Groundwater Sampling Locations

Figure 60 - Bruce B Radiological Groundwater Sampling Locations

7.2 Sampling Methodology

Monitoring wells were purged and sampled using the “low flow” technique, that is, purging the well at a slower flow rate and recording measurements of field chemistry parameters frequently – every 3 to 5 minutes. Field chemistry parameters including temperature, electrical conductance, pH, oxidation reduction potential and dissolved oxygen were recorded utilizing field metres throughout purging. Sampling occurs once field parameters have stabilized, which is indicative of stabilized groundwater conditions and ensures that the sample is representative of the surrounding formation. Sampling was performed in alignment with American Society for Testing and Measures standard D6771 [R-165].

7.3 Quality Control

Data quality for the 2023 groundwater sampling campaign was evaluated using groundwater samples which were collected from June 20 to June 23 and from October 13 to October 20. The evaluation followed individual method requirements and guidelines from the United States Environmental Protection Agency National Functional Guidelines for Inorganic Superfunds Method Data Review (Environmental Protection Agency 2020a) [R-166 and National Functional Guidelines for Organic Superfunds Method Data Review (Environmental Protection Agency 2020b) [R-167]. The analytical results were evaluated using the criteria of precision, accuracy, representativeness, comparability and completeness. The data quality evaluation covered 97 normal groundwater samples, 13 normal surface water samples, 5 normal soil samples, 16 groundwater field duplicate samples, 4 surface water field duplicate samples, 2 soil field duplicate samples, 13 field blank samples, 16 trip blank samples and the associated laboratory quality control samples.

The data quality evaluation is an assessment of whether the data meet the predefined data quality objectives. The goal of the assessment is to demonstrate that a sufficient number of representative samples have been collected and the resulting analytical data can be used to support project decision-making processes.

For 2023, the groundwater analytical data provided for evaluation was considered valid and can be used for decision making.

7.4 Evaluation Criteria

Groundwater sample results for conventional parameters are compared against the Ministry of Environment, Conservation and Parks Site Condition Standards [R-168] (either Table 2 –Full Depth Generic Site Condition Standards in a Potable Groundwater Condition or Table 8 – Generic Site Condition Standards for Use Within 30m of a Water Body in a Potable Groundwater Condition based on groundwater monitoring site location). These evaluation criteria are considered protective of the environment and human health and do not represent reportable limits.

For the purpose of identification of changes in conditions, groundwater sample results for tritium are compared against statistically based evaluation criteria. These criteria are derived using a mean plus three standard deviations approach. This value is established as the upper level of background and provides a reasonable benchmark for the identification of anomalous results which may potentially require further investigation or trending. This value is calculated using results from all wells which would be considered “similar” in terms of atmospheric tritium exposure. Seasonality is not differentiated in the derivation of the value.

The criteria are applied to identify any anomalous results which may require further investigation. As part of the follow up investigation, five-year trends for monitoring locations with results which were observed to be greater than the evaluation criteria are reviewed to verify that levels are within historical range or are decreasing. These plots are shown below.

7.5 Results

7.5.1 Groundwater Flow Conditions

Groundwater level measurements were taken over the entire site between October 11 and October 12. In 2023, a total of 151 locations were inspected and had water levels taken.

The shallow groundwater table is expected to be highly variable because of the presence and variable depths of extensive fill areas, which influence surface water drainage and infiltration and have variable hydraulic conductivities. Although the overburden groundwater is generally expected to flow westward toward Lake Huron, local groundwater flow direction and regimes may be highly variable, in part because of the presence of subsurface structures, utility trenches, foundations, and so on. Some shallow groundwater may flow towards surface water features (drains, ditches, wetlands, etc.). The upper bedrock at the Site is fractured; therefore, it is expected that shallow groundwater will also flow downward to the bedrock. The flow direction of the deeper groundwater within the bedrock will be influenced by the size and degree of bedrock fracture interconnections but is ultimately controlled by the hydraulic gradient.

Based on water level measurements taken, the inferred groundwater flow direction remains unchanged from 2022.

7.5.2 Groundwater Sampling Results

Groundwater samples for tritium were taken from wells within the protected area in the spring and fall of 2023. The 2023 data can be found in APPENDIX G. Spring and fall criteria values were calculated and were applied against spring and fall sampling results respectively. Figure 61, Figure 62 and Figure 63 show the monitoring locations which were found to be above the applied criteria. The fall evaluation criterion (red line) was plotted to simplify the presentation of the data. Tritium levels observed in BATR-1-14B appear to be increasing and this is in alignment with increased tritium in air emissions from Bruce A in 2022 and 2023. Tritium in groundwater is a result of atmospheric wet deposition from station air emissions. This is supported through higher tritium levels in wells with shallower intervals and increased observations in the spring due to snow melt and increased precipitation. Monitoring at this location will continue in 2024. Tritium levels observed in BATR-3-12 and BBTR-7-12 appear to be decreasing with BATR-3-12 falling below the criterion in the fall. Monitoring at these locations will continue in 2024 to confirm these decreasing trends.

Overall, tritium in groundwater results within the protected areas generally fall below evaluation criteria. Results shown to be above this criteria are confirmed to be in alignment with station emissions and are decreasing. Continued monitoring will confirm these observations.

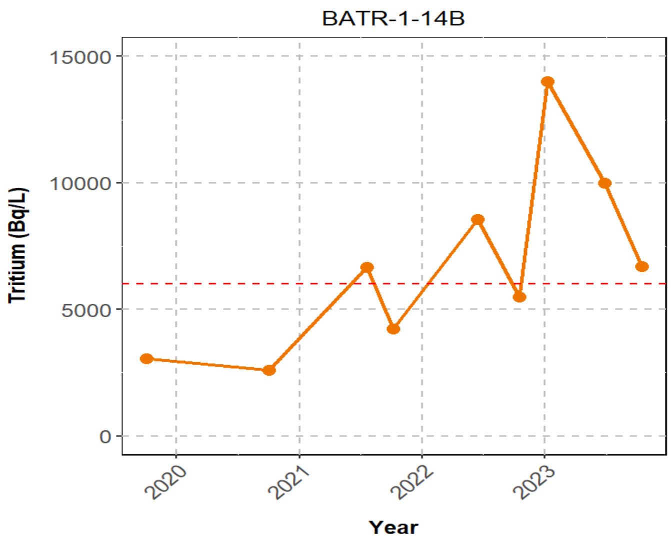


Figure 61 - Tritium in Groundwater at BATR-1-14B (Dashed line represents evaluation criteria of 6000.1 becquerels per litre)

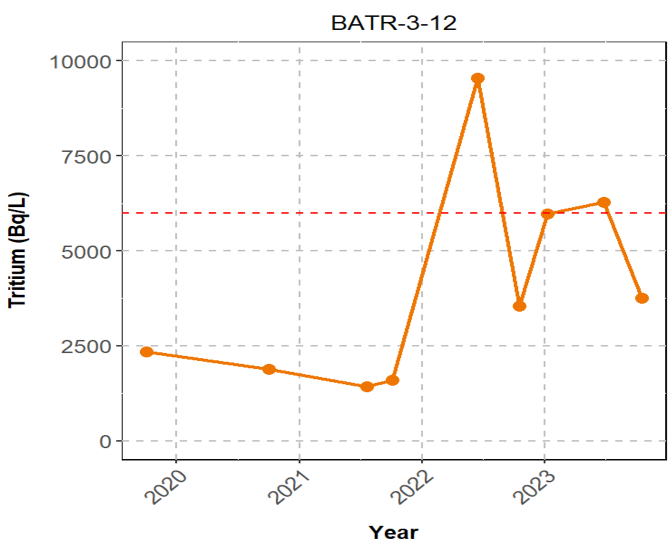


Figure 62 - Tritium in Groundwater at BATR-3-12 (Dashed line represents evaluation criteria of 6000.1 becquerels per litre)

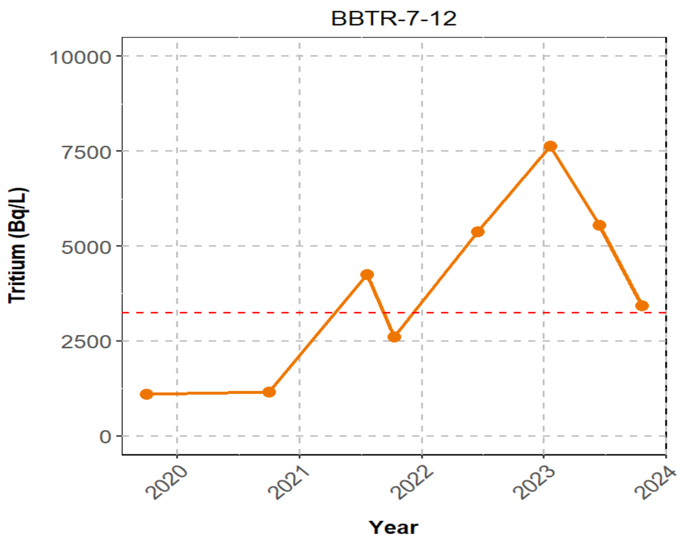


Figure 63 - Tritium in Groundwater at BBTR-7-12 (Dashed line represents evaluation criteria of 3228.1 becquerels per litre)

Groundwater samples for petroleum hydrocarbons were taken from monitoring wells located across the Bruce Power site according to the sampling and analysis plan and as per Figure 58. Dissolved petroleum hydrocarbons were observed above the applied site condition standard at several monitoring locations and are related to past events. These results were within historical trends and shown to be decreasing. The applied standard is considered protective of human health and the environment but does not represent a reportable limit. Where results were observed to be above the evaluation criteria, five-year trends confirm that the result is not of concern and decreasing as expected. It is important to note that Bruce Power adopted a low-flow sampling methodology in the fall of 2022. The low flow method is established to better reflect the dissolved concentrations of petroleum hydrocarbons. The observed higher concentrations within the well-volume method samples (prior to low flow sampling) likely reflect interference from entrained sediments or immiscible product due to agitation of the water column and do not provide representative observations of the dissolved groundwater concentration only. The plots are shown below.

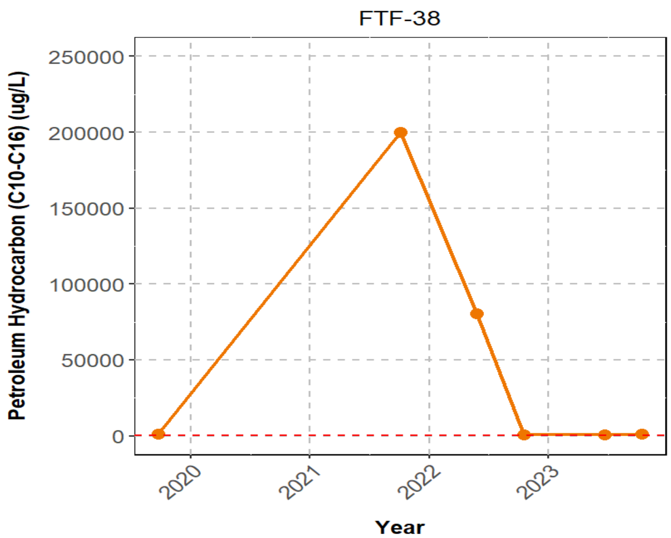


Figure 64 - Petroleum Hydrocarbons (F2) in Groundwater at FTF-38 (Dashed line represents evaluation criteria of 150 micrograms per litre)

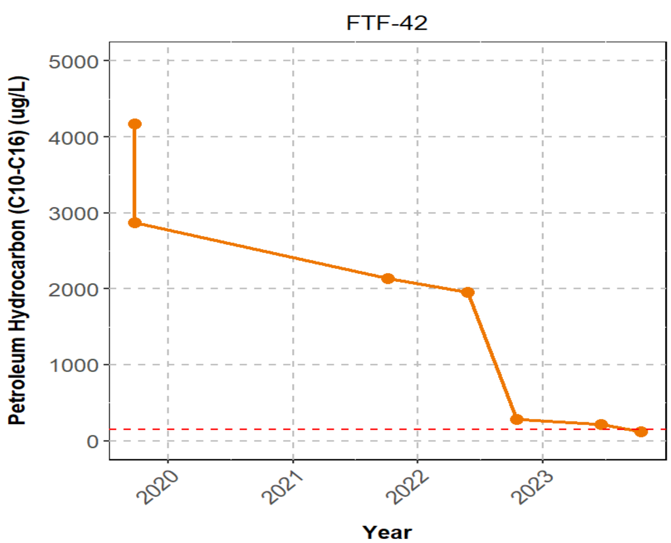


Figure 65 - Petroleum Hydrocarbons (F2) in Groundwater at FTF-42 (Dashed line represents evaluation criteria of 150 micrograms per litre)

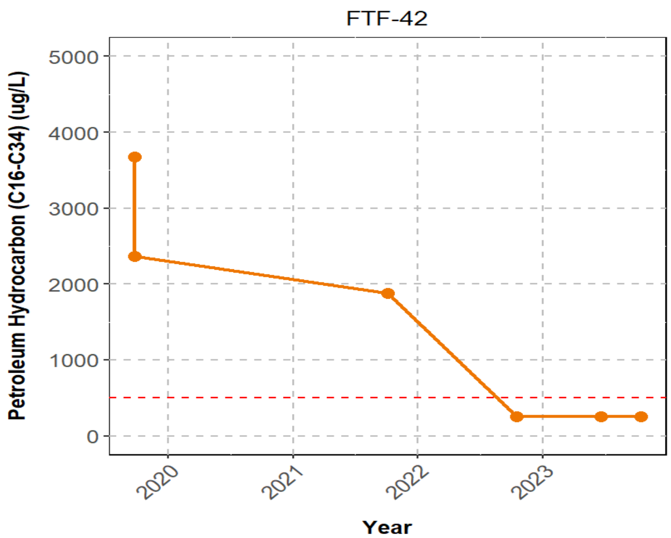


Figure 66 - Petroleum Hydrocarbons (F3) in Groundwater at FTF-42 (Dashed line represents evaluation criteria of 500 micrograms per litre)

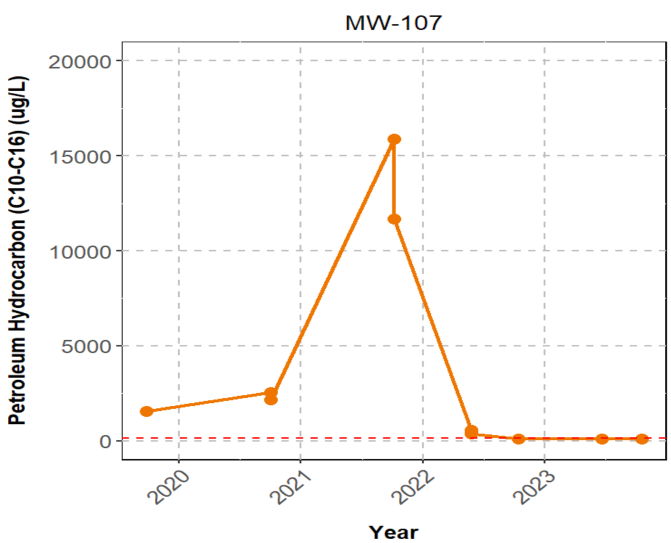


Figure 67 - Petroleum Hydrocarbons (F2) in Groundwater at MW-1-07 (Dashed line represents evaluation criteria of 150 micrograms per litre)

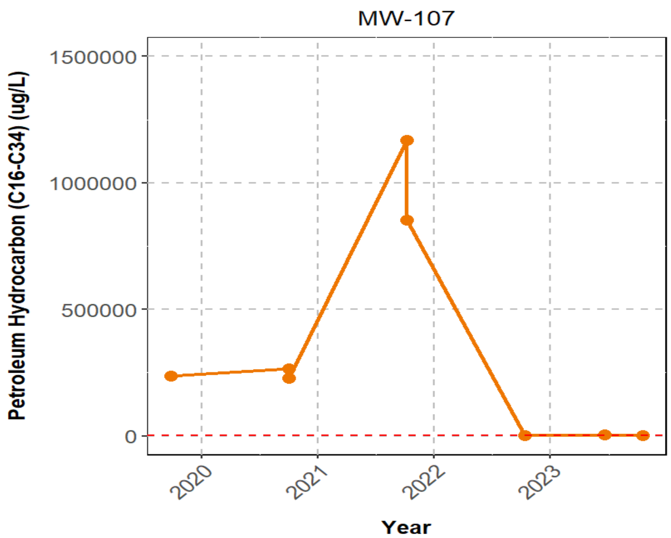


Figure 68 - Petroleum Hydrocarbons (F3) in Groundwater at MW-1-07 (Dashed line represents evaluation criteria of 500 micrograms per litre)

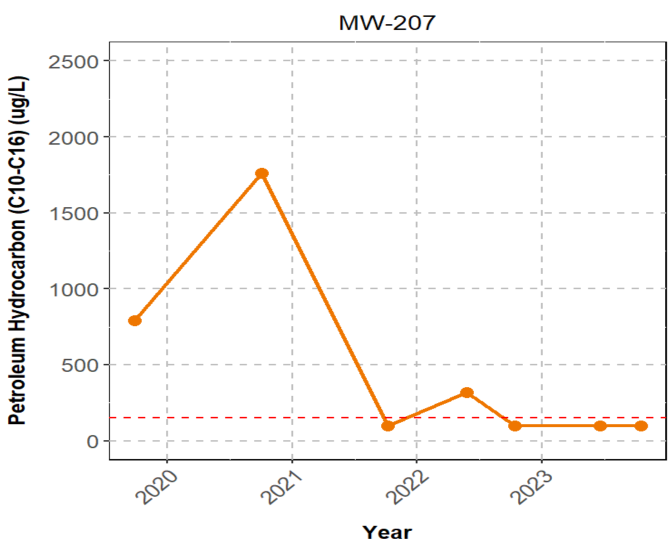


Figure 69 - Petroleum Hydrocarbons (F2) in Groundwater at MW-2-07 (Dashed line represents evaluation criteria of 150 micrograms per litre)

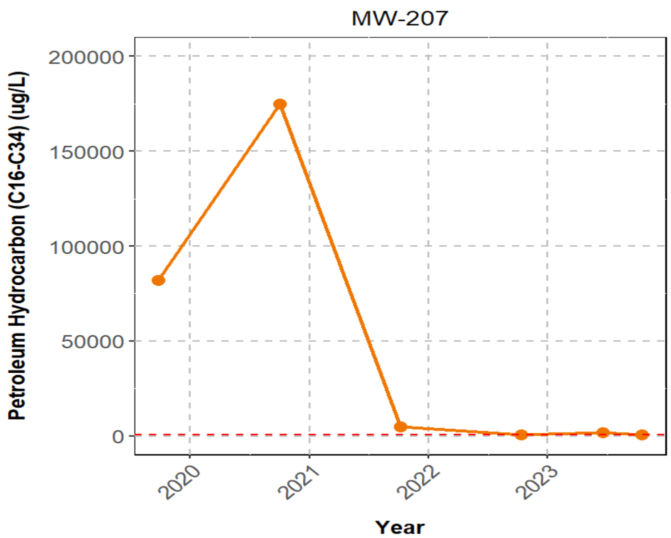


Figure 70 - Petroleum Hydrocarbons (F3) in Groundwater at MW-2-07 (Dashed line represents evaluation criteria of 500 micrograms per litre)

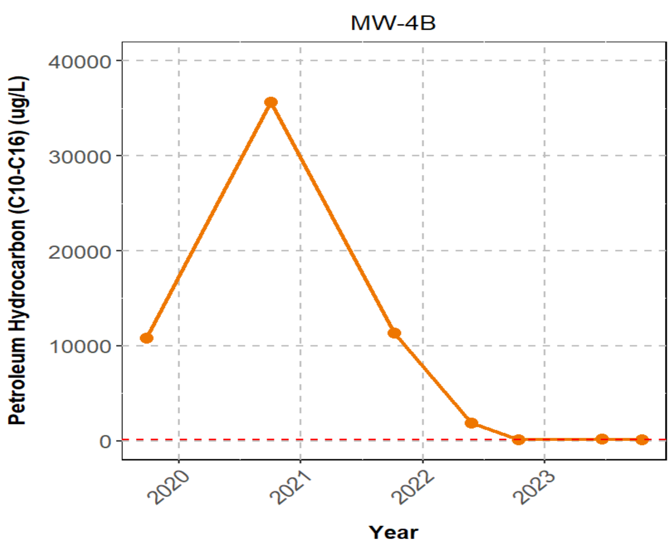


Figure 71 - Petroleum Hydrocarbons (F2) in Groundwater at MW-4B (Dashed line represents evaluation criteria of 150 micrograms per litre)

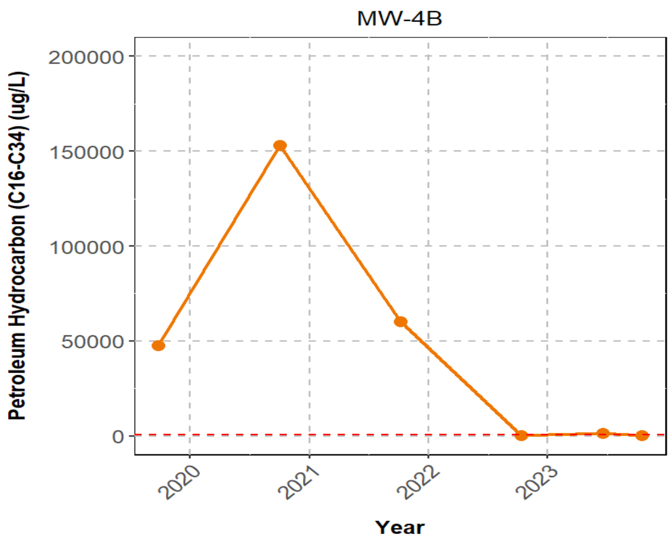


Figure 72 - Petroleum Hydrocarbons (F3) in Groundwater at MW-4B (Dashed line represents evaluation criteria of 500 micrograms per litre)

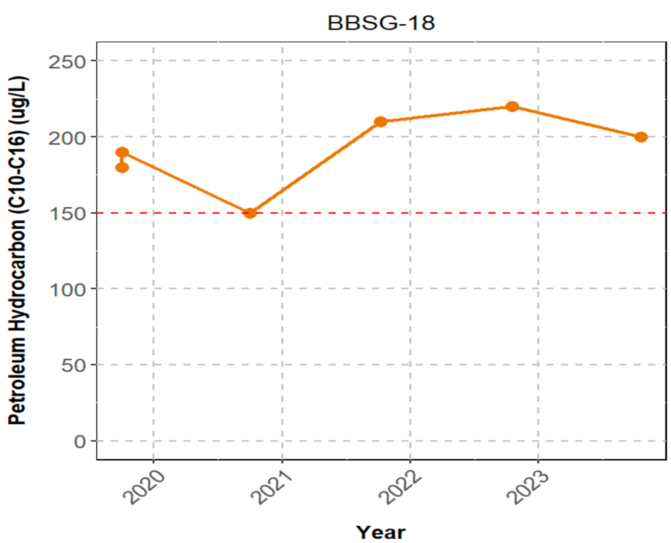


Figure 73 - Petroleum Hydrocarbons (F2) in Groundwater at BBSG-18 (Dashed line represents evaluation criteria of 150 micrograms per litre)

Other results to note included observations of sodium, chloride, chloroform, and dissolved metals vanadium, nickel, and arsenic as well as perfluoroalkyl and polyfluoroalkyl substances. Discussion on these observations is provided below.

- Sodium and chloride - related to road salting at Bruce B and former Acid Wash Pond
- Vanadium and Nickel - related to historical boiler cleaning activities at the former Acid Wash Pond area
- Arsenic – minor exceedance at the Soil Management Area
- Chloroform – residual contamination from a domestic water line leak in front of Unit 3
- Perfluoroalkyl and polyfluoroalkyl substances – observations related to the use firefighting foams related to training activities. No criteria currently exists for these substances. They are compared against the Health Canada Drinking Water Screening criteria as a conservative measure.

All of these results were shown to be within historic ranges and/or decreasing and are not a cause for concern. Monitoring will continue in 2024 to ensure this trend continues. Results are included in APPENDIX G.

8.0 WASTE MANAGEMENT

Bruce Power manages many different forms of waste to ensure they are disposed of safely without polluting the environment:

- Hazardous waste (oils, chemicals, lighting lamps and ballasts – some of these are recycled)
- Recyclable waste (glass, plastic, metal, cardboard, paper, wood, batteries, and electronics)
- Organics waste (food waste, compostable materials, paper towels)
- Radiological waste (low-, intermediate-, and high-level radiological waste is transferred to Ontario Power Generation for further processing and storage)
- Landfill waste (wastes that are neither hazardous, recyclable, compostable, nor radiological)

Bruce Power complies with all waste regulations and requirements of the relevant Federal, Provincial, and Municipal authorities. Further, Bruce Power has taken an active role for many years to reduce all forms of waste: from an environmental and financial standpoint waste reduction is good for our company and the community in which we reside. Our philosophy employs a whole life-cycle approach in that we reduce waste at the consumer level, generate less waste at the company level, find opportunities to reuse products (on-site, off-site donations, or sell them at auction), and implement recycling programs that are available in the ever-changing recycling market. To minimize the amount of waste sent to landfill each day, Bruce Power has implemented several initiatives that apply the principles of reduce, reuse, recycle, and recover. Wherever its fate, each waste stream generated at Bruce Power is processed and disposed of in a safe and environmentally responsible manner.

Table 48 summarizes the waste management and pollution prevention reports submitted to regulatory agencies.

Table 48 - Bruce Power Waste Regulatory Reporting

Waste	**Report Title**	**Regulatory Agency**	**Submission Date (Frequency)**
Conventional Waste	Report of a Waste Reduction Work Plan, *O Reg 102/94*	Internal Report	Q1 2024 (Annual)
Conventional Waste	Report of a Waste Audit, *O Reg 102/94*	Internal Report	Q1 2024 (Annual)
Waste & Pollution Prevention - Polychlorinated Biphenyl	*Federal PCB Regulations* Bruce Power 2023 Annual Report Declaration	Environment and Climate Change Canada	March 31, 2024 (Annual)
Waste & Pollution Prevention - Polychlorinated Biphenyl	2023 Annual Polychlorinated Biphenyl Waste Storage Report for Bruce A Storage Facility #10400A003	Ministry of Environment, Conservation and Parks	January 31, 2024 (Annual)
Waste & Pollution Prevention - Polychlorinated Biphenyl	2023 Annual Polychlorinated Biphenyl (PCB) Waste Storage Report for the Waste Chemical Transfer Facility Storage Facility #10402A001	Ministry of Environment, Conservation and Parks	January 31, 2024 (Annual)

8.1 Conventional Waste

The primary objective of the Conventional Waste Program is to process wastes in a safe and environmentally responsible manner while diverting as much waste from landfill as possible. Bruce Power achieves waste minimization through the application of reduce, reuse, recover, repurpose and recycle principles.

Conventional waste at Bruce Power is managed and disposed of in accordance with regulatory requirements including:

- The *Ontario Environmental Protection Act* [R-169]
- *Ontario Regulation 347, General Waste Management* [R-170]
- *Ontario Regulation 103/94, Industrial, Commercial and Institutional Source Separation Programs* [R-171]
- *Ontario Regulation 102/94, Waste Audits and Waste Reduction Work Plans* [R-172]
- *Transport Canada's Transportation of Dangerous Goods Act* [R-173]

Management of conventional waste includes all non-hazardous and non-radiological items: recyclables, compost, and waste destined for landfill. As defined in *Ontario Reg.103/94* [R-171], Bruce Power is a large manufacturing establishment and is mandated to have recycling programs in place for the following materials:

- Aluminum
- Cardboard (corrugated)
- Fine paper
- Glass
- Newsprint
- High Density Polyethylene (jugs, pails, crates, totes, and drums)
- Low Density Polyethylene (film*)
- Polystyrene expanded foam*
- Polystyrene trays, reels and spools*
- Steel
- Wood (Excluding painted, treated, or laminated wood)

*Limitations apply depending on the availability of service providers able to recycle these materials.

In addition to these recycling programs, Bruce Power has an established composting program for organic waste including food waste, paper towels, and biodegradable coffee cups, lids and food containers.

Bruce Power utilizes approved waste disposal vendors to collect conventional wastes on site. Waste disposal vendors are bound by Environmental Compliance Approvals that stipulate approved wastes that can be accepted by the landfill or facility.

As shown in Table 49, the total amount of conventional waste produced at Bruce Power in 2023 was 2,268 metric tons. While 707 metric tons of waste were sent to landfill, a total of 1,561 metric tons were diverted to a recycling or compost program. More than two-thirds of all the conventional waste produced in 2023 was diverted from landfill.

Table 49 - Conventional Waste Generated at Bruce Power from 2016 to 2023 [1 metric ton (mt) = 1,000 kg]

Year	Landfill (mt)	Compost (mt)	Recycling (mt)	Total (mt)	Diversion Rate
2016	555	103	1,145	1,965	64%
2017	462	97	1,042	1,795	63%
2018	572	111	1,226	1,967	68%
2019	609	61	1,287	2,016	67%
2020	524	62	1,219	1,805	71%
2021	597	98	1,457	2,152	72%
2022	929	93	1,851	2,873	68%
2023	707	78	1,483	2,268	69%

In 2023, 31% of Bruce Power's conventional waste was sent to landfill, 3% was composted, and the remainder was recycled via several different recycling streams (65%). The distribution among different waste streams has changed significantly over time, depending on the types of activities occurring at the company (commissioning/decommissioning) and the different recycling processes available in the global waste management market.

As per *Ontario Regulation 102/94* [R-172], Bruce Power must also perform an annual conventional waste audit. The waste audit must be completed by a third-party vendor, and a waste audit report that includes a waste reduction work plan must be prepared for Bruce Power. Independent assessments of Bruce Power's performance in conventional waste management have occurred annually for many years. The auditor's assessments consistently show that Bruce Power is performing well in comparison to other large industrial facilities.

8.1.1 Diversion Initiatives

Bruce Power makes every effort to increase diversion whenever possible. In addition to the compost and recycling streams provided by our standard conventional waste vendor, we have set up additional contracts and relationships to further divert waste on site from landfill. Some examples of the additional diversion streams include e-wastes scrap metal, Styrofoam, binder recycling and reuse, film plastic and furniture donation to local Not for Profits. In addition, Bruce Power worked on increasing waste diversion by improving signage and messaging about waste streams across site in accordance with the site's Waste Reduction Work Plan prepared in compliance with *Ontario Regulation 102/94, Waste Audits and Waste Reduction Work Plans* [R-172]. This new signage included pictures of common waste types sold or used on site to help employees determine which waste stream is appropriate to use. This is typically updated annually to keep up with the changes in products and packaging offered on site. Articles in the company newsletter as well as segments in the monthly safety and performance excellence videos were also used to reiterate expectations to ensure employees are diverting their waste correctly.

8.2 Hazardous Waste

Bruce Power's Hazardous Waste Program ensures the safe handling, storage and disposal of hazardous wastes in accordance with regulatory requirements outlined in the *Environmental Protection Act, Ontario Regulation 347, General Waste Management* [R-174].

Hazardous wastes, such as chemicals, oils, batteries, and fluorescent tubes, are generated at numerous locations on-site. They are carefully tracked to ensure all hazardous waste is safely disposed of in accordance with all applicable regulatory requirements. Bruce Power has an excellent network of external waste vendors (certified to carry and/or receive hazardous wastes) who frequently work with us to dispose of all our hazardous waste streams in an industrially and environmentally safe manner. Hazardous wastes are routinely diverted from landfill by recycling batteries, light tubes, oil, and electronic waste.

8.2.1 Oil Recycling

In 2021, a site wide oil recycling program was established with a hazardous waste vendor to recycle oils from turbine lubricating oil and electrical transformer systems. The used oil from these systems are often of high-quality with low levels of contaminants such as water, particulate or chemicals. As such, these used oils can be recycled and reused in other industrial applications.

In 2023, Bruce Power disposed of 520,511 litres of oil with 365,591 litres being recycled. This means 70% of Bruce Power's waste oil was able to be recycled and reused, reducing a significant quantity of oil that would otherwise go to the hazardous waste stream.

8.2.2 Hazardous Waste Inspections

In February 2023, the Ministry of Environment, Conservation and Parks performed a Subject Waste inspection at both Bruce A and Bruce B stations. No instances of non-compliance or non-conformance were identified during the inspection and no further action was required, as a result of the inspection, by the ministry. Some general observations included that Bruce Power has a valid registration number as required by *Regulation 347*, Bruce Power has properly registered all their subject waste on the Hazardous Waste Program Registry, Bruce Power has characterized their waste in accordance with the Generator Registration Manual, and Bruce Power has stored, handled, and maintained subject waste to prevent leaks or spills.

Additionally, the Canadian Nuclear Safety Commission performed a Hazardous Waste field inspection of the Bruce B chemical waste area in December of 2023. The Canadian Nuclear Safety Commission found Bruce B to be in compliance with the regulatory and licence requirements. Monthly inspections of Bruce Power's two licensed Provincial Polychlorinated Biphenyls Waste Storage Facilities continue to occur as required by the Federal *Polychlorinated Biphenyls Regulations Statutory Orders and Regulations/208-273 2008* [R-175]. No significant issues were identified in 2023.

8.2.3 Polychlorinated Biphenyls

According to the *Polychlorinated Biphenyls Regulation Statutory Orders and Regulations* /208-273 [R-175], equipment containing Polychlorinated Biphenyls in a concentration of at least 50 parts per million but less than 500 parts per million, must have the equipment removed from site by December 31, 2025. This includes electrical transformers and their auxiliary electrical equipment, lighting ballasts, and capacitors. Electrical cables, not in use, in any concentration must also be removed so that they are not "abandoned in place" which is a violation of the *Environmental Protection Act* [R-115]. Currently, there is no regulatory removal date for Polychlorinated Biphenyls cables that are in use. In 2018, a plan was created for Polychlorinated Biphenyls removal, focusing on the above equipment, to meet the regulatory deadline of December 31, 2025. This plan is reviewed and updated on a regular basis to ensure that Bruce Power will complete the Polychlorinated Biphenyls removal work before the regulatory deadline. In 2023, 101 drums of Polychlorinated Biphenyls electrical equipment and lighting ballast waste was disposed of in support of this regulatory requirement.

9.0 AUDITS

Bruce Power has an internal audit program to meet the auditing requirements of both the N288 series of environmental standards for nuclear power plants and the Canadian Standards Association International Standards Association 14001, Environmental Management System standard. This audit program identifies areas of non-conformance with the standards where corrective actions are taken as well as identifies opportunities for improvement for consideration. Internal audits take a deep dive into process and is able to identify areas that show weaknesses which when strengthened contribute to a more robust system.

Bruce Power also undergoes an audit of the environmental management system by an external, accredited third party auditor. This audit occurs annually with one in every three years being a re-certification audit which confirms adherence to the International Organization for Standardization 14001 standard.

9.1 Internal Audits

9.1.1 N288 Series of Environmental Standards for Nuclear Power Plants

In 2023 there were internal audits conducted for the N288.4-10, Environmental Monitoring Programs at Nuclear Facilities and Uranium Mines and Mills [R-5], N288.5-11, Effluent Monitoring Programs at Class 1 Nuclear Facilities and Uranium Mines and Mills [R-16] and N288.8-17, Establishing and Implementing Action Levels for Releases to the Environment from Nuclear Facilities standards in the N288.8 Series of Environmental Standards. Additional audits were used to credit the evaluation of the core elements of the N288.4 and N288.5 audits and this approach is detailed in the audit plan. The Dosimetry audit as well as the Audit of the Audit evaluated in part some of the elements of the standards.

The Canadian Standards Association N288.4/.5 Effluent and Environmental Monitoring Audit overview concluded the environmental monitoring progrm under N288.4-10 had general conformance and the effluent monitoring program did not, in specific occurances, fully conform with the requirements of N288.5-11 in the areas of records, sample analysis and equipment calibrations that are primarily associated with station chemistry [R-176]. Corrective actions have been put in place and are tracked to ensure completion.

There were no deficiencies identifed with the design of the effluent monitoring and environmental monitoring programs. It was noted both programs perform adequate risk assessments for the protection of human and non-human biota [R-176].

The N288.4-10 portion of the audit showed some shortcomings with the fish impingement program in the areas of minor procedural non-adherence and documentation. The potential impacts of these minor non-conformances were assessed and it was determined that there would be no impact to the actual identification, quantification and recording of fish impinged. These issues were rectified by completing procedure revisions and ensuring latest revisions were available in the pumphouses. All corrective actions are complete. There were no deficiencies related to field observations of radiological environmental monitoring performed by the Health Physics Lab in relation with the N288.4 portion of the audit [R-176].

The audit against the requirements of the N288.8-17, Establishing and Implementing Action Levels for Releases to the Environment from Nuclear Facilities standard confirmed the development and implementation of action levels for releases to the environment was effective and performed in compliance with the standard [R-177].

In 2020 there was an audit of the Canadian Standards Association N288.7-15, Groundwater Protection Programs at Class 1 Nuclear Facilities and Uranium Mines and Mills [R-18]. The next audit to the N288.7 standard will be in 2025.

9.1.2 Canadian Standards Association International Standards Association 14001 Environmental Management System Standard Internal Audit

The 2023 internal audit conducted for the International Standards Association 14001 Environmental Management System Standard concluded Bruce Power has a mature Environmental Management System that is effectively implemented and maintained in conformance with the requirements of the Bruce Power Management Systems as well as the 14001 standard [R-178]. There was an area of weakness identified within the conventional air emissions program pertaining to the implementation of the revised *Federal Halocarbon Regulations*, specifically for the completion of an activity log for cylinders, physical tagging of equipment and minor administrative requirements not yet updates in the program governance. Bruce Power has developed corrective actions to address the audit findings and continues drive towards excellence in environmental protection via a continuously improving environmental management system.

