GE-Hitachi Nuclear Energy Canada Inc.

January 1 to December 31

2014

The information contained in this report concerns the performance and operation of GE Hitachi Nuclear Energy Canada Inc.'s (GEH-C) Class 1B nuclear facilities located in Peterborough and Toronto, Ontario. This report is prepared to meet fuel fabrication operating licence FFOL-3620.00/2020 condition 2.4. The content shows adherence to the GE Hitachi commitment to operate a safe Class 1B nuclear facility, 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	EHS Team March 27, 2015	EHS & Licencing Manager March 27, 2015

Signing Authority Contact Information:

Paul Desiri, EHS & Licencing Manager

1025 Lansdowne Avenue

Toronto, ON. M6H 3Z6

Phone number: 416-583-4264

Email: paul.desiri@ge.com

Report Distribution:

Submitted to: J. Amalraj, CNSC Project Officer on March 31, 2015

CC:

- M. Ward GEH-C
- D. LeFrancois GEH-C
- D. Pile GEH-C
- J. MacPhee GEH-C
- K. Kan GE Canada
- Union – Health and Safety Representatives

1 EXECUTIVE SUMMARY

The purpose of this compliance report is to demonstrate that GE Hitachi Nuclear Energy Canada Inc. (GEH-C) has successfully met the requirements of the Nuclear Safety and Control Act and the Class 1B Nuclear Fuel Facility Operating Licence renewed by the Canadian Nuclear Safety Commission (CNSC) on January 1, 2011, and expiring December 31, 2020. The licence authorizes GEH-C to operate and modify its nuclear fuel facility for the production of natural and depleted uranium dioxide (UO_2) pellets in Toronto and produce and test fuel bundles in Peterborough. The Peterborough facility is additionally authorized to receive, repair, modify and return contaminated equipment from off-site nuclear facilities.

This report is prepared based on the Canadian Nuclear Safety Commission'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 under separate cover.

GEH-C 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

GEH-C maintains the following internal certifications:

- GE Global Star Site for Health and Safety program excellence
- GE Health Ahead Certification

Employee workplace exposures, conducted by CNSC approved methods and systems, were below regulatory limits. Overall, dose trends were favorable 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. One *Action Level* was exceeded for a Whole Body dose from a Peterborough employee. The event was reported to the CNSC in accordance with licence conditions. An investigation into the incident concluded that the majority of this exposure was non-occupational because of improper dosimeter storage.

Air and water emissions are routinely measured from both facilities to demonstrate compliance with the Canadian Nuclear Safety Commission's environmental protection requirements and the ALARA principle. All measurements were below GEH-C A*ction Levels* and annual releases were a very small fraction of regulatory limits.

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 adversely affect employee health and safety, the environment or the public as a result of the operation of GEH-C's facilities are assessed through the Change Control program.

Each facility has established emergency response plans that describe the actions to be taken in order 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

GEH-C 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 daily and as required.

GEH-C 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. Shipments occur 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.

GEH-C 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, GEH-C 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. *Internal Control Level* exceedances result in internal investigation and correction and are not CNSC reportable events.

GEH-C 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 GEH-C operations to interested members of the public. Public interest in the Peterborough facility remained low, while public interest in the Toronto facility decreased last year and was considered moderate during the reporting period. Enquiries were tracked and responded to in a timely manner. Improvements to the program were ongoing during the reporting period, including various upgrades to our dedicated public information web site. The Community Liaison Committee, 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 GEH-C 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

GE Hitachi Nuclear Energy Canada Inc. (GEH-C) operates a Class 1B nuclear facility to fabricate natural uranium fuel in two separate facilities. Ceramic grade uranium dioxide powder from Cameco Corporation is received at GEH-C's Toronto Facility where uranium dioxide pellets are fabricated. The majority of these pellets are shipped to GEH-C's Peterborough Facility and assembled into CANDU (Canadian Deuterium Uranium) reactor fuel bundles. Smaller quantities of pellets are fabricated for our parent company in Wilmington North Carolina. Finished bundles are then shipped to various customers. In addition, GEH-C's Class 1B licence approves the receipt of contaminated equipment for repair/modification in Peterborough.

As a nuclear facility, GEH-C 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 Human Resources and Skills Development Canada (HRSDC). GEH-C facilities are also regulated federally by Transport Canada. GEH-C is additionally regulated provincially by the Ontario Ministry of the Environment (MOE). Compliance to these agency requirements is ensured through management systems, GE 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

GEH-C also maintains GE Global Star certification for Health and Safety program excellence, and Health Ahead certification for workplace wellness.

GEH-C'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 GEH-C management team reviews, prioritizes and controls workplace hazards and ensures compliance with the pertinent regulatory requirements, applicable codes and GE 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 <0.5	Achieved	Not Achieved
Zero lost time injuries	Achieved	Not Achieved
Days away from work rate <0.2	Achieved	Not Achieved
Drive EHS Excellence – Zero notice of violation, penalties, permit misses, reportable releases	Achieved	Achieved
All EHS findings tracked in Action Tracking System; 100% closed on time (30-days regulatory, all<120 days)	Not Achieved (93% regulatory closed within 30 days; 96% closed within 120 days)	Achieved (100% regulatory closed within 30 days; 100% closed within 120 days)
100% completion Environment Health and Safety regulatory training	Achieved	Achieved
Favorable dose trend with at least a 5% reduction in average effective radiation dose	Not Achieved	Not Achieved*

Table 1: Primary Environment, Health and Safety Goals

** Note - Effective 2014, all shop employees are included in the internal dose monitoring program. This has resulted in an increase in total effective dose.*

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 doses 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. With the exception of one unusual Peterborough TLD result that was attributed to non-occupational exposure, all dose measurement results for employees were below GEH-C 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 GEH-C 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.

Production operations continued routinely, without any significant challenges. Natural uranium dioxide pellets were shipped to GEH-C's facilities without incident. They were assembled into CANDU reactor fuel bundles in Peterborough and were then safely shipped to various customers. Radiation Safety Instructions 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
ALARA	As Low as Reasonably Achievable (social and economic factors considered)
ATS	Action Tracking System
CANDU	Canadian Deuterium Uranium
CCME	Canadian Council of Ministers of the Environment
CLC	Canada Labour Code
CNSC	Canadian Nuclear Safety Commission
dpm	Disintegrations per minute
EHS	Environment, Health and Safety
EMS	Environmental Management System – ISO 14001
GEH-C	General Electric Nuclear Energy Canada Inc.
IAEA	International Atomic Energy Agency
ISO	International Standards Organization
MOE	Ministry of the Environment
mSv	millisievert – unit of measure for radiation dose
NFPA	National Fire Protection Association

Acronym	Definition
ppm	Parts per million
QALA	Quality Assurance for Licenced Activity
RSI	Radiation Safety Instruction
SSC	Systems, structures and components
TDG	Transportation of Dangerous Goods
TLD	Thermoluminescent Dosimeter
UO_2	Uranium Dioxide
WSC	Workplace Safety Committee

Table 2: Definition of Acronyms

PART I: WORKER PROTECTION

3 FACILITY OPERATIONS

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

GEH-C maintains four 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 in order to ensure that radiation doses are as low as reasonably achievable.
- 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.

During the reporting period, there were no vacant key positions. The following modifications were made to the company organization structure:

- In July 2014, the Peterborough Environment, Health and Safety (EHS) department was restructured. Three employees reporting changed from the EHS Leader. Two now report to the Plant Manager of Fuel Assembly Operations and one reports to the Plant Manager of Nuclear Services. All EHS employees also have dotted line reporting to the Manager EHS and Licencing.
- In September 2014, a Lead Project engineer was hired to provide process improvement support to the Toronto facility.
- In December 2014, the Maintenance Leader was promoted to Manager, Shop Operations of Fuel Assembly. All production operations employees now report directly to the Manager Shop Operations. He continues to lead process maintenance activities.

