Nuclear Energy Canada Inc.

January 1 to December 31

2016

The information contained in this report concerns the performance and operation of BWXT Nuclear Energy Canada Inc.'s (BWXT NEC) Class 1B 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 shows adherence to the BWXT NEC commitment to operate safe Class 1B 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 and Date	Approved by and Date
00	Initial Issue	S. Rheubottom 2017-03-30	D. Snopek 2017-03-31

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1 EXECUTIVE SUMMARY

BWXT Nuclear Energy Canada Inc. (BWXT NEC), (formerly known as GE-Hitachi Nuclear Energy Canada Inc.), 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 1B 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 1B 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 1 A & B Nuclear Facilities*. It has been divided into two parts to separate worker protection from public and environmental protection. 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. To demonstrate commitment and ensure compliance, BWXT NEC maintains the following external registrations:

- International Standards Organization (ISO) 9001:2008 Quality Management System
- Canadian Standards Association (CSA) Z299.1-1985 Quality Management System
- ISO 14001:2004 Environmental Management System

BWXT NEC has established facility specific CNSC approved A*ction Levels* for various radiological and environmental parameters. An A*ction 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.

Employee workplace 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*.

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 A*ction Levels* and annual releases were a very small fraction of regulatory limits.

During the reporting period, BWXT Canada Ltd. (BWXT Canada), a subsidiary of BWX Technologies Inc, completed its acquisition of GE Hitachi Nuclear Energy Canada Inc. The licensee now operates under the name BWXT Nuclear Energy Canada Inc. (BWXT NEC) as a subsidiary of BWXT Canada. 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 BWXT NEC's facilities are assessed through the approved Change Control program.

Each facility has established emergency response plans 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 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 facilities in protecting employees, the local community and the environment through sound emergency management practices. The emergency response plans fulfil the CNSC operating licence requirements and the following standards or guides:

1. CAD/CSA-Z731-03, *Emergency Planning for Industry Standard*
2. NFPA 801, *Fire Protection for Facilities Handling Radioactive Materials*
3. CNSC Regulatory Guide G-225, *Emergency Planning at Class 1 Nuclear Facilities and Uranium Mines and Mills*
4. The Province of Ontario Nuclear Emergency Plan Part VIII
5. Canada Labour Code
6. CNSC Regulatory Document REGDOC 2.10.1, *Nuclear Emergency Preparedness and Response*
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 RD-336 *Accounting and Reporting of Nuclear Material*. Movement (inventory changes) of natural and depleted uranium are documented and reported to the CNSC as required. Verifications were conducted jointly by the IAEA and the CNSC.

BWXT NEC safely transports Class 7 radioactive material shipments as defined by the *Transportation of Dangerous Goods (TDG) Act and Regulations*. Shipments occur routinely between the uranium powder supplier and the Toronto and Peterborough facilities, customers and waste vendors. A minor non-compliance occurred for a Class 7 shipment from Peterborough to Toronto with respect to classification. There was no impact to any employee, the public or the environment as a result of the miss. All other shipments occurred in accordance with TDG Regulations, CNSC Packaging and Transport of Nuclear Substances Regulations and IAEA Regulations for the Safe Transport of Radioactive Material as applicable.

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, and keeping all environmental impacts well within applicable standards and as low as reasonably achievable.

The public information program defines the process for providing information about BWXT NEC operations to interested members of the public. 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 report demonstrates that BWXT NEC has successfully met the requirements of the Nuclear Safety and Control Act, Regulations and CNSC Class 1 B nuclear facility operating licence requirements.

TABLE OF CONTENTS

FIGURES

TABLES

2 INTRODUCTION

BWXT Nuclear Energy Canada Inc. (BWXT NEC) (formerly known as GE-Hitachi Nuclear Energy Canada Inc.) 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 1B nuclear facility operations. 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 Ave., and produce and test fuel bundles in Peterborough at 1160 Monaghan Rd. 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.

As a nuclear facility, BWXT NEC is federally regulated for health and safety. The federal health and safety legislation is commonly referred to as Canada Labour Code (CLC) Part II and regulations. The CLC is enforced by Employment and Social Development Canada (ESDC). BWXT NEC facilities are also regulated federally by Transport Canada. BWXT NEC is additionally regulated provincially by the Ontario Ministry of the Environment and Climate Change (MOECC). Compliance to these agency requirements is ensured through management systems, company policies and the following external registrations:

1. International Standards Organization (ISO) 9001:2008 Quality Management System
2. Canadian Standards Association (CSA) Z299.1-1985 Quality Management System
3. ISO 14001:2004 Environmental Management System

BWXT NEC's 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 safety goals and objectives established for the reporting period and the corresponding results are in Table 1.

Goal	Peterborough Results	Toronto Results
Injury rate <0.4	Achieved	Not Achieved
Days away from work rate <0.2	Achieved	Achieved
Zero notice of violation, penalties, permit misses, reportable releases	Not Achieved	Achieved
All EHS findings tracked in Action Tracking System; 95% closed on time (30-days regulatory, non-regulatory 90 days)	Achieved	Achieved
100% completion Environment Health and Safety regulatory training	Achieved	Achieved
100% power audits complete by November 30, 2016	Achieved	Achieved

Table 1: Primary Environment, Health and Safety Goals

The primary facility potential hazard 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 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 BWXT NEC A*ction Levels* and regulatory limits.

Air and water emissions are routinely measured to demonstrate compliance with the Canadian Nuclear Safety Commission's environmental protection requirements and the ALARA principle. All measurements were below BWXT NEC A*ction Levels* and annual releases were a small fraction of regulatory limits. Because of the very low potential for releases, environmental monitoring is not required at the Peterborough facility.

During the reporting period, BWXT Canada Ltd. (BWXT Canada), a subsidiary of BWX Technologies Inc, completed its acquisition of GE-Hitachi Nuclear Energy Canada Inc. The licensee now operates under the name BWXT Nuclear Energy Canada Inc. (BWXT NEC) as a subsidiary of BWXT Canada.

Production operations continued routinely, without any significant challenges. Natural uranium dioxide pellets were shipped to BWXT NEC's facilities without incident. They were assembled into CANDU reactor fuel bundles in Peterborough and were then safely shipped to customers. EHS Work Permits were issued for the receipt of potentially contaminated equipment from Nuclear Reactor Sites for repair or modification at the Peterborough facility. These tasks were carried out safely and successfully with the involvement of the EHS department.

Table 2 defines the acronyms used in this report.

Acronym	Definition
AED	Automated External Defibrillator
ALARA	As Low as Reasonably Achievable (social and economic factors considered)
ATS	Action Tracking System
BMS	Business Management System
BWXT NEC	BWXT Nuclear Energy Canada Inc.
CANDU	Canadian Deuterium Uranium
CCME	Canadian Council of Ministers of the Environment
CLC	Canada Labour Code
CNSC	Canadian Nuclear Safety Commission
CPR	Cardiopulmonary Resuscitation
CSA	Canadian Standards Association
CTS	Critical-to-Safety
dpm	Disintegrations per minute
EHS	Environment, Health and Safety
EMS	Environmental Management System – ISO 14001
ESDC	Employment and Social Development Canada
ESA	Electrical Safety Authority

Acronym	Definition
GE	General Electric
GEH-C	GE-Hitachi Nuclear Energy – Canada Inc.
IAEA	International Atomic Energy Agency
ICL	Internal Control Level
ISO	International Standards Organization
MOECC	Ministry of the Environment and Climate Change
MP	Member of Parliament
MPP	Member of Provincial Parliament
mSv	milliSievert – unit of measure for radiation dose
NEW	Nuclear Energy Worker
NFPA	National Fire Protection Association
ppm	Parts per million
QA	Quality Assurance
QALA	Quality Assurance for Licenced Activity
RSI	Radiation Safety Instruction
SAT	Systematic Approach to Training
SSC	Systems, structures and components
TDG	Transportation of Dangerous Goods
TLD	Thermoluminescent Dosimeter
TSSA	Technical Standards & Safety Authority
UO_2	Uranium Dioxide
WSC	Workplace Safety Committee

Table 2: Definition of Acronyms

PART I: WORKER PROTECTION

3 FACILITY OPERATIONS

During the reporting period, BWXT Canada Ltd. (BWXT Canada), a subsidiary of BWX Technologies Inc., completed its acquisition of GE-Hitachi Nuclear Energy Canada Inc. The licensee now operates under the name BWXT Nuclear Energy Canada Inc. (BWXT NEC) as a subsidiary of BWXT Canada.

The following key position changes occurred:

- The President remains Mark Ward, who continues to have overall responsibility for BWXT NEC. His role now includes responsibility for BWXT Canada Cambridge operations.

During the reporting period, the following modifications were made to the company organization structure:

- In April 2016, the Senior EHS & Regulatory Manager resigned from the company and was replaced by David Snopek, a company veteran. His title is now the Director, EHS & Regulatory and he is the licencing authority. His role now includes the BWXT Canada Cambridge, ON facility.
- In October 2016, the Manager Quality Assurance & Six Sigma retired and was replaced by a company veteran who was the Arnprior site Quality Assurance Manager. His role now includes the BWXT Canada Cambridge, ON facility.
- In December 2016, the organization structure was revised to integrate BWXT NEC with BWXT Canada. This resulted in some changes to job titles and roles. The revised organization structure has been provided to the CNSC separately.

BWXT NEC plant operations continued safely during the reporting period. Plant personnel followed procedures satisfactorily, as reflected in internal and external audits, self-assessments, radiation surveys and air sampling measurements. Details are provided in subsequent sections of this report.

During the reporting period, there were no major modifications to either facility.

BWXT NEC maintains five EHS related committees that review high risk activities and/or 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.
- 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.

In accordance with EHS program requirements, registrations and certifications, internal audits are conducted annually to assess conformance to internal and external requirements. A total of 16 internal audits were

conducted. There were nine external agency inspections. This included inspection by the CNSC and IAEA. Details on the scope and findings are provided in subsequent sections of this report.

4 PRODUCTION

All possession and 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 C. There was a one-week production shutdown in the first quarter, a three-week production shutdown in the third quarter and a two-week production shutdown in the fourth quarter for both sites. Production shutdowns are for engineering projects and equipment maintenance.

A small amount of uranium contaminated waste from the Peterborough facility is sent to the Toronto facility where it is combined with a larger volume and shipped together to an approved radioactive waste 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. Waste generation details are provided in Appendix C and submitted to CNSC separately.

5 FACILITY MODIFICATIONS

Changes made to the physical facilities, equipment, processes, procedures or practices that could impact product quality or employee health and safety or the environment or the public as a result of the operation of BWXT NEC's facilities are assessed through the Change Control program. Changes that occurred during the reporting period are summarized in section 6.4.2. No major modifications occurred that would affect the safety analysis of the facilities.

6 SAFETY AND CONTROL AREAS

6.1 Management

6.1.1 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 licenced activity, which ensures applicable buildings and facilities, process equipment, and processes used in support of licenced activities are conducted in accordance with the Nuclear Safety Control Act and Regulations, applicable CNSC Quality Assurance (QA) requirements, jurisdictional requirements and compliance best practices.

The program management system implementation and effectiveness review is scheduled for April to review the previous calendar year. The following elements are reviewed:

- Evaluation of the effectiveness and continuing suitability of the EHS Mission Statement and the Health and Safety Program;
- Results of external agency audits where applicable;
- Results of QA for licenced 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 Health and Safety and ALARA Committee (where applicable) objectives and targets have been met;
- Changing circumstances and recommendations for improvement;
- Follow-up actions from previous management reviews.

The above inputs are reviewed to ensure the management system's continuing suitability, adequacy and effectiveness. 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. The previous management review meeting resulted in six actions that were formally issued for follow-up by the applicable functional lead(s), and tracked to closure. Overall, the implemented quality assurance for licenced activity program was considered suitable, adequate and effectively implemented in Toronto and Peterborough. Continuous improvement remains a priority.

6.1.1.1 Management System Program Improvements

All management system documentation required in licence condition 2.1 is in place. Continuous improvements to the documented management system are ongoing. The EHS Policy, in place since 2012, has been continued by BWXT NEC. In 2016, in addition to administrative edits, several minor continuous improvements were made to management system program elements as follows:

- The Business Management System Manual was updated to include Nuclear Safety and Security Culture;
- The Change Control program was improved to include the requirement for change control to be applied as follows:
  - Software that determines compliance to regulatory or licence requirements
  - Software that determines compliance to fuel manufacturing customer quality requirements (e.g. drawings, specifications, contracts)
  - Security (physical and information).

6.1.1.2 Licenced Activity Related Audits

Table 3 provides a summary of internal audits conducted in the reporting period. The summary does not include internal audits that form part of the International Standards Organization (ISO) 9001/Z299 system which have a product focus but do share some overlap with safety, e.g., management system, documentation, training etc.

BWXT NEC did not conduct any external audits of other facilities during the review period which relate to the licenced activities at the facility.

Audit Type	Peterborough		Toronto	
	Number of Audits	Number of Non-conformances	Number of Audits	Number of Non-conformances
Compliance (Power Audits)	5	0	5	0
Quality Assurance for Licenced Activity	2	3	2	3
Environmental (14001)	1	1	1	0
TOTAL	8	4	8	3

Table 3: Summary of Internal Audits

6.1.1.3 Licenced Activity Related Self-Assessments

The Management Self-Assessments procedure was improved with respect to scheduling and performance. Table 4 provides a summary of self-assessments conducted in the reporting period.

Program Element	Peterborough		Toronto	
	Number of Self-Assessments	Number of Findings	Number of Self-Assessments	Number of Findings
Calibration Program (product quality scope)	1	0	1	1
Radiation Protection	1	2	1	7
Emergency Preparedness and Response	1	0	1	4
Procurement (product quality scope)	1	8	1	7
Environmental Protection	1	0	1	6
Change Control	1	2	1	2
Waste Management	1	0	1	4
Training (fuel shop on the job training scope)	1	0	0	0
TOTAL	8	12	7	31

Table 4: Summary of Self-Assessments

6.2 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 Licenced Activity Quality Assurance Manual, the Radiation Protection Manual and the Health and Safety Manual. 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. Both facilities achieved 100% regulatory training completion in the reporting period. The Training Tracker Tool in Gensuite® tracks EHS-related training. Gensuite is a suite of award-winning, integrated Web applications enabling compliance and EHS excellence. Specific course completion details are provided in subsequent sections of this report.

Following the implementation of the Systematic Approach to Training (SAT) program in 2015, the focus in 2016 was the application of SAT to new and legacy training. Programs that include personnel who may be required to perform duties that affect safety have been prioritized and those brought into compliance with SAT include:

- Training on knowledge areas such as Fuel Shop Hazards Awareness, EHS Orientation, Foreign Material Exclusion, Fuel Internal Auditing
- Training on tasks such as First Aid/Automated External Defibrillator/Cardiopulmonary Resuscitation, Aerial Lift, Fall Arrest, Overhead Cranes
- Training for roles such as EHS Specialist, Fuel EHS Technician, Fuel Maintenance Technician, Fuel Metallurgical Lab Technician, Fuel Operator & Inspector, Fuel Quality Technician, and Fuel Ultrasonic Test & Metrology Quality Technician

Implementation of the SAT principles to existing and new training roles and programs continues into 2017.

The facilities are staffed with a sufficient number of qualified workers as well as the minimum number of responsible people to carry on the licenced 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.

6.3 Operating Performance

The "Operating Performance" Safety and Control Area covers an overall review of the operations licenced activities. Management conducts routine meetings to review operations at each facility including a discussion of health and safety concerns. Health and safety related employee concerns and actions are assigned and tracked in the Gensuite software system and is a measure of employee engagement.

Operating performance is monitored with key performance indicators and program goals. In accordance with EHS program requirements, registrations and certifications, internal audits are conducted annually to assess conformance to internal and external requirements. Related licenced activity audits are summarized in Table 3 and section 6.1.1.2 above. There were nine external agency inspections, including those by the CNSC and IAEA.

6.4 Facility and Equipment

6.4.1 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 a proposed 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 licenced facility.

Modifications to the facility are made in accordance with BMS-P-008 *Change Control*, which requires review of environment, health and safety 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.). 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.

6.4.2 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 or employee health and safety or 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 through this program, including third-party reviews as required. Adequate mitigations can then be applied including modification of the proposed change, up to rejection of the proposed change.

The following significant improvements to the physical plants have been implemented during the reporting period:

- Furnace filter housing systems were replaced (Building 7 Toronto)
- Replacement of laundry room air conditioning unit (Building 7 Toronto)
- Noise abatement of two external air conditioning/exhaust systems (Building 7 Toronto)
- Lighting replacement of fuel shop floor (Building 21-1 Peterborough)
- Fire separation enhancements (Building 24/22 Peterborough)
- Addition of a fire exit (Building 26-22 tunnel Peterborough)

6.4.3 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 equipment maintenance, work order management, building/facility maintenance and management, asset management and manufacturing maintenance. Maintenance Connection connects maintenance

personnel to extend asset lifecycle, prevent equipment failures, improve labour productivity, reduce costly equipment downtimes, and lower the total cost of maintenance. This software allows BWXT NEC to efficiently perform all the above-mentioned tasks as well as help to control and identify Critical-to-Safety (CTS) and Critical-to-Quality assets and parts. Preventive maintenance tasks deemed CTS are designated in this system as described in business wide procedure BMS-P-016, *Enterprise Asset Management Program Procedure*.