9.2 External Audits

9.2.1 Canadian Standards Association International Standards Association 14001 Environmental Management System Standard (External Audit)

The 2023 external audit was a re-registration audit which confirmed Bruce Power's conformance to the International Organization for Standardization 14001, Environmental Management Systems standard.

There were no non-conformances and no opportunities for improvement identified, therefore no corrective actions were required as a result of the 2023 environmental management system external audit.

Bruce Power received "Outstanding", the highest score, in the areas of Management, Internal Audits, Operational Control and Resources. Noting there was strong evidence of:

- Management commitment, customer and/or interested party satisfaction, knowledge and awareness across the company of environmental policy and objectives and senior management is fully engaged in supporting the environmental management system.

- Internal audits are performed at planned intervals, audit reports are clear and concise, actions taken as a result of internal audits demonstrate a significant and measurable improvement over time, the corrective action process ensures timely implementation and overall effectiveness of resolution and audit findings indicate a deep dive into respective areas.

- Operational controls are planned, developed and are consistent with management processes; processes and activities run consistently, data is collected and reviewed to verify the effectiveness of operational controls with evidence of significant improvement trends. Best practices and Lessons Learned are shared throughout the organization.

- Resources for effective maintenance and improvement of the management system are defined and effectively deployed. Levels of competency are defined and demonstrated, and lesson learned and best practices are used regularly to determine resource requirements.

The areas of Corrective Actions and Continual Improvement received scores of Mature, the second highest score. The corrective action program is effective, shows stability over time and includes a thorough review of the effectiveness of the actions taken and problem-solving tolls used to support the process. In the area of continuous improvement data streams are being used to drive continual improvement over time.

Bruce Power is successfully re-certified to the International Organization for Standardization 14001, Environmental Management Systems standard until November 2026. There will be surveillance audits conducted annually leading up to the next re-certification audit scheduled for 2026.

10.0 CONCLUSION

The purpose of this report is to fulfill regulatory requirements on environmental protection in accordance with Licence Condition 3.3 of the Bruce A and B Power Reactor Operating Licence [R-1] and the Canadian Nuclear Safety Commission Regulatory Document REGDOC-3.1.1 Reporting Requirements for Nuclear Power Plants, Section 3.5 [R-2]. Within this report, Bruce Power has provided information on effluent and emission results, environmental monitoring findings and demonstrated our continued commitment to environmental protection and sustainability.

Bruce Power continued to have strong community relations and demonstrated commitment to continued engagement with the local Indigenous Nations and communities of the Saugeen Ojibway Nation, Métis Nation of Ontario, and Historic Saugeen Métis throughout 2023 and will continue to build on these strengths and commitments.

Bruce Power supports provincial and federal carbon-reduction goals through our 2027 Net Zero Strategy and Green Financing initiatives. In 2023, Bruce Power was recognized on Morningstar Sustainalytics' 2023 list as "Environment Social Governance Industry Top Rated" and "Environment Social Governance Regional Top Rated". Being recognized with a strong Environment Social Governance Risk Rating continues Bruce Power's trend of annual improvement while maintaining a "Low Risk" ESG Rating, with 2023 being our lowest, and most favourable, Environment Social Governance Risk Rating of 12.6.

For the thirty-second consecutive year, Bruce Power's contribution to the annual dose of a member of the public is less than the lower threshold for significance (less than 10 microsieverts per year) and is considered *de minimus*. The maximum dose associated with Bruce Power operations in 2023 was obtained for the Bruce Subsistence Farmer (BSF2) Child who received 1.4 microsieverts per year. All other representative persons have a lower dose. This maximum dose is a small fraction of a percent of the legal limit of 1,000 microsieverts per year.

An updated retrospective and predictive Environmental Risk Assessment was prepared and submitted to regulators in June 2022. Review of the 2022 Environmental Risk Assessment by the Canadian Nuclear Safety Commission and Environment and Climate Change Canada concluded that the report is consistent with the overall methodology and complies with all the applicable requirements of Canadian Standards Association N288.6-12 [R-62]. The potential risk from physical stressors and from radiological and non-radiological releases to the environment were found to be generally low to negligible.

Through Bruce Power's normal operation and outage maintenance activities, airborne emissions and waterborne effluents are released to the environment and monitored following robust monitoring standards to confirm releases remain within compliance limits and ensure environmental protection. All radiological releases remained well below regulatory limits, and all conventional effluent parameter limits were met. Additionally, the dose to public remained well below the lower threshold for significance at a fraction of a percent of the legal dose limit.

Bruce Power's radiological and conventional environmental monitoring programs are designed to continuously verify that environmental protection is being maintained and that any releases have a minimal impact on the surroundings. The radiological environmental monitoring program monitors radionuclides in the air, precipitation, water, agricultural and animal products, beach sand, soil, and sediment. The conventional environmental monitoring program monitors for conventional contaminants, physical stressors, and biological. In 2023, conventional environmental monitoring for contaminants included water quality in the lake and on-site surface water features. In addition, thermal monitoring, fish impingement monitoring and wildlife surveys continued in 2023. Results of the radiological and conventional environmental monitoring programs in 2023 demonstrated that there were no significant or adverse changes to contaminant levels or wildlife species presence in the environment. This provides verification of the continued effectiveness of environmental protection policies and programs at Bruce Power.

Bruce Power's groundwater protection program is designed to achieve established groundwater protection goals in alignment with Canadian Standards Association N288.7-15, Groundwater Protection Programs at Class 1 Nuclear Facilities and Uranium Mines and Mills. By establishing and monitoring performance against groundwater program objectives which include a robust groundwater monitoring program, Bruce Power continues to refine and improve the groundwater conceptual site model and inform key stakeholders with respect to groundwater quality.

Bruce Power continues to comply with all waste regulations and requirements of the relevant Federal, Provincial, and Municipal authorities. Further, Bruce Power plans to continue taking an active role to reduce all forms of waste: from an environmental and financial standpoint waste reduction is good for our company and the community in which we reside.

Finally, Bruce Power's compliance with the International Organization for Standardization 14001 standard and the Canadian Standards Association N288.4, N288.5 and N288.7 standards has been verified through internal independent oversight audits. Opportunities for improvement and any identified gaps are being addressed and do not impact overall conformance to the14001 or the N288 series standards.

The 2023 Environmental Protection Report provides evidence to support the conclusion that Bruce Power is complying with all relevant provincial, federal, and regulatory requirements and legislation. Beyond compliance, Bruce Power is striving to measure and minimize its impact on the environmental through excellence in effluent and emissions management, continuous environmental monitoring, spill prevention and waste management. Bruce Power plans to continue to strive for excellence in all aspects of environmental monitoring and protection throughout 2024.

11.0 REFERENCES

[R-1] Canadian Nuclear Safety Commission. Bruce A and Bruce B Power Reactor Operating Licence Bruce Nuclear Generating Stations A and B. 18.03/2028 2018.

[R-2] Canadian Nuclear Safety Commission. Reporting Requirements for Nuclear Power Plants, REGDOC-3.1.1 version 2. 2016.

[R-3] Canadian Nuclear Safety Commission. Licence Condition Handbook (LCH-PR-18.03/2028-R004) Bruce Nuclear Generating Stations A and B Nuclear Power Reactor Operating Licence Licence # PROL 18.03/2028. 2018.

[R-4] Bruce Power. Bruce Power 2022 Environmental Quantitative Risk Assessment. Bruce Power; 2022 Jun. Report No.: B-REP-03443-00024 Rev 000.

[R-5] Canadian Standards Association. CSA N288.4-10, Environmental Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills. 2010.

[R-6] Government of Ontario. Environmental Protection Act. R.S.O 1990, Chapter E. 19 1990.

[R-7] Government of Ontario. Ontario Water Resources Act. R.S.O. 1990, c. O.40.

[R-8] Government of Canada. Nuclear Safety and Control Act. S.C. 1997, c. 9 1997.

[R-9] Government of Canada. General Nuclear Safety and Control Regulations. SOR/2000-202 2015.

[R-10] Government of Canada. Class I Nuclear Facilities Regulation. SOR/2000-204 2017.

[R-11] Government of Canada. Radiation Protection Regulations. SOR/2000-203 2017.

[R-12] Canadian Nuclear Safety Commission. Environmental Protection, Environmental Principles, Assessments and Protection Measures, REGDOC-2.9.1, version 1.2. 2020.

[R-13] International Standards Organization. ISO 14001: 2015 Environmental Management System Requirements with Guidance for Use. 2015.

[R-14] Bruce Power. BP-PROG-00.02, Environmental Management, R013. 2020.

[R-15] Canadian Standards Association. CSA N288.1-20, Guidelines for Modelling Radionuclide Environmental Transport, Fate, and Exposure Associated with Normal Operation of Nuclear Facilities. 2020.

[R-16] Canadian Standards Association. CSA N288.5-11, Effluent Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills. 2011.

[R-17] Canadian Standards Association. CSA N288.6-12, Environmental Risk Assessments at Class I Nuclear Facilities and Uranium Mines and Mills. 2012.

[R-18] Canadian Standards Association. CSA N288.7-15, Groundwater Protection Programs at Class I Nuclear Facilities and Uranium Mines and Mills. 2015.

[R-19] Canadian Standards Association. CSA N288.8-17, Establishing and Implementing Action Levels for Releases to the Environment from Nuclear Facilities. 2017.

[R-20] Canadian Standards Association. CSA N288.9-19, Guideline for Design of Fish Impingement and Entrainment Programs at Nuclear Facilities. 2019.

[R-21] Canadian Standards Association. CSA N288.3.4-13, Performance Testing of Nuclear Air-Cleaning Systems at Nuclear Facilities. 2013.

[R-22] International Standards Organization. ISO 14001: 2015 Environmental Management System Requirements with Guidance for Use. 2015.

[R-23] Canadian Standards Association. CSA N286-12, Management System Requirements for Nuclear Facilities. 2012.

[R-24] Sinclair D. 2023 OPG WWMF Summary. 2024.

[R-25] Canadian Nuclear Safety Commission. Waste Facility Operating Licence for Western Waste Management Facility. WFOL-W4-314.00 2027.

[R-26] Ontario Power Generation. N-STD-OP-0031, Monitoring of Nuclear and Hazardous Substances in Effluents, R009.

[R-27] Canadian Standards Association. CSA N288.5-11, Effluent Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills. 2011.

[R-28] Canadian Nuclear Safety Commission. Licence Condition Handbook (LCH-W4-314.00 2027) Western Waste Management Facility.

[R-29] Canadian Standards Association. CSA N288.6-12, Environmental Risk Assessments at Class I Nuclear Facilities and Uranium Mines and Mills. Canadian Standards Association; 2012.

[R-30] Ecometrix Incorporated. Environmental Risk Assessment 2021 Update: Western Waste Management Facility. Ontario Power Generation; 2021 Dec. Report No.: 01098-REP-07701-00015-R000.

[R-31] Ontario Power Generation. Ontario Power Generation, Regulatory Reporting [Internet]. Regulatory Reporting. [cited 2024 Feb 9]. Available from: https://www.opg.com/reporting/regulatory-reporting/

[R-32] Stirling C. 2023 CNL Douglas Point Summary. 2024.

[R-33] Canadian Nuclear Laboratories. Douglas Point Prototype Reactor [Internet]. [cited 2024 Feb 9]. Available from: https://www.cnl.ca/environmental-stewardship/decommissioning-the-douglas-point-prototype-reactor/http://www.audubon.org/.

[R-34] Peplinskie G. 2020 Emissions Data. 2021.

[R-35] Kinectrics. Kinectrics, Ontario Nuclear Services [Internet]. Ontario Nuclear Services. [cited 2024 Feb 9]. Available from: https://www.kinectrics.com/capabilities/facilities/nuclear-licensed-facilities/ontario-nuclear-services

[R-36] Peng J. 2023 Kinectrics ONSF Summary. 2024.

[R-37] Figel C. 2023 Energy Solutions Radiological Emissions. 2024.

[R-38] Canadian Nuclear Safety Commission, Independent Environmental Monitoring Program (IEMP) [Internet]. [cited 2024 Feb 7]. Available from: https://www.cnsc-ccsn.gc.ca/eng/resources/maps-of-nuclear-facilities/iemp/

[R-39] Canadian Nuclear Safety Commission. Independent Environmental Monitoring Program: Bruce A and B Nuclear Generating Stations [Internet]. Canadian Nuclear Safety Commission. [cited 2021 Feb 25]. Available from: http://nuclearsafety.gc.ca/eng/resources/maps-of-nuclear-facilities/iemp/bruce.cfm

[R-40] Canadian Nuclear Safety Commission. Independent Environmental Monitoring Program [Internet]. Canadian Nuclear Safety Commission. [cited 2024 Feb 6]. Available from: https://open.canada.ca/data/en/dataset/a98ebc25-1f77-42c1-aba8-9e186666f489

[R-41] Lane R, Dagher E, Burtt J, Thompson A. Radiation Exposure and Cancer Incidence (1990 to 2008) around Nuclear Power Plants in Ontario, Canada. J Environ Prot. 2013;4:888–913.

[R-42] Bruce Power. Saugeen Ojibway Nation Community Workshop. 2019 Oct 17; Southampton, ON.

[R-43] Saugeen Ojibway Nation. Oral Presentation from the Saugeen Ojibway Nation In the Matter of Bruce Power Inc. Application to Renew the Power Reactor Operating Licence for the Bruce A and B Nuclear Generating Stations. Oral presented at: CMD-15-H2.118; 2015.

[R-44] Saugeen Ojibway Nation. Oral Presentation Submission from Saugeen Ojibway Nation In the Matter of the Western Waste Management Facility Request to renew the Waste Facility Operating Licence for the Western Waste Management Facility. Oral presented at: CMD-17-H3.12; 2017.

[R-45] Historic Saugeen Métis. Historic Saugeen Métis [Internet]. Historic Saugeen Métis. 2014. Available from: http://saugeenmetis.com/index.php

[R-46] ENVIRON EC (Canada) Inc. Métis Traditional Way of Life Study, Southampton, Ontario. Prepared for the Historic Saugeen Métis, Southampton, Ontario, Canada. 2010 Feb. Report No.: CA-1200-180A.

[R-47] Metis Nation of Ontario. Métis Consultation & Accommodation. A Guide for Government and Industry on Engaging Métis in Ontario. [Internet]. Available from: http://www.metisnation.org/media/51974/duty_to_consult_guide.pdf.

[R-48] Health Canada, Government of Canada. Understanding Radiation [Internet]. [cited 2024 Feb 6]. Available from: https://www.canada.ca/en/health-canada/services/health-risks-safety/radiation/understanding.html

[R-49] Canadian Nuclear Safety Commission, Government of Canada. Natural Background Radiation [Internet]. Government of Canada. 2020 [cited 2024 Feb 6]. Available from: https://nuclearsafety.gc.ca/eng/resources/fact-sheets/natural-background-radiation.cfm

[R-50] International Atomic Energy Agency. Radiation in Everyday Life [Internet]. IAEA. [cited 2024 Feb 6]. Available from: https://www.iaea.org/Publications/Factsheets/English/radlife

[R-51] Canadian Nuclear Safety Commission, Government of Canada. Understanding Radiation [Internet]. [cited 2024 Feb 6]. Available from: https://nuclearsafety.gc.ca/eng/resources/fact-sheets/understanding-radiation.cfm

[R-52] Government of Canada. Radiation Protection Regulations (SOR/2000-203) last amended on September 22. 2017.

[R-53] AECB. Advisory Committee on Radiological Protection and the Advisory Committee on Nuclear Safety. Recommended de minimus radiation dose rates for Canada. 1990.

[R-54] D. Hart and T. Yankovich. Uncertainty in Dose Estimates Based on Environmental Monitoring. CANDU Owner Group Inc; 2010.

[R-55] Calian. Bruce Power Public Dose Calculations 2023. 2024 Apr. Report No.: B-REP-03419-01APR2024.

[R-56] Canadian Standards Association. CSA N288.2-19, Guidelines for Calculating the Radiological Consequences to the Public of a Release of Airborne Radioactive Material for Nuclear Reactor Accidents. 2019.

[R-57] Kinectrics. 2023 Meteorological Data Analysis. 2024 Feb. Report No.: B-REP-03481.21-12FEB2024.

[R-58] Canadian Nuclear Safety Commission, Government of Canada. Natural Background Radiation (superceded) [Internet]. Government of Canada. 2020 [cited 2023 Apr 3]. Available from: https://nuclearsafety.gc.ca/eng/resources/fact-sheets/natural-background-radiation.cfm

[R-59] Government of Canada. Nuclear Safety and Control Act. S.C. 1997, c. 9 1997.

[R-60] Impact Assessment Act. S.C. 2019 2019.

[R-61] Bruce Power. Appendices for Bruce Power 2022 Environmental Quantitative Risk Assessment. Bruce Power; 2022 Jun. Report No.: B-REP-03443-00023 Rev 001.

[R-62] Hornof M. Bruce A and B: Bruce Power 2022 Environmental Risk Assessment BP-CORR-00531-03806/e-Doc 6956400. 2023.

[R-63] Government of Canada. Radiation Protection Regulations. SOR/2000-203 2017.

[R-64] UNSCEAR. Sources and Effects of Ionizing Radiation. United Nations Scientific Committee on the Effects of Atomic Radiation. Volume II – Scientific Annexes C, D and E. 2011.

[R-65] Fisheries and Oceans Canada. Paragraph 35(2)(b) Fisheries Act Authorization issued to Bruce Power Ltd. Partnership. 14-HCAA-00225 2019.

[R-66] Bruce Power. Assessment of Feasible Mitigation Measures for Thermal Effluent and Impingement/Entrainment (AFMM). 2020 Mar. Report No.: B-REP-07101-31MAR2020.

[R-67] Sigouin L. Bruce A and B: Assessment of Feasible Mitigation Measures for Thermal Effluent and Impingement/Entrainment - Closure of Action Item 2021-07-23156 BP-CORR-00531-02658. 2022.

[R-68] Bruce Power. Bruce Power Summary of Climate Change Implications of Bruce Power Operations under MCR: Potential Operational Effects of CCW Operations on Thermal State of Nearshore Waters under Future Climate Change Conditions. 2020 Oct. Report No.: B-REP-07021-21OCT2020.

[R-69] Association CS. CSA N288.1-14 Update No. 3 Guidelines for Calculating Derived Release Limits for Radioactive Material in Airborne and Liquid Effluents for Normal Operation of Nuclear Facilities. 2018.

[R-70] Government of Canada. Radiation Protection Regulations (SOR/2000-203). SOR/2000-203 2021.

[R-71] CSA N288.8-17 Establishing and Implementing Action Levels for Releases to the Environment from Nuclear Facilities. Canadian Standards Association; 2017.

[R-72] Seepe B. 2023 WWMF Radiological Emissions. 01MAR2024.

[R-73] Peng J. 2023 Kinectrics ONSF Radiological Emissions. 2024.

[R-74] Stirling C. 2023 CNL Radiological Emissions. 2023.

[R-75] Canadian Standards Association. CSA N288.7-15, Groundwater Protection Programs at Class I Nuclear Facilities and Uranium Mines and Mills. 2015.

[R-76] Seepe B. 2022 WWMF Radiological Emissions. 2023.

[R-77] MECP (Ontario Ministry of Environment, Conservation and Parks. Ontario Regulation (O. Reg.) 169/03 Ontario Drinking Water Standards (ODWS). 2020.

[R-78] Government of Ontario. Air Pollution Local Air Quality. O. Reg. 419/05.

[R-79] Government of Ontario. Ontario Water Resources Act. R.S.O. 1990, c. O.40.

[R-80] Ontario Ministry of Environment, Conservation and Parks. Amended Environmental Compliance Approval (BA Water). 0731-B2MKYL Jul 20, 2018.

[R-81] Ontario Ministry of Environment, Conservation and Parks. Amended Environmental Compliance Approval (BB Water). 5209-BLBSZY Jun 25, 2020.

[R-82] Ontario Ministry of Environment, Conservation and Parks. Amended Environmental Compliance Approval (COS Water). 9809-9KXLEB Sep 17, 2014.

[R-83] Ontario Ministry of Environment, Conservation and Parks. Permit to Take Water, BA [Internet]. P-300-2114648110 2021. Available from: BP-CORR-00541-00125

[R-84] Ontario Ministry of Environment, Conservation and Parks. Permit to Take Water, BB [Internet]. P-300-4114675736 2021. Available from: BP-CORR-00541-00126

[R-85] Ontario Ministry of Environment, Conservation and Parks. Permit to Take Water, COS [Internet]. P-300-7116089842 2021. Available from: BP-CORR-00541-00127

[R-86] Government of Ontario. Ontario Regulation 390/18: Greenhouse Gas Emissions: Quantification, Reporting and Verification.

[R-87] Government of Canada. Federal Halocarbon Regulations. SOR/2022-210.

[R-88] Government of Canada. Notice to Report Under the authority of Section 46 of the Canadian Environmental Protection Act (CEPA), operators of facilities that meet the criteria specified in the annual notice with respect to reporting of greenhouse gases (GHGs), published in the Canada Gazette, are required to report facility GHG emissions to Environment and Climate Change Canada by the annual June 1st reporting deadline.

[R-89] Canada G. Notice to Report: Under the authority of the Canadian Environmental Protection Act, 1999 (CEPA 1999), owners or operators of facilities that meet published reporting requirements are required to report to the NPRI.

[R-90] Government of Canada. Ozone-depleting Substances and Halocarbon Alternatives Regulations - SOR/2016-137. SOR/2016-137.

[R-91] Government of Ontario. Ozone Depleting Substances and other Halocarbons. O. Reg. 463/10.

[R-92] Ontario Ministry of Environment, Conservation and Parks. Environmental Compliance Approval for Air and Noise 7477-8PGMTZ. 7477-8PGMTZ 2011.

[R-93] Ontario Ministry of Environment, Conservation and Parks. Environmental Compliance Approval with Limited Operational Flexibility Number 7477-8PMGTZ, Ministry Reference Number 5480-8JXGHY. 2021.

[R-94] Government of Canada. Federal Halocarbon Regulations. SOR/2003-289.

[R-95] Government of Canada. Notice with respect to substances in the National Pollutant Release Inventory. 1999.

[R-96] Pinchin Ltd. Emission and Dispersion Summary Report (ESDM) Report for Bruce Power: Table A3: 2020 Emission Summary Table. Pinchin Ltd.; 2021. Report No.: 65470.

[R-97] Air Dispersion Modelling Guideline for Ontario [Guideline A-11], Version 3.0. Ontario Ministry of Environment and Climate Change;

[R-98] Environment and Climate Change Canada. Guide for Reporting to the National Pollutant Release Inventory, 2020 and 2021.

[R-99] Ferguson S. Hydrazine, Ammonia and Morpholine Calculation Methodology for National Pollutant Release Inventory Reporting. Report No.: B-REP-07297-00001.

[R-100] Government of Ontario. Quantification, Reporting and Verification of Greenhouse Gas Emissions. O. Reg. 389/18.

[R-101] Government of Ontario. Environmental Protection Act. R.S.O 1990, Chapter E. 19 1990.

[R-102] Ministry of Environment, Conservation, and Parks. Environmental Compliance Approval (BA Water). A-500-3151105259 Jul 11, 2023.

[R-103] Ministry of Environment, Conservation, and Parks. Environmental Compliance Approval (BB Water).

[R-104] Ontario Ministry of Environment, Conservation and Parks. Amended Environmental Compliance Approval (COS Water) [Internet]. 9809-9KXLEB Sep 17, 2014. Available from: NK37-CORR-00541-00522

[R-105] Government of Ontario. Environmental Penalties. O. Reg. 223/07.

[R-106] Ontario Ministry of Environment, Conservation and Parks. Amended Environmental Compliance Approval (COS Water). 4640-CEGKDU Jan 17, 2023.

[R-107] Bruce Power. Q2 2022 Effluent Discharge Report. 2022 Aug. Report No.: BP-CORR-00541-00149.

[R-108] Bruce Power. Q4 2022 Effluent Discharge Report. 2023 Feb. Report No.: BP-CORR-00541-00183.

[R-109] Government of Ontario. Environmental Protection Act, Ontario Regulation 215/95, Effluent Monitoring and Effluent Limits, Electric Power Generation Sector.

[R-110] Ontario Ministry of Environment, Conservation and Parks. Amended Environmental Compliance Approval - Notice 1 (BB Water) [Internet]. 5209-BLBSZY Jan 25, 2021. Available from: BP-CORR-00541-00074

[R-111] Ontario Ministry of Environment, Conservation and Parks. Amended Environmental Compliance Approval - Notice 1 (COS Water) [Internet]. 9809-9KXLEB Jan 25, 2021. Available from: BP-CORR-00541-00075

[R-112] Fisheries D, Oceans. Wastewater Systems Effluent Regulations, SOR/2012-139. 2012.

[R-113] Government of Ontario. Water Taking and Transfer. O. Reg. 387/04 2004.

[R-114] Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater Version 2.0. Government of Ontario; 2016.

[R-115] Environment and Climate Change Canada. Canadian Environmental Protection Act, 1999, Federal Environmental Quality Guidelines: Aluminum. 2021 Jun.

[R-116] Government of Canada. Canadian Environmental Protection Act. S.C. 1999, c. 33 1999.

[R-117] Natasha O’Neill. P2 Plans- Hydrazine: Notification of Non-Engagement. 07JAN2021.

[R-118] Environment and Climate Change Canada. Environmental Emergencies Regulations, 2019 (SOR/2019-51) [Internet]. Available from: https://laws-lois.justice.gc.ca/eng/regulations/SOR-2019-51/index.html

[R-119] Giardino R, Houser C. Introduction to the Critical Zone. Dev Earth Surf. 2015;19:1–13.

[R-120] Government of Canada, Health Canada Services. Radiation Surveillance Program [Internet]. [cited 2024 Mar 7]. Available from: https://www.canada.ca/en/health-canada/services/health-risks-safety/radiation/understanding/measurements.html

[R-121] Government of Canada, Health Canada Services. 2023 Dose Data from the Fixed Point Surveillance Network [Internet]. [cited 2024 Feb 6]. Available from: https://www.canada.ca/en/health-canada/services/health-risks-safety/radiation/understanding/measurements/2023-dose-data-fixed-point-surveillance-network.html

[R-122] Klukus MH. Tritium in the Great Lakes; Concentration – Time Model. 1999.

[R-123] Talbot K. Notification/Action Protocols for Abnormal Tritium Releases at BNPD. 1996. Report No.: B-CORR-00548-00002.

[R-124] Government of Ontario. Training and Skills Development. Nuclear Reactor Surveillance Program 2012 Report to the Assurance Monitoring Group [Internet]. Ministry of Labour; Available from: https://www.labour.gov.on.ca/english/hs/pubs/rpms/index.php

[R-125] Bruce Power. 2019 Environmental Protection Report. 2020 May. Report No.: B-REP-07000-00012.

[R-126] Kinectrics. Quality Assurance Manual, QAM-1 Rev 25. 2023.

[R-127] Canadian Standards Association. CSA N299.1-16, Quality Assurance Program Requirements for the Supply of Items and Services for Nuclear Power Plants, Category 1. 2016.

[R-128] Calian. Calian Nuclear Quality Assurance Manual. 2021.

[R-129] EcoMetrix. Tool Qualification Report for IMPACT 5.5.2. 2018.

[R-130] Ontario Power Generation. 2023 Results of Environmental Monitoring Programs for Darlington and Pickering Nuclear. 2024. Report No.: N-REP-03443-10031.

[R-131] Canadian Standards Association. CSA N288.4-10, Environmental Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills. 2010.

[R-132] MECP (Ontario Ministry of the Environment, Conservation and Parks). Provincial Water Quality Objectives (PWQOs). 1994.

[R-133] Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WGQ) for the Protection of Aquatic Life. 1999.

[R-134] Health Canada. Guidelines for Canadian Drinking Water Quality - Summary Table. Sep, 2022.

[R-135] CCME (Canadian Council of Ministers of the Environment). Water Quality Guidelines for the Protection of Aquatic Life. [Internet]. 2022. Available from: Accessed online at: https://ccme.ca/en/summary-table

[R-136] U.S. EPA (United States Environmental Protection Agency). Causal Analysis/Diagnosis Decision Information System (CADDIS), Volume 2: Sources, Stressors and Responses. pH [Internet]. 2021. Available from: https://www.epa.gov/caddis-vol2/caddis-volume-2-sources-stressors-responses-ph#:~:text=U.S.%20EPA%20water%20quality%20criteria%20for%20pH%20in,ultimately%20lead%20to%20reduced%20biological%20diversity%20in%20streams.

[R-137] Howell ET, D.R.Barton C-LF, Kaltenecker G. Fine-scale nutrient enrichment and water quality on the rural shores of Southeast Lake Huron. J Gt Lakes Res. 2014;40:126–40.

[R-138] Government of Canada. Guidelines for Canadian Drinking Water Quality: Guideline Technical Document - Aluminum.

[R-139] Government of Canada. Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Iron [Internet]. Government of Canada. 1978 [cited 2021 Mar 16]. Available from: https://wwwhttps://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-iron.html#a8.kincardine.ca/en/living-here/water.aspx#

[R-140] Bruce Power. 2020 Environmental Protection Report. Tiverton, ON, Canada: Bruce Power; 2021. Report No.: B-REP-07000-00013.

[R-141] CCME (Canadian Council of Ministers of the Environment). Canadian Water Quality Guidelines for the Protection of Aquatic Life. Zinc (Dissolved) 2018. Gatineau, QC: CCME (Canadian Council of Ministers of the Environment); 2018 p. 13.

[R-142] Bruce Power. 2021 Environmental Protection Report. Tiverton, ON, Canada: Bruce Power; 2022. Report No.: B-REP-07000-00014.

[R-143] SENES. Additional Studies to Support Thermal Effects Monitoring Biota – Benthic Invertebrates and Macrophytes (Preliminary Results). 2013.

[R-144] Fisheries and Oceans Canada. Paragraph 35(2)(b) Fisheries Act Authorization issued to Bruce Power Ltd. Partnership. 14-HCAA-00225 2019.

[R-145] Barnthouse L, Fietsch C-L, Snider D. Quantifying Restoration Offsets at a Nuclear Power Plant in Canada. Environmental Management. 2019. Report No.: 64: 593-607.

[R-146] Randall R, Minns C. Comparison of a Habitat Productivity Index (HPI) and an Index of Biotic Integrity (IBI) for Measuring the Productive Capacity of Fish Habitat in Nearshore Areas of the Great Lakes. Journal of Great Lakes Research, 28(2): 240-255. 2002.

[R-147] Government of Canada. Species at Risk Act (S.C. 2002, c. 29) [Internet]. 2002. Available from: http://laws lois.justice.gc.ca/eng/acts/s 15.3/.

[R-148] Fetzer WW, Brooking TE, Jackson JR, Rudstam LG. Overwinter mortality of Gizzard Shad: Evaluation of starvation and cold temperature stress. Trans Am Fish Soc. 2011;140(6):1460–71.

[R-149] Biotactic Inc. Biotactic 2019 Research Photos [Internet]. [cited 2022 Apr 7]. Available from: https://www.biotactic.com/2019-research-photos/

[R-150] Biotactic Inc. Biotactic 2020 Research Photos [Internet]. [cited 2022 Apr 7]. Available from: https://www.biotactic.com/2020-research-photos/

[R-151] Biotactic Inc. Biotactic 2021 Research Photos [Internet]. [cited 2022 Apr 7]. Available from: https://www.biotactic.com/2021-research-photos/

[R-152] Biotactic, Inc. Biotactic 2022 Research Photos [Internet]. [cited 2023 Mar 14]. Available from: https://www.biotactic.com/2022-research-photos/

[R-153] Biotactic Inc. Biotactic.com [Internet]. [cited 2023 Mar 14]. Available from: https://www.biotactic.com/

[R-154] Bruce Power and Biotactic Inc. Tracking Rainbow Trout Movement in the Saugeen River Before and After Removal of the Truax Dam, Winter 2022 Update Report. [Internet]. [cited 2023 Mar 14]. Available from: https://www.biotactic.com/wp-content/uploads/Radio_Summary_Report_for_Public_20220309.pdf

[R-155] Biotactic Inc. Rainbow Trout Migration Patterns in the Saugeen River Watershed [Internet]. [cited 2023 Mar 14]. Available from: https://www.biotactic.com/migratory-patterns-of-rainbow-trout/

[R-156] Biotactic Inc. Salmonid Redd Counts in the Saugeen River [Internet]. Available from: https://www.biotactic.com/salmonid-redd-counts-in-the-saugeen-river/

[R-157] Jones E, Mansur E, Desjardine M, Ryan K. Saugeen Ojibway Nation Coastal Waters Monitoring Program (CWMP) 2020 Field Season Summary Report [Internet]. Saugeen Ojibway Nation Environment Office; 2021 Mar. Available from: https://www.saugeenojibwaynation.ca/

[R-158] The Great Lakes Marsh Monitoring Program (MMP). Bird Studies Canada and Environment Canada-Ontario Region. 1994.

[R-159] Ontario Ministry of Natural Resources and Forestry. Survey Protocol for Ontario Species at Risk Snakes. Peterborough, Ontario: Ontario Ministry of Natural Resources and Forestry, Species Conservation Policy Branch; 2016 p. ii +17pp.

[R-160] Ontario Nature, Sukumar S, Vezina B, Netten T. Long-Term Monitoring Protocol for Ontario Snakes. 2023.

[R-161] Horrigan E, Riley DrJ. Why the Turtle Crossed the Road and Other FAQ's About Turtle Nests [Internet]. Why the Turtle Crossed the Road and Other FAQ's About Turtle Nests. [cited 2024 Mar 20]. Available from: https://ontarionature.org/faq-about-turtle-nests-blog/

[R-162] Cadman MD, Sutherland DA, Beck GG, Lepage D, Couturier AR. Atlas of the Breeding Birds of Ontario, 2001-2005. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature. In: (eds.). Toronto; 2007. p. xxii +706pp.

[R-163] Birds Canada. Nocturnal Owl Surveys in Central Ontario: A Citizen Scientist's Guide [Internet]. [cited 2024 Mar 18]. Available from: https://birdscanada.org/wp-content/uploads/2022/02/Owl-Survey-Central-ON-Citizen-Science-Guide-2022-1.pdf

[R-164] Canadian Standards Association. CSA N288.7:23 - Groundwater protection and monitoring for nuclear facilities and uranium mines and mills.

[R-165] ASTM International. American Society for Testing and Measures Standard D6771. Book of Standards Volume:04.09;

[R-166] US EPA. U.S. Environmental Protection Agency National Functional Guidelines for Inorganic Superfunds Method Data Review. EPA;

[R-167] USEPA (United States Environmental Protection Agency). National Functional Guidelines for Organic Superfunds Method Data Review. USEPA; 2020.

[R-168] Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act. Ministry of the Environment; 2011 Apr.

[R-169] Government of Ontario. Environmental Protection Act R.S.O. 1990.

[R-170] Government of Ontario, Ontario Regulation 347, General Waste Management.

[R-171] Government of Ontario, Ontario Regulation 103/94, Industrial, Commercial and Institutional Source Separation Programs.

[R-172] Government of Ontario, Ontario Regulation 102/94, Waste Audits and Waste Reduction Work Plans.

[R-173] Government of Canada. Transportation of Dangerous Goods. S.C. 1992, c. 34 1992.

[R-174] GENERAL - WASTE MANAGEMENT [Internet]. R.R.O., REGULATION 347 Dec 6, 2003. Available from: https://www.ontario.ca/laws/regulation/900347

[R-175] Government of Canada. PCB Regulations. SOR/208-273 2008.

[R-176] Allin, Kevin. N288.4/.5 Effluent and Environmental Monitoring. Bruce Power; 13APR2023.

[R-177] Laderkarl, Lizzi. Development and Implementation of Radiological Effluent Action Levels (CSA N288.8). Bruce Power; 24AUG2023.

[R-178] Laderkarl, Lizzi. Environmental Management. Bruce Power; 26JUN2023.

[R-179] Bruce Power. 2021 Bruce Power Site Specific Survey Report. B-REP-03443-00016, Rev 1; 2023.

[R-180] US Environmental Protection Agency. Meteorological Monitoring Guidance for Regulatory Modeling Applications. EPA; 2000 Feb. Report No.: EPA-454/R-99-005.

[R-181] US Environmental Protection Agency. Guideline on Air Quality Models. 1986. Report No.: EPA-450/0278-027R.

[R-182] DeVaull GE et al. Understanding Atmospheric Dispersion of Accidental Releases. American Institute of Chemical Engineers; 1996 Oct. Report No.: ISBN 0-8169-0681-5.

[R-183] Emerson K, Russo RC, Lund RE, Thurston RV. Aqueous Ammonia Equilibrium Calculations: Effect of pH and Temperature. J Fish Res Board Can [Internet]. 1975 Dec 1 [cited 2022 Feb 11];32(12):2379–83. Available from: http://www.nrcresearchpress.com/doi/10.1139/f75-274

APPENDIX A: REPRESENTATIVE PERSON PARAMETERS FOR DOSE CALCULATION

Table 50 - Generic Rates of Intake of Air, Water and Various Foods

Parameter	Units	Infant (1 year old)	Child (10 year old)	Adult (male)
Inhalation Rate	Cubic metre per year	1830	5660	5950
Water Ingestion Rate	Litre per year	0	151.1	379.6
Grain Intake	Kilogram per year	55.2	140.7	163.5
Fruit & Berry Intake	Kilogram per year	54.6	88.8	99.4
Vegetable Intake	Kilogram per year	25.8	69.7	128.1
Mushrooms Intake	Kilogram per year	0.3	1.0	1.2
Potato Intake	Kilogram per year	8.7	30.9	47.9
Total Plant Product Ingestion Rate	**Kilogram per year**	**144.5**	**331.1**	**440.0**
Beef Intake	Kilogram per year	4.4	13.1	45.8
Pork Intake	Kilogram per year	3.5	10.4	19.8
Lamb Intake	Kilogram per year	0.0	1.0	0.6
Poultry Intake	Kilogram per year	8.2	21.9	38.9
Egg Intake	Kilogram per year	2.1	8.1	19.2
Game (Deer, Rabbit) Intake	Kilogram per year	0.5 or 0.7	1.6 or 2.2	5.8 or 7.8
Milk Intake	Kilogram per year	242.7	228.1	125.6
Total Animal Product Ingestion Rate	**Kilogram per year**	**262.8 or 263.0**	**286.8 or 287.4**	**260.4 or 262.4**
Total Fish Ingestion Rate	**Kilogram per year**	**1.8 or 2.5**	**5.4 or 7.2**	**8.2 or 11.1**

Note:

1. The 1-year old infant is assumed to ingest cow's milk, which accounts for all fluid needs. Water (or formula made from water) is not ingested, as per CSA N288.1 [R-15]

2. All values are mean or central values from CSA N288.1 [R-15], with the exception of the Hunter/Fisher fish intake and game (e.g. deer, rabbit) intake for all age classes, which is based on the Site Specific Survey [R-179].