During the reporting period, there were fire safety upgrades completed in both licensed locations. In Toronto, various upgrades to security were made which are considered security protected information. In Toronto, safety improvements to Furnace 5 were also achieved including upgrades to ensure NFPA, ESA, CSA, and TSSA compliance.

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 28 internal audits were conducted. There were 10 external agency inspections. This included the CNSC, IAEA and MOE. 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 supplied to the CNSC in Appendix C and submitted under separate cover. There was a one-week production shutdown in the 1st quarter, a three week production shutdown in the 3rd Quarter and a one-week production shutdown in the 4th 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 0.006% 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 under separate cover.

5 FACILITY MODIFICATIONS

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 GEH-C'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 GEH-C 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 was conducted by management on February 19, 2015 for the 2014 calendar year. The following elements were reviewed:

1. Results of quality assurance for licenced activity (QALA) internal and external audits (where applicable) and findings
2. Review of Health and Safety Scorecard results for each Global Star Element
3. Review of Management Self-Assessments
4. Trends in non-conformances (Gensuite Action Tracking System (ATS) items)
5. Trends in Incident and Measurement (Gensuite I&I) items for root cause
6. Extent to which Workplace Safety Committee and ALARA Committee (where applicable) objectives and targets have been met
7. Radiation exposure results and trends
8. Changing circumstances and recommendations for improvement
9. Evaluation of the effectiveness and continuing suitability of the EHS Mission Statement and the Health and Safety Program
10. Follow-up actions from previous management reviews

Overall, the implemented QALA program is considered suitable, adequate and effectively implemented throughout Toronto and Peterborough. Continuous improvement remains a priority. Opportunities for improvement are identified in the meeting minutes and entered into ATS.

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 GEH-C documented management system are on-going. The EHS Policy remains unchanged since 2012. In 2014, minor continuous improvements were made to management system program elements as follows:

- The Document Structure and Content procedure was updated to include Fuel Sourcing.
- The Document Use and Compliance procedure was re-written for clarity.
- The Management Self-Assessments and Annual Management Review procedure was updated to add that risk is considered in setting self-assessment frequencies.
- A new procedure establishing high-level Training Program Requirements was released.
- A new procedure outlining the major elements of the Enterprise Asset Management (EAM) program through the Maintenance Connection software suite was released.
- The Change Notice work instruction was updated to include organizational changes and parts substitution for critical-to-safety equipment in its scope. The update also included a new risk assessment module that permits low risk changes to proceed outside of additional constraints, and requires high risk changes to be managed by a formal project team or project management specialist.

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.

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

	Peterborough		Toronto	
	Number of Audits	Number of Non-conformances	Number of Audits	Number of Non-conformances
GEH-C Cross Business Audits	1	2	1	3
General Electric Cross Business Audits	0	0	0	0
GEH-C Compliance Audits (Power Audits)	10	0	10	0
Quality Assurance for Licenced Activity	1	0	3	1
Environmental (14001) Audit	1	1	1	0
TOTAL	13	3	15	4

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.

	Peterborough		Toronto	
	Number of Self-Assessments	Number of Findings	Number of Self-Assessments	Number of Findings
Radiation Protection	1	1	1	4
Work Planning Control and Verification	1	1	1	4
Environmental Protection	1	5	1	3
Waste	1	6	1	4
Non-Conformance and Corrective Actions (EHS not included in scope)	1	1	1	2
Document and Record Control (EHS not included in scope)	1	2	1	1
Emergency Preparedness and Fire Protection	1	3	1	1
TOTAL	7	19	7	19

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 GEH-C 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 described in the license application document section 3.2 and outlined in the Licenced Activity Quality Assurance Manual, 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 job safety analysis training. Both facilities achieved 100% regulatory training completion in the reporting period. Specific course completion details are in subsequent sections of this report.

The GEH-C working group for the implementation of a Systematic Approach to Training method continued to meet weekly during the reporting period. Their goal is to systematically define, design, develop, implement, evaluate, record and manage worker training. A training guide, procedure and process developments are ongoing. The status of implementation is reported separately to the CNSC.

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 if needed.

6.3 Operating Performance

The "Operating Performance" Safety and Control Area covers an overall review of the operations licenced activities. Management conduct 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.

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 28 internal audits were conducted. Related licenced activity audits are summarized in Table 3 and section 6.1.1.2 above. There were 10 external agency inspections. This included the CNSC, IAEA and MOE.

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*, and Health and Safety Manual Procedure 14.0 *Management of Change and Preventive Maintenance* which requires review of environment, health and safety 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 done 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, as part of the change process.

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 GEH-C's facilities are assessed through the Change Control program and *Management of Change and Preventive Maintenance* procedures. 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 modification.

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

- Lead shielding was added to the bundle assembly weld conveyor as an *As Low as Reasonably Achievable* initiative (Building 21 Peterborough)
- New de-ionized water system for the fuel process (Building 21 Peterborough)
- Bundle rework area was rearranged as an *As Low as Reasonably Achievable* initiative with improved shielding and a bundle cart parking area (Bundle 21 Peterborough)
- All necessary hardware and software to provide GE-Hitachi with a sprinkler system separated from GE Motors was installed (Peterborough)
- New 3-phase power distribution panel to feed Furnace #1, Bipel, Cooling tower #1, Elevator, Hot Water (Building 7 Toronto)
- Continued security and monitoring system upgrades (Toronto)
- Lead shielding installations on carts and outside the 2nd floor change room by the Supervisor's office (Building 7 Toronto)
- Smoke detection installation in elevator machine room (Building 7 Toronto)
- Audio/visual fire alarm unit in compactor room (Building 9 Toronto)

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 have fully transitioned from the previous MP2 maintenance software system to Maintenance Connections. Maintenance Connections is a Web-Based Maintenance Management Software (or Web-Based CMMS Software) for Equipment Maintenance, Work Order Software, Building Maintenance Software, Facility Maintenance Software, Facility Management Software, Asset Management Software and Manufacturing Maintenance Software. Maintenance Connection connects maintenance personnel to extend asset lifecycle, track maintenance costs, prevent and predict equipment failures, improve labor productivity, reduce costly equipment downtimes, minimize investments in inventory, and lower the total cost of maintenance. This new software allows GEH-C to efficiently perform all the above mentioned tasks as well as help to control and identify Critical –to-Safety and Critical-to-Quality assets and parts. Preventive maintenance tasks deemed

Critical-to-Safety are designated in this system as described in Health and Safety Manual Procedures 14.0 *Management of Change and Preventive Maintenance*.

In the event of an incident, the preventive maintenance program for that equipment is reviewed if necessary. In Peterborough, a routine inspection revealed that the R2 area hydraulic tote cart was not functioning correctly in the up/down motion. A semi-annual task is now in place to inspect the equipment. A near miss during acid dispensing in a fume hood triggered a new semi-annual task to service the acid dispensette ball valves to prevent sticking. In Toronto, the preventive maintenance programs for the BWR torit, welding carts, and 4H48 exhaust were reviewed following near misses with these systems. There was an incident where air monitoring exceeded internal control levels during an RSI for a torit filter change. As a result, a work instruction and an additional task were created to ensure that filter changes are performed regularly on the torit systems. Following an incident where a cylinder fell while being transported, an additional check to verify welding cylinders are secure was added to the monthly inspection checklist. As well, the frequency of 4H48 exhaust maintenance was reviewed and found to be adequate following an incident with a broken belt.

In Peterborough, 99% of tasks deemed Critical-to-Safety issued in 2014 were completed without the need for follow-up. In Toronto, 90% of tasks deemed Critical-to-Safety issued in 2014 were completed without the need for follow-up.

Independent verification is done 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. A review of other areas in Toronto and in Peterborough continues to identify whether other maintenance activities require post-maintenance verification and testing.

The preventive maintenance program is considered to be adequate, however, as stated; a review of maintenance activities requiring post-maintenance verification and testing continues in both Toronto and Peterborough. In addition, review and update of the critical-to-safety lists continues into 2015.

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.