All tasks deemed CTS are flagged accordingly in the maintenance software system. Independent verification is in place on the 6H68, 4H48, rotoclone, and furnace ventilation systems in Toronto during filter changes (maintenance). Following rotoclone ductwork maintenance, smoke testing is performed to confirm that flow in the lines has not been blocked by the maintenance activity.

In Peterborough and Toronto respectively, 95% and 94% of CTS tasks issued were completed within 14 days of the target completion date. All CTS tasks issued in 2016 are closed.

Preventive maintenance is considered during the assessment of changes as part of the business Change Control process. Additionally, in the event of an incident, the preventive maintenance program for related equipment is reviewed as applicable.

During the reporting period, the following reviews and changes to preventive maintenance tasks were completed:

- A task step was added to wipe down the beryllium coaters prior to dismantle as an ALARA initiative to potentially reduce airborne beryllium concentration in the B3 mask room during coater cleaning. (Peterborough)
- The frequency of coater cleans was reviewed to determine if there is a link between cycle count and air sampling results. A linear regression test indicated there was insufficient evidence to support a change in current cleaning frequencies. (Peterborough)
- A daily centrifuge level check was added to the maintenance software to ensure levels are maintained to prevent flooding in the rotoclone room. (Toronto)

The preventive maintenance program is periodically assessed through self-assessments and internal and external audits. The program is adequate and effective.

6.5 Core Control Processes

6.5.1 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 CNSC's 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 I*nternal 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.

A component of the radiation protection program is area classification. Areas of each facility are classified into four different areas 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 *Internal Control Levels* for surface or airborne contamination.
- Active Area - these areas are designed for handling materials with loose contamination that is potentially above unclassified *Internal Control Levels* for surface or airborne contamination. 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 *Internal Control Levels* for surface or airborne contamination.
- R2 Area - these areas are designed for operations involving exposed non-dispersible nuclear substances, where external radiation is of concern and surface or airborne 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. Surface or airborne contamination may be above R2 *Internal Control Levels* and below R3 *Internal Control Levels* for surface or airborne contamination.

During the reporting period, there was one A*ction Level* exceedance for urinalysis is Toronto. All dose measurements were below *Action Levels* and regulatory limits.

6.5.1.1 Contamination Control Data

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 loose surface uranium 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. In the event a swipe measurement exceeds an *Internal Control Level*; the area is cleaned and re-swiped to verify cleanliness.

Routine surface contamination measurement results are summarized in Table 5.

	Classification and Area Description	Internal Control Level	2015		2016	
			Total Number of Samples	Total Number Samples Exceeding Internal Control Level (%)	Total Number of Samples	Total Number Samples Exceeding Internal Control Level (%)
Peterborough	R2 - Pellet Loading, Element Welding and Pellet Storage	2200 dpm/100 cm^2	479	1(<1%)	548	0 (0%)
	R1 - Bundle Assembly, Inspection, Receiving, Building 24	220 dpm/100 cm^2	169	0 (0%)	176	0 (0%)
	Active - Met Lab, Waste Room	220 dpm/100 cm^2	120	1(<1%)	174	1 (<1%)
	Unclassified - Items, Main Hallway	220 dpm/100 cm^2	368	0 (0%)	462	0 (0%)
Toronto	R3-Powder Preparation, Pressing, Grinding, Laboratory	22,000 dpm/100 cm^2	444	1 (<1%)	444	0 (0%)
	R2-Sintering, Sorting & Stacking, Laboratory	2,200 dpm/100 cm^2	510	15 (3%)	504	14 (3%)
	Active - Plant Washrooms, Laundry Room	2,200 dpm/100 cm^2	144	0 (0%)	144	0 (0%)
	Unclassified	220 dpm/100 cm^2	297	16 (5%)	288	13 (5%)

Table 5: Surface Contamination Result Summary

Peterborough surface contamination remains very low. Surface contamination results are reviewed by EHS staff and discussed if necessary at ALARA Committee Meetings. During the reporting period, there was one exceedances of an *Internal Control Level,* which was recleaned. Overall, 99% of swipes were within *Internal Control Levels*, indicative of effective contamination control measures and cleaning schedules.

Toronto surface contamination remains steady in the number of samples exceeding the *Internal Control Level* in 2016 over 2015. Surface contamination results are reviewed by EHS staff and discussed at

Workplace Safety Committee Meetings. The Toronto ALARA committee is continuing its goal to reduce the number of sample results above the *Internal Control Levels*. Overall, 98% of swipes were within *Internal Control Levels*, indicative of effective contamination control measures and cleaning schedules.

One personnel contamination event occurred in Toronto during the reporting period. An Operator had a pellet sliver in her finger. The foreign object was removed by the employee with some bleeding allowed before washing. The finger was scanned to verify that the object was completely removed before bandaging. The Operator was not wearing a glove on the injured hand when the incident occurred.

6.5.1.2 Air Monitoring Data

In Peterborough, each process workstation where open uranium dioxide pellets are handled is periodically monitored during routine operations for airborne uranium dioxide. Filter papers are counted in-house and verified periodically by an independent external laboratory using delayed neutron activation analysis. In Toronto, each process workstation is monitored continuously during standard operating conditions for airborne uranium dioxide and counted in-house. Internal dose to workers in Toronto is estimated based on these air monitoring results.

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.

Workstation air sampling results (excluding Toronto's lunchroom) are summarized in Table 6.

	Peterborough			Toronto		
	2014	**2015**	**2016**	**2014**	**2015**	**2016**
Number of Workstations Sampled	3	4	4	22	22	21
Total Number of Samples Collected	46	44	50	5313	5229	5271
Total Number of Samples Exceeding *Internal Control Level* (facility and area specific)	0	0	0	7	9	2
Total Number of Samples Exceeding *Action Level* (facility and area specific)	0	0	0	0	0	0
Average Concentration (dpm/m^3)	0.67	0.15	0.11	11.0	8.9	9.2
Maximum Value Recorded (dpm/m^3)	1.86	1.04	0.97	753*	294	244

Table 6: Workstation Air Monitoring Summary

*The maximum result in 2014 occurred during the execution of a radiation safety instruction for the change-out of the torit filters in the BWR Grinding Room.

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

In Toronto, two workstation air samples exceeded the *Internal Control Level*. Trends remain steady, except for the 2014 maximum concentration discussed above.

6.5.1.3 Facility Radiological Conditions

Routine gamma surveys are conducted within each facility using calibrated portable handheld radiation detectors. The surveys are conducted monthly in Peterborough and quarterly in Toronto. Measured

dose rates are compared to targets for areas based on area classification and occupancy. When necessary, items are moved to alternative storage locations. Areas that appear routinely higher than target dose rates may be investigated for improvements, such as shielding.

Dose rate results are summarized in Table 7.

	Peterborough			Toronto		
	2014	2015	2016	2014	2015	2016
Total Number of Locations Surveyed	417	394	373	102	160	160
Average Dose Rate (µSv/h) on Shop Floor	3.1	2.9	3.1	3.8	2.8	2.7
Average Dose Rate (µSv/h) in Storage Areas	4.9	5.7	5.6	6.7	7.0	5.0

Table 7: Routine Dose Rate Survey Result Summary

Dose rates remain steady in both locations. The facility surveys focus on radioactive material handling areas and adjacent occupied locations. Variability due to the timing of the monthly survey is a factor in the results, as production levels vary over the year.

6.5.1.4 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. All Toronto employees working where exposed UO_2 material is processed submit urine samples for uranyl ion analysis during the week/month (depending on the work area). 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. Urinalysis at BWXT NEC 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. Internal dose is estimated based on air monitoring.

Urinalysis results are summarized in Table 8.

	Peterborough			Toronto		
	2014	2015	2016	2014	2015	2016
Number of urine samples analyzed	108	112	109	2021	2065	1907
Number of samples above *Internal Control Level* (5 µg U/L)	0	0	0	3	6	3
Number of samples above *Action Level* (10 µg U/L)	0	0	0	0	0	1
Maximum result (µg U/L)	0.5	<0.1	<0.1	6.8	6.8	13.0

Table 8: Urinalysis Results Summary

Of all urinalysis samples from Peterborough processed between 2005 and 2016, only 0.3% of samples (5/1583) have measured above the minimum detectable concentration of 0.1 µg U/L (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 this facility are minimal and that current engineered and administrative controls, where applicable, are adequately controlling the risk.

In Toronto, a total of three urinalysis samples were above the *Internal Control Level* of 5 µg U/L during the reporting period, including one above the Action Level of 10 µg U/L. Details of the Action Level exceedance are provided in section 6.5.1.10.

6.5.1.5 Dose Control Data

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 the general public (1 mSv/year) in the course of the person's work with nuclear substances or at our nuclear facilities. All fuel shop NEWs at BWXT NEC are assigned personal passive dosimeters known as TLDs (thermoluminescent dosimeter). These passive dosimeters record 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 to monitor extremity dose. The test results and the weekly hours of contact are used to estimate the extremity dose. TLDs are exchanged routinely, monthly (Toronto) or quarterly (Peterborough), and analyzed by a CNSC licenced external dosimetry service provider. On receipt, knowledgeable staff reviews the monitoring results, and compares them to associated *Internal Control Levels*, *Action Levels* and regulatory limits.

All radiation exposures received by personnel in the reporting period were within *Internal Control Levels*, *Action Levels* and regulatory limits. Regulatory limits are specified in the *Radiation Protection Regulations* with exception during the control of an emergency and the consequent immediate and urgent remedial work. Regulatory limits are listed in Table 9 and Table 10. BWXT NEC dosimetry results are summarized in the following sub-sections. Table 11 provides a summary of dosimetry data with employees and one customer grouped in various ranges of exposure.

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. Technicians are employees who support the licenced activities, (Fuel Shop or Services Manufacturing Shop) e.g. electrical, mechanical, quality control, laboratory, etc. Staff includes management and professional employees who support the Operators and Technicians with the licenced activities.

Effective Dose Limits		
Person	**Period**	**Effective Dose (mSv)**
Nuclear energy worker, including a pregnant nuclear energy worker	(a) One-year dosimetry period (b) Five-year dosimetry period	50 100
Pregnant nuclear energy worker	Balance of the pregnancy	4
A person who is not a nuclear energy worker	One calendar year	1

Table 9: Regulatory Effective Dose Limits

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

Table 10: Regulatory Equivalent Dose Limits

		Total # Individuals Monitored	Total # of Individuals in Dose Range (mSv)							
			0 - 1	1 - 5	5 - 10	10 - 20	20 - 50	50 - 100	100 - 200	200 - 500
Peterborough	Whole Body Effective	88	68	17	3	0	0	0	0	0
	Skin	88	64	8	5	10	1	0	0	0
	Extremity	30	5	9	4	8	4	0	0	0
Toronto	Whole Body Effective	63	25	29	8	1	0	0	0	0
	Skin	63	19	8	14	11	10	1	0	0
	Extremity	44	1	6	8	6	15	7	1	0

Table 11: Radiation Dose Distribution

6.5.1.6 Whole Body Effective Dose

Whole body effective dose is summarized in Table 12. Data presented for Toronto is whole body effective dose, which is monitored external and calculated internal dose. The contribution from internal dose is indicated. Peterborough does not have any measurable internal dose; the effective dose is the TLD whole body dose. 2016 Peterborough doses includes the fuel shop and the Nuclear Services division. This has reduced the average Technician dose as compared to previous years, as 2015 and 2014 data excludes the contribution from the Nuclear Services division.

	Year	Peterborough			Toronto	
		Operators	Technicians	Staff	Operators (Internal)	Staff
Maximum (mSv)	2016	5.82	1.13	0.75	11.79 (2.73)	0.23
	2015	5.77	1.29	1.69	8.38 (2.50)	3.25
	2014	7.55	1.35	1.40	7.80 (2.56)	1.84
Average (mSv/person)	2016	2.02	0.14	0.37	3.19 (1.13)	0.04
	2015	2.03	0.27	0.84	2.10 (0.90)	0.30
	2014	2.75	0.35	0.71	3.06 (1.13)	0.27
Minimum (mSv)	2016	0.00	0.00	0.00	0.27 (0.08)	0.00
	2015	0.00	0.00	0.14	0.10 (0.10)	0.00
	2014	0.00	0.00	0.00	0.13 (0.01)	0.00

Table 12: Whole Body Effective Dose Summary

6.5.1.6.1 Peterborough Trending

Average annual whole body dose trend for all monitored employees is shown in Figure 1. Whole body dose by workgroup is listed in Table 12. Overall, the average whole body dose trend is flat. Maximum and average doses are trending down in all workgroups from 2013 to 2016.

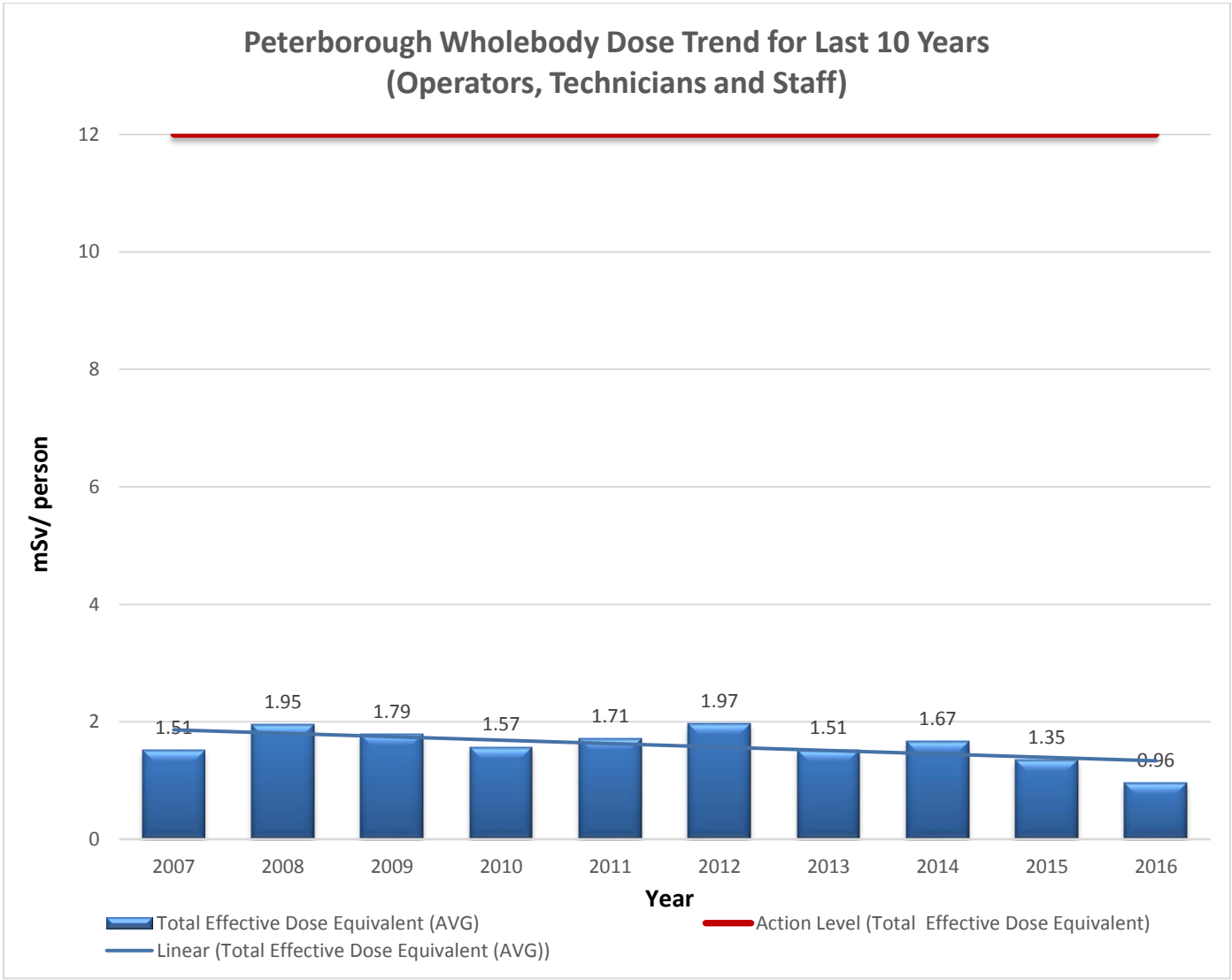


Figure 1: Peterborough 10-year Average Annual Whole Body Dose

6.5.1.7 Toronto Trending

Average annual whole body dose trend for all monitored employees is shown in Figure 2. Note: This is whole body dose only, and excludes internal dose. Whole body and internal dose by workgroup is listed in Table 12. Average whole body dose is trending down over all, with Operator dose remaining steady from 2014 to present. Average and maximum Staff doses continue to decrease.