Table 51 - Percentage of Food Intake Obtained from Local Sources for Non-Farm Resident

Food Type	**Infant (1 year old)**	**Child (10 year old)**	**Adult**
Milk and dairy	23.1%	19.9%	12.1%
Beef	0.72%	1.95%	6.95%
Pork	0.39%	1.07%	2.23%
Poultry	0.85%	2.07%	4.06%
Egg	0.29%	1.00%	2.62%
Deer	0.10%	0.29%	1.11%
Honey	0.08%	0.20%	0.27%
Total Animal Products	**25.5%**	**26.5%**	**29.3%**
Grain	3.44%	3.84%	3.35%
Fruit and Berries	10.4%	7.40%	6.23%
Vegetables (above-ground)	4.26%	5.02%	6.95%
Root Vegetables	1.57%	2.44%	2.85%
Total plant Products	**19.7%**	**18.7%**	**19.4%**
Fish	23.0%	23.0%	23.0%

Note: Values are percentage of total annual intake of combined food group (e.g., fish, plants, animals).

Table 52 - Percentage of Food Intake Obtained from Local Sources for Non-Dairy Farm Resident

Food Type	**Infant (1 year old)**	**Child (10 year old)**	**Adult**
Milk and dairy	12.5%	10.7%	6.51%
Beef	1.04%	2.80%	9.97%
Pork	0.58%	1.59%	3.33%
Poultry	1.41%	3.42%	6.70%
Egg	0.56%	1.94%	5.10%
Deer	0.20%	0.57%	2.22%
Honey	0.10%	0.26%	0.34%
Total Animal Products	**16.4%**	**21.3%**	**34.2%**

Food Type	Infant (1 year old)	Child (10 year old)	Adult
Grain	4.25%	4.73%	4.13%
Fruit and Berries	21.1%	15.0%	12.6%
Vegetables (above-ground)	10.1%	12.0%	16.5%
Root Vegetables	3.60%	5.62%	6.56%
Total Plant Products	**39.1%**	**37.3%**	**39.8%**
Fish	22.3%	22.3%	22.3%

Note: Values are percentage of total annual intake of combined food group (e.g., fish, plants, animals).

Table 53 - Percentage of Food Intake Obtained from Local Sources for Dairy Farm Resident

Food Type	Infant (1 year old)	Child (10 year old)	Adult
Milk and dairy	62.0%	53.4%	32.4%
Beef	1.04%	2.82%	10.1%
Pork	0.67%	1.82%	3.81%
Poultry	1.88%	4.57%	8.96%
Egg	0.66%	2.31%	6.07%
Deer	0.20%	0.57%	2.22%
Honey	0.12%	0.30%	0.40%
Total Animal Products	**66.6%**	**65.8%**	**63.9%**
Grain	7.92%	8.82%	7.71%
Fruit and Berries	13.8%	9.79%	8.25%
Vegetables (above-ground)	10.3%	12.1%	16.8%
Root Vegetables	3.51%	5.48%	6.39%
Total Plant Products	**35.5%**	**36.3%**	**39.1%**
Fish	25.0%	25.0%	25.0%

Note: Values are percentage of total annual intake of combined food group (e.g., fish, plants, animals).

Table 54 - Percentage of Food Intake Obtained from Local Sources for Subsistence Farm Resident

Food Type	**Infant (1 year old)**	**Child (10 year old)**	**Adult**
Subsistence Farms			
Milk and dairy	73.9%	63.6%	38.6%
Beef	1.97%	5.33%	19.0%
Pork	1.33%	3.64%	7.61%
Poultry	3.14%	7.62%	14.9%
Egg	0.81%	2.81%	7.39%
Deer	0.20%	0.57%	2.22%
Honey	0.18%	0.47%	0.62%
Total Animal Products	**81.5%**	**84.1%**	**90.4%**
Grain	18.7%	20.8%	18.2%
Fruit and Berries	28.4%	20.2%	17.0%
Vegetables (above-ground)	17.1%	20.1%	27.9%
Root Vegetables	5.80%	9.04%	10.5%
Total Plant Products	**69.9%**	**70.2%**	**73.6%**
Fish	100%	100%	100%

Note: Values are percentage of total annual intake of combined food group (e.g., fish, plants, animals).

Table 55 - Percentage of Food Intake Obtained from Local Sources for Hunter-Fisher Resident

Food Type	**Infant (1 year old)**	**Child (10 year old)**	**Adult**
Milk and dairy	23.1%	19.9%	12.0%
Beef	0.64%	1.72%	6.11%
Pork	0.39%	1.06%	2.21%
Poultry	0.86%	2.09%	4.07%
Egg	0.31%	1.08%	2.82%
Deer	0.27%	0.77%	2.97%
Honey	0.13%	0.33%	0.43%

Food Type	**Infant (1 year old)**	**Child (10 year old)**	**Adult**
Total Animal Products	**25.7%**	**26.9%**	**30.6%**
Grain	7.57%	8.44%	7.38%
Fruit and Berries	20.5%	14.5%	12.2%
Vegetables (above-ground)	8.60%	10.2%	14.0%
Root Vegetables	2.72%	4.24%	4.94%
Total Plant Products	**39.3%**	**37.4%**	**38.6%**
Fish	100%	100%	100%

Note: Values are percentage of total annual intake of combined food group (e.g., fish, plants, animals).

APPENDIX B: 2023 METEORLOGICAL DATA ANALYSIS

The 2023 meteorological data for the Bruce Power site were analyzed as outlined below [R-57]. The Triple Joint Frequency data at the 10 metre elevation of the on-site 50 metre tower is used in the dose to public calculation.

The raw hourly data was screened, and in addition to the brief data gap at the off-site 10 metre tower in July for unknown reasons, there were also instances where the wind speed was 0 at both towers due to calm or no wind conditions. These datasets cannot be used for air dispersion modelling and were treated as missing data [R-56]. For these cases, the data of the previous hour were used, provided that the data gap was less than four hours. For a data gap of four hours of more, the data from the on-site tower were used to fill out the gap identified for the off-site tower and vice versa. This is aligned with the requirements of Canadian Standards Association N288.2 [R-56].

For the missing hourly data from the off-site 10 metre tower, the 15-minute data from the same tower for the same time period was processed based on the Environmental Protection Agency approach [R-180] and were used for substitution.

Once the data gaps had been filled, the Double Joint Frequency was calculated for the 10 metre off-site tower and for the 10 metre and 50 metre elevations for the 50 metre on-site tower. The Triple Joint Frequency was then calculated for the 50 metre on-site tower at the 10 metre elevation only. The wind speed bins, wind direction sectors and stability class were determined as described below.

Wind speeds were grouped into bins defined in Canadian Standards Association N288.1 [R-15], which are reproduced in Table 56 The wind direction was then divided into 16 wind direction sectors with each sector being 22.5 degrees, as shown in Table 57.

Table 56 - Wind Speed Bins Used for the Generation of Double Joint Frequency and Triple Joint Frequency Tables

Wind Speed Class	Wind Speed, u (m/s)
1	$u \leq 2$
2	$2 < u \leq 3$
3	$3 < u \leq 4$
4	$4 < u \leq 5$
5	$5 < u \leq 6$
6	$u > 6$

Table 57 - Wind Direction Sectors

Wind Sector (direction from which wind is blowing)	Wind Direction (θ) in degrees
N	θ > 348.75 or θ ≤ 11.25
NNE	11.25 < θ ≤ 33.75
NE	33.75 < θ ≤ 56.25
ENE	56.25 < θ ≤ 78.75
E	78.75 < θ ≤ 101.25
ESE	101.25 < θ ≤ 123.75
SE	123.75 < θ ≤ 146.25
SSE	146.25 < θ ≤ 168.75
S	168.75 25 < θ ≤ 191.25
SSW	191.25 < θ ≤ 213.75
SW	213.75 < θ ≤ 236.25
WSW	236.25 < θ ≤ 258.75
W	258.75 < θ ≤ 281.25
WNW	281.25 < θ ≤ 303.75
NW	303.75 < θ ≤ 326.25
NNW	326.25 < θ ≤ 348.75

The Pasquill-Gifford stability classes A to F were used. Stability class was estimated from the standard deviation of wind direction measured, taking into account night-time conditions and wind speeds [R-181]. . A surface roughness of 0.4 m was assumed for all sectors. This value represents rural areas with mixed farming, tall bushes and small villages, consistent with CSA N288.2 [R-56]. Inclusion of surface roughness in the methodology for determining Pasquill-Gifford stability category is a refinement in the classification scheme, which results in shifting more cases towards the neutral D-stability class conditions with increased roughness [R-182].

The calculated Double Joint Frequency and Triple Joint Frequency data at the 50 metre on-site meteorological tower are presented in Table 58, Table 59, Table 60.

Table 58 - Annual Average Double Joint Frequency for Bruce Power Site for Year 2023 – 50 metre Meteorological Tower at 10 metre Height

Wind Direction (wind blowing from)	Wind Speed, u (m/s)						
	u ≤ 2	2 < u ≤ 3	3 < u ≤ 4	4 < u ≤ 5	5 < u ≤ 6	u > 6	Total
	Frequency (%) at 10 m Height						
N	2.77	1.82	1.68	1.47	0.47	0.19	8.40
NNE	2.15	1.12	0.79	0.64	0.11	0.03	4.84
NE	3.56	1.20	0.29	0.19	0.00	0.00	5.24
ENE	3.13	1.21	0.38	0.02	0.00	0.00	4.74
E	2.69	1.32	0.67	0.23	0.02	0.06	5.00
ESE	4.34	1.55	0.66	0.18	0.01	0.02	6.77
SE	4.93	1.38	1.08	0.43	0.10	0.06	7.99
SSE	2.87	1.46	1.18	0.70	0.27	0.23	6.70
S	2.04	1.53	1.69	1.40	0.61	0.45	7.72
SSW	1.34	1.40	1.87	1.42	0.89	0.41	7.33
SW	1.06	0.86	1.24	0.94	0.91	0.79	5.80
WSW	0.80	0.78	0.91	0.66	0.54	0.97	4.66
W	0.91	0.70	0.81	0.71	0.64	0.95	4.71
WNW	1.13	0.89	0.86	0.58	0.39	0.39	4.24
NW	1.88	1.46	1.20	1.21	0.76	0.91	7.43
NNW	2.18	1.78	1.96	1.44	0.63	0.45	8.44
Total	37.79	20.46	17.27	12.23	6.36	5.90	100.00

Table 59 - Annual Average Double Joint Frequency for Bruce Power Site for Year 2023 – 50 metre Meteorological Tower at 50 metre Height

Wind Direction (wind blowing from)	Wind Speed, u (m/s)						
	u ≤ 2	2 < u ≤ 3	3 < u ≤ 4	4 < u ≤ 5	5 < u ≤ 6	u > 6	Total
	Frequency (%) at 50 m Height						
N	0.57	0.95	1.00	1.12	0.82	2.75	7.21
NNE	0.62	0.72	0.99	0.90	0.68	2.56	6.47
NE	0.55	0.76	1.37	1.02	0.62	0.43	4.75
ENE	0.68	1.05	1.48	1.07	0.57	0.45	5.31
E	0.70	0.98	0.84	0.99	0.47	0.53	4.51
ESE	0.55	0.86	1.24	1.30	1.18	0.91	6.04
SE	0.51	0.74	1.27	1.13	0.94	1.07	5.66
SSE	0.33	0.50	0.91	1.08	1.29	1.56	5.68
S	0.31	0.50	0.59	0.99	2.00	2.48	6.87
SSW	0.45	0.63	1.06	1.34	1.63	5.33	10.43

Wind Direction (wind blowing from)	**Wind Speed, u (m/s)**						
	u ≤ 2	**2 < u ≤ 3**	**3 < u ≤ 4**	**4 < u ≤ 5**	**5 < u ≤ 6**	**u > 6**	**Total**
	Frequency (%) at 50 m Height						
SW	0.33	0.61	0.90	1.20	0.84	3.11	6.99
WSW	0.30	0.53	0.54	0.75	0.82	2.66	5.59
W	0.31	0.43	0.47	0.63	0.48	2.52	4.84
WNW	0.38	0.66	0.53	0.57	0.57	2.07	4.77
NW	0.57	0.70	0.83	0.49	0.83	3.42	6.85
NNW	0.55	1.12	1.10	0.90	0.95	3.40	8.01
Total	7.69	11.74	15.14	15.49	14.69	35.25	100.00

Table 60 - Annual Average Triple Joint Frequency for Bruce Power Site for Year 2023 – 50 metre Meteorological Tower at 10 metre Height

Stability Class	**Wind Direction** (wind blowing from)	**Wind Speed, u (m/s)**						
		u ≤ 2	**2 < u ≤ 3**	**3 < u ≤ 4**	**4 < u ≤ 5**	**5 < u ≤ 6**	**u > 6**	**Total**
		Frequency (%) at 10 m Height						
A	N	0.53	0.89	1.08	0.82	0.25	0.03	3.61
	NNE	0.21	0.33	0.25	0.22	0.02	0.00	1.03
	NE	0.19	0.09	0.02	0.00	0.00	0.00	0.31
	ENE	0.38	0.26	0.07	0.00	0.00	0.00	0.71
	E	0.23	0.31	0.18	0.06	0.01	0.00	0.79
	ESE	0.21	0.13	0.06	0.02	0.00	0.00	0.41
	SE	0.18	0.09	0.05	0.01	0.00	0.00	0.33
	SSE	0.21	0.17	0.16	0.14	0.05	0.01	0.73
	S	0.22	0.34	0.63	0.56	0.14	0.16	2.04
	SSW	0.24	0.62	0.97	0.78	0.30	0.02	2.92
	SW	0.21	0.35	0.51	0.22	0.17	0.03	1.50
	WSW	0.23	0.34	0.41	0.11	0.02	0.02	1.14
	W	0.13	0.31	0.24	0.08	0.02	0.01	0.79
	WNW	0.31	0.38	0.15	0.02	0.01	0.05	0.91
	NW	0.26	0.49	0.11	0.00	0.01	0.00	0.88
	NNW	0.40	0.65	0.35	0.25	0.06	0.05	1.76
	Total	4.11	5.75	5.25	3.29	1.06	0.39	19.85
B	N	0.34	0.33	0.09	0.02	0.00	0.00	0.79
	NNE	0.14	0.14	0.08	0.07	0.01	0.00	0.43
	NE	0.11	0.25	0.07	0.03	0.00	0.00	0.47
	ENE	0.26	0.21	0.13	0.00	0.00	0.00	0.59

Stability Class	Wind Direction (wind blowing from)	Wind Speed, u (m/s)						
		u ≤ 2	2 < u ≤ 3	3 < u ≤ 4	4 < u ≤ 5	5 < u ≤ 6	u > 6	Total
		Frequency (%) at 10 m Height						
	E	0.16	0.19	0.27	0.05	0.00	0.03	0.71
	ESE	0.15	0.25	0.21	0.07	0.01	0.00	0.68
	SE	0.17	0.23	0.30	0.21	0.02	0.01	0.94
	SSE	0.09	0.19	0.19	0.24	0.14	0.15	1.00
	S	0.07	0.23	0.19	0.18	0.11	0.08	0.87
	SSW	0.08	0.16	0.24	0.22	0.22	0.11	1.03
	SW	0.08	0.10	0.17	0.17	0.15	0.21	0.88
	WSW	0.05	0.13	0.22	0.21	0.17	0.34	1.11
	W	0.08	0.10	0.31	0.24	0.26	0.24	1.23
	WNW	0.08	0.11	0.22	0.19	0.17	0.05	0.82
	NW	0.18	0.34	0.31	0.39	0.15	0.26	1.63
	NNW	0.17	0.34	0.94	0.58	0.19	0.01	2.24
	Total	2.21	3.31	3.93	2.87	1.61	1.50	15.42
C	N	0.21	0.01	0.00	0.00	0.00	0.00	0.22
	NNE	0.13	0.00	0.00	0.00	0.00	0.00	0.13
	NE	0.13	0.08	0.02	0.00	0.00	0.00	0.23
	ENE	0.13	0.01	0.00	0.00	0.00	0.00	0.14
	E	0.13	0.03	0.00	0.00	0.00	0.00	0.16
	ESE	0.26	0.05	0.00	0.00	0.00	0.00	0.31
	SE	0.15	0.11	0.07	0.00	0.00	0.00	0.33
	SSE	0.08	0.01	0.00	0.00	0.00	0.00	0.09
	S	0.06	0.01	0.00	0.00	0.00	0.00	0.07
	SSW	0.09	0.02	0.00	0.00	0.00	0.00	0.11
	SW	0.06	0.01	0.00	0.00	0.00	0.00	0.07
	WSW	0.09	0.06	0.01	0.01	0.06	0.03	0.26
	W	0.00	0.02	0.00	0.01	0.02	0.00	0.06
	WNW	0.03	0.00	0.02	0.00	0.00	0.00	0.06
	NW	0.14	0.11	0.05	0.08	0.11	0.18	0.67
	NNW	0.21	0.06	0.03	0.01	0.02	0.00	0.33
	Total	1.87	0.61	0.21	0.11	0.22	0.22	3.23
D	N	0.25	0.00	0.17	0.63	0.22	0.16	1.43
	NNE	0.18	0.07	0.42	0.35	0.08	0.03	1.14
	NE	0.56	0.33	0.17	0.16	0.00	0.00	1.22
	ENE	0.33	0.29	0.11	0.02	0.00	0.00	0.75
	E	0.48	0.18	0.18	0.13	0.01	0.02	1.00
	ESE	0.79	0.32	0.37	0.09	0.00	0.02	1.59

Stability Class	Wind Direction (wind blowing from)	Wind Speed, u (m/s)						
		u ≤ 2	2 < u ≤ 3	3 < u ≤ 4	4 < u ≤ 5	5 < u ≤ 6	u > 6	Total
		Frequency (%) at 10 m Height						
	SE	1.12	0.27	0.66	0.22	0.08	0.05	2.40
	SSE	0.42	0.21	0.79	0.32	0.09	0.07	1.89
	S	0.34	0.16	0.70	0.66	0.35	0.21	2.42
	SSW	0.15	0.00	0.45	0.42	0.38	0.27	1.67
	SW	0.15	0.02	0.43	0.55	0.59	0.55	2.29
	WSW	0.13	0.01	0.25	0.33	0.29	0.57	1.58
	W	0.15	0.01	0.19	0.38	0.33	0.70	1.76
	WNW	0.15	0.03	0.41	0.37	0.21	0.30	1.46
	NW	0.26	0.09	0.67	0.74	0.49	0.47	2.73
	NNW	0.29	0.03	0.55	0.59	0.35	0.39	2.20
	Total	5.74	2.03	6.53	5.96	3.47	3.80	27.53
E	N	0.53	0.14	0.33	0.00	0.00	0.00	0.99
	NNE	0.74	0.18	0.03	0.00	0.00	0.00	0.96
	NE	1.36	0.35	0.00	0.00	0.00	0.00	1.71
	ENE	0.75	0.18	0.07	0.00	0.00	0.00	1.00
	E	0.64	0.41	0.03	0.00	0.00	0.00	1.08
	ESE	1.35	0.54	0.03	0.00	0.00	0.00	1.92
	SE	1.53	0.45	0.01	0.00	0.00	0.00	1.99
	SSE	0.86	0.55	0.03	0.00	0.00	0.00	1.44
	S	0.51	0.48	0.17	0.00	0.00	0.00	1.16
	SSW	0.29	0.26	0.22	0.00	0.00	0.00	0.76
	SW	0.16	0.16	0.13	0.00	0.00	0.00	0.45
	WSW	0.11	0.10	0.02	0.00	0.00	0.00	0.24
	W	0.23	0.13	0.07	0.00	0.00	0.00	0.42
	WNW	0.19	0.15	0.06	0.00	0.00	0.00	0.40
	NW	0.50	0.27	0.06	0.00	0.00	0.00	0.83
	NNW	0.49	0.41	0.09	0.00	0.00	0.00	0.99
	Total	10.24	4.76	1.36	0.00	0.00	0.00	16.36
F	N	0.92	0.45	0.00	0.00	0.00	0.00	1.37
	NNE	0.75	0.40	0.00	0.00	0.00	0.00	1.15
	NE	1.21	0.09	0.00	0.00	0.00	0.00	1.30
	ENE	1.28	0.26	0.00	0.00	0.00	0.00	1.54
	E	1.06	0.19	0.00	0.00	0.00	0.00	1.26
	ESE	1.59	0.27	0.00	0.00	0.00	0.00	1.86
	SE	1.78	0.23	0.00	0.00	0.00	0.00	2.01

Stability Class	**Wind Direction** (wind blowing from)	**Wind Speed, u (m/s)**						
		u ≤ 2	**2 < u ≤ 3**	**3 < u ≤ 4**	**4 < u ≤ 5**	**5 < u ≤ 6**	**u > 6**	**Total**
		Frequency (%) at 10 m Height						
	SSE	1.21	0.33	0.00	0.00	0.00	0.00	1.54
	S	0.84	0.31	0.00	0.00	0.00	0.00	1.15
	SSW	0.49	0.34	0.00	0.00	0.00	0.00	0.83
	SW	0.41	0.21	0.00	0.00	0.00	0.00	0.62
	WSW	0.19	0.14	0.00	0.00	0.00	0.00	0.33
	W	0.33	0.13	0.00	0.00	0.00	0.00	0.46
	WNW	0.37	0.22	0.00	0.00	0.00	0.00	0.58
	NW	0.54	0.15	0.00	0.00	0.00	0.00	0.68
	NNW	0.63	0.29	0.00	0.00	0.00	0.00	0.91
	Total	13.61	4.00	0.00	0.00	0.00	0.00	17.60
Grand Total		37.79	20.46	17.27	12.23	6.36	5.90	100.00

APPENDIX C: 2023 DETAILED DOSE CALCULATION RESULTS

Table 61 - Dose to Representative Persons Located at BR1

Age Class	Radionuclide	Air Inhalation	Air Immersion	Water Ingestion	Water Immersion	Soil (ingestion and external)	Sediment (ingestion and external)	Fish Ingestion	Plant Ingestion	Animal Ingestion	Total
Adult	Carbon-14	3.95E-04	4.54E-07	5.77E-06	4.03E-09	3.36E-11	8.94E-08	2.90E-02	1.31E-01	1.58E-01	3.19E-01
Adult	Cobalt-60	9.94E-07	3.77E-08	2.23E-06	9.91E-05	3.28E-03	1.43E-03	4.51E-04	7.17E-06	6.22E-05	5.33E-03
Adult	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Adult	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E-03	5.16E-04	0.00E+00	6.01E-03	1.31E-02
Adult	Tritium oxide	4.00E-01	0.00E+00	1.03E-02	4.38E-03	0.00E+00	0.00E+00	3.89E-03	1.40E-01	1.62E-02	5.74E-01
Adult	Iodine, mixed fission products	4.59E-06	3.09E-07	0.00E+00	0.00E+00	4.79E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.38E-06
Adult	Noble Gases	0.00E+00	1.54E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.54E-01
Adult	**Total**	4.00E-01	1.54E-01	1.03E-02	4.48E-03	3.28E-03	7.95E-03	3.39E-02	2.71E-01	1.80E-01	1.06E+00
Child	Carbon-14	5.63E-04	4.54E-07	3.17E-06	4.03E-09	7.30E-11	1.04E-06	1.74E-02	1.51E-01	1.13E-01	2.82E-01
Child	Cobalt-60	1.42E-06	3.77E-08	2.87E-06	9.91E-05	3.28E-03	1.44E-03	6.34E-04	1.80E-05	6.07E-05	5.53E-03
Child	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Child	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.58E-03	1.73E-04	0.00E+00	1.33E-03	8.08E-03
Child	Tritium oxide	4.75E-01	0.00E+00	5.11E-03	3.65E-03	0.00E+00	0.00E+00	2.18E-03	1.30E-01	1.57E-02	6.32E-01
Child	Iodine, mixed fission products	1.03E-05	3.09E-07	0.00E+00	0.00E+00	4.80E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.11E-05
Child	Noble Gases	0.00E+00	1.54E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.54E-01
Child	**Total**	4.76E-01	1.54E-01	5.11E-03	3.75E-03	3.28E-03	8.01E-03	2.04E-02	2.81E-01	1.30E-01	1.08E+00
Infant	Carbon-14	3.85E-04	4.54E-07	0.00E+00	5.91E-11	1.24E-10	2.28E-06	1.19E-02	1.26E-01	1.16E-01	2.54E-01
Infant	Cobalt-60	1.04E-06	4.90E-08	0.00E+00	1.16E-06	4.27E-03	1.88E-03	5.31E-04	1.92E-05	5.02E-05	6.75E-03
Infant	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Infant	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.55E-03	7.07E-05	0.00E+00	5.05E-04	9.13E-03
Infant	Tritium oxide	3.28E-01	0.00E+00	0.00E+00	1.36E-04	0.00E+00	0.00E+00	1.56E-03	1.35E-01	2.65E-02	4.91E-01

Age Class	Radionuclide	Air Inhalation	Air Immersion	Water Ingestion	Water Immersion	Soil (ingestion and external)	Sediment (ingestion and external)	Fish Ingestion	Plant Ingestion	Animal Ingestion	Total
Infant	Iodine, mixed fission products	1.23E-05	4.02E-07	0.00E+00	0.00E+00	6.26E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.33E-05
Infant	Noble Gases	0.00E+00	1.99E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.99E-01
Infant	**Total**	3.28E-01	1.99E-01	0.00E+00	1.37E-04	4.27E-03	1.04E-02	1.40E-02	2.61E-01	1.43E-01	9.60E-01

Note:

1. All doses reported in units of microsieverts per year.

2. Dose associated with cesium-137 includes dose due to external exposure to progeny of cesium-137 in air, water, soil, and sediment.

3. Dose associated with tritium oxide includes dose incurred via ingestion of organically bound tritium in fish, plant produce and animal products.

Table 62 - Dose to Representative Persons Located at BR17

Age Class	Radionuclide	Air Inhalation	Air Immersion	Water Ingestion	Water Immersion	Soil (ingestion and external)	Sediment (ingestion and external)	Fish Ingestion	Plant Ingestion	Animal Ingestion	Total
Adult	Carbon-14	2.12E-04	2.44E-07	3.67E-06	4.00E-09	6.91E-12	8.94E-08	2.90E-02	8.70E-02	8.97E-02	2.06E-01
Adult	Cobalt-60	6.43E-07	2.44E-08	2.23E-06	9.91E-05	3.32E-03	1.43E-03	4.51E-04	6.94E-06	6.21E-05	5.37E-03
Adult	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Adult	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E-03	5.16E-04	0.00E+00	6.01E-03	1.31E-02
Adult	Tritium oxide	2.55E-01	0.00E+00	1.03E-02	4.38E-03	0.00E+00	0.00E+00	3.89E-03	7.13E-02	1.61E-02	3.61E-01
Adult	Iodine, mixed fission products	2.97E-06	2.00E-07	0.00E+00	0.00E+00	3.38E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.51E-06
Adult	Noble Gases	0.00E+00	9.92E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.92E-02
Adult	**Total**	2.55E-01	9.92E-02	1.03E-02	4.48E-03	3.32E-03	7.95E-03	3.39E-02	1.58E-01	1.12E-01	6.85E-01
Child	Carbon-14	3.03E-04	2.44E-07	2.02E-06	4.00E-09	1.50E-11	1.04E-06	1.74E-02	9.53E-02	7.32E-02	1.86E-01
Child	Cobalt-60	9.17E-07	2.44E-08	2.87E-06	9.91E-05	3.32E-03	1.44E-03	6.34E-04	1.75E-05	6.06E-05	5.57E-03
Child	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Child	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.58E-03	1.73E-04	0.00E+00	1.33E-03	8.08E-03
Child	Tritium oxide	3.04E-01	0.00E+00	5.11E-03	3.65E-03	0.00E+00	0.00E+00	2.18E-03	6.72E-02	1.56E-02	3.97E-01
Child	Iodine, mixed fission products	6.65E-06	2.00E-07	0.00E+00	0.00E+00	3.38E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.19E-06
Child	Noble Gases	0.00E+00	9.92E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.92E-02
Child	**Total**	3.04E-01	9.92E-02	5.11E-03	3.75E-03	3.32E-03	8.01E-03	2.04E-02	1.63E-01	9.02E-02	6.96E-01
Infant	Carbon-14	2.07E-04	2.44E-07	0.00E+00	4.81E-11	2.56E-11	2.28E-06	1.19E-02	7.82E-02	8.81E-02	1.78E-01
Infant	Cobalt-60	6.72E-07	3.17E-08	0.00E+00	1.16E-06	4.31E-03	1.88E-03	5.31E-04	1.86E-05	5.01E-05	6.80E-03
Infant	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Infant	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.55E-03	7.07E-05	0.00E+00	5.05E-04	9.13E-03
Infant	Tritium oxide	2.09E-01	0.00E+00	0.00E+00	1.36E-04	0.00E+00	0.00E+00	1.56E-03	6.83E-02	2.65E-02	3.06E-01
Infant	Iodine, mixed fission products	7.96E-06	2.60E-07	0.00E+00	0.00E+00	4.41E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.66E-06
Infant	Noble Gases	0.00E+00	1.28E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.28E-01
Infant	**Total**	2.10E-01	1.28E-01	0.00E+00	1.37E-04	4.31E-03	1.04E-02	1.40E-02	1.47E-01	1.15E-01	6.29E-01

Note:

1. All doses reported in units of microsieverts per year.
2. Dose associated with cesium-137 includes dose due to external exposure to progeny of cesium-137 in air, water, soil, and sediment.
3. Dose associated with tritium oxide includes dose incurred via ingestion of organically bound tritium in fish, plant produce and animal products.

Table 63 - Dose to Representative Persons Located at BR25

Age Class	Radionuclide	Air Inhalation	Air Immersion	Water Ingestion	Water Immersion	Soil (ingestion and external)	Sediment (ingestion and external)	Fish Ingestion	Plant Ingestion	Animal Ingestion	Total
Adult	Carbon-14	1.27E-05	1.46E-08	1.58E-06	3.98E-09	1.52E-11	8.94E-08	2.90E-02	3.34E-02	1.55E-02	7.79E-02
Adult	Cobalt-60	1.17E-06	4.42E-08	2.23E-06	9.91E-05	4.41E-03	1.43E-03	4.51E-04	9.43E-06	6.28E-05	6.46E-03
Adult	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Adult	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E-03	5.16E-04	0.00E+00	6.01E-03	1.31E-02
Adult	Tritium oxide	4.68E-01	0.00E+00	1.03E-02	4.38E-03	0.00E+00	0.00E+00	3.89E-03	1.00E-01	1.62E-02	6.02E-01
Adult	Iodine, mixed fission products	5.37E-06	3.61E-07	0.00E+00	0.00E+00	5.73E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.30E-06
Adult	Noble Gases	0.00E+00	1.79E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.79E-01
Adult	**Total**	4.68E-01	1.79E-01	1.03E-02	4.48E-03	4.41E-03	7.95E-03	3.39E-02	1.33E-01	3.78E-02	8.79E-01
Child	Carbon-14	1.81E-05	1.46E-08	8.66E-07	3.98E-09	3.31E-11	1.04E-06	1.74E-02	3.52E-02	2.94E-02	8.20E-02
Child	Cobalt-60	1.66E-06	4.42E-08	2.87E-06	9.91E-05	4.41E-03	1.44E-03	6.34E-04	2.38E-05	6.18E-05	6.67E-03
Child	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Child	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.58E-03	1.73E-04	0.00E+00	1.33E-03	8.08E-03
Child	Tritium oxide	5.56E-01	0.00E+00	5.11E-03	3.65E-03	0.00E+00	0.00E+00	2.18E-03	9.76E-02	1.57E-02	6.80E-01
Child	Iodine, mixed fission products	1.20E-05	3.61E-07	0.00E+00	0.00E+00	5.74E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.30E-05
Child	Noble Gases	0.00E+00	1.79E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.79E-01
Child	**Total**	5.56E-01	1.79E-01	5.11E-03	3.75E-03	4.41E-03	8.01E-03	2.04E-02	1.33E-01	4.64E-02	9.56E-01
Infant	Carbon-14	1.24E-05	1.46E-08	0.00E+00	3.69E-11	5.64E-11	2.28E-06	1.19E-02	3.57E-02	5.81E-02	1.06E-01
Infant	Cobalt-60	1.22E-06	5.75E-08	0.00E+00	1.16E-06	5.73E-03	1.88E-03	5.31E-04	2.53E-05	5.11E-05	8.22E-03
Infant	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Infant	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.55E-03	7.07E-05	0.00E+00	5.05E-04	9.13E-03
Infant	Tritium oxide	3.84E-01	0.00E+00	0.00E+00	1.36E-04	0.00E+00	0.00E+00	1.56E-03	1.06E-01	2.65E-02	5.17E-01
Infant	Iodine, mixed fission products	1.44E-05	4.70E-07	0.00E+00	0.00E+00	7.48E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.56E-05
Infant	Noble Gases	0.00E+00	2.31E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.31E-01
Infant	**Total**	3.84E-01	2.31E-01	0.00E+00	1.37E-04	5.73E-03	1.04E-02	1.40E-02	1.41E-01	8.52E-02	8.72E-01

Note:

1. All doses reported in units of microsieverts per year.
2. Dose associated with cesium-137 includes dose due to external exposure to progeny of cesium-137 in air, water, soil, and sediment.
3. Dose associated with tritium oxide includes dose incurred via ingestion of organically bound tritium in fish, plant produce and animal products.

Table 64 - Dose to Representative Persons Located at BR27

Age Class	Radionuclide	Air Inhalation	Air Immersion	Water Ingestion	Water Immersion	Soil (ingestion and external)	Sediment (ingestion and external)	Fish Ingestion	Plant Ingestion	Animal Ingestion	Total
Adult	Carbon-14	1.27E-05	1.46E-08	3.37E-05	4.13E-09	1.52E-11	8.94E-08	2.90E-02	3.34E-02	1.55E-02	7.79E-02
Adult	Cobalt-60	1.17E-06	4.42E-08	6.66E-05	1.04E-04	3.21E-03	1.43E-03	4.51E-04	1.04E-05	6.33E-05	5.33E-03
Adult	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Adult	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E-03	5.16E-04	0.00E+00	6.01E-03	1.31E-02
Adult	Tritium oxide	4.68E-01	0.00E+00	9.22E-03	4.37E-03	0.00E+00	0.00E+00	3.89E-03	1.00E-01	1.62E-02	6.01E-01
Adult	Iodine, mixed fission products	5.37E-06	3.61E-07	0.00E+00	0.00E+00	5.44E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.27E-06
Adult	Noble Gases	0.00E+00	1.79E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.79E-01
Adult	**Total**	4.68E-01	1.79E-01	9.32E-03	4.47E-03	3.21E-03	7.95E-03	3.39E-02	1.33E-01	3.78E-02	8.76E-01
Child	Carbon-14	1.81E-05	1.46E-08	1.85E-05	4.13E-09	3.31E-11	1.04E-06	1.74E-02	3.52E-02	2.94E-02	8.20E-02
Child	Cobalt-60	1.66E-06	4.42E-08	8.58E-05	1.04E-04	3.21E-03	1.44E-03	6.34E-04	2.59E-05	6.26E-05	5.56E-03
Child	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Child	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.58E-03	1.73E-04	0.00E+00	1.33E-03	8.08E-03
Child	Tritium oxide	5.56E-01	0.00E+00	4.59E-03	3.64E-03	0.00E+00	0.00E+00	2.18E-03	9.76E-02	1.57E-02	6.80E-01
Child	Iodine, mixed fission products	1.20E-05	3.61E-07	0.00E+00	0.00E+00	5.45E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.29E-05
Child	Noble Gases	0.00E+00	1.79E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.79E-01
Child	**Total**	5.56E-01	1.79E-01	4.69E-03	3.75E-03	3.21E-03	8.01E-03	2.04E-02	1.33E-01	4.64E-02	9.54E-01
Infant	Carbon-14	1.24E-05	1.46E-08	0.00E+00	1.88E-10	5.64E-11	2.28E-06	1.19E-02	3.57E-02	5.81E-02	1.06E-01
Infant	Cobalt-60	1.22E-06	5.75E-08	0.00E+00	7.17E-06	4.17E-03	1.88E-03	5.31E-04	2.82E-05	5.18E-05	6.67E-03
Infant	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Infant	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.55E-03	7.07E-05	0.00E+00	5.05E-04	9.13E-03
Infant	Tritium oxide	3.84E-01	0.00E+00	0.00E+00	1.27E-04	0.00E+00	0.00E+00	1.56E-03	1.06E-01	2.65E-02	5.17E-01
Infant	Iodine, mixed fission products	1.44E-05	4.70E-07	0.00E+00	0.00E+00	7.11E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.56E-05
Infant	Noble Gases	0.00E+00	2.31E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.31E-01
Infant	**Total**	3.84E-01	2.31E-01	0.00E+00	1.34E-04	4.17E-03	1.04E-02	1.40E-02	1.41E-01	8.52E-02	8.70E-01

Note:

1. All doses reported in units of microsieverts per year.
2. Dose associated with cesium-137 includes dose due to external exposure to progeny of cesium-137 in air, water, soil, and sediment.
3. Dose associated with tritium oxide includes dose incurred via ingestion of organically bound tritium in fish, plant produce and animal products.