GEH-C has an established radiation protection program to address the hazards from UO_2 and keep employee doses ALARA. The major potential hazard is inhalation of airborne UO_2 particles. A respiratory protection program is in place. Measurements are performed of 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 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. The GEH-C program ensures that surface and airborne contamination and radiation doses to employees are monitored and controlled.

GEH-C has established facility specific CNSC approved *Action Levels* for various radiological and environmental parameters. An *Action Level* is defined in the *Radiation Protection Regulations* "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, GEH-C 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. These classifications are defined in the Radiation Protection Manual as follows:

- Unclassified Area - these areas do not involve nuclear substances and in which 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 *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 loose contamination may be above R1 *Internal Control Levels*.
- R3 Areas - these areas are designed for operations involving exposed solid dispersible nuclear substances, where external radiation may be of concern and where the hazard of contaminant inhalation or ingestion is identified. Loose contamination may be above R2 *Internal Control Levels* and below R3 *Internal Control Levels* for surface or airborne contamination.

Whole body, skin and extremity dose measurements are performed using thermoluminescent dosimeters (TLDs) to ensure compliance with the Canadian Nuclear Safety Commission's radiation dose limits and the ALARA principle. One 2014 dose measurement exceeded a quarterly *Action Level* in Peterborough. Details are provided in section 6.5.1.4. All 2014 dose measurements were below 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.

Surface contamination measurement results are summarized in Table 5.

	Classification and Area Description	Internal Control Level	2013		2014	
			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	592	0 (0%)	591	2 (<1%)
	R1 - Bundle Assembly, Inspection, Receiving, Building 24	220 dpm/100 cm^2	185	1 (<1%)	197	1 (<1%)
	Active - Met Lab	220 dpm/100 cm^2	108	1 (<1%)	111	1 (<1%)
	Unclassified - Items, Main Hallway	220 dpm/100 cm^2	348	2 (<1%)	463	2 (<1%)
Toronto	R3-Powder Preparation, Pressing, Grinding, Laboratory	22,000 dpm/100 cm^2	480	3 (<1%)	444	2 (<1%)
	R2-Sintering, Sorting & Stacking, Laboratory	2,200 dpm/100 cm^2	456	19 (4%)	504	23 (5%)
	Active - Plant Washrooms, Laundry Room	2,200 dpm/100 cm^2	144	1 (<1%)	144	0 (0%)
	Unclassified	220 dpm/100 cm^2	240	6 (2%)	284	19 (7%)

Table 5: Surface Contamination Result Summary

Peterborough surface contamination remains steady and low. Surface contamination results are reviewed by EHS staff. During the reporting period, there were six exceedances of *Internal Control Levels*. All areas were cleaned and re-swiped to confirm they were below *Internal Control Levels*.

Toronto surface contamination has seen an increase in the number of samples exceeding the Internal Control Level in 2014 over 2013. Surface contamination results are reviewed by EHS staff and discussed at Workplace Safety Committee Meetings. An additional five locations were added to the monthly swipe program. Without the addition of the five new locations, a 16% decrease in ICL exceedances over 2013 would have been seen.

Employee training and awareness as well the use of controlled area barriers saw an improvement in the number of ICL exceedances in these new areas towards the end of 2014. The Toronto ALARA committee is continuing its goal to reduce the number of sample results above the *Internal Control Levels* in 2015.

One personnel contamination event occurred in Toronto during the reporting period. A decontamination operator noticed she had powder on the back of her coveralls and in her hair. She changed her clothes and showered. This resulted from cleaning in a congested space and could have been prevented with improved job planning. The incident and the importance of job planning were communicated to employees. In Toronto, employees leaving the Radiation Areas are required to wash their hands, and Operators are required to shower at the end of their shift. In Peterborough, employees leaving the R2 area are required to wash their hands.

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 Radiation Safety Instructions (RSI). The 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.

Routine workstation air sampling results are summarized in Table 6.

	Peterborough			Toronto		
	2012	**2013**	**2014**	**2012**	**2013**	**2014**
Number of Workstations Sampled	3	3	3	19	19	22
Total Number of Samples Collected	47	48	46	4998	4979	5313
Total Number of Samples Exceeding *Internal Control Level* (facility and area specific)	0	0	0	1	2	7
Total Number of Samples Exceeding *Action Level* (facility and area specific)	0	0	0	0	0	0
Average Concentration (dpm/m^3)	0.83	0.57	0.67	9.0	10.0	11.0
Maximum Value Recorded (dpm/m^3)	3.70	2.0	1.86	212	212	753*

Table 6: Workstation Air Monitoring Summary

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

*The maximum result occurred during the execution of a radiation safety instruction for the change-out of the torit filters in the BWR Grinding Room. This result and all other *Internal Control Level* exceedances were investigated internally. All corrective and preventative actions are closed.

6.5.1.3 Facility Radiological Conditions

Routine gamma surveys are conducted at each facility. Peterborough conducts the survey on a monthly basis and Toronto on a quarterly basis. 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 are investigated for improvements, such as shielding.

Dose rate results are summarized in Table 7.

	Peterborough			Toronto		
	2012	2013	2014	2012	2013	2014
Total Number of Locations Surveyed	241	314	417	99	100	102
Average Dose Rate (µSv/h) on Shop Floor	2.1	2.0	3.1	3.1	3.4	3.8
Average Dose Rate (µSv/h) in Storage Areas	7.3	2.6	4.9	6.6	8.2	6.7

Table 7: Routine Dose Rate Survey Result Summary

In Peterborough, dose rates remain steady. The Peterborough facility focuses on radioactive material handling areas and adjacent occupied locations. The majority of areas surveyed are showing a slight increase in average dose rate. This may be the result of a variance in the locations of the survey, as production quantities did not increase year over year.

In Toronto, dose rates are fairly consistent with a slight increase in 2014 from previous years on the shop floor. This can be attributed to a higher inventory of stored uranium dioxide during the times when surveys were conducted.

6.5.1.4 Urinalysis Results

All Peterborough employees working greater than thirty hours in an R2 classified area, where exposed UO_2 material is processed, 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 GEH-C 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		
	2012	2013	2014	2012	2013	2014
Number of urine samples analyzed	99	105	108	1733	1961	2021
Number of samples above *Internal Control Level* (5 µg U/L)	0	0	0	1	2	3
Number of samples above *Action Level* (10 µg U/L)	0	0	0	0	1	0
Maximum result (µg U/L)	<0.1	0.3*	0.5	9.3	13.5	6.8

Table 8: Urinalysis Results Summary

Of all urinalysis samples from Peterborough processed between 2005 and 2014, only 0.4% of samples (5/1362) have measured above 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. *NOTE: Table 8 was revised to update the 2013 maximum result from 0.1 to 0.3 µg U/L. This was an entry error during preparation of the 2013 report.

In Toronto, a total of 3 samples were above the *Internal Control Level* of 5 µg U/L during the reporting period. Two of these samples were from the same employee. No samples exceeded the *Action Level* of 10 µg U/L. Investigations are conducted for all *Internal Control Level* exceedances. Six corrective actions have been identified from the three investigations. All corrective actions are closed.

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 NEWs at GEH-C 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, with the exception of one quarterly *Action Level* exceedance in Peterborough. Details are provided in section 6.5.1.10. 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. GEH-C dosimetry results are summarized in the following sub-sections. Table 11 provides a summary of dosimetry data with employees 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. 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. GEH-C implemented reporting by workgroup in 2012.

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

Effective Dose Limits		
Person	**Period**	**Effective Dose (mSv)**
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	78	48	22	8	0	0	0	0	0
	Skin	78	43	16	2	13	4	0	0	0
	Extremity	30	3	6	4	6	9	2	0	0
Toronto	Whole Body Effective	67	35	26	6	0	0	0	0	0
	Skin	67	18	11	11	15	11	1	0	0
	Extremity	51	7	3	7	9	13	10	2	0

Table 11: Radiation Dose Distribution

6.5.1.6 Whole Body Effective Dose

Whole body effective dose is summarized in Table 12. Toronto dose for operators includes calculated internal dose. Toronto staff is the TLD whole body dose. As Peterborough does not have any measurable internal dose, the effective dose is the TLD whole body dose. Peterborough doses presented and trended are for the fuel shop only; four TLDs assigned to NEWs working for the Services division are excluded as all four results were zero and would reduce the average.