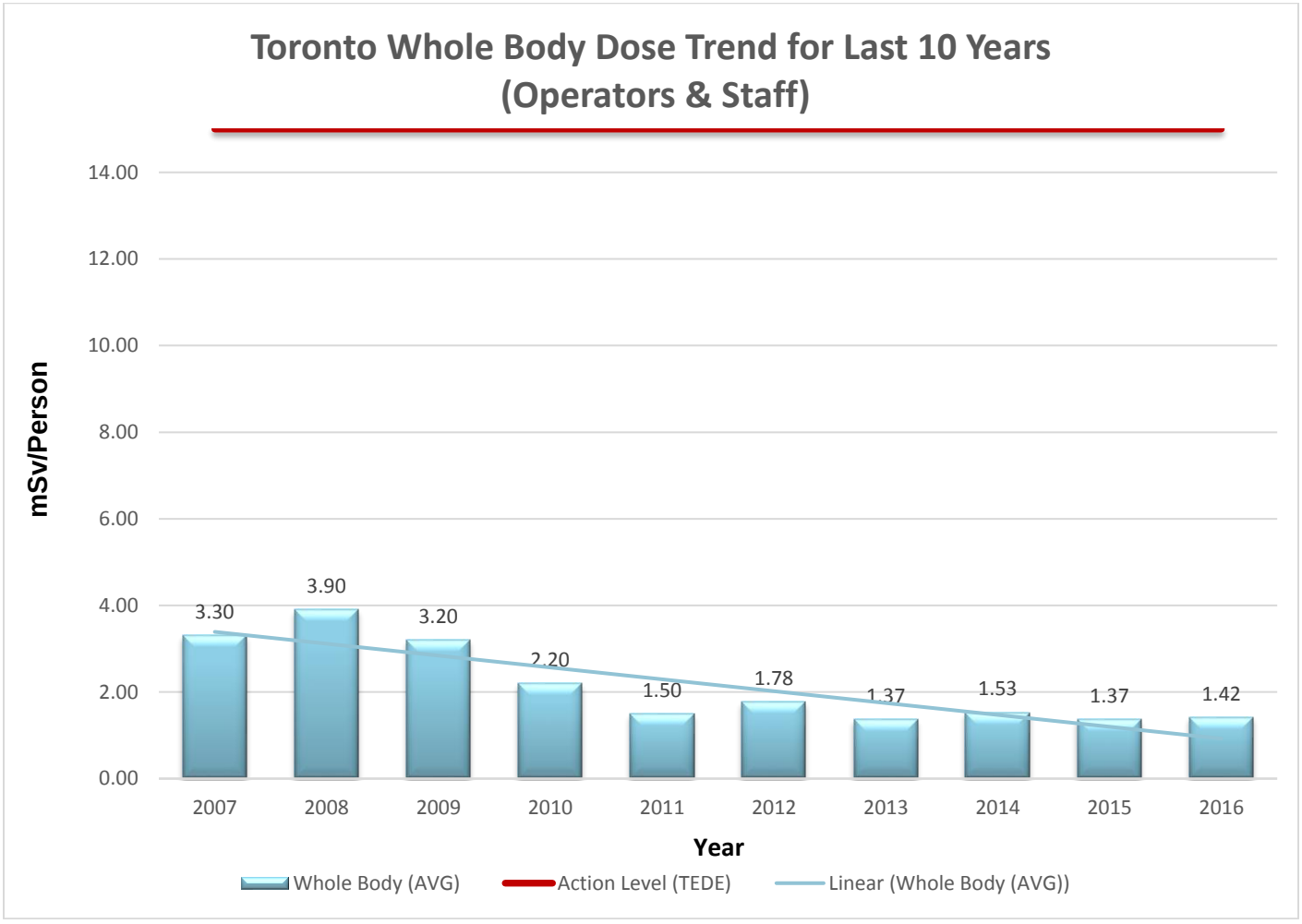


Figure 2: Toronto 10-Year Average Annual Whole Body Dose

6.5.1.8 Equivalent Skin Dose

Equivalent skin dose is summarized in Table 13. 2016 Peterborough doses includes the fuel shop and the Nuclear Services division. This has reduced the average Technician dose as compared to previous years, as 2015 and 2014 data excludes the contribution from the Nuclear Services division.

	Year	Peterborough			Toronto	
		Operators	Technicians	Staff	Operators	Staff
Maximum (mSv)	2016	21.15	1.74	0.95	74.26	4.08
	2015	22.47	2.57	3.69	54.99	3.86
	2014	29.91	2.30	2.06	51.67	1.99
Average (mSv/person)	2016	6.11	0.18	0.39	14.82	0.49
	2015	7.11	0.59	0.98	13.16	0.47
	2014	8.65	0.56	0.85	14.43	0.41
Minimum (mSv)	2016	0.00	0.00	0.00	0.00	0.00
	2015	0.00	0.00	0.14	0.00	0.00
	2014	0.00	0.00	0.00	0.00	0.00

Table 13: Equivalent Skin Dose Summary

6.5.1.8.1 Peterborough Trending

Average annual skin dose trend for all monitored employees is shown in Figure 3. Skin dose by workgroup is listed in Table 13. Skin doses across all workgroups remain a fraction of the regulatory limit and the *Action Level*. Maximum Technician and Staff skin dose is trending down from 2013 to 2016. Average skin doses are showing steady from 2013 to 2016.

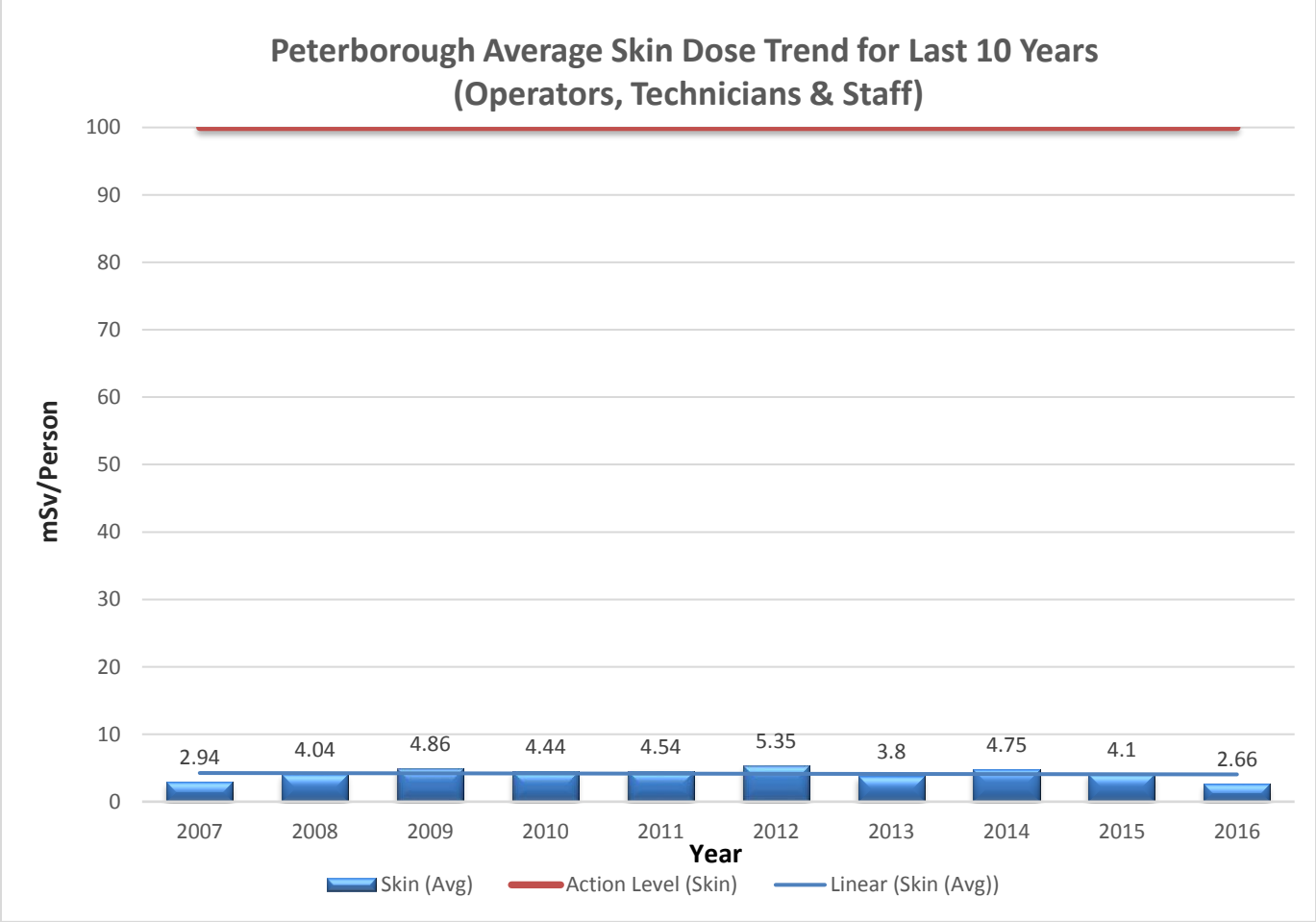


Figure 3: Peterborough 10-year Average Annual Skin Dose

6.5.1.8.2 Toronto Trending

Average annual skin dose trend for all monitored employees is shown in Figure 4. Skin dose by workgroup is listed in Table 12. Skin doses remain a small fraction of the applicable limit and the BWXT NEC *Action Level.* Trends are showing that average skin dose is decreasing. The year over year decrease in skin dose has resulted from a combination of shielding improvements made in the Sort Stack, Grinding and Sintering areas and an improvement in ALARA awareness and operator experience. While the primary objective of shielding improvements was reduction in gamma exposures, there will also be a reduction in overall beta fields in the work area from the shielding.

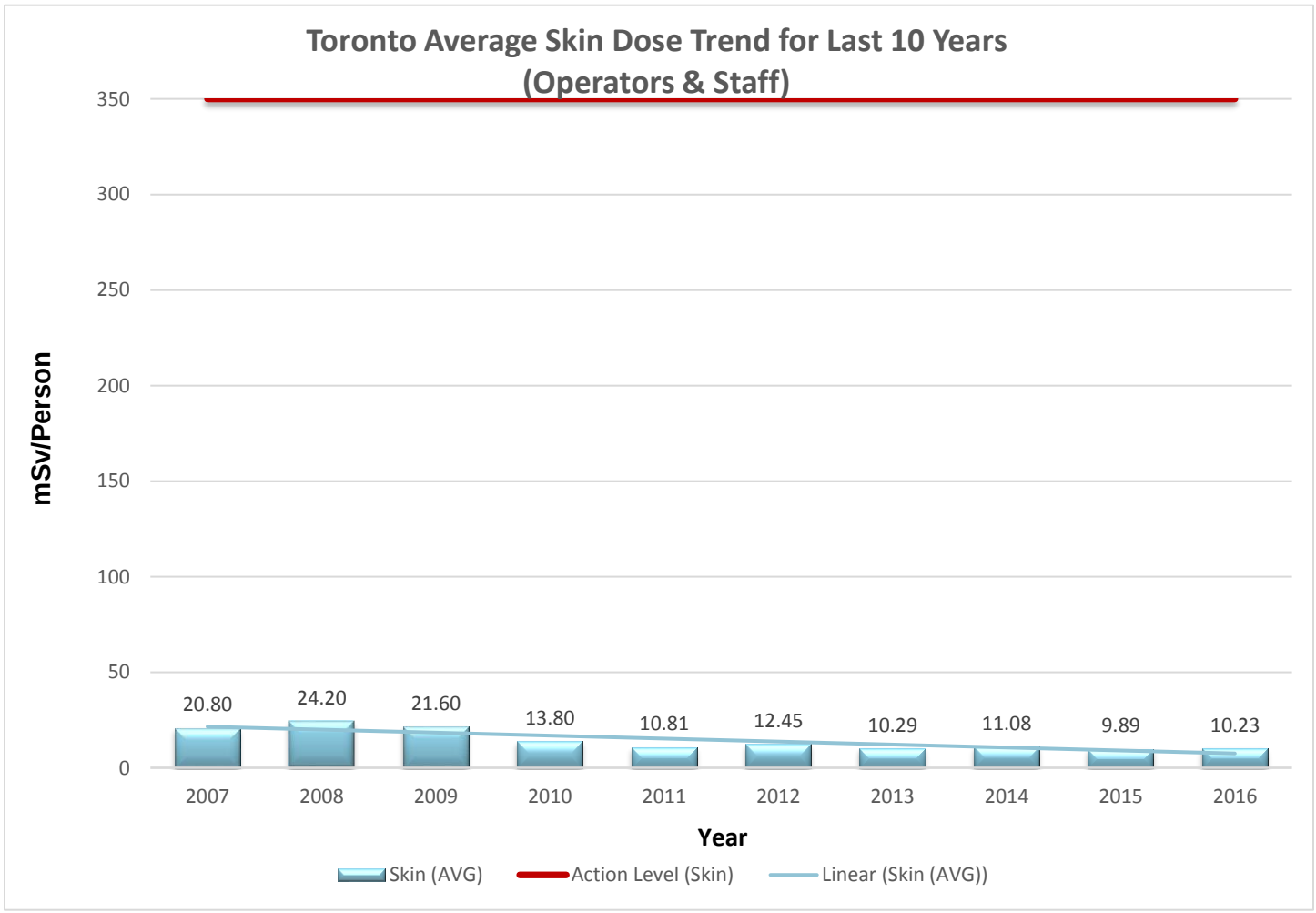


Figure 4: Toronto 10-Year Average Annual Skin Dose

6.5.1.9 Equivalent Extremity Dose

Equivalent extremity dose is summarized in Table 14. In Peterborough, Services employees do not participate in the extremity monitoring program.

	Year	Peterborough			Toronto	
		Operators	Technicians	Staff	Operators	Staff
Maximum (mSv)	2016	32.84	3.6	2.25	119.47	N/A
	2015	39.34	4.98	4.82	109.62	N/A
	2014	98.98	12.01	2.57	102.44	N/A
Average (mSv/person)	2016	11.33	2.54	1.24	28.93	N/A
	2015	14.34	2.03	4.82	30.30	N/A
	2014	20.88	4.62	2.57	31.96	N/A
Minimum (mSv)	2016	0.26	0.63	0.23	0.85	N/A
	2015	0.00	0.32	4.82	0.00	N/A
	2014	0.00	0.49	2.57	0.00	N/A

Table 14: Equivalent Extremity Dose Summary

6.5.1.9.1 Peterborough Trending

Average annual extremity dose trend for all monitored employees is shown in Figure 5. Extremity dose by workgroup is listed in Table 14. Extremity doses across all workgroups remain a fraction of the regulatory limit and the *Action Level* and show a decreasing average dose. This is primarily due to changes in how extremity doses are calculated. Ring testing, which was previously done for a two-week period on an annual basis, is now performed for a one week period on a quarterly basis and the current measurements are considered more representative of actual doses. Maximum and average Operator dose is showing a slight reduction from 2013 to 2016. Maximum Technician dose is showing a slight reduction while average Technician dose is showing steady from 2013 to 2016.

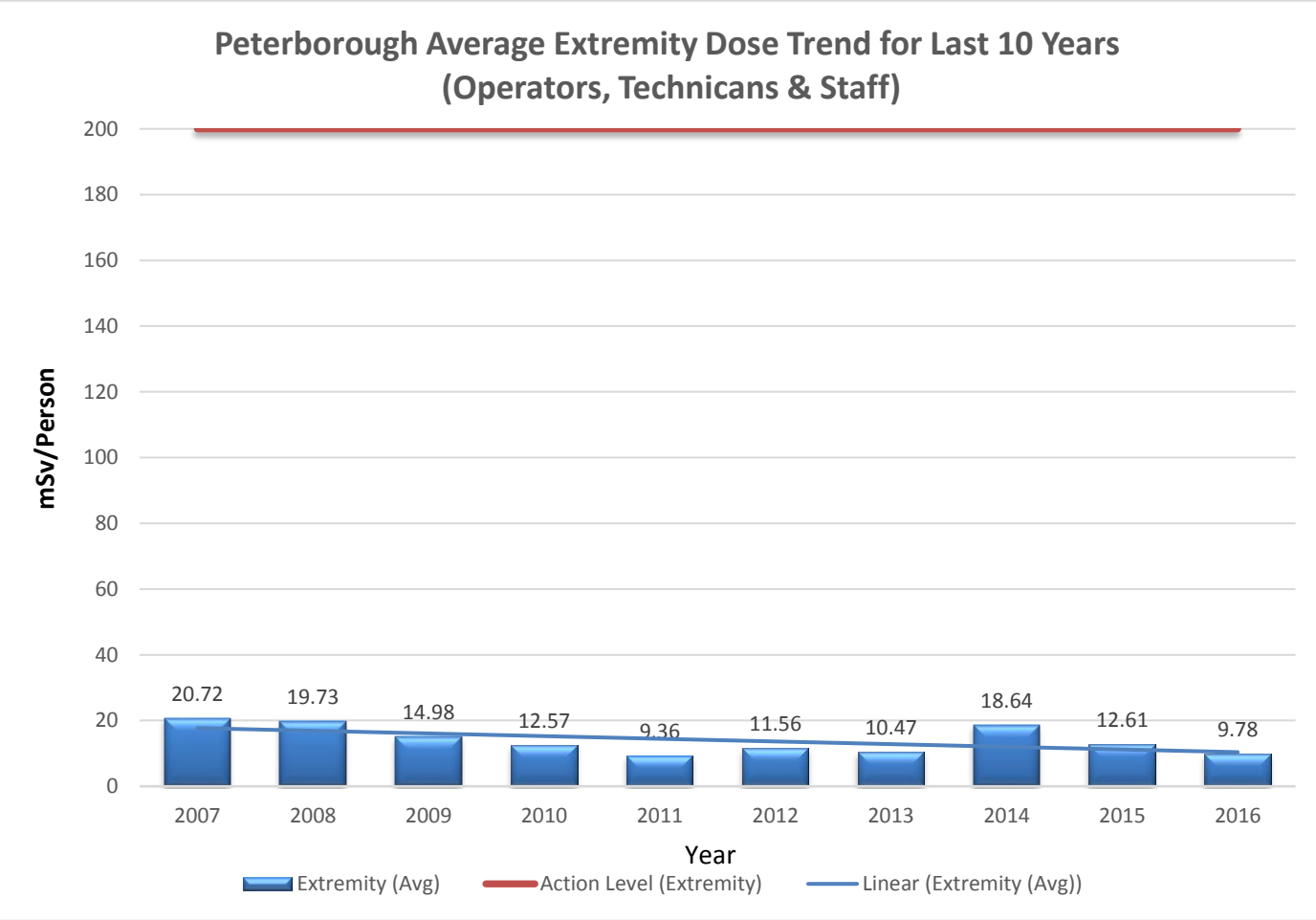


Figure 5: Peterborough 10-year Average Annual Extremity Dose

6.5.1.9.2 Toronto Trending

Average annual extremity dose trend for all monitored employees (Operators only; Staff are not monitored) is shown in Figure 6. Extremity dose by workgroup is listed in Table 12. Extremity doses continue to show a decreasing trend to average dose since 2008. This is primarily due to changes in how extremity doses are calculated. Ring testing, which was done for two weeks on a quarterly basis prior to 2009, is now performed for one week on a quarterly basis and the new measurements are considered more representative of actual doses. Also, while the primary objective of shielding improvements was reduction in gamma exposures, there will also be a reduction in overall beta fields in the work area from the shielding.