Table 65 - Dose to Representative Persons Located at BR32

Age Class	Radionuclide	Air Inhalation	Air Immersion	Water Ingestion	Water Immersion	Soil (ingestion and external)	Sediment (ingestion and external)	Fish Ingestion	Plant Ingestion	Animal Ingestion	Total
Adult	Carbon-14	1.27E-05	1.46E-08	7.95E-05	5.18E-09	5.05E-10	8.94E-08	2.90E-02	3.34E-02	1.55E-02	7.80E-02
Adult	Cobalt-60	1.15E-06	4.35E-08	1.59E-04	1.36E-04	8.10E-03	1.43E-03	4.51E-04	1.83E-05	6.66E-05	1.04E-02
Adult	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Adult	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E-03	5.16E-04	0.00E+00	6.01E-03	1.31E-02
Adult	Tritium oxide	4.62E-01	0.00E+00	9.79E-03	4.37E-03	0.00E+00	0.00E+00	3.89E-03	1.00E-01	1.62E-02	5.97E-01
Adult	Iodine, mixed fission products	5.31E-06	3.58E-07	0.00E+00	0.00E+00	5.39E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.21E-06
Adult	Noble Gases	0.00E+00	1.77E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.77E-01
Adult	**Total**	4.62E-01	1.77E-01	1.00E-02	4.50E-03	8.10E-03	7.95E-03	3.39E-02	1.33E-01	3.77E-02	8.75E-01
Child	Carbon-14	1.81E-05	1.46E-08	4.36E-05	5.18E-09	1.10E-09	1.04E-06	1.74E-02	3.52E-02	2.94E-02	8.20E-02
Child	Cobalt-60	1.64E-06	4.35E-08	2.05E-04	1.36E-04	8.10E-03	1.44E-03	6.34E-04	4.56E-05	6.81E-05	1.06E-02
Child	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Child	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.58E-03	1.73E-04	0.00E+00	1.33E-03	8.08E-03
Child	Tritium oxide	5.50E-01	0.00E+00	4.87E-03	3.64E-03	0.00E+00	0.00E+00	2.18E-03	9.76E-02	1.57E-02	6.74E-01
Child	Iodine, mixed fission products	1.19E-05	3.58E-07	0.00E+00	0.00E+00	5.40E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.28E-05
Child	Noble Gases	0.00E+00	1.77E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.77E-01
Child	**Total**	5.50E-01	1.77E-01	5.12E-03	3.78E-03	8.10E-03	8.01E-03	2.04E-02	1.33E-01	4.64E-02	9.51E-01
Infant	Carbon-14	1.24E-05	1.46E-08	0.00E+00	3.22E-10	1.87E-09	2.28E-06	1.19E-02	3.57E-02	5.81E-02	1.06E-01
Infant	Cobalt-60	1.20E-06	5.66E-08	0.00E+00	1.27E-05	1.05E-02	1.88E-03	5.31E-04	4.94E-05	5.67E-05	1.31E-02
Infant	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Infant	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.55E-03	7.07E-05	0.00E+00	5.05E-04	9.13E-03
Infant	Tritium oxide	3.79E-01	0.00E+00	0.00E+00	7.24E-05	0.00E+00	0.00E+00	1.56E-03	1.06E-01	2.65E-02	5.13E-01
Infant	Iodine, mixed fission products	1.42E-05	4.65E-07	0.00E+00	0.00E+00	7.05E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.54E-05
Infant	Noble Gases	0.00E+00	2.29E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.29E-01
Infant	**Total**	3.79E-01	2.29E-01	0.00E+00	8.51E-05	1.05E-02	1.04E-02	1.40E-02	1.41E-01	8.52E-02	8.70E-01

Note:

1. All doses reported in units of microsieverts per year.
2. Dose associated with cesium-137 includes dose due to external exposure to progeny of cesium-137 in air, water, soil, and sediment.
3. Dose associated with tritium oxide includes dose incurred via ingestion of organically bound tritium in fish, plant produce and animal products.

Table 66 - Dose to Representative Persons Located at BR48

Age Class	Radionuclide	Air Inhalation	Air Immersion	Water Ingestion	Water Immersion	Soil (ingestion and external)	Sediment (ingestion and external)	Fish Ingestion	Plant Ingestion	Animal Ingestion	Total
Adult	Carbon-14	3.86E-04	4.44E-07	5.68E-06	4.03E-09	3.36E-11	8.94E-08	2.90E-02	1.58E-01	1.55E-01	3.42E-01
Adult	Cobalt-60	1.17E-06	4.44E-08	2.23E-06	9.91E-05	5.77E-03	1.43E-03	4.51E-04	1.20E-05	6.35E-05	7.83E-03
Adult	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Adult	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E-03	5.16E-04	0.00E+00	6.01E-03	1.31E-02
Adult	Tritium oxide	4.71E-01	0.00E+00	1.03E-02	4.38E-03	0.00E+00	0.00E+00	3.89E-03	1.18E-01	1.62E-02	6.24E-01
Adult	Iodine, mixed fission products	5.42E-06	3.65E-07	0.00E+00	0.00E+00	6.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.40E-06
Adult	Noble Gases	0.00E+00	1.81E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.81E-01
Adult	**Total**	4.72E-01	1.81E-01	1.03E-02	4.48E-03	5.77E-03	7.95E-03	3.39E-02	2.77E-01	1.77E-01	1.17E+00
Child	Carbon-14	5.51E-04	4.44E-07	3.12E-06	4.03E-09	7.30E-11	1.04E-06	1.74E-02	1.74E-01	1.12E-01	3.03E-01
Child	Cobalt-60	1.67E-06	4.44E-08	2.87E-06	9.91E-05	5.77E-03	1.44E-03	6.34E-04	3.02E-05	6.29E-05	8.04E-03
Child	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Child	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.58E-03	1.73E-04	0.00E+00	1.33E-03	8.08E-03
Child	Tritium oxide	5.60E-01	0.00E+00	5.11E-03	3.65E-03	0.00E+00	0.00E+00	2.18E-03	1.20E-01	1.57E-02	7.07E-01
Child	Iodine, mixed fission products	1.21E-05	3.65E-07	0.00E+00	0.00E+00	6.11E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.31E-05
Child	Noble Gases	0.00E+00	1.81E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.81E-01
Child	**Total**	5.61E-01	1.81E-01	5.11E-03	3.75E-03	5.77E-03	8.01E-03	2.04E-02	2.94E-01	1.29E-01	1.21E+00
Infant	Carbon-14	3.76E-04	4.44E-07	0.00E+00	5.86E-11	1.24E-10	2.28E-06	1.19E-02	1.42E-01	1.14E-01	2.69E-01
Infant	Cobalt-60	1.23E-06	5.78E-08	0.00E+00	1.16E-06	7.51E-03	1.88E-03	5.31E-04	3.22E-05	5.22E-05	1.00E-02
Infant	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Infant	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.55E-03	7.07E-05	0.00E+00	5.05E-04	9.13E-03
Infant	Tritium oxide	3.86E-01	0.00E+00	0.00E+00	1.36E-04	0.00E+00	0.00E+00	1.56E-03	1.37E-01	2.66E-02	5.52E-01
Infant	Iodine, mixed fission products	1.45E-05	4.75E-07	0.00E+00	0.00E+00	7.97E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.58E-05
Infant	Noble Gases	0.00E+00	2.34E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.34E-01
Infant	**Total**	3.87E-01	2.34E-01	0.00E+00	1.37E-04	7.51E-03	1.04E-02	1.40E-02	2.80E-01	1.41E-01	1.07E+00

Note:

1. All doses reported in units of microsieverts per year.
2. Dose associated with cesium-137 includes dose due to external exposure to progeny of cesium-137 in air, water, soil, and sediment.
3. Dose associated with tritium oxide includes dose incurred via ingestion of organically bound tritium in fish, plant produce and animal products.

Table 67 - Dose to Representative Persons Located at BF8

Age Class	Radionuclide	Air Inhalation	Air Immersion	Water Ingestion	Water Immersion	Soil (ingestion and external)	Sediment (ingestion and external)	Fish Ingestion	Plant Ingestion	Animal Ingestion	Total
Adult	Carbon-14	2.35E-04	2.70E-07	1.89E-05	3.97E-09	1.52E-11	8.94E-08	2.81E-02	1.65E-01	1.46E-01	3.39E-01
Adult	Cobalt-60	5.39E-07	2.04E-08	2.68E-05	9.82E-05	2.33E-03	1.43E-03	4.37E-04	1.13E-05	1.22E-04	4.45E-03
Adult	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Adult	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E-03	5.01E-04	0.00E+00	1.20E-02	1.91E-02
Adult	Tritium oxide	2.12E-01	0.00E+00	2.14E-02	4.33E-03	0.00E+00	0.00E+00	3.77E-03	1.49E-01	2.23E-02	4.14E-01
Adult	Iodine, mixed fission products	2.49E-06	1.68E-07	0.00E+00	0.00E+00	2.72E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.93E-06
Adult	Noble Gases	0.00E+00	8.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.30E-02
Adult	**Total**	2.13E-01	8.30E-02	2.14E-02	4.43E-03	2.33E-03	7.95E-03	3.29E-02	3.14E-01	1.80E-01	8.59E-01
Child	Carbon-14	3.35E-04	2.70E-07	1.04E-05	3.97E-09	3.31E-11	1.04E-06	1.69E-02	1.75E-01	9.72E-02	2.89E-01
Child	Cobalt-60	7.69E-07	2.04E-08	3.45E-05	9.82E-05	2.33E-03	1.44E-03	6.15E-04	2.72E-05	1.15E-04	4.65E-03
Child	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Child	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.58E-03	1.68E-04	0.00E+00	2.62E-03	9.36E-03
Child	Tritium oxide	2.53E-01	0.00E+00	1.06E-02	3.61E-03	0.00E+00	0.00E+00	2.11E-03	1.52E-01	1.47E-02	4.36E-01
Child	Iodine, mixed fission products	5.58E-06	1.68E-07	0.00E+00	0.00E+00	2.73E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.02E-06
Child	Noble Gases	0.00E+00	8.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.30E-02
Child	**Total**	2.53E-01	8.30E-02	1.07E-02	3.71E-03	2.33E-03	8.01E-03	1.98E-02	3.27E-01	1.15E-01	8.22E-01
Infant	Carbon-14	2.29E-04	2.70E-07	0.00E+00	1.32E-11	5.64E-11	2.28E-06	1.15E-02	1.48E-01	8.70E-02	2.47E-01
Infant	Cobalt-60	5.64E-07	2.66E-08	0.00E+00	0.00E+00	3.03E-03	1.88E-03	5.15E-04	2.98E-05	9.22E-05	5.54E-03
Infant	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Infant	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.55E-03	6.86E-05	0.00E+00	1.01E-03	9.63E-03
Infant	Tritium oxide	1.74E-01	0.00E+00	0.00E+00	9.15E-05	0.00E+00	0.00E+00	1.51E-03	1.74E-01	1.84E-02	3.68E-01
Infant	Iodine, mixed fission products	6.67E-06	2.18E-07	0.00E+00	0.00E+00	3.56E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.24E-06
Infant	Noble Gases	0.00E+00	1.08E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.08E-01
Infant	**Total**	1.74E-01	1.08E-01	0.00E+00	9.15E-05	3.03E-03	1.04E-02	1.36E-02	3.22E-01	1.06E-01	7.38E-01

Note:

1. All doses reported in units of microsieverts per year.

2. Dose associated with cesium-137 includes dose due to external exposure to progeny of cesium-137 in air, water, soil, and sediment.

3. Dose associated with tritium oxide includes dose incurred via ingestion of organically bound tritium in fish, plant produce and animal products.

Table 68 - Dose to Representative Persons Located at BF14

Age Class	Radionuclide	Air Inhalation	Air Immersion	Water Ingestion	Water Immersion	Soil (ingestion and external)	Sediment (ingestion and external)	Fish Ingestion	Plant Ingestion	Animal Ingestion	Total
Adult	Carbon-14	1.70E-04	1.95E-07	1.82E-05	3.96E-09	1.52E-11	8.94E-08	2.81E-02	1.18E-01	1.07E-01	2.53E-01
Adult	Cobalt-60	1.15E-06	4.35E-08	2.68E-05	9.82E-05	3.70E-03	1.43E-03	4.37E-04	1.67E-05	1.24E-04	5.83E-03
Adult	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Adult	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E-03	5.01E-04	0.00E+00	1.20E-02	1.91E-02
Adult	Tritium oxide	4.62E-01	0.00E+00	2.14E-02	4.33E-03	0.00E+00	0.00E+00	3.77E-03	2.09E-01	2.26E-02	7.24E-01
Adult	Iodine, mixed fission products	5.31E-06	3.58E-07	0.00E+00	0.00E+00	5.52E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.22E-06
Adult	Noble Gases	0.00E+00	1.77E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.77E-01
Adult	**Total**	4.62E-01	1.77E-01	2.14E-02	4.43E-03	3.70E-03	7.95E-03	3.29E-02	3.27E-01	1.42E-01	1.18E+00
Child	Carbon-14	2.42E-04	1.95E-07	1.00E-05	3.96E-09	3.31E-11	1.04E-06	1.69E-02	1.29E-01	7.43E-02	2.20E-01
Child	Cobalt-60	1.64E-06	4.35E-08	3.45E-05	9.82E-05	3.70E-03	1.44E-03	6.15E-04	4.02E-05	1.17E-04	6.04E-03
Child	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Child	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.58E-03	1.68E-04	0.00E+00	2.62E-03	9.36E-03
Child	Tritium oxide	5.50E-01	0.00E+00	1.06E-02	3.61E-03	0.00E+00	0.00E+00	2.11E-03	2.00E-01	1.49E-02	7.81E-01
Child	Iodine, mixed fission products	1.19E-05	3.58E-07	0.00E+00	0.00E+00	5.52E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.28E-05
Child	Noble Gases	0.00E+00	1.77E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.77E-01
Child	**Total**	5.50E-01	1.77E-01	1.07E-02	3.71E-03	3.70E-03	8.01E-03	1.98E-02	3.29E-01	9.19E-02	1.19E+00
Infant	Carbon-14	1.66E-04	1.95E-07	0.00E+00	9.69E-12	5.64E-11	2.28E-06	1.15E-02	1.17E-01	7.13E-02	2.00E-01
Infant	Cobalt-60	1.20E-06	5.66E-08	0.00E+00	0.00E+00	4.81E-03	1.88E-03	5.15E-04	4.39E-05	9.40E-05	7.34E-03
Infant	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Infant	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.55E-03	6.86E-05	0.00E+00	1.01E-03	9.63E-03
Infant	Tritium oxide	3.79E-01	0.00E+00	0.00E+00	9.15E-05	0.00E+00	0.00E+00	1.51E-03	2.15E-01	1.85E-02	6.14E-01
Infant	Iodine, mixed fission products	1.42E-05	4.65E-07	0.00E+00	0.00E+00	7.21E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.54E-05
Infant	Noble Gases	0.00E+00	2.29E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.29E-01
Infant	**Total**	3.79E-01	2.29E-01	0.00E+00	9.15E-05	4.81E-03	1.04E-02	1.36E-02	3.32E-01	9.09E-02	1.06E+00

Note:

1. All doses reported in units of microsieverts per year.
2. Dose associated with cesium-137 includes dose due to external exposure to progeny of cesium-137 in air, water, soil, and sediment.
3. Dose associated with tritium oxide includes dose incurred via ingestion of organically bound tritium in fish, plant produce and animal products.

Table 69 - Dose to Representative Persons Located at BF16

Age Class	Radionuclide	Air Inhalation	Air Immersion	Water Ingestion	Water Immersion	Soil (ingestion and external)	Sediment (ingestion and external)	Fish Ingestion	Plant Ingestion	Animal Ingestion	Total
Adult	Carbon-14	2.12E-04	2.44E-07	1.86E-05	3.97E-09	6.91E-12	8.94E-08	2.81E-02	1.42E-01	1.32E-01	3.02E-01
Adult	Cobalt-60	6.43E-07	2.44E-08	2.68E-05	9.82E-05	3.08E-03	1.43E-03	4.37E-04	1.39E-05	1.23E-04	5.21E-03
Adult	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Adult	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E-03	5.01E-04	0.00E+00	1.20E-02	1.91E-02
Adult	Tritium oxide	2.55E-01	0.00E+00	2.14E-02	4.33E-03	0.00E+00	0.00E+00	3.77E-03	1.49E-01	2.24E-02	4.57E-01
Adult	Iodine, mixed fission products	2.97E-06	2.00E-07	0.00E+00	0.00E+00	3.32E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.50E-06
Adult	Noble Gases	0.00E+00	9.92E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.92E-02
Adult	**Total**	2.55E-01	9.92E-02	2.14E-02	4.43E-03	3.08E-03	7.95E-03	3.29E-02	2.91E-01	1.66E-01	8.82E-01
Child	Carbon-14	3.03E-04	2.44E-07	1.02E-05	3.97E-09	1.50E-11	1.04E-06	1.69E-02	1.49E-01	8.91E-02	2.56E-01
Child	Cobalt-60	9.17E-07	2.44E-08	3.45E-05	9.82E-05	3.08E-03	1.44E-03	6.15E-04	3.35E-05	1.16E-04	5.42E-03
Child	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Child	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.58E-03	1.68E-04	0.00E+00	2.62E-03	9.36E-03
Child	Tritium oxide	3.04E-01	0.00E+00	1.06E-02	3.61E-03	0.00E+00	0.00E+00	2.11E-03	1.37E-01	1.47E-02	4.72E-01
Child	Iodine, mixed fission products	6.65E-06	2.00E-07	0.00E+00	0.00E+00	3.33E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.18E-06
Child	Noble Gases	0.00E+00	9.92E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.92E-02
Child	**Total**	3.04E-01	9.92E-02	1.07E-02	3.71E-03	3.08E-03	8.01E-03	1.98E-02	2.86E-01	1.07E-01	8.41E-01
Infant	Carbon-14	2.07E-04	2.44E-07	0.00E+00	1.17E-11	2.56E-11	2.28E-06	1.15E-02	1.24E-01	8.14E-02	2.17E-01
Infant	Cobalt-60	6.72E-07	3.17E-08	0.00E+00	0.00E+00	4.01E-03	1.88E-03	5.15E-04	3.66E-05	9.30E-05	6.53E-03
Infant	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Infant	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.55E-03	6.86E-05	0.00E+00	1.01E-03	9.63E-03
Infant	Tritium oxide	2.09E-01	0.00E+00	0.00E+00	9.15E-05	0.00E+00	0.00E+00	1.51E-03	1.38E-01	1.84E-02	3.68E-01
Infant	Iodine, mixed fission products	7.96E-06	2.60E-07	0.00E+00	0.00E+00	4.34E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.65E-06
Infant	Noble Gases	0.00E+00	1.28E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.28E-01
Infant	**Total**	2.10E-01	1.28E-01	0.00E+00	9.15E-05	4.01E-03	1.04E-02	1.36E-02	2.62E-01	1.01E-01	7.29E-01

Note:

1. All doses reported in units of microsieverts per year.
2. Dose associated with cesium-137 includes dose due to external exposure to progeny of cesium-137 in air, water, soil, and sediment.
3. Dose associated with tritium oxide includes dose incurred via ingestion of organically bound tritium in fish, plant produce and animal products.

Table 70 - Dose to Representative Persons Located at BSF2

Age Class	Radionuclide	Air Inhalation	Air Immersion	Water Ingestion	Water Immersion	Soil (ingestion and external)	Sediment (ingestion and external)	Fish Ingestion	Plant Ingestion	Animal Ingestion	Total
Adult	Carbon-14	1.85E-04	2.12E-07	2.30E-06	3.96E-09	1.52E-11	8.94E-08	1.26E-01	3.70E-01	2.59E-01	7.55E-01
Adult	Cobalt-60	5.39E-07	2.04E-08	0.00E+00	9.82E-05	1.76E-03	1.43E-03	1.96E-03	1.65E-05	1.24E-04	5.38E-03
Adult	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Adult	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E-03	2.25E-03	0.00E+00	1.20E-02	2.08E-02
Adult	Tritium oxide	2.12E-01	0.00E+00	1.12E-02	4.33E-03	0.00E+00	0.00E+00	1.69E-02	2.44E-01	4.50E-02	5.34E-01
Adult	Iodine, mixed fission products	2.49E-06	1.68E-07	0.00E+00	0.00E+00	2.59E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.92E-06
Adult	Noble Gases	0.00E+00	8.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.30E-02
Adult	**Total**	2.13E-01	8.30E-02	1.12E-02	4.43E-03	1.76E-03	7.95E-03	1.47E-01	6.14E-01	3.16E-01	1.40E+00
Child	Carbon-14	2.64E-04	2.12E-07	1.26E-06	3.96E-09	3.31E-11	1.04E-06	7.58E-02	4.12E-01	2.47E-01	7.36E-01
Child	Cobalt-60	7.69E-07	4.90E-08	0.00E+00	1.16E-06	1.76E-03	1.44E-03	2.76E-03	4.19E-05	1.20E-04	6.11E-03
Child	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Child	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.58E-03	7.52E-04	0.00E+00	2.62E-03	9.94E-03
Child	Tritium oxide	2.53E-01	0.00E+00	5.59E-03	3.61E-03	0.00E+00	0.00E+00	9.47E-03	2.49E-01	4.72E-02	5.67E-01
Child	Iodine, mixed fission products	5.58E-06	1.68E-07	0.00E+00	0.00E+00	2.59E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.01E-06
Child	Noble Gases	0.00E+00	8.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.30E-02
Child	**Total**	2.53E-01	8.30E-02	5.59E-03	3.61E-03	1.76E-03	8.01E-03	8.88E-02	6.61E-01	2.97E-01	1.40E+00
Infant	Carbon-14	1.80E-04	2.12E-07	0.00E+00	1.03E-11	5.64E-11	2.28E-06	5.16E-02	3.39E-01	3.39E-01	7.30E-01
Infant	Cobalt-60	5.64E-07	2.66E-08	0.00E+00	0.00E+00	2.28E-03	1.88E-03	2.31E-03	4.27E-05	1.05E-04	6.62E-03
Infant	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Infant	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.55E-03	3.07E-04	0.00E+00	1.01E-03	9.87E-03
Infant	Tritium oxide	1.74E-01	0.00E+00	0.00E+00	9.14E-05	0.00E+00	0.00E+00	6.78E-03	2.69E-01	8.30E-02	5.33E-01
Infant	Iodine, mixed fission products	6.67E-06	2.18E-07	0.00E+00	0.00E+00	3.38E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.23E-06
Infant	Noble Gases	0.00E+00	1.08E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.08E-01
Infant	**Total**	1.74E-01	1.08E-01	0.00E+00	9.14E-05	2.28E-03	1.04E-02	6.10E-02	6.08E-01	4.23E-01	1.39E+00

Note:

1. All doses reported in units of microsieverts per year.
2. Dose associated with cesium-137 includes dose due to external exposure to progeny of cesium-137 in air, water, soil, and sediment.
3. Dose associated with tritium oxide includes dose incurred via ingestion of organically bound tritium in fish, plant produce and animal products.

Table 71 - Dose to Representative Persons Located at BSF3

Age Class	Radionuclide	Air Inhalation	Air Immersion	Water Ingestion	Water Immersion	Soil (ingestion and external)	Sediment (ingestion and external)	Fish Ingestion	Plant Ingestion	Animal Ingestion	Total
Adult	Carbon-14	1.85E-04	2.13E-07	2.31E-06	3.96E-09	1.52E-11	8.94E-08	1.26E-01	3.54E-01	2.59E-01	7.39E-01
Adult	Cobalt-60	5.39E-07	2.04E-08	0.00E+00	9.82E-05	2.34E-03	1.43E-03	1.96E-03	2.13E-05	1.25E-04	5.97E-03
Adult	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Adult	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E-03	2.25E-03	0.00E+00	1.20E-02	2.08E-02
Adult	Tritium oxide	2.12E-01	0.00E+00	1.12E-02	4.33E-03	0.00E+00	0.00E+00	1.69E-02	2.56E-01	4.50E-02	5.46E-01
Adult	Iodine, mixed fission products	2.49E-06	1.68E-07	0.00E+00	0.00E+00	2.73E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.93E-06
Adult	Noble Gases	0.00E+00	8.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.30E-02
Adult	**Total**	2.13E-01	8.30E-02	1.12E-02	4.43E-03	2.34E-03	7.95E-03	1.47E-01	6.10E-01	3.17E-01	1.40E+00
Child	Carbon-14	2.64E-04	2.13E-07	1.27E-06	3.96E-09	3.31E-11	1.04E-06	7.58E-02	3.92E-01	2.48E-01	7.16E-01
Child	Cobalt-60	7.69E-07	2.04E-08	0.00E+00	9.82E-05	2.34E-03	1.44E-03	2.76E-03	5.42E-05	1.23E-04	6.81E-03
Child	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Child	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.58E-03	7.52E-04	0.00E+00	2.62E-03	9.94E-03
Child	Tritium oxide	2.53E-01	0.00E+00	5.59E-03	3.61E-03	0.00E+00	0.00E+00	9.47E-03	2.37E-01	4.72E-02	5.56E-01
Child	Iodine, mixed fission products	5.58E-06	1.68E-07	0.00E+00	0.00E+00	2.73E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.02E-06
Child	Noble Gases	0.00E+00	8.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.30E-02
Child	**Total**	2.53E-01	8.30E-02	5.59E-03	3.71E-03	2.34E-03	8.01E-03	8.88E-02	6.29E-01	2.98E-01	1.37E+00
Infant	Carbon-14	1.80E-04	2.13E-07	0.00E+00	1.03E-11	5.64E-11	2.28E-06	5.16E-02	3.14E-01	3.40E-01	7.05E-01
Infant	Cobalt-60	5.64E-07	2.66E-08	0.00E+00	0.00E+00	3.04E-03	1.88E-03	2.31E-03	5.52E-05	1.10E-04	7.39E-03
Infant	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Infant	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.55E-03	3.07E-04	0.00E+00	1.01E-03	9.87E-03
Infant	Tritium oxide	1.74E-01	0.00E+00	0.00E+00	9.14E-05	0.00E+00	0.00E+00	6.78E-03	2.27E-01	8.30E-02	4.92E-01
Infant	Iodine, mixed fission products	6.67E-06	2.18E-07	0.00E+00	0.00E+00	3.56E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.24E-06
Infant	Noble Gases	0.00E+00	1.08E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.08E-01
Infant	**Total**	1.74E-01	1.08E-01	0.00E+00	9.14E-05	3.04E-03	1.04E-02	6.10E-02	5.41E-01	4.24E-01	1.32E+00

Note:

1. All doses reported in units of microsieverts per year.
2. Dose associated with cesium-137 includes dose due to external exposure to progeny of cesium-137 in air, water, soil, and sediment.
3. Dose associated with tritium oxide includes dose incurred via ingestion of organically bound tritium in fish, plant produce and animal products.

Table 72 - Dose to Representative Persons Located at BDF1

Age Class	Radionuclide	Air Inhalation	Air Immersion	Water Ingestion	Water Immersion	Soil (ingestion and external)	Sediment (ingestion and external)	Fish Ingestion	Plant Ingestion	Animal Ingestion	Total
Adult	Carbon-14	2.12E-04	2.44E-07	2.06E-06	3.97E-09	6.91E-12	8.94E-08	3.16E-02	1.90E-01	1.90E-01	4.11E-01
Adult	Cobalt-60	6.43E-07	2.44E-08	0.00E+00	9.82E-05	2.90E-03	1.43E-03	4.90E-04	1.27E-05	1.24E-04	5.05E-03
Adult	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Adult	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E-03	5.61E-04	0.00E+00	1.20E-02	1.91E-02
Adult	Tritium oxide	2.55E-01	0.00E+00	8.77E-03	4.33E-03	0.00E+00	0.00E+00	4.23E-03	1.37E-01	3.76E-02	4.48E-01
Adult	Iodine, mixed fission products	2.97E-06	2.00E-07	0.00E+00	0.00E+00	3.28E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.50E-06
Adult	Noble Gases	0.00E+00	9.92E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.92E-02
Adult	**Total**	2.55E-01	9.92E-02	8.78E-03	4.43E-03	2.90E-03	7.95E-03	3.68E-02	3.27E-01	2.40E-01	9.82E-01
Child	Carbon-14	3.03E-04	2.44E-07	1.13E-06	3.97E-09	1.50E-11	1.04E-06	1.89E-02	2.06E-01	2.01E-01	4.26E-01
Child	Cobalt-60	9.17E-07	2.44E-08	0.00E+00	9.82E-05	2.90E-03	1.44E-03	6.90E-04	3.15E-05	1.22E-04	5.28E-03
Child	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Child	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.58E-03	1.88E-04	0.00E+00	2.62E-03	9.38E-03
Child	Tritium oxide	3.04E-01	0.00E+00	4.37E-03	3.61E-03	0.00E+00	0.00E+00	2.37E-03	1.24E-01	4.68E-02	4.84E-01
Child	Iodine, mixed fission products	6.65E-06	2.00E-07	0.00E+00	0.00E+00	3.28E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.18E-06
Child	Noble Gases	0.00E+00	9.92E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.92E-02
Child	**Total**	3.04E-01	9.92E-02	4.37E-03	3.71E-03	2.90E-03	8.01E-03	2.22E-02	3.30E-01	2.50E-01	1.02E+00
Infant	Carbon-14	2.07E-04	2.44E-07	0.00E+00	1.18E-11	2.56E-11	2.28E-06	1.29E-02	1.64E-01	3.00E-01	4.77E-01
Infant	Cobalt-60	6.72E-07	3.17E-08	0.00E+00	0.00E+00	3.77E-03	1.88E-03	5.77E-04	3.19E-05	1.09E-04	6.37E-03
Infant	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Infant	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.55E-03	7.69E-05	0.00E+00	1.01E-03	9.64E-03
Infant	Tritium oxide	2.09E-01	0.00E+00	0.00E+00	9.14E-05	0.00E+00	0.00E+00	1.70E-03	1.16E-01	8.89E-02	4.16E-01
Infant	Iodine, mixed fission products	7.96E-06	2.60E-07	0.00E+00	0.00E+00	4.28E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.64E-06
Infant	Noble Gases	0.00E+00	1.28E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.28E-01
Infant	**Total**	2.10E-01	1.28E-01	0.00E+00	9.14E-05	3.78E-03	1.04E-02	1.53E-02	2.80E-01	3.90E-01	1.04E+00

Note:

1. All doses reported in units of microsieverts per year.
2. Dose associated with cesium-137 includes dose due to external exposure to progeny of cesium-137 in air, water, soil, and sediment.
3. Dose associated with tritium oxide includes dose incurred via ingestion of organically bound tritium in fish, plant produce and animal products.

Table 73 - Dose to Representative Persons Located at BDF9

Age Class	Radionuclide	Air Inhalation	Air Immersion	Water Ingestion	Water Immersion	Soil (ingestion and external)	Sediment (ingestion and external)	Fish Ingestion	Plant Ingestion	Animal Ingestion	Total
Adult	Carbon-14	1.24E-04	1.42E-07	1.20E-06	3.95E-09	0.00E+00	8.94E-08	3.16E-02	1.23E-01	1.11E-01	2.66E-01
Adult	Cobalt-60	5.39E-07	2.04E-08	0.00E+00	9.82E-05	1.97E-03	1.43E-03	4.90E-04	8.83E-06	1.23E-04	4.12E-03
Adult	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Adult	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E-03	5.61E-04	0.00E+00	1.20E-02	1.91E-02
Adult	Tritium oxide	2.12E-01	0.00E+00	8.77E-03	4.33E-03	0.00E+00	0.00E+00	4.23E-03	1.24E-01	3.47E-02	3.89E-01
Adult	Iodine, mixed fission products	2.49E-06	1.68E-07	0.00E+00	0.00E+00	2.64E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.92E-06
Adult	Noble Gases	0.00E+00	8.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.30E-02
Adult	**Total**	2.13E-01	8.30E-02	8.78E-03	4.43E-03	1.97E-03	7.95E-03	3.68E-02	2.48E-01	1.58E-01	7.61E-01
Child	Carbon-14	1.77E-04	1.42E-07	6.61E-07	3.95E-09	0.00E+00	1.04E-06	1.89E-02	1.36E-01	1.17E-01	2.72E-01
Child	Cobalt-60	7.69E-07	2.04E-08	0.00E+00	9.82E-05	1.97E-03	1.44E-03	6.90E-04	2.18E-05	1.18E-04	4.34E-03
Child	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Child	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.58E-03	1.88E-04	0.00E+00	2.62E-03	9.38E-03
Child	Tritium oxide	2.53E-01	0.00E+00	4.37E-03	3.61E-03	0.00E+00	0.00E+00	2.37E-03	1.24E-01	4.00E-02	4.27E-01
Child	Iodine, mixed fission products	5.58E-06	1.68E-07	0.00E+00	0.00E+00	2.65E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.01E-06
Child	Noble Gases	0.00E+00	8.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.30E-02
Child	**Total**	2.53E-01	8.30E-02	4.37E-03	3.71E-03	1.97E-03	8.01E-03	2.22E-02	2.60E-01	1.60E-01	7.96E-01
Infant	Carbon-14	1.21E-04	1.42E-07	0.00E+00	6.87E-12	0.00E+00	2.28E-06	1.29E-02	1.15E-01	1.75E-01	3.03E-01
Infant	Cobalt-60	5.64E-07	2.66E-08	0.00E+00	0.00E+00	2.57E-03	1.88E-03	5.77E-04	2.22E-05	1.02E-04	5.15E-03
Infant	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Infant	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.55E-03	7.69E-05	0.00E+00	1.01E-03	9.64E-03
Infant	Tritium oxide	1.74E-01	0.00E+00	0.00E+00	9.14E-05	0.00E+00	0.00E+00	1.70E-03	1.33E-01	7.38E-02	3.82E-01
Infant	Iodine, mixed fission products	6.67E-06	2.18E-07	0.00E+00	0.00E+00	3.45E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.23E-06
Infant	Noble Gases	0.00E+00	1.08E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.08E-01
Infant	**Total**	1.74E-01	1.08E-01	0.00E+00	9.14E-05	2.57E-03	1.04E-02	1.53E-02	2.47E-01	2.50E-01	8.08E-01

Note:

1. All doses reported in units of microsieverts per year.
2. Dose associated with cesium-137 includes dose due to external exposure to progeny of cesium-137 in air, water, soil, and sediment.
3. Dose associated with tritium oxide includes dose incurred via ingestion of organically bound tritium in fish, plant produce and animal products.

Table 74 - Dose to Representative Persons Located at BDF12

Age Class	Radionuclide	Air Inhalation	Air Immersion	Water Ingestion	Water Immersion	Soil (ingestion and external)	Sediment (ingestion and external)	Fish Ingestion	Plant Ingestion	Animal Ingestion	Total
Adult	Carbon-14	2.12E-04	2.44E-07	2.06E-06	3.97E-09	6.91E-12	8.94E-08	3.16E-02	1.90E-01	1.90E-01	4.11E-01
Adult	Cobalt-60	6.43E-07	2.44E-08	0.00E+00	9.82E-05	2.93E-03	1.43E-03	4.90E-04	1.28E-05	1.24E-04	5.08E-03
Adult	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Adult	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E-03	5.61E-04	0.00E+00	1.20E-02	1.91E-02
Adult	Tritium oxide	2.55E-01	0.00E+00	8.77E-03	4.33E-03	0.00E+00	0.00E+00	4.23E-03	1.37E-01	3.76E-02	4.48E-01
Adult	Iodine, mixed fission products	2.97E-06	2.00E-07	0.00E+00	0.00E+00	3.28E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.50E-06
Adult	Noble Gases	0.00E+00	9.92E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.92E-02
Adult	**Total**	2.55E-01	9.92E-02	8.78E-03	4.43E-03	2.93E-03	7.95E-03	3.68E-02	3.27E-01	2.40E-01	9.83E-01
Child	Carbon-14	3.03E-04	2.44E-07	1.13E-06	3.97E-09	1.50E-11	1.04E-06	1.89E-02	2.06E-01	2.01E-01	4.26E-01
Child	Cobalt-60	9.17E-07	2.44E-08	0.00E+00	9.82E-05	2.93E-03	1.44E-03	6.90E-04	3.17E-05	1.22E-04	5.30E-03
Child	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Child	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.58E-03	1.88E-04	0.00E+00	2.62E-03	9.38E-03
Child	Tritium oxide	3.04E-01	0.00E+00	4.37E-03	3.61E-03	0.00E+00	0.00E+00	2.37E-03	1.24E-01	4.68E-02	4.84E-01
Child	Iodine, mixed fission products	6.65E-06	2.00E-07	0.00E+00	0.00E+00	3.29E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.18E-06
Child	Noble Gases	0.00E+00	9.92E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.92E-02
Child	**Total**	3.04E-01	9.92E-02	4.37E-03	3.71E-03	2.93E-03	8.01E-03	2.22E-02	3.30E-01	2.50E-01	1.02E+00
Infant	Carbon-14	2.07E-04	2.44E-07	0.00E+00	1.18E-11	2.56E-11	2.28E-06	1.29E-02	1.64E-01	3.00E-01	4.77E-01
Infant	Cobalt-60	6.72E-07	3.17E-08	0.00E+00	0.00E+00	3.80E-03	1.88E-03	5.77E-04	3.22E-05	1.09E-04	6.40E-03
Infant	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Infant	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.55E-03	7.69E-05	0.00E+00	1.01E-03	9.64E-03
Infant	Tritium oxide	2.09E-01	0.00E+00	0.00E+00	9.14E-05	0.00E+00	0.00E+00	1.70E-03	1.16E-01	8.89E-02	4.16E-01
Infant	Iodine, mixed fission products	7.96E-06	2.60E-07	0.00E+00	0.00E+00	4.29E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.64E-06
Infant	Noble Gases	0.00E+00	1.28E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.28E-01
Infant	**Total**	2.10E-01	1.28E-01	0.00E+00	9.14E-05	3.80E-03	1.04E-02	1.53E-02	2.80E-01	3.90E-01	1.04E+00

Note:

1. All doses reported in units of microsieverts per year.
2. Dose associated with cesium-137 includes dose due to external exposure to progeny of cesium-137 in air, water, soil, and sediment.
3. Dose associated with tritium oxide includes dose incurred via ingestion of organically bound tritium in fish, plant produce and animal products.