	Year	Peterborough			Toronto	
		Operators	Technicians	Staff	Operators	Staff
Maximum (mSv)	2014	7.55	1.35	1.40	7.62	1.84
	2013	7.96	1.99	1.77	7.80	1.71
	2012	9.16	1.71	2.58	9.22	1.11
Average (mSv/person)	2014	2.75	0.35	0.71	2.75	0.27
	2013	2.70	0.43	0.66	2.30	0.29
	2012	3.32	0.54	0.93	2.75	0.16
Minimum (mSv)	2014	0.00	0.00	0.00	0.00	0.00
	2013	0.00	0.00	0.00	0.00	0.00
	2012	0.00	0.00	0.00	0.00	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. Average Operator and Staff doses are flat from 2012 to 2014. Average Technician doses are slightly reduced from 2012 to 2014.

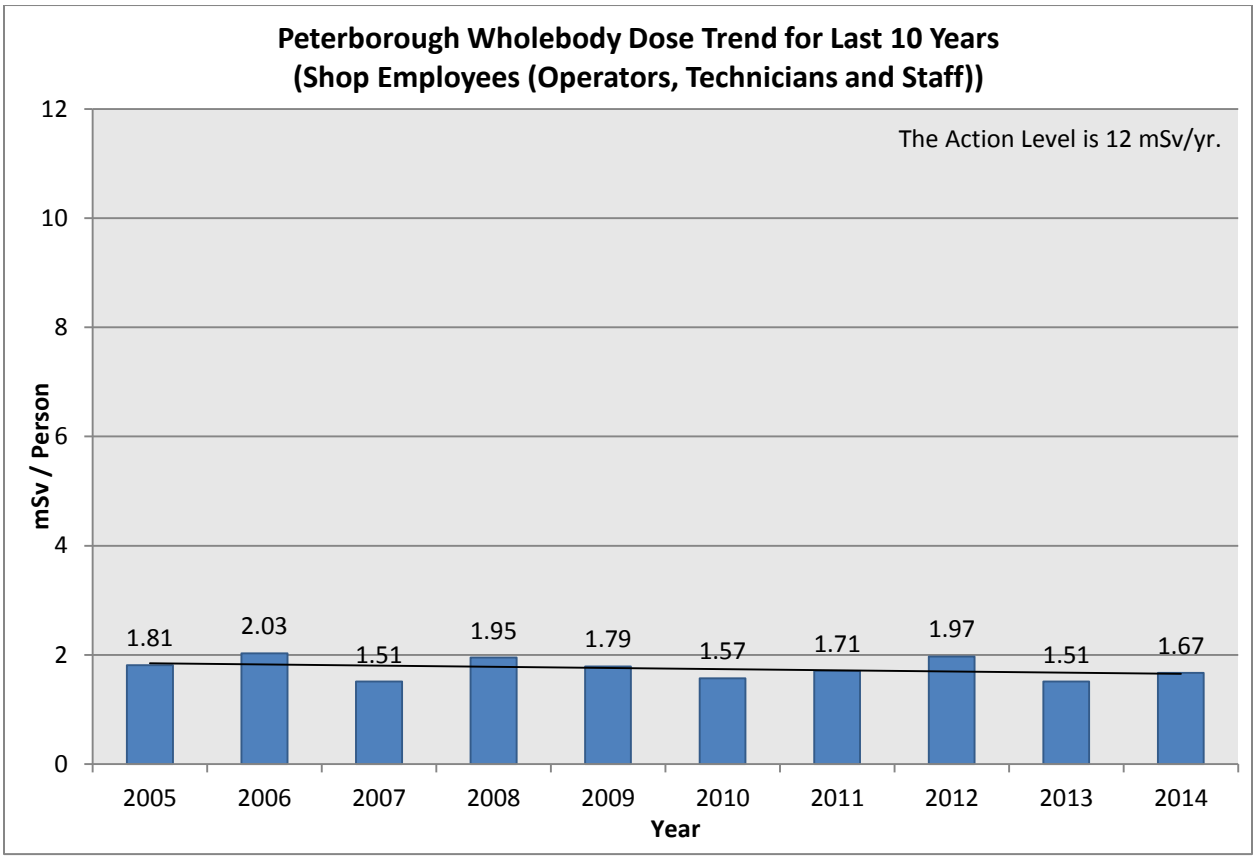

Figure 1: Peterborough 10-year Average Annual Whole Body Dose

6.5.1.7 Toronto Trending

Average annual whole body dose trend for all monitored employees is shown in Figure 1. Whole body dose by workgroup is listed in Table 12. Trends are showing that Toronto average whole body dose has decreased year over year from 2008 to 2011. The year over year decrease in whole body dose is considered to be a combination of shielding improvements made in the Sort Stack, Grinding and Sintering areas and an improvement in ALARA awareness and operator experience. 2012 shows a slight increase in average, which is in line with the increased overtime hours for shop floor employees. 2013 hours have returned to typical levels. As a result, average Operator doses are reduced slightly from 2012 to 2013. Average Operator dose has increased slightly for 2014 over 2013 and is most likely due to increased inspection. Average Staff doses continue to decrease in 2014 over 2013.

