Nuclear Energy Canada Inc.

Annual Compliance Monitoring Report

January 1 to December 31

2018

The information contained in this report concerns the performance and operation of BWXT Nuclear Energy Canada Inc.'s (BWXT NEC) Class IB nuclear facilities located in Peterborough and Toronto, Ontario. This report is prepared to meet fuel fabrication operating licence FFOL-3620.01/2020 condition 2.4. The content demonstrates adherence to the BWXT NEC commitment to operate safe Class IB nuclear facilities, as well as demonstrate compliance with applicable regulations and licence conditions specified by the Canadian Nuclear Safety Commission.

Peterborough & Toronto

Revision	Description	Prepared by Date	Approved by Date
00	Initial Issue	S. Rheubottom 2019-03-29	D. Snopek 2019-03-29

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1 EXECUTIVE SUMMARY

BWXT Nuclear Energy Canada Inc. (BWXT NEC) has been involved with the Canada Deuterium Uranium (CANDU®) industry from its earliest years. BWXT NEC produces nuclear fuel bundles used by the CANDU fleet to generate clean electricity that powers homes, business and the Canadian economy. BWXT NEC operates in three plant locations: Arnprior, Toronto and Peterborough, Ontario. BWXT NEC's Toronto and Peterborough facilities are Class IB nuclear facility operations. The operating licence issued by the Canadian Nuclear Safety Commission (CNSC) authorizes BWXT NEC to operate and modify its nuclear fuel facility to produce natural and depleted uranium dioxide (UO_2) pellets in Toronto at 1025 Lansdowne Ave., and produce and test fuel bundles in Peterborough at 1160 Monaghan Rd. The Peterborough facility is additionally authorized to receive, repair, modify and return contaminated equipment from off-site nuclear facilities.

The purpose of this compliance report is to demonstrate that BWXT NEC has successfully met the requirements of the Nuclear Safety and Control Act, associated regulations and the Class IB Nuclear Fuel Facility Operating Licence FFOL-3620.01/2020 revised by the CNSC on December 16, 2016, and expiring December 31, 2020. This report is prepared based on the CNSC's *Annual Compliance Monitoring and Operational Performance Reporting Requirements for Class I A & B Nuclear Facilities* and REGDOC-3.1.2 *Reporting Requirements, Volume I: Non-Power Reactor Class 1 Nuclear Facilities and Uranium Mines and Mills*. Appendices containing confidential and proprietary information are submitted to the CNSC separately.

BWXT NEC is committed to continuously improve systems to protect employees, the environment and our communities against environment, health and safety hazards. We work to implement programs and objectives to conserve natural resources, prevent pollution and minimize waste. Maintaining a safe and healthy work environment for our employees is a top business priority. BWXT has implemented a business management system that defines the requirements of the quality assurance program for the licensed activity, which ensures applicable buildings and facilities, process equipment, and processes used in support of licensed activities are conducted in accordance with the Nuclear Safety Control Act and Regulations, applicable CNSC requirements, jurisdictional requirements and compliance best practices.

No significant operational changes occurred at either facility. Upgrades were made to programs with the objective of achieving continuous improvement and environmental health and safety excellence. Details are provided in the main sections of this report. Changes made to the physical facilities, equipment, processes, procedures or practices that could impact employee health and safety, the environment or the public as a result of the operation of the facilities are assessed through the business-wide Change Control program.

BWXT NEC has established facility specific CNSC approved A*ction Levels* for various radiological and environmental parameters. An Action Level is defined in the *Radiation Protection Regulations* "as specific dose of radiation or other parameter that, if reached, may indicate a loss of control of part of a licensee's radiation protection program, and triggers a requirement for specific action to be taken." Action Levels are also applied to environmental protection. Action Levels are set below regulatory limits; however, they are CNSC reportable events. Accordingly, BWXT NEC has established *Internal Control Levels* for various radiological and environmental parameters that are set even lower than Action Levels to act as an early warning system. Internal Control Level exceedances result in internal investigation and correction and are not CNSC reportable events.

There were two regulatory reportable events in 2018. The Peterborough site reported a small spill of metal working fluid onto a concrete pad and adjacent grassy area from a metal recycling bin. All used absorbent materials and affected soil was collected and all bins returned to the vendor. In accordance with facility licence conditions and MOECP regulations, the spill was reported to the Spills Action Centre and the CNSC. The Toronto site reported emergency organization activation as a result of a large rain event which resulted in the loss of power and an excessive rate of surface water entering the freight elevator and flooding the basement of building 7. In accordance with facility licence conditions, this event was reported to the CNSC.

Employee workplace radiation exposures are measured by CNSC approved methods and systems. Overall, dose trends are favourable and consistent with an effective application of the ALARA (As Low as Reasonably Achievable - Social and Economic Factors considered) principle. All measured radiation exposures received by personnel in the reporting period were within regulatory limits and below Action Levels.

BWXT NEC has established conventional health and safety programs to manage the non-radiological workplace safety hazards to protect personnel. Key performance indicators are used to measure the success of the programs throughout the year. The Peterborough site was injury-free (zero recordable or lost time) in 2018 and achieved a BWXT President and Chief Executive Officer Safety Award as recognition for their excellent safety performance.

BWXT NEC recognizes that an effective way of maintaining public trust is to maintain environmental excellence. This requires a demonstrated commitment to operating in accordance with the highest environment, health and safety standards. The facilities maintain effective environmental management systems to achieve environmental goals and objectives and keep all environmental impacts well within applicable standards and as low as reasonably achievable. These programs demonstrate compliance to relevant federal and provincial legislation. Environmental protection programs are also compliant with the following standards:

- Canadian Standards Association (CSA) N288.4-10, *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills*,
- CSA N288.5-11, *Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills*
- CSA N288.6-12, *Environmental risk assessments at Class I nuclear facilities and uranium mines and mills*

Air and water emissions are routinely measured from both facilities to demonstrate compliance with the CNSC's environmental protection requirements and the ALARA principle. All measurements were below Action Levels and annual releases were a very small fraction of regulatory limits.

Established emergency response plans are in place that describe the actions to be taken to minimize health and environmental hazards, which may result from fires, explosions, or the release of hazardous materials. This includes effects to the local area and members of the public. The plans intend to reduce the risk of emergencies such as fires, and assist emergency staff and plant personnel in understanding key emergency response issues, and assist the facilities in protecting employees, the local community and the environment through sound emergency management practices. The emergency response plans were developed in accordance with federal laws and standards as follows and fulfils the CNSC operating licence requirements.

1. CAD/CSA-Z731-03, *Emergency Planning for Industry Standard*
2. CNSC Regulatory Guide G-225, *Emergency Planning at Class I Nuclear Facilities and Uranium Mines and Mills*
3. The Province of Ontario Nuclear Emergency Plan Part VIII
4. Canada Labour Code
5. CNSC Regulatory Document REGDOC 2.10.1, *Nuclear Emergency Preparedness and Response*
6. National Fire Protection Association (NFPA) 801, *Fire Protection for Facilities Handling Radioactive Materials*
7. CSA N393-13, *Fire Protection for Facilities that Process, Handle, or Store Nuclear Substances*

BWXT NEC has implemented and maintains a safeguards program and undertakes all required measures to ensure safeguards implementation in accordance with International Atomic Energy Agency (IAEA) commitments and CNSC regulatory document 2.13.1 *Safeguards and Nuclear Material Accountancy* of natural and depleted uranium are documented and reported to the CNSC as required. The IAEA and the CNSC jointly conduct annual verifications.

BWXT NEC safely transports dangerous goods, including Class 7 radioactive material shipments as governed by the *Transportation of Dangerous Goods (TDG)* Act and Regulations and the *Packaging and Transport of Nuclear Substances Regulations*. Shipments occur routinely between suppliers and the Toronto and Peterborough facilities, customers and waste vendors.

BWXT NEC places great importance on its relationships with all levels of local government and residents in the communities in which it operates and works to ensure there is open communication and awareness of BWXT NEC's operating activities. The public information program defines the process for providing information about BWXT NEC operations. Public interest in both facilities was low during the reporting period. Enquiries were tracked and responded to in a timely manner. The Community Liaison Committee (Toronto), whose mandate is to provide a forum for a cross-section of neighbours and other community stakeholders to share information and ideas, continued to meet regularly.

This compliance monitoring report demonstrates that BWXT NEC has successfully met the requirements of the Nuclear Safety and Control Act, Regulations and CNSC Class IB nuclear facility operating licence conditions.

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2 INTRODUCTION

The purpose of this compliance monitoring report is to demonstrate that BWXT NEC has successfully met the requirements of the Nuclear Safety and Control Act, associated regulations and the Class IB Nuclear Fuel Facility Operating Licence FFOL-3620.01/2020 revised by the Canadian Nuclear Safety Commission (CNSC) on December 16, 2016, and expiring December 31, 2020. This report is prepared based on the CNSC's *Annual Compliance Monitoring and Operational Performance Reporting Requirements for Class I A & B Nuclear Facilities* and REGDOC-3.1.2 *Reporting Requirements, Volume I: Non-Power Reactor Class 1 Nuclear Facilities and Uranium Mines and Mills*. Appendices containing confidential and proprietary information are submitted to the CNSC separately.

BWXT Nuclear Energy Canada Inc. (BWXT NEC) has been involved with the Canada Deuterium Uranium (CANDU®) industry from its earliest years. BWXT NEC produces nuclear fuel bundles used by the CANDU fleet to generate clean electricity that powers homes, business and the Canadian economy. BWXT NEC operates in three plant locations: Arnprior, Toronto and Peterborough, Ontario. BWXT NEC's Toronto and Peterborough facilities are Class IB nuclear facility operations. Nuclear substance use is regulated federally by the CNSC and the Nuclear Safety and Control Act and Regulations. The CNSC operating licence authorizes BWXT NEC to operate and modify its nuclear fuel facility to produce natural and depleted uranium dioxide (UO_2) pellets in Toronto at 1025 Lansdowne Avenue (Figure 1), and produce and test fuel bundles in Peterborough at 1160 Monaghan Road (Figure 2). Finished bundles are then shipped to various customers. The Peterborough facility is additionally authorized to receive, repair, modify and return contaminated equipment from off-site nuclear facilities.

There were no significant modifications or changes to the site or facilities. There were no changes to the facility operating licence in 2018.

Figure 1: BWXT NEC Toronto

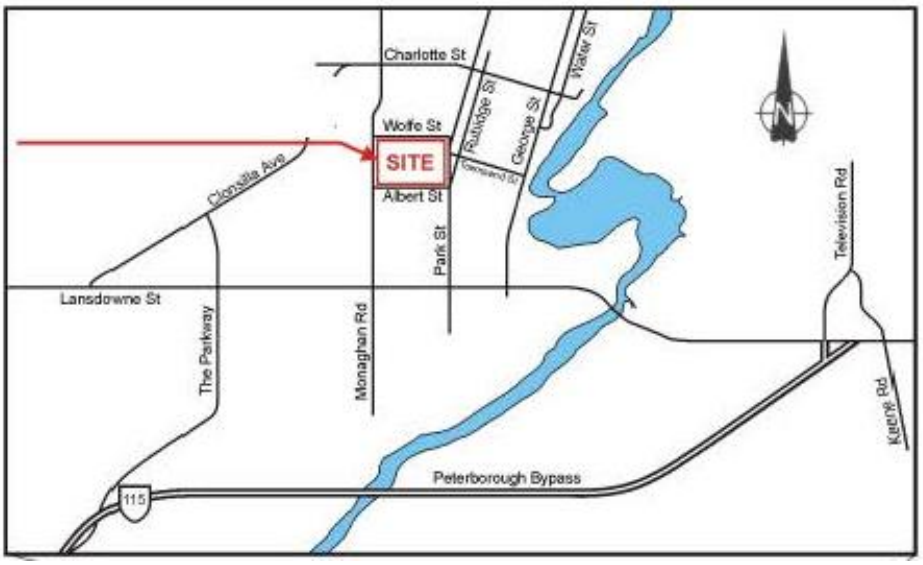


Figure 2: BWXT NEC Peterborough

BWXT NEC is federally regulated for health and safety. The federal health and safety legislation is the Canada Labour Code Part II and the Canada Occupational Health and Safety Regulations. The Canada Labour Code is enforced by Employment and Social Development Canada. The purpose of Part II of the Canada Labour Code is to prevent accidents and injury to health arising out of, linked with or occurring in the course of employment. BWXT NEC facilities are also regulated federally by Transport Canada. BWXT NEC is additionally regulated environmentally through municipal Sewer Use Bylaws and provincially by the Ontario Ministry of the Environment, Conservation and Parks (MOECP).

BWXT NEC is committed to the establishment and continuous improvement of a healthy Safety Culture. Safety Culture refers to the core values and behaviours resulting from a collective commitment by our company's leaders and individuals to emphasize safety, quality, ethics, and security over competing goals to ensure protection of people and the environment. The Environment, Health and Safety (EHS) Mission Statement defines it as a top business priority to continuously improve our EHS systems to protect fellow employees, the environment, and our communities against known and potential environmental, health and safety hazards. The BWXT NEC management team reviews, prioritizes and controls workplace hazards and ensures compliance with the pertinent regulatory requirements, applicable codes and company policies.

The primary facility potential radiological hazard from uranium is the inhalation of airborne UO_2 particles. Measurements are performed for airborne and surface traces of uranium as an indicator of process containment efficiency. Urine samples provided by employees are used to indicate if inhalation may have occurred. A lesser potential radiological hazard exists in the form of low-level external gamma and beta radiation exposure to employees

Whole body, skin and extremity dose measurements are conducted to demonstrate compliance with the dose limits specified in the *Radiation Protection Regulations* and the ALARA principle. All dose measurement results for employees were below Action Levels and regulatory limits.

Air and water emissions are routinely measured to demonstrate regulatory compliance and the ALARA principle. All measurements were below *Action Levels* and annual releases were a small fraction of regulatory limits.

Table 1 defines the acronyms used in this report.

Acronym	Definition
ALARA	As Low as Reasonably Achievable (social and economic factors considered)
ATS	Action Tracking System
BWXT NEC	BWXT Nuclear Energy Canada Inc.
CANDU	CANadian Deuterium Uranium
CCME	Canadian Council of Ministers of the Environment
CLC	Community Liaison Committee
CNSC	Canadian Nuclear Safety Commission
CSA	Canadian Standards Association
CTS	Critical-to-Safety
dpm	Disintegrations per minute
EHS	Environment, Health and Safety
EMS	Environmental Management System
IAEA	International Atomic Energy Agency
MOECP	Ministry of the Environment, Conservation and Parks
MP	Member of Parliament
MPP	Member of Provincial Parliament
mSv	milliSievert – unit of measure for radiation dose 1 mSv = 0.001 Sv
NEW	Nuclear Energy Worker
NFPA	National Fire Protection Association
ppm	Parts per million
QA	Quality Assurance
RSI	Radiation Safety Instruction
SAT	Systematic Approach to Training
SSC	Systems, structures and components
TDG	Transportation of Dangerous Goods
TEDE	Total Effective Dose Equivalent
TLD	Thermoluminescent Dosimeter
UO_2	Uranium Dioxide
µSv	microSievert – unit of measure of radiation dose 1 µSv = 0.001 mSv = 0.000001 Sv
WSC	Workplace Safety Committee

Table 1: Definition of Acronyms

3 SAFETY AND CONTROL AREAS

3.1 Operating Performance

The "Operating Performance" Safety and Control Area covers an overall review of the operations licensed activities. Over the reporting period, BWXT NEC continued to operate in a manner that supports the company mission to continuously improve EHS systems to protect fellow employees, the environment, and communities against known and potential environmental, health and safety hazards. Operating performance is monitored with key performance indicators and program goals. In accordance with EHS program requirements, internal audits and self-assessments are conducted routinely to assess conformance to internal and external requirements. Related licensed activity audits and self-assessments are summarized in subsequent sections.

The BWXT NEC management team continued to review, prioritize and control workplace hazards and ensure compliance with the pertinent regulatory requirements, applicable codes and company policies. Reporting of EHS-related concerns is encouraged through a rewards program. These are assigned and tracked to completion in the Gensuite® software system and is used as a measure of employee engagement.

Facility operations continued routinely and safely without any significant challenges. During the reporting period, there were no significant modifications made to either facility. UO_2 pellets were shipped to BWXT NEC's Peterborough facility without incident. The pellets were assembled into CANDU reactor fuel bundles and were then safely shipped to customers. Plant personnel followed procedures satisfactorily, as reflected in internal and external audits, self-assessments, radiation surveys, contamination monitoring, air sampling measurements and other safety inspections. Details are provided in subsequent sections of this report. There were no Action Level exceedances.

There were two regulatory reportable events in 2018.

- At the Peterborough site, an outdoor open-topped metal recycling bin was discovered to be leaking by continuous drip through an open drain hole. The material was suspected to be metal working fluid as identified by appearance and odour by knowledgeable personnel. Approximately 5 to 10 L of the fluid leaked onto a concrete pad and adjacent grassy area. All used absorbent materials and affected soil was collected and the bins returned to the vendor. The spill was acknowledged as a quality assurance miss on the part of the vendor such that metal shavings with metal working fluid should not have been in the bin on delivery. Corrective actions were implemented with no recurrence of a similar event. In accordance with facility licence conditions and MOECP regulations, the spill was reported to the Spills Action Centre and the CNSC.
- At the Toronto site, the emergency operations centre was activated as a result of a large rain event resulting in a loss of power with an excessive rate of surface water entering the freight elevator and flooding the basement of building 7. Approximately fifty drums of water were collected and diverted to the water treatment system for treatment, testing and release over several days. This event was reported to the CNSC in accordance with the site emergency program.

The President of BWXT NEC is responsible for all activities within the company. The various functional groups, such as Human Resources, EHS, Quality and Communications report directly or indirectly to the President. Senior Management accountability for the effectiveness of the management systems is defined. The Director, EHS & Regulatory is responsible for the overall EHS program.

The following key position changes occurred:

- In October 2018, Jordan Brown assumed the role of Peterborough Fuel Production Manager. The Production Manager is responsible for all of fuel assembly manufacturing and engineering.

During the reporting period, there were no pertinent modifications to the company organization structure. The company senior management organization structure is shown in Figure 3.

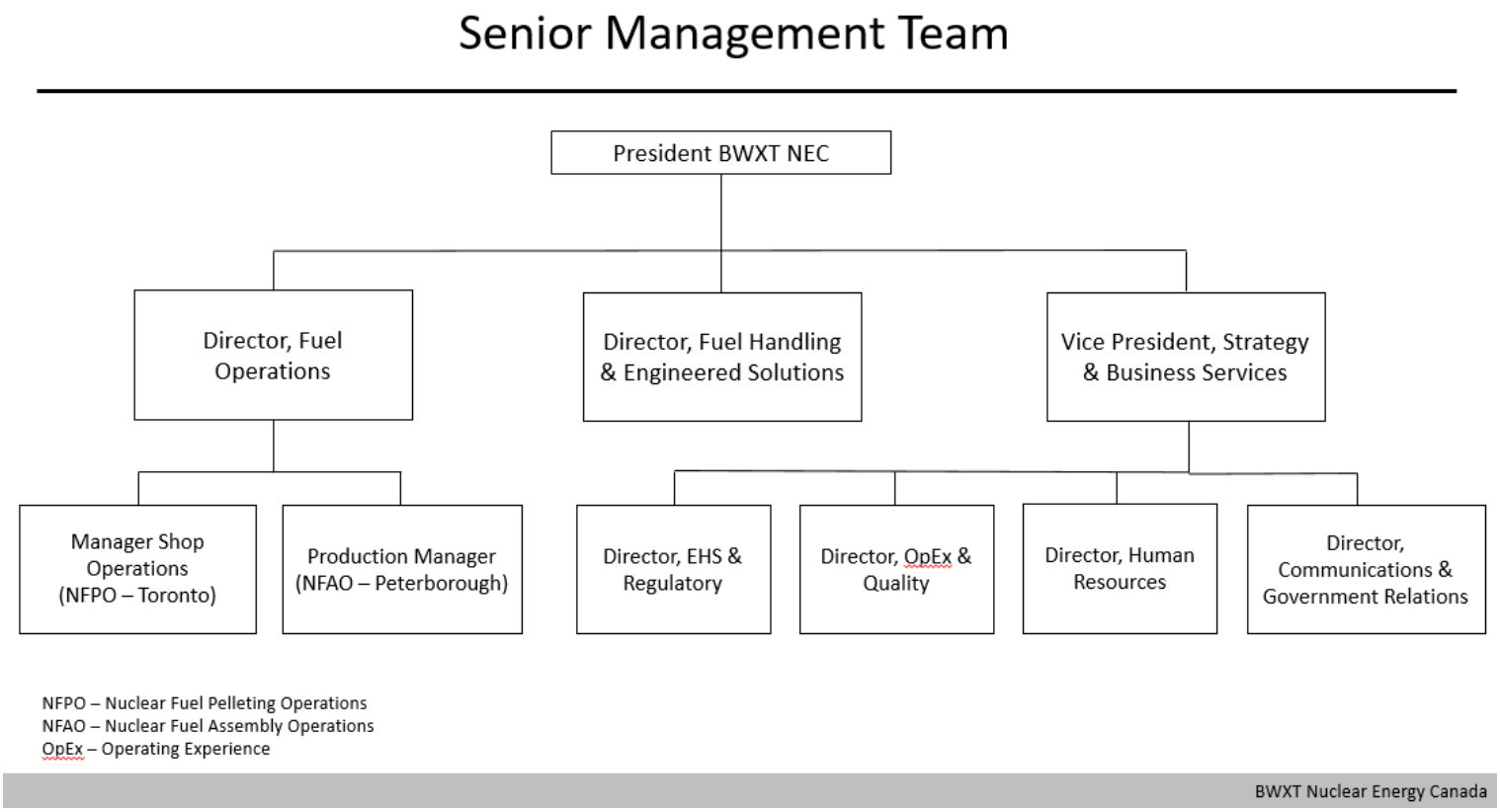


Figure 3: BWXT NEC Organization Structure

BWXT NEC maintains five EHS related committees that review activities including proposed changes to ensure safe plant operations. They are:

- Health and Safety Policy Committee - comprised of unionized workers and management to contribute to making the company as safe as possible by promoting health and safety awareness, making recommendations to workers and management regarding policies and procedures for safe working practices
- Workplace Safety Committee (WSC) - comprised of unionized workers and management to prevent accidents and occupational illness by promoting health and safety awareness, making recommendations to workers and management regarding safe work practices and monitoring health and safety issues until resolved
- As Low as Reasonably Achievable (ALARA) Committee - comprised of unionized workers and management to continuously improve the radiation safety program and implement ALARA practices where practical to ensure that radiation doses are as low as reasonably achievable.