Table 75 - Dose to Representative Persons Located at BDF13

Age Class	Radionuclide	Air Inhalation	Air Immersion	Water Ingestion	Water Immersion	Soil (ingestion and external)	Sediment (ingestion and external)	Fish Ingestion	Plant Ingestion	Animal Ingestion	Total
Adult	Carbon-14	1.33E-04	1.53E-07	1.29E-06	3.96E-09	0.00E+00	8.94E-08	3.16E-02	1.19E-01	9.09E-02	2.42E-01
Adult	Cobalt-60	5.39E-07	2.04E-08	0.00E+00	9.82E-05	1.54E-03	1.43E-03	4.90E-04	7.08E-06	1.21E-04	3.68E-03
Adult	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Adult	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E-03	5.61E-04	0.00E+00	1.20E-02	1.91E-02
Adult	Tritium oxide	2.12E-01	0.00E+00	8.77E-03	4.33E-03	0.00E+00	0.00E+00	4.23E-03	1.37E-01	3.07E-02	3.98E-01
Adult	Iodine, mixed fission products	2.49E-06	1.68E-07	0.00E+00	0.00E+00	2.54E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.91E-06
Adult	Noble Gases	0.00E+00	8.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.30E-02
Adult	**Total**	2.13E-01	8.30E-02	8.78E-03	4.43E-03	1.54E-03	7.95E-03	3.68E-02	2.57E-01	1.34E-01	7.45E-01
Child	Carbon-14	1.90E-04	1.53E-07	7.11E-07	3.96E-09	0.00E+00	1.04E-06	1.89E-02	1.29E-01	5.56E-02	2.04E-01
Child	Cobalt-60	7.69E-07	2.04E-08	0.00E+00	9.82E-05	1.54E-03	1.44E-03	6.90E-04	1.75E-05	1.12E-04	3.89E-03
Child	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Child	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.58E-03	1.88E-04	0.00E+00	2.62E-03	9.38E-03
Child	Tritium oxide	2.53E-01	0.00E+00	4.37E-03	3.61E-03	0.00E+00	0.00E+00	2.37E-03	1.24E-01	3.08E-02	4.17E-01
Child	Iodine, mixed fission products	5.58E-06	1.68E-07	0.00E+00	0.00E+00	2.54E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.00E-06
Child	Noble Gases	0.00E+00	8.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.30E-02
Child	**Total**	2.53E-01	8.30E-02	4.37E-03	3.71E-03	1.54E-03	8.01E-03	2.22E-02	2.53E-01	8.91E-02	7.18E-01
Infant	Carbon-14	1.30E-04	1.53E-07	0.00E+00	7.39E-12	0.00E+00	2.28E-06	1.29E-02	1.03E-01	3.81E-02	1.54E-01
Infant	Cobalt-60	5.64E-07	2.66E-08	0.00E+00	0.00E+00	2.00E-03	1.88E-03	5.77E-04	1.78E-05	8.89E-05	4.56E-03
Infant	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Infant	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.55E-03	7.69E-05	0.00E+00	1.01E-03	9.64E-03
Infant	Tritium oxide	1.74E-01	0.00E+00	0.00E+00	9.14E-05	0.00E+00	0.00E+00	1.70E-03	1.16E-01	5.31E-02	3.45E-01
Infant	Iodine, mixed fission products	6.67E-06	2.18E-07	0.00E+00	0.00E+00	3.32E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.22E-06
Infant	Noble Gases	0.00E+00	1.08E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.08E-01
Infant	**Total**	1.74E-01	1.08E-01	0.00E+00	9.14E-05	2.00E-03	1.04E-02	1.53E-02	2.19E-01	9.24E-02	6.21E-01

Note:

1. All doses reported in units of microsieverts per year.
2. Dose associated with cesium-137 includes dose due to external exposure to progeny of cesium-137 in air, water, soil, and sediment.
3. Dose associated with tritium oxide includes dose incurred via ingestion of organically bound tritium in fish, plant produce and animal products.

Table 76 - Dose to Representative Persons Located at BDF14

Age Class	Radionuclide	Air Inhalation	Air Immersion	Water Ingestion	Water Immersion	Soil (ingestion and external)	Sediment (ingestion and external)	Fish Ingestion	Plant Ingestion	Animal Ingestion	Total
Adult	Carbon-14	1.20E-04	1.38E-07	1.17E-06	3.95E-09	0.00E+00	8.94E-08	3.16E-02	1.20E-01	1.07E-01	2.59E-01
Adult	Cobalt-60	5.39E-07	2.04E-08	0.00E+00	9.82E-05	1.27E-03	1.43E-03	4.90E-04	6.02E-06	1.22E-04	3.41E-03
Adult	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Adult	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E-03	5.61E-04	0.00E+00	1.20E-02	1.91E-02
Adult	Tritium oxide	2.12E-01	0.00E+00	8.77E-03	4.33E-03	0.00E+00	0.00E+00	4.23E-03	1.24E-01	3.07E-02	3.85E-01
Adult	Iodine, mixed fission products	2.49E-06	1.68E-07	0.00E+00	0.00E+00	2.48E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.91E-06
Adult	Noble Gases	0.00E+00	8.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.30E-02
Adult	**Total**	2.13E-01	8.30E-02	8.78E-03	4.43E-03	1.27E-03	7.95E-03	3.68E-02	2.44E-01	1.50E-01	7.50E-01
Child	Carbon-14	1.71E-04	1.38E-07	6.41E-07	3.95E-09	0.00E+00	1.04E-06	1.89E-02	1.32E-01	1.14E-01	2.65E-01
Child	Cobalt-60	7.69E-07	2.04E-08	0.00E+00	9.82E-05	1.27E-03	1.44E-03	6.90E-04	1.49E-05	1.15E-04	3.63E-03
Child	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Child	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.58E-03	1.88E-04	0.00E+00	2.62E-03	9.38E-03
Child	Tritium oxide	2.53E-01	0.00E+00	4.37E-03	3.61E-03	0.00E+00	0.00E+00	2.37E-03	1.24E-01	3.08E-02	4.18E-01
Child	Iodine, mixed fission products	5.58E-06	1.68E-07	0.00E+00	0.00E+00	2.48E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.99E-06
Child	Noble Gases	0.00E+00	8.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.30E-02
Child	**Total**	2.53E-01	8.30E-02	4.37E-03	3.71E-03	1.27E-03	8.01E-03	2.22E-02	2.56E-01	1.47E-01	7.79E-01
Infant	Carbon-14	1.17E-04	1.38E-07	0.00E+00	6.66E-12	0.00E+00	2.28E-06	1.29E-02	1.12E-01	1.70E-01	2.95E-01
Infant	Cobalt-60	5.64E-07	2.66E-08	0.00E+00	0.00E+00	1.65E-03	1.88E-03	5.77E-04	1.51E-05	9.77E-05	4.22E-03
Infant	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Infant	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.55E-03	7.69E-05	0.00E+00	1.01E-03	9.64E-03
Infant	Tritium oxide	1.74E-01	0.00E+00	0.00E+00	9.14E-05	0.00E+00	0.00E+00	1.70E-03	1.33E-01	5.31E-02	3.62E-01
Infant	Iodine, mixed fission products	6.67E-06	2.18E-07	0.00E+00	0.00E+00	3.24E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.21E-06
Infant	Noble Gases	0.00E+00	1.08E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.08E-01
Infant	**Total**	1.74E-01	1.08E-01	0.00E+00	9.14E-05	1.65E-03	1.04E-02	1.53E-02	2.45E-01	2.24E-01	7.78E-01

Note:

1. All doses reported in units of microsieverts per year.
2. Dose associated with cesium-137 includes dose due to external exposure to progeny of cesium-137 in air, water, soil, and sediment.
3. Dose associated with tritium oxide includes dose incurred via ingestion of organically bound tritium in fish, plant produce and animal products.

Table 77 - Dose to Representative Persons Located at BDF15

Age Class	Radionuclide	Air Inhalation	Air Immersion	Water Ingestion	Water Immersion	Soil (ingestion and external)	Sediment (ingestion and external)	Fish Ingestion	Plant Ingestion	Animal Ingestion	Total
Adult	Carbon-14	1.34E-04	1.54E-07	1.31E-06	3.96E-09	0.00E+00	8.94E-08	3.16E-02	1.32E-01	1.20E-01	2.84E-01
Adult	Cobalt-60	5.39E-07	2.04E-08	0.00E+00	9.82E-05	1.52E-03	1.43E-03	4.90E-04	7.00E-06	1.22E-04	3.66E-03
Adult	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Adult	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E-03	5.61E-04	0.00E+00	1.20E-02	1.91E-02
Adult	Tritium oxide	2.12E-01	0.00E+00	8.77E-03	4.33E-03	0.00E+00	0.00E+00	4.23E-03	1.24E-01	3.07E-02	3.85E-01
Adult	Iodine, mixed fission products	2.49E-06	1.68E-07	0.00E+00	0.00E+00	2.53E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.91E-06
Adult	Noble Gases	0.00E+00	8.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.30E-02
Adult	**Total**	2.13E-01	8.30E-02	8.78E-03	4.43E-03	1.52E-03	7.95E-03	3.68E-02	2.56E-01	1.63E-01	7.74E-01
Child	Carbon-14	1.92E-04	1.54E-07	7.17E-07	3.96E-09	0.00E+00	1.04E-06	1.89E-02	1.45E-01	1.27E-01	2.92E-01
Child	Cobalt-60	7.69E-07	2.04E-08	0.00E+00	9.82E-05	1.52E-03	1.44E-03	6.90E-04	1.73E-05	1.16E-04	3.87E-03
Child	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Child	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.58E-03	1.88E-04	0.00E+00	2.62E-03	9.38E-03
Child	Tritium oxide	2.53E-01	0.00E+00	4.37E-03	3.61E-03	0.00E+00	0.00E+00	2.37E-03	1.24E-01	3.08E-02	4.18E-01
Child	Iodine, mixed fission products	5.58E-06	1.68E-07	0.00E+00	0.00E+00	2.54E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.00E-06
Child	Noble Gases	0.00E+00	8.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.30E-02
Child	**Total**	2.53E-01	8.30E-02	4.37E-03	3.71E-03	1.52E-03	8.01E-03	2.22E-02	2.69E-01	1.61E-01	8.05E-01
Infant	Carbon-14	1.31E-04	1.54E-07	0.00E+00	7.46E-12	0.00E+00	2.28E-06	1.29E-02	1.22E-01	1.90E-01	3.25E-01
Infant	Cobalt-60	5.64E-07	2.66E-08	0.00E+00	0.00E+00	1.97E-03	1.88E-03	5.77E-04	1.76E-05	9.93E-05	4.55E-03
Infant	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Infant	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.55E-03	7.69E-05	0.00E+00	1.01E-03	9.64E-03
Infant	Tritium oxide	1.74E-01	0.00E+00	0.00E+00	9.14E-05	0.00E+00	0.00E+00	1.70E-03	1.33E-01	5.31E-02	3.62E-01
Infant	Iodine, mixed fission products	6.67E-06	2.18E-07	0.00E+00	0.00E+00	3.31E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.22E-06
Infant	Noble Gases	0.00E+00	1.08E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.08E-01
Infant	**Total**	1.74E-01	1.08E-01	0.00E+00	9.14E-05	1.97E-03	1.04E-02	1.53E-02	2.54E-01	2.44E-01	8.08E-01

Note:

1. All doses reported in units of microsieverts per year.
2. Dose associated with cesium-137 includes dose due to external exposure to progeny of cesium-137 in air, water, soil, and sediment.
3. Dose associated with tritium oxide includes dose incurred via ingestion of organically bound tritium in fish, plant produce and animal products.

Table 78 - Dose to Representative Persons Located at BHF1

Age Class	Radionuclide	Air Inhalation	Air Immersion	Water Ingestion	Water Immersion	Soil (ingestion and external)	Sediment (ingestion and external)	Fish Ingestion	Plant Ingestion	Animal Ingestion	Total
Adult	Carbon-14	5.50E-05	6.32E-08	9.62E-05	2.06E-09	6.12E-10	1.26E-08	1.19E-02	4.71E-02	2.78E-02	8.70E-02
Adult	Cobalt-60	1.67E-07	6.34E-09	2.08E-04	6.77E-05	6.83E-03	1.43E-03	2.44E-04	3.24E-05	1.01E-05	8.82E-03
Adult	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Adult	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E-03	1.50E-03	0.00E+00	0.00E+00	8.03E-03
Adult	Tritium oxide	6.07E-02	0.00E+00	6.61E-02	2.24E-03	0.00E+00	0.00E+00	1.54E-03	9.81E-02	2.38E-02	2.53E-01
Adult	Iodine, mixed fission products	7.71E-07	5.19E-08	0.00E+00	0.00E+00	7.69E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.00E-07
Adult	Noble Gases	0.00E+00	2.57E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.57E-02
Adult	**Total**	6.07E-02	2.57E-02	6.64E-02	2.31E-03	6.83E-03	7.95E-03	1.52E-02	1.45E-01	5.17E-02	3.82E-01
Child	Carbon-14	7.84E-05	6.32E-08	5.28E-05	2.06E-09	1.33E-09	1.47E-07	1.07E-02	5.19E-02	2.55E-02	8.82E-02
Child	Cobalt-60	2.39E-07	6.34E-09	2.68E-04	6.77E-05	6.83E-03	1.44E-03	5.14E-04	8.04E-05	1.94E-05	9.22E-03
Child	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Child	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.58E-03	7.52E-04	0.00E+00	0.00E+00	7.33E-03
Child	Tritium oxide	7.22E-02	0.00E+00	3.29E-02	1.87E-03	0.00E+00	0.00E+00	1.29E-03	9.15E-02	2.83E-02	2.28E-01
Child	Iodine, mixed fission products	1.73E-06	5.19E-08	0.00E+00	0.00E+00	7.71E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.86E-06
Child	Noble Gases	0.00E+00	2.57E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.57E-02
Child	**Total**	7.22E-02	2.57E-02	3.32E-02	1.94E-03	6.83E-03	8.01E-03	1.33E-02	1.43E-01	5.39E-02	3.59E-01
Infant	Carbon-14	5.35E-05	6.32E-08	0.00E+00	3.89E-10	2.26E-09	3.22E-07	7.30E-03	4.26E-02	3.32E-02	8.32E-02
Infant	Cobalt-60	1.75E-07	8.24E-09	0.00E+00	1.66E-05	8.88E-03	1.88E-03	4.30E-04	8.75E-05	2.52E-05	1.13E-02
Infant	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Infant	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.55E-03	3.07E-04	0.00E+00	0.00E+00	8.86E-03
Infant	Tritium oxide	4.98E-02	0.00E+00	0.00E+00	4.89E-04	0.00E+00	0.00E+00	9.24E-04	8.86E-02	4.88E-02	1.89E-01
Infant	Iodine, mixed fission products	2.07E-06	6.75E-08	0.00E+00	0.00E+00	1.01E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.23E-06
Infant	Noble Gases	0.00E+00	3.33E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.33E-02
Infant	**Total**	4.98E-02	3.33E-02	0.00E+00	5.05E-04	8.88E-03	1.04E-02	8.96E-03	1.31E-01	8.20E-02	3.25E-01

Note:

1. All doses reported in units of microsieverts per year.

2. Dose associated with cesium-137 includes dose due to external exposure to progeny of cesium-137 in air, water, soil, and sediment.

3. Dose associated with tritium oxide includes dose incurred via ingestion of organically bound tritium in fish, plant produce and animal products.

Table 79 - Dose to Representative Persons Located at BEC

Age Class	Radionuclide	Air Inhalation	Air Immersion	Water Ingestion	Water Immersion	Soil (ingestion and external)	Sediment (ingestion and external)	Fish Ingestion	Plant Ingestion	Animal Ingestion	Total
Adult	Carbon-14	4.88E-05	5.61E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.88E-05
Adult	Cobalt-60	1.48E-07	5.60E-09	0.00E+00	0.00E+00	7.40E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.40E-04
Adult	Cesium-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Adult	Cesium-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Adult	Tritium oxide	5.87E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.87E-02
Adult	Iodine, mixed fission products	6.83E-07	4.60E-08	0.00E+00	0.00E+00	7.71E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.06E-07
Adult	Noble Gases	0.00E+00	2.28E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.28E-02
Adult	**Total**	5.88E-02	2.28E-02	0.00E+00	0.00E+00	7.40E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.23E-02

Note:

1. All doses reported in units of microsieverts per year.
2. Dose associated with cesium-137 includes dose due to external exposure to progeny of cesium-137 in air, water, soil, and sediment.
3. Dose associated with tritium oxide includes dose incurred via ingestion of organically bound tritium in fish, plant produce and animal products.

APPENDIX D: RADIOLOGICAL ENVIRONMENTAL MONITORING PROFICIENCY TESTING

As explained in Section 6.1.7.4, acceptance criteria for the Eckert & Ziegler Analytics Proficiency Testing are:

$$\frac{(V_L + 1\sigma_L)}{V_A} \geq 0.75 \quad \text{AND} \quad \frac{(V_L - 1\sigma_L)}{V_A} \leq 1.2$$

Where:

V_L = Bruce Power Health Physics Laboratory value
σ_L = S_L, Bruce Power Health Physics Laboratory one sigma uncertainty value
V_A = Analytics Supplier value

The analytics supplier did not supply milk, soil and water samples with a cobalt-58 spike in the fourth quarter. Therefore, results for this radionuclide for quarter 4 were not available.

All results met the acceptance criteria for 2023.

Table 80 - 2023 Eckert & Ziegler Analytics Test Results for Tritium in Water

Quarter	Bruce Power Value V_L (Bq/L)	1 Standard Deviation (S_L)	Eckert & Ziegler Analytics Value V_A (Bq/L)	$(V_L+S_L)/V_A$	$(V_L-S_L)/V_A$
1	4.54E+02	7.03E+00	4.67E+02	99%	96%
2	4.32E+02	5.81E+00	4.46E+02	98%	96%
3	4.68E+02	2.05E+01	4.76E+02	103%	94%
4	1.99E+01	2.18E+00	1.99E+01	111%	89%

Table 81 - 2023 Eckert & Ziegler Analytics Test Results for Gross Beta in Water

Quarter	Bruce Power Value V_L (Bq/L)	1 Standard Deviation (S_L)	Eckert & Ziegler Analytics Value V_A (Bq/L)	$(V_L+S_L)/V_A$	$(V_L-S_L)/V_A$
1	8.76E+00	5.89E-01	8.47E+00	110%	97%
2	7.59E+00	5.11E-01	7.57E+00	107%	93%

Quarter	Bruce Power Value V_L (Bq/L)	1 Standard Deviation (S_L)	Eckert & Ziegler Analytics Value V_A (Bq/L)	$(V_L+S_L)/V_A$	$(V_L-S_L)/V_A$
3	9.29E+00	6.25E-01	8.87E+00	112%	98%
4	6.69E+00	4.51E-01	6.56E+00	109%	95%

Table 82 - 2023 Eckert & Ziegler Analytics Test Results for Iodine in Milk

Quarter	Bruce Power Value V_L (Bq/L)	1 Standard Deviation (S_L)	Eckert & Ziegler Analytics Value V_A (Bq/L)	$(V_L+S_L)/V_A$	$(V_L-S_L)/V_A$
1	3.62E+00	5.48E-01	3.58E+00	117%	86%
2	3.19E+00	1.48E-01	3.35E+00	100%	91%
3	3.43E+00	3.13E-01	3.48E+00	107%	89%
4	3.62E+00	3.01E-01	3.52E+00	112%	94%

Table 83 - 2023 Eckert & Ziegler Analytics Test Results for Gamma in a Filter

Radionuclide	Bruce Power Value V_L (Bq)	1 Standard Deviation (S_L)	Eckert & Ziegler Analytics Value V_A (Bq)	$(V_L+S_L)/V_A$	$(V_L-S_L)/V_A$
Cerium-141	3.33E+00	2.05E-01	3.29E+00	108%	95%
Cobalt-58	2.89E+00	1.21E-01	3.09E+00	97%	89%
Cobalt-60	6.31E+00	1.86E-01	6.60E+00	98%	93%
Chromium-51	7.25E+00	4.89E-01	7.14E+00	108%	95%
Cesium-134	4.48E+00	9.97E-02	4.72E+00	97%	93%
Cesium-137	3.10E+00	1.29E-01	3.32E+00	97%	89%
Iron-59	2.74E+00	9.57E-02	2.88E+00	98%	92%
Manganese-54	4.25E+00	1.74E-01	4.25E+00	104%	96%
Zinc-65	7.06E+00	2.94E-01	7.24E+00	102%	93%

Table 84 - 2023 Eckert & Ziegler Analytics Test Results for Iodine-131 in a Cartridge

Radionuclide	Bruce Power Value V_L (Bq)	1 Standard Deviation (S_L)	Eckert & Ziegler Analytics Value V_A (Bq)	$(V_L+S_L)/V_A$	$(V_L-S_L)/V_A$
Iodine-131	2.62E+00	1.93E-01	3.35E+00	84%	73%

Table 85 - 2023 Eckert & Ziegler Analytics Test Results for Gamma in Milk

Quarter	Radionuclide	Bruce Power Value V_L (Bq/L)	1 Standard Deviation (S_L)	Eckert & Ziegler Analytics Value V_A (Bq/L)	$(V_L+S_L)/V_A$	$(V_L-S_L)/V_A$
1	Cerium-141	5.52E+00	4.18E-01	5.14E+00	116%	99%
1	Cobalt-58	4.42E+00	2.04E-01	4.83E+00	96%	87%
1	Cobalt-60	9.47E+00	3.03E-01	1.03E+01	95%	89%
1	Chromium-51	1.07E+01	8.77E-01	1.12E+01	104%	88%
1	Cesium-134	6.60E+00	1.87E-01	7.39E+00	92%	87%
1	Cesium-137	4.66E+00	2.13E-01	5.20E+00	94%	85%
1	Iron-59	4.31E+00	1.84E-01	4.50E+00	100%	92%
1	Iodine-131	3.00E+00	2.31E-01	3.03E+00	107%	91%
1	Manganese-54	6.44E+00	2.83E-01	6.65E+00	101%	93%
1	Zinc-65	1.08E+01	4.89E-01	1.13E+01	100%	91%
2	Cerium-141	3.90E+00	2.69E-01	4.43E+00	94%	82%
2	Cobalt-58	4.16E+00	1.94E-01	5.09E+00	85%	78%
2	Cobalt-60	1.08E+01	3.25E-01	1.36E+01	82%	77%
2	Chromium-51	9.21E+00	8.13E-01	1.08E+01	93%	78%
2	Cesium-134	5.34E+00	1.79E-01	6.76E+00	82%	76%
2	Cesium-137	7.07E+00	3.06E-01	8.51E+00	87%	79%
2	Iron-59	4.84E+00	1.93E-01	6.36E+00	79%	73%
2	Iodine-131	2.43E+00	2.02E-01	2.75E+00	96%	81%
2	Manganese-54	4.92E+00	2.23E-01	6.00E+00	86%	78%

Quarter	Radionuclide	Bruce Power Value V_L (Bq/L)	1 Standard Deviation (S_L)	Eckert & Ziegler Analytics Value V_A (Bq/L)	$(V_L+S_L)/V_A$	$(V_L-S_L)/V_A$
2	Zinc-65	7.17E+00	3.46E-01	9.16E+00	82%	74%
3	Cerium-141	3.96E+00	1.80E-01	3.84E+00	108%	98%
3	Cobalt-58	2.28E+00	7.54E-02	2.43E+00	97%	91%
3	Cobalt-60	7.61E+00	1.37E-01	8.24E+00	94%	91%
3	Chromium-51	7.48E+00	4.74E-01	7.57E+00	105%	93%
3	Cesium-134	3.82E+00	1.23E-01	4.22E+00	94%	88%
3	Cesium-137	4.62E+00	2.08E-01	5.23E+00	92%	84%
3	Iron-59	2.80E+00	8.43E-02	2.91E+00	99%	93%
3	Iodine-131	1.26E+00	8.95E-02	1.38E+00	98%	85%
3	Manganese-54	5.12E+00	1.36E-01	5.41E+00	97%	92%
3	Zinc-65	6.93E+00	2.43E-01	7.52E+00	95%	89%
4	Cerium-141	3.26E+00	1.50E-01	3.28E+00	104%	95%
4	Cobalt-58	Not available	Not available	Not available	Not available	Not available
4	Cobalt-60	3.14E+00	6.50E-02	3.44E+00	93%	90%
4	Chromium-51	5.04E+00	3.98E-01	5.64E+00	96%	82%
4	Cesium-134	4.86E+00	9.23E-02	5.29E+00	94%	90%
4	Cesium-137	4.18E+00	1.13E-01	4.47E+00	96%	91%
4	Iron-59	3.83E+00	1.23E-01	3.99E+00	99%	93%
4	Iodine-131	1.34E+00	1.83E-01	1.48E+00	103%	78%
4	Manganese-54	3.42E+00	1.72E-01	3.64E+00	99%	89%
4	Zinc-65	4.35E+00	1.39E-01	4.71E+00	95%	89%

Table 86 - 2023 Eckert & Ziegler Analytics Test Results for Gamma in Water

Quarter	Analyte	Bruce Power Value V_L (Bq/L)	1 Standard Deviation (S_L)	Eckert & Ziegler Analytics Value V_A (Bq/L)	$(V_L+S_L)/V_A$	$(V_L-S_L)/V_A$
1	Cerium-141	5.34E+00	5.36E-01	5.05E+00	116%	95%
1	Cobalt-58	4.72E+00	2.44E-01	4.74E+00	105%	94%
1	Cobalt-60	9.82E+00	3.13E-01	1.01E+01	100%	94%
1	Chromium-51	1.42E+01	1.54E+00	1.10E+01	143%	115%
1	Cesium-134	7.00E+00	2.34E-01	7.25E+00	100%	93%
1	Cesium-137	4.96E+00	2.51E-01	5.10E+00	102%	92%
1	Iron-59	4.39E+00	2.27E-01	4.42E+00	104%	94%
1	Iodine-131	3.11E+00	2.95E-01	3.25E+00	105%	87%
1	Manganese-54	6.57E+00	3.11E-01	6.52E+00	106%	96%
1	Zinc-65	1.14E+01	5.60E-01	1.11E+01	108%	98%
2	Cerium-141	3.44E+00	3.28E-01	3.05E+00	124%	102%
2	Cobalt-58	3.41E+00	1.75E-01	3.50E+00	103%	93%
2	Cobalt-60	9.47E+00	3.04E-01	9.33E+00	105%	98%
2	Chromium-51	7.44E+00	1.24E+00	7.44E+00	117%	83%
2	Cesium-134	4.72E+00	1.56E-01	4.66E+00	105%	98%
2	Cesium-137	5.81E+00	2.86E-01	5.86E+00	104%	94%
2	Iron-59	4.42E+00	2.39E-01	4.38E+00	106%	95%
2	Iodine-131	1.87E+00	3.28E-01	2.06E+00	107%	75%
2	Manganese-54	4.17E+00	2.17E-01	4.13E+00	106%	96%
2	Zinc-65	6.51E+00	3.74E-01	6.31E+00	109%	97%
3	Cerium-141	4.97E+00	2.38E-01	4.30E+00	121%	110%
3	Cobalt-58	2.70E+00	1.36E-01	2.72E+00	104%	94%
3	Cobalt-60	9.13E+00	2.32E-01	9.23E+00	101%	96%
3	Chromium-51	8.28E+00	2.03E+00	8.48E+00	122%	74%
3	Cesium-134	4.81E+00	1.01E-01	4.72E+00	104%	100%
3	Cesium-137	6.06E+00	1.74E-01	5.86E+00	106%	101%

Quarter	Analyte	Bruce Power Value V_L (Bq/L)	1 Standard Deviation (S_L)	Eckert & Ziegler Analytics Value V_A (Bq/L)	$(V_L+S_L)/V_A$	$(V_L-S_L)/V_A$
3	Iron-59	3.45E+00	1.24E-01	3.26E+00	110%	102%
3	Iodine-131	2.09E+00	2.23E-01	1.96E+00	118%	95%
3	Manganese-54	6.26E+00	1.77E-01	6.06E+00	106%	100%
3	Zinc-65	8.22E+00	2.65E-01	8.42E+00	101%	95%
4	Cerium-141	3.90E+00	2.29E-01	3.29E+00	125%	111%
4	Cobalt-58	Not available	Not available	Not available	Not available	Not available
4	Cobalt-60	3.48E+00	9.13E-02	3.44E+00	104%	98%
4	Chromium-51	5.28E+00	8.27E-01	5.64E+00	108%	79%
4	Cesium-134	5.09E+00	1.19E-01	5.30E+00	98%	94%
4	Cesium-137	4.44E+00	2.00E-01	4.48E+00	104%	95%
4	Iron-59	3.83E+00	1.34E-01	3.99E+00	99%	93%
4	Iodine-131	1.58E+00	2.32E-01	1.48E+00	123%	91%
4	Manganese-54	3.81E+00	1.76E-01	3.64E+00	109%	100%
4	Zinc-65	4.42E+00	3.16E-01	4.71E+00	100%	87%

Table 87 - 2023 Eckert & Ziegler Analytics Test Results for Gamma in Soil

Quarter	Analyte	Bruce Power Value V_L (Bq/kg)	1 Standard Deviation (S_L)	Eckert & Ziegler Analytics Value V_A (Bq/kg)	$(V_L+S_L)/V_A$	$(V_L-S_L)/V_A$
1	Cerium-141	8.55E+00	5.60E-01	8.14E+00	112%	98%
1	Cobalt-58	6.86E+00	3.05E-01	7.64E+00	94%	86%
1	Cobalt-60	1.49E+01	4.42E-01	1.63E+01	94%	89%
1	Chromium-51	1.60E+01	1.27E+00	1.77E+01	97%	83%
1	Cesium-134	1.03E+01	2.43E-01	1.17E+01	90%	86%
1	Cesium-137	9.72E+00	4.54E-01	1.07E+01	95%	87%
1	Iron-59	6.85E+00	2.96E-01	7.12E+00	100%	92%

Quarter	Analyte	Bruce Power Value V_L (Bq/kg)	1 Standard Deviation (S_L)	Eckert & Ziegler Analytics Value V_A (Bq/kg)	$(V_L+S_L)/V_A$	$(V_L-S_L)/V_A$
1	Manganese-54	9.68E+00	4.20E-01	1.05E+01	96%	88%
1	Zinc-65	1.69E+01	7.05E-01	1.79E+01	98%	91%
2	Cerium-141	7.40E+00	4.91E-01	7.09E+00	111%	97%
2	Cobalt-58	6.99E+00	3.16E-01	8.14E+00	90%	82%
2	Cobalt-60	1.87E+01	5.52E-01	2.17E+01	88%	83%
2	Chromium-51	1.46E+01	1.34E+00	1.73E+01	92%	76%
2	Cesium-134	9.54E+00	2.33E-01	1.08E+01	91%	86%
2	Cesium-137	1.38E+01	5.66E-01	1.63E+01	88%	81%
2	Iron-59	8.52E+00	2.98E-01	1.02E+01	86%	81%
2	Manganese-54	8.46E+00	4.15E-01	9.60E+00	92%	84%
2	Zinc-65	1.25E+01	5.30E-01	1.46E+01	89%	82%
3	Cerium-141	7.29E+00	2.79E-01	6.79E+00	111%	103%
3	Cobalt-58	3.97E+00	1.14E-01	4.31E+00	95%	89%
3	Cobalt-60	1.34E+01	2.28E-01	1.46E+01	94%	91%
3	Chromium-51	1.31E+01	6.85E-01	1.34E+01	103%	93%
3	Cesium-134	6.81E+00	1.16E-01	7.47E+00	93%	90%
3	Cesium-137	1.09E+01	2.78E-01	1.17E+01	96%	91%
3	Iron-59	4.75E+00	1.18E-01	5.15E+00	95%	90%
3	Manganese-54	8.97E+00	2.27E-01	9.57E+00	96%	91%
3	Zinc-65	1.24E+01	3.29E-01	1.33E+01	96%	91%
4	Cerium-141	8.19E+00	3.18E-01	7.93E+00	107%	99%
4	Cobalt-58	Not available	Not available	Not available	Not available	Not available
4	Cobalt-60	7.68E+00	1.37E-01	8.31E+00	94%	91%
4	Chromium-51	1.26E+01	1.61E+00	1.36E+01	104%	81%
4	Cesium-134	1.15E+01	1.70E-01	1.28E+01	91%	89%
4	Cesium-137	1.24E+01	3.11E-01	1.33E+01	96%	91%
4	Iron-59	8.91E+00	2.01E-01	9.63E+00	95%	90%

Quarter	Analyte	Bruce Power Value V_L (Bq/kg)	1 Standard Deviation (S_L)	Eckert & Ziegler Analytics Value V_A (Bq/kg)	$(V_L+S_L)/V_A$	$(V_L-S_L)/V_A$
4	Manganese-54	7.93E+00	2.12E-01	8.79E+00	93%	88%
4	Zinc-65	1.03E+01	2.75E-01	1.14E+01	93%	88%

APPENDIX E: LAKE WATER QUALITY SAMPLE RESULTS

Where no value is provided for the screening criteria in the following tables, it means that no criteria are available to assess risk to receptors; often because the parameter is not associated with acute or chronic toxicity.

The screening criteria for dissolved oxygen is temperature dependent. For the purposes of this report, a temperature of 15°C was considered to derive the Provincial Water Quality Objective guideline of 6 mg/L.

Un-ionized ammonia (NH_3) is calculated from measurements of total ammonia (NH_3 + NH_4^+), temperature and pH according to [R-183]. Ammonia concentrations reported in mg/L NH_3 units were converted to mg/L NH_3-N units by multiplying by 0.82247.

Table 88 - The results of water quality samples taken from 1 metre below the lake surface on December 19, 2023 from 3 long-term monitoring locations in Lake Huron. Screening criteria chosen are the most conservative available. The screening criteria for aluminum varies and is calculated on a per sample basis using pH measured at the time of sampling event. The screening criteria for total cadmium, total copper, total lead and total nickel vary with hardness and are calculated on a per sample basis using hardness measured at the time of sampling event. The screening criteria for zinc varies and is calculated on a per sample basis using hardness, pH and Dissolved Organic Carbon measured at time of sampling event.