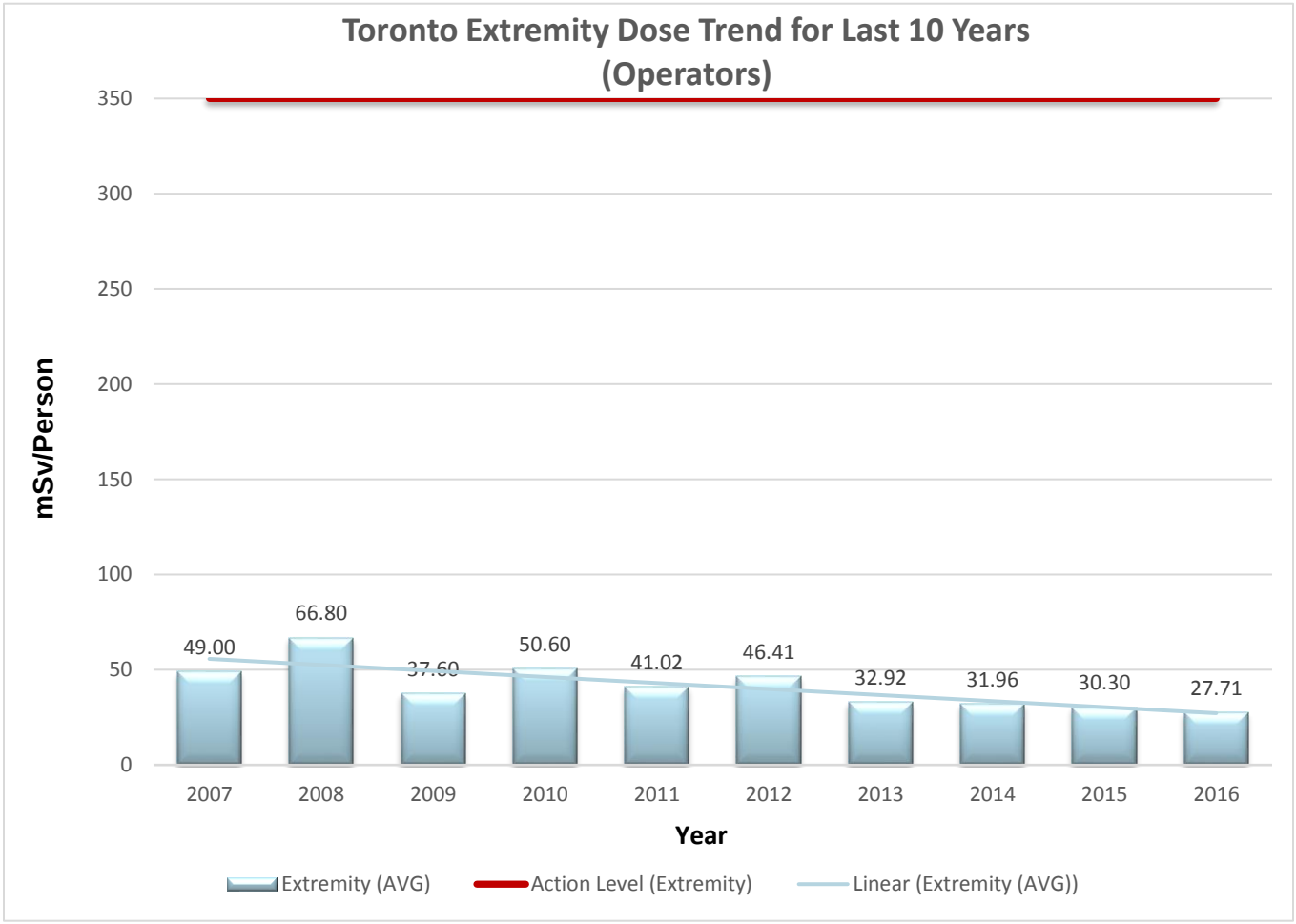


Figure 6: Toronto 10-Year Average Annual Extremity Dose

6.5.1.10 Exceedances of Regulatory Limits or Action Levels

All measured radiation exposures received by personnel in the reporting period were within *Internal Control Levels* and regulatory limits.

One *Action Level* exceedance occurred for a urinalysis sample from Toronto. On May 3rd, 2016, BWXT NEC reviewed urinalysis results from samples taken on April 19th, 2016. One of the samples was 13 µg/L which exceeds the *Action Level* of 10 µg/L. There were no other elevated results. The lab confirmed the value was correct based on a recount. A preliminary telephone report was made to the

CNSC on May 3rd and an email summary was provided later that same day. At the time of the preliminary report, the April 26th follow-up sample was already at the lab and was used as the confirmation sample in accordance with the Radiation Protection Manual. The result of the confirmation sample was 1.3 µg/L. An investigation was conducted to review the event and identify corrective actions. Potential causes of the urinalysis result are sample contamination with ingestion not having been ruled out. Six corrective actions therefore address these two potential causes. All corrective actions are closed.

6.5.1.11 Radiation Protection Program Effectiveness

The radiation protection program is effectively implemented. Elements of the radiation protection program such as dose monitoring, contamination monitoring, radiation field surveys, etc. are reviewed internally by EHS staff and the ALARA Committee on a regular basis. Details of the reviews are recorded in meeting minutes.

An internal audit of the radiation protection program, with a focus on elements of radiation protection program effectiveness and compliance, is conducted annually at each site. A copy of these reports is provided to the CNSC separately.

6.5.1.12 Radiation Protection Program Improvements

Several minor continuous improvements to the Radiation Protection Manual were instituted during the reporting period:

- A Non-NEW dose control program was formally developed and documented following a review of facility dose rates and potential visitor/contractor exposure.
- A review of Toronto's internal dose assignment program was completed in 2016 to verify inputs into the dose estimation process. Several minor improvements were made to the work instruction for clarity.
- Minor administrative edits and continuous improvements were made to 27 other work instructions across both sites.

6.5.1.13 Summary of Radiation Protection Program Performance

Radiation protection program goals are monitored through the ALARA Committees as summarized in section 6.5.1.14 below.

6.5.1.14 Summary of ALARA Committee Performance

The ALARA Committees meet quarterly at a minimum. The Peterborough committee met four times and the Toronto committee met five times during the reporting period. Dose results, radiation protection related audits and radiation protection related employee concerns were reviewed and discussed. Actions are assigned and tracked as part of the meeting minutes.

ALARA Committee goals and results for the reporting period are provided in Table 15. 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.

Peterborough achieved all ALARA goals during the reporting period, including a 24% collective dose reduction from 2015 (normalized for production). Dose reduction is occurring as result of ongoing efforts to improve ALARA awareness and TLD storage compliance. There was a significant reduction in the amount of rework from 2015 to 2016 and improvements to the rework process itself.

Toronto achieved all ALARA goals during the reporting period, including a 14% collective dose reduction from 2015 (normalized for production). Toronto's ALARA Committee remains focused on the commitment to improving air monitoring and swipe results each year through the installation of engineering controls and best practice techniques.

	Goal	Actual	Result
Peterborough	3% reduction in collective whole body dose (normalized for production)	24% reduction	Achieved
	>97% compliance in TLD audits	99.6% compliance	Achieved
	Investigate the possibility of upgrading to electronic data entry to the Radiation Database	Electronic data entry is possible, but data format presents a challenge	Achieved
	Conduct four shop floor demonstrations of the ALARA principles	4/4	Achieved
Toronto	Downward employee dose trend (normalized for production)	14% reduction	Achieved
	Ventilation Improvements: average annual concentration of workstation air monitoring results <10 dpm/m^3	9.2 dpm/m^3	Achieved
	5% reduction in surface contamination monitoring results that exceed the *Internal Control Level* compared to 2015	16% reduction (27 in 2016, 32 in 2015)	Achieved
	Conduct four employee shop floor meetings/demonstrations/communications of the ALARA principles	4/4	Achieved

Table 15: ALARA Committee Goals and Results

2017 goals for Peterborough are established as follows:

1. 3% reduction in collective whole body dose (corrected for production)
2. >98% compliance in TLD audits
3. Complete a shielding project along the final inspection conveyor
4. Conduct four shop floor demonstrations of the ALARA principles

2017 goals for Toronto are established as follows:

1. Downward collective employee dose trend (normalized for production)
2. Ventilation improvements: average annual concentration of workstation air monitoring results <10 dpm/m^3
3. 5% reduction in surface contamination monitoring results that exceed the *Internal Control Level* compared to 2016
4. Complete 1 shielding project

6.5.1.15 Summary of Radiation Protection Training Program and Effectiveness

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 made

available to employees with computer access. Testing is performed on completion of the training to demonstrate employee understanding. Training Tracker is updated with these results.

	Course Name	Number of Employees Who Required Course	% Required Completed
Peterborough	Fuel Shop Hazards Awareness (Includes Radiation Safety) (Initial and Refresher)	11	100%
Toronto	Radiation Safety (Initial and Refresher)	17	100%

Table 16: Radiation Protection Training Summary

6.5.1.16 Summary of Radiation Device and Instrumentation Performance

All radiation devices and instruments were maintained in a state of safe operation. Radiation calibrations are conducted within 12 months of the previous calibration as required by regulation. Where calibration is expired or where detectors fail calibration, they are removed from service until they are repaired and meet radiation calibration expectations.

6.5.1.17 Summary of Inventory Control Measures

A current inventory of non-production radioactive sources is maintained by each facility. The inventory for each facility is provided in Appendix A and B, submitted to CNSC separately.

6.6 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 implemented a management system for environmental, health and safety program excellence. This is ensured through the implementation of program elements including training, contractor safety, fall protection, electrical safety, hot work, cranes and hoists, chemical management and others. These programs also demonstrate compliance to the CLC part II.

6.6.1 Health and Safety Program Effectiveness

The environment health and safety framework includes all worker safety and environmental protection elements as follows:

- 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
- Change Control and Preventative Maintenance
- Industrial Hygiene
- Chemical Management
- Ergonomics
- Lock-Out Tag-Out
- Environmental Defences

6.6.1.1 Peterborough

Peterborough conducted a total of 68 investigations and inspections. This includes WSC inspections, manager inspections, near miss and incident investigations. These investigations and inspections led to a total of 229 actions logged into ATS and tracked to closure. One action remains open from actions initiated in December. The top five finding categories were housekeeping, equipment safety, emergency response procedures, walking/working surfaces and chemical management compatibility/segregation.

6.6.1.2 Toronto

Toronto conducted a total of 70 investigations and inspections. This includes WSC inspections, staff safety inspections, near miss and incident investigations. These investigations and inspections, excluding staff safety inspections, led to a total of 121 actions being identified. The Toronto WSC targets one inspection every four weeks. WSC investigation findings are logged and tracked to closure outside of the ATS system. The top five finding categories from WSC inspections were housekeeping, chemicals, radiation safety, unsafe condition, and electrical. The top five categories of findings in ATS from incident investigations were radiation safety, industrial hygiene, process safety, ergonomics, and emergency response.

6.6.2 Workplace Safety Committee Performance

Elements of the Health and Safety Program are implemented and reviewed by the WSC. Regulatory findings resulting from these inspections are closed within 30 days.

Each facility committee meets monthly, with a minimum of nine meetings required annually. In Peterborough, twelve meetings were held; quorum was not met at one meeting. In Toronto, ten regular meetings were held and quorum was met at all meetings.

Established goals for each facility's reporting period are summarized in Table 17.

	Goal	Actual	Result
Peterborough	Meet at least 9 times/year	9	Achieved
	Every area inspected at least quarterly	4/4	Achieved
	Review and validate WSC Charter	1/1	Achieved
	Joint meeting/discussion with other EHS teams (ALARA, Ergo, ERT)	3/3	Achieved
	Review a section of the CLC part II at meetings	9/9	Achieved
	Review 2 EHS programs	2/2	Achieved
Toronto	Committee member roles and responsibilities refresher training	1/1	Achieved
	Program review (Risk Assessments or EHS procedures) (3)	3/3	Achieved
	Shop floor involvement/communication – increase by 10% over 2015	14% decrease	Not Achieved
	Joint meeting with other EHS teams	1/1	Achieved

Table 17: Workplace Safety Committee Goals and Results

2017 goals for Peterborough are established as follows:

1. Committee to meet at least nine times per year
2. Every area inspected at least quarterly
3. Review and validate WSC charter
4. Conduct a joint meeting/discussion with other EHS teams (ALARA, Ergonomics, Emergency Response, Beryllium)
5. Review a section of the CLC part II at meetings
6. CLC training for committee members

2017 goals for Toronto are established as follows:

1. Committee member training on electrical safety regulations
2. Program review (Risk Assessments or EHS procedures) (3)
3. Shop floor involvement/communication – increase by 10% over 2016
4. Joint meeting with other EHS teams

6.6.3 Health and Safety Program Improvements

6.6.3.1 Peterborough

Several continuous improvements to the Health and Safety program were instituted during the reporting period:

- A training matrix was developed by worker job category to ensure training assignments are consistent across a workgroup. New or transferred workers are assigned training through task assignment in the Gensuite Training Tracker application.
- Several training modules were updated to comply with the SAT methodology. For example:
  - Overhead Crane
  - Fall Arrest
  - Fuel Shop Hazards Awareness
  - Critical to Safety, Critical to Quality
- The contractor EHS approval process was simplified.
- A single EHS Work Permit system was implemented to replace the former beryllium safety instruction, radiation safety instruction and non-routine job safety analysis to ensure all hazards are considered for non-routine or high-risk work.
- A standard methodology for the annual chemical sweep was implemented with the goal to improve regulatory compliance and limit the inventory of chemicals on site.

6.6.3.2 Toronto

Several continuous improvements to the Health and Safety program were instituted during the reporting period:

- There was a focus on emergency response as the site prepared for an emergency exercise with Toronto Fire Services. Several additional table top drills were held and corrective actions implemented to strengthen the program.
- The respiratory protection program was reviewed in detail following a comprehensive review of CSA standard Z94.4-11. Program improvements were related to cleaning respirators, audits, hygiene practices, contamination measurements of respirators/storage areas, and increasing frequency of fit testing for frequent wearers.
- The operator training program was reviewed and a new methodology for qualifying operators introduced in 2016. The main objectives were to review/update current process documents to ensure critical safety, quality, and production requirements were adequately defined. In addition to the process documents, a series of checklists associated with a process were developed to measure competency of the operator. The aim is to continue this work over the next several years until all operations are completed.
- In 2013, BWXT NEC began the engineering and design work to bring the furnaces into compliance with the National Fire Protection Association-86 (2011) code for furnaces. The first furnace was finished in spring 2014, and was completely upgraded to meet NFPA 86. In addition, supporting systems were brought into compliance with applicable technical standards (Technical Standards & Safety Authority) and electrical codes (Electrical Safety Authority). The

second furnace was upgraded and work was completed in December 2014. Two additional furnaces were updated in 2015, and the final furnace was completed in 2016.