- Beryllium Safety Committee – comprised of unionized workers and management to continuously improve the beryllium safety program and reduce potential beryllium hazards to workers at the Peterborough site.
- Ergonomics Committee - comprised of unionized workers and management to develop, monitor and administer the ergonomic procedure and recognize, reduce and where possible eliminate physical and cognitive ergonomic risk factors.

3.1.1 Possession and Processing

All possession and monthly processing limits, as specified in the CNSC facility operating licence were met. Production data is proprietary and is provided separately to the CNSC in Appendix A.

Production shutdowns are scheduled periodically throughout the year for engineering projects and equipment maintenance. In the reporting period, there were five weeks of production shutdowns at each site. There was one-week in the first quarter, one week in the second-quarter, two-weeks in the third quarter and one-week in the fourth quarter.

3.1.2 Regulatory Inspections

Excluding safeguards related inspections, which are described in section 3.13 of this report, there were three external regulatory inspections at the Peterborough site. The CNSC completed two routine inspections. The first was a routine compliance inspection and included selected elements of operating performance, fitness for service, radiation protection, conventional health and safety and packaging and transport. It also reviewed the effectiveness of corrective actions that arose from previous inspections and past events. One Action Notice was raised with respect to the critical-to-safety program documentation. Corrective actions were assigned and tracked to closure. The second inspection had a focus on environmental monitoring and compliance. In addition, the MOECP conducted an environmental compliance inspection. The focus was on hazardous waste management and compliance to the air emissions requirements of the site Environmental Compliance Approval. Details on environmental inspections are provided in sections 3.9 and 3.9.1.

Excluding safeguards related inspections, which are described in section 3.13 of this report, there were nine external regulatory inspections at the Toronto site. The CNSC completed four routine inspections. The first was a routine compliance inspection and included selected elements of operating performance, fitness for service, radiation protection, conventional health and safety and packaging and transport. One Action Notice was raised with respect to the critical-to-safety program documentation. Corrective actions were assigned and tracked to closure. The second inspection focused on fire protection. Details are provided in section 3.10. The third inspection focused on emergency preparedness and fire safety through observation of a full-scale emergency exercise. Details are provided in section 3.10. The fourth inspection focused on environmental monitoring and compliance. In addition, the MOECP assessed compliance with the Environmental Compliance Approval for air emissions. The City of Toronto assessed compliance with municipal water emission legislation. The details of environmental inspections are provided in sections 3.9 and 3.9.2. Technical Standards and Safety Authority completed an inspection of the passenger elevator. Employment and Social Development Canada conducted an inspection focused on conventional health and safety. Details are provided in section 3.8.

3.2 Management System

The "Management System" Safety and Control Area covers the framework which establishes the processes and programs required to ensure that the organization achieves its safety objectives and continuously monitors its performance against these objectives, as well as fostering a healthy safety culture. The management system defines the requirements of the quality assurance program for the licensed activity, which ensures applicable buildings and facilities, process equipment, and processes used

in support of licensed activities are conducted in accordance with the Nuclear Safety Control Act and Regulations, applicable CNSC requirements, jurisdictional requirements and compliance best practices. A graded approach is used in the application of the management system program elements, such that the requirements are applied in a manner commensurate with the safety significance of the licensed activity, system, component or structure. The management system is comprised of the following core program elements:

1. Organization and Responsibilities
2. Personnel Capability
3. Use of Experience
4. Work Planning Control
5. Work Processes Control
6. Verification
7. Problem Identification and Resolution
8. Corrective Action
9. Change Control
10. Document Control and Records
11. Audits
12. Management Self-Assessment
13. Management Program Review
14. Supply Chain

The Director, OpEx and Quality is assigned the responsibility for monitoring and assessing the effectiveness of the business Licensed Activity management system. The Director, OpEx and Quality is responsible and has the freedom to identify problems, initiate or recommend solutions, and confirm their implementation and effectiveness. The company senior management organization structure is shown in Figure 3.

The management system is fully implemented and compliant with CSA Standard N286-12, *Management System Requirements for Nuclear Facilities*. All management system documentation required by operating licence condition 2.1 is in place. Continuous improvement is achieved through several review processes, including self-assessments, audits, incident investigations and management reviews. The EHS Policy establishes the direction for the management system. There were no major changes to the management system or responsibilities within during the reporting period.

3.2.1 Licensed Activity Related Self-Assessments

The Self-Assessment Program governs a proactive process for self-critical, candid and objective evaluation of performance by a functional area measuring their process performance against goals established from business plans or external benchmarking standards. The Self-Assessment Program is a management tool used to engage the workforce in early and proactive detection of organizational or systematic weaknesses. It is a Functional Manager's opportunity to take a structured look at their own function. Self-Assessments help identify low level issues or trends for early resolution before more significant problems occur. A Self-Assessment schedule is prepared annually and ensures that each

program element is reviewed periodically based on a risk-related approach. A summary of self-assessments conducted in the reporting period is provided in Table 2. In addition to the Self-Assessment Program, routine compliance reviews are completed against regulatory EHS requirements, such as general environmental, water management, safety management and emergency response. All identified non-conformances are assigned and tracked to closure. There were no major deficiencies identified and any opportunities for continuous improvement were noted in the self-assessment reports.

Program Element	Peterborough		Toronto	
	Number of Self-Assessments	Number of Findings	Number of Self-Assessments	Number of Non-Conformances
Audit Program	1	0	1	0
Emergency Preparedness and Fire Protection	1	6	1	6
Environmental Protection	1	0	1	0
Management Reviews	1	0	1	2
Management Self-Assessments	1	1	0	0
Preventive Maintenance	1	0	1	4
Procurement / Vendor Management	0	0	1	5
Radiation Protection	1	2	1	4
Waste Management	1	4	1	3
Totals	8	13	8	24

Table 2: Summary of Self-Assessments

In the reporting period, minor continuous improvements were made to the Management Self-Assessments procedure and work instruction for clarity.

3.2.2 Licensed Activity Internal Audits

Internal auditing is an independent, objective activity designed to add value and continuously improve programs. Periodic assessment of program effectiveness is conducted through systematic internal audits that are planned and carried out on behalf of management to measure performance, the effectiveness of the program element processes and to promote continuous improvement. An audit schedule is prepared annually and ensures that each licensed activity program element is audited at least once every three years.

Table 3 provides a summary of internal audits conducted in the reporting period. All identified non-conformances are assigned and tracked to closure. A review of all the findings is conducted as part of the management review to determine if any systemic deficiencies have been identified. Based on the review, continuous improvement opportunities are discussed and documented in the meeting minutes with actions tracked to closure.

Audit Scope		Number of Non-Conformances
Peterborough	Document Control and Records	4
	Environmental Protection (Dangerous Goods Shipping)	1
	Maintenance	1
	Radiation Protection	2
Toronto	Environmental Protection (Dangerous Goods Shipping)	3
	Non-Conformances and Corrective Actions	1
	Personnel Capability/Training	2
	Radiation Protection	3
	Total	17

Table 3: Summary of Internal Audits

BWXT NEC did not conduct any formal external audits of other facilities during the review period that related to the licensed activities at the facility.

3.2.3 Management Reviews

Management reviews for EHS program elements are conducted once annually before the end of April each year to review the previous calendar year activities. The EHS Management Reviews encompass the following items:

- Status of actions from previous management reviews;
- Follow-up actions from previous management reviews.
- Results of external agency audits where applicable;
- Open regulatory compliance obligations;
- Results of Reg Auditor (Gensuite) compliance evaluations;
- Results of QA for licensed activity internal and external audits (where applicable);
- Results of QA for licensed activity management self-assessments;
- Trends in non-conformances (Gensuite Action Tracking System items) for closure metrics;
- EHS related Quality Assurance Actions;
- Trends in Incident and Measurement (Gensuite) items for root cause;
- Status of EHS training activities;
- Procurement process;
- Extent to which Environmental, Health and Safety and ALARA objectives and targets have been met;
- Radiation dose trends;

- Communications and changes in the needs and expectations of interested parties, including complaints;
- Changing external and internal issues, including compliance obligations;
- Changes in risks and opportunities;
- Opportunities for continual improvement;
- Evaluation of the effectiveness and continuing suitability of the EHS Mission Statement and the Environment, Health and Safety Program.

The above inputs are reviewed to ensure continuing suitability, adequacy and effectiveness of the management system. The criteria for these are:

- **Suitable**: Does the system satisfy the requirements and represent the best way of doing things for our business?
- **Adequate:** Is the system fit for its current purpose?
- **Effective:** Does the system enable the right things to be done? Is it driving continuous improvement?

Formal meeting minutes are prepared. Actions are formally issued for follow-up by the applicable functional lead(s) and retained as a record. The previous management review meeting resulted in seven actions that were formally issued for follow-up by the applicable functional lead(s), and tracked to closure in Action Tracking System (ATS). Overall, the implemented management system for the licensed activity program was considered suitable, adequate and effectively implemented at both facilities. Continuous improvement remains a priority.

3.3 Human Performance Management

The "Human Performance Management" Safety and Control Area covers activities that enable effective human performance, through the development and implementation of processes that ensure that BWXT NEC staff members are sufficient in numbers in all relevant job areas, and have the necessary knowledge, skills and tools in place to safely carry out their duties.

The training program is outlined in the Licensed Activity QA Manual, and business-wide training procedures. Qualifications and training requirements are identified and personnel are given the appropriate training to ensure they are competent at the work they do. This training includes on-the-job training, radiation protection and safety risk assessment training. Workers only perform functions for which they are qualified. Both facilities achieved 100% regulatory training completion in the reporting period. Compliance to regulatory training completion is a key performance indicator that is tracked throughout the year.

Following the implementation of the Systematic Approach to Training (SAT) program in 2015, 2018 continued with a focus on the application of SAT to new and legacy training. Programs that have been developed in compliance with SAT include:

- Training on knowledge areas such as Mental Health for Supervisors, Lockout/Tagout Awareness, Spill Response, Accident Investigation, Radiation Protection Manual - Area Classification, Radiation Protection Manual – Waste & Transport, Environmental, Radiation Safety Officer, and Emergency Preparedness & Fire Prevention
- Training on tasks such as Lockout/Tagout for Authorized Employees
- Training for Peterborough roles such as Quality Assurance Manager, Manager of Shop Operations, Manufacturing Engineer and Process Specialist, and Manufacturing Specialist. Training for Toronto roles such as Material Handling Shipping/Receiving, Quality Assurance Inspector, Operator

(including Decontamination and Lead Hand), and Maintenance Tech. Training for Quality Assurance Specialist in both locations.

Progress continues based on the established schedule for bringing the remaining courses into compliance with SAT following the 2017 transition to a new learning management system, EHS-related training was fully tracked in SAP® SuccessFactors® Learning for the 2018 calendar year. Key EHS course completion details are provided in Table 4.

Course Name	Number of Peterborough Employees Who Required Course (% Required Completed)	Number of Toronto Employees Who Required Course (% Required Completed)
Aerial Lift Practical	N/A	3 (100%)
Aerial Lifts	0	0
Certified Powered Industrial Truck Operator	7 (100%)	N/A
Change Area Contamination Control	N/A	9 (100%)
Compressed Gas Safety	45 (100%)	35 (100%)
Electrical Safety – Canada	41 (100%)	8 (100%)
Emergency and Disaster Preparedness – Canada	78 (100%)	11 (100%)
Emergency Response & Fire Prevention Awareness	N/A	50 (100%)
Fall Protection Advanced	0	7 (100%)
First Aid (Emergency)	0	6 (100%)
First Aid (ERT)	13 (100%)	8 (100%)
Indoor Hoisting and Rigging – Canada	3 (100%)	11 (100%)
Lockout Tagout (LOTO) Procedure & Demonstration	19 (100%)	14 (100%)
Lockout/Tagout – Canada	53 (100%)	12 (100%)
Lockout/Tagout for Authorized Persons	5 (100%)	6 (100%)
Manufacturing Area Hazards Awareness (includes Radiation and Beryllium Safety)	66 (100%)	N/A
OHS for Managers and Supervisors (Canada Labour Code Part II)	0	0
Overhead Cranes Level 1 & Practical	7 (100%)	N/A
Overhead Cranes Level 2 Fuel	0	N/A
Overhead Cranes Level 2 & Practical (Services)	8 (100%)	N/A

Course Name	Number of Peterborough Employees Who Required Course (% Required Completed)	Number of Toronto Employees Who Required Course (% Required Completed)
Portable Fire Extinguisher Training (Practical)	9 (100%)	9 (100%)
Portable Fire Extinguishers – Canada	271 (100%)	50 (100%)
Powered Industrial Truck - Driving Evaluation	N/A	7 (100%)
Powered Industrial Truck Safety with Propane Handling	12 (100%)	N/A
Powered Walkie Stacker Safety	4 (100%)	N/A
Radiation Safety	N/A	10 (100%)
Respirator Selection Use and Care	10 (100%)	2 (100%)
Respiratory Protection - Canada	14 (100%)	50 (100%)
Security Awareness	51 (100%)	13 (100%)
Transportation of Dangerous Goods	3 (100%)	2 (100%)
Workplace Hazardous Materials Information System - Canada	83 (100%)	10 (100%)

Table 4: Key Training Course Completion Summary

The facilities are staffed with a sufficient number of qualified workers as well as the minimum number of responsible people to carry on the licensed activities safely and in accordance with the Nuclear Safety and Control Act and its Regulations. EHS and other staff are available after business hours as needed through cell phones and pagers.

3.4 Safety Analysis

The "Safety Analysis" Safety and Control Area covers the maintenance of the safety analysis which supports the overall safety case for the facility. The safety analysis is a systematic evaluation of the potential hazards associated with the conduct of an activity or facility, and considers the effectiveness of preventive measures and strategies in reducing the effects of such hazards.

The safety analyses utilized a combination of What-if Analysis, Hazards and Operability and Quantitative Risk Analysis and documents a systematic evaluation of hazards associated with the licensed facilities.

Modifications to the facilities are made in accordance with the business-wide Change Control program, which requires review of EHS parameters for new or modified facilities, processes, and new or relocated machinery, apparatus and equipment. Under this process, a proposed modification is screened for potential impact on the facility safety analysis. Where screening identifies a potential impact, a more detailed review of the proposed modification is conducted to identify if the change impacts a safety system, or the basis of the safety assessment (e.g. materials, quantities, locations, etc.). Third-party reviews or regulatory approvals are conducted as required. In this way, impacts on the safety analysis are identified and the safety analysis is validated and updated, where necessary.

During the reporting period, there were no changes that impacted the safety analysis for the facilities. As a result, there were no updates to the facility safety analysis reports at either site during the reporting period. Physical changes are described in the following section. A routine update of the safety analysis for the Peterborough and Toronto sites has been initiated in 2019.

3.5 Physical Design

The "Physical Design" Safety and Control Area relates to activities that impact on the ability of systems, structures and components (SSC) to meet and maintain their design basis, given new information arising over time and taking into account changes in the external environment.

Changes made to the physical facilities, equipment, processes, procedures or practices that could adversely affect product quality, employee health and safety, the environment or the public as a result of the operation of BWXT NEC's facilities are assessed through the Change Control program. Any changes to the design basis are identified and assessed by key stakeholders through this program, including third-party reviews as required. Adequate mitigations are applied including modification of the proposed change, up to rejection of the proposed change.

There were no significant changes to the physical plants during the reporting period. There were no modifications that affected the safety analysis of the facilities.

3.6 Fitness for Service

The "Fitness for Service" Safety and Control Area covers activities that impact on the physical condition of SSCs to ensure that they remain effective over time. This includes programs that ensure all equipment is available to perform its intended function when called upon to do so.

Both facilities are using an asset management and preventive maintenance software system. Maintenance Connection® is a web-based maintenance management software for work order and asset management. Maintenance Connection assists BWXT NEC in efficiently managing preventive maintenance tasks as well as to control and identify maintenance on Critical-to-Safety (CTS) and Critical-to-Quality assets and parts. Preventive maintenance tasks on CTS equipment are designated in this system as described in the business wide Enterprise Asset Management Program Procedure.

Certain CTS tasks have associated independent post-maintenance verification or testing. For example, in Toronto, independent verification is in place on the ventilation systems during filter changes as well as following rotoclone ductwork maintenance.

In both Peterborough and Toronto 99% of CTS tasks issued were completed within 14 days of the target completion date. All CTS tasks issued in the reporting period are closed.

Preventive maintenance is considered during the assessment of changes as part of the business-wide Change Control program. Additionally, in the event of a near miss, incident, injury or inspection, the preventive maintenance program for related equipment is reviewed as applicable. As a result, during the reporting period, the following improvements to preventive maintenance tasks were implemented:

- A new preventive maintenance task was added for the building 9 west shipping doors (Toronto)

Managing aging means ensuring the availability of required safety functions throughout the service life of the plant, with account taken for changes that occur with time and use. Aging management applies to SSCs that can, directly or indirectly, have an adverse effect on the safe operation of the plant. The asset management program accounts for aging through the CTS program inspection, testing and maintenance tasks. These processes provide warning signs and initiate corrective and preventive maintenance activities. Items identified for replacement are assessed through the Change Control program.

The preventive maintenance program is periodically assessed through self-assessments and internal audits, discussed in section 3.2 of this report. Key performance indicators are in place and are routinely reviewed. The program is adequate and effective and is continually improved.

3.7 Radiation Protection

The "Radiation Protection" Safety and Control Area covers the implementation of the radiation protection program, in accordance with the *Radiation Protection Regulations*. This program ensures that contamination and radiation doses received are monitored and controlled.

BWXT NEC has an established radiation protection program to address the hazards from UO_2 and keep employee doses ALARA. The major potential worker hazard is inhalation of airborne UO_2 particles. Measurements are performed of airborne and surface traces of uranium as an indicator of process containment efficiency. A respiratory protection program is in place. Urine samples provided by employees are used to indicate if inhalation may have occurred and to monitor clearance of uranium from the body. A lesser potential hazard exists in the form of low-level external gamma and beta doses to employees. Routine gamma surveys are conducted and Nuclear Energy Workers are issued thermoluminescent dosimeters (TLDs) to measure whole body, skin and extremity dose to ensure compliance with the regulatory radiation dose limits and the ALARA principle. The BWXT NEC program ensures that surface and airborne contamination and radiation doses to employees are monitored and controlled.

BWXT NEC has established facility specific CNSC approved Action Levels for various radiological and environmental parameters. An Action Level is defined in the *Radiation Protection Regulations* as “a specific dose of radiation or other parameter that, if reached, may indicate a loss of control of part of a licensee’s radiation protection program, and triggers a requirement for specific action to be taken.” Action Levels are set below regulatory limits; however, they are CNSC reportable events. Accordingly, BWXT NEC has established Internal Control Levels for various radiological and environmental parameters that are set even lower than Action Levels to act as an early warning system. An Internal Control Level exceedance results in internal investigation and corrective action. During the reporting period, all measurements were below Action Levels and regulatory limits.

A component of the radiation protection program is area classification. Areas of each facility are classified into four different categories for the purpose of controlling the spread of radioactive contamination, and ensuring appropriate controls are in place. These classifications are defined in the Radiation Protection Manual as follows:

- Unclassified Area - these areas do not involve nuclear substances and are considered public domain. Incidental contamination does not exceed the unclassified area Internal Control Levels.
- Active Area - these areas are designed for handling materials with loose contamination that is potentially above unclassified area Internal Control Levels. External radiation hazards are not of significant concern.
- R1 Area - these areas are designed for operations where only external radiation is of concern, and loose contamination is below R1 area Internal Control Levels.
- R2 Area - these areas are designed for operations involving exposed non-dispersible nuclear substances, where external radiation is of concern and loose contamination may be above R1 Internal Control Levels.
- R3 Areas - these areas are designed for operations involving exposed solid dispersible nuclear substances, where external radiation may be of concern and where the hazard of contaminant inhalation or ingestion is identified. Loose contamination may be above R2 Internal Control

Levels and below R3 Internal Control Levels. Where the inhalation hazard is high, respiratory protection is required for all area entries.

BWXT NEC has a well-established integrated management system for environmental, health and safety program excellence. The radiation protection program is effectively implemented. BWXT NEC has an established EHS Mission Statement that is reviewed and signed annually by the President of BWXT NEC. The Mission Statement includes a commitment to ALARA and continuous improvement. Elements of the radiation protection program such as dose monitoring, contamination monitoring, and radiation field surveys, etc. are conducted by qualified workers and reviewed internally by EHS staff and Committees on a regular basis. Details of the reviews are recorded in meeting minutes.

An internal audit and self-assessment of the radiation protection program, with a focus on elements of radiation protection program effectiveness and compliance, is conducted annually at each site. Non-conformances are addressed and tracked to completion in accordance with program requirements.

Key components of the radiation protection program include:

- Compliance with all relevant regulatory requirements;
- The setting of ALARA goals and objectives;
- Hazard recognition, risk assessment and change control processes;
- A comprehensive worker training program;
- Documented safety concerns, near misses and incidents with appropriate root-cause analysis, preventive and corrective actions.