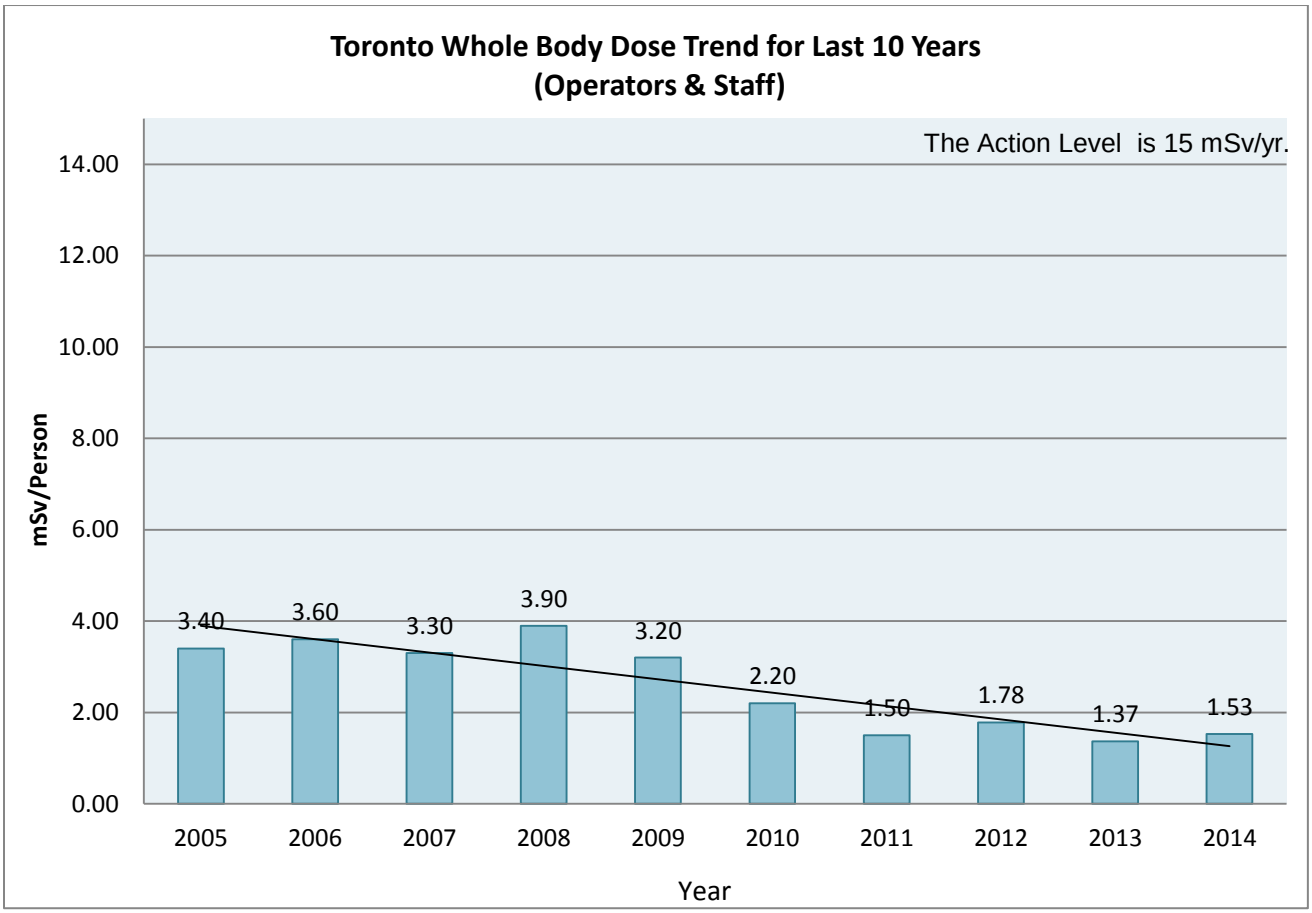

Figure 2: Toronto 10-Year Average Annual Whole Body Dose

6.5.1.8 Equivalent Skin Dose

Equivalent skin dose is summarized in Table 13. Peterborough doses presented and trended are for the fuel shop only; four TLDs assigned to NEWs working for the Services division are excluded as all four results were zero and would reduce the average.

	Year	Peterborough			Toronto	
		Operators	Technicians	Staff	Operators	Staff
Maximum (mSv)	2014	29.91	2.30	2.06	51.67	1.99
	2013	31.20	3.59	1.97	52.84	5.40
	2012	36.99	2.53	2.53	58.40	6.67
Average (mSv/person)	2014	8.65	0.56	0.85	14.43	0.41
	2013	7.57	0.60	0.71	13.81	0.71
	2012	9.55	0.77	0.95	17.38	0.67
Minimum (mSv)	2014	0.00	0.00	0.00	0.00	0.00
	2013	0.00	0.00	0.00	0.00	0.00
	2012	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 GEH-C *Action Level*. Average Operator, Technician and Staff doses are showing steady from 2012 to 2014.

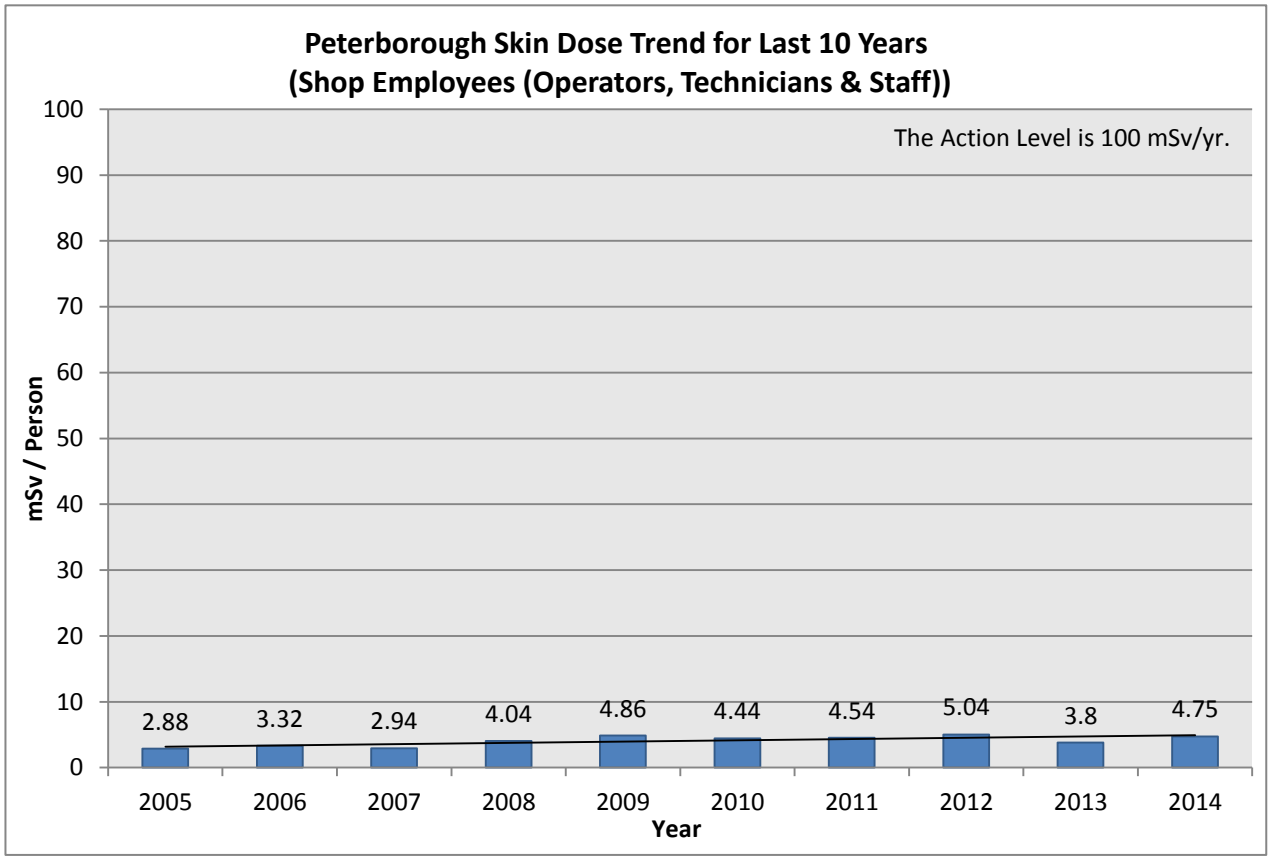

Figure 3: Peterborough 10-year Average Annual Skin Dose

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 GEH-C *Action Level*. Trends are showing that average skin dose has decreased year over year from 2008 to 2011. The year over year decrease in skin dose is considered to be 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. Average Operator dose has increased slightly for 2014 over 2013 and is most likely due to increased inspection. Average Staff doses are reduced in 2014 over 2013.