Parameter	Unit	Lowest Screening Criteria Value	Source of Screening Criteria	Bruce A Discharge LWQ1	Bruce B Discharge LWQ2	Baie du Doré LWQ5
Specific Conductivity	Microsiemens per Centimetre	No value	Not applicable	229	229	428
pH	No unit	6.5 – 8.5	Provincial Water Quality Objective	9.4	9.3	8.7
Temperature	Degrees Celsius	No value	Not applicable	15.5	14.7	0.5
Dissolved Oxygen (DO)	Milligrams per Litre	6	Provincial Water Quality Objective	14.7	15.9	12.2
Total Ammonia-N	Micrograms per Litre	No value	Not applicable	224	123	828
Un-ionized ammonia (NH_3-N)	Micrograms per Litre	15.6	Canadian Council of Ministers of the Environment	91.9	42.1	31.3

Parameter	**Unit**	**Lowest Screening Criteria Value**	**Source of Screening Criteria**	**Bruce A Discharge LWQ1**	**Bruce B Discharge LWQ2**	**Baie du Doré LWQ5**
Total Phosphorous	Micrograms per Litre	20	Provincial Water Quality Objective	17.4	56.2	70.2
Total Dissolved Solids	Milligrams per Litre	No value	Not applicable	112	130	185
Hardness ($CaCO_3$)	Milligrams per Litre	No value	Not applicable	104	102	163
Total Suspended Solids	Milligrams per Litre	No value	Not applicable	14.6	11.2	49.0
Alkalinity (Total as $CaCO_3$)	Milligrams per Litre	No value	Not applicable	92.6	87.3	145
Dissolved Organic Carbon	Milligrams per Litre	No value	Canadian Council of Ministers of the Environment	1.86	1.92	4.83
Nitrite (NO_2^--N)	Micrograms per Litre	60	Canadian Council of Ministers of the Environment	<10	<10	<10
Chloride	Milligrams per Litre	120	Canadian Council of Ministers of the Environment	8.17	8.31	11.7
Nitrate (NO_3^--N)	Milligrams per Litre	2.93	Canadian Council of Ministers of the Environment	0.408	0.300	0.661
Sulphate (SO_4^{2-})	Milligrams per Litre	No value	Not applicable	14.4	14.6	11.6
Fluoride	Micrograms per Litre	120	Canadian Council of Ministers of the Environment	77	78	118
Total Aluminum	Micrograms per Litre	75	Provincial Water Quality Objective	116	88.9	1650
Total Antimony	Micrograms per Litre	6	Health Canada Guidelines for Canadian Drinking Water Quality and Ontario Drinking Water Standards (O.Reg. 169/03)	0.12	0.12	0.12
Total Arsenic	Micrograms per Litre	5	Provincial Water Quality Objective and Canadian Council of Ministers of the Environment	0.57	0.62	1.07

Parameter	**Unit**	**Lowest Screening Criteria Value**	**Source of Screening Criteria**	**Bruce A Discharge LWQ1**	**Bruce B Discharge LWQ2**	**Baie du Doré LWQ5**
Total Barium	Micrograms per Litre	1000	Ontario Drinking Water Standards (O.Reg. 169/03)	15.5	14.8	24.4
Total Boron	Micrograms per Litre	200	Provincial Water Quality Objective	14	14	15
Total Cadmium	Micrograms per Litre	0.16 – 0.24	Canadian Council of Ministers of the Environment	0.0108	0.0117	0.0368
Chromium III	Micrograms per Litre	8.9	Provincial Water Quality Objective and Canadian Council of Ministers of the Environment	0.80	0.59	3.46
Chromium VI	Micrograms per Litre	1	Provincial Water Quality Objective and Canadian Council of Ministers of the Environment	<0.50	<0.50	<0.50
Total Chromium	Micrograms per Litre	50	Ontario Drinking Water Standards (O.Reg. 169/03) and Health Canada Guidelines for Canadian Drinking Water Quality	0.80	0.59	3.46
Total Copper	Micrograms per Litre	2.41 to 3.59	Canadian Council of Ministers of the Environment	1.29	0.82	3.29
Total Iron	Micrograms per Litre	300	Health Canada Guidelines for Canadian Drinking Water Quality	178	126	1960
Total Lead	Micrograms per Litre	3.26 to 5	Canadian Council of Ministers of the Environment and Provincial Water Quality Objectives	0.201	0.283	1.14
Total Mercury	Micrograms per Litre	0.026	Canadian Council of Ministers of the Environment	<0.005	<0.005	<0.005
Total Molybdenum	Micrograms per Litre	40	Provincial Water Quality Objective	0.511	0.515	0.411
Total Nickel	Micrograms per Litre	25	Provincial Water Quality Objective	0.87	0.56	2.74
Total Selenium	Micrograms per Litre	1	Canadian Council of Ministers of the Environment	0.113	0.100	0.155
Total Uranium	Micrograms per Litre	5	Provincial Water Quality Objective	0.240	0.247	0.459

Parameter	**Unit**	**Lowest Screening Criteria Value**	**Source of Screening Criteria**	**Bruce A Discharge LWQ1**	**Bruce B Discharge LWQ2**	**Baie du Doré LWQ5**
Total Vanadium	Micrograms per Litre	6	Provincial Water Quality Objective	<0.50	<0.50	3.07
Total Zinc	Micrograms per Litre	12 - 27	Canadian Council of Ministers of the Environment	<3.0	<3.0	8.3
F1 (C6-C10)	Micrograms per Litre	No value	Not applicable	<25	<25	<25
F1 (C6-C10) - BTEX	Micrograms per Litre	No value	Not applicable	<25	<25	<25
F2 (C10-C16 Hydrocarbons)	Micrograms per Litre	No value	Not applicable	<100	<100	<100
F3 (C16-C34 Hydrocarbons)	Micrograms per Litre	No value	Not applicable	<250	<250	<250
F4 (C34-C50 Hydrocarbons)	Micrograms per Litre	No value	Not applicable	<250	<250	<250
Reached Baseline at C50	No unit	No value	Not applicable	Yes	Yes	Yes
Benzene	Micrograms per Litre	1	Ontario Drinking Water Standards (O.Reg. 169/03)	<0.50	<0.50	<0.50
Ethylbenzene	Micrograms per Litre	8	Provincial Water Quality Objective	<0.50	<0.50	<0.50
o-Xylene	Micrograms per Litre	No value	Not applicable	<0.30	<0.30	<0.30
p+m-Xylene	Micrograms per Litre	No value	Not applicable	<0.40	<0.40	<0.40
Toluene	Micrograms per Litre	0.8	Provincial Water Quality Objective	<0.50	<0.50	<0.50
Xylene (Total)	Micrograms per Litre	2	Provincial Water Quality Objective	<0.50	<0.50	<0.50
Morpholine	Micrograms per Litre	4	Provincial Water Quality Objective	2.0	2.3	<1.0

Parameter	Unit	Lowest Screening Criteria Value	Source of Screening Criteria	Bruce A Discharge LWQ1	Bruce B Discharge LWQ2	Baie du Doré LWQ5
Hydrazine	Micrograms per Litre	26	Notice requiring the preparation and implementation of pollution prevention plans in respect of hydrazine related to the electricity sector, https://canadagazette.gc.ca/rp-pr/p1/2018/2018-11-10/html/sup1-eng.html.	6.1	6.4	3.5
Phenol	Micrograms per Litre	1	Provincial Water Quality Objective	6.5	2.1	5.0

Table 89 - The range and number of water quality measurements taken from on-site surface water monitoring locations at Bruce Power between 2019 and 2023.

Parameter	Unit	Historical Trend (2019 – 2023) Range (min to max)	Historical Trend (2019 – 2023) Number of observations	Historical Trend (2019 – 2023) Number of exceedances (if applicable)
Temperature	Degrees Celsius	0.5 - 31	30	Not applicable
pH	No unit	7.7 - 9.4	30	11
Dissolved Oxygen	Milligrams per Litre	7.3 - 16	30	0
Specific Conductivity	Microsiemens per Centimetre	219 - 430	25	Not applicable
Total Dissolved Solids	Milligrams per Litre	70 – 185	25	Not applicable
Total Suspended Solids	Milligrams per Litre	<1.0 - 49	28	Not applicable
Hardness ($CaCO_3$)	Milligrams per Litre	92.6 – 163	20	Not applicable
Alkalinity (Total as $CaCO_3$)	Milligrams per Litre	78 – 145	25	Not applicable
Dissolved Organic Carbon	Milligrams per Litre	2.09 – 4.83	14	Not applicable
Total Ammonia-N	Micrograms per Litre	<10 – 922	33	Not applicable

Parameter	Unit	Historical Trend (2019 – 2023) Range (min to max)	Historical Trend (2019 – 2023) Number of observations	Historical Trend (2019 – 2023) Number of exceedances (if applicable)
Un-ionized ammonia (NH_3-N)	Micrograms per Litre	<Detect - 170	33	10
Nitrite (NO_2^--N)	Micrograms per Litre	<10	28	0
Nitrate (NO_3^--N)	Milligrams per Litre	0.2 – 0.9	25	0
Total Phosphorous	Micrograms per Litre	2.0 – 70	28	5
Sulphate (SO_4^{2-})	Milligrams per Litre	11.6 – 23.2	25	Not applicable
Chloride	Milligrams per Litre	7.6 - 12	25	0
Fluoride	Micrograms per Litre	70 - 118	25	0
Hydrazine	Micrograms per Litre	<0.2 – 7.1	25	0
Morpholine	Micrograms per Litre	<0.1 – 2.6	20	0
Total Aluminum	Micrograms per Litre	<5 - 1650	28	3
Total Antimony	Micrograms per Litre	0.11 – 0.19	14	0
Total Arsenic	Micrograms per Litre	0.53 – 1.1	28	0
Total Barium	Micrograms per Litre	1.42 – 24.4	14	0
Total Boron	Micrograms per Litre	11.0 – 21.0	28	0
Total Cadmium	Micrograms per Litre	<0.005 – 0.037	28	0
Total Chromium	Micrograms per Litre	<0.50 – 3.46	28	0
Chromium III	Micrograms per Litre	<0.50 – 3.46	20	0
Chromium VI	Micrograms per Litre	<0.50 – 0.58	25	0

Parameter	Unit	Historical Trend (2019 – 2023) Range (min to max)	Historical Trend (2019 – 2023) Number of observations	Historical Trend (2019 – 2023) Number of exceedances (if applicable)
Total Copper	Micrograms per Litre	<0.9 – 3.3	28	2
Total Iron	Micrograms per Litre	<10 - 1960	28	1
Total Lead	Micrograms per Litre	<0.05 – 10.5	28	2
Total Mercury	Micrograms per Litre	<0.005	14	0
Total Molybdenum	Micrograms per Litre	0.41 – 0.56	14	0
Total Nickel	Micrograms per Litre	<0.50 – 2.74	28	0
Total Selenium	Micrograms per Litre	0.10 – 0.16	14	0
Total Uranium	Micrograms per Litre	0.22 – 0.46	14	1
Total Vanadium	Micrograms per Litre	<0.50 – 3.07	14	8
Total Zinc	Micrograms per Litre	<0.20 - 130	28	9
Benzene	Micrograms per Litre	<0.20	25	0
Toluene	Micrograms per Litre	<0.20	25	0
Ethylbenzene	Micrograms per Litre	<0.20	25	0
o-Xylene	Micrograms per Litre	<0.20	25	Not applicable
p+m-Xylene	Micrograms per Litre	<0.40	25	Not applicable
Xylenes (Total)	Micrograms per Litre	<0.40	25	0
F1 (C6-C10)	Micrograms per Litre	<25	25	Not applicable
F1 (C6-C10) - BTEX	Micrograms per Litre	<25	25	Not applicable

Parameter	Unit	Historical Trend (2019 – 2023) Range (min to max)	Historical Trend (2019 – 2023) Number of observations	Historical Trend (2019 – 2023) Number of exceedances (if applicable)
F2 (C10-C16 Hydrocarbons)	Micrograms per Litre	<100	25	Not applicable
F3 (C16-C34 Hydrocarbons)	Micrograms per Litre	<200	25	Not applicable
F4 (C34-C50 Hydrocarbons)	Micrograms per Litre	<200	25	Not applicable
Reached Baseline at C50	No unit	Not applicable	25	Not applicable
Phenol	Micrograms per Litre	<1.0 – 6.5	20	10

APPENDIX F: ON-SITE SURFACE WATER SAMPLE RESULTS

Where no value is provided for the screening criteria in the following tables, it means that no criteria are available to assess risk to receptors; often because the parameter is not associated with acute or chronic toxicity.

The screening criteria for dissolved oxygen is temperature dependent. For the purposes of this report, a temperature of 15˚C was considered to derive the Provincial Water Quality Objective guideline of 6 mg/L.

Un-ionized ammonia (NH_3) is calculated from measurements of total ammonia ($NH_3 + NH_4^+$), temperature and pH according to [R-183]. Ammonia concentrations reported in mg/L NH_3 units were converted to mg/L NH_3-N units by multiplying by 0.82247.

Stream C – Upstream (SW1) is located on the east side of Tie Road and is used an indicator of background water conditions in the stream as it enters the Bruce Power site.

Table 90 - The results of surface water quality samples taken in 2023 from Stream C – Upstream (SW1) and Downstream (SW2). Screening criteria chosen are the most conservative available. The screening criteria for aluminum varies and is calculated on a per sample basis using pH measured at the time of sampling event. The screening criteria for total cadmium, total copper, total lead and total nickel vary with hardness and are calculated on a per sample basis using hardness measured at the time of sampling event. The screening criteria for zinc varies and is calculated on a per sample basis using hardness, pH and Dissolved Organic Carbon measured at time of sampling event.

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	Stream C – Upstream SW1 12-Apr-23	Stream C – Downstream SW2 12-Apr-23	Stream C – Upstream SW1 22-Aug-23	Stream C – Downstream SW2 22-Aug-23	Stream C – Upstream SW1 16-Nov-23	Stream C – Downstream SW2 16-Nov-23
Temperature	No value	Degrees Celsius	Not applicable	10.6	8.1	8.9 (2022 value)	8.2 (2022 value)	5.5	5.2
pH	6.5-8.5	No unit	Provincial Water Quality Objective	8.1	7.9	8.4	8.4	7.1	7.2
Dissolved Oxygen	6	Milligrams per Litre	Provincial Water Quality Objective	8.6	8.9	Not measured	Not measured	10.64	11.4
Specific Conductivity	No value	Microsiemens per Centimetre	Not applicable	1070	1680	569	602	572	750
Total Dissolved Solids	No value	Milligrams per Litre	Not applicable	217	238	283	302	271	291
Total Suspended Solids	No value	Milligrams per Litre	Not applicable	<3.0	<3.0	41.9	47.1	30.0	<3.0
Hardness ($CaCO_3$)	No value	Milligrams per Litre	Not applicable	236	231	282	284	296	282

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	Stream C – Upstream SW1 12-Apr-23	Stream C – Downstream SW2 12-Apr-23	Stream C – Upstream SW1 22-Aug-23	Stream C – Downstream SW2 22-Aug-23	Stream C – Upstream SW1 16-Nov-23	Stream C – Downstream SW2 16-Nov-23
Alkalinity (Total as $CaCO_3$)	No value	Milligrams per Litre	Not applicable	232	223	293	285	281	280
Dissolved Organic Carbon	No value	Milligrams per Litre	Not applicable	3.26	4.07	5.02	6.53	4.75	5.46
Total Ammonia-N	No value	Micrograms per Litre	Not applicable	29.0	40.5	71.6	58.6	57.8	48.7
Un-ionized ammonia (NH_3-N)	15.6	Micrograms per Litre	Canadian Council of Ministers of the Environment	0.6	0.5	2.8	2.4	0.1	0.1
Nitrite (NO_2^--N)	60	Micrograms per Litre	Canadian Council of Ministers of the Environment	<10	<10	<10	<10	<10	<10
Nitrate (NO_3^--N)	2.93	Milligrams per Litre	Canadian Council of Ministers of the Environment	0.159	0.164	<0.020	<0.020	0.253	0.148
Total Phosphorous	20	Micrograms per Litre	Provincial Water Quality Objective	21.8	12.6	92.2	98.0	42.5	12.7
Sulphate (SO_4^{2-})	No value	Milligrams per Litre	Not applicable	6.02	7.60	2.32	3.25	6.93	6.59

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	Stream C – Upstream SW1 12-Apr-23	Stream C – Downstream SW2 12-Apr-23	Stream C – Upstream SW1 22-Aug-23	Stream C – Downstream SW2 22-Aug-23	Stream C – Upstream SW1 16-Nov-23	Stream C – Downstream SW2 16-Nov-23
Chloride	120	Milligrams per Litre	Canadian Council of Ministers of the Environment	18.9	28.2	16.6	29.6	18.7	25.7
Fluoride	120	Micrograms per Litre	Canadian Council of Ministers of the Environment	209	225	296	287	227	232
Total Aluminum	75	Micrograms per Litre	Provincial Water Quality Objective	317	181	473	552	313	53.6
Total Antimony	6	Micrograms per Litre	Ontario Drinking Water Standards, O.Reg. 169/03 and Health Canada Guidelines for Canadian Drinking Water Quality	<0.10	<0.10	<0.10	<0.10	0.12	<0.10

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	Stream C – Upstream SW1 12-Apr-23	Stream C – Downstream SW2 12-Apr-23	Stream C – Upstream SW1 22-Aug-23	Stream C – Downstream SW2 22-Aug-23	Stream C – Upstream SW1 16-Nov-23	Stream C – Downstream SW2 16-Nov-23
Total Arsenic	5	Micrograms per Litre	Provincial Water Quality Objective and Canadian Council of Ministers of the Environment	0.32	0.28	1.08	0.93	0.37	0.29
Total Barium	1000	Micrograms per Litre	Ontario Drinking Water Standards, O.Reg. 169/03	16.6	15.7	22.8	22.4	16.9	14.8
Total Boron	200	Micrograms per Litre	Provincial Water Quality Objective	13	15	17	18	12	14
Total Cadmium	0.09 – 0.37	Micrograms per Litre	Canadian Council of Ministers of the Environment	0.009	0.006	0.0347	0.0333	0.0133	0.0058

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	Stream C – Upstream SW1 12-Apr-23	Stream C – Downstream SW2 12-Apr-23	Stream C – Upstream SW1 22-Aug-23	Stream C – Downstream SW2 22-Aug-23	Stream C – Upstream SW1 16-Nov-23	Stream C – Downstream SW2 16-Nov-23
Total Chromium	50	Micrograms per Litre	Ontario Drinking Water Standards, O.Reg. 169/03 and Health Canada Guidelines for Canadian Drinking Water Quality	0.63	<0.50	1.01	1.33	0.74	<0.50
Chromium III	8.9	Micrograms per Litre	Provincial Water Quality Objective and Canadian Council of Ministers of the Environment	0.63	<0.50	1.01	1.33	0.74	<0.50
Chromium VI	1	Micrograms per Litre	Provincial Water Quality Objective and Canadian Council of Ministers of the Environment	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	Stream C – Upstream SW1 12-Apr-23	Stream C – Downstream SW2 12-Apr-23	Stream C – Upstream SW1 22-Aug-23	Stream C – Downstream SW2 22-Aug-23	Stream C – Upstream SW1 16-Nov-23	Stream C – Downstream SW2 16-Nov-23
Total Copper	4	Micrograms per Litre	Canadian Council of Ministers of the Environment	1.40	1.11	1.55	1.78	1.28	0.63
Total Iron	300	Micrograms per Litre	Health Canada Guidelines for Canadian Drinking Water Quality	391	189	3070	1570	867	168
Total Lead	5	Micrograms per Litre	Health Canada Guidelines for Canadian Drinking Water Quality and Provincial Water Quality Objective	0.233	0.279	0.617	0.880	0.278	0.066
Total Mercury	0.026	Micrograms per Litre	Canadian Council of Ministers of the Environment	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Parameter	**Lowest Screening Criteria Value**	**Unit**	**Source of Screening Criteria**	**Stream C – Upstream SW1 12-Apr-23**	**Stream C – Downstream SW2 12-Apr-23**	**Stream C – Upstream SW1 22-Aug-23**	**Stream C – Downstream SW2 22-Aug-23**	**Stream C – Upstream SW1 16-Nov-23**	**Stream C – Downstream SW2 16-Nov-23**
Total Molybdenum	40	Micrograms per Litre	Provincial Water Quality Objective	0.220	0.329	0.134	0.263	0.186	0.246
Total Nickel	25	Micrograms per Litre	Provincial Water Quality Objective	0.74	0.58	1.18	1.49	1.07	0.62
Total Selenium	1	Micrograms per Litre	Canadian Council of Ministers of the Environment	0.088	0.097	0.164	0.175	0.066	0.098
Total Uranium	5	Micrograms per Litre	Provincial Water Quality Objective	0.626	0.713	0.241	0.429	0.525	0.63
Total Vanadium	6	Micrograms per Litre	Provincial Water Quality Objective	0.85	0.62	1.43	1.50	0.86	<0.50
Total Zinc	20	Micrograms per Litre	Provincial Water Quality Objective	3.7	3.7	12.5	7.4	4.1	<3.0
Benzene	1	Micrograms per Litre	Ontario Drinking Water Standards, O.Reg. 169/03	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	Stream C – Upstream SW1 12-Apr-23	Stream C – Downstream SW2 12-Apr-23	Stream C – Upstream SW1 22-Aug-23	Stream C – Downstream SW2 22-Aug-23	Stream C – Upstream SW1 16-Nov-23	Stream C – Downstream SW2 16-Nov-23
Toluene	0.8	Micrograms per Litre	Provincial Water Quality Objective	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Ethylbenzene	8	Micrograms per Litre	Provincial Water Quality Objective	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
o-Xylene	No value	Micrograms per Litre	Not applicable	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
p+m-Xylene	No value	Micrograms per Litre	Not applicable	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Xylenes (Total)	2	Micrograms per Litre	Provincial Water Quality Objective	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
F1 (C6-C10)	No value	Micrograms per Litre	Not applicable	<25	<25	<25	<25	<25	<25
F1 (C6-C10) - BTEX	No value	Micrograms per Litre	Not applicable	<25	<25	<25	<25	<25	<25
F2 (C10-C16 Hydrocarbons)	No value	Micrograms per Litre	Not applicable	<100	<100	<100	<100	<100	<100
F3 (C16-C34 Hydrocarbons)	No value	Micrograms per Litre	Not applicable	<250	<250	<250	<250	<250	<250
F4 (C34-C50 Hydrocarbons)	No value	Micrograms per Litre	Not applicable	<250	<250	<250	<250	<250	<250

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	Stream C – Upstream SW1 12-Apr-23	Stream C – Downstream SW2 12-Apr-23	Stream C – Upstream SW1 22-Aug-23	Stream C – Downstream SW2 22-Aug-23	Stream C – Upstream SW1 16-Nov-23	Stream C – Downstream SW2 16-Nov-23
Reached Baseline at C50	No value	No unit	Not applicable	Yes	Yes	Yes	Yes	Yes	Yes
Phenol	1	Micrograms per Litre	Provincial Water Quality Objective	<1.0	<1.0	1.6	1.2	2.3	2.7

Table 91 - The results of surface water quality samples taken in 2023 from the Eastern Drainage Ditch SW3. Screening criteria chosen are the most conservative available. The screening criteria for aluminum varies and is calculated on a per sample basis using pH measured at the time of sampling event. The screening criteria for total cadmium, total copper, total lead and total nickel vary with hardness and are calculated on a per sample basis using hardness measured at the time of sampling event. The screening criteria for zinc varies and is calculated on a per sample basis using hardness, pH and Dissolved Organic Carbon measured at time of sampling event.

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	Eastern Drainage Ditch SW3 12-Apr-23	Eastern Drainage Ditch – Duplicate 12-Apr-23	Eastern Drainage Ditch SW3 22-Aug-23	Eastern Drainage Ditch – Duplicate 22-Aug-23	Eastern Drainage Ditch SW3 16-Nov-23	Eastern Drainage Ditch – Duplicate 16-Nov-23
Temperature	No value	Degrees Celsius	Not applicable	8.7	8.7	6.8 (2022 value)	6.8 (2022 value)	8.9	8.9
pH	6.5-8.5	No unit	Provincial Water Quality Objective	7.8	7.8	8.2	8.0	7.1	7.1

Parameter	**Lowest Screening Criteria Value**	**Unit**	**Source of Screening Criteria**	**Eastern Drainage Ditch SW3 12-Apr-23**	**Eastern Drainage Ditch – Duplicate 12-Apr-23**	**Eastern Drainage Ditch SW3 22-Aug-23**	**Eastern Drainage Ditch – Duplicate 22-Aug-23**	**Eastern Drainage Ditch SW3 16-Nov-23**	**Eastern Drainage Ditch – Duplicate 16-Nov-23**
Dissolved Oxygen	6	Milligrams per Litre	Provincial Water Quality Objective	5.0	5.0	1990	1990	11.0	11.0
Specific Conductivity	No value	Microsiemens per Centimetre	Not applicable	1340	1340	952	942	1740	1740
Total Dissolved Solids	No value	Milligrams per Litre	Not applicable	876	910	123	45.3	826	804
Total Suspended Solids	No value	Milligrams per Litre	Not applicable	<3.0	<3.0	264	347	3.4	5.0
Hardness ($CaCO_3$)	No value	Milligrams per Litre	Not applicable	321	315	225	213	302	299
Alkalinity (Total as $CaCO_3$)	No value	Milligrams per Litre	Not applicable	256	256	5.48	6.18	286	295
Dissolved Organic Carbon	No value	Milligrams per Litre	Not applicable	3.9	4.3	256	256	6.61	6.19
Total Ammonia-N	No value	Micrograms per Litre	Not applicable	23.5	504	3.9	4.3	201	210
Un-ionized ammonia (NH_3-N)	15.6	Micrograms per Litre	Canadian Council of Ministers of the Environment	0.3	5.8	2.9	8.1	0.4	0.4

Parameter	**Lowest Screening Criteria Value**	**Unit**	**Source of Screening Criteria**	**Eastern Drainage Ditch SW3 12-Apr-23**	**Eastern Drainage Ditch – Duplicate 12-Apr-23**	**Eastern Drainage Ditch SW3 22-Aug-23**	**Eastern Drainage Ditch – Duplicate 22-Aug-23**	**Eastern Drainage Ditch SW3 16-Nov-23**	**Eastern Drainage Ditch – Duplicate 16-Nov-23**
Nitrite (NO_2^--N)	60	Micrograms per Litre	Canadian Council of Ministers of the Environment	<50	<50	<50	<50	<50	<50
Nitrate (NO_3^--N)	2.93	Milligrams per Litre	Canadian Council of Ministers of the Environment	0.364	0.778	<0.100	1.68	0.431	0.295
Total Phosphorous	20	Micrograms per Litre	Provincial Water Quality Objective	5.4	5.5	36.8	76.6	8.4	11.5
Sulphate (SO_4^{2-})	No value	Milligrams per Litre	Not applicable	19.6	21.6	21.2	21.2	20.0	17.8
Chloride	120	Milligrams per Litre	Canadian Council of Ministers of the Environment	416	418	456	454	344	337
Fluoride	120	Micrograms per Litre	Canadian Council of Ministers of the Environment	335	340	632	664	543	553

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	Eastern Drainage Ditch SW3 12-Apr-23	Eastern Drainage Ditch – Duplicate 12-Apr-23	Eastern Drainage Ditch SW3 22-Aug-23	Eastern Drainage Ditch – Duplicate 22-Aug-23	Eastern Drainage Ditch SW3 16-Nov-23	Eastern Drainage Ditch – Duplicate 16-Nov-23
Total Aluminum	75	Micrograms per Litre	Provincial Water Quality Objective	31.1	25.0	198	638	24.9	15
Total Antimony	6	Micrograms per Litre	Ontario Drinking Water Standards, O.Reg. 169/03 and Health Canada Guidelines for Canadian Drinking Water Quality	<1.00	0.16	<1.00	<1.00	0.18	0.18
Total Arsenic	5	Micrograms per Litre	Provincial Water Quality Objective and Canadian Council of Ministers of the Environment	<1.00	0.27	<1.00	1.06	0.27	0.26

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	Eastern Drainage Ditch SW3 12-Apr-23	Eastern Drainage Ditch – Duplicate 12-Apr-23	Eastern Drainage Ditch SW3 22-Aug-23	Eastern Drainage Ditch – Duplicate 22-Aug-23	Eastern Drainage Ditch SW3 16-Nov-23	Eastern Drainage Ditch – Duplicate 16-Nov-23
Total Barium	1000	Micrograms per Litre	Ontario Drinking Water Standards, O.Reg. 169/03	46.7	45.0	77.9	98.1	53.5	53.8
Total Boron	200	Micrograms per Litre	Provincial Water Quality Objective	<100	43	<100	<100	28	27
Total Cadmium	0.09 – 0.37	Micrograms per Litre	Canadian Council of Ministers of the Environment	<0.050	0.020	<0.0500	0.0746	0.0189	0.0131

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	Eastern Drainage Ditch SW3 12-Apr-23	Eastern Drainage Ditch – Duplicate 12-Apr-23	Eastern Drainage Ditch SW3 22-Aug-23	Eastern Drainage Ditch – Duplicate 22-Aug-23	Eastern Drainage Ditch SW3 16-Nov-23	Eastern Drainage Ditch – Duplicate 16-Nov-23
Total Chromium	50	Micrograms per Litre	Ontario Drinking Water Standards, O.Reg. 169/03 and Health Canada Guidelines for Canadian Drinking Water Quality	<5.00	0.51	<5.00	<5.00	<0.50	<0.50
Chromium III	8.9	Micrograms per Litre	Provincial Water Quality Objective and Canadian Council of Ministers of the Environment	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	Eastern Drainage Ditch SW3 12-Apr-23	Eastern Drainage Ditch – Duplicate 12-Apr-23	Eastern Drainage Ditch SW3 22-Aug-23	Eastern Drainage Ditch – Duplicate 22-Aug-23	Eastern Drainage Ditch SW3 16-Nov-23	Eastern Drainage Ditch – Duplicate 16-Nov-23
Chromium VI	1	Micrograms per Litre	Provincial Water Quality Objective and Canadian Council of Ministers of the Environment	<0.50	0.51	<0.50	<0.50	<0.50	<0.50
Total Copper	4	Micrograms per Litre	Canadian Council of Ministers of the Environment	<5.00	2.62	<5.00	7.18	1.95	1.74
Total Iron	300	Micrograms per Litre	Health Canada Guidelines for Canadian Drinking Water Quality	<100	65	524	1640	71	52

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	Eastern Drainage Ditch SW3 12-Apr-23	Eastern Drainage Ditch – Duplicate 12-Apr-23	Eastern Drainage Ditch SW3 22-Aug-23	Eastern Drainage Ditch – Duplicate 22-Aug-23	Eastern Drainage Ditch SW3 16-Nov-23	Eastern Drainage Ditch – Duplicate 16-Nov-23
Total Lead	5	Micrograms per Litre	Health Canada Guidelines for Canadian Drinking Water Quality and Provincial Water Quality Objective	1.75	1.44	<0.50	1.58	0.075	<0.050
Total Mercury	0.026	Micrograms per Litre	Canadian Council of Ministers of the Environment	<0.005	<0.005	<0.0050	0.0246	<0.005	<0.005
Total Molybdenum	40	Micrograms per Litre	Provincial Water Quality Objective	1.02	1.15	1.63	1.32	1.34	1.34
Total Nickel	25	Micrograms per Litre	Provincial Water Quality Objective	<5.00	1.39	<5.00	<5.00	1.80	2.07

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	Eastern Drainage Ditch SW3 12-Apr-23	Eastern Drainage Ditch – Duplicate 12-Apr-23	Eastern Drainage Ditch SW3 22-Aug-23	Eastern Drainage Ditch – Duplicate 22-Aug-23	Eastern Drainage Ditch SW3 16-Nov-23	Eastern Drainage Ditch – Duplicate 16-Nov-23
Total Selenium	1	Micrograms per Litre	Canadian Council of Ministers of the Environment	<0.50	0.224	<0.500	<0.500	0.200	0.218
Total Uranium	5	Micrograms per Litre	Provincial Water Quality Objective	1.57	1.57	1.94	2.08	1.96	1.98
Total Vanadium	6	Micrograms per Litre	Provincial Water Quality Objective	1.17	1.21	10.0	16.0	11.9	11.6
Total Zinc	20	Micrograms per Litre	Provincial Water Quality Objective	<30.0	13.7	<30.0	66.0	17.2	14.2
Benzene	1	Micrograms per Litre	Ontario Drinking Water Standards, O.Reg. 169/03	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	Eastern Drainage Ditch SW3 12-Apr-23	Eastern Drainage Ditch – Duplicate 12-Apr-23	Eastern Drainage Ditch SW3 22-Aug-23	Eastern Drainage Ditch – Duplicate 22-Aug-23	Eastern Drainage Ditch SW3 16-Nov-23	Eastern Drainage Ditch – Duplicate 16-Nov-23
Toluene	0.8	Micrograms per Litre	Provincial Water Quality Objective	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Ethylbenzene	8	Micrograms per Litre	Provincial Water Quality Objective	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
o-Xylene	No value	Micrograms per Litre	Not applicable	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
p+m-Xylene	No value	Micrograms per Litre	Not applicable	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Xylenes (Total)	2	Micrograms per Litre	Provincial Water Quality Objective	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
F1 (C6-C10)	No value	Micrograms per Litre	Not applicable	<25	<25	<25	<25	<25	<25
F1 (C6-C10) - BTEX	No value	Micrograms per Litre	Not applicable	<25	<25	<25	<25	<25	<25
F2 (C10-C16 Hydrocarbons)	No value	Micrograms per Litre	Not applicable	<100	<100	<100	<100	<100	<100

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	Eastern Drainage Ditch SW3 12-Apr-23	Eastern Drainage Ditch – Duplicate 12-Apr-23	Eastern Drainage Ditch SW3 22-Aug-23	Eastern Drainage Ditch – Duplicate 22-Aug-23	Eastern Drainage Ditch SW3 16-Nov-23	Eastern Drainage Ditch – Duplicate 16-Nov-23
F3 (C16-C34 Hydrocarbons)	No value	Micrograms per Litre	Not applicable	<250	<250	<250	<250	<250	<250
F4 (C34-C50 Hydrocarbons)	No value	Micrograms per Litre	Not applicable	<250	<250	<250	<250	<250	<250
Reached Baseline at C50	No value	No unit	Not applicable	Yes	Yes	Yes	Yes	Yes	Yes
Phenol	1	Micrograms per Litre	Provincial Water Quality Objective	<1.0	<1.0	4.0	4.0	6.3	4.3

Table 92 - The results of surface water quality samples taken in 2023 from the Former Sewage Lagoon. Screening criteria chosen are the most conservative available. The screening criteria for aluminum varies and is calculated on a per sample basis using pH measured at the time of sampling event. The screening criteria for total cadmium, total copper, total lead and total nickel vary with hardness and are calculated on a per sample basis using hardness measured at the time of sampling event. The screening criteria for zinc varies and is calculated on a per sample basis using hardness, pH and Dissolved Organic Carbon measured at time of sampling event.

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	Former Sewage Lagoon 12-Apr-23	Former Sewage Lagoon 22-Aug-23	Former Sewage Lagoon 16-Nov-23
Temperature	No value	Degrees Celsius	Not applicable	9.5	8.5 (2022 value)	8.7
pH	6.5-8.5	No unit	Provincial Water Quality Objective	8.6	8.3	7.0
Dissolved Oxygen	6	Milligrams per Litre	Provincial Water Quality Objective	6.1	Not measured	10.9
Specific Conductivity	No value	Microsiemens per Centimetre	Not applicable	1310	117	1980
Total Dissolved Solids	No value	Milligrams per Litre	Not applicable	96	36	46
Total Suspended Solids	No value	Milligrams per Litre	Not applicable	<3.0	23.1	32.2
Hardness ($CaCO_3$)	No value	Milligrams per Litre	Not applicable	114	52.7	93.7
Alkalinity (Total as $CaCO_3$)	No value	Milligrams per Litre	Not applicable	118	61.6	96.6
Dissolved Organic Carbon	No value	Milligrams per Litre	Not applicable	6.6	10.4	8.9
Total Ammonia-N	No value	Micrograms per Litre	Not applicable	28.4	74.1	39.5

Parameter	**Lowest Screening Criteria Value**	**Unit**	**Source of Screening Criteria**	**Former Sewage Lagoon 12-Apr-23**	**Former Sewage Lagoon 22-Aug-23**	**Former Sewage Lagoon 16-Nov-23**
Un-ionized ammonia (NH_3-N)	15.6	Micrograms per Litre	Canadian Council of Ministers of the Environment	1.9	2.3	0.1
Nitrite (NO_2^--N)	60	Micrograms per Litre	Canadian Council of Ministers of the Environment	<10	<10	<10
Nitrate (NO_3^--N)	2.93	Milligrams per Litre	Canadian Council of Ministers of the Environment	0.176	<0.020	<0.020
Total Phosphorous	20	Micrograms per Litre	Provincial Water Quality Objective	1.3	148	49.2
Sulphate (SO_4^{2-})	No value	Milligrams per Litre	Not applicable	20.4	<0.30	1.06
Chloride	120	Milligrams per Litre	Canadian Council of Ministers of the Environment	54.3	1.04	3.03
Fluoride	120	Micrograms per Litre	Canadian Council of Ministers of the Environment	797	395	349
Total Aluminum	75	Micrograms per Litre	Provincial Water Quality Objective	63.9	70.0	64.9

Parameter	**Lowest Screening Criteria Value**	**Unit**	**Source of Screening Criteria**	**Former Sewage Lagoon 12-Apr-23**	**Former Sewage Lagoon 22-Aug-23**	**Former Sewage Lagoon 16-Nov-23**
Total Antimony	6	Micrograms per Litre	Ontario Drinking Water Standards, O.Reg. 169/03 and Health Canada Guidelines for Canadian Drinking Water Quality	0.27	0.36	0.23
Total Arsenic	5	Micrograms per Litre	Provincial Water Quality Objective and Canadian Council of Ministers of the Environment	0.38	0.57	0.44
Total Barium	1000	Micrograms per Litre	Ontario Drinking Water Standards, O.Reg. 169/03	13.6	12.1	12.9
Total Boron	200	Micrograms per Litre	Provincial Water Quality Objective	<10	<10	<10
Total Cadmium	0.09 – 0.37	Micrograms per Litre	Canadian Council of Ministers of the Environment	<0.0050	0.0117	0.0064
Total Chromium	50	Micrograms per Litre	Ontario Drinking Water Standards, O.Reg. 169/03 and Health Canada Guidelines for Canadian Drinking Water Quality	<0.50	1.00	<0.50

Parameter	**Lowest Screening Criteria Value**	**Unit**	**Source of Screening Criteria**	**Former Sewage Lagoon 12-Apr-23**	**Former Sewage Lagoon 22-Aug-23**	**Former Sewage Lagoon 16-Nov-23**
Chromium III	8.9	Micrograms per Litre	Provincial Water Quality Objective and Canadian Council of Ministers of the Environment	<0.50	1.00	<0.50
Chromium VI	1	Micrograms per Litre	Provincial Water Quality Objective and Canadian Council of Ministers of the Environment	<0.50	<0.50	<0.50
Total Copper	2.00-2.64	Micrograms per Litre	Canadian Council of Ministers of the Environment	0.77	3.79	0.81
Total Iron	300	Micrograms per Litre	Health Canada Guidelines for Canadian Drinking Water Quality	41	129	34
Total Lead	5	Micrograms per Litre	Health Canada Guidelines for Canadian Drinking Water Quality and Provincial Water Quality Objective	0.935	0.148	0.056
Total Mercury	0.026	Micrograms per Litre	Canadian Council of Ministers of the Environment	<0.005	<0.005	<0.005

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	Former Sewage Lagoon 12-Apr-23	Former Sewage Lagoon 22-Aug-23	Former Sewage Lagoon 16-Nov-23
Total Molybdenum	40	Micrograms per Litre	Provincial Water Quality Objective	0.342	0.325	0.186
Total Nickel	25	Micrograms per Litre	Provincial Water Quality Objective	<0.50	0.61	<0.50
Total Selenium	1	Micrograms per Litre	Canadian Council of Ministers of the Environment	<0.050	0.065	<0.050
Total Uranium	5	Micrograms per Litre	Provincial Water Quality Objective	0.145	0.099	0.102
Total Vanadium	6	Micrograms per Litre	Provincial Water Quality Objective	<0.50	<0.50	<0.50
Total Zinc	2.5	Micrograms per Litre	Site-specific target level	<3.0	8.6	4.6
Benzene	1	Micrograms per Litre	Ontario Drinking Water Standards, O.Reg. 169/03	<0.50	<0.50	<0.50
Toluene	0.8	Micrograms per Litre	Provincial Water Quality Objective	<0.50	<0.50	<0.50
Ethylbenzene	8	Micrograms per Litre	Provincial Water Quality Objective	<0.50	<0.50	<0.50
o-Xylene	No value	Micrograms per Litre	Not applicable	<0.30	<0.30	<0.30
p+m-Xylene	No value	Micrograms per Litre	Not applicable	<0.40	<0.40	<0.40

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	Former Sewage Lagoon 12-Apr-23	Former Sewage Lagoon 22-Aug-23	Former Sewage Lagoon 16-Nov-23
Xylenes (Total)	2	Micrograms per Litre	Provincial Water Quality Objective	<0.50	<0.50	<0.50
F1 (C6-C10)	No value	Micrograms per Litre	Not applicable	<25	<25	<25
F1 (C6-C10) - BTEX	No value	Micrograms per Litre	Not applicable	<25	<25	<25
F2 (C10-C16 Hydrocarbons)	No value	Micrograms per Litre	Not applicable	<100	<100	<100
F3 (C16-C34 Hydrocarbons)	No value	Micrograms per Litre	Not applicable	<250	<250	<250
F4 (C34-C50 Hydrocarbons)	No value	Micrograms per Litre	Not applicable	<250	<250	<250
Reached Baseline at C50	No value	No unit	Not applicable	Yes	Yes	Yes
Phenol	1	Micrograms per Litre	Provincial Water Quality Objective	<1.0	2.4	3.5

Table 93 - The results of surface water quality samples taken in 2023 from the B31 Pond. Screening criteria chosen are the most conservative available. The screening criteria for aluminum varies and is calculated on a per sample basis using pH measured at the time of sampling event. The screening criteria for total cadmium, total copper, total lead and total nickel vary with hardness and are calculated on a per sample basis using hardness measured at the time of sampling event. The screening criteria for zinc varies and is calculated on a per sample basis using hardness, pH and Dissolved Organic Carbon measured at time of sampling event.