The radiation protection program includes all worker radiation safety elements that demonstrate compliance to relevant regulations, codes and standards:

- EHS policy commitment to ALARA
- Area classifications and requirements
- Material handling
- Non-routine or high-risk work controls
- Internal and external radiation hazard assessments
- Internal and external radiation monitoring and recording

Continuous improvement is achieved through several review processes, including site inspections, reported safety concerns, near miss and incident investigations, self-assessments and audits. There were no major changes to the radiation protection program during the reporting period. Minor continuous improvements were instituted:

- For both sites, criteria for providing radiation dosimeters to Nuclear Energy Workers (NEWs) from other nuclear sites was included.
- For Peterborough, the radiation instrumentation work instruction was revised to clarify expectations for pre-use source testing and quality control.
- For Toronto, the urinalysis work instruction was revised to include split and duplicate samples.
- Minor administrative edits and continuous improvements were made to 15 other work instructions across both sites.

The radiation protection program is well-established and effective. Radiation dose trends demonstrate the company's commitment to ALARA. Program goals are monitored through the site's ALARA Committees as summarized in section 3.7.1.

3.7.1 ALARA Committee Performance

The ALARA committees work to review and continuously improve elements of the radiation safety program, and implement ALARA practices where practical in order to ensure that radiation dose levels are as low as reasonably achievable. Committee members consist of both unionized and management employees. The ALARA Committees meet quarterly at a minimum. Each site committee met four times during the reporting period. Dose results, radiation protection related events, audits, and employee concerns were reviewed and discussed. Actions are assigned and tracked as part of the meeting minutes. Committee activities are communicated to all workers.

ALARA Committee goals and results for the reporting period are provided in Table 5 and Table 6 for Peterborough and Toronto respectively. Goals that are not achieved are informally reviewed by the ALARA Committee to discuss probable causes. The feasibility of achievement is discussed and implementation plans revised as needed. These are considered during future goal setting.

3.7.1.1 Peterborough ALARA Committee

Reporting period ALARA goals are summarized in Table 5. Peterborough did not achieve its year-over-year dose reduction goal. This dose reduction target is based on collective dose once it has been normalized with production quantities. This ensures the targets are based on reductions in dose and not reductions in production amounts. The increase in collective dose is likely as a result of a customer-driven project as well as increased overtime due to the end of the contract bundle production obligations.

Peterborough ALARA Committee Goals	Actual	Result
3% reduction in collective whole body dose (normalized for production)	6% increase	Not Achieved
>99% compliance in TLD audits	99% compliance	Achieved
Complete one shielding project by year end	1/1	Achieved
Develop a uranium spill response plan	Complete	Achieved

Table 5: Peterborough ALARA Committee Goals and Results

2019 goals for Peterborough are established as follows:

1. 3% reduction in collective whole body dose (normalized for production)
2. >99% wear and storage compliance in TLD audits
3. Complete a shielding project by year end

3.7.1.2 Toronto ALARA Committee

Reporting period ALARA goals are summarized in Table 6.

Toronto ALARA Committee Goals	Actual	Result
Establish four proactive trending data charts and incorporate into committee meetings	4/4	Achieved
Conduct four audits on TLD wearing practices to enforce proper radiation monitoring	4/4	Achieved
Produce four ALARA Awareness posters or demonstrations to promote radiation protection	4/4	Achieved

Table 6: Toronto ALARA Committee Goals and Results

2019 goals for Toronto are established as follows:

1. Swipe program involvement and improvements
2. ALARA presentation at all employee communication meeting
3. Training for ALARA committee members (supplement to Radiation Safety)

3.7.2 Radiation Protection Training Program and Effectiveness

Radiation protection training programs are compliant with the SAT methodology. An internal or external specialist in radiation protection periodically provides classroom training to new and continuing NEWs or those working in areas with radioactive materials. Online training is also available to employees with computer access. Testing is performed on completion of the training to demonstrate employee understanding. In Peterborough, radiation protection training is rolled into the site-wide Manufacturing Area Hazards Awareness course. Course content includes general shop floor rules, radiation fundamentals, sources of ionizing radiation, health effects, emergency response and other safety-related content. Training completion is monitored using a learning management software system, which tracks and triggers retraining as required. Course completion details are provided in section 3.3. Training effectiveness is monitored through radiation dose results, internal inspections, self-assessments and audits as well as incident investigations.

3.7.3 Radiation Device and Instrumentation Performance

Radiation detection instrument error can occur due to a variety of factors: drift, environment, electrical supply, addition of components to the output loop, process changes, etc. Each site maintains a system for managing radiation detection instrument calibrations. Calibration is conducted to ensure accurate indication during field use. Calibrations are performed under environmentally controlled conditions suitable for the inspections, measurements, and tests being performed, as determined by the equipment manufacturer. Calibration intervals are established, so that calibration occurs before any anticipated significant changes occur in measurement capability. Radiation detection equipment calibrations are conducted within 12 months of the previous calibration as required by regulation.

All active radiation devices and instruments were maintained in a state of safe operation. Where calibration is expired or where detectors fail calibration, they are removed from service until they are repaired and meet radiation calibration expectations.

The calibration program was updated to include processes for reviewing and accepting calibration reports/certificates, and actions to be taken in the event of unsatisfactory or questionable results.

3.7.4 Contamination Control Data

When radioactive material is not in a sealed container and when it is handled, there is the potential for it to be spread onto other objects. This is known as radioactive contamination. Radioactive contamination refers to small amounts of nuclear substances on surfaces or within the air, where its presence is unintended or undesirable.

Surface contamination measurements (swipes) are conducted in manufacturing areas of each facility. The potential for surface contamination is greater in the Toronto facility since UO_2 powder is received and handled. Contamination by itself is not necessarily an indicator of exposure potential but can be used as an indicator of housekeeping conditions; however significant amounts of loose surface contamination has the potential to become airborne. If this occurs, the air monitoring results will reflect the increased airborne concentration and appropriate corrective action is then taken. Internal Control Levels are applied to each area classification. In the event a swipe measurement exceeds an Internal Control Level; the area is cleaned and re-swiped to verify cleanliness. Trends are monitored. There were no major personnel contamination events during the reporting period.

3.7.4.1 Peterborough Surface Contamination

Routine surface contamination measurement results are summarized in Table 7. Peterborough surface contamination remains very low. Surface contamination results are reviewed by EHS staff and discussed if necessary at ALARA Committee Meetings. Overall, 99.9% of routine swipes were within Internal Control Levels, indicative of effective contamination control measures and cleaning schedules.

Peterborough					
Classification and Area Description	Internal Control Level	2017		2018	
		Total Number of Samples	Total Number Samples Exceeding Internal Control Level (%)	Total Number of Samples	Total Number Samples Exceeding Internal Control Level (%)
R2 - Pellet Loading, Element Welding and Pellet Storage	2,200 dpm/100 cm^2	507	0 (0%)	515	0 (0%)
R1 - Bundle Assembly, Inspection, Receiving, Building 24	220 dpm/100 cm^2	176	0 (0%)	154	0 (0%)
Active - Met Lab, Waste Room	220 dpm/100 cm^2	162	0 (0%)	165	0 (0%)
Unclassified - Items, Main Hallway	220 dpm/100 cm^2	403	0 (0%)	471	1 (0.2%)

Table 7: Peterborough Surface Contamination Results

3.7.4.2 Toronto Surface Contamination

Routine surface contamination measurement results are summarized in Table 8. Toronto surface contamination remains fairly steady in the number of samples exceeding the Internal Control Levels. Surface contamination results are reviewed by EHS staff and discussed at Workplace Safety Committee Meetings. Overall, 99% of swipes were within Internal Control Levels, indicative of effective contamination control measures and cleaning schedules.

Toronto					
Classification and Area Description	Internal Control Level	2017		2018	
		Total Number of Samples	Total Number Samples Exceeding Internal Control Level (%)	Total Number of Samples	Total Number Samples Exceeding Internal Control Level (%)
R3-Powder Preparation, Pressing, Grinding, Laboratory	22,000 dpm/100 cm^2	445	2 (0.4%)	444	0 (0.0%)
R2-Sintering, Sorting & Stacking, Laboratory	2,200 dpm/100 cm^2	508	21 (4%)	508	7 (1%)
Active - Plant Washrooms, Laundry Room	2,200 dpm/100 cm^2	145	0 (0%)	145	0 (0%)
Unclassified	220 dpm/100 cm^2	288	15 (5%)	293	5 (2%)

Table 8: Toronto Surface Contamination Results

3.7.5 Air Monitoring

As part of a well-established and implemented industrial hygiene programs, both facilities sample breathing air for measurement of uranium content. Workstation air monitoring is a key performance indicator that speaks to effective administrative and engineered controls. Respiratory protection programs are in place. Non-routine work functions, such as machine maintenance, modifications, etc. are controlled by EHS Work Permits (Peterborough) or Radiation Safety Instructions (RSI) (Toronto). The EHS Work Permit/RSI specifies protective measures, including those to reduce exposure to airborne UO_2. This may or may not include air monitoring and/or respirator use.

3.7.5.1 Peterborough Air Monitoring

In Peterborough, each process workstation where open UO_2 pellets are handled are periodically monitored during routine operations for airborne UO_2. All filter papers are counted in-house and verified by an independent external laboratory using delayed neutron activation analysis. Workstation air sampling results are summarized in Table 9.

Peterborough Workstation Air Monitoring	2016	2017	2018
Number of Workstations Sampled	4	4	4
Total Number of Samples Collected	50	46	49
Total Number of Samples Exceeding Internal Control Level (facility and area specific)	0	0	0
Total Number of Samples Exceeding Action Level (facility and area specific)	0	0	0
Average Concentration (dpm/m^3)	0.11	0.05	0.04
Maximum Value Recorded (dpm/m^3)	0.97	0.15	0.12

Table 9: Peterborough Workstation Air Monitoring Summary

In Peterborough, average and maximum workstation air monitoring results continue to remain negligible and below Internal Control Levels. No trends are discernible.

3.7.5.2 Toronto Air Monitoring

In Toronto, each process workstation is monitored continuously during routine operating conditions for airborne UO_2 and counted in-house. Internal dose to workers in Toronto is estimated and assigned based on these air monitoring results. Workstation air sampling results are summarized in Table 10.

Toronto Workstation Air Monitoring	2016	2017	2018
Number of Workstations Sampled	21	21	21
Total Number of Samples Collected	5271	5208	5250
Total Number of Samples Exceeding Internal Control Level (facility and area specific)	2	1	5
Total Number of Samples Exceeding Action Level (facility and area specific)	0	0	0
Average Concentration (dpm/m^3)	9.2	7.1	9.6
Maximum Value Recorded (dpm/m^3)	244	306	365

Table 10: Toronto Workstation Air Monitoring Summary

In the reporting period, five workstation air samples exceeded the Internal Control Level in Toronto. Three were associated with the Grinder Swarf Collection room and two were for Pre-Press Feed 2. Both air sample stations are located in rooms that require respiratory protection upon room entry. The results were noticed during the daily air sample result reviews.

The three elevated results in the Grinder Swarf Collection room were associated with bowl dumping operations. An operator was performing the task and was unaware to wipe bowls before dumping. Training materials were reviewed and a posting was placed in from of the collection room. Upon identifying and correcting the issue the results resumed back to normal.

The two elevated results for the Pre-Press Feed 2 were related to the machine and was immediately tagged out pending maintenance investigation. The first elevated result was due to a ripped boot which has now been replaced. As a result, the preventive maintenance task was reviewed for adequacy and appropriateness of frequency. During the review, it was determined that the related task was

deactivated in the system and has since been reactivated. In addition, the daily and weekly cleaning was confirmed to have been completed. The second elevated result was due to a malfunctioning clamp. The clamp did not provide a proper seal and has been replaced with a functional clamp. There was no preventive maintenance task associated with the clamp. Inspection of the clamp was added as a step in an existing preventive maintenance task. Results have resumed back to normal.

3.7.6 Facility Radiological Conditions

Radiation fields from use and storage of radioactive materials may result in external radiation doses to workers. In order to ensure that radiation dose rates are ALARA, routine gamma radiation surveys are conducted periodically within each facility using calibrated portable handheld radiation detectors. Measured dose rates are compared to targets for areas based on area classification and occupancy. When necessary, items are moved to alternative storage locations and/or temporarily shielded. Areas that appear routinely higher than target dose rates may be investigated for improvements, such as permanent shielding or reconfiguration. Routine dose rate measurements are summarized in Table 11 and Table 12 for Peterborough and Toronto respectively. Dose rates remain steady in both locations. The facility gamma surveys focus on radioactive material handling and storage areas and adjacent occupied locations. Variability due to the timing of the surveys is a factor in the results, as production levels and movement of materials vary over the course of a year.

Peterborough Dose Rates	2016	2017	2018
Total Number of Locations Surveyed	373	360	384
Average Dose Rate (µSv/h) on Shop Floor	3.1	3.0	3.1
Average Dose Rate (µSv/h) in Storage Areas	5.6	4.3	4.2

Table 11: Peterborough Routine Dose Rate Survey Summary

Toronto Dose Rates	2016	2017	2018
Total Number of Locations Surveyed	160	160	160
Average Dose Rate (µSv/h) on Shop Floor	2.7	2.6	3.0
Average Dose Rate (µSv/h) in Storage Areas	5.0	7.5	5.5

Table 12: Toronto Routine Dose Rate Survey Summary

3.7.7 Urinalysis Results

The presence of uranium in the urine is an indication of recent inhalation of UO_2 dust or the systemic clearance of an established thorax burden. At BWXT NEC, urinalysis is used as a screening tool to initiate further review of internal dose control measures and practices but is not used to estimate internal dose. In Toronto, internal dose is estimated based on workstation air monitoring (refer to section 3.7.9).

3.7.7.1 Peterborough Urinalysis Results

All Peterborough employees working where exposed UO_2 material is processed (R2 classified area) for a period greater than 30 hours per quarter, or working as a roving inspector during the quarter, submit urine samples for uranyl ion analysis. Samples are analyzed by an external laboratory for uranium content using Inductively Coupled Plasma - Mass Spectrometry with a minimum detectable concentration of 0.1 µg U/L. Results are compared to Internal Control Levels and Action Levels and entered and retained in an electronic database. Urinalysis results are summarized in Table 13.

Of all urinalysis samples from Peterborough processed between 2005 and 2018, only 0.3% of samples (5/1790) have measured above the minimum detectable concentration of 0.1 µg U/L, and were less than 0.5 µg U/L. These occurrences were well below the Internal Control Level of 5 µg U/L. This demonstrates that the inhalation hazards at the Peterborough facility are negligible and that current engineered and administrative controls, where applicable, are adequately controlling the risk.

Peterborough Urinalysis	2016	2017	2018
Number of urine samples analyzed	109	99	108
Number of samples above Internal Control Level (5 µg U/L)	0	0	0
Number of samples above Action Level (10 µg U/L)	0	0	0
Maximum result (µg U/L)	<0.1	<0.1	<0.1

Table 13: Peterborough Urinalysis Results Summary

3.7.7.2 Toronto Urinalysis Results

All Toronto employees working where exposed UO_2 material is processed submit urine samples for uranyl ion analysis weekly or monthly, depending on the work area. Samples are analyzed by an external laboratory for uranium content using Inductively Coupled Plasma - Mass Spectrometry with a minimum detectable concentration of 0.1 µg U/L. Results are compared to Internal Control Levels and Action Levels and entered and retained in an electronic database. Urinalysis results are summarized in Table 14.

In Toronto, there were no sample results above the Internal Control Level of 5 µg U/L during the reporting period. There were no Action Level exceedances. This demonstrates that current engineered and administrative controls, where applicable, are adequately controlling the inhalation hazard.

Toronto Urinalysis	2016	2017	2018
Number of urine samples analyzed	1907	1621	1600
Number of samples above Internal Control Level (5 µg U/L)	3	0	0
Number of samples above Action Level (10 µg U/L)	1	0	0
Maximum result (µg U/L)	13.0	4.9	3.5

Table 14: Toronto Urinalysis Results Summary

3.7.8 Radiation Doses

Radiation dose refers to the energy deposited or absorbed in materials through which it passes. Equivalent dose is used to assess how much biological damage is expected from the absorbed dose. It takes the properties of different types of radiation into account. Effective dose is used to assess the potential for long-term effects that might occur in the future. It is a calculated value, measured in milliSievert (mSv), which takes into account the absorbed dose to all organs of the body, the relative harm level of the radiation, and the sensitivities of each organ to radiation. All radiation exposures received by employees in the reporting period were within Internal Control Levels, Action Levels and regulatory limits. Action Levels are site specific and are accepted by the CNSC through the facility operating licence conditions handbook. Regulatory limits are specified in the *Radiation Protection Regulations.* Regulatory limits are listed in Table 15 and Table 16. All measured radiation doses received by individuals in the reporting period were within Internal Control Levels, Action Levels and regulatory limits.

Effective Dose Limits		
Person	**Period**	**Effective Dose (mSv)**
NEW, including a pregnant NEW	(a) One-year dosimetry period (b) Five-year dosimetry period	50 100
Pregnant NEW	Balance of the pregnancy	4
A person who is not a NEW (i.e. a member of the public)	One calendar year	1

Table 15: Regulatory Effective Dose Limits

Equivalent Dose Limits			
Organ or Tissue	**Person**	**Period**	**Equivalent Dose (mSv)**
Lens of an eye	(a) NEW (b) Any other person	One-year dosimetry period One calendar year	150 15
Skin	(a) NEW (b) Any other person	One-year dosimetry period One calendar year	500 50
Hands and feet	(a) NEW (b) Any other person	One-year dosimetry period One calendar year	500 50

Table 16: Regulatory Equivalent Dose Limits

All employees are classified as either Nuclear Energy Workers (NEWs) or Non-Nuclear Energy Workers (Non-NEWs). All contractors are classified non-NEWs. All NEWs are deemed to have a reasonable probability of receiving a dose of radiation that is greater than the prescribed limit for a member of the public (1 mSv/year) in the course of the person's work with nuclear substances or at our nuclear facilities. All fuel assembly NEWs at BWXT NEC are assigned personal passive dosimeters known as TLDs (thermoluminescent dosimeter). These passive dosimeters measure the whole body and skin doses received in each monitoring period. TLD rings are worn on certain employee's hands for a one-week period each quarter. The test results and the weekly hours of contact are used to estimate the extremity dose. TLDs are exchanged monthly (Toronto) or quarterly (Peterborough), and analyzed by a CNSC licensed external dosimetry service provider. The dosimetry service provider reports the measured doses to BWXT NEC and to the National Dose Registry. On receipt, knowledgeable staff reviews the monitoring results, and compares them to associated Internal Control Levels, Action Levels and regulatory limits.

BWXT NEC dosimetry results are summarized in the following sub-sections. Employees are divided into workgroups based on job function for dosimetry analysis and trending. Operators are employees who manufacture product and includes the Customer Site Representative(s). Technicians are employees who support the licensed activities, (Fuel Assembly or Fuel Handling and Engineered Solutions) e.g. electrical, mechanical, quality control, laboratory, etc. Staff includes management and professional employees who support the Operators and Technicians with the licensed activities.

3.7.9 Total Effective Dose Equivalent (TEDE)

TEDE includes TLD monitored external and calculated internal dose based on workstation air monitoring at the Toronto site. As a result of operations involving sintered ceramic pellets, the Peterborough site does not have any measurable internal dose.

3.7.9.1 Peterborough TEDE

Peterborough does not have any measurable internal dose; therefore, the TEDE is the measured TLD external whole body dose. Table 17 provides a summary of TEDE dosimetry measurements with monitored workers grouped in various ranges of exposure. Approximately 73% of Peterborough's TEDE are less than 1 mSv. TEDE measurement results by work group are summarized in Table 18. Note that average dose results include zero measurements. The collective dose for 2018 was 87.1 mSv. The maximum individual five-year dose is well below the 100 mSv regulatory limit at 20.8 mSv (2014-2018).

The average annual external whole body dose trend for all monitored individuals is shown in Figure 4. Whole body dose by workgroup is listed in Table 18. Overall, average external whole body dose is trending down. Maximum and average doses are also trending down in each workgroup. Dose reduction is occurring as result of ongoing efforts to improve ALARA awareness and TLD wear and storage compliance. Significant reductions to the amount of rework are also occurring. Recent ergonomic improvements (bundle manipulators, collaborative robot) and improvements to conveyor shielding in bundle welding and final inspection are also contributors to dose reductions. The increase in maximum dose in 2018 is likely as a result of a customer-driven project in the final inspection area, as well as increased overtime due to the end of the contract bundle production obligations.