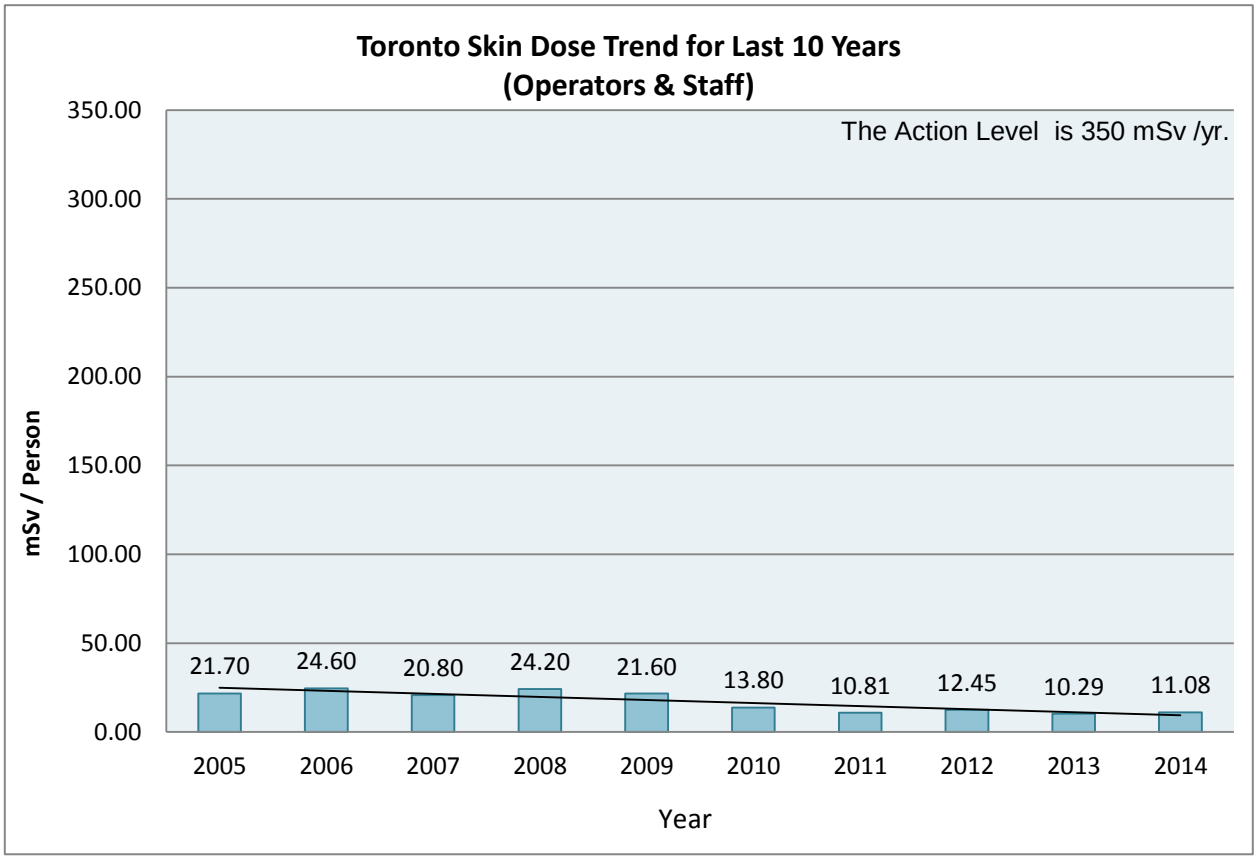

Figure 4: Toronto 10-Year Average Annual Skin Dose

.

6.5.1.9 Equivalent Extremity Dose

Equivalent extremity dose is summarized in Table 14. Only one staff employee participated in the program in 2012 to 2014.

	Year	Peterborough			Toronto	
		Operators	Technicians	Staff	Operators	Staff
Maximum (mSv)	2014	98.98	12.01	2.57	102.44	N/A
	2013	76.03	13.57	4.78	143.59	N/A
	2012	58.82	19.60	1.84	357.29	71.38
Average (mSv/person)	2014	20.88	4.62	2.57	31.96	N/A
	2013	16.40	1.39	4.78	32.92	N/A
	2012	17.15	2.19	1.84	45.83	71.38
Minimum (mSv)	2014	0.00	0.49	2.57	0.00	N/A
	2013	0.00	0.00	4.78	1.21	N/A
	2012	0.00	0.00	0.00	0.00	71.38

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 GEH-C *Action Level* and show a decreasing average dose from 2006 through 2013. 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. Average Operator dose has increased from 2012 to 2014. This may be as a result of increased inspections, as well as newly trained employees in final inspection. Technician doses are showing a slight reduction from 2012 to 2014. Average Staff dose is a single monitored employee.

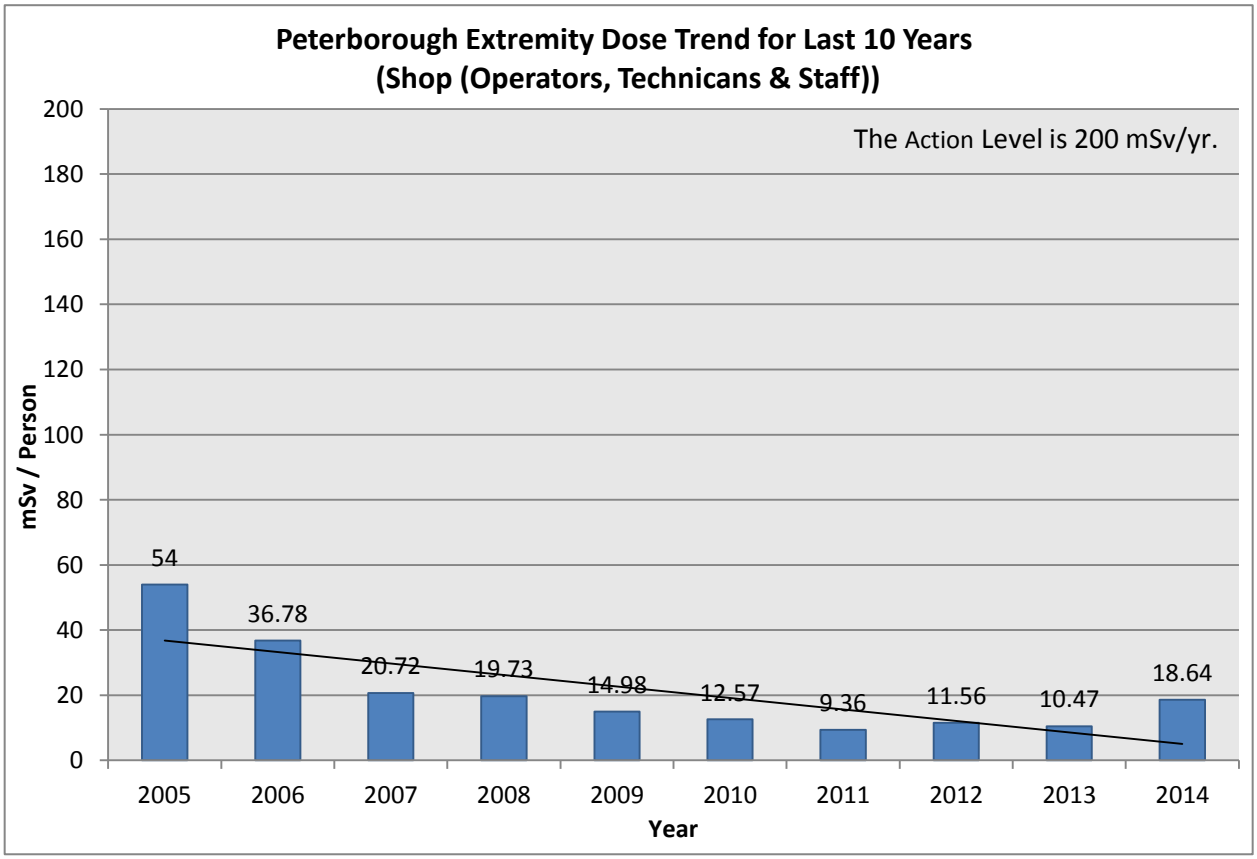

Figure 5: Peterborough 10-year Average Annual Extremity Dose

6.5.1.9.2 Toronto Trending

Average annual extremity dose trend for all monitored employees 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 an annual basis prior to 2009, is now performed 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. The slight increase in 2012 extremity dose is likely due to increased overtime hours for operators. Average Operator doses are reduced slightly from 2013 to 2014.