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	B31 Pond 12-Apr-23	B31 Pond 22-Aug-23	B31 Pond 16-Nov-23
Temperature	No value	Degrees Celsius	Not applicable	10.7	9.0 (2022 value)	5.8
pH	6.5-8.5	No unit	Provincial Water Quality Objective	7.9	8.3	7.9
Dissolved Oxygen	6	Milligrams per Litre	Provincial Water Quality Objective	7.5	Not measured	19.3
Specific Conductivity	No value	Microsiemens per Centimetre	Not applicable	1120	341	1050
Total Dissolved Solids	No value	Milligrams per Litre	Not applicable	242	153	213
Total Suspended Solids	No value	Milligrams per Litre	Not applicable	4.4	78.9	<3.0
Hardness ($CaCO_3$)	No value	Milligrams per Litre	Not applicable	192	86.8	128
Alkalinity (Total as $CaCO_3$)	No value	Milligrams per Litre	Not applicable	184	87.2	134
Dissolved Organic Carbon	No value	Milligrams per Litre	Not applicable	3.7	8.2	4.0

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	B31 Pond 12-Apr-23	B31 Pond 22-Aug-23	B31 Pond 16-Nov-23
Total Ammonia-N	No value	Micrograms per Litre	Not applicable	36.7	124	42.6
Un-ionized ammonia (NH_3-N)	15.6	Micrograms per Litre	Canadian Council of Ministers of the Environment	0.5	3.7	0.4
Nitrite (NO_2^--N)	60	Micrograms per Litre	Canadian Council of Ministers of the Environment	<10	<10	<50
Nitrate (NO_3^--N)	2.93	Milligrams per Litre	Canadian Council of Ministers of the Environment	<0.020	<0.020	0.295
Total Phosphorous	20	Micrograms per Litre	Provincial Water Quality Objective	11.9	83.4	11.5
Sulphate (SO_4^{2-})	No value	Milligrams per Litre	Not applicable	10.6	3.57	17.8
Chloride	120	Milligrams per Litre	Canadian Council of Ministers of the Environment	54.5	54.1	337
Fluoride	120	Micrograms per Litre	Canadian Council of Ministers of the Environment	246	274	553
Total Aluminum	75	Micrograms per Litre	Provincial Water Quality Objective	86.3	1520	18.3

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	B31 Pond 12-Apr-23	B31 Pond 22-Aug-23	B31 Pond 16-Nov-23
Total Antimony	6	Micrograms per Litre	Ontario Drinking Water Standards, O.Reg. 169/03 and Health Canada Guidelines for Canadian Drinking Water Quality	0.19	0.15	0.15
Total Arsenic	5	Micrograms per Litre	Provincial Water Quality Objective and Canadian Council of Ministers of the Environment	0.34	0.70	0.24
Total Barium	1000	Micrograms per Litre	Ontario Drinking Water Standards, O.Reg. 169/03	20.5	19.8	12.2
Total Boron	200	Micrograms per Litre	Provincial Water Quality Objective	21	76	79
Total Cadmium	0.09 – 0.37	Micrograms per Litre	Canadian Council of Ministers of the Environment	0.0199	0.0599	0.006

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	B31 Pond 12-Apr-23	B31 Pond 22-Aug-23	B31 Pond 16-Nov-23
Total Chromium	50	Micrograms per Litre	Ontario Drinking Water Standards, O.Reg. 169/03 and Health Canada Guidelines for Canadian Drinking Water Quality	<0.50	2.84	<0.50
Chromium III	8.9	Micrograms per Litre	Provincial Water Quality Objective and Canadian Council of Ministers of the Environment	<0.50	<0.50	<0.50
Chromium VI	1	Micrograms per Litre	Provincial Water Quality Objective and Canadian Council of Ministers of the Environment	<0.50	2.84	<0.50
Total Copper	2	Micrograms per Litre	Site-Specific Target Level	6.07	19.2	1.66
Total Iron	300	Micrograms per Litre	Health Canada Guidelines for Canadian Drinking Water Quality	116	2040	52

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	B31 Pond 12-Apr-23	B31 Pond 22-Aug-23	B31 Pond 16-Nov-23
Total Lead	5	Micrograms per Litre	Health Canada Guidelines for Canadian Drinking Water Quality and Provincial Water Quality Objective	0.330	2.19	0.066
Total Mercury	0.026	Micrograms per Litre	Canadian Council of Ministers of the Environment	<0.005	<0.005	<0.005
Total Molybdenum	40	Micrograms per Litre	Provincial Water Quality Objective	0.686	0.518	0.615
Total Nickel	25	Micrograms per Litre	Provincial Water Quality Objective	1.76	2.96	<0.50
Total Selenium	1	Micrograms per Litre	Canadian Council of Ministers of the Environment	0.112	0.148	0.076
Total Uranium	5	Micrograms per Litre	Provincial Water Quality Objective	0.981	0.336	0.598
Total Vanadium	6	Micrograms per Litre	Provincial Water Quality Objective	0.89	3.22	<0.50
Total Zinc	20	Micrograms per Litre	Provincial Water Quality Objective	15.2	46.7	3.4
Benzene	1	Micrograms per Litre	Ontario Drinking Water Standards, O.Reg. 169/03	<0.50	<0.50	<0.50

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	B31 Pond 12-Apr-23	B31 Pond 22-Aug-23	B31 Pond 16-Nov-23
Toluene	0.8	Micrograms per Litre	Provincial Water Quality Objective	<0.50	<0.50	<0.50
Ethylbenzene	8	Micrograms per Litre	Provincial Water Quality Objective	<0.50	<0.50	<0.50
o-Xylene	No value	Micrograms per Litre	Not applicable	<0.30	<0.30	<0.30
p+m-Xylene	No value	Micrograms per Litre	Not applicable	<0.40	<0.40	<0.40
Xylenes (Total)	2	Micrograms per Litre	Provincial Water Quality Objective	<0.50	<0.50	<0.50
F1 (C6-C10)	No value	Micrograms per Litre	Not applicable	<25	<25	<25
F1 (C6-C10) - BTEX	No value	Micrograms per Litre	Not applicable	<25	<25	<25
F2 (C10-C16 Hydrocarbons)	No value	Micrograms per Litre	Not applicable	<100	<100	<100
F3 (C16-C34 Hydrocarbons)	No value	Micrograms per Litre	Not applicable	<250	<250	<250
F4 (C34-C50 Hydrocarbons)	No value	Micrograms per Litre	Not applicable	<250	<250	<250
Reached Baseline at C50	No value	No unit	Not applicable	Yes	Yes	Yes
Phenol	1	Micrograms per Litre	Provincial Water Quality Objective	<1.0	<1.0	5.3

Table 94 - The results of surface water quality samples taken in 2023 from the B16 Pond. Screening criteria chosen are the most conservative available. The screening criteria for aluminum varies and is calculated on a per sample basis using pH measured at the time of sampling event. The screening criteria for total cadmium, total copper, total lead and total nickel vary with hardness and are calculated on a per sample basis using hardness measured at the time of sampling event. The screening criteria for zinc varies and is calculated on a per sample basis using hardness, pH and Dissolved Organic Carbon measured at time of sampling event.

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	B16 Pond 12-Apr-23	B16 Pond 22-Aug-23	B16 Pond 16-Nov-23
Temperature	No value	Degrees Celsius	Not applicable	11.1	9.0 (2022 value)	8.6
pH	6.5-8.5	No unit	Provincial Water Quality Objective	8.0	8.3	7.1
Dissolved Oxygen	6	Milligrams per Litre	Provincial Water Quality Objective	5.4	Not measured	10.98
Specific Conductivity	No value	Microsiemens per Centimetre	Not applicable	1240	1150	1000
Total Dissolved Solids	No value	Milligrams per Litre	Not applicable	434	557	419
Total Suspended Solids	No value	Milligrams per Litre	Not applicable	5.2	6.1	<3.0
Hardness ($CaCO_3$)	No value	Milligrams per Litre	Not applicable	182	168	180
Alkalinity (Total as $CaCO_3$)	No value	Milligrams per Litre	Not applicable	164	153	180
Dissolved Organic Carbon	No value	Milligrams per Litre	Not applicable	5.9	15.4	10.1

Parameter	**Lowest Screening Criteria Value**	**Unit**	**Source of Screening Criteria**	**B16 Pond 12-Apr-23**	**B16 Pond 22-Aug-23**	**B16 Pond 16-Nov-23**
Total Ammonia-N	No value	Micrograms per Litre	Not applicable	91.4	68.7	63.6
Un-ionized ammonia (NH_3-N)	15.6	Micrograms per Litre	Canadian Council of Ministers of the Environment	1.7	1.3	0.1
Nitrite (NO_2^--N)	60	Micrograms per Litre	Canadian Council of Ministers of the Environment	<10	<50	<10
Nitrate (NO_3^--N)	2.93	Milligrams per Litre	Canadian Council of Ministers of the Environment	<0.020	<0.100	<0.020
Total Phosphorous	20	Micrograms per Litre	Provincial Water Quality Objective	12.2	19.1	8.5
Sulphate (SO_4^{2-})	No value	Milligrams per Litre	Not applicable	6.53	1.76	3.25
Chloride	120	Milligrams per Litre	Canadian Council of Ministers of the Environment	187	259	194
Fluoride	120	Micrograms per Litre	Canadian Council of Ministers of the Environment	249	330	284
Total Aluminum	75	Micrograms per Litre	Provincial Water Quality Objective	43.7	38.5	16.5

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	B16 Pond 12-Apr-23	B16 Pond 22-Aug-23	B16 Pond 16-Nov-23
Total Antimony	6	Micrograms per Litre	Ontario Drinking Water Standards, O.Reg. 169/03 and Health Canada Guidelines for Canadian Drinking Water Quality	0.11	<0.10	<0.10
Total Arsenic	5	Micrograms per Litre	Provincial Water Quality Objective and Canadian Council of Ministers of the Environment	0.29	0.47	0.27
Total Barium	1000	Micrograms per Litre	Ontario Drinking Water Standards, O.Reg. 169/03	10.0	16.1	16.6
Total Boron	200	Micrograms per Litre	Provincial Water Quality Objective	<10	16	10
Total Cadmium	0.09 – 0.37	Micrograms per Litre	Canadian Council of Ministers of the Environment	0.009	0.006	<0.005

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	B16 Pond 12-Apr-23	B16 Pond 22-Aug-23	B16 Pond 16-Nov-23
Total Chromium	50	Micrograms per Litre	Ontario Drinking Water Standards, O.Reg. 169/03 and Health Canada Guidelines for Canadian Drinking Water Quality	<0.50	<0.50	<0.50
Chromium III	8.9	Micrograms per Litre	Provincial Water Quality Objective and Canadian Council of Ministers of the Environment	<0.50	<0.50	<0.50
Chromium VI	1	Micrograms per Litre	Provincial Water Quality Objective and Canadian Council of Ministers of the Environment	<0.50	<0.50	<0.50
Total Copper	4	Micrograms per Litre	Canadian Council of Ministers of the Environment	2.2	2.27	<0.5
Total Iron	300	Micrograms per Litre	Health Canada Guidelines for Canadian Drinking Water Quality	192.0	281	80

Parameter	**Lowest Screening Criteria Value**	**Unit**	**Source of Screening Criteria**	**B16 Pond 12-Apr-23**	**B16 Pond 22-Aug-23**	**B16 Pond 16-Nov-23**
Total Lead	5	Micrograms per Litre	Health Canada Guidelines for Canadian Drinking Water Quality and Provincial Water Quality Objective	0.220	0.105	<0.05
Total Mercury	0.026	Micrograms per Litre	Canadian Council of Ministers of the Environment	<0.005	<0.0050	<0.005
Total Molybdenum	40	Micrograms per Litre	Provincial Water Quality Objective	0.430	0.276	0.336
Total Nickel	25	Micrograms per Litre	Provincial Water Quality Objective	0.77	<0.50	<0.50
Total Selenium	1	Micrograms per Litre	Canadian Council of Ministers of the Environment	<0.050	0.089	0.062
Total Uranium	5	Micrograms per Litre	Provincial Water Quality Objective	0.626	0.275	0.443
Total Vanadium	6	Micrograms per Litre	Provincial Water Quality Objective	<0.50	<0.50	<0.50
Total Zinc	20	Micrograms per Litre	Provincial Water Quality Objective	6.4	7.3	<3.0
Benzene	1	Micrograms per Litre	Ontario Drinking Water Standards, O.Reg. 169/03	<0.50	<0.50	<0.50

Parameter	Lowest Screening Criteria Value	Unit	Source of Screening Criteria	B16 Pond 12-Apr-23	B16 Pond 22-Aug-23	B16 Pond 16-Nov-23
Toluene	0.8	Micrograms per Litre	Provincial Water Quality Objective	<0.50	<0.50	<0.50
Ethylbenzene	8	Micrograms per Litre	Provincial Water Quality Objective	<0.50	<0.50	<0.50
o-Xylene	No value	Micrograms per Litre	Not applicable	<0.30	<0.30	<0.30
p+m-Xylene	No value	Micrograms per Litre	Not applicable	<0.40	<0.40	<0.40
Xylenes (Total)	2	Micrograms per Litre	Provincial Water Quality Objective	<0.50	<0.50	<0.50
F1 (C6-C10)	No value	Micrograms per Litre	Not applicable	<25	<25	<25
F1 (C6-C10) - BTEX	No value	Micrograms per Litre	Not applicable	<25	<25	<25
F2 (C10-C16 Hydrocarbons)	No value	Micrograms per Litre	Not applicable	<100	<100	<100
F3 (C16-C34 Hydrocarbons)	No value	Micrograms per Litre	Not applicable	<250	<250	<250
F4 (C34-C50 Hydrocarbons)	No value	Micrograms per Litre	Not applicable	<250	<250	<250
Reached Baseline at C50	No value	No unit	Not applicable	Yes	Yes	Yes
Phenol	1	Micrograms per Litre	Provincial Water Quality Objective	<1.0	1.8	2.7

Table 95 - The range and number of water quality measurements taken from on-site surface water monitoring locations at Bruce Power between 2019 and 2023.

Parameter	Unit	Historical Trend (2019 – 2023) Range (min to max)	Historical Trend (2019 – 2023) Number of observations	Historical Trend (2019 – 2023) Number of exceedances (if applicable)
Temperature	Degrees Celsius	1.1 – 23	94	Not applicable
pH	No unit	6.7 – 10	100	18
Dissolved Oxygen	Milligrams per Litre	4.3 - 21	88	10
Specific Conductivity	Microsiemens per Centimetre	170 - 2120	97	Not applicable
Total Dissolved Solids	Milligrams per Litre	36 – 1000	101	Not applicable
Total Suspended Solids	Milligrams per Litre	1.0 – 209	101	Not applicable
Hardness ($CaCO_3$)	Milligrams per Litre	52.7 – 347	98	Not applicable
Alkalinity (Total as $CaCO_3$)	Milligrams per Litre	51.7 – 298	101	Not applicable
Dissolved Organic Carbon	Milligrams per Litre	1.9 – 18	83	Not applicable
Total Ammonia-N	Micrograms per Litre	<50 – 30000	98	Not applicable
Un-ionized ammonia (NH_3-N)	Micrograms per Litre	<1.0 – 2971	98	15
Nitrite (NO_2^--N)	Micrograms per Litre	<10 - 10	98	0
Nitrate (NO_3^--N)	Milligrams per Litre	<0.03 – 1.7	98	0
Total Phosphorous	Micrograms per Litre	<3.0 – 304	98	33
Sulphate (SO_4^{2-})	Milligrams per Litre	<1 – 48.4	91	Not applicable
Chloride	Milligrams per Litre	1.0 – 728	89	48
Fluoride	Micrograms per Litre	29.3 - 1360	98	94

Parameter	**Unit**	**Historical Trend (2019 – 2023) Range (min to max)**	**Historical Trend (2019 – 2023) Number of observations**	**Historical Trend (2019 – 2023) Number of exceedances (if applicable)**
Total Aluminum	Micrograms per Litre	2.0 – 2230	102	40
Total Antimony	Micrograms per Litre	<0.1 – 0.4	95	0
Total Arsenic	Micrograms per Litre	<0.1 – 3.0	95	0
Total Barium	Micrograms per Litre	1.6 – 98	102	0
Total Boron	Micrograms per Litre	<10 – 166	95	0
Total Cadmium	Micrograms per Litre	<0.003 – 0.493	102	1
Total Chromium	Micrograms per Litre	<0.50 - 12	102	0
Chromium III	Micrograms per Litre	<1.0 – 11	89	1
Chromium VI	Micrograms per Litre	0.3 – 0.5	101	0
Total Copper	Micrograms per Litre	<0.001 – 19.2	102	21
Total Iron	Micrograms per Litre	18.0 – 25400	102	34
Total Lead	Micrograms per Litre	<0.005 – 3.79	102	1
Total Mercury	Micrograms per Litre	<0.005 – 0.025	101	0
Total Molybdenum	Micrograms per Litre	0.1 – 4.9	102	0
Total Nickel	Micrograms per Litre	0.3 – 6.3	102	0
Total Selenium	Micrograms per Litre	<0.05 – 0.74	95	0
Total Uranium	Micrograms per Litre	0.1 – 5.2	102	1

Parameter	**Unit**	**Historical Trend (2019 – 2023) Range (min to max)**	**Historical Trend (2019 – 2023) Number of observations**	**Historical Trend (2019 – 2023) Number of exceedances (if applicable)**
Total Vanadium	Micrograms per Litre	<0.50 - 21	102	8
Total Zinc	Micrograms per Litre	<2.0 - 488	102	
Benzene	Micrograms per Litre	<0.20	97	0
Toluene	Micrograms per Litre	<0.20	97	0
Ethylbenzene	Micrograms per Litre	<0.20	97	0
o-Xylene	Micrograms per Litre	<0.20	97	Not applicable
p+m-Xylene	Micrograms per Litre	<0.40 – 0.50	97	Not applicable
Xylenes (Total)	Micrograms per Litre	<0.40 – 0.84	97	0
F1 (C6-C10)	Micrograms per Litre	<20	97	Not applicable
F1 (C6-C10) - BTEX	Micrograms per Litre	<25	90	Not applicable
F2 (C10-C16 Hydrocarbons)	Micrograms per Litre	<100	98	Not applicable
F3 (C16-C34 Hydrocarbons)	Micrograms per Litre	<100 – 200	98	Not applicable
F4 (C34-C50 Hydrocarbons)	Micrograms per Litre	<100 - 280	98	Not applicable
Reached Baseline at C50	No unit	Not applicable	91	Not applicable
Phenol	Micrograms per Litre	<1.0 - 22	83	42

APPENDIX G: GROUNDWATER SAMPLING RESULTS

Table 96 - Bruce A Protected Area Tritium Results

Well Identification	Unit	2023 Spring Result	2023 Fall Result
BA-1-1	Bequerels per Litre	10.3	7.1
BA-1-2	Bequerels per Litre	53.6	41.2
BA-2-1	Bequerels per Litre	-0.7	-0.6
BA-2-2	Bequerels per Litre	9.1	0.2
BA-2-3	Bequerels per Litre	356.0	260.0
BA-3-1	Bequerels per Litre	-0.8	-1.6
BA-3-2	Bequerels per Litre	0.0	0.4
BA-3-3	Bequerels per Litre	256.0	147.0
BA-4-1	Bequerels per Litre	6.8	4.4
BA-4-2	Bequerels per Litre	2570.0	1660.0
BA-5-1	Bequerels per Litre	0.8	1.4
BA-5-2	Bequerels per Litre	-2.9	0.8
BATR-1-12	Bequerels per Litre	3720.0	3310.0
BATR-1-13	Bequerels per Litre	2000.0	2350.0
BATR-1-14A	Bequerels per Litre	53.0	21.5
BATR-1-14B	Bequerels per Litre	9990.0	6700.0
BATR-1-15	Bequerels per Litre	2130.0	2170.0
BATR-3-11	Bequerels per Litre	16.4	28.3
BATR-3-12	Bequerels per Litre	6290.0	3750.0
BATR-4-10	Bequerels per Litre	3300.0	2810.0

Note:

1. The Bruce A Evaluation Criteria for the spring season is 5959.0 Bequerels per Litre
2. The Bruce A Evaluation Criteria for the fall season is 6000.1 Bequerels per Litre

Table 97 - Bruce B Protected Area Tritium Results

Well Identification	Unit	2023 Spring Result	2023 Fall Result
BB-1-1	Bequerels per Litre	No sample	No sample
BB-1-2	Bequerels per Litre	No sample	367.0
BB-1-3	Bequerels per Litre	No sample	307.0
BB-2-1	Bequerels per Litre	15.7	11.2
BB-2-2	Bequerels per Litre	849.0	894.0
BB-3-1	Bequerels per Litre	1.6	4.4
BB-3-2	Bequerels per Litre	92.1	9.1
BB-3-3	Bequerels per Litre	257.0	266.0
BB-4-1	Bequerels per Litre	17.2	24.1
BB-4-2	Bequerels per Litre	303.0	131.0
BB-4-3	Bequerels per Litre	1510.0	1600.0
BB-5-1	Bequerels per Litre	248.0	148.0
BB-5-2	Bequerels per Litre	376.0	388.0
BB-5-3	Bequerels per Litre	527.0	469.0
BBTR-5-11	Bequerels per Litre	630.0	No sample
BBTR-6-28	Bequerels per Litre	1170.0	1070.0
BBTR-6-30	Bequerels per Litre	1210.0	1080.0
BBTR-6-40	Bequerels per Litre	1350.0	1260.0
BBTR-7-12	Bequerels per Litre	5560.0	3430.0
BBTR-8-12	Bequerels per Litre	1070.0	807.0

Note:

1. The Bruce B Evaluation Criteria for the spring season is 3228.1 Bequerels per Litre
2. The Bruce B Evaluation Criteria for the fall season is 3245.1 Bequerels per Litre

Table 98 - Fire Training Facility Hydrocarbons Results

Well Identification	Sample Date	Units	F1 (C6-C10) Result	F1-BTEX Result	F2 (C10-C16) Result	F3 (C16-C34) Result	F4 (C34-C50) Result
FTF-23	6/21/2023	Micrograms per Litre	25	25	100	250	250
FTF-23	10/16/2023	Micrograms per Litre	25	25	100	250	250
FTF-24	6/21/2023	Micrograms per Litre	25	25	100	250	250
FTF-24	10/16/2023	Micrograms per Litre	25	25	100	250	250
FTF-26	6/22/2023	Micrograms per Litre	25	25	100	250	250
FTF-26	10/17/2023	Micrograms per Litre	25	25	100	250	250
FTF-28	6/21/2023	Micrograms per Litre	25	25	100	250	250
FTF-28	10/16/2023	Micrograms per Litre	25	25	100	250	250
FTF-38	6/22/2023	Micrograms per Litre	25	25	790	250	250
FTF-38	10/16/2023	Micrograms per Litre	58	58	1090	570	250
FTF-42	6/21/2023	Micrograms per Litre	25	25	220	250	250
FTF-42	10/16/2023	Micrograms per Litre	25	25	120	250	250

Well Identification	Sample Date	Units	F1 (C6-C10) Result	F1-BTEX Result	F2 (C10-C16) Result	F3 (C16-C34) Result	F4 (C34-C50) Result
FTF-45	6/22/2023	Micrograms per Litre	25	25	100	250	250
FTF-45	10/17/2023	Micrograms per Litre	25	25	100	250	250
FTF-46	6/21/2023	Micrograms per Litre	25	25	100	250	250
FTF-46	10/17/2023	Micrograms per Litre	25	25	100	250	250
FTF-50	6/22/2023	Micrograms per Litre	25	25	100	250	250
FTF-50	10/16/2023	Micrograms per Litre	25	25	100	250	250
FTF-52	6/22/2023	Micrograms per Litre	25	25	100	250	250
FTF-52	10/16/2023	Micrograms per Litre	25	25	100	250	250
FTF-61	10/16/2023	Micrograms per Litre	25	25	100	250	250
FTF-68S	6/21/2023	Micrograms per Litre	25	25	100	250	250
FTF-68S	10/17/2023	Micrograms per Litre	25	25	100	250	250

Note:

1. The Evaluation Criteria for parameters F1 (C6-C10) and F1-BTEX is 750 Micrograms per Litre

2. The Evaluation Criteria for parameter F2 (C10-C16) is 150 Micrograms per Litre

3. The Evaluation Criteria for parameters F3 (C16-C34) and F4 (C34-C50) is 500 Micrograms per Litre

Table 99 - Bruce Heavy Water Lands (Former Oil Storage Area) Hydrocarbons Results

Well Identification	Sample Date	Units	F1 (C6-C10) Result	F1-BTEX Result	F2 (C10-C16) Result	F3 (C16-C34) Result	F4 (C34-C50) Result
MW1-07	6/20/2023	Micrograms per Litre	25	25	100	3910	250
MW1-07	10/18/2023	Micrograms per Litre	25	25	100	2480	250
MW2-07	6/20/2023	Micrograms per Litre	25	25	100	1860	250
MW2-07	10/18/2023	Micrograms per Litre	25	25	100	520	250
MW3-07	6/20/2023	Micrograms per Litre	25	25	100	250	250
MW3-07	10/18/2023	Micrograms per Litre	25	25	100	250	250
MW4-07	6/20/2023	Micrograms per Litre	25	25	100	250	250
MW4-07	10/18/2023	Micrograms per Litre	25	25	100	250	250
MW-4A	6/20/2023	Micrograms per Litre	25	25	100	250	250
MW-4A	10/18/2023	Micrograms per Litre	25	25	100	250	250

Well Identification	Sample Date	Units	F1 (C6-C10) Result	F1-BTEX Result	F2 (C10-C16) Result	F3 (C16-C34) Result	F4 (C34-C50) Result
MW-4B	6/20/2023	Micrograms per Litre	25	25	170	1240	250
MW-4B	10/18/2023	Micrograms per Litre	25	25	100	250	250
MW5-07	6/20/2023	Micrograms per Litre	25	25	100	250	250
MW5-07	10/18/2023	Micrograms per Litre	25	25	100	250	250

Note:

1. The Evaluation Criteria for parameters F1 (C6-C10) and F1-BTEX is 420 Micrograms per Litre
2. The Evaluation Criteria for parameter F2 (C10-C16) is 150 Micrograms per Litre
3. The Evaluation Criteria for parameters F3 (C16-C34) and F4 (C34-C50) is 500 Micrograms per Litre

Table 100 - Soil Management Area Nutrients and Anions Results

Well Identification	Sample Date	Ammonia Result (Milligrams per Litre)	Chloride Result (Milligrams per Litre)	Conductivity Result (Millisiemens per Centimetre)	Hardness (as CaCO3) Result (Milligrams per Litre)	pH Result (pH units)	Phosphorus Result (Milligrams per Litre)	Total Kjeldahl Nitrogen Result (Milligrams per Litre)
MW05-7	9/8/2023		21.4	0.701		7.91	0.0033	0.129
SMA-MW01	6/20/2023	0.0965	4.92	0.731	376	7.42	0.0027	0.282
SMA-MW01	9/7/2023		7.64	0.716		7.69	0.0063	0.532

Well Identification	Sample Date	Ammonia Result (Milligrams per Litre)	Chloride Result (Milligrams per Litre)	Conductivity Result (Millisiemens per Centimetre)	Hardness (as CaCO3) Result (Milligrams per Litre)	pH Result (pH units)	Phosphorus Result (Milligrams per Litre)	Total Kjeldahl Nitrogen Result (Milligrams per Litre)
SMA-MW02	6/20/2023	0.241	30.1	0.702	301	7.42	0.0352	0.241
SMA-MW02	9/7/2023		23.3	0.779		7.62	0.0448	0.389
SMA-MW03	6/20/2023	0.268	63.8	1.5	608	7.64	0.0063	0.364
SMA-MW03	9/7/2023		63.5	1.41		7.9	0.0077	0.224
SMA-MW04	6/20/2023	0.394	36	1.73	905	7.27	0.0342	0.658
SMA-MW04	9/7/2023		32	1.58		7.39	0.0622	0.91
SMA-MW05	9/8/2023		28.7	0.874		7.48	0.004	0.271
SMA-MW05	6/20/2023	0.154	17.7	1.75	816	7.83	0.0044	0.189
SMA-MW05	9/7/2023		16.6	1.64		7.99	0.0118	0.118
SMA-MW06	9/19/2023			0.139		7.8		
SMA-MW06	3/23/2023		338	1.45		8.29	0.05	
SMA-MW07	11/21/2023						0.05	
SMA-SW1	3/23/2023		336	1.43		8.31	0.05	
SMA-SW1	6/22/2023						0.05	
SMA-SW2	9/8/2023						0.05	
SMA-SW2	11/21/2023						0.05	
SMA-SW2	9/8/2023						0.05	
SMA-SW2	11/21/2023						0.05	

Well Identification	Sample Date	Ammonia Result (Milligrams per Litre)	Chloride Result (Milligrams per Litre)	Conductivity Result (Millisiemens per Centimetre)	Hardness (as CaCO3) Result (Milligrams per Litre)	pH Result (pH units)	Phosphorus Result (Milligrams per Litre)	Total Kjeldahl Nitrogen Result (Milligrams per Litre)
SMA-SW3	3/23/2023		467	1.75		8.29	0.05	
SMA-SW3	6/22/2023						0.5	
WOD-5	9/8/2023						0.05	
WOD-5	11/21/2023						0.05	
WOD-5								
WOD-5								

Note:

1. The Evaluation Criteria for Chloride is 790 milligrams per Litre

Table 101 - Soil Management Area Metals Results (Spring)

Parameter	Units	Evaluation Criteria	Well MW05-7 Result	Well SMA-MW01 Result	Well SMA-MW02 Result	Well SMA-MW03 Result	Well SMA-MW04 Result	Well SMA-MW05 Result	Well SMA-MW06 Result
Aluminum	Micrograms per Litre								
Antimony	Micrograms per Litre	6	0.1	0.1	0.1	0.1	0.12	1	1
Arsenic	Micrograms per Litre	25	0.73	0.2	0.32	2.06	0.47	10.8	1
Barium	Micrograms per Litre	1000	29.4	25	30.6	32.2	40.6	50.5	29.4
Beryllium	Micrograms per Litre	4	0.02	0.02	0.02	0.02	0.02	0.2	0.2
Bismuth	Micrograms per Litre								
Boron	Micrograms per Litre	5000	52	70	16	36	233	313	478
Cadmium	Micrograms per Litre	2.1	0.005	0.005	0.005	0.005	0.005	0.05	0.05
Calcium	Micrograms per Litre								
Cesium	Micrograms per Litre								
Chromium	Micrograms per Litre	50	0.5	0.5	0.5	0.5	0.5	5	5

Parameter	Units	Evaluation Criteria	Well MW05-7 Result	Well SMA-MW01 Result	Well SMA-MW02 Result	Well SMA-MW03 Result	Well SMA-MW04 Result	Well SMA-MW05 Result	Well SMA-MW06 Result
Cobalt	Micrograms per Litre	3.8	0.56	0.1	0.1	0.21	0.82	1.66	1
Copper	Micrograms per Litre	69	0.69	1.51	0.91	0.2	1.61	2	2
Iron	Micrograms per Litre								
Lead	Micrograms per Litre	10	0.05	0.05	0.05	0.05	0.05	0.5	0.5
Lithium	Micrograms per Litre								
Magnesium	Micrograms per Litre								
Manganese	Micrograms per Litre								
Molybdenum	Micrograms per Litre	70	0.224	1.1	0.571	1.45	6.69	4.04	14
Nickel	Micrograms per Litre	100	0.79	0.5	0.5	0.64	1.29	5	5
Phosphorus	Micrograms per Litre								
Potassium	Micrograms per Litre								
Rubidium	Micrograms per Litre								

Parameter	Units	Evaluation Criteria	Well MW05-7 Result	Well SMA-MW01 Result	Well SMA-MW02 Result	Well SMA-MW03 Result	Well SMA-MW04 Result	Well SMA-MW05 Result	Well SMA-MW06 Result
Selenium	Micrograms per Litre	10	0.074	0.198	0.239	0.353	0.118	0.5	0.5
Silicon	Micrograms per Litre								
Silver	Micrograms per Litre	1.2	0.01	0.01	0.01	0.01	0.01	0.1	0.1
Sodium	Micrograms per Litre	490000	15400	51800	3250	21800	102000	45600	85600
Strontium	Micrograms per Litre								
Sulfur	Micrograms per Litre								
Tellurium	Micrograms per Litre								
Thallium	Micrograms per Litre	2	0.01	0.01	0.01	0.01	0.027	0.1	0.1
Thorium	Micrograms per Litre								
Tin	Micrograms per Litre								
Titanium	Micrograms per Litre								
Tungsten	Micrograms per Litre								

Parameter	Units	Evaluation Criteria	Well MW05-7 Result	Well SMA-MW01 Result	Well SMA-MW02 Result	Well SMA-MW03 Result	Well SMA-MW04 Result	Well SMA-MW05 Result	Well SMA-MW06 Result
Uranium	Micrograms per Litre	20	0.685	0.694	0.959	0.175	4.05	7.44	3.94
Vanadium	Micrograms per Litre	6.2	0.5	0.5	0.5	0.5	0.55	5	5
Zinc	Micrograms per Litre	890	1	1	1	1	6.1	10	10
Zirconium	Micrograms per Litre								

Note:

1. Wells MW05-7 and SMA-MW01 were sampled on June 21, 2023.

2. Wells SMA-MW02, SMA-MW03, SMA-MW04, SMA-MW05 and SMA-MW06 were sampled on June 20, 2023.

Table 102 - Soil Management Area Metals Results (Fall)

Parameter	Units	Evaluation Criteria	Well SMA-MW01 Result	Well SMA-MW02 Result	Well SMA-MW03 Result	Well SMA-MW04 Result	Well SMA-MW05[1] Result	Well SMA-MW05[2] Result	Well SMA-MW06 Result	Well SMA-MW07 Result
Aluminum	Micrograms per Litre			2.4	6.4					2.2
Antimony	Micrograms per Litre	6	0.1			0.19	1	0.1	1	0.1
Arsenic	Micrograms per Litre	25	0.26	0.62	2.8	0.84	26.5	1.18	1	0.86
Barium	Micrograms per Litre	1000	26.5	41.8	47.3	53.1	73.1	46.6	34.8	39.8
Beryllium	Micrograms per Litre	4	0.02	0.02	0.02	0.02	0.2	0.02	0.2	0.02
Bismuth	Micrograms per Litre									0.05
Boron	Micrograms per Litre	5000	91	30	52	348	306	118	557	32
Cadmium	Micrograms per Litre	2.1	0.0052	0.005	0.005	0.005	0.05	0.0068	0.05	0.005
Calcium	Micrograms per Litre									71900
Cesium	Micrograms per Litre									0.01
Chromium	Micrograms per Litre	50	0.5	0.5	0.1	0.5	5	0.5	5	0.5

Parameter	**Units**	**Evaluation Criteria**	**Well SMA-MW01 Result**	**Well SMA-MW02 Result**	**Well SMA-MW03 Result**	**Well SMA-MW04 Result**	**Well SMA-MW05[1] Result**	**Well SMA-MW05[2] Result**	**Well SMA-MW06 Result**	**Well SMA-MW07 Result**
Cobalt	Micrograms per Litre	3.8	0.1	0.1	0.26	0.86	1.83	0.42	1	0.57
Copper	Micrograms per Litre	69	1.48	1.86	0.5	1.04	2	4.97	2	0.49
Iron	Micrograms per Litre									26
Lead	Micrograms per Litre	10	0.05	0.05	0.05	0.05	0.5	0.05	0.5	0.05
Lithium	Micrograms per Litre									2.7
Magnesium	Micrograms per Litre									24300
Manganese	Micrograms per Litre									49.3
Molybdenum	Micrograms per Litre	70	1.23	0.851	2.15	6.24	2.19	0.218	16	4.23
Nickel	Micrograms per Litre	100	0.5	0.58	0.78	1.2	5	1	5	0.51
Phosphorus	Micrograms per Litre									50
Potassium	Micrograms per Litre									2360
Rubidium	Micrograms per Litre									2.04

Parameter	Units	Evaluation Criteria	Well SMA-MW01 Result	Well SMA-MW02 Result	Well SMA-MW03 Result	Well SMA-MW04 Result	Well SMA-MW05[1] Result	Well SMA-MW05[2] Result	Well SMA-MW06 Result	Well SMA-MW07 Result
Selenium	Micrograms per Litre	10	0.134	0.239	0.07	0.095	0.5	0.094	0.5	0.05
Silicon	Micrograms per Litre									4070
Silver	Micrograms per Litre	1.2	0.01	0.01	0.01	0.01	0.1	0.01	0.1	0.01
Sodium	Micrograms per Litre	490000	40300	7700	28100	104000	37700	24000	87500	58700
Strontium	Micrograms per Litre									1070
Sulfur	Micrograms per Litre									6460
Tellurium	Micrograms per Litre									0.2
Thallium	Micrograms per Litre	2	0.01	0.015	0.01	0.034	0.1	0.01	0.1	0.015
Thorium	Micrograms per Litre									0.1
Tin	Micrograms per Litre									0.1
Titanium	Micrograms per Litre									0.3
Tungsten	Micrograms per Litre									1.26

Parameter	Units	Evaluation Criteria	Well SMA-MW01 Result	Well SMA-MW02 Result	Well SMA-MW03 Result	Well SMA-MW04 Result	Well SMA-MW05[1] Result	Well SMA-MW05[2] Result	Well SMA-MW06 Result	Well SMA-MW07 Result
Uranium	Micrograms per Litre	20	0.777	1.37	0.248	5.28	7.99	0.932	4.22	1.14
Vanadium	Micrograms per Litre	6.2	0.5	0.71	0.5	0.72	5	0.5	5	0.5
Zinc	Micrograms per Litre	890	1	1.5	3	1.6	10	1.1	10	1
Zirconium	Micrograms per Litre									0.3

Note:

1. Wells SMA-MW02, SMA-MW03, SMA-MW04, SMA-MW05[1] and SMA-MW06 were sampled on September 7, 2023.
2. Wells SMA-MW01 and SMA-MW05[2] were sampled on September 8, 2023.
3. Well SMA-MW07 was sampled on October 16, 2023.