6.6.4 Hazardous Occurrences

In Peterborough, there were no hazardous occurrences. There was a total of 14 first aids. Of the 14 first aids, 12 occurred in fuel, one in services and one in the office. Five of the injuries were classed as abrasion/scratch; three of the injuries were classed as struck/rub or abraded; and three were classed as struck against injuries. There were 14 near miss events, and the top categories was industrial hygiene and radiation protection.

In Toronto, there was one hazardous occurrence reported to ESDC. An employee sustained a low back injury (a pulled back muscle) while bending over in the change room to put on shoes. There was a total of 11 first aids. Nine out of the eleven first aids involved an injury to the hand or fingers. Four of the injuries were classed as struck against and four were classed as contact with a sharp object. There were 14 near miss events and the top three categories were safety, radiation protection, and environmental.

PART II: PUBLIC AND ENVIRONMENTAL PROTECTION

6.7 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 licenced activities.

BWXT NEC facilities are ISO 14001:2004 registered to ensure effective environmental management systems are in place to achieve environmental goals and objectives. The environmental management system considers all relevant legal requirements. These programs demonstrate compliance to relevant federal and provincial legislation.

BWXT NEC has established facility specific CNSC approved *Action Levels* for various environmental parameters. An A*ction 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 A*ction 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.

The Peterborough facility also uses beryllium as part of the fuel bundle manufacturing process. Beryllium use in a federally regulated facility is governed by the *Canada Labour Code Part II* and the *Canada Occupational Health and Safety Regulations*. 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 currently set at 0.01 µg per cubic meter of air. The POI is the plant/public boundary. BWXT NEC has established an *Internal Control Level* of 0.01 µg/m^3 air at the stack exit. Dilution between the stack and the plant boundary will also reduce the concentrations at the POI to below legislated limits. At the request of the CNSC, beryllium emission monitoring results are summarized where applicable in the following sub-sections.

6.7.1 Air Effluent Monitoring

6.7.1.1 Peterborough

A single process uranium air emission point exists in the Peterborough facility. The R2 Area Decan Station exhausts through a High Efficiency Particulate Air and absolute filter. The facility performs weekly in-stack monitoring by inserting a probe into the duct centerline and withdrawing 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*.

Three beryllium exhaust vents are measured by inserting a probe into the duct centerline and withdrawing 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 level is 0.002 µg beryllium. A calculation of the concentration is then made. In 2016, the Peterborough site has implemented continuous monitoring at each of the three stacks on a weekly basis, rather than one 24-hour sample per week.

A summary of air effluent sampling results is in Table 18.

6.7.1.2 Toronto

The Toronto facility performs continuous in-stack sampling and boundary air monitoring for uranium. In-stack monitoring is completed by inserting a probe into the duct centerline and withdrawing a sample of air across a filter capable of trapping uranium dust. The samples are analyzed daily and verified periodically externally by an independent laboratory. Boundary samples are high volume air samples drawn at five positions 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 18 and Table 19. In 2016, continuous sampling from the three furnace stacks in Toronto was implemented September 1, 2016 and results are included in this report with estimated releases for 2012 to 2015 and from January 1 to August 31st, 2016.

	Stack Description	Emission Contaminant	Total Number of Samples	Regulatory Release Limit (# Samples Exceeding Limit)	Highest Value Recorded (µg/m3)	Average Value Recorded (µg/m3)	Total Discharge (g)
Peterborough	R2 Decan	Uranium	44	Action Level: 1 µg/m3 (0)	0.012	0.001	0.004
	North	Beryllium	42	Ministry of Environment Limit: 0.01 µg Be/m3 (0)	0.001	0.000	N/A
	South	Beryllium	39	Ministry of Environment Limit: 0.01 µg Be/m3 (0)	0.001	0.000	N/A
	Acid	Beryllium	35	Ministry of Environment Limit: 0.01 µg Be/m3 (0)	0.002	0.000	N/A
Toronto	Rotoclone	Uranium	251	Action Level: 1 µg/m3 (0)	0.355	0.009	2.18
	6H-68	Uranium	251	Action Level: 1 µg/m3 (0)	0.145	0.004	3.49
	4H-48	Uranium	251	Action Level: 1 µg/m3 (0)	0.500	0.006	1.32
	Furnace #1	Uranium	251	Action Level: 1 µg/m3 (0)	0.105	0.011	1.24*
	Furnace #2/4	Uranium	251	Action Level: 1 µg/m3 (0)	0.809	0.076	1.16*
	Furnace #5/6	Uranium	251	Action Level: 1 µg/m3 (0)	0.132	0.011	1.41*

Table 18: Summary of Hazardous Substance Releases to Air at Exhaust Stack

***NOTE:** Furnace discharge values include estimated discharges from January 1 to August 31, 2016 and assumes each furnace equally releases the same amount of uranium. Stack monitoring of the furnace exhaust was implemented September 1, 2016.

	Peterborough	Toronto		
		2014	2015	2016
Number of Boundary Samples Taken	N/A	260	265	260
Number of Samples > *Action Level* (0.08 µg/m^3)	N/A	0	0	0
Average Concentration (µg U/m^3)	N/A	0.001	0.001	0.001
Highest Value Recorded (µg U/m3)	N/A	0.003	0.002	0.039

Table 19: Summary of Boundary Air Quality Monitoring

Air monitoring results are trended over five years as shown in the Figure 7 and Figure 8. Toronto's boundary monitor results are trended over five years as shown in Figure 9. The maximum value occurred during week 21 and may have been caused by improvements to sampling of the furnace stacks at that time. In addition, the boundary monitor failed for a portion of the sample period and collected a lower volume than typical.

6.7.1.2.1 Peterborough Trending

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 air releases, presented in Figure 7, shows a stable five-year performance consisting of very low air releases. The total release of 0.004 g in the reporting period is well below the discharge limit of 550 g.

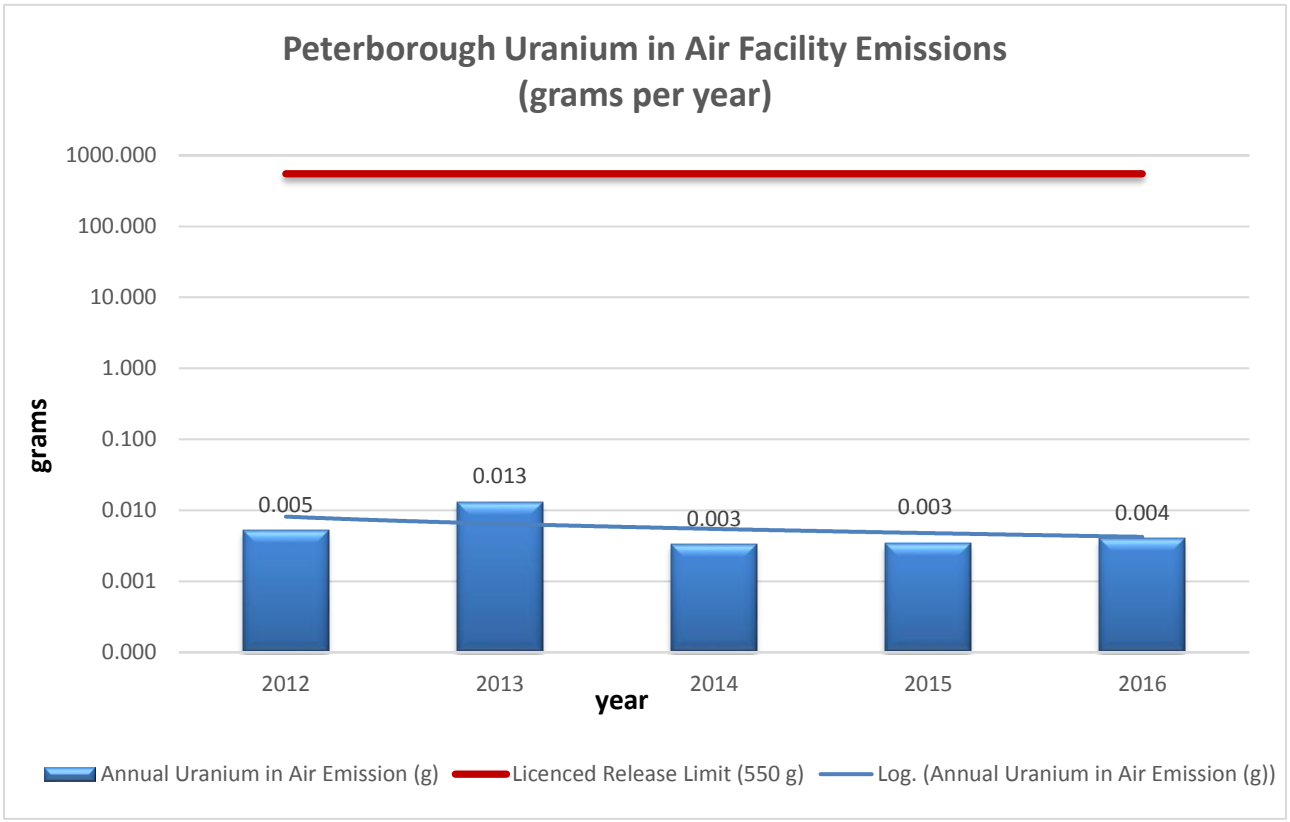


Figure 7: Peterborough Stack Air Emission Trending

Note: the above graph has a logarithmic scale

6.7.1.2.2 Toronto Trending

The Toronto stack air emission trend is steady. The total release of 10.8 g during the reporting period is well below the discharge limit of 760 g. The total release includes furnace discharge values estimated from January 1 to August 31, 2016 and monitored results from September 1, 2016 to year end.

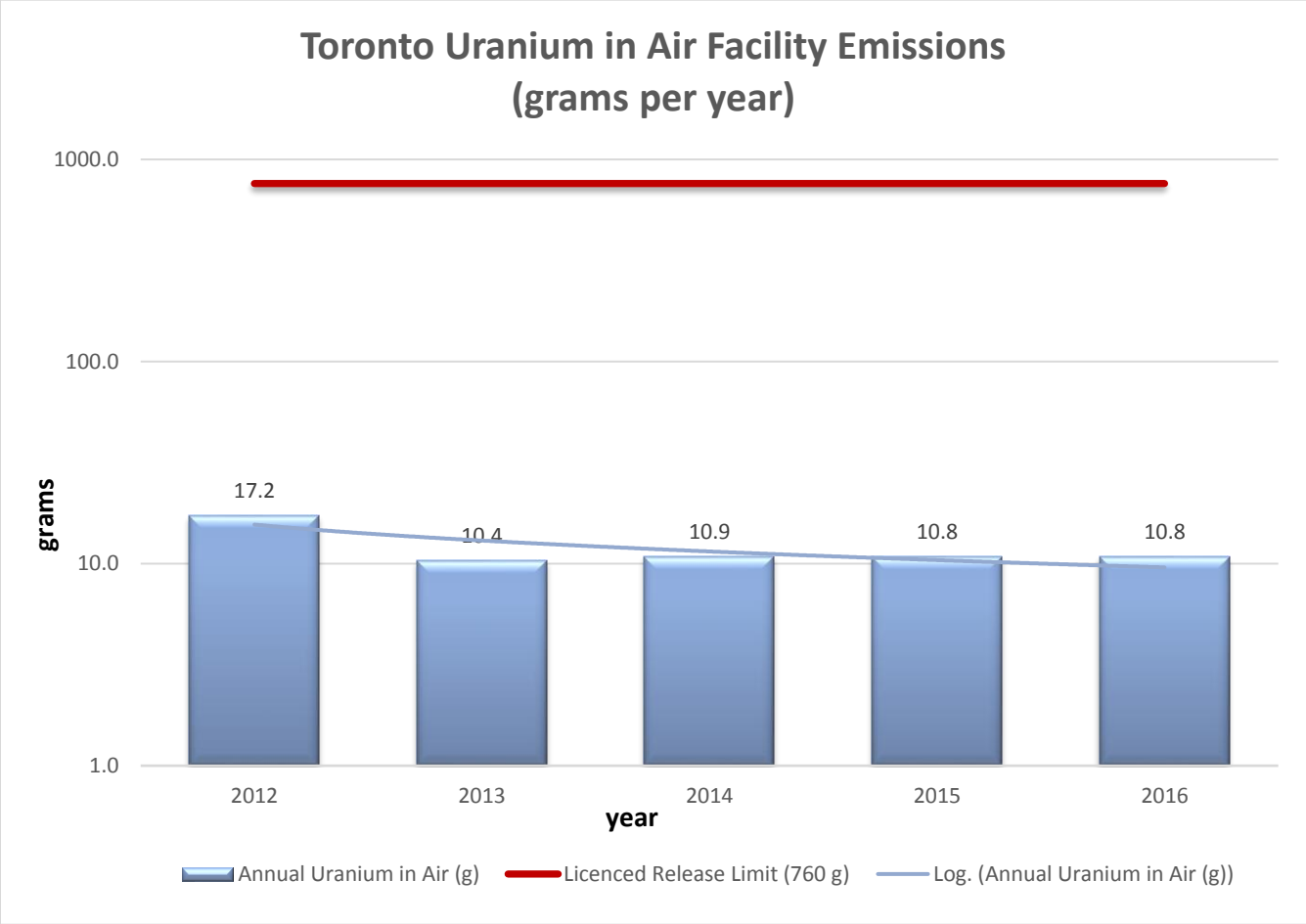


Figure 8: Toronto Stack Air Emission Trending

Note: the above graph has a logarithmic scale

The Toronto boundary air monitor maximum concentration measurements continue to remain low and well below the A*ction Level* of 0.08 µg/m^3.

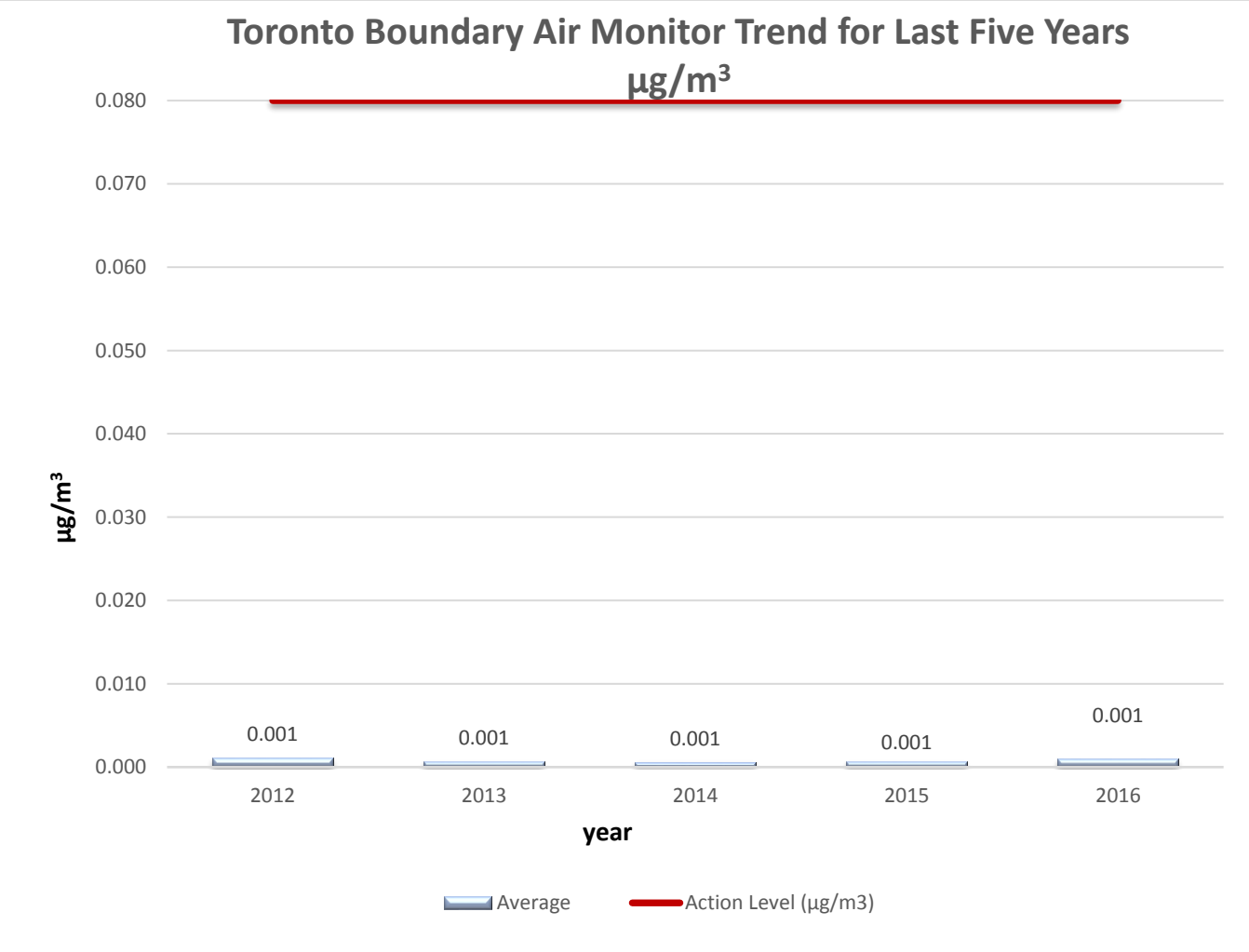


Figure 9: Toronto Boundary Monitor Air Emission Trending

6.7.2 Water Effluent Monitoring

In Peterborough, all potentially uranium-contaminated waste water is held for determination of the quantity and concentration of uranium prior to disposal. 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 water sample result is verified to be below the *Internal Control Level* of 3 ppm and the A*ction Level* of 6 ppm (per batch), the wash water is filtered again during discharge to the sanitary sewer. The plant sewer also receives other wastewater from the non-nuclear fuel operations resulting in increased dilution prior to discharge to city sewers. Total grams are measured prior to additional filtering and dilution during discharge.