Total # Individuals	Peterborough Total # of Individuals in Dose Range (mSv)							
	0 - 1	1 - 5	5 - 10	10 - 20	20 - 50	50 - 100	100 - 200	200 - 500
78	57	19	2	0	0	0	0	0

Table 17: Peterborough Total Effective Radiation Dose Equivalent Distribution

	Year	Peterborough			
		All Workgroups	Operators	Technicians	Staff
Maximum (mSv)	2018	6.53	6.53	0.67	1.03
	2017	5.05	5.05	0.61	0.79
	2016	5.82	5.82	1.13	0.75
	2015	5.77	5.77	1.29	1.69
	2014	7.55	7.55	1.35	1.40
Average (mSv/person)	2018	1.12	2.12	0.31	0.48
	2017	0.99	2.06	0.13	0.39
	2016	0.96	2.02	0.14	0.37
	2015	2.03	2.03	0.27	0.84
	2014	2.75	2.75	0.35	0.71

Table 18: Peterborough Whole Body External Dose Summary

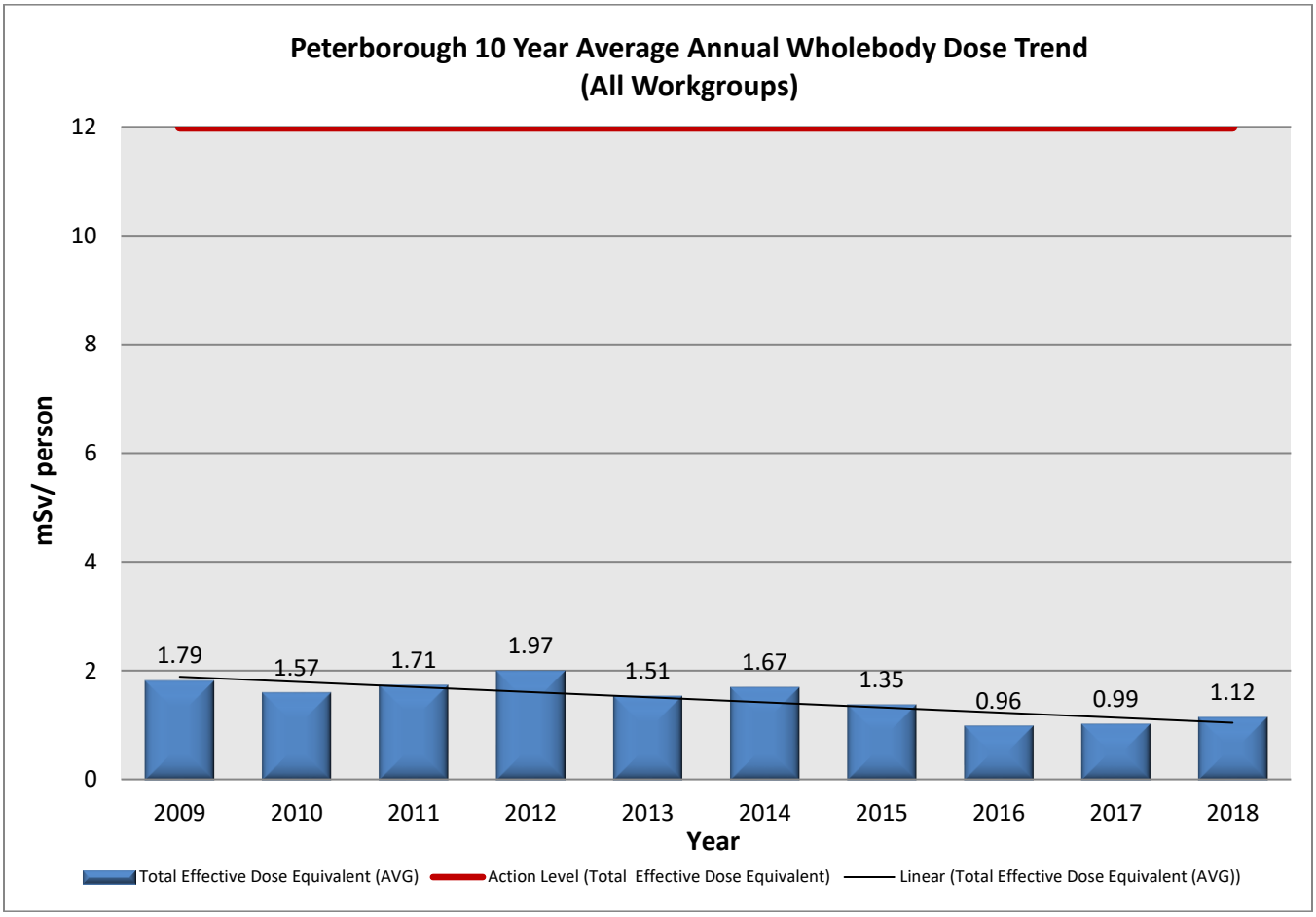


Figure 4: Peterborough 10-Year Average Annual Whole Body Dose

3.7.9.2 Toronto TEDE

Table 19 provides a summary of TEDE dosimetry measurements with monitored workers grouped in various ranges of exposure. Approximately 48% of Toronto's TEDE are less than 1 mSv. TEDE measurement results by work group are summarized in Table 20. Note that average dose results include zero measurements. The total collective dose for 2018 was 99.3 mSv. The maximum individual five-year dose is well below the 100 mSv regulatory limit at 39.0 mSv (2014-2018).

The average annual external whole body dose trend for all monitored individuals is shown in Figure 5. Note: This is external whole body dose only, and excludes internal dose. External whole body and internal dose by workgroup is listed in Table 20. Average external whole body dose is trending down over all, with Operator dose remaining steady. Average and maximum Staff doses are very low. Shielding improvements made in the Sort and Stack, Grinding and Sintering areas and an improvement in ALARA awareness and operator experience are examples of dose reduction initiatives.

Total # Individuals	Toronto Total # of Individuals in Dose Range (mSv)							
	0 - 1	1 - 5	5 - 10	10 - 20	20 - 50	50 - 100	100 - 200	200 - 500
58	28	26	4	0	0	0	0	0

Table 19: Toronto Total Effective Radiation Dose Equivalent Distribution

	Year	Toronto			
		All Workgroups (TEDE)	Operators External	Operators Internal	Staff (TEDE)
Maximum (mSv)	2018	9.16	8.07	1.86	2.06
	2017	8.54	8.54	2.37	0.40
	2016	11.79	11.79	2.80	0.23
	2015	8.45	7.71	2.33	3.25
	2014	7.80	7.80	2.56	1.84
Average (mSv/person)	2018	1.74	1.67	0.80	0.12
	2017	1.55	2.41	0.71	0.03
	2016	2.22	2.06	1.13	0.04
	2015	2.11	2.67	0.95	0.30
	2014	1.53	3.06	1.13	0.27

Table 20: Toronto Whole Body Internal and External Dose Summary

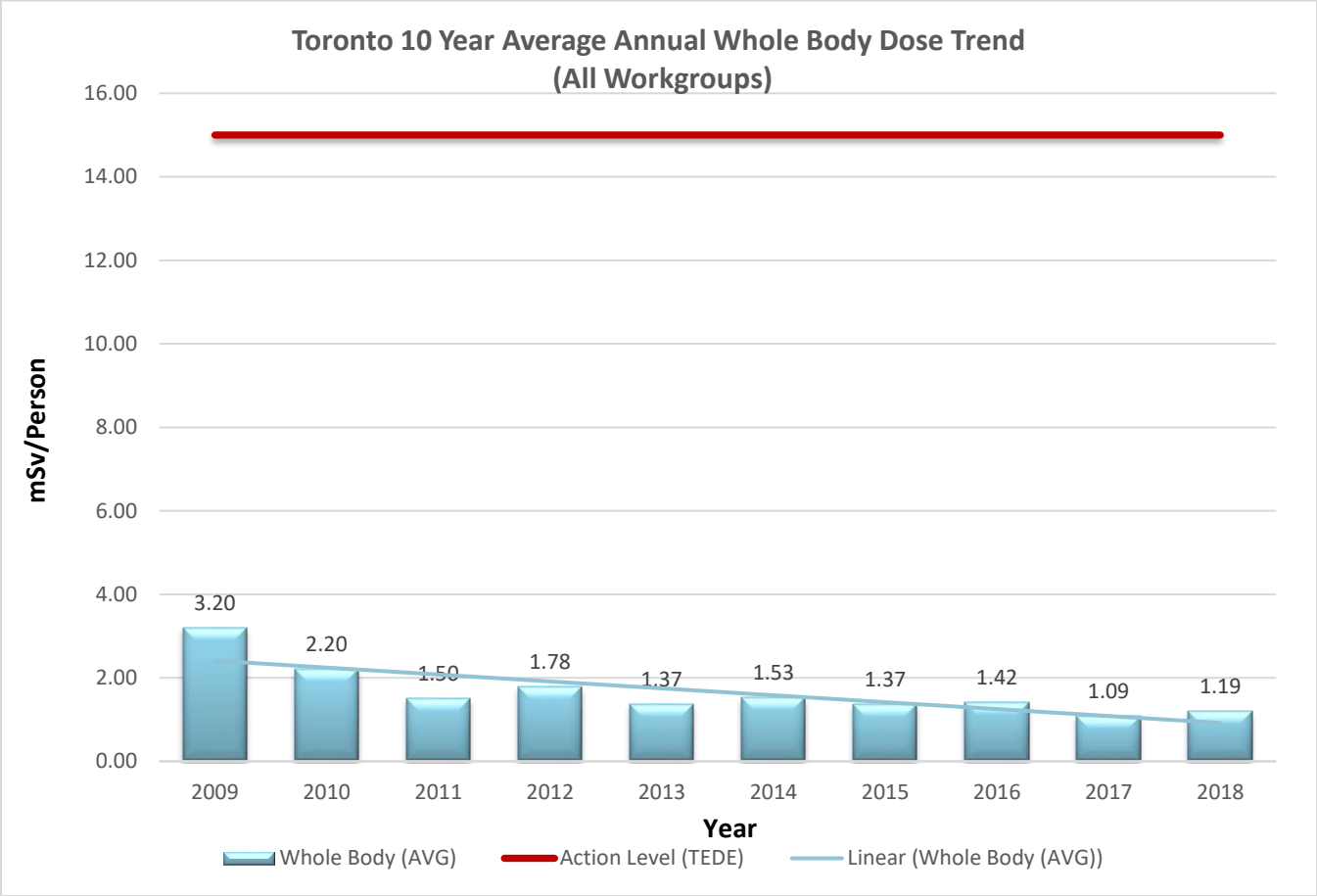


Figure 5: Toronto 10 Year Average Annual Whole Body Dose

3.7.10 Equivalent Skin Dose

Whole body TLDs measure the skin doses received in each monitoring period. Skin dose is the measure of the radiation dose that is absorbed by the skin from the deposition of energy from low penetrating radiation.

3.7.10.1 Peterborough Skin Dose

Table 21 provides a summary of equivalent skin dosimetry measurements with monitored workers grouped in various ranges of exposure. Approximately 69% of Peterborough's skin doses are less than 1 mSv. Equivalent skin dose by work group is summarized in Table 22. The average annual skin dose trend for all monitored individuals is shown in Figure 6. Skin doses across all workgroups remain a fraction of the Action Level and regulatory limit with trends showing steady.

Total # Individuals	Peterborough Total # of Individuals in Dose Range (mSv)							
	0 - 1	1 - 5	5 - 10	10 - 20	20 - 50	50 - 100	100 - 200	200 - 500
78	54	7	8	9	0	0	0	0

Table 21: Peterborough Equivalent Skin Radiation Dose Equivalent Distribution

	Year	Peterborough			
		All Workgroups	Operators	Technicians	Staff
Maximum (mSv)	2018	17.87	17.87	0.92	1.69
	2017	25.14	25.14	0.84	1.08
	2016	21.15	21.15	1.74	0.95
	2015	22.47	22.47	2.57	3.69
	2014	29.91	29.91	2.30	2.06
Average (mSv/person)	2018	2.87	6.05	0.38	0.57
	2017	2.77	6.26	0.17	0.49
	2016	2.66	6.11	0.18	0.39
	2015	4.10	7.11	0.59	0.98
	2014	4.75	8.65	0.56	0.85

Table 22: Peterborough Equivalent Skin Dose Summary

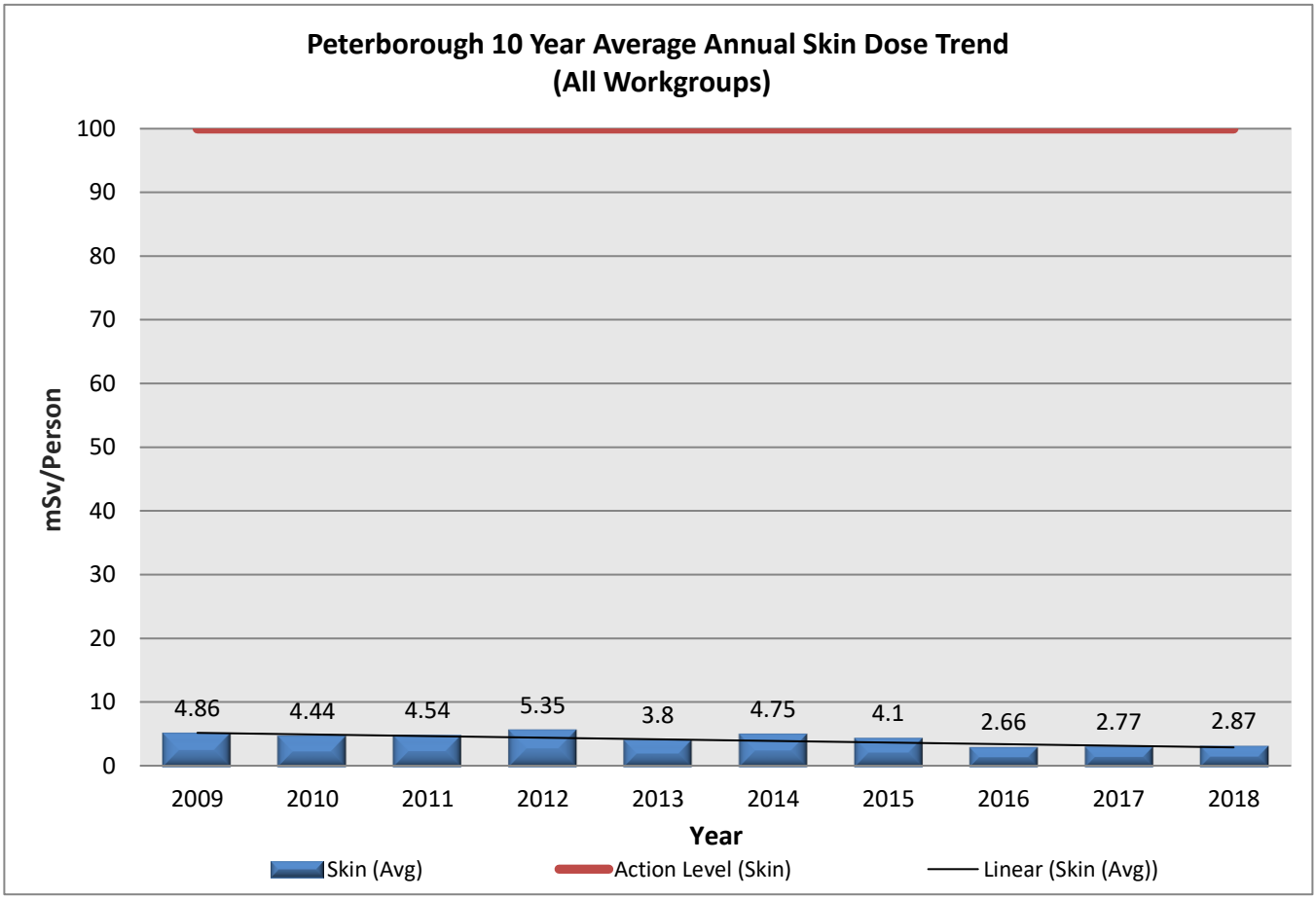


Figure 6: Peterborough 10 Year Average Annual Skin Dose

3.7.10.2 Toronto Skin Dose

Table 23 provides a summary of equivalent skin dosimetry measurements with monitored workers grouped in various ranges of exposure. Approximately 33% of Toronto's skin doses are less than 1 mSv. Skin dose by workgroup is listed in Table 24. The average annual skin dose trend for all monitored individuals is shown in Figure 7.

Skin doses across all workgroups remain a fraction of the applicable Action Level and regulatory limit. The overall trend is showing that average skin dose is decreasing, while the trend is steady in separate workgroups over recent years. The year over year decrease in overall skin dose has resulted from a combination of shielding improvements made in the Sort and Stack, Grinding and Sintering areas and an improvement in ALARA awareness and operator experience. While the primary objective of shielding improvements is reduction in gamma exposures, there is also a reduction in overall beta fields in the work area from the shielding.

Total # Individuals	Toronto Total # of Individuals in Dose Range (mSv)							
	0 - 1	1 - 5	5 - 10	10 - 20	20 - 50	50 - 100	100 - 200	200 - 500
58	19	9	11	11	6	2	0	0

Table 23: Toronto Equivalent Skin Radiation Dose Equivalent Distribution

	Year	Toronto		
		All Workgroups	Operators	Staff
Maximum (mSv)	2018	58.36	58.36	8.97
	2017	54.27	54.27	4.43
	2016	74.26	74.26	4.08
	2015	54.99	54.99	3.86
	2014	51.67	51.67	1.99
Average (mSv/person)	2018	8.92	12.68	0.54
	2017	7.85	11.80	0.34
	2016	10.23	14.82	0.49
	2015	9.89	13.16	0.47
	2014	11.08	14.43	0.41

Table 24: Toronto Equivalent Skin Dose Summary

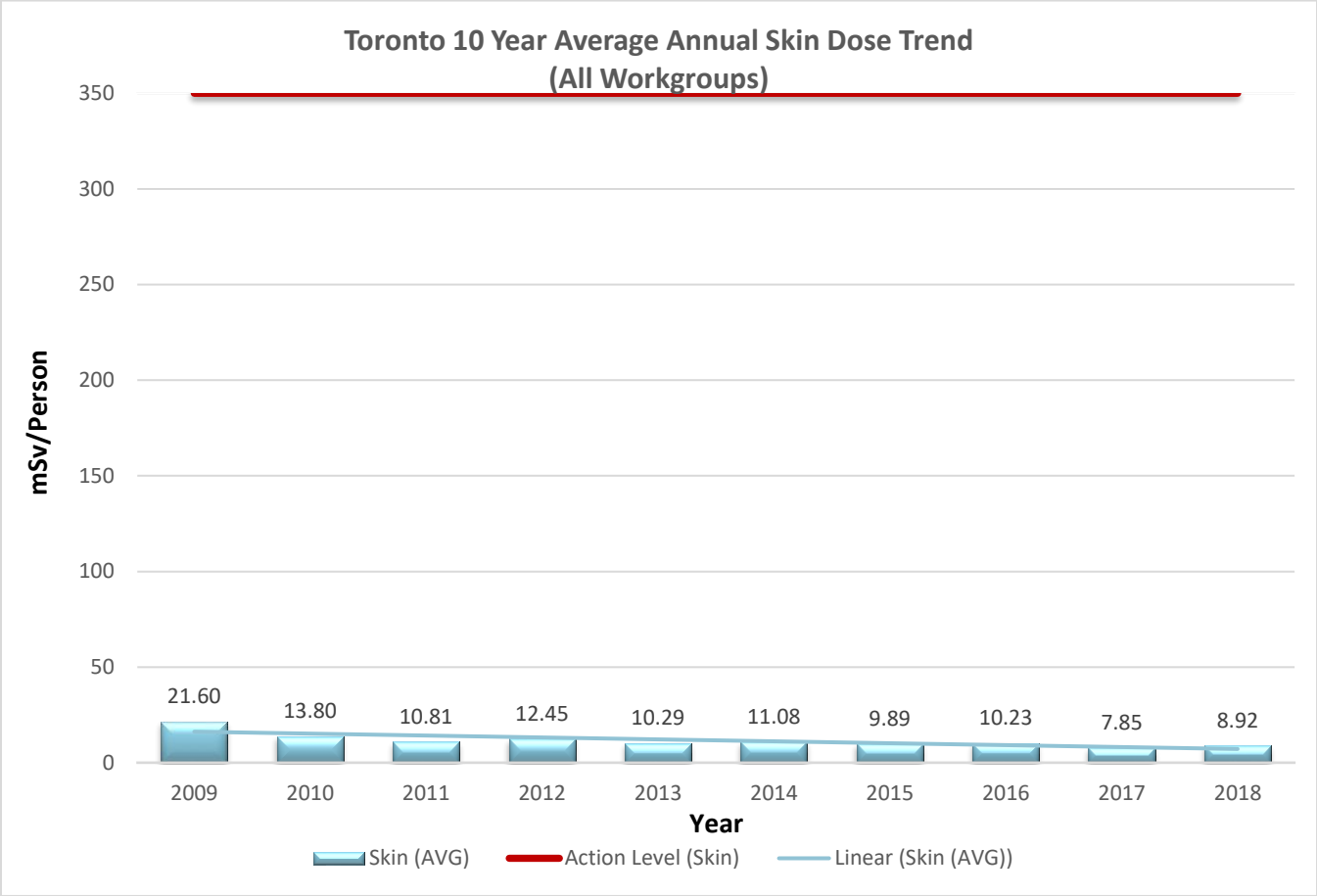


Figure 7: Toronto 10-Year Average Annual Skin Dose

3.7.11 Equivalent Extremity Dose

TLD rings are worn on certain individual's hands for a one-week period each quarter to measure extremity dose. A scaling factor is calculated based on hours worked in the quarter and is provided to the dosimetry service provider each monitoring period. The dosimetry service provider applies the scaling factor to the measured dose to estimate the exposure.

3.7.11.1 Peterborough Extremity Dose

Table 25 provides a summary of equivalent extremity dosimetry measurements with monitored workers grouped in various ranges of exposure. Approximately 76% of Peterborough's extremity doses are less than 20 mSv. Equivalent extremity dose by work group is summarized in Table 26. In Peterborough, Fuel Handling and Engineered Solutions employees do not participate in the extremity monitoring program. The average annual extremity dose trend for all monitored individuals is shown in Figure 8. Extremity doses across all workgroups remain a fraction of the Action Level and regulatory limit and show a steady average dose trend.