Table 103 - Soil Management Area Polycyclic Aromatic Hydrocarbons Results (Spring)

Parameter	Units	Evaluation Criteria	Well MW05-7 Result	Well SMA-MW01 Result	Well SMA-MW02 Result	Well SMA-MW03 Result	Well SMA-MW04 Result	Well SMA-MW05 Result	Well SMA-MW06 Result
1-2-MethylNaphthalenes	Micrograms per Litre	3.2							
1-Methylnaphthalene	Micrograms per Litre	3.2	0.01	0.016	0.011	0.014	0.015	0.01	0.01
2-Methylnaphthalene	Micrograms per Litre	3.2	0.01	0.025	0.016	0.017	0.019	0.01	0.012
Acenaphthene	Micrograms per Litre	4.1	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Acenaphthylene	Micrograms per Litre	1	0.01	0.01	0.01	0.01	0.013	0.01	0.01
Anthracene	Micrograms per Litre	1	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Benzo(a)anthracene	Micrograms per Litre	1	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Benzo(a)pyrene	Micrograms per Litre	0.01	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Benzo(b&j)fluoranthene	Micrograms per Litre		0.01	0.01	0.01	0.01	0.01	0.01	0.01
Benzo(g,h,i)perylene	Micrograms per Litre	0.2	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Benzo(k)fluoranthene	Micrograms per Litre	0.1	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Parameter	**Units**	**Evaluation Criteria**	**Well MW05-7 Result**	**Well SMA-MW01 Result**	**Well SMA-MW02 Result**	**Well SMA-MW03 Result**	**Well SMA-MW04 Result**	**Well SMA-MW05 Result**	**Well SMA-MW06 Result**
Chrysene	Micrograms per Litre	0.1	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Dibenzo(a,h)anthracene	Micrograms per Litre	0.2	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Fluoranthene	Micrograms per Litre	0.41	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Fluorene	Micrograms per Litre	120	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Indeno(1,2,3-cd)Pyrene	Micrograms per Litre	0.2	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Methylnaphthalene	Micrograms per Litre	3.2	0.015	0.041	0.027	0.031	0.034	0.015	0.015
Naphthalene	Micrograms per Litre	11	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Phenanthrene	Micrograms per Litre	1	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Pyrene	Micrograms per Litre	4.1	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Note:

1. Wells MW05-7 and SMA-MW01 were sampled June 21, 2023.
2. The remaining wells, SMA-MW02, SMA-MW03, SMA-MW04, SMA-MW05 and SMA-MW06, were sample June 20, 2023.

Table 104 - Soil Management Area Polycyclic Aromatic Hydrocarbons Results (Fall)

Parameter	Units	Evaluation Criteria	Well SMA-MW01 Result	Well SMA-MW02 Result	Well SMA-MW03 Result	Well SMA-MW04 Result	Well SMA-MW05[1] Result	Well SMA-MW05[2] Result	Well SMA-MW06 Result	Well SMA-MW07 Result
1-2-MethylNaphthalenes	Micrograms per Litre	3.2	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
1-Methylnaphthalene	Micrograms per Litre	3.2	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
2-Methylnaphthalene	Micrograms per Litre	3.2	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Acenaphthene	Micrograms per Litre	4.1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Acenaphthylene	Micrograms per Litre	1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Anthracene	Micrograms per Litre	1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Benzo(a)anthracene	Micrograms per Litre	1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Benzo(a)pyrene	Micrograms per Litre	0.01	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Benzo(b&j)fluoranthene	Micrograms per Litre		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Benzo(g,h,i)perylene	Micrograms per Litre	0.2	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Benzo(k)fluoranthene	Micrograms per Litre	0.1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Parameter	Units	Evaluation Criteria	Well SMA-MW01 Result	Well SMA-MW02 Result	Well SMA-MW03 Result	Well SMA-MW04 Result	Well SMA-MW05[1] Result	Well SMA-MW05[2] Result	Well SMA-MW06 Result	Well SMA-MW07 Result
Chrysene	Micrograms per Litre	0.1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Dibenzo(a,h)anthracene	Micrograms per Litre	0.2	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Fluoranthene	Micrograms per Litre	0.41	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Fluorene	Micrograms per Litre	120	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Indeno(1,2,3-cd)Pyrene	Micrograms per Litre	0.2	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Methylnaphthalene	Micrograms per Litre	3.2								
Naphthalene	Micrograms per Litre	11	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Phenanthrene	Micrograms per Litre	1	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Pyrene	Micrograms per Litre	4.1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Note:

1. Wells SMA-MW02, SMA-MW03, SMA-MW04, SMA-MW05[1] and SMA-MW06 were sampled on September 7, 2023.
2. Wells SMA-MW01 and SMA-MW05[2] were sampled September 8, 2023.
3. Well SMA-MW07 was sampled on October 16, 2023.

Table 105 - Soil Management Area Hydrocarbons Results

Well Identification	Sample Date	Units	F1 (C6-C10) Result	F1-BTEX Result	F2 (C10-C16) Result	F3 (C16-C34) Result	F4 (C34-C50) Result
MW05-7	6/21/2023	Micrograms per Litre	25	25	100	250	250
SMA-MW01	6/21/2023	Micrograms per Litre	25	25	100	250	250
SMA-MW01	9/8/2023	Micrograms per Litre	25	25	100	250	250
SMA-MW02	6/20/2023	Micrograms per Litre	25	25	100	250	250
SMA-MW02	9/7/2023	Micrograms per Litre	25	25	100	250	250
SMA-MW03	6/20/2023	Micrograms per Litre	25	25	100	250	250
SMA-MW03	9/7/2023	Micrograms per Litre	25	25	100	250	250
SMA-MW04	6/20/2023	Micrograms per Litre	25	25	100	250	250
SMA-MW04	9/7/2023	Micrograms per Litre	25	25	100	250	250
SMA-MW05	6/20/2023	Micrograms per Litre	25	25	100	250	250
SMA-MW05	9/7/2023	Micrograms per Litre	25	25	100	250	250
SMA-MW05	9/8/2023	Micrograms per Litre	25	25	100	250	250

Well Identification	Sample Date	Units	F1 (C6-C10) Result	F1-BTEX Result	F2 (C10-C16) Result	F3 (C16-C34) Result	F4 (C34-C50) Result
SMA-MW06	6/20/2023	Micrograms per Litre	25	25	100	250	250
SMA-MW06	9/7/2023	Micrograms per Litre	25	25	100	250	250
SMA-MW07	10/16/2023	Micrograms per Litre	25	25	100	250	250

Note:

1. The Evaluation Criteria for parameters F1 (C6-C10) and F1-BTEX is 420 Micrograms per Litre.
2. The Evaluation Criteria for F2 (C10-C16) is 150 Micrograms per Litre.
3. The Evaluation Criteria for parameters F3 (C16-C34) and F4 (C34-C50) is 500 Micrograms per Litre.

Table 106 - Soil Management Area Volatile Organic Compounds Results (Spring)

Parameter	Units	Evaluation Criteria	Well MW05-7 Result	Well SMA-MW01 Result	Well SMA-MW02 Result	Well SMA-MW03 Result	Well SMA-MW05 Result	Well SMA-MW06 Result
1,1,1,2-Tetrachloroethane	Micrograms per Litre	1.1	0.5	0.5	0.5	0.5	0.5	0.5
1,1,1-Trichloroethane	Micrograms per Litre	200	0.5	0.5	0.5	0.5	0.5	0.5
1,1,2,2-Tetrachloroethane	Micrograms per Litre	1	0.5	0.5	0.5	0.5	0.5	0.5
1,1,2-Trichloroethane	Micrograms per Litre	4.7	0.5	0.5	0.5	0.5	0.5	0.5

Parameter	**Units**	**Evaluation Criteria**	**Well MW05-7 Result**	**Well SMA-MW01 Result**	**Well SMA-MW02 Result**	**Well SMA-MW03 Result**	**Well SMA-MW05 Result**	**Well SMA-MW06 Result**
1,1-Dichloroethane	Micrograms per Litre	5	0.5	0.5	0.5	0.5	0.5	0.5
1,1-Dichloroethene	Micrograms per Litre	1.6	0.5	0.5	0.5	0.5	0.5	0.5
1,2-Dibromoethane	Micrograms per Litre	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1,2-Dichlorobenzene	Micrograms per Litre	3	0.5	0.5	0.5	0.5	0.5	0.5
1,2-Dichloroethane	Micrograms per Litre	1.6	0.5	0.5	0.5	0.5	0.5	0.5
1,2-Dichloropropane	Micrograms per Litre	5	0.5	0.5	0.5	0.5	0.5	0.5
1,3-Dichlorobenzene	Micrograms per Litre	59	0.5	0.5	0.5	0.5	0.5	0.5
1,3-Dichloropropene	Micrograms per Litre	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1,4-Dichlorobenzene	Micrograms per Litre	1	0.5	0.5	0.5	0.5	0.5	0.5
Acetone	Micrograms per Litre	2700	20	20	20	20	20	20
Benzene	Micrograms per Litre	5	0.5	0.5	0.5	0.5	0.5	0.5
Bromodichloromethane	Micrograms per Litre	16	0.5	0.5	0.5	0.5	0.5	0.5

Parameter	**Units**	**Evaluation Criteria**	**Well MW05-7 Result**	**Well SMA-MW01 Result**	**Well SMA-MW02 Result**	**Well SMA-MW03 Result**	**Well SMA-MW05 Result**	**Well SMA-MW06 Result**
Bromoform	Micrograms per Litre	25	0.5	0.5	0.5	0.5	0.5	0.5
Bromomethane	Micrograms per Litre	0.89	0.5	0.5	0.5	0.5	0.5	0.5
Carbon tetrachloride	Micrograms per Litre	0.79	0.2	0.2	0.2	0.2	0.2	0.2
Chlorobenzene	Micrograms per Litre	30	0.5	0.5	0.5	0.5	0.5	0.5
Chlorodibromomethane	Micrograms per Litre	25	0.5	0.5	0.5	0.5	0.5	0.5
Chloroform	Micrograms per Litre	2.4	0.5	0.5	0.5	0.5	0.5	0.5
cis-1,2-Dichloroethene	Micrograms per Litre	1.6	0.5	0.5	0.5	0.5	0.5	0.5
cis-1,3-Dichloropropene	Micrograms per Litre	0.5	0.3	0.3	0.3	0.3	0.3	0.3
Dichlorodifluoromethane	Micrograms per Litre	590	0.5	0.5	0.5	0.5	0.5	0.5
Dichloromethane	Micrograms per Litre	50	1	1	1	1	1	1
Ethylbenzene	Micrograms per Litre	2.4	0.5	0.5	0.5	0.5	0.5	0.5
Methyl Ethyl Ketone	Micrograms per Litre	1800	20	20	20	20	20	20

Parameter	**Units**	**Evaluation Criteria**	**Well MW05-7 Result**	**Well SMA-MW01 Result**	**Well SMA-MW02 Result**	**Well SMA-MW03 Result**	**Well SMA-MW05 Result**	**Well SMA-MW06 Result**
Methyl Isobutyl Ketone	Micrograms per Litre	640	20	20	20	20	20	20
Methyl tert-butyl ether	Micrograms per Litre	15	0.5	0.5	0.5	0.5	0.5	0.5
n-Hexane	Micrograms per Litre	51	0.5	0.5	0.5	0.5	0.5	0.5
Styrene	Micrograms per Litre	5.4	0.5	0.5	0.5	0.5	0.5	0.5
Tetrachloroethene	Micrograms per Litre	1.6	0.5	0.5	0.5	0.5	0.5	0.5
Toluene	Micrograms per Litre	22	0.5	0.5	0.5	0.5	0.5	0.5
Total BTEX	Micrograms per Litre		1	1	1	1	1	1
trans-1,2-Dichloroethene	Micrograms per Litre	1.6	0.5	0.5	0.5	0.5	0.5	0.5
trans-1,3-Dichloropropene	Micrograms per Litre	0.5	0.3	0.3	0.3	0.3	0.3	0.3
Trichloroethylene	Micrograms per Litre	1.6	0.5	0.5	0.5	0.5	0.5	0.5
Trichlorofluoromethane	Micrograms per Litre	150	0.5	0.5	0.5	0.5	0.5	0.5
Vinyl Chloride	Micrograms per Litre	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Parameter	Units	Evaluation Criteria	Well MW05-7 Result	Well SMA-MW01 Result	Well SMA-MW02 Result	Well SMA-MW03 Result	Well SMA-MW05 Result	Well SMA-MW06 Result
Xylene, o	Micrograms per Litre		0.3	0.3	0.3	0.3	0.3	0.3
Xylenes, m & p	Micrograms per Litre		0.4	0.4	0.4	0.4	0.4	0.4
Xylenes, Total	Micrograms per Litre	300	0.5	0.5	0.5	0.5	0.5	0.5

Note:

1. Wells SMA-MW02, SMA-MW03, SMA-MW05 and SMA-MW06 were sampled on June 20, 2023.

2. Wells MW05-7 and SMA-MW01 were sampled on June 21, 2023.

Table 107 - Soil Management Area Volatile Organic Compounds Results (Fall)

Parameter	Units	Evaluation Criteria	Well SMA-MW01 Result	Well SMA-MW02 Result	Well SMA-MW03 Result	Well SMA-MW04 Result	Well SMA-MW05[1] Result	Well SMA-MW05[2] Result	Well SMA-MW06 Result	Well SMA-MW07 Result
1,1,1,2-Tetrachloroethane	Micrograms per Litre	1.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1,1,1-Trichloroethane	Micrograms per Litre	200	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1,1,2,2-Tetrachloroethane	Micrograms per Litre	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1,1,2-Trichloroethane	Micrograms per Litre	4.7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Parameter	Units	Evaluation Criteria	Well SMA-MW01 Result	Well SMA-MW02 Result	Well SMA-MW03 Result	Well SMA-MW04 Result	Well SMA-MW05[1] Result	Well SMA-MW05[2] Result	Well SMA-MW06 Result	Well SMA-MW07 Result
1,1-Dichloroethane	Micrograms per Litre	5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1,1-Dichloroethene	Micrograms per Litre	1.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1,2-Dibromoethane	Micrograms per Litre	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1,2-Dichlorobenzene	Micrograms per Litre	3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1,2-Dichloroethane	Micrograms per Litre	1.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1,2-Dichloropropane	Micrograms per Litre	5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1,3-Dichlorobenzene	Micrograms per Litre	59	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1,3-Dichloropropene	Micrograms per Litre	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1,4-Dichlorobenzene	Micrograms per Litre	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Acetone	Micrograms per Litre	2700	20	20	20	20	20	20	20	20
Benzene	Micrograms per Litre	5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Bromodichloromethane	Micrograms per Litre	16	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Parameter	**Units**	**Evaluation Criteria**	**Well SMA-MW01 Result**	**Well SMA-MW02 Result**	**Well SMA-MW03 Result**	**Well SMA-MW04 Result**	**Well SMA-MW05[1] Result**	**Well SMA-MW05[2] Result**	**Well SMA-MW06 Result**	**Well SMA-MW07 Result**
Bromoform	Micrograms per Litre	25	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Bromomethane	Micrograms per Litre	0.89	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Carbon tetrachloride	Micrograms per Litre	0.79	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Chlorobenzene	Micrograms per Litre	30	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Chlorodibromomethane	Micrograms per Litre	25	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Chloroform	Micrograms per Litre	2.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
cis-1,2-Dichloroethene	Micrograms per Litre	1.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
cis-1,3-Dichloropropene	Micrograms per Litre	0.5	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Dichlorodifluoromethane	Micrograms per Litre	590	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Dichloromethane	Micrograms per Litre	50	1	1	1	1	1	1	1	1
Ethylbenzene	Micrograms per Litre	2.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Methyl Ethyl Ketone	Micrograms per Litre	1800	20	20	20	20	20	20	20	20

Parameter	**Units**	**Evaluation Criteria**	**Well SMA-MW01 Result**	**Well SMA-MW02 Result**	**Well SMA-MW03 Result**	**Well SMA-MW04 Result**	**Well SMA-MW05[1] Result**	**Well SMA-MW05[2] Result**	**Well SMA-MW06 Result**	**Well SMA-MW07 Result**
Methyl Isobutyl Ketone	Micrograms per Litre	640	20	20	20	20	20	20	20	20
Methyl tert-butyl ether	Micrograms per Litre	15	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
n-Hexane	Micrograms per Litre	51	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Styrene	Micrograms per Litre	5.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Tetrachloroethene	Micrograms per Litre	1.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Toluene	Micrograms per Litre	22	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total BTEX	Micrograms per Litre		1	1	1	1	1	1	1	1
trans-1,2-Dichloroethene	Micrograms per Litre	1.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
trans-1,3-Dichloropropene	Micrograms per Litre	0.5	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Trichloroethylene	Micrograms per Litre	1.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Trichlorofluoromethane	Micrograms per Litre	150	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Vinyl Chloride	Micrograms per Litre	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Parameter	Units	Evaluation Criteria	Well SMA-MW01 Result	Well SMA-MW02 Result	Well SMA-MW03 Result	Well SMA-MW04 Result	Well SMA-MW05[1] Result	Well SMA-MW05[2] Result	Well SMA-MW06 Result	Well SMA-MW07 Result
Xylene, o	Micrograms per Litre		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Xylenes, m & p	Micrograms per Litre		0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Xylenes, Total	Micrograms per Litre	300	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Note:

1. Wells SMA-MW02, SMA-MW03, SMA-MW04, SMA-MW05[1] and SMA-MW06 were sampled on September 7, 2023.
2. Wells SMA-MW01 and SMA-MW05 were sampled on September 8, 2023.
3. Well SMA-MW07 was sampled on October 16, 2023.

Table 108 - Bruce A Standby Generators Area Hydrocarbon Results

Well Identification	Sample Date	F1 (C6-C10) Result (Micrograms per Litre)	F1-BTEX Result (Micrograms per Litre)	F2 (C10-C16) Result (Micrograms per Litre)	F3 (C16-C34) Result (Micrograms per Litre)	F4 (C34-C50) Result (Micrograms per Litre)
BASG-13	10/17/2023	25	25	100	250	250
BASG-14	10/17/2023	25	25	100	250	250
BASG-15	10/17/2023	25	25	100	250	250
BASG-16	10/17/2023	25	25	100	250	250
BASG-17	10/17/2023	25	25	100	250	250
BASG-21	10/17/2023	25	25	100	250	250
BASG-22	10/17/2023	25	25	100	250	250
BASG-25	10/17/2023	25	25	100	250	250
BASG-26	10/17/2023	25	25	100	250	250

Note:

1. The Evaluation Criteria for parameters F1 (C6-C10) and F1-BTEX is 420 Micrograms per Litre.
2. The Evaluation Criteria for parameter F2 (C10-C16) is 150 Micrograms per Litre.
3. The Evaluation Criteria for parameters F3 (C16-C34) and F4 (C34-C50) is 500 Micrograms per Litre.

Table 109 - Bruce A Standby Generators Area Nutrients and Anions Results

Well Site	Alkalinity, Total as $CaCO_3$ (Milligrams per Litre)	Ammonia (Milligrams per Litre)	Chloride (Milligrams per Litre)	Fluoride (Milligrams per Litre)	Nitrate and Nitrite as N (Milligrams per Litre)	Nitrate as N (Milligrams per Litre)	Nitrite as N (Milligrams per Litre)	Phosphorus (Milligrams per Litre)	Sulphate (Milligrams per Litre)	Total Kjeldahl Nitrogen (Milligrams per Litre)
BASG-13	196	0.222	25.1	1.28	0.112	0.1	0.05	0.009	593	0.241
BASG-14	222	0.0559	12.4	0.812	0.112	0.1	0.05	0.0061	1170	0.238
BASG-15	296	0.005	52.2	1.5	0.112	0.1	0.05	0.002	244	0.05
BASG-16	332	0.005	1.34	1.54	1.04	1.04	0.01	0.0032	118	0.264
BASG-17	189	0.005	152	0.711	0.149	0.149	0.01	0.0022	38.8	0.05
BASG-21	297	0.005	659	1.09	0.713	0.713	0.05	0.0108	39.9	0.157
BASG-22	347	0.149	422	0.673	0.112	0.1	0.05	0.0147	54.9	0.252
BASG-25	295	0.005	1.33	0.942	0.0224	0.02	0.01	0.0032	29.1	0.14
BASG-26	226	0.111	0.76	0.652	0.712	0.712	0.01	0.0207	9.21	0.345

Note:

1. Each well was sampled on October 17, 2023.

2. The Evaluation Criteria for Chloride is 790 Milligrams per Litre.

Table 110 - Bruce A Transformers Area Hydrocarbon Results

Well Identification	Sample Date	F1 (C6-C10) Result (Micrograms per Litre)	F1-BTEX Result (Micrograms per Litre)	F2 (C10-C16) Result (Micrograms per Litre)	F3 (C16-C34) Result (Micrograms per Litre)	F4 (C34-C50) Result (Micrograms per Litre)
BATR-1-12	10/18/2023	25	25	100	250	250
BATR-1-13	10/17/2023	25	25	100	250	250
BATR-1-14A	10/17/2023	25	25	100	250	250
BATR-1-14B	10/17/2023	25	25	100	250	250
BATR-1-15	10/17/2023	25	25	100	250	250
BATR-3-11	10/18/2023	25	25	100	250	250
BATR-3-12	10/18/2023	25	25	100	250	250
BATR-4-10	10/18/2023	25	25	100	250	250

Note:

1. The Evaluation Criteria for parameters F1 (C6-C10) and F1-BTEX is 420 Micrograms per Litre.
2. The Evaluation Criteria for parameter F2 (C10-C16) is 150 Micrograms per Litre.
3. The Evaluation Criteria for parameters F3 (C16-C34) and F4 (C34-C50) is 500 Micrograms per Litre.

Table 111 - Bruce A Transformers Area Nutrients and Anions Results

Well Identification	Sample Date	Units	Alkalinity, Total (as CaCO3)	Ammonia	Chloride	Fluoride	Nitrate and Nitrite, as N	Nitrate, as N	Nitrite, as N	Phosphorus	Sulphate	Total Kjeldahl Nitrogen
BATR-1-12	10/18/2023	Milligrams per Litre	183	0.005	256	1.02	1.45	1.45	0.05	0.0032	17.6	0.248
BATR-1-13	10/17/2023	Milligrams per Litre	313	0.005	218	1.06	0.112	0.1	0.05	0.0047	356	0.062
BATR-1-14A	10/17/2023	Milligrams per Litre	146	0.02	21.2	1.59	0.112	0.1	0.05	0.002	661	0.063
BATR-1-14B	10/17/2023	Milligrams per Litre	136	0.005	84.4	0.962	3.93	3.93	0.01	0.0046	15.6	0.344
BATR-1-15	10/17/2023	Milligrams per Litre	182	0.005	220	1.1	2.05	2.05	0.05	0.0042	249	0.31
BATR-3-11	10/18/2023	Milligrams per Litre	95.7	0.005	14.6	0.956	0.289	0.289	0.01	0.0021	17.7	0.093
BATR-3-12	10/18/2023	Milligrams per Litre	172	0.0085	33.1	0.998	3.39	3.39	0.01	0.0073	10.7	0.336
BATR-4-10	10/18/2023	Milligrams per Litre	170	0.005	49.5	1.6	3.71	3.71	0.01	0.0183	18.7	0.428

Note:

1. The Evaluation Criteria for Chloride is 790 Milligrams per Litre.

Table 112 - Bruce A Transformers Area Select Volatile Organic Compounds Results

Well Identification	Sample Date	Units	Bromodichloromethane	Bromoform	Chlorodibromomethane	Chloroform
BATR-1-12	10/18/2023	Micrograms per Litre	0.5	0.5	0.5	0.5
BATR-1-13	10/17/2023	Micrograms per Litre	0.5	0.5	0.5	0.5
BATR-1-14A	10/17/2023	Micrograms per Litre	0.5	0.5	0.5	0.5
BATR-1-14B	10/17/2023	Micrograms per Litre	0.5	0.5	0.5	0.5
BATR-1-15	10/17/2023	Micrograms per Litre	0.5	0.5	0.5	0.5
BATR-3-11	10/18/2023	Micrograms per Litre	0.5	0.5	0.5	22.8
BATR-3-12	10/18/2023	Micrograms per Litre	0.5	0.5	0.5	0.51
BATR-4-10	10/18/2023	Micrograms per Litre	0.5	0.5	0.5	1.92

Note:

1. The Evaluation Criteria for Bromodichloromethane is 16 Micrograms per Litre.
2. The Evaluation Criteria for Bromoform and Chlorodibromomethane is 25 Micrograms per Litre.
3. The Evaluation Criteria for Chloroform is 2.4 Micrograms per Litre.

Table 113 - Bruce B Transformers Area Hydrocarbons Results

Well Identification	Sample Date	Units	F1 (C6-C10) Result	F1-BTEX Result	F2 (C10-C16) Result	F3 (C16-C34) Result	F4 (C34-C50) Result
BBTR-5-11	10/19/2023	Micrograms per Litre	49	49	100	250	250
BBTR-5-12	10/19/2023	Micrograms per Litre	46	46	100	250	250
BBTR-5-13	10/19/2023	Micrograms per Litre	44	44	100	250	250
BBTR-5-14	10/19/2023	Micrograms per Litre	25	25	100	250	250
BBTR-6-28	10/19/2023	Micrograms per Litre	25	25	100	250	250
BBTR-6-30	10/19/2023	Micrograms per Litre	25	25	100	250	250
BBTR-6-40	10/19/2023	Micrograms per Litre	25	25	100	250	250
BBTR-7-12	10/19/2023	Micrograms per Litre	25	25	100	250	250
BBTR-8-12	10/19/2023	Micrograms per Litre	38	38	100	250	250

Note:

1. The Evaluation Criteria for F1 (C6-C10) and F1-BTEX is 400 Micrograms per Litre.
2. The Evaluation Criteria for F2 (C10-C16) is 150 Micrograms per Litre.
3. The Evaluation Criteria for F3 (C16-C34) and F4 (C34-C50) is 500 Micrograms per Litre.

Table 114 - Bruce B Transformers Area Nutrients and Anions Results

Well Identification	Sample Date	Units	Alkalinity, Total (as CaCO3)	Ammonia	Chloride	Fluoride	Nitrate and Nitrite, as N	Nitrate, as N	Nitrite, as N	Phosphorus	Sulphate	Total Kjeldahl Nitrogen
BBTR-5-11	10/19/2023	Milligrams per Litre	205	0.005	61.4	2.23	1.33	1.3	0.033	0.0045	31.7	0.292
BBTR-5-12	10/19/2023	Milligrams per Litre	187	0.005	977	1.44	1.22	1.22	0.05	0.0079	95.6	0.123
BBTR-5-13	10/19/2023	Milligrams per Litre	201	0.0056	1560	1.83	0.464	0.464	0.1	0.0037	118	0.087
BBTR-5-14	10/19/2023	Milligrams per Litre	207	0.005	1590	1.79	0.797	0.797	0.1	0.0062	123	0.125
BBTR-6-28	10/19/2023	Milligrams per Litre	198	0.005	314	2.15	1.42	1.42	0.05	0.0021	27.2	0.176
BBTR-6-30	10/19/2023	Milligrams per Litre	133	0.005	219	1.7	1.53	1.53	0.05	0.0037	27.4	0.197
BBTR-6-40	10/19/2023	Milligrams per Litre	296	0.116	1350	2.01	0.224	0.2	0.1	0.0069	130	0.291
BBTR-7-12	10/19/2023	Milligrams per Litre	174	0.005	481	1.94	0.112	0.1	0.05	0.003	50.8	0.236
BBTR-8-12	10/19/2023	Milligrams per Litre	241	0.005	622	1.56	0.476	0.476	0.05	0.0026	45.8	0.163

Note:

1. The Evaluation Criteria for Chloride is 790 Milligrams per Litre.

Table 115 - Bruce B Transformers Area Select Volatile Organic Compounds Results

Well Identification	Sample Date	Units	Bromodichloromethane	Bromoform	Chlorodibromomethane	Chloroform
BBTR-5-11	10/19/2023	Micrograms per Litre	0.5	0.5	0.5	0.5
BBTR-5-12	10/19/2023	Micrograms per Litre	0.5	0.5	0.5	0.5
BBTR-5-13	10/19/2023	Micrograms per Litre	0.5	0.5	0.5	0.5
BBTR-5-14	10/19/2023	Micrograms per Litre	0.5	0.5	0.5	0.5
BBTR-6-28	10/19/2023	Micrograms per Litre	0.5	0.5	0.5	0.5
BBTR-6-30	10/19/2023	Micrograms per Litre	0.5	0.5	0.5	0.5
BBTR-6-40	10/19/2023	Micrograms per Litre	0.5	0.5	0.5	0.5
BBTR-7-12	10/19/2023	Micrograms per Litre	0.5	0.5	0.5	0.5
BBTR-8-12	10/19/2023	Micrograms per Litre	0.5	0.5	0.5	0.5

Note:

1. The Evaluation Criteria for Bromodichloromethane is 16 Micrograms per Litre.
2. The Evaluation Criteria for Bromoform and Chlorodibromomethane is 25 Micrograms per Litre.
3. The Evaluation Criteria for Chloroform is 2.4 Micrograms per Litre.

Table 116 - Bruce B Standby Generators Area – South Hydrocarbons Results

Well Identification	Sample Date	Units	F1 (C6-C10) Result	F1-BTEX Result	F2 (C10-C16) Result	F3 (C16-C34) Result	F4 (C34-C50) Result
BBSG-16	10/18/2023	Micrograms per Litre	25	25	100	250	250
BBSG-18	10/18/2023	Micrograms per Litre	25	25	200	250	250
BBSG-19	10/18/2023	Micrograms per Litre	25	25	100	250	250
BBSG-20	10/18/2023	Micrograms per Litre	25	25	100	250	250
BBSG-42	10/19/2023	Micrograms per Litre	25	25	100	250	250
BBSG-43	10/18/2023	Micrograms per Litre	25	25	100	250	250
BBSG-44	10/18/2023	Micrograms per Litre	25	25	100	250	250
BBSG-45	10/18/2023	Micrograms per Litre	25	25	100	250	250
BBSG-46	10/18/2023	Micrograms per Litre	25	25	100	250	250

Note:

1. The Evaluation Criteria for F1 (C6-C10) and F1-BTEX is 400 Micrograms per Litre.
2. The Evaluation Criteria for F2 (C10-C16) is 150 Micrograms per Litre.
3. The Evaluation Criteria for F3 (C16-C34) and F4 (C34-C50) is 500 Micrograms per Litre.

Table 117 - Bruce B Standby Generators Area – South Nutrients and Anions Results

Well Identification	Sample Date	Units	Alkalinity, Total (as CaCO3)	Ammonia	Chloride	Fluoride	Nitrate and Nitrite, as N	Nitrate, as N	Nitrite, as N	Phosphorus	Sulphate	Total Kjeldahl Nitrogen
BBSG-16	10/18/2023	Milligrams per Litre	120	0.005	38.9	0.761	0.479	0.479	0.01	0.0028	22.3	0.078
BBSG-18	10/18/2023	Milligrams per Litre	182	0.132	105	1.3	0.126	0.126	0.01	0.0065	20.9	0.204
BBSG-19	10/18/2023	Milligrams per Litre	162	0.005	558	1.81	1.13	1.13	0.05	0.0054	68.8	0.102
BBSG-20	10/18/2023	Milligrams per Litre	216	0.005	1.82	1.34	1.53	1.53	0.01	0.0031	37	0.426
BBSG-42	10/19/2023	Milligrams per Litre	135	0.005	167	0.938	0.999	0.999	0.01	0.0086	31.8	0.099
BBSG-43	10/18/2023	Milligrams per Litre	144	0.005	147	1.37	0.783	0.783	0.01	0.002	34.2	0.151
BBSG-44	10/18/2023	Milligrams per Litre	103	0.005	67.6	0.864	0.907	0.907	0.01	0.0026	18.2	0.168
BBSG-45	10/18/2023	Milligrams per Litre	174	0.005	548	1.49	1.09	1.09	0.05	0.0077	52.5	0.105
BBSG-46	10/18/2023	Milligrams per Litre	157	0.005	513	1.39	0.997	0.997	0.05	0.0079	50.1	0.128

Note:

1. The Evaluation Criteria for Chloride is 790 Milligrams per Litre.

Table 118 - Central Maintenance Facility Hydrocarbons Results

Well Identification	Sample Date	Units	Result	Result	Result	Result	Result
CMLF-1	10/17/2023	Micrograms per Litre	25	25	100	250	250
CMLF-2	10/17/2023	Micrograms per Litre	25	25	100	250	250
CMLF-3	10/17/2023	Micrograms per Litre	25	25	100	250	250
CMLF-4	10/17/2023	Micrograms per Litre	25	25	100	250	250
CMLF-5	10/17/2023	Micrograms per Litre	25	25	100	250	250
CMLF-6	10/17/2023	Micrograms per Litre	25	25	100	250	250

Note:

1. The Evaluation Criteria for F1 (C6-C10) and F1-BTEX is 400 Micrograms per Litre.
2. The Evaluation Criteria for F2 (C10-C16) is 150 Micrograms per Litre.
3. The Evaluation Criteria for F3 (C16-C34) and F4 (C34-C50) is 500 Micrograms per Litre.

Table 119 - Bunker C Oil Ignition Day Tank and Acid Wash Pond Area Metals Results

Parameter	Units	Evaluation Criteria	BCO-28A Result	BCO-28B Result	BCO-AWP-18 Result	BCO-AWP-36 Result	BCO-AWP-39 Result
Antimony	Micrograms per Litre	6	1	1	1.67	1	1.55
Arsenic	Micrograms per Litre	25	3.84	1	1	1	3.56
Barium	Micrograms per Litre	1000	40	29.4	55.2	33	45.1
Beryllium	Micrograms per Litre	4	0.2	0.2	0.2	0.2	0.2
Boron	Micrograms per Litre	5000	155	205	100	100	140
Cadmium	Micrograms per Litre	2.7	0.05	0.05	0.05	0.05	0.05
Chromium	Micrograms per Litre	50	5	5	5	5	5
Cobalt	Micrograms per Litre	3.8	1	1	1	1	1
Copper	Micrograms per Litre	87	2	2	2.05	2.15	3.2
Lead	Micrograms per Litre	10	0.5	0.5	0.5	0.5	0.5
Molybdenum	Micrograms per Litre	70	9.29	4.8	7.79	2.56	14.7
Nickel	Micrograms per Litre	100	11.5	5	71.1	5	141

Parameter	Units	Evaluation Criteria	BCO-28A Result	BCO-28B Result	BCO-AWP-18 Result	BCO-AWP-36 Result	BCO-AWP-39 Result
Antimony	Micrograms per Litre	6	1	1	1.67	1	1.55
Selenium	Micrograms per Litre	10	0.5	1.07	1.24	0.5	2.42
Silver	Micrograms per Litre	1.5	0.1	0.1	0.1	0.1	0.1
Sodium	Micrograms per Litre	490000	349000	207000	536000	247000	542000
Thallium	Micrograms per Litre	2	0.225	0.199	0.205	0.1	0.146
Uranium	Micrograms per Litre	20	7.67	4.25	2.74	1.31	2.86
Vanadium	Micrograms per Litre	6.2	5	29.3	664	89.2	4410
Zinc	Micrograms per Litre	1100	10	10	10	10	10

Note:

1. The sample date for all samples was October 16, 2023.