A second hazardous 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, which is conservative and consistent with international drinking water guidelines for beryllium. Currently, the 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)).

In Toronto, bulk quantities of UO_2 powder are handled. This requires frequent cleaning and washing, creating higher concentrations of uranium in wastewater to be treated. The water is used to clean protective clothing, walls, floors, equipment and in various other janitorial functions. The water is treated to remove uranium dioxide 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 A*ction Level* of 6 ppm (per batch). 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).

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 A*ction Level* for a batch is 6 ppm)
4. The released water mixes with sanitary water
5. Dilution factors range from 4 to about 12; the resulting volume discharges to a combined sanitary/storm city sewer
6. Reported results do not include dilution, i.e., sample measurements are taken prior to mixing with non-process water

Results from water effluent monitoring are summarized in Table 20. Annual discharges for uranium are trended in Figure 10 and Figure 11. Beryllium average and maximum concentrations and *Internal Control Level* exceedances are trending down following the replacement of the weir settling system in December 2015.

	Peterborough			Toronto		
	2014	**2015**	**2016**	**2014**	**2015**	**2016**
Total Amount of Liquid Discharged (L) from Uranium Processing Areas	820	820	820	1,500,470	1,487,250	1,239,375
Maximum Uranium Concentration in Undiluted Water (ppm)	0.29	0.09	0.48	2.46	2.44	3.65
Average Uranium Concentration in Undiluted Water (ppm)	0.17	0.07	0.15	0.61	0.47	0.83
Number of Samples Exceeding *Action Level* (6 ppm per batch)	0	0	0	0	0	0
Total Uranium Discharge to Sewer (g)	0.14	0.06	0.13	720	390	650
Minimum pH	N/A	N/A	N/A	7.0	6.6	6.7
Average pH	N/A	N/A	N/A	7.4	7.1	7.1
Maximum pH	N/A	N/A	N/A	7.8	7.7	7.7
Total Number of Samples Analyzed for Beryllium Concentration in Water	14	20	18	N/A	N/A	N/A
Maximum Beryllium Concentration in Water µg/L	5.3	65.5	2.5	N/A	N/A	N/A
Average Beryllium Concentration in Water µg/L	≤1.3	4.5	0.4	N/A	N/A	N/A
Number of Samples Exceeding Internal Control Level (4 µg/L)	2	3	0	N/A	N/A	N/A

Table 20: Liquid Effluent Monitoring Results

6.7.2.1 Peterborough Trending

In Peterborough, 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 A*ction Levels* of 6 ppm (per batch) and 3 ppm (annual average). The total release of 0.13 g is a very small fraction of the derived release limit and of the discharge limit of 760 kg/year.

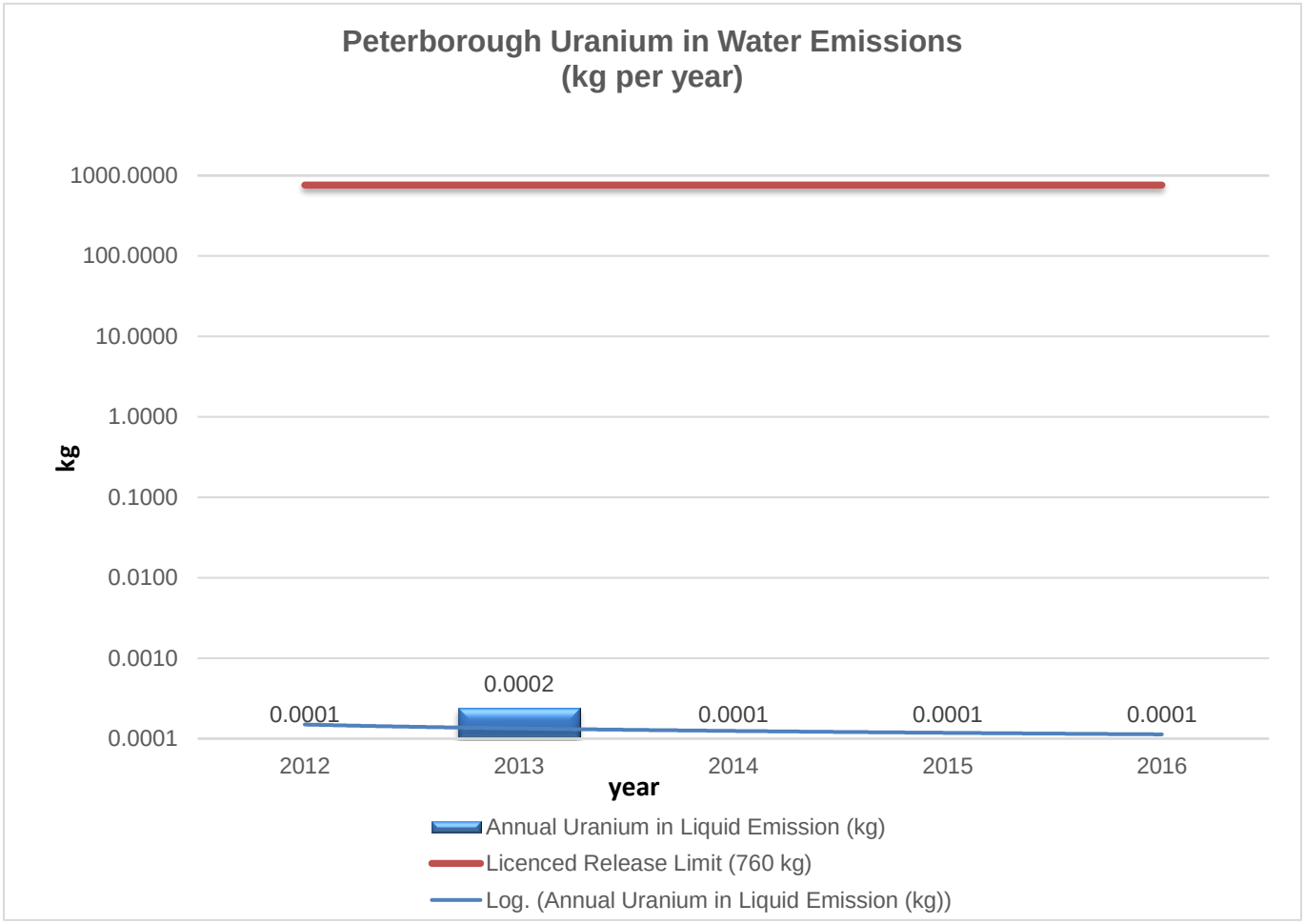


Figure 10: Peterborough Water Emission Trending

Note: the above graph has a logarithmic scale

6.7.2.2 Toronto Trending

Toronto liquid effluent releases are overall trending downward over the five years. Water release results continue to remain low and below the A*ction Levels* of 6 ppm (per batch) and 3 ppm (annual average). The total release of 0.65 kg during the reporting period is well below the derived release limit of 9000 kg/year.

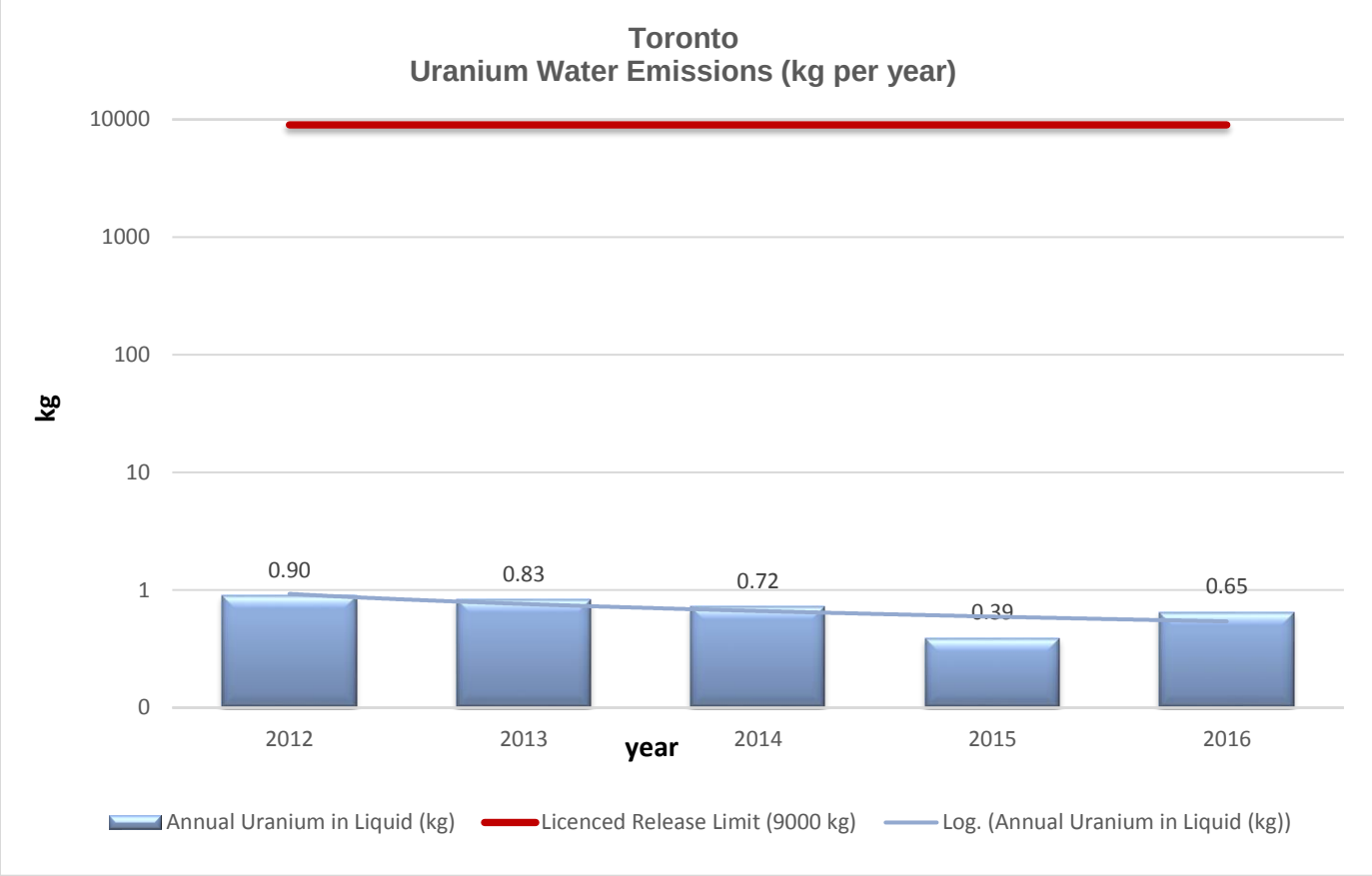


Figure 11: Toronto Water Emission Trending

Note: the above graph has a logarithmic scale

6.7.3 Well and Soil Sampling Measurements/Monitoring

Well monitoring is not required at either facility.

Airborne UO_2 emissions impinge on the ground surface downstream of the release point. UO_2 is insoluble in water but may be washed into the soil by rainfall, snow, etc. Surface uranium levels will indicate deposited emissions. Depositions of uranium can be 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 have increased and investigation is made into the cause(s).

At the Toronto facility, samples of surface soil are retrieved from 49 locations per a documented plan by a third-party consultant. The samples are analyzed by an independent laboratory by Inductively Coupled

Plasma Mass Spectrometry for natural uranium in parts per million (1 µg U/g). The minimum detectable concentration is 0.5 parts per million (0.5 µg U/g). Results are compared to previous years and the Canadian Council of Ministers of the Environment (CCME) guidelines. In Ontario, background levels of uranium in soil are generally below 2.5 µg/g. A summary of results taken in the reporting period are listed in Table 21. Each individual soil sampling result is listed in Table 22. Locations are colour coded per their area classification as shown in Table 21: 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 activities.

	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)	1.2	2.7	0.5
Maximum concentration (µg U/g)	1.2	13.6	0.7

Table 21: Toronto Soil Sampling Result Summary

Sample Location ID	Uranium Content (µg U/g)	% of guideline
1	<0.5	<2.2
2	<0.5	<2.2
3	1.2	0.4
4	<0.5	<1.5
5	0.7	2.1
6	4.7	14.2
7	4.4	13.3
8	6.0	18.2
9	2.5	7.6
10	1.9	5.8
11	1.1	3.3
12	5.0	15.2

Sample Location ID	Uranium Content (µg U/g)	% of guideline
13	3.4	10.3
14	7.4	22.4
15	8.2	24.8
16	6.8	20.6
17	13.6	41.2
18	1.9	5.8
19	1.3	3.9
20	1.5	4.5
21	1.3	3.9
22	1.9	5.8
23	0.8	2.4
24	0.7	2.1
25	2.5	7.6
26	2.0	6.1
27	1.9	5.8
28	1.0	3.0
29	1.2	3.6
30	0.7	2.1
31	1.5	4.5
32	1.2	3.6
33	1.3	3.9
34	0.6	1.8
35	0.8	2.4
36	<0.5	<2.2
37	0.7	2.1
38	0.5	2.2
41	<0.5	<1.5
42	<0.5	<2.2
43	<0.5	<2.2
44	<0.5	<2.2
45	0.7	3.0
46	<0.5	<2.2

Sample Location ID	Uranium Content (µg U/g)	% of guideline
47	<0.5	<2.2
48	<0.5	<2.2
49	<0.5	<2.2
50	<0.5	<2.2
51	<0.5	<2.2

Table 22: Toronto Individual Soil Sampling Results

6.7.4 Exceedances of Regulatory Limits or Action Levels

No *Action Levels* or regulatory limits were exceeded during the reporting period.

6.7.5 Total Estimated Doses to Critical Group

The estimated dose to the public includes the realistic pathways occurring as a result of air emissions summarized in Table 23.

Pathway	Description
Air immersion	Airborne uranium dioxide particles (UO_2) can expose members of the public via direct radiation This is accounted for in the Peterborough and Toronto Derived Release Limits
Air inhalation	Airborne uranium dioxide particles (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 ground shine	Gamma ground shine dose from direct radiation This is accounted for in the Toronto Derived Release Limit
Soil deposition beta 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

Table 23: Radiological Exposure Pathways

The facility Derived Release Limits account for the 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 CNSC's regulatory dose limit as defined in the *Radiation Protection Regulations*. The Derived Release Limits assume that a member of the public occupies the BWXT NEC boundary continuously (24 hours per day, 365 days per year). 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.

In 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 estimated to be 0.00 µSv. Beginning in 2016, environmental TLDs at the Peterborough plant boundary were put in place. The estimated effective dose as a result of gamma radiation during the reporting period is 0.00 µSv for a total estimated critical receptor dose of 0.00 µSv.

In 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 0.7 µSv. Environmental TLDs at the Toronto plant boundary are also used to estimate a public gamma dose. The estimated effective dose as a result of gamma radiation during the reporting period is 0.00 µSv for a total estimated critical receptor dose of 0.7 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 and Toronto facilities are a fraction of the public dose limit. This is presented for the current and previous reporting periods in Table 24.

Period	Peterborough		Toronto	
	Estimated Annual Public Dose (µSv)	% of Public Dose Limit (1,000 µSv = 1 mSv)	Estimated Annual Public Dose (µSv)	% of Public Dose Limit (1,000 µSv = 1 mSv)
2016	0.0	0%	0.7	0.0%
2015	0.0	0%	10.1	1.0%
2014	0.0	0%	5.5	0.6%

Table 24: Estimated Annual Public Dose

6.7.6 Environmental Protection Program Effectiveness

BWXT NEC's Peterborough and Toronto facilities are registered to ISO 14001:2004. As part of the requirement for maintaining ISO 14001 registrations an Environmental Management System (EMS) is in place that meets the requirements of ISO 14001:2004.

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 and safety issues. WSC members carry out routine plant safety and environmental inspections. After an inspection, the inspection 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 BWXT NEC's Action Tracking System (ATS).

The following audits of the environmental protection program are conducted at each facility:

- The EMS is audited internally every year as per ISO 14001:2004
- The EMS is audited externally (by SAI Global) every year as per ISO 14001:2004
- An annual self-assessment is conducted

Following an audit or self-assessment, the findings are documented, corrective actions identified and tracked to completion in ATS.

In the reporting period, there were 20 environmental related findings for Peterborough and 14 for Toronto. These findings were identified from internal and external inspections and audits, self-

assessments, employee concerns, incident investigations and other program reviews. The category groups for Peterborough were waste, management systems, and air. The category groups for Toronto were air, environmental – multi-media and waste. There were no major non-conformances at either site. All corrective actions are closed.