Total # Individuals	Peterborough Total # of Individuals in Dose Range (mSv)							
	0 - 1	1 - 5	5 - 10	10 - 20	20 - 50	50 - 100	100 - 200	200 - 500
27	6	0	6	8	7	0	0	0

Table 25: Peterborough Total Extremity Radiation Dose Equivalent Distribution

	Year	Peterborough			
		All Workgroups	Operators	Technicians	Staff
Maximum (mSv)	2018	46.06	46.06	0.68	0.88
	2017	43.18	43.18	1.20	2.17
	2016	32.84	32.84	3.6	2.25
	2015	39.34	39.34	4.98	4.82
	2014	98.98	98.98	12.01	2.57
Average (mSv/person)	2018	14.34	17.52	0.49	0.88
	2017	13.62	15.36	1.03	2.17
	2016	9.78	11.33	2.54	1.24
	2015	12.61	14.34	2.03	4.82
	2014	18.64	20.88	4.62	2.57

Table 26: Peterborough Equivalent Extremity Dose Summary

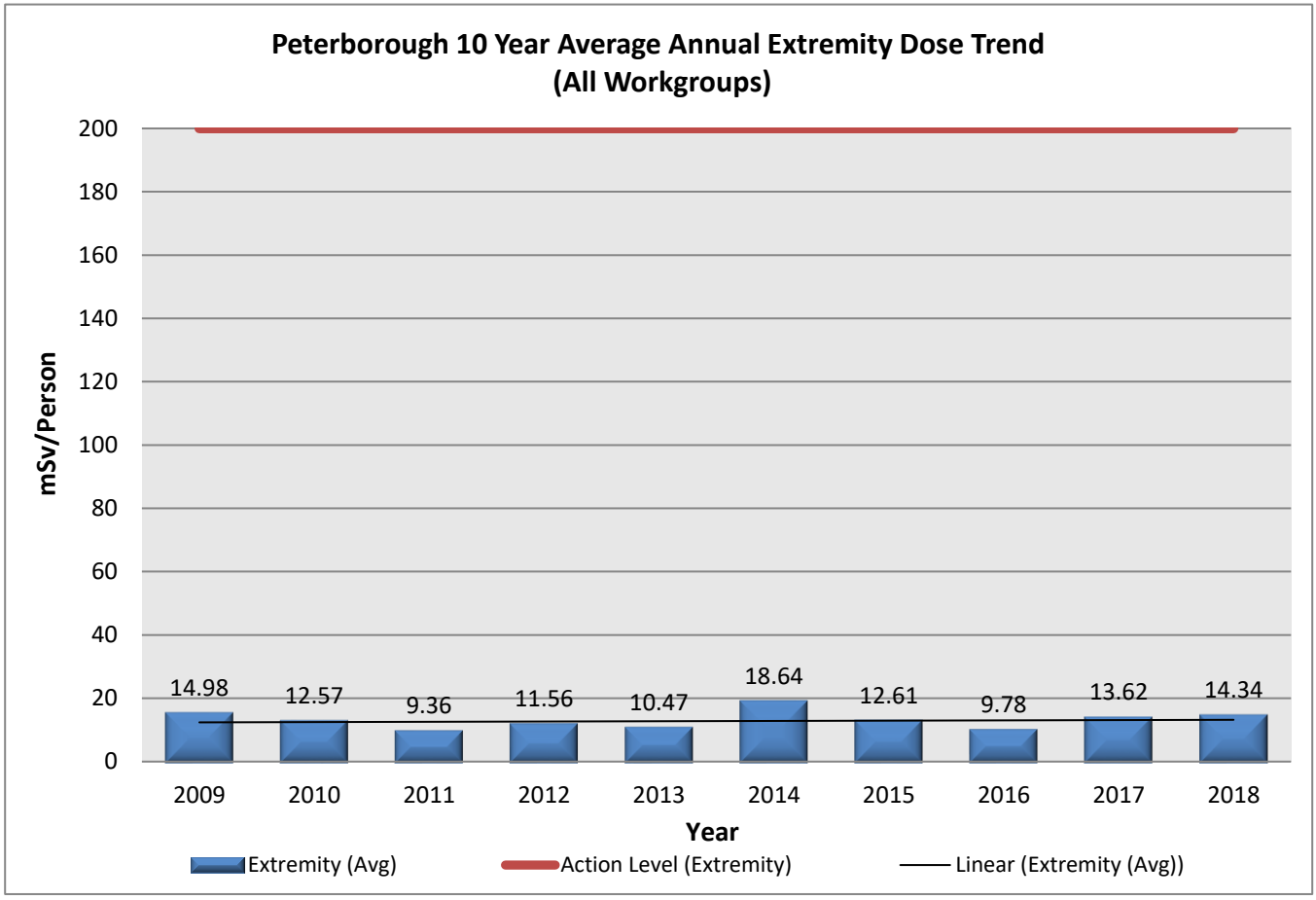


Figure 8: Peterborough 10-Year Average Annual Extremity Dose

3.7.11.2 Toronto Extremity Dose

Table 27 provides a summary of equivalent extremity dosimetry measurements with monitored workers grouped in various ranges of exposure. Approximately 58% of Toronto's extremity doses are less than 20 mSv. Equivalent extremity dose by work group is summarized in Table 28. In Toronto, Staff do not participate in the extremity monitoring program. The average annual extremity dose trend for all monitored individuals is shown in Figure 9. Average extremity doses continue to show a decreasing trend. Area shielding improvements have also reduced workstation dose rates.

Total # Individuals	Toronto Total # of Individuals in Dose Range (mSv)							
	0 - 1	1 - 5	5 - 10	10 - 20	20 - 50	50 - 100	100 - 200	200 - 500
40	0	10	7	6	8	9	0	0

Table 27: Toronto Extremity Radiation Dose Equivalent Distribution

	Year	Toronto		
		All Workgroups	Operators	Staff
Maximum (mSv)	2018	83.33	83.33	N/A
	2017	115.07	115.07	N/A
	2016	119.47	119.47	N/A
	2015	109.62	109.62	N/A
	2014	102.44	102.44	N/A
Average (mSv/person)	2018	24.56	24.56	N/A
	2017	27.36	27.36	N/A
	2016	29.58	29.58	N/A
	2015	30.30	30.30	N/A
	2014	31.96	31.96	N/A

Table 28: Toronto Equivalent Extremity Dose Summary

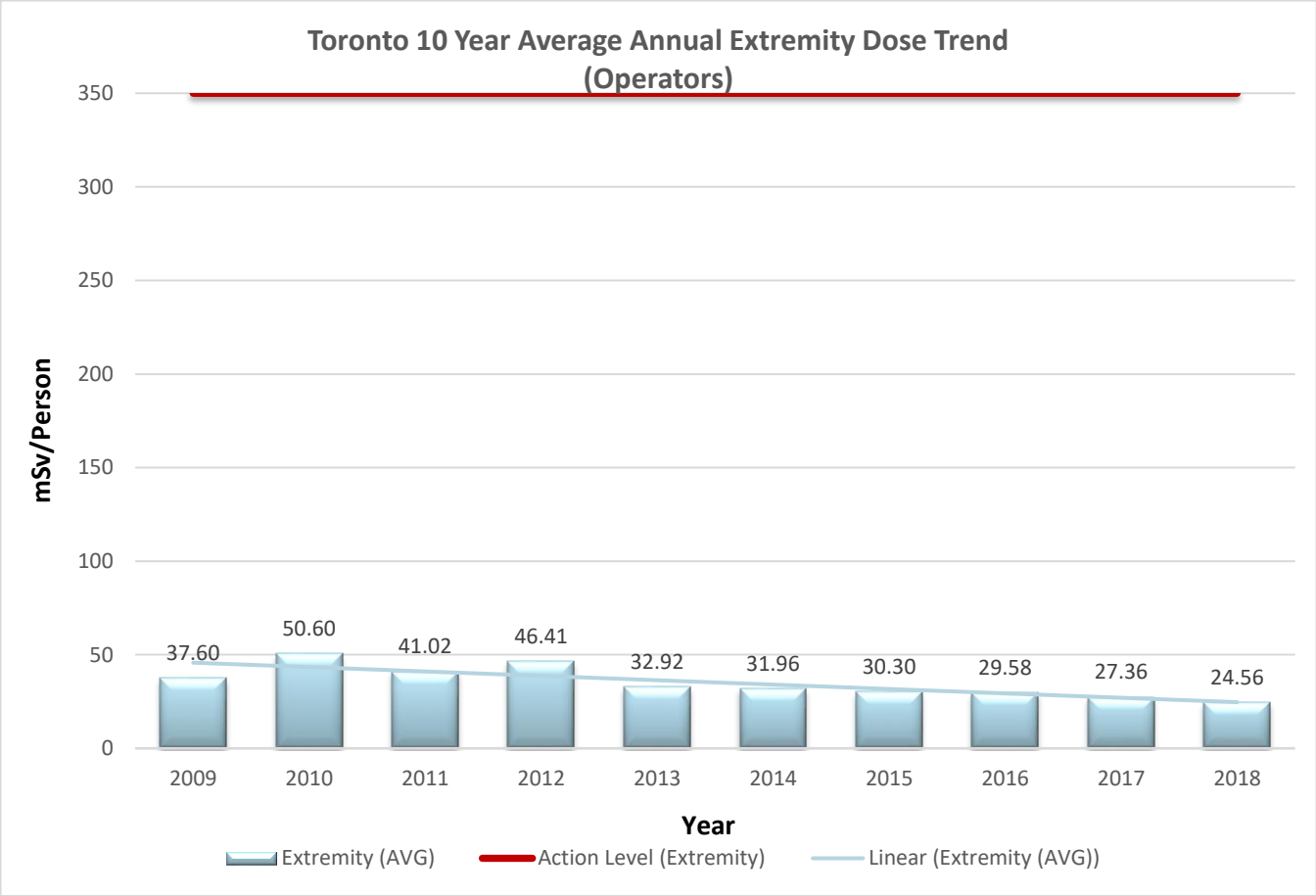


Figure 9: Toronto 10-Year Average Annual Extremity Dose

3.7.12 Total Estimated Doses to Members of the Public

Radiation doses to members of the public are specified in the *Radiation Protection Regulations* and listed in Table 15. It is a calculated value, measured in mSv, which takes into account the absorbed dose to all organs of the body, the relative harm level of the radiation, and the sensitivities of each organ to radiation. To ensure compliance with this regulation, BWXT NEC has established "Derived Release Limits" (DRLs) for uranium emissions to the environment. The facility DRLs account for the realistic exposure pathways as described in the facilities Radiation Protection Manual to restrict dose to a member of the public to 1 mSv (1,000 µSv) per year, which is the regulatory dose limit. The DRLs assume that a member of the public occupies the BWXT NEC boundary continuously (24 hours per day, 365 days per year). The realistic pathways considered are summarized in Table 29. Note: Liquid effluent is not included in the calculation of public dose as the effluent from both facilities is discharged directly to city sewer systems and is not used for drinking.

The contribution from gamma radiation emission to the nearest member of the public is calculated from the net sum of the nearest environmental TLD results from all monitoring periods.

Pathway	Description
Air immersion	Airborne UO_2 particles can expose members of the public via direct radiation This is accounted for in the Peterborough and Toronto Derived Release Limits
Air inhalation	Airborne UO_2 can expose members of the public via inhalation This is accounted for in the Peterborough and Toronto Derived Release Limits
Soil deposition gamma radiation ground shine	Gamma ground shine dose from direct radiation This is accounted for in the Toronto Derived Release Limit
Soil deposition beta radiation ground shine	Beta ground shine dose from direct radiation This is accounted for in the Toronto facility Derived Release Limit
Soil re-suspension and inhalation	Soil re-suspension and inhalation dose This is accounted for in the Toronto facility Derived Release Limit
Gamma radiation	Gamma radiation measured using environmental TLDs strategically located along the plant boundaries

Table 29: Radiological Exposure Pathways

3.7.12.1 Peterborough

Through direct correlation with the facility Derived Release Limits, the estimated effective dose as a result of air releases during the reporting period is 0.00 µSv. Environmental TLDs at the Peterborough plant boundary are in place and used to estimate a public gamma dose. The estimated effective dose as a result of direct gamma radiation during the reporting period is 0.00 µSv. As a result of Peterborough operations, the total estimated radiation dose to a member of the public is 0.00 µSv. In comparison to the 1 mSv (1,000 µSv) per year effective dose limit to a member of the public, doses from the operations at the Peterborough facility are negligible. This is summarized for the past five years in Table 30.

Period	Peterborough	
	Estimated Annual Public Dose (µSv)	% of Public Dose Limit (1,000 µSv = 1 mSv)
2018	0.0	0%
2017	0.0	0%
2016	0.0	0%
2015	0.0	0%
2014	0.0	0%

Table 30: Peterborough Estimated Annual Public Dose

3.7.12.2 Toronto

Through direct correlation with the facility Derived Release Limits, the estimated effective dose as a result of air releases during the reporting period is 0.41 µSv. Environmental TLDs at the Toronto plant boundary are in place and used to estimate a public gamma dose. The estimated effective dose as a result of direct gamma radiation during the reporting period is 0.00 µSv. As a result of Toronto operations, the total estimated radiation dose to a member of the public is 0.41 µSv.

In comparison to the 1 mSv (1,000 µSv) per year effective dose limit to a member of the public, doses from the operations at the Toronto facility is a fraction of the regulatory public dose limit. This is summarized for the current and previous reporting periods in Table 31.

Period	Toronto	
	Estimated Annual Public Dose (µSv)	% of Public Dose Limit (1,000 µSv = 1 mSv)
2018	0.4	0.0%
2017	17.5	1.8%
2016	0.7	0.0%
2015	9.8	1.0%
2014	5.2	0.5%

Table 31: Toronto Estimated Annual Public Dose

3.8 Conventional Health and Safety

The "Conventional Health and Safety" Safety and Control Area covers the implementation of a program to manage non-radiological workplace safety hazards and to protect personnel and equipment.

BWXT NEC has a well-established integrated management system for environmental, health and safety program excellence. This is ensured through the effective implementation of program elements. BWXT NEC has an established EHS Mission Statement that is reviewed and signed annually by the President of BWXT NEC. BWXT NEC's objective is to eliminate or minimize as low as reasonably achievable both known and potential environmental, safety and health hazards which could impact our employees and the communities in which they live. EHS is a shared responsibility, top business priority and is continually improved.

Key components of the Health and Safety program include:

- Compliance with all safety and health-related regulatory requirements;
- The setting of EHS goals and objectives;
- Hazard recognition, risk assessment and change control processes;
- A comprehensive worker training program;
- Documented safety concerns near misses and incidents with appropriate root-cause analysis, preventive and corrective actions.

The EHS program includes all worker safety elements that demonstrate compliance to relevant regulations, codes and standards:

- EHS Policy
- Hazard Analysis and Regulatory Compliance
- Employee Involvement
- EHS Specialist
- Accident/Incident Investigation
- EHS Training
- Housekeeping
- Personal Protective Equipment
- Contractor Safety
- Emergency Preparedness/Response
- Risk Assessments
- High Risk Operations
- Industrial Hygiene
- Chemical Management
- Ergonomics
- Lock-Out Tag-Out

In the reporting period, Employment and Social Development Canada conducted a routine inspection at the Toronto facility to assess compliance with federal health and safety legislation. The governing legislation

includes the Canada Labour Code Part II and the Canada Occupational Health and Safety Regulations. As a result of the inspection, six minor non-compliances were identified. The non-compliances were related to posting of required documents, contents of the Workplace Violence Prevention Policy and electrical panel obstructions. All actions were assigned and tracked to closure.

Continuous improvement is achieved through several review processes, including site inspections, reported safety concerns, near miss and incident investigations. The effectiveness of the overall program is reviewed throughout the year and evaluated in the annual management review (section 3.2.3).

Chemical management is a well-established health and safety program element. In 2015, Workplace Hazardous Material Information System (WHMIS) legislation (Hazardous Products Regulations) was updated to require compliance to the Globally Harmonized System of Classification and labelling of Chemicals (GHS) for specified controlled or hazardous products. WHMIS is designed to address employers' and workers' right to know about the hazards and safe work practices related to certain chemicals. GHS defines and classifies the hazards of chemical products, and consistently communicates health and safety information on labels and safety data sheets. A multi-year transition plan was announced giving suppliers until May 31, 2017 to use WHMIS 1988 or WHMIS 2015 to classify and communicate the hazards of their products. Beginning June 1, 2017 to May 31, 2018, distributors can continue to use WHMIS 1988 or WHMIS 2015. Employers could use WHMIS 1988 or WHMIS 2015 until December 1, 2018. This means that workplaces will continue to see both WHMIS 1988 and WHMIS 2015 labelling and safety data sheets through 2018 and longer for discontinued products.

Under WHMIS 2015, employers must continue to:

- ✓ Educate and train workers on the hazards and safe use of products
- ✓ Ensure that hazardous products are properly labelled
- ✓ Prepare workplace labels and SDSs as necessary
- ✓ Provide access for workers to up-to-date SDSs
- ✓ Review the education and training provided to employees annually or whenever work conditions or hazard information changes.

During this transition period, BWXT NEC has included both 1988 and 2015 systems in their employee-training programs, and continues to update secondary labeling and provide SDSs compliant with WHMIS 2015 as products come in. In 2018, BWXT NEC updated the Chemical Management Programs and associated labeling systems, performed site-wide chemical sweeps and revised education and training programs in consultation with the workplace safety committees to meet WHMIS 2015. This training will be fully implemented in 2019.

In addition, a committee charter was developed for the Beryllium Safety Team in Peterborough.

3.8.1 Workplace Safety Committees

3.8.1.1 Peterborough WSC

In Peterborough, eleven meetings were held with quorum. A total of 39 investigations and inspections were conducted in the reporting period. This includes WSC inspections, manager inspections, and near miss, incident and injury investigations. These investigations and inspections led to a total of 178 actions logged and tracked to closure. In Peterborough, the top finding categories were housekeeping, policies/procedures/written programs, emergency equipment, walking/working surfaces and chemical management. Established committee goals for the reporting period are summarized in Table 32.

Peterborough WSC Goals	Actual	Result
Develop two ways to promote health and safety awareness	2/2	Achieved
Joint meeting/discussion with other EHS teams (ALARA, Ergonomics, Emergency Response Team, Beryllium Safety)	4/4	Achieved
Review workplace inspection checklist and update as necessary	1/1	Achieved
Review and define training requirements for WSC	1/1	Achieved

Table 32: Peterborough Workplace Safety Committee Goals and Results

2019 goals for Peterborough are established as follows:

- Meet at least nine times as required by the Canada Labour Code Part II
- Develop an in-house training course for new WSC members by year end
- Joint meetings with other site EHS Teams (ALARA, Ergonomic, ERT, Beryllium)
- Review one EHS Program for improvements by year end

3.8.1.2 Toronto WSC

In Toronto, ten meetings were held with quorum. A total of 41 investigations and inspections were conducted in the reporting period. This includes WSC inspections, manager inspections, and near miss, incident and injury investigations. These investigations and inspections led to a total of 151 actions logged and tracked to closure. The top finding categories from WSC inspections were housekeeping, unsafe condition, chemical, electrical, and personal protective equipment.

Established goals for the reporting period are summarized in Table 33.

Toronto WSC Goals	Actual	Result
Review one EHS program per quarter to promote program compliance	4/4	Achieved
Conduct formal workplace safety committee training by November 2018	Completed	Achieved
Complete one WSC activities presentation at an all employee meeting by year end	Completed	Achieved
Conduct one joint meeting with the other EHS teams (ALARA, Ergo) by year end	Completed	Achieved

Table 33: Toronto Workplace Safety Committee Goals and Results

2019 goals for Toronto are established as follows:

- WSC Presentation at all employee meeting
- Review one EHS program per quarter to promote program compliance
- Proactive safety improvement project

3.8.2 Hazardous Occurrences

Under the *Canada Occupational Health and Safety Regulations* there are several different types of hazardous occurrences including:

- Minor Injury: any employment injury or an occupational disease for which medical treatment is provided and excludes a disabling injury.
- Disabling Injury: any employment injury or an occupational disease that results in either time loss, or modified duties. Disabling injuries can be either temporary (sprained wrist), or permanent (severed limb), depending on whether or not the employee is expected to make a full recovery.
- Loss of Consciousness: from an electric shock or a toxic or oxygen deficient atmosphere.
- Rescue / Revival or other Emergency Procedures: any incident that requires emergency procedures to be implemented, such as a hazardous substance spill, bomb threat or violence prevention procedure.

Annual reports are provided to the Minister Employment and Social Development Canada as required by regulation.

3.8.2.1 Peterborough Injury and Illness

The Peterborough site was injury-free (no recordable or lost time injuries) in 2018 and achieved a BWXT President and Chief Executive Officer Safety Award as recognition for their excellent safety performance. During the reporting period there were 19 first aids. Eleven first aids occurred in fuel assembly, four in Fuel Handling and Engineered Solutions, and four in the office. The top injury categories were ‘rubbed/abraded,’ ‘falls same level,’ ‘lifting/lowering/carrying/pushing or pulling,’ and ‘struck by.’ There were 17 near misses logged following defined event classification criteria. The top noted categories were ‘safety,’ ‘other health and safety,’ ‘water,’ ‘other environmental,’ and ‘hazardous materials transportation.’

3.8.2.2 Toronto Injury and Illness

In Toronto, there were 13 first aids and three recordable injuries (no lost time). Eleven out of the 16 injuries involved an injury to the hand or arm. Six of the injuries were classed as ‘contact with a sharp object’ and two were classed as ‘lifting, lowering, carrying, pushing, or pulling.’ There were 11 near miss events logged following defined event classification criteria. The top three noted categories were ‘other health and safety,’ ‘safety,’ and ‘radiation protection.’

3.9 Environmental Protection

The "Environmental Protection" Safety and Control Area covers programs that monitor and control all releases of nuclear and hazardous substances into the environment, as well as their effects on the environment as a result of licensed activities.

BWXT NEC facilities have well-established environmental management systems to ensure effective monitoring programs are in place to achieve environmental goals and regulatory compliance. Environmental protection programs are also compliant with:

- CSA N288.4-10, *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills*,
- CSA N288.5-11, *Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills*, and

- CSA N288.6-12, *Environmental risk assessments at Class I nuclear facilities and uranium mines and mills*.

Radiological and non-radiological substances are released to the environment as the result of operations at BWXT NEC. Environmental protection is regulated municipally for water effluent through sewer-use by-laws, provincially for air effluent and federally through the CNSC. Airborne and waterborne radiological and non-radiological emissions to the environment are monitored as part of the effluent monitoring programs. BWXT NEC's environmental monitoring program is comprised of the following components:

1. Air effluent
2. High-volume ambient air
3. Water effluent
4. Soil sampling

BWXT NEC has established facility specific CNSC approved Action Levels for various environmental parameters. An Action Level is defined in the *Radiation Protection Regulations* as "specific dose of radiation or other parameter that, if reached, may indicate a loss of control of part of a licensee's radiation protection program, and triggers a requirement for specific action to be taken." Action Levels are also applied to environmental protection. Action Levels are set below regulatory limits; however, they are CNSC reportable events. Accordingly, BWXT NEC has established Internal Control Levels for various environmental parameters that are set even lower than Action Levels to act as an early warning system. Internal Control Level exceedances trigger an internal investigation and corrective actions; however, they are not CNSC reportable events. No Action Levels or regulatory limits were exceeded during the reporting period.