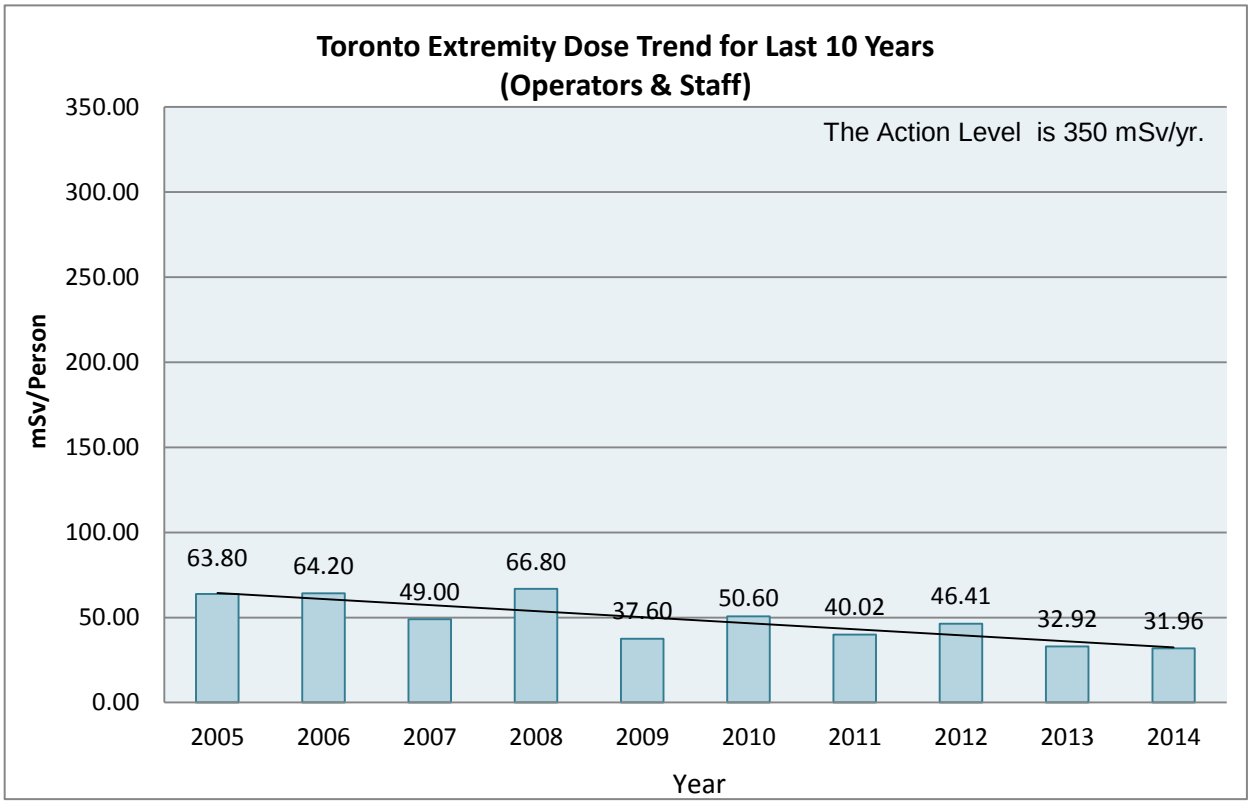

Figure 6: Toronto 10-Year Average Annual Extremity Dose

6.5.1.10 Exceedances of Regulatory Limits or Action Levels

In Peterborough, a third quarter Whole Body TLD measured 6.24 mSv deep dose equivalent, which exceeded the *Internal Control Level* and *Action Level*. The unusual reading was retrieved online on October 30, 2014, and immediately communicated internally, then reported verbally to the CNSC. The investigation into the unusual dose was conducted in accordance with Radiation Protection Manual work instructions and revealed that the employee was not storing her TLD in the low dose rate area badge rack as required. The employee stated that her TLD was not stored in the badge rack, but was left on her shop coat in the End Closure Weld area when off-shift. This was noted in the final report to the CNSC. The final report provided a dose estimate reflective of the employee's actual exposure based on area dose rates and hours worked. The CNSC Project Officer has accepted the investigation results and dose estimate.

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

6.5.1.11 Radiation Protection Program Effectiveness

The radiation protection program is effectively implemented. One *Action Level* exceedance occurred for whole body dose at the Peterborough facility. Details are provided in section 6.5.1.10. 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 Committees 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 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:

- One radiation protection work instruction effective at both sites was updated with administrative edits as a result of annual procedure review.
- Peterborough's Uranium Analysis Efficiency Determination and Delayed Neutron Activation Analysis work instructions were updated to reflect the uranium conversion factor for uranium oxide rather than natural uranium.
- Peterborough's In-Stack Air Sampling work instruction was updated to establish an Internal Control Level for air effluent following the annual Internal Control Level review.
- Peterborough's Breathing Air Monitoring work instruction was updated to include a photo and a description of the air filters used.
- Peterborough's Surface Contamination Monitoring work instruction was updated to provide instructions for use of the Canberra i-matic auto counter.
- Peterborough's Radiation Safety Instruction work instruction was updated to require the inclusion of an action plan for responding to alarms or spills (if relevant).
- Peterborough's Janitorial Duties in Radiation Classified Areas work instruction was superseded by a Fuel Manufacturing work instruction that includes other areas as well.
- Peterborough's Radioactive Waste Management Work Instruction was updated to include zirconium waste segregation instructions and the location of a new radioactive waste container in the shipping/receiving area.
- Peterborough's and Toronto's shared Radiation Dosimeter Incident work instruction was updated to include dosimeters damaged as well as lost and include the use of an incident reporting form and an investigation reporting template.
- Peterborough and Toronto's TLD work instructions were updated to clarify internal reporting requirements.
- Toronto's Uranium Analysis Efficiency Determination work instruction was updated to change the reference of swipe papers to air filters and improve instructions.

- Toronto's radiation safety instruction work instruction was updated to clarify the results of air monitoring that occur as a result of work conducted during non-routine work.
- Toronto's soil sampling survey plan was updated to include additional detail for sampling at reference objects to address CNSC Action Notice GEHC-2012-12-11-A5.

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 during the reporting period. The Toronto committee met five times during the reporting period. Dose results, radiation protection related audits, 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.

	Goal	Actual	Result
Peterborough	5% reduction in collective whole body dose for the fuel shop (corrected for production)	2% reduction	Not Achieved
	5% reduction to average whole body dose for final inspection operators (corrected for production)	1% reduction	Not Achieved
	Review current surface contamination monitoring locations	Completed	Achieved
	Recognition of ALARA committee members	Completed	Achieved
Toronto	Downward trend of employee dose results	3.2 mSv/person and <11 mSv maximum	Achieved
	Average uranium in air below 10 dpm/m^3	Average 12 dpm/m^3	Not Achieved
	Reduce surface contamination results that exceed the Internal Control Level by 10% from 2013 (27)	0% reduction (27) from 2013 (new swipe locations excluded)	Not Achieved
	Employee shop floor demos (4)	4 demos completed	Achieved

Table 15: ALARA Committee Goals and Results

2015 goals for Peterborough are established as follows:

1. 5% reduction in collective whole body dose (corrected for production)
2. Complete previous shielding project (1)
3. >95% compliance in TLD audits
4. >95% swipes below Internal Control Level

2015 goals for Toronto are established as follows:

1. Downward employee dose trend (shielding projects, education)
2. Average annual concentration of workstation air monitoring results <10 dpm/m^3
3. 10% reduction in surface contamination monitoring results that exceed the *Internal Control Level* compared to 2014
4. Conduct four employee shop floor demonstrations of the ALARA principles

6.5.1.15 Summary of Radiation Protection Training Program and Effectiveness

The Training Tracker Tool in Gensuite® tracks radiation safety, and other EHS-related training. Gensuite is a suite of award-winning, integrated Web applications enabling compliance and EHS excellence. An internal or external specialist in radiation protection is contracted periodically to provide classroom training to new and continuing NEWs. Online refresher 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 Completed	% Required Completed
Peterborough	Radiation Safety (Initial and Refresher)	67	100%
Toronto	Radiation Safety (Initial and Refresher)	13	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. 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 under separate cover.

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.

GEH-C maintains internal GE Global Star certification for health and safety program excellence. This is ensured through the implementation of twenty-one program elements including training, housekeeping, personal protective equipment, respirator, contractor safety, fall protection, electrical safety, hot work, cranes and hoists,

chemical management and others. Routine self-assessments and program evaluations are conducted to ensure compliance. These programs also demonstrate compliance to the CLC part II.