6.7.7 Environmental Protection Program Improvements

Both sites implemented program improvements and achieved compliance with the following environmental standards by the end of the reporting period:

- 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

In the second quarter of 2016, the Peterborough plant completed a review of historical beryllium releases, which consisted of a 24-hour sample on one of the three beryllium stacks per week. The review concluded that emissions, when modelled to the point of impingement, are consistently several orders of magnitude below the environmental limit imposed by the MOECC. However, to eliminate any uncertainty from periodic sampling, the required equipment was installed and monitoring implemented at each of the three beryllium stacks continuously.

In the third quarter of 2016, the Toronto plant completed installation of continuous sampling equipment on all three furnace exhausts (furnace 1, furnaces 2 and 4, and furnaces 5 and 6). For the first eight months of the year, emissions were estimated, with measurements beginning in September.

In 2015 at the Toronto plant, ceramic microfiltration as a technology to treat wastewater was investigated and determined to meet or exceed discharge compliance criteria, potentially reducing water emissions ten-fold. Further investigation into the feasibility of transitioning to this filtration system in 2016 determined that it was not possible. Automation of the treatment process is under investigation for 2017.

6.7.8 Environmental Protection Program Performance

2016 environmental protection goals and results are summarized in Table 25.

	Goal	Actual	Result
Peterborough	Reduce the quantity of beryllium hazardous waste by 25% through implementation of reusable cloth towels at the beryllium area hand washing sink	1.1% reduction	Not Achieved
	Develop and implement a standard methodology for chemical sweeps by year end	1/1	Achieved
	Update site-wide designated substance survey by year end	1/1	Achieved
	Implement isokinetic sampling from all three beryllium stacks by end of 2nd quarter	3/3	Achieved
Toronto	Water Effluent – Average tank releases <0.8 ppm	0.83 ppm	Not Achieved
	Emissions – 5% reduction over 5-year average	14% reduction	Achieved
	Chemical – reduction of on-site inventory by 5%	5% increase	Not Achieved
	Noise – completion of abatement project	3/3	Achieved
	Implement sampling from furnace stacks	3/3	Achieved
	Completion of Treasure Hunt Project	1/1	Achieved

Table 25: EMS Program Goals

2017 goals for Peterborough are established as follows:

1. Investigate the feasibility of recycling zirconium skeletons to reduce beryllium hazardous waste
2. Implement preventive maintenance for significant environmental aspects in Nuclear Services
3. Roll-out manufacturing area hazards awareness training to the site

2017 goals for Toronto are established as follows:

1. Water Effluent – Average tank releases <0.8 ppm
2. Water Effluent – Investigate the removal of a secondary chemical
3. Air Emissions - >5% reduction over 5-year average
4. Energy/Greenhouse Gases – Reduce identified air leaks by 25%
5. Chemical – Reduce on-site inventory by 5% from 2016
6. Waste Management – Set-up processing area in B7

6.8 Emergency Management and Response

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. This includes effects to the local area and members of the public. The plan is 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 fulfil the CNSC operating licence requirements and the following standards or guides:

- CSA-Z731-03 Emergency Planning for Industry Standard
- NFPA 801, Fire Protection for Facilities Handling Radioactive Materials
- CNSC Regulatory Guide G-225, Emergency Planning at Class 1 Nuclear Facilities and Uranium Mines and Mills
- The Province of Ontario Nuclear Emergency Plan Part VIII
- Canada Labour Code

6.8.1 Review of Emergency Preparedness Program Activities

Emergency drills were performed in the following areas:

At the Peterborough site:

1. Fire safety/Evacuation (two)
2. Medical Emergency Response Team table-top exercise (one)

The drills and exercise at the Peterborough facility resulted in six actions being identified and tracked to completion in the ATS. Actions were related to the emergency reporting number, pull station alarms, timeliness of evacuation and minor continuous improvements.

At the Toronto site:

1. Fire/Evacuation Drill (two)
2. Crisis Management Drill (one)
3. Fire/Emergency Response Team table-top exercise (one)
4. Full-scale emergency response exercise (one)

The drills and table-top exercise at the Toronto facility resulted in five actions being identified and tracked to completion in the ATS. Actions were related to training, procedures, and equipment/personal protective equipment availability. The full-scale emergency response exercise included external emergency responders and regulatory observers. Actions arising from the emergency exercise are under review.

6.8.2 Emergency Preparedness Training Program and Effectiveness

The Peterborough Emergency Response Team was trained on fire extinguishers, spill response, first aid/cardio-pulmonary resuscitation/automatic external defibrillator, and blood borne pathogens. Training course completion for the site is summarized in Table 26.

The Toronto Fire Warders were trained on fire extinguishers and fire warden responsibilities. The Toronto first aid team was trained in first aid/cardio-pulmonary resuscitation/automatic external defibrillator and blood-borne pathogens. Training course completion for the site is summarized in Table 26.

	Course Name	Number of Employees Who Required Course	% Required Completed
Peterborough	EHS Overview for Manufacturing (includes accident prevention, emergency preparedness and fire prevention)	11	100%
	Portable Fire Extinguisher Training (Practical)	7	100%
	Portable Fire Extinguishers	271	100%
	Blood borne Pathogens for Potentially Exposed Individuals (Initial & Refresher)	12	100%
	First Aid/CPR/AED	33	100%
Toronto	Emergency Preparedness and Fire Prevention (Initial & Refresher)	44	100%
	Portable Fire Extinguisher Training (Practical)	13	100%
	Portable Fire Extinguishers	54	100%
	Blood borne Pathogens Awareness (Initial & Refresher)	5	100%
	First Aid/CPR/AED	10	100%

Table 26: Emergency Preparedness and Fire Prevention Training Summary

6.8.3 Fire Protection Program Activities and Effectiveness

A 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 FHA, previously accepted by the CNSC, meets the required standards and remained in effect during the reporting period.

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. Continuous improvements are added to the ATS. Site familiarization tours are conducted annually with Peterborough and Toronto Fire Services, as the primary responders for the facilities.

In Peterborough, 22 Action Tracking System findings were raised related to emergency preparation, egress and fire protection. Findings entered into these categories originated from routine site safety inspections, and third-party audits. There were no major non-conformances. All corrective actions have been implemented and the findings closed.

In Toronto, 25 Action Tracking System findings were raised related to emergency response and fire protection. Findings entered into these categories originated from site safety inspections, self-assessments, internal & external audits, and emergency drill lessons learned. There were no major non-conformances. All corrective actions have been implemented and findings closed. Actions arising from the emergency exercise are under review.

6.8.4 Fire Protection Program Improvements

The site's documented fire protection programs 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 Protection Program is based on the documented fire hazards analysis and ensures that measures are appropriate to the facility.

In 2016, BWXT NEC completed a review of existing procedures to CNSC REGDOC-2.10.1, Version 2, *Emergency Management and Fire Protection, Nuclear Emergency Preparedness and Response* and the CSA standard N393-13, *Fire Protection for Facilities that Process, Handle or Store Nuclear Substances*. Opportunities for improvement were identified and resulted in several procedural revisions at the two sites. The CNSC required documented emergency response and fire protection programs have been submitted to the CNSC for review. Additionally, in Toronto, a supplementary FHA was completed to identify and assess potential external fires and the impact on the facility and its occupants and has been submitted to the CNSC for review.

6.9 Waste and By-Product Management

The "Waste and By-product 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 also covers the ongoing decontamination and planning for decommissioning activities.

Waste and by-product management is described and summarized in Appendix C, submitted to the CNSC separately.

6.10 Nuclear Security

The "Nuclear Security" Safety and Control Area covers the programs required to implement and support the security requirements stipulated in the regulations, in the operating licence, and in industry expectations for the facilities.

Facilities are compliant with CNSC requirements. There were no breaches of security and no significant program improvements made at either site during the reporting period.

6.11 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 RD-336 *Accounting and Reporting of Nuclear Material*. Movement of natural and depleted uranium (inventory changes) are documented and reported to the CNSC as required.

In Peterborough, a Physical Inventory Taking was conducted on July 8th, 2016. A Physical Inventory Verification involving the CNSC and the IAEA followed on July 11th and 12th, 2016. In Toronto, the Physical Inventory Taking was conducted on July 13th. A Physical Inventory Verification involving the CNSC and IAEA followed on July 14th and 15th 2016. The scope concerned book examination and physical verification of nuclear material. In Peterborough, material unaccounted for was discovered and investigated. The cause was determined to be an accounting error that occurred on February 11th, 2016 for a shipment from Toronto to Peterborough. Inventories have been updated to reflect current.

Short Notice Random Inspections were conducted by the CNSC and IAEA on February 9, 2016 in Toronto and on April 21, 2016 in Peterborough. The scope concerned verification of records for current shipments of finished product. Physical pellet samples were taken for confirmation of natural uranium. No major non-conformances were noted.

6.12 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 licenced facilities.

In April 2016, a minor compliance miss for a Class 7 shipment from Peterborough to Toronto was reportable to the CNSC. A pellet stack was discovered in Toronto in a skid of contaminated empty trays. The presence of pellets was not included on the shipping documentation. The skid was classified as UN2908 on the bill of lading and it should have been classified as a UN2912 shipment. There was no impact to any employee, the public or the environment as a result of the miss. A full Tap Root investigation was conducted that identified two causal factors. Two corrective and preventive actions were logged into ATS and tracked to closure.

All other shipments to and from both facilities were conducted safely according to regulations during the reporting period.

6.13 Other Matters of Regulatory Interest

6.13.1 Public Information Program

6.13.1.1 Employee/Internal Communications

BWXT NEC has approximately 350 employees at three locations in Ontario – Arnprior, Peterborough and Toronto.

Employees are recognized for the valuable role they play in the spread of factual information to their social, family, community and professional networks about the positive contributions that BWXT NEC makes to the communities in which it operates and to the nuclear industry.

A key focus for the year was around executive communications and building and maintaining a positive relationship between employees and the President who came to that role in mid-2015.

With the acquisition of the licensee by BWXT Canada announced in August, 2016, the focus of employee communication shifted from standard information to addressing employees' information needs in order to effectively ready the organization for a successful closing and transition to the new owner.

Words with Ward – Executive Blog

In January 2016, the President launched a blog titled Words with Ward with the objective to provide insightful, high-level information to employees and engage in two-way dialogue. The blog was issued monthly to all employees via email and linked to the employee portal where employees could provide comments or ask questions.

The blogs covered a range of topics such as industry updates, the Company's ongoing focus on safety and quality, community relations activities and other general business updates/information.

Employee Conversation Sessions

In 2016 the President launched a series called Employee Conversation Sessions. The objective of these sessions was to provide every employee the opportunity to open-dialogue with the President in small groups of 10 to 15 and share their ideas, thoughts and experiences or simply ask questions. The sessions were voluntary attendance and were very well attended. Following the acquisition announcement, the sessions continued and much of the dialogue shifted to questions about the acquisition and pending transition.

All-Employee Meetings

Two all-employee meetings were held at each of the sites, one of the meetings incorporated the annual all-employee barbeque. The meetings provide employees with business updates, health and safety performance, corporate messaging, project updates, organizational news, etc. and were led by members of the leadership team.

Monitors and Information Boards

Television monitors are installed on the manufacturing floors and lunch rooms at the Peterborough and Toronto facilities. The monitors are used regularly to communicate messages to employees who do not work on a computer due to the nature of their jobs. Information that is regularly communicated include:

- Safety Awareness Tips
- EHS Updates
- Site Visitors
- Schedule Updates
- Training Opportunities
- Local company-sponsored events/activities

The use of the television monitors helps BWXT NEC communicate more effectively and timely with production and manufacturing-based employees. Information is updated and changed as needed and approximately 100 messages were posted to the monitors at each location last year.

Employee information boards located in the manufacturing areas are a place where employees without regular use of computers could pick up printed communications. These included blog posts, stories from the employee portal, safety information and other company information.

6.13.1.2 Acquisition Announcement Communications

The announcement for the definitive agreement for the sale of GEH-C to BWXT Canada was made to employees and the public on August 18, 2016. A primary objective of the announcement was to inform employees, media, regulators and other key stakeholders of the sale and instill confidence in these stakeholder groups that the announcement would have no impact on the general operational, safety and quality performance of the Company.

Employee Communications

Employees were the primary focus of acquisition communications as they are the licensee's most valuable asset. All three operations were notified at the same time with Toronto and Arnprior sites being connected to Peterborough where senior leadership made the announcement. The announcement to employees was coordinated with the public announcement to ensure compliance with Security Exchange Commission rules.

A formal letter was also issued to International Federation of Professional & Technical Engineers and Unifor national union leaders on the day of the announcement.

A significant amount of communication to employees occurred between August 18, 2016 and the announcement of the successful closing of the acquisition on December 19, 2016. Two all-employee meeting sessions took place between the announcement and closing including meetings at all three sites and one town hall meeting connecting the three locations via webcast. Other forms of communication included email updates, a dedicated area for acquisition and transition information on an internal platform, and the employee conversation sessions which continued throughout the process and provided a venue for small group dialogue.

News Release

A GE and Hitachi, Ltd. news release and a BWX Technologies, Inc. news release were separately issued on the Businesswire to ensure the announcement reached a broad audience.

The GE and Hitachi, Ltd. news release was also issued to local media in Arnprior and Peterborough.

Media Coverage

As a result of the announcement approximately 15 media articles appeared in local, national, trade and U.S. outlets. Overall media coverage was balanced and focused on the facts of the announcement.

Stakeholder Notifications

Notification of stakeholders outside of the employee base was an important aspect of the overall communications plan. The news release was leveraged as a tool to communicate the announcement to a range of stakeholders including government officials, customers, industry associations, community groups/organizations and residents.

6.13.1.3 Acquisition Closing Communications

On December 19, 2016, BWXT Canada announced it had completed its acquisition of GEH-C and the company had been renamed as BWXT Nuclear Energy Canada Inc.

Employees

Employees were welcomed to the BWXT family through an email message from the BWXT Canada President. Employees were also provided with a detailed booklet with a wealth of information that helped ensure employees could continue their work safely and without interruption. The President of BWXT Canada and the President of BWXT NEC also conducted all-employee meetings at all three sites in early January, 2017.

News Release

BWXT issued a news release on the Businesswire. BWXT NEC issued a localized press release that focused on continued safe operations and confirmed that operations would continue in the three communities of Arnprior, Peterborough and Toronto.

Media Coverage

The acquisition closing announcement garnered some media interest with articles appearing in the following outlets:

- CTV News Kitchener
- Peterborough Examiner
- Waterloo Record

Stakeholder Notifications

As with the August announcement, notification to stakeholders following the closing of the acquisition in December was an important aspect of the overall communications plan to support seamless operations and overall awareness across a range of stakeholder groups. The news release was leveraged as a tool to communicate the closing of the acquisition to government officials, customers, industry associations, community groups/organizations and residents.

Website

The website was rebranded to BWXT Nuclear Energy Canada and is located at www.nec.bwxt.com.

The rebranded website launched on December 19, 2016 and a redirection was implemented to point the GEH-C website to www.nec.bwxt.com.

Key metrics for the new website from Dec.19 to 31:

- Session: 336
- Users: 259
- Pageviews: 814

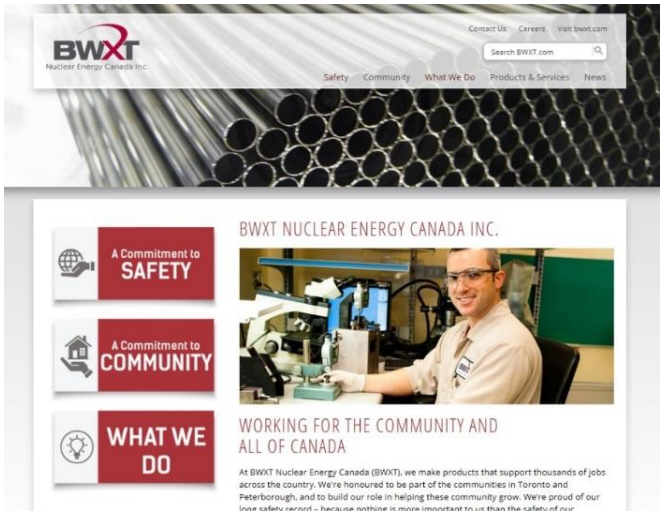


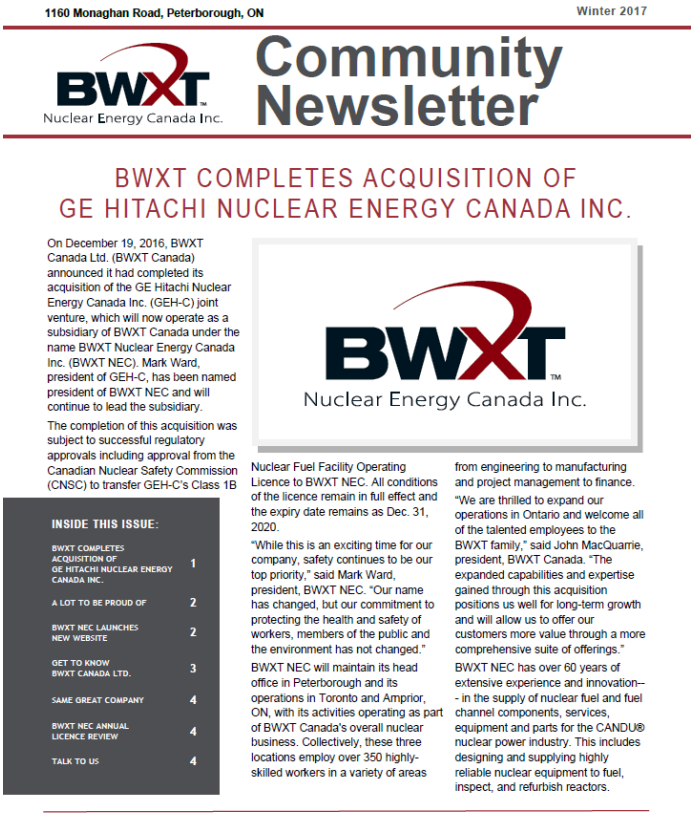
Figure 12: BWXT NEC Rebranded Website

Community Newsletters

With the acquisition closing in mid-December near the holiday season, Community Newsletters were held back and released in January.