To complement existing and ongoing compliance activities and site monitoring programs, the CNSC implemented an Independent Environmental Monitoring Program to verify that the public and environment around CNSC-regulated facilities are not adversely affected by releases to the environment. This verification is achieved through independent sampling and analysis by the CNSC. This program applies to the BWXT NEC operations. Sampling was last conducted in 2018. The results are compared to relevant provincial and federal guidelines and are available on the CNSC website.

BWXT NEC has a well-established integrated management system for environmental, health and safety program excellence. This is ensured through the effective implementation of program elements. BWXT NEC has an established EHS Mission Statement that is reviewed and signed annually by the President of BWXT NEC. BWXT NEC's objective is to eliminate or minimize as low as reasonably achievable both known and potential environmental hazards which could impact our employees and the communities in which they live. EHS is a shared responsibility, top business priority and is continually improved.

An Environmental Management System (EMS) is in place to identify and control environmental aspects and drive continuous improvement to enhance performance and minimize risk to the employees and the public.

Key components of the environmental protection program include:

- Compliance with all environmental-related regulatory requirements;
- The setting of environmental goals and objectives;
- Hazard recognition, risk assessment and change control processes;
- A comprehensive worker training program;

- Documented environmental concerns, near misses and incidents with appropriate root-cause analysis, preventive and corrective actions.

The EHS program includes all environmental protection elements that demonstrate compliance to relevant regulations, codes and standards:

- Air
- Water
- Waste
- Dangerous goods shipping
- Boundary radiation monitoring
- Soil sampling (Toronto)

Internal inspections are completed on a routine basis and focus on all areas of the plant. The purpose of these inspections is to identify environmental as well as health and safety issues. WSC members carry out routine plant inspections. After an inspection, the findings are documented, corrective actions identified, and submitted to responsible personnel to address. Depending on the complexity of the finding immediate action may be required (i.e. equipment shutdown), or the action may be incorporated into meeting minutes, or tracked in the ATS.

An annual internal self-assessment and audit of the environmental protection program elements are conducted at each facility (3.2.1 and 3.2.2). Following these proactive reviews, the findings are documented, corrective actions identified and tracked to completion.

Continuous improvement is achieved through several review processes, including site inspections, reported concerns, near miss and incident investigations, self-assessments and audits. Environmental goals performance is discussed in 3.9.1.

In the reporting period, the CNSC conducted an environmental protection inspection at the Peterborough and Toronto facilities to assess compliance with specific clauses of the Nuclear Safety and Control Act and its associated Regulations, the operating licence and its associated licence conditions handbook, as well as BWXT NEC's programs and procedures as necessary. The inspection also reviewed the implementation and effectiveness of corrective actions that arose from enforcement actions from previous inspections as well as past events that have occurred at the facilities. As a result of the inspection, there were two areas of improvement issued in two Action Notices related to the security of environmental TLDs at the Peterborough site and designated hazardous waste storage areas at the Toronto site. All actions were assigned and tracked to closure.

There were no major program changes at the Peterborough site.

In Toronto, several program improvements were instituted. An engineering review was completed to identify opportunities to improve furnace exhaust performance. The facility purchased additional generators, and other infrastructure to aid in water management/laboratory analysis in the event of a flood and/or extended power failure. A new machine for decontamination of waste material was installed and trialled with the goal of reducing radioactive waste. Testing is ongoing to determine its effectiveness.

In the reporting period, minor administrative updates were made to four environmental documents.

3.9.1 Peterborough Environmental Protection Program Performance

In the reporting period, the MOECP conducted a routine inspection at the Peterborough facility to assess compliance with provincial environmental legislation regarding the air emissions. The governing

legislation includes the Environmental Protection Act and Regulation 419/05 titled "Air Pollution – Local Air Quality". As a result of the inspection, there were no non-compliances or required actions.

There was one environmentally-related reportable event at the Peterborough site. An outdoor open-topped metal recycling bin was discovered to be leaking by continuous drip through an open drain hole. The material was suspected to be metal working fluid as identified by appearance and odour by knowledgeable personnel. Approximately 5 to 10 L of the fluid leaked onto a concrete pad and adjacent grassy area. All used absorbent materials and affected soil was collected and the bins returned to the vendor. The spill was acknowledged as a quality assurance miss on the part of the vendor such that metal shavings with metal working fluid should not have been in the bin on delivery. Corrective actions were implemented with no recurrence of a similar event. In accordance with facility licence conditions and MOECP regulations, the spill was reported to the Spills Action Centre and the CNSC.

Environmental protection goals and results are summarized in Table 34. Challenges with beryllium waste reduction continued into 2018 with area clean-ups and new initiatives, such as lighting replacements. This resulted in an increase is the amount of beryllium waste generated. These projects continue into 2019.

Peterborough Environmental Protection Program Goals	Actual	Result
Update chemical spill response plan by year end	Complete	Achieved
Improve spill containment at the berg chiller by year end	Complete	Achieved
Beryllium hazardous waste reduction by >10% from previous year	6% Increase	Not Achieved
Complete one asbestos abatement project by year end	Complete	Achieved

Table 34: Peterborough Environmental Program Goals

2019 goals for Peterborough are established as follows:

1. Develop and implement site-wide environmental awareness training
2. Review and improve change control involving chemicals
3. Install coolant mixing stations in the B26 tool room
4. Complete one asbestos abatement project.

3.9.2 Toronto Environmental Protection Program Performance

In the reporting period, the MOECP conducted a routine inspection at the Toronto facility to assess compliance with provincial environmental legislation regarding the air emissions. The governing legislation includes the Environmental Protection Act and Regulation 419/05 titled "Air Pollution – Local Air Quality". As a result of the inspection, there were no non-compliances or required actions.

In addition, the City of Toronto conducted a routine inspection to assess compliance with municipal environmental legislation regarding water emissions. The governing legislation includes the City of Toronto Sewer Use By-Law. The inspection included analytical water sampling. As a result of the inspection and follow-up discussion, additional investigation into the installation of a Maintenance Access Hole or alternate sampling device is ongoing.

Environmental protection goals and results are summarized in Table 35.

Toronto Environmental Protection Program Goals	Actual	Result
Energy/Greenhouse Gases – Reduce identified air leaks by 25%	76% Reduction of identified leaks	Achieved
Chemical – Reduce on-site inventory by 5% from 2017	Complete	Achieved
Chemical – Replacement of three janitorial chemicals to environmentally friendly substitutes	Complete	Achieved
Waste Management – Trial new cleaning machine for decontamination of materials	Complete	Achieved

Table 35: Toronto Environmental Program Goals

2019 goals for Toronto are established as follows:

1. Furnace 5/6 exhaust ventilation improvements
2. Groundwater management improvements
3. Water analysis program/equipment review
4. Noise abatement projects

3.9.3 Air Effluent Monitoring

BWXT NEC facilities have valid Environmental Compliance Approvals issued by the Ministry of Environment, Conservation and Parks (MOECP) for air emissions. In accordance with permit conditions, each site maintains emission summary and dispersion modelling reports and acoustic assessment reports that demonstrate compliance to relevant legislation. Annual summary reports are submitted to the MOECP annually.

Measured uranium air emissions are included in the estimated dose to members of the public through direct correlation with facility DRLs. Details are provided in section 3.7.12.

3.9.3.1 Peterborough Air Monitoring

A single process uranium air emission point exists in the Peterborough facility. The R2 Area Decan Station exhausts through a High Efficiency Particulate Air filter. The facility performs continuous in-stack monitoring drawing a sample of air across a filter capable of trapping uranium dust. The filter papers are analyzed in-house and verified externally by an independent laboratory for testing by delayed neutron activation analysis. The minimum detection limit is 0.01 µg uranium. Results are compared to the previous results and to relevant Internal Control Levels and Action Levels.

The Peterborough facility uses beryllium as part of the fuel bundle manufacturing process. The Environmental Protection Act of Ontario (R.S.O. 1990, c. E. 19) and Ontario Regulation 419/05 *Air Pollution – Local Air Quality Regulation* determine the permitted concentration of contaminant release. The release limit at the Point of Impingement (POI) for Beryllium is 0.01 µg per cubic meter of air. The POI is the plant/public boundary. In accordance with the relevant provincial regulations, an Environmental Compliance Approval is valid for the site's operations with modelling in place to confirm compliance.

Three beryllium air emission points exist in the Peterborough facility. Monitoring of this emission is not required by the MOECP. Due to the additional regulation by the CNSC, BWXT NEC monitors the contaminant concentration in each stack and has established an Action Level of 0.03 µg/m^3 and an

Internal Control Level of 0.01 µg/m^3 at the stack exit, which are both very conservative. The facility performs continuous in-stack monitoring drawing a sample of air across a filter capable of trapping beryllium. The filter is analyzed for beryllium using the Atomic Absorption method or the Inductively Coupled Plasma - Atomic Emission Spectrometer method at an external independent laboratory. The result is related to the air volume passed through the filter. The minimum detection limit is 0.002 µg beryllium. A calculation of the concentration is then made and compared to the previous results, and to relevant Internal Control Levels and Action Levels.

A summary of air effluent sampling results is in Table 36. Uranium air release results continue to remain low and well below the Action Level of 1 µg/m^3. The five-year trend graph of annual uranium air releases, presented in Figure 10, shows a stable five-year performance consisting of very low measurements. The total release of 0.002 g in the reporting period is well below the regulatory established discharge limit of 550 g per year.

Peterborough Air Emissions						
Stack Description	**Emission Contaminant**	**Total Number of Samples**	**Action Level (µg/m^3) (# Samples Exceeding Level)**	**Highest Value Recorded (µg/m^3)**	**Average Value Recorded (µg/m^3)**	**Total Discharge (g)**
R2 Decan	Uranium	47	1.0 (0)	0.006	0.000	0.002
North	Beryllium	47	0.03 (0)	0.001	0.000	N/A
South	Beryllium	47	0.03 (0)	0.001	0.000	N/A
Acid	Beryllium	47	0.03 (0)	0.000	0.000	N/A

Table 36: Summary of Peterborough Uranium in Air Emissions

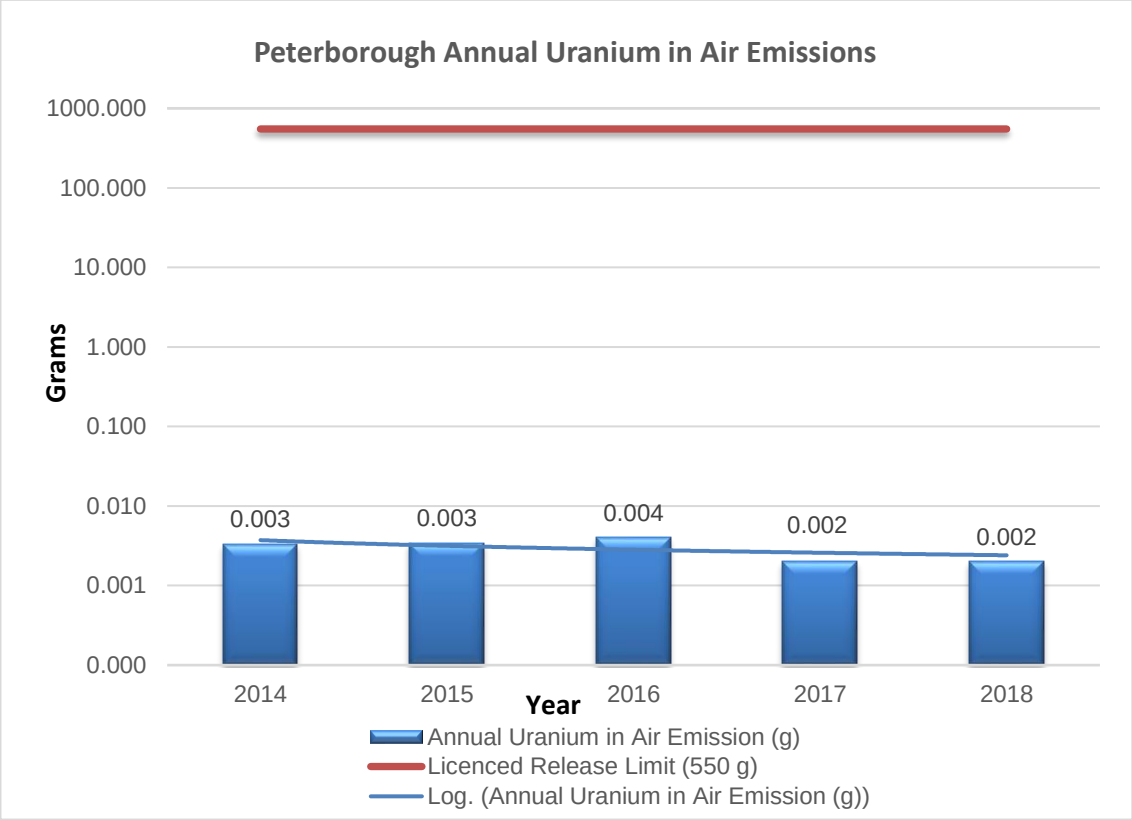


Figure 10: Peterborough Annual Uranium Air Emission Trending

Note: the above graph has a logarithmic scale

3.9.3.2 Toronto Air Monitoring

The Toronto facility performs continuous in-stack sampling and boundary air monitoring for uranium. The facility performs continuous in-stack monitoring drawing a sample of air across a filter capable of trapping uranium dust. The samples are analyzed daily and verified externally by an independent laboratory periodically. Boundary samples are high volume air samples drawn at five positions strategically located around the facility perimeter. Boundary samples are analyzed externally by an independent laboratory. The external independent laboratory tests the filter papers by delayed neutron activation analysis. The minimum detection limit is 0.01 µg uranium. Results are compared to the previous results, and to relevant Internal Control Levels and Action Levels.

A summary of air effluent sampling results is in Table 37 and Table 38. Air monitoring results are trended over five years as shown in the Figure 10 and Figure 11. Toronto's average boundary monitor results are trended over five years as shown in Figure 12. The Toronto stack air emission is trending down. The total release of 6.3 g during the reporting period is well below the discharge limit of 760 g. The total release includes all monitored locations (Rotoclone, 6H-68, 4H-48, Furnace #1, Furnace #2/4 and Furnace #5/6). The downward trend is primarily the result of measured furnace stack emissions in 2017 and 2018, rather than the conservative estimates applied prior. In addition, the furnace filter housings were replaced in late 2016 to improve performance and ease of maintenance tasks including filter changes.

Toronto's average boundary monitor results are trended over five years in Figure 12 and consist of very low uranium in air concentrations. The boundary air monitor maximum concentration measurements also continue to remain low and well below the Action Level of 0.08 µg/m^3.

Toronto Uranium in Air Emissions						
Stack Description	**Emission Contaminant**	**Total Number of Samples**	**Action Level (µg/m^3) (# Samples Exceeding Level)**	**Highest Value Recorded (µg/m^3)**	**Average Value Recorded (µg/m^3)**	**Total Discharge (g)**
Rotoclone	Uranium	250	1.0 (0)	0.464	0.005	1.40
6H-68	Uranium	250	1.0 (0)	0.118	0.002	2.05
4H-48	Uranium	250	1.0 (0)	0.086	0.002	0.30
Furnace #1	Uranium	250	1.0 (0)	0.112	0.007	1.40
Furnace #2/4	Uranium	250	1.0 (0)	0.092	0.002	0.21
Furnace #5/6	Uranium	250	1.0 (0)	0.467	0.005	0.92

Table 37: Summary of Toronto Uranium in Air Emissions

	Toronto		
	2016	2017	2018
Number of Boundary Air Samples Taken	260	260	260
Number of Samples > Action Level (0.08 µg/m^3)	0	0	0
Average Concentration (µg U/m^3)	0.001	0.000	0.000
Highest Value Recorded (µg U/m3)	0.039	0.008	0.003

Table 38: Summary of Toronto Boundary Air Quality Monitoring

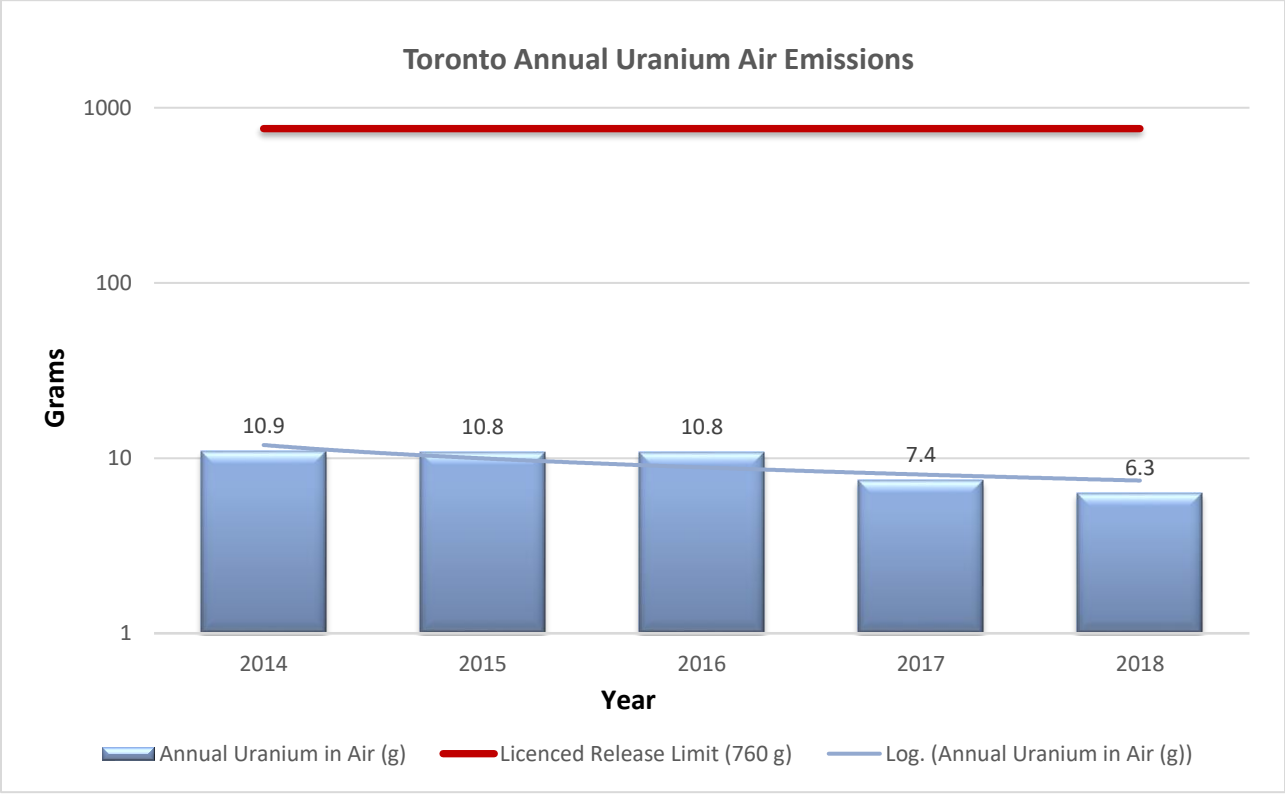


Figure 11: Toronto Annual Uranium Air Emission Trending

Note: the above graph has a logarithmic scale

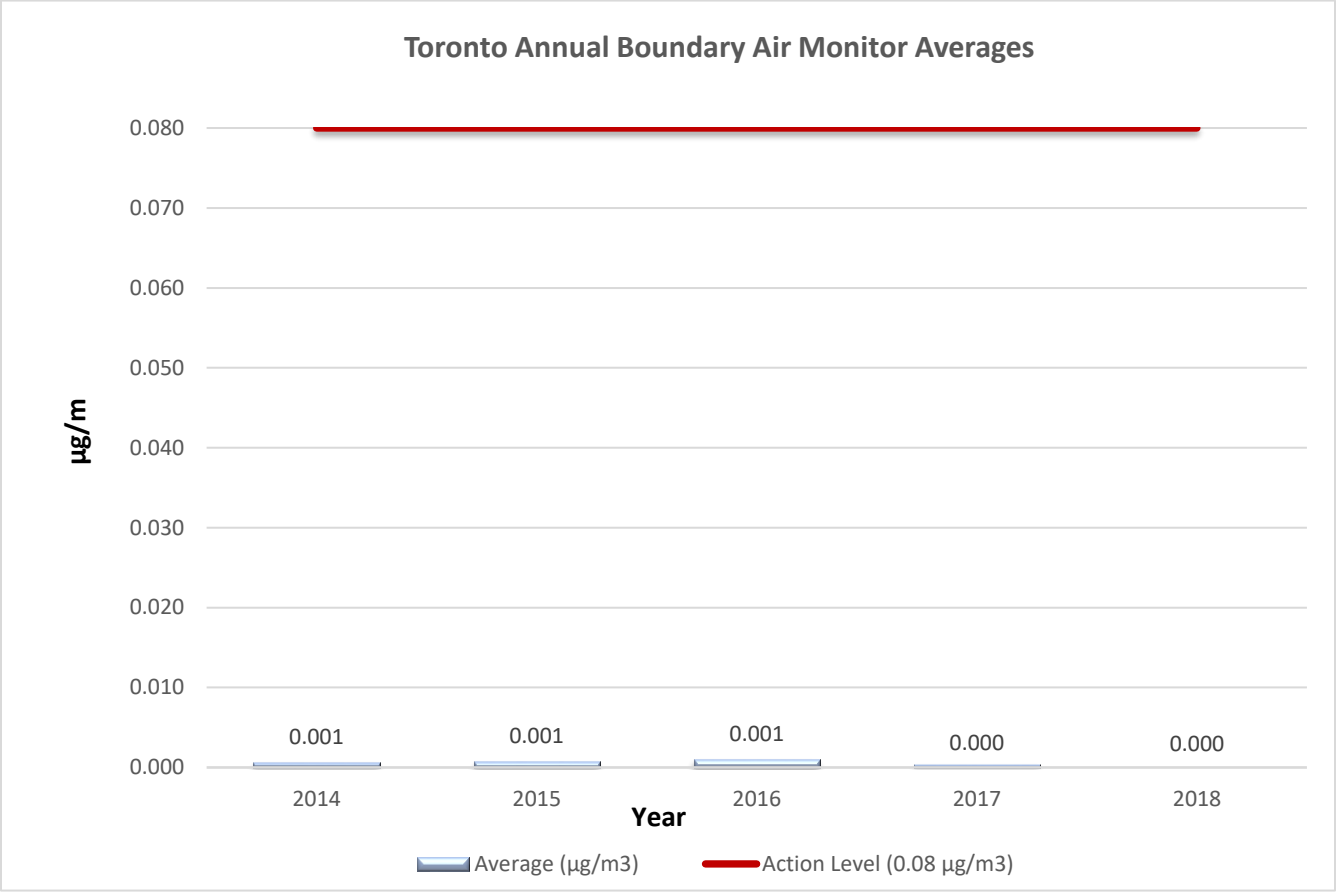


Figure 12: Toronto Annual Boundary Air Monitor Average Concentration Trending

3.9.4 Water Effluent Monitoring

3.9.4.1 Peterborough Water Monitoring

All potentially uranium-contaminated wastewater is held for determination of the quantity and concentration of uranium prior to discharge. Liquid waste generated from routine activities, such as washing floors, walls and equipment in the uranium pellet loading and end closure weld area, is held in a 205 Litre (45-gallon) drum stored in the maintenance area. Most of the potentially contaminated waste water originates from floor washing. The water is filtered prior to sampling, and then sent for independent analysis at an external laboratory. The minimum detectable concentration is 0.000002 mg U/L (parts per million (ppm)).