The newsletters were rebranded to BWXT NEC and featured an update on the acquisition closing, new branding, and messages from the President of BWXT Canada and the President of BWXT NEC.

The January-issued newsletters were delivered to approximately 1,500 addresses near the Peterborough facility and 1,700 addresses near the Toronto facility.



1160 Monaghan Road, Peterborough, ON — Winter 2017

Nuclear Energy Canada Inc.

Community Newsletter

BWXT COMPLETES ACQUISITION OF GE HITACHI NUCLEAR ENERGY CANADA INC.

On December 19, 2016, BWXT Canada Ltd. (BWXT Canada) announced it had completed its acquisition of the GE Hitachi Nuclear Energy Canada Inc. (GEH-C) joint venture, which will now operate as a subsidiary of BWXT Canada under the name BWXT Nuclear Energy Canada Inc. (BWXT NEC). Mark Ward, president of GEH-C, has been named president of BWXT NEC and will continue to lead the subsidiary.

The completion of this acquisition was subject to successful regulatory approvals including approval from the Canadian Nuclear Safety Commission (CNSC) to transfer GEH-C's Class 1B Nuclear Fuel Facility Operating Licence to BWXT NEC. All conditions of the licence remain in full effect and the expiry date remains as Dec. 31, 2020.

"While this is an exciting time for our company, safety continues to be our top priority," said Mark Ward, president, BWXT NEC. "Our name has changed, but our commitment to protecting the health and safety of workers, members of the public and the environment has not changed."

BWXT NEC will maintain its head office in Peterborough and its operations in Toronto and Amprior, ON, with its activities operating as part of BWXT Canada's overall nuclear business. Collectively, these three locations employ over 350 highly-skilled workers in a variety of areas from engineering to manufacturing and project management to finance.

"We are thrilled to expand our operations in Ontario and welcome all of the talented employees to the BWXT family," said John MacQuarrie, president, BWXT Canada. "The expanded capabilities and expertise gained through this acquisition positions us well for long-term growth and will allow us to offer our customers more value through a more comprehensive suite of offerings."

BWXT NEC has over 60 years of extensive experience and innovation--- in the supply of nuclear fuel and fuel channel components, services, equipment and parts for the CANDU® nuclear power industry. This includes designing and supplying highly reliable nuclear equipment to fuel, inspect, and refurbish reactors.

INSIDE THIS ISSUE:

Figure 13: Peterborough Community Newsletter

External Signage

The replacement of GEH-C signage on the building exteriors in Toronto and Peterborough were a priority and part of the effort to establish the new brand within the two communities. Most of the existing external signs were replaced within a few days of the December 19 announcement of the successful completion of the acquisition.

The Toronto rock sign will be replaced in the first quarter of 2017 and a large BWXT illuminated sign will be placed on the south corner of Building 26 in Peterborough.

Figure 14: BWXT NEC External Signage

6.13.1.4 Government Stakeholders

BWXT NEC recognizes the importance of building and maintaining relationships with all levels of government in the communities in which it operates and proactively seeks to engage local elected officials to ensure representatives are aware of BWXT NEC's operating activities in Toronto and Peterborough.

In 2016, letters were issued to government officials in Toronto and Peterborough inviting them to meet with Company representatives and tour the respective facility in their riding. Letters were sent to the following government officials:

- MPP for Davenport
- MP for Davenport
- MP for Peterborough-Kawartha
- MP for Northumberland-Peterborough South and Parliamentary Secretary to the Minister of Natural Resources
- Mayor of Peterborough

Meetings were arranged with officials but schedule changes and conflicts prevailed.

The MPP for Peterborough had toured the facility in December, 2015 and will be contacted in 2017 to request a meeting and tour. The Mayor of Peterborough had visited the Peterborough facility in November 2015.

BWXT NEC's commitment to improve and establish relationships with government representatives extends beyond its facilities licensed by the CNSC. MP and MPP representatives from the Renfrew-Nippising-Pembroke riding which encompass Arnprior, were invited to meet and tour the Arnprior facility.

BWXT NEC also participated in Canadian Nuclear Association activities including Hill Day (May) and Fall Legislature Day (September).

6.13.1.5 Community

Volunteerism

Volunteering is a vibrant part of the BWXT NEC culture and employees support a wide-range of local community organizations and groups with the objective to support the long-term well-being of the communities in which BWXT NEC operates.

In 2016, about BWXT NEC Peterborough employees spent over 700 hours supporting 24 local community initiatives including Habitat for Humanity, One Roof Diner, Ashburnham Community Gardens and Greenwing Fishing Derby among others.

Toronto employees supported Clean Together Toronto by cleaning up the city side of the Lansdowne and Brandon Avenue property, as well as the grounds at the Primrose Avenue Parkette and portions of St. Clarens Avenue. Employee volunteers from the Toronto facility also supported the Ignatius Old-Growth Forest Project, helping to restore one acre of land by planting trees. Employees also supported the Daily Bread Food Bank through its annual food drive and collected toiletries and monetary donations for the Red Cross to support Help for Fort McMurray.

Community Investment

The Peterborough operation supported a range of community-based groups/initiatives that help improve community life in three key areas: community and cultural, charitable and health care support, education and vocational support. Examples include bursaries to local high school graduates, support for the Peterborough Science Fair and funding to support St. Alphonsus Elementary School's playground equipment. The Peterborough operation also donated a sizeable number of tools such as various gauges, height masters and indicators to Norwood District High School. The tools were all from the standard manufacturing division of the business.

In Toronto, BWXT NEC donated 15 Google Chrome Books to Pauline Junior Public School to support learning and access to technology for students in grades 4 to 6. Members of the Toronto facility's social club voted to make a financial contribution to Sick Kids Hospital and a donation was made on the employees' behalf.

GEH-C and GE Energy Management employees in Peterborough worked together to raise funds for the Peterborough United Way.

In Toronto, employee efforts supported GE Canada's United Way campaign.

The money is raised through payroll donations and employee-led fundraising initiatives.

Sponsorship and Special Events

The Company sponsored the Peterborough Dragon Boat Festival in 2016 as a Silver Sponsor. In Toronto, GE Canada provided support to local arts group, Drum Artz on behalf of GEH-C.

BWXT NEC also lends its support to the communities which are host to the utilities as they play an important role in Ontario's nuclear industry and some BWXT NEC employees also live and work in these communities:

- Bruce Power Charity Golf Tournament – Kincardine Community Health Care Foundation - August 12th
- Tribute to Duncan Hawthorne – Liv a Little Foundation – April 20th
- Darlington Refurbishment Charity Golf Tournament for Big Brothers Big Sisters of Clarington – June 22nd

- Unity for Autism's 2016 Charity Golf – September 22nd
- Durham LAV Monument – September

In March, 2016, the President attended the Rotary Club to deliver an overview of the company's operations in Peterborough to approximately 70 Rotary Club Members. The presentation resulted media coverage in the Peterborough Examiner and on CHEX TV, both of which included quotes from the President and information gleaned from the presentation.

Tours

Following the Rotary Club presentation in March, Rotary Club members were invited to tour the Peterborough operation. Three tours were conducted with approximately 30 members. Guests toured through the fuel manufacturing facility in Building 21 and nuclear services in Building 26.

In Toronto, members of the Canadian Radiation Protection Association were provided with a tour of the Toronto facility. Attendees included representatives from various universities.

Community Barbeques

BWXT NEC is committed to improving its communications and relationships with its local communities. To support this commitment, community barbeques were held in Peterborough on June 11, 2016 and in Toronto on June 25th. The barbeques were held to engage neighbours, community members and other stakeholders, and educate them on the respective facility's operations.

The Peterborough barbeque was the first for the Peterborough operation and an estimated 150 community members came out. An estimated 130 community members attended the second annual community barbeque in Toronto.

Senior leaders and managers staffed the barbeques and provided information about its operations and educated guests on the role of nuclear in Ontario.

Figure 15: Peterborough Barbeque Information Booth

Guests were treated to free barbeque fare such as hamburgers and hotdogs, and could speak with senior leaders and managers. Newly designed posters provided visuals and information about the Company's history, highly-skilled workforce, engineering and manufacturing capabilities, track record of safety and regulatory compliance, public information program and natural uranium. At the Toronto barbeque, guests were treated to a performance by Drum Artz, a local arts and music program which was sponsored by GE Canada.

Local media in Peterborough were advised of the barbeque, resulting in a brief article in the Peterborough Examiner which helped to encourage attendance.

Community Newsletters

Community newsletters are an important tool for BWXT NEC to inform residents about the company's presence in the community, participation in and/or support for community initiatives and operational performance including health and safety information and emergency exercises.

Three newsletters were issued to the Toronto community in 2016. The distribution of Toronto newsletters was nearly tripled in 2016 compared to 2015 by increasing the distribution list from approximately 600 addresses to approximately 1,700. The Toronto newsletter is translated to Portuguese and included in the mailing. Two newsletters were issued to approximately 1,500 addresses in the Peterborough community.

In addition to the newsletters, a postcard was issued to the Toronto community notifying residents of a planned emergency exercise taking place at the facility on October 25th, and a flyer was distributed in June reminding the Toronto community of the June 25th barbeque.

Community Liaison Committee - Toronto

The Toronto Community Liaison Committee (CLC) was established in 2013 and meets four times per year at the Toronto facility in the evenings. The CLC is not a decision-making body but provides a forum for the exchange of information between the community and BWXT NEC. Members can bring forward questions, discuss concerns and identify opportunities to improve community relations, while the Company can learn more about community priorities, interests and activities, and improve how it shares information about work at the Lansdowne Avenue facility, health & safety initiatives and community activities.

In 2016 there were five members who are neighbours and residents in the community. CLC members provide input on BWXT NEC activities such as newsletter content, annual barbeque, community initiatives, etc. Their input is valuable in guiding communications efforts with area residents.

Members meet with staff to dialogue about the facility's operations and receive updates on topics such as emergency planning and training, volunteer initiatives and environmental monitoring.

On the day of the announcement of the definitive agreement for the sale of GEH-C to BWXT Canada, CLC members were provided with the news release. At the September meeting, members expressed interest in understanding BWXT Canada's commitment to the community. As the acquisition did not close until Dec. 19, 2016, this discussion will occur at the first meeting of the year scheduled for March, 2017.

In 2016, a Terms of Reference for the CLC was established, with input from CLC members. The Terms of Reference provides guidance on the structure and purpose of the CLC, along with conduct and length of membership and renewal.

To help support the continued improvement of the CLC and encourage new membership, a recruitment campaign was launched on Oct. 3, 2016. A call for applicants, along with the application, were posted

on the website and a call for applicants was included in the November Toronto Community Newsletter. Letters and applications were mailed or emailed to local community organizations. Current CLC members supported efforts by encouraging their networks in the community to apply for membership.

New member selection occurs early in 2017 and new members will be provided with an orientation prior to the first meeting of the year.

2016 CLC meeting dates:

- Mar. 23, 2016
- June 29, 2016
- Sept. 20, 2016
- Nov. 23, 2016

Meeting records are posted to the Company's website.

Website

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 2016, there were 9,560 total sessions from 7,677 users. Top pages visited were: Home page (43 percent of all unique page views), What We Do (14 percent) and Products & Services (12 percent).

Over the course of 2016, new information was updated on the website. The following represents some of the updates that were made to the website:

- The 2015 annual compliance report was posted
- A call for applications to the Toronto CLC was posted
- Copies of the Toronto (three) and Peterborough (two) newsletters were posted
- An update on the Rotary Club presentation was posted
- The Independent Environmental Monitoring Program results for Peterborough 2014 were posted

Public Inquiries

Members of the public can contact the company through a toll-free 1.800# and a general email. While still GEH-C through most of 2016, the toll-free number was 1-855-696-9588 and the email was GEH.Canada@ge.com. Both were posted on GEH-C's website and provided in Community newsletters.

Following the acquisition which closed in December, 2016, the 1-800# remained the same and email was changed to questions@bwxt.com. These are both posted on the BWXT NEC website and will be included in community newsletters.

In 2016, 105 emails were received and 44 phone calls. Key topics were:

- Employment verification requests
- Employment or co-op student inquiries/sending resumes
- Community barbeque responses

- Security clearance requests

6.13.1.6 Media

Earned Media

The media are a valuable component of BWXT NEC's communications program and are recognized as an important conduit to reaching local and broader audiences. Media can play a significant role in helping to educate and shape the perception and understanding of BWXT NEC's operations.

In 2016, BWXT NEC conducted media interviews with CHEX TV and the Peterborough Examiner following its Rotary Club presentation. BWXT NEC also reached out to the Peterborough media leading up to its community barbeque to generate awareness of the event. The resulting coverage was positive and included quotes from BWXT NEC spokespeople.

Significant announcements in 2016 were the announcement of the definitive agreement for the sale of GEH-C to BWXT Canada Ltd., on August 18th and the closing of that sale which was announced on December 19th. The resulting media coverage (noted in 6.13.1.2 and 6.13.1.3), was overall balanced.

The Company also received media coverage because of its support of the Peterborough Dragon Boat Festival.

Advertising

2016 advertising included the placement of ads in:

- University of Ontario Institute of Technology Engineering Guidebook
- Canadian Nuclear Association Year Book

6.13.1.7 Social Media

GE Hitachi's twitter account was used to issue tweets about GEH-C activities. In total, 13 tweets were sent out in 2016, more than any other year. Tweets were used to create awareness of the community barbeques and volunteer activities in the Peterborough and Toronto communities.

2017 Look Ahead

BWXT NEC is committed to improving its use of social media and will leverage BWX Technologies (BWXT) social media assets to enhance its social media engagement. BWXT social media assets include:

- Facebook
- LinkedIn
- Twitter
- YouTube

6.13.1.8 Public Disclosures Protocol

BWXT NEC has a Public Disclosure Protocol in place that sets out guidelines to providing timely information to interested members of the public and other stakeholders. Disclosures are posted to the Company website and emailed to a distribution list of interested individuals and groups.

Information about the Public Disclosure Protocol is made available on the website along with any disclosures made. In 2016, three Public Disclosures were made, one at each site, both of which were

innocuous operational events with no risk to the public, workers or environment, and one general disclosure regarding the CNSC's approval to transfer GEH-C's licence to BWXT NEC.

The Disclosure made related to Toronto was:

- False alarm resulting from the elevator approaching its weight limit (Jan. 15)

The Disclosure made related to Peterborough was:

- Accidental activation of the fire alarm due to a sprinkler flow test (Mar. 15)

6.13.2 Site-Specific

6.13.2.1 Nuclear Criticality

This section is not applicable. BWXT NEC does not have an active Nuclear Criticality Program since neither facility process enriched uranium.

6.13.2.2 Financial Guarantee

As a result of the amalgamation and the formation of BWXT NEC in December 2016, BWXT NEC provided a replacement financial guarantee reflecting the corporate name change in early January 2017. The amount of the replacement financial guarantee was unchanged and is based on preliminary decommissioning plans previously accepted by the CNSC. Plan updates are required every 5 years.

6.13.3 Improvement Plans and Future Outlook

There are no significant operational changes planned for 2016.

6.13.4 Safety Performance Objectives for the Following Year

Facility operations are expected to remain constant in 2017. Fuel production levels are projected to be similar to the amount processed in 2016. No significant changes are currently forecasted for the Fuel operations. The facility operating licence remains valid until 2020.

7 CONCLUDING REMARKS

At BWXT NEC, 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.

There were no significant environmental issues or incidents encountered during the reporting period. All production limits were respected. Transportation of dangerous goods was conducted between suppliers and customers and waste vendors without risk to workers, the public or the environment. Conventional health and safety and radiation protection programs were well implemented. Whole body effective, skin and extremity radiation dose measurement results for employees were below *Action Levels* and regulatory limits. Environmental protection programs were well implemented. Both facilities maintained ISO 14001:2004 Environmental Management System registrations. Facility emission results were all very low and below *Action Levels* and regulatory limits. Annual releases to the water and air were both a very small fraction of regulatory limits, resulting in minimal dose to the public.

This compliance report demonstrates that BWXT NEC has successfully met the requirements of the Nuclear Safety and Control Act, Regulations and CNSC Class 1B nuclear facility operating licence requirements.