After the wash water sample result is verified to be below the Internal Control Level of 3 ppm and the Action Level of 6 ppm (per batch), the wash water is filtered again during discharge to the sanitary sewer. These concentrations are measured prior to additional filtering and dilution during discharge.

A second liquid effluent from the Peterborough facility is beryllium in water that is generated from equipment use and washing. BWXT NEC has established an Internal Control Level of 4 µg/L and an Action Level of 40 µg/L. The Internal Control Level is conservative and consistent with international drinking water guidelines for beryllium. All potentially beryllium contaminated water passes through a weir settling system prior to release to the sanitary sewer. Regular sampling of the beryllium wastewater is conducted. The water sample consists of a 24-hour composite sample taken from the

outflow lines. It is sent for analysis at an external independent laboratory. The minimum detectable concentration is 0.007 µg Be/L (0.000007 mg Be/L or parts per million (ppm)).

Beryllium average and maximum concentrations and Internal Control Level exceedances are trending down overall following the replacement of the weir settling system in December 2015. Where Internal Control Levels are exceeded, internal investigation is conducted and corrective/preventive actions are tracked to closure.

The five-year trend graph of uranium water releases shows a stable five-year performance consisting of very low water releases. The sample batch number size is limited and trending is difficult due to small random fluctuations in low concentrations. Water release results continue to remain low and below the Action Levels of 6 ppm (per batch) and 3 ppm (annual average). The total release of 0.01 g is a very small fraction of the derived release limit and of the regulatory discharge limit of 760 kg/year.

	Peterborough		
	2016	**2017**	**2018**
Total Amount of Liquid Discharged (L) from Uranium Processing Areas	820	820	820
Maximum Uranium Concentration in Undiluted Water (ppm)	0.48	0.09	0.03
Average Uranium Concentration in Undiluted Water (ppm)	0.15	0.04	0.02
Number of Samples Exceeding Action Level (6 ppm per batch)	0	0	0
Total Uranium Discharge to Sewer (g)	0.13	0.03*	0.01
Total Number of Samples Analyzed for Beryllium Concentration in Water	18	17	19
Maximum Beryllium Concentration in Water µg/L	2.5	5.4	2.5
Average Beryllium Concentration in Water µg/L	0.4	1.0	0.6
Number of Samples Exceeding Internal Control Level (4 µg/L)	0	2	0
Number of Samples Exceeding Action Level (40 µg/L)	N/A	N/A	0

Table 39: Peterborough Liquid Effluent Monitoring Results

*Total uranium discharge to sewer (g) for Peterborough was revised from 2017's annual compliance report to reflect actual discharge.

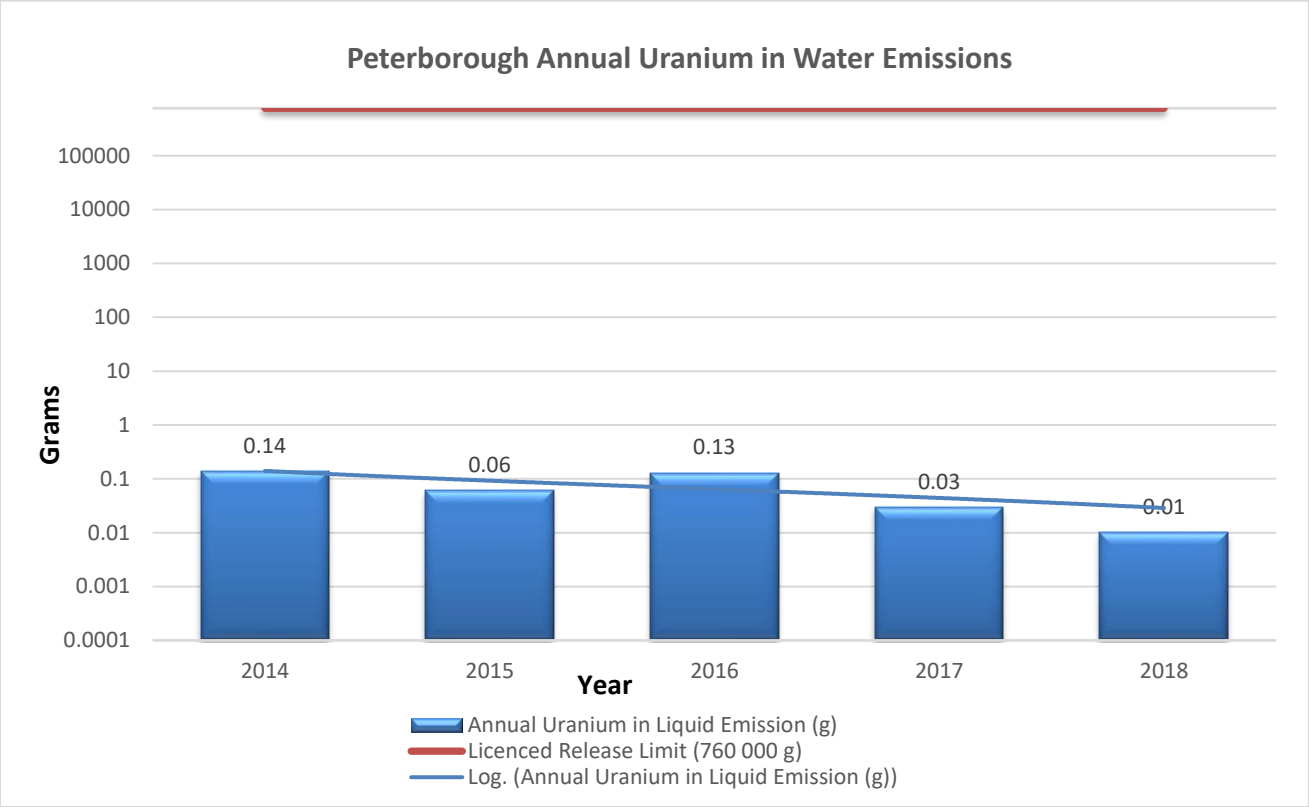


Figure 13: Peterborough Water Emission Trending

Note: the above graph has a logarithmic scale

3.9.4.2 Toronto Water Monitoring

In Toronto, water is used to clean protective clothing, walls, floors, equipment and in various other janitorial functions. The water is treated to remove UO_2 and the concentration of UO_2 in waste water leaving the treatment system is measured in-house. The concentration of UO_2 in the total waste water leaving the plant premises is calculated and compared to the Internal Control Level of 3 ppm and the Action Level of 6 ppm (per batch). Maximum values reported are calculated from the analyzed in-house samples. In addition, a weekly composite sample is prepared and sent for independent analysis at an external laboratory. The minimum detectable concentration is 0.000001 mg U/L or parts per million (ppm). Averages and annual releases are calculated from the weekly composite samples.

The water effluent treatment system at the Toronto facility operates as follows:

1. Waste water is held in batches
2. Each batch is treated, then sampled
3. Each batch is only released when in-house sample results confirm the concentration is less than 3 ppm (note: The Action Level for a batch is 6 ppm)

Results from water effluent monitoring are summarized in Table 40. Sample measurements are taken at the point of release, prior to mixing with non-process water. Annual discharges for uranium are trended in Figure 13 and Figure 14. Toronto liquid effluent releases are showing a stable trend over five years. Water release results continue to remain low and below the Action Levels of 6 ppm (per batch) and 3 ppm

(annual average). The total release of 0.94 kg during the reporting period is well below the derived release limit of 9000 kg/year.

	Toronto		
	2016	**2017**	**2018**
Total Amount of Liquid Discharged (L) from Uranium Processing Areas	1,239,375	1,140,225	1,295,560
Maximum Uranium Concentration at the point of release (ppm)	2.80**	2.56	2.95
Average Uranium Concentration in at the point of release (ppm)	0.81**	1.12	0.72***
Number of Samples Exceeding Action Level (6 ppm per batch)	0	0	0
Total Uranium Discharge to Sewer (g)	650	941	935
Minimum pH	6.7	6.1	7.1
Average pH	7.1	7.2	7.6
Maximum pH	7.7	7.8	8.7

Table 40: Toronto Liquid Effluent Monitoring Results

**Values are revised from 2016's annual compliance report to reflect undiluted concentrations; diluted concentrations included dilution of effluent within the plant sewer prior to entry to the municipal sewers and were previously reported in error.

***Values reported 2018 going forward are from external laboratory composite samples.

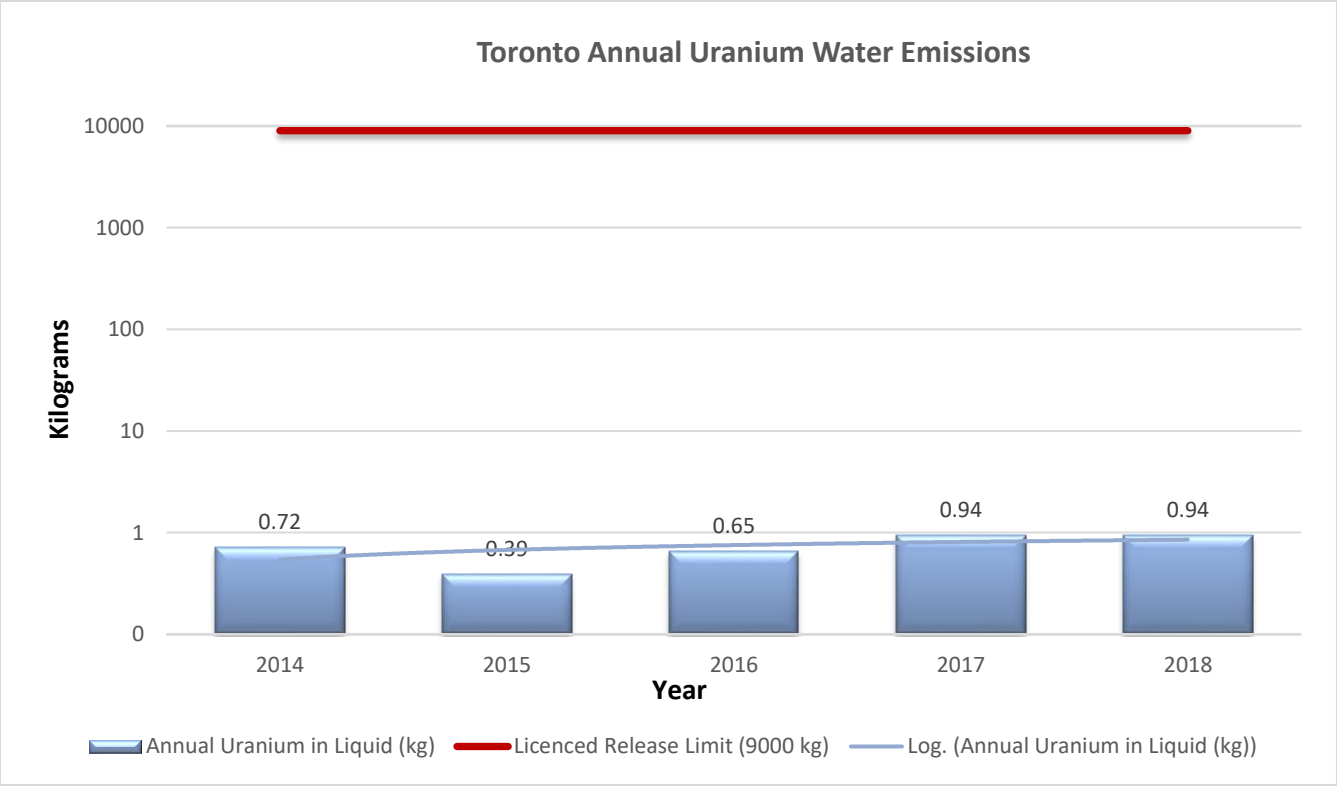


Figure 14: Toronto Water Emission Trending

Note: the above graph has a logarithmic scale

3.9.5 Soil Sampling Measurements/Monitoring

Uranium may be detected at low levels in various rocks, ores, soil, water, air and plants. In Ontario, background levels of uranium in soil are generally below 2.5 µg/g. The Canadian Council of Ministers of the Environment (CCME) have established soil quality guidelines to protect human health and the natural environment. The guidelines represent levels of uranium in soil below which no risk to human health is expected. For residential and parkland land use, the guideline is 23 µg/g; for commercial use, the guideline is 33 µg/g; for industrial land use the guideline is 300 µg/g. These guidelines have been adopted by the Ontario MOECP and are listed in Ontario Regulation 153/04. Uranium content in soil at concentrations higher than the MOECP standards suggest a need for further assessment, and mitigation of the source of the uranium to eliminate potential exposure and environmental impairment.

The facilities UO_2 air emissions are the primary pathway for potential release into the natural environment by impingement on the ground surface in the immediate vicinity of the facility depending on the wind direction. UO_2 is insoluble in water but may be washed into the soil by rainfall, snow, etc. Surface uranium levels will indicate deposited emissions. It is noted that the amount of uranium released through air emissions from both facilities in any year, based on actual measurements, is extremely low.

Depositions of uranium are measured by taking small samples of surface soil and analyzing for natural uranium. Soil sampling is not conducted at the Peterborough facility due to the negligible air release amounts. Soil sampling is conducted annually at the Toronto facility. If soil analysis indicates rising natural uranium levels, emissions may have increased and investigation is made into the cause(s).

At the Toronto facility, samples of surface soil are retrieved from 49 locations in accordance with a documented plan. The samples are analyzed by an independent laboratory by Inductively Coupled Plasma Mass Spectrometry for natural uranium in parts per million. The minimum detectable concentration is 1.0 part per million (1.0 µg U/g). Results are compared to previous years and the CCME guidelines. A summary of results taken in the reporting period is listed in Table 41. Each individual soil sampling result is listed in Table 42. Locations are colour coded per their area classification: BWXT NEC property is blue, industrial/commercial lands are purple, and all other locations are green. Note: location ID 39 and 40 were removed from the plan in 2013 because of inaccessibility due to construction.

	Location Description		
	On BWXT NEC property	**On industrial/commercial lands, i.e. south rail lands**	**All other locations, i.e. residential**
Relevant CCME Guideline (µg U/g)	**300 µg U/g**	**33 µg U/g**	**23 µg U/g**
Number of Samples Taken	1	34	14
Average concentration (µg U/g)	1.3	2.3	0.0
Maximum concentration (µg U/g)	1.3	11.9	1.0

Table 41: Toronto Soil Sampling Result Summary

Sample Location ID	Uranium Content (µg U/g)	% of guideline
1	<1.0	<4.3
2	<1.0	<4.3
3	1.3	0.4
4	<1.0	<3.0
5	1.3	3.9
6	4.7	14.2
7	7.1	21.5
8	2.9	8.8
9	3.0	9.1
10	1.4	4.2
11	3.3	10.0
12	1.6	4.8
13	2.1	6.4

Sample Location ID	Uranium Content (µg U/g)	% of guideline
14	8.1	24.5
15	2.9	8.8
16	2.8	8.5
17	11.9	36.1
18	<1.0	<3.0
19	<1.0	<3.0
20	1.5	4.5
21	1.1	3.3
22	4.5	13.6
23	1.1	3.3
24	<1.0	<3.0
25	2.2	6.7
26	5.0	15.2
27	3.1	9.4
28	1.1	3.3
29	<1.0	<3.0
30	<1.0	<3.0
31	1.5	4.5
32	1.8	5.5
33	1.2	3.6
34	<1.0	<3.0
35	<1.0	<3.0
36	<1.0	<4.3
37	1.5	<4.5
38	<1.0	<4.3
41	<1.0	<3.0
42	<1.0	<4.3
43	<1.0	<4.3
44	<1.0	<4.3
45	<1.0	<4.3
46	<1.0	<4.3
47	<1.0	<4.3

Sample Location ID	Uranium Content (µg U/g)	% of guideline
48	<1.0	<4.3
49	<1.0	<4.3
50	<1.0	<4.3
51	<1.0	<4.3

Table 42: Toronto Individual Soil Sampling Results

The analytical results for uranium concentrations for all soil samples analyzed are, without exception well below the acceptable standard published by the MOECP under Ontario Regulation 153/04 and CCME soil quality guideline. The results show a range of concentrations from <1.0 µg/g to 11.9 µg/g with 37 sample locations having reported uranium concentrations below the Ontario background concentration of 2.5 ppm.

It is noted that uranium content increased marginally compared to the 2017 results at 12 locations and decreased at 11 locations.

The results are similar to historical results, MOECP and the CNSC for soil samples collected during previous annual sampling events.

3.10 Emergency Management and Fire Protection

The emergency preparedness and fire protection programs are well-established and effective. Each facility has established emergency response plans that describe the actions to be taken to minimize the health and environmental hazards, which may result from fires, explosions, or the release of hazardous materials. The plans include effects to the local area and members of the public. The plans are intended to reduce the risk of fires within the facility and assist emergency staff and plant personnel in understanding key emergency response issues, and assist the facility in protecting employees, the local community and the environment through sound emergency management practices. The emergency response plans are developed in accordance with federal laws and standards as follows and meets the CNSC operating licence requirements:

- CAD/CSA-Z731-03, *Emergency Planning for Industry Standard*
- CNSC Regulatory Guide G-225, *Emergency Planning at Class I Nuclear Facilities and Uranium Mines and Mills*
- The Province of Ontario Nuclear Emergency Plan Part VIII
- Canada Labour Code
- CNSC Regulatory Document REGDOC 2.10.1, *Nuclear Emergency Preparedness and Response*
- NFPA 801, *Fire Protection for Facilities Handling Radioactive Materials*
- CSA N393-13, *Fire Protection for Facilities that Process, Handle, or Store Nuclear Substances*

Continuous improvement is achieved through several review processes, including site inspections, reported safety concerns, near miss and incident investigations, drills and self-assessments. Non-conformances tracked to closure.

In the reporting period, the CNSC conducted two Emergency Management and Fire Protection compliance inspections at the Toronto facility to assess compliance with specific clauses of the Nuclear Safety and Control Act, its associated Regulations, the operating licence, its associated licence conditions handbook, as well as BWXT's programs and procedures. The emergency management inspection also

reviewed the implementation and effectiveness of corrective actions that arose from enforcement actions from a previous emergency management inspection conducted at the Toronto Facility. As a result of the two inspections, there were four Action Notices issued. Two were related to fire doors, and two were related to documentation and record-keeping. There were no non-conformances noted with respect to the emergency exercise. Corrections actions were assigned and tracked to closure.

At the Toronto site, the emergency organization was activated during the reporting period. This was a result of a large rain event resulting in a loss of power with an excessive rate of surface water entering the freight elevator and flooding the basement of building 7. Approximately fifty drums of water were collected and diverted to the water treatment system for treatment, testing and release over several days. This event was reported to the CNSC in accordance with the site emergency plan.

3.10.1 Emergency Preparedness Program Activities

During the reporting period, the Peterborough site improved its chemical spill response plan. This was achieved through a review and update of spill kit contents, revised response plans for minor and major spills and implementing donning and doffing training for on-site emergency responders.

The Toronto site fully implemented its revised Emergency Response Program. Program improvements included the redistribution of roles and responsibilities, a clear definition of the command and control structure, and the development of detailed work instructions for response. A designated Emergency Operations Centre location was established and equipped with the tools and technology required to respond to an emergency event. Toronto Fire Services participated in joint emergency exercises throughout the year. The Canadian Nuclear Safety Commission conducted an emergency preparedness inspection at the Toronto facility where the improved emergency response program was exercised successfully.

Emergency preparedness training is achieved through response drills where actual responses are regularly critiqued to continually improve the effectiveness of the process. These are conducted at least annually. All employees are trained on established fire prevention measures, emergency situation responses, emergency evacuation routes and their responsibilities. Awareness training is conducted during new employee orientation and refreshed through response drills. On-site emergency responders are provided with the level of training necessary to allow them to effectively perform their designated services as defined in each facilities training matrix. Training course completion is summarized in Table 4.

Tests of the emergency response plans were performed in the following areas:

At the Peterborough site:

1. Fire safety/Evacuation (three)
2. Medical emergency (one)
3. Beryllium ventilation system failure (one)

At the Toronto site:

1. Fire safety/evacuation (three)
2. Emergency plan (four)
3. Medical emergency (one)

3.10.2 Fire Protection Program Activities

The documented fire hazards analysis (FHA) identifies the facility fire hazards and their potential impact on the worker and public safety and asset protection. The current FHAs, previously accepted by the CNSC, meets the required standards and remained in effect during the reporting period. The facilities maintain documented fire safety plans that are compliant with the National Fire Code of Canada, the National Building Code of Canada and NFPA 801, *Standard for Fire Protection for Facilities Handling Radioactive Materials*. The fire safety plans are based on the documented FHA and ensures that measures are appropriate to the facility. They provide information on resources in the buildings, emergency procedures and actions to be taken in the event of a fire. They include the training schedule, duties of designated personnel, details of maintenance procedures and fire protection measures. The information assists the occupants in utilizing life safety features in the buildings, ensure an orderly evacuation at the time of an emergency and provide a maximum degree of flexibility to achieve the necessary fire safety for the buildings.

Fire protection systems are inspected and tested in accordance with the National Fire Code of Canada following an established schedule. A third-party review and internal self-assessment is conducted annually at each site. Identified continuous improvements are tracked to completion using the ATS. As the primary responders for the facilities, site familiarization tours are scheduled annually with Peterborough and Toronto Fire Services.

During the reporting period, BWXT NEC worked with Peterborough Fire Service and Toronto Fire Services to establish a clear basis for contingency response planning between the organizations to deal with fire and rescue emergency situations at BWXT NEC. This facilitates effective communication and exchange of relevant information, and assures timely reliable, effective decision making and response actions. Site hazard reviews, and site familiarization tours are scheduled annually with Peterborough Fire Service and Toronto Fire Services.

Additionally, in Toronto, Fire Protection program documentation was separated from Emergency Plan documentation and updated to better align with *CSA N393-13, Fire Protection for Facilities that Process, Handle, or Store Nuclear Substances*. The Fire Hazard Analysis for both building 7 and building 9 were reviewed and updated in 2018.

Physical plant changes are periodically made to improve fire protection programs. In Toronto, minor changes to improve the fire protection program were implemented including the installation of a fire damper between adjacent production rooms, the installation of a fire door to replace a deficient door, and upgrading to fire rated glass on a door identified as not having the proper rated material.

3.11 Waste Management

The "Waste Management" Safety and Control Area covers internal waste and by-product related programs which form part of the facility's operations, up to the point where the waste is removed from the facility to a separate waste and by-product management facility. This Safety and Control Area also covers the ongoing decontamination and planning for decommissioning activities.

Radioactive wastes are any materials that contain a radioactive nuclear substance, and which have been declared to be waste. BWXT NEC has an effective and well-established radioactive waste disposal program that ensures all radioactive waste disposals are compliant with the Nuclear Safety and Control Act and Regulations and the facility operating licence conditions. Radioactive solid waste generated from fuel manufacturing, which consist of, or are contaminated by uranium are accumulated in controlled and classified areas. A low volume of radioactive wastes from Peterborough are transported to and consolidated with the Toronto facility wastes. These are combined, compacted for volume reduction where possible, and shipped routinely to a licensed radioactive waste disposal facility. In Toronto, only about

0.01% of the uranium that is processed ends up in waste streams. Nearly all nuclear material is used in the product or recycled back to the supplier.

The Peterborough site conducts an annual Waste Audit and Waste Reduction Work Plan in accordance with Ontario Regulation 102/94 under the Environmental Protection Act. This audit is not required at the Toronto facility. The audit serves to assess and advance the non-nuclear waste diversion initiatives and consists of the physical collection and sorting of generated waste and includes a waste composition study. It provides a prepared Waste Reduction Work Plan where areas of success are highlighted and opportunities for improvement are identified through waste reduction, reuse and recycling. The results of the audit are communicated to employees and waste reduction and diversion initiatives are undertaken.

In the reporting period, the MOECP conducted a routine inspection at the Peterborough facility to assess compliance with provincial environmental legislation regarding the generation and management of subject waste. The governing legislation includes the Environmental Protection Act and Regulation 347 titled "General - Waste Management". As a result of the inspection, there were no non-compliances or required actions.

Waste management and generation details are further described in Appendix B, submitted to the CNSC separately.

3.12 Security

The "Security" Safety and Control Area covers the programs required to implement and support the security requirements stipulated in the regulations and in the operating licence.

Each site maintains a well-established and documented security program that is in compliance with the CNSC Nuclear Security Regulations and fuel facility operating licence conditions. The program manuals identify the individual responsibilities for implementation and maintenance of the program. The manuals include instructions for administering the security program, provides the basis for security protocols and identifies the controls in place to meet regulatory requirements. Program details are prescribed information and confidential.

3.13 Safeguards and Non-Proliferation

The "Safeguards and Non-proliferation" Safety and Control Area covers the programs required for the successful implementation of the obligations arising from the Canada/IAEA Safeguards and Non-proliferation Agreement. BWXT NEC has implemented and maintains a safeguards program and undertakes all required measures to ensure safeguards implementation in accordance with IAEA commitments and CNSC regulatory document 2.13.1 *Safeguards and Nuclear Material Accountancy (which superseded RD-336 Accounting and Reporting of Nuclear Material)*. Movement of safeguarded nuclear material (inventory changes) are documented and reported to the CNSC as required.

In Peterborough, the Physical Inventory Taking was conducted on June 25, 2018. A Physical Inventory Verification and Design Information Verification involving the CNSC and the IAEA followed on June 26, 2018. The scope of the Physical Inventory Verification concerned book examination, physical verification of nuclear material and evaluation of the quality and performance of BWXT NEC Inc.'s measurement system. The scope of the Design Information Verification concerned verification of the facility, general building design, essential equipment, accounting procedures, operator's measurement system, nuclear material characteristics, nuclear material location & flow and operational status of the facility. Short Notice Random Inspections were conducted by the IAEA on May 3rd 2018 and November 15th 2018. The CNSC was in attendance during the May inspection. The inspection involved physical examination of bundle boxes, sampling and scanning of pellet skids and verification of records. No major non-conformances were noted.

In Toronto, the Physical Inventory Taking was conducted on June 27, 2018. A Physical Inventory Verification and Design Information Verification involving the CNSC and IAEA followed on June 28, 2018. The scope of the Physical Inventory Verification concerned book examination, physical verification of nuclear material and evaluation of the quality and performance of BWXT NEC Inc.'s measurement system. The scope of the Design Information Verification concerned verification of the facility, general building design, essential equipment, accounting procedures, operator's measurement system, nuclear material characteristics, nuclear material location & flow and operational status of the facility. Short Notice Random Inspections were conducted by the IAEA on February 15, 2018 and May 1, 2018. The CNSC was in attendance during the May inspection. The inspection involved sampling, measurements and verification of records. No major non-conformances were noted.

3.14 Packaging and Transport of Nuclear Substances

The "Packaging and Transport of Nuclear Substances" Safety and Control Area covers the packaging and transport of nuclear substances and other nuclear materials to and from the licensed facilities. In the reporting period, all packaging and shipments to and from both facilities were conducted safely according to relevant regulations. Shipments of dangerous goods are not routinely made from BWXT NEC by air, rail or water. Routine road shipments of both dangerous goods and non dangerous goods are made between suppliers, the Toronto plant, and the Peterborough plant and customer nuclear generating stations. Shipments of nuclear substances are only made to persons in Canada holding a valid CNSC licence to possess such substances (as required), or persons not in Canada, as approved by an Export Permit and/or Export Licence (as required).

The transportation of dangerous goods in Canada is regulated by Transport Canada through the Transportation of Dangerous Goods Regulations. Additional requirements for the transport of Class 7 radioactive materials is regulated by the CNSC through the Packaging and Transportation of Nuclear Substances Regulations. In addition, the IAEA has established uniform regulations for all modes of transportation throughout the world. The IAEA has published the Regulations for the Safe Transport of Radioactive Material and the CNSC has endorsed these through the Packaging and Transport of Nuclear Substances Regulations.

BWXT NEC has an established Emergency Response Assistance Plan compliant to Part 7 of the TDG. It is in place to ensure that timely and effective response protocols are in place with the intent to protect public safety, property and the environment in the event of an accident involving the transportation of natural or depleted UO_2. Transportation of uranium materials to and from BWXT NEC are included in the plan.

4 OTHER MATTERS OF REGULATORY INTEREST

4.1 Public Information Program

4.1.1 Employee/Internal Communications

BWXT NEC uses a variety of means to engage its ~400 employees in Peterborough, Toronto and Arnprior. The company uses the employee portal (intranet), electronic bulletin boards, email alerts and printed communications to issue company news, executive blogs and general business updates.

The president of BWXT NEC held all-employee meetings at all sites in the fourth quarter of 2018 and during the summer attends staff appreciation barbeques at all sites to provide general business updates, health, safety and quality performance, and to address employee questions.

4.1.2 Government Stakeholders

BWXT NEC places great importance on its relationships with all three levels of government in the communities in which it operates and works to ensure there is open communication and awareness of BWXT NEC's operating activities.

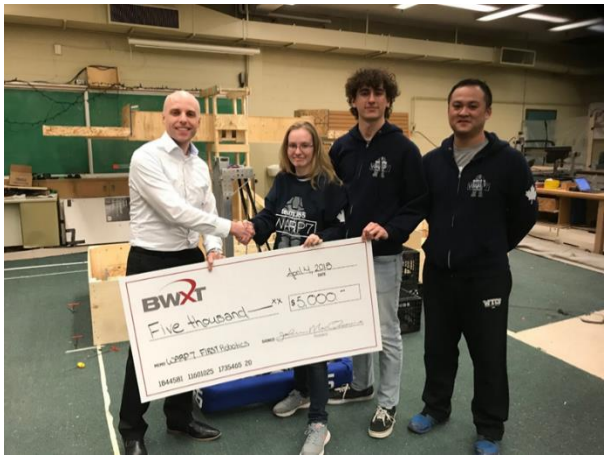
In 2018, BWXT NEC mailed its spring community newsletter and annual compliance report to the Member of Parliament (MP) and Member of Provincial Parliament (MPP) for Peterborough-Kawartha, MP and MPP for Davenport, Mayor and Councillors for Peterborough and Councillor for Davenport. Copies of the spring newsletter and annual compliance report were also sent to Toronto Public Health. In July of 2018, BWXT NEC issued congratulatory letters to the newly elected MPPs for Peterborough and Davenport and the Ontario Minister of Energy. All three communications included a brief overview of our company along with an invitation to tour our facilities and to get to know BWXT NEC better.

In July, BWXT NEC officials addressed the Toronto Board of Health at Toronto City Hall and in late September, BWXT NEC's president met with the MP for Davenport to provide an update on BWXT NEC operations in Toronto.

4.1.3 Community Volunteerism

BWXT NEC remains active in the community through its BWXT Volunteer Strong program. In 2018, BWXT NEC employees volunteered at 13 community events in Peterborough. These events included: Little Lake Shoreline Clean-Up, Ontario Turtle Conservation Centre, Big Brothers Big Sisters, Greenwing Fishing Derby, Earth Day Super Spring Clean-Up, Canadian Cancer Society's Dragon Boat Race, Daffodil and Pink Ribbon fundraisers, the Peterborough Regional Science Fair, Kawartha Food Share Food Drive, James Fund Walk and Run, Canadian Canoe Museum, Five Counties Winterfest, Canadian Blood Services, and Angel Tree. BWXT NEC volunteers helped make these events a success in the Peterborough community and support our key pillars of focus for the community, which include education, health & wellbeing, arts & culture, environment and Indigenous relations.

4.1.4 Community Investment



In Peterborough, BWXT NEC made charitable contributions to Big Brothers Big Sisters, The Canadian Cancer Society, Fleming College, Kenner Collegiate, Adam Scott Collegiate and Vocational Institute, Greenwing/Ontario Federation of Anglers and Hunters, Five Counties Children's Centre, Kawartha Food Share, Canadian Canoe Museum and Kinark Child & Family Services.

In Toronto, BWXT NEC made charitable contributions to the Toronto District School Board's Western Technical Commercial School for both their FIRST Robotics Program as well as a bursary award. BWXT NEC also made charitable

contributions to the Davenport-Perth Neighbourhood & Community Health Centre and The Stop Community Food Centre on Davenport Road.

4.1.5 Tours

BWXT NEC provides facility tours to help engage members of the industry and the public in an effort to better understand our business. In 2018, BWXT NEC provided facility tours to Professional Engineers of Ontario, University of Ontario Institute of Technology, North American Young Generation in Nuclear, Ontario Power Generation and Ontario Flying Farmers.

While BWXT NEC offered tours to our local elected officials in May and again with newly elected members of provincial parliament in July, the company did not receive any requests for tours from elected officials in 2018.

4.1.6 Community Barbeques

Community barbeques were held in Peterborough on June 21, 2018 and in Toronto on June 27, 2018. The barbeques provide a means to engage neighbours, community members and other stakeholders, and to educate them about our business. Over 200 members from each community attended the barbeques that were staffed by BWXT senior leaders and managers. Posters were displayed to share visuals and information about BWXT NEC's capabilities, safety and compliance, public information program and facts about natural uranium.

4.1.7 Community Newsletters

BWXT NEC distributes, and posts to its website, community newsletters as a tool to share information with the local communities about the company's operational performance, health and safety, activities in the community and general information.

Three newsletters were issued to both the Toronto and Peterborough surrounding communities in May, September and December of 2018 and were also posted to our public information website. In both communities, distribution increased to 2,500 residents around our facilities compared to approximately 2,000 in Toronto and 1,500 in Peterborough in 2017.

4.1.8 Community Liaison Committee - Toronto

The Toronto Community Liaison Committee (CLC) was established in 2013 and meets four times per year at the Toronto BWXT NEC facility in the evenings. The CLC is a forum for the exchange of information between the community and BWXT NEC and allows members to bring forward questions, discuss concerns and identify opportunities to improve community relations.

BWXT NEC held a new member orientation on April 3rd and met with the CLC on April 12th, June 13th, October 11th and December 11th of 2018. Meeting records are posted to the company's website.

In 2018, members met with BWXT NEC staff to discuss the facility's operations and received updates on topics such as Indigenous relations, the annual compliance report, emergency preparedness, community initiatives and BWXT NEC's application for relicensing.

Guest speakers to the CLC in 2018 included an official from Ontario Power Generation in June, an official from Bruce Power in October and two officials from the CNSC in December.

In 2018, the CLC had a membership of five and the company launched a recruitment campaign in the fall of 2018 to attract new members for which two applications were received in December of 2018. Both applications were accepted upon review and will join the committee in 2019.

4.1.9 Public Attitude Surveying

In October and November of 2018, a 10-minute survey, conducted either online or by telephone was performed among residents of Toronto and Peterborough who live in proximity to BWXT NEC facilities. BWXT NEC also mailed postcards with an invitation to complete the survey online to neighbourhoods in proximity to the Toronto and Peterborough facilities.

The survey explored participants' familiarity with and impressions of BWXT NEC. The survey also explored participants' support for and understanding of various sources of energy, including nuclear power.

The objective of the survey was to understand residents' awareness and opinions regarding BWXT NEC's operations in their local communities. The results of the survey will provide BWXT NEC with a perspective for making improvements in its public outreach initiatives, which will be measured against the baseline data generated.

4.1.10 Website

BWXT NEC has a dedicated public information website, located at www.nec.bwxt.com.

The website provides information about the company's operations and activities that can be accessed by members of the public and other key stakeholders 24/7.

In 2018, there were 8,100 total sessions from 6,380 users. Top pages visited were: Home page (45 per cent of all unique page views), Contact Us (9 per cent) and What We Do (6 per cent).

Over the course of 2018, new information was regularly updated on the website. The following represents some of the updates that were posted:

- OPG contract award news release
- Copies of the Toronto (three) and Peterborough (three) newsletters
- Emergency Preparedness Drill Announcements
- Community barbeque information
- Notice of annual public meeting

4.1.11 Information Brochures

BWXT maintains public information brochures for the Peterborough and Toronto sites. These brochures are available at both sites for use during tours and meetings and are also posted on our public website. Brochures are used as information tools at community events like job fairs and community barbeques.

4.1.12 Public Inquiries

Members of the public can contact the company by dialing a toll-free number, 1-855-696-9588 and/or emailing questions@bwxt.com. These contact details appear on BWXT NEC's website and in community newsletters and public information brochures.

In 2018, 322 emails were received by questions@bwxt.com, the majority of which were spam, solicitations, job seekers or agencies seeking employment verifications. Calls to the toll free number were

primarily related to employment verification or customs clearance requests with approximately ten calls and six emails relating to either community giving or public/media relations.

All emails and calls to the information line were appropriately handled and addressed.

4.1.13 Earned Media

In 2018, BWXT NEC issued one news release on March 12 regarding the contract extension of nuclear fuel manufacturing for Ontario Power Generation.

BWXT NEC was also mentioned in three Peterborough news articles regarding the GE facility (January, March and December). References to BWXT NEC in these articles covered the fact that it will continue to operate at its current location and is not impacted by the activity at GE.

Overall, media coverage in 2018 was neutral/positive.

4.1.14 Social Media

BWXT NEC leverages BWX Technologies' social media channels, which include Twitter, Linked-In and Facebook, to share information about BWXT NEC activities. In 2018, BWXT NEC issued 25 social media posts including nine job openings, three employee profiles, two news items, eight community event notifications and three company capability profiles.

4.1.15 Public Disclosure Protocol

BWXT NEC has a Public Disclosure Protocol in place that sets guidelines to providing timely information to interested members of the public and other stakeholders. This Protocol and any Public Disclosures issued by BWXT NEC can be found at www.nec.bwxt.com under the Community tab.

In 2018, five Public Disclosures were made, two at the Toronto location and three at the Peterborough site.

The Disclosures made related to Toronto were:

- Aug. 8 – Activation of emergency plan in response to extended power outage
- Nov. 14 – False alarm from inadvertent activation of an elevator emergency call button

The Disclosures made related to Peterborough were:

- Feb. 16 – Small leak of oily water
- Apr. 3 – False alarm due to sprinkler alarm with no sprinkler activation
- Dec. 6 – Unusual odour observed as a result of routine maintenance work conducted on the roof

4.1.16 Indigenous Relations

BWXT NEC has been a member of the Canadian Council of Aboriginal Business (CCAB) since September of 2017 and is currently Progressive Aboriginal Certified (PAR) at the committed level. This signifies BWXT's commitment to continual improvement in Indigenous relations and intention to undergo external verification of performance in the future.

The BWXT PAR Committee meets regularly to review objectives outlined in the PAR criteria as the company works to find ways to strengthen its ties with Indigenous communities.

BWXT NEC's local Indigenous communities were identified and contacted with an introductory letter in April of 2018 and again in December of 2018 to inform them about our application for relicensing.

The company is also an active member within the Indigenous Relations Suppliers Network, established by Bruce Power.

The company sponsored the Saugeen Ojibway Nation's Youth Leaders in Training Dinner in March of 2018, and a BWXT NEC representative attended the Organization of Canadian Nuclear Industries First Nations, Métis and Inuit Engagement Workshop in May of 2018. In July, BWXT NEC sponsored the Métis Nation of Ontario's National General Assembly. In October, BWXT NEC also attended the CCAB's Indigenous Relations Supplier event.

Overall, the CCAB PAR program supports BWXT NEC's commitment to engaging Indigenous communities and building and sustaining meaningful long-term relationships with them. More information on BWXT NEC's commitment to Indigenous relations, including our policy, can be found at www.nec.bwxt.com under the Communities tab.

4.2 Financial Guarantees

Preliminary decommissioning plans are in place and routinely updated in accordance with facility operating licence conditions and CNSC guidance document G-129, *Decommissioning Planning for Licensed Activities*. Plans are in place to ensure forethought for materials and waste management, radiological surveys, conventional health, safety and security, emergency response, quality assurance, financial guarantees, environmental assessment and final end-state reporting in the event of future site decommissioning activities.

In accordance with CNSC guidance document G-206, *Financial Guarantees for the Decommissioning of Licensed Activities* BWXT NEC currently maintains a letter of credit for the full preliminary decommissioning plan amount. Plan updates are required at least every 5 years.

4.3 Improvement Plans and Future Outlook

BWXT NEC remains committed to continuously improve our EHS programs to improve efficiency and minimize risk to employees, the public and the environment. Facility operations are projected to remain constant in 2019. Fuel production levels are projected to be similar to the amount processed in 2018.

The facility operating licence remains valid until the end of 2020. In November of 2018 BWXT NEC submitted an application to the CNSC to renew its Class 1B operating licence for a period of 10 years. BWXT NEC is seeking one change to its licence with regard to pellet manufacturing operations. BWXT NEC is seeking the flexibility during the proposed next 10-year licence period to permit BWXT NEC to produce natural uranium pellets at both the Peterborough and Toronto facilities. While there is currently no plan to change the existing state of operations, including the flexibility to allow BWXT NEC's Peterborough facility to conduct pelleting will help to ensure that BWXT NEC has the ability to adapt as needed to changing business needs over the decade-long licence period.

The following additional improvements are planned for the next year:

- Improvements to the vendor management program.
- Improvements with respect to the Hazard Prevention Program.
- Revision of the Emergency Plan at the Peterborough facility.
- Reduce potential for repetitive injury in the Sort and Stack operation (Toronto).

5 CONCLUDING REMARKS

BWXT NEC is committed to the establishment and continuous improvement of a healthy Safety Culture. Safety Culture refers to the core values and behaviours resulting from a collective commitment by our company's leaders and individuals to emphasize safety, quality, ethics, and security over competing goals to ensure protection of employees, the public and the environment. It is a top business priority to continuously improve our EHS systems to protect fellow employees, the environment, and our communities against environmental, health and safety hazards. BWXT NEC management recognizes, reviews, prioritizes and controls workplace hazards and ensures compliance with applicable regulatory requirements, applicable codes and company policies.

Governed by an integrated management system, conventional health and safety, radiation protection programs and environmental protection programs are well implemented. All radiation dose measurement results were below Internal Control Levels, Action Levels and regulatory limits. Environmental protection programs are well implemented. There were no significant environmental issues or incidents encountered during the reporting period. Facility emission results were very low and below Action Levels and regulatory limits. Annual releases to the air and water were both a very small fraction of regulatory limits, resulting in minimal dose to the public.

All production and possession limits were respected. Transportation of dangerous goods was conducted safely between suppliers, customers and waste vendors without risk to workers, the public or the environment.

This annual compliance monitoring and operational performance report demonstrates that BWXT NEC has successfully met the requirements of the Nuclear Safety and Control Act, Regulations and CNSC Class IB nuclear facility operating licence requirements.