6.6.1 Health and Safety Program Effectiveness

The GE business is in transition to a new environment health and safety framework (Framework 2.0) which covers all worker safety and environmental protection elements including the following:

1. Leadership and Accountability
2. Regulatory Applicability
3. EHS Processes and Systems
4. Emergency Preparedness and Response
5. Risk Assessment
6. Highly Hazardous Processes
7. Safety Defenses
8. Exposure Defenses
9. Environmental Defenses
10. Dangerous Goods
11. Contractor Management
12. Preventive Maintenance
13. Distributed Workforce Defenses

Both sites are targeting transition to the new framework requirements by the end of 2015.

6.6.1.1 Peterborough

In 2014, Peterborough conducted a total of 65 investigations and inspections. This includes WSC inspections, and incident investigations. These investigations and inspections led to a total of 228 health and safety hazards being identified and logged into Action Tracking System (ATS) to track corrective action to closure. One finding remains open to develop a work instruction for non-radiological hazardous waste storage area maintenance. The top 5 finding categories were general work area, housekeeping, electrical safety, equipment safety, and chemical storage/labelling.

6.6.1.2 Toronto

In 2014, Toronto conducted a total of 40 investigations and inspections. This includes WSC inspections, and incident investigations. These investigations and inspections led to a total of 217 health and safety hazards being identified. The Toronto WSC targets one inspection every three weeks. WSC investigation findings are logged and tracked to closure outside of the ATS system. The top 5 finding categories from WSC inspections were chemical, equipment, housekeeping, radiation, and unsafe condition. The top five categories of findings in ATS from incident investigations were materials handling, equipment safety, industrial hygiene, industrial hygiene/medical, and EHS Management.

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 on a monthly basis. In Peterborough, ten meetings were held and quorum was met at all ten meetings. In Toronto, eleven regular meetings were held and one meeting focused on industrial hygiene was held; quorum was met at all meetings.

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

	Goal	Actual	Result
Peterborough	Zero recordable Injuries	2	Not Achieved
	Zero days away from work	0	Achieved
	Meet at least 9 x per year	10	Achieved
	Every area inspected at least quarterly	4/4	Achieved
	100% regulatory training completed by Dec. 31st	100%	Achieved
	Review and validate WSC Charter	Conducted	Achieved
	Accident/incident investigation exercise	0	Not Achieved
	Joint meeting with EHS teams (Ergonomics, ALARA)	1 ALARA	Achieved
	Review a section of the CLC part II at meetings	10 Conducted	Achieved
	Identify opportunities for continued training throughout the year	B24 JHA	Achieved
Toronto	Increased committee unity/involvement	Increased Operator Involvement	Achieved
	Shop floor meetings	3	Achieved
	Electrical safety training	Conducted	Achieved
	Conduct group inspections – 1 per inspection team	Not Conducted	Not Achieved

Table 17: Workplace Safety Committee Goals and Results

2015 goals for Peterborough are established as follows:

1. 0 recordable injuries
2. 0 lost time injuries
3. Meet at least 9 times/year
4. Every area inspected at least quarterly
5. 100% regulatory training completed by Dec. 31
6. Review and validate WSC Peterborough Charter
7. Review a section of the CLC part II at every meeting
8. Accident/Incident investigation exercise
9. Joint meeting with ALARA, Ergonomics, Emergency Response teams
10. Each member to participate in one non-WSC inspection related health and safety item

2015 goals for Toronto are established as follows:

1. Reoccurring shop floor inspection with whole committee
2. Participation in root cause review
3. Shop floor involvement/communication – increase by 10%
4. Canada Labour Code training
5. Conduct 3 program reviews

6.6.3 Health and Safety Program Improvements

6.6.3.1 Peterborough

The fuel assembly and Services operations continued to implement a multiyear strategy for machine guarding upgrades. Various physical guards were installed and enhanced on equipment throughout the shop; guards which were removable without the need for tools were upgraded to require the use of tools to remove.

In 2014, GE began transitioning to a new combined environment health and safety scorecard (Framework 2.0). The target is to fully implement the new scorecard at all GEH-C facilities in 2015.

A multiyear strategy to identify and reduce ergonomic risks for employees was initiated in Peterborough. A standard template is used to identify ergonomic risk factors which are then reviewed by the workplace ergonomics team. The exercise is to be completed for every operation in the facility and data collected is used to create a risk map. Completion of ergonomic risk reduction projects are tracked to completion.

6.6.3.2 Toronto

In 2014, there was a focus on shop floor communication sessions. On a monthly basis operators would meet with EHS, Production, and Quality representatives and discuss upcoming events, issues, and changes. This forum ensured that there was a consistent delivery of key messages affecting all employees. The Toronto site also established a team whose goal is to review critical to safety equipment and tasks. A new format for the list and additional information is being collected in order to ensure tight controls are in place for these systems.

In 2013, GEH-C began the engineering and design work to bring the legacy furnaces into compliance with the NFPA-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 (TSSA) and electrical codes (ESA). The second furnace was upgraded and work completed December 2014.

6.6.4 Hazardous Occurrences

No hazardous occurrences occurred at Peterborough during the reporting period. One lost time injury occurred Sept 15, 2014 in Toronto. There were a total of 16 first aids in Peterborough and 8 first aids in Toronto. There was one medical aid in Toronto. There were 2 medical aids in Peterborough. There were a total of 39 near misses in Peterborough and 14 near misses in Toronto.

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.

GEH-C facilities are ISO 14001 registered to ensure effective environmental management systems are in place to achieve environmental goals and objectives. The environmental management system takes into account all relevant legal requirements. These programs demonstrate compliance to relevant federal and provincial legislation.

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

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 0.03 µg per cubic meter of air. The POI is the plant/public boundary. GEH-C has established an *Internal Control Level* of 0.03 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 GEH-C Peterborough Facility performs weekly in-stack monitoring by removal of a filter capable of trapping uranium dust in the exhaust system. Filter papers are analyzed in-house and verified externally by an independent laboratory for testing by delayed neutron activation analysis. The 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. The air is passed through a filter capable of trapping beryllium. Filters are changed periodically. 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.

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

6.7.1.2 Toronto

The Toronto facility performs continuous in-stack sampling and boundary air monitoring for uranium. Boundary samples are high volume air samples drawn at five positions around the facility perimeter. The in-house filter papers are analyzed in-house daily and verified externally. Boundary samples are analyzed externally only. The independent laboratory tests the filter papers by delayed neutron activation analysis. The 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 are in Table 18 and Table 19.

	Peterborough	**Toronto**
Number of Uranium Air Exhaust Samples Taken	47	724
Number of Uranium Samples > *Action Level* (1 µg/m^3)	0	0
Average Uranium Concentration (µg U/m^3)	0.0006	0.017
Highest Uranium Value Recorded (µg U/m^3)	0.0023	0.439
Total Uranium Discharge to Air (g)	0.0033	6.30
Number of Beryllium Air Exhaust Samples Taken	143	N/A
Number of Beryllium Samples > Ministry of Environment Limit (0.03 µg Be/m^3)	0	N/A
Average Beryllium Concentration (µg Be/m^3)	0.0005	N/A
Highest Beryllium Value Recorded (µg Be/m^3)	0.0045	N/A

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

	Peterborough	**Toronto**
Number of Boundary Samples Taken	N/A	260
Number of Samples > *Action Level* (0.08 µg/m^3)	N/A	0
Average Concentration (µg U/m^3)	N/A	0.0006
Highest Value Recorded (µg U/m3)	N/A	0.0029

Table 19: Summary of Boundary Air Quality Monitoring

Air monitoring results are trended over 5 years as shown in the Figure 7 and Figure 8. Toronto's boundary monitor results are trended over 5 years as shown in Figure 9.

6.7.1.2.1 Peterborough Trending

Air release results continue to remain low and well below the Action Level of 1 µg/m³. The five year trend graph of annual air releases, presented in Figure 7, shows a fairly stable five year performance consisting of very low air releases. The increase in 2011 may be due to an increase in the production amount over prior years. The increase in 2013 is attributed to two higher than usual sample results in the year. Investigations into the two samples results were inconclusive. The total release of 0.0033 g in the reporting period is well below the discharge limit of 550 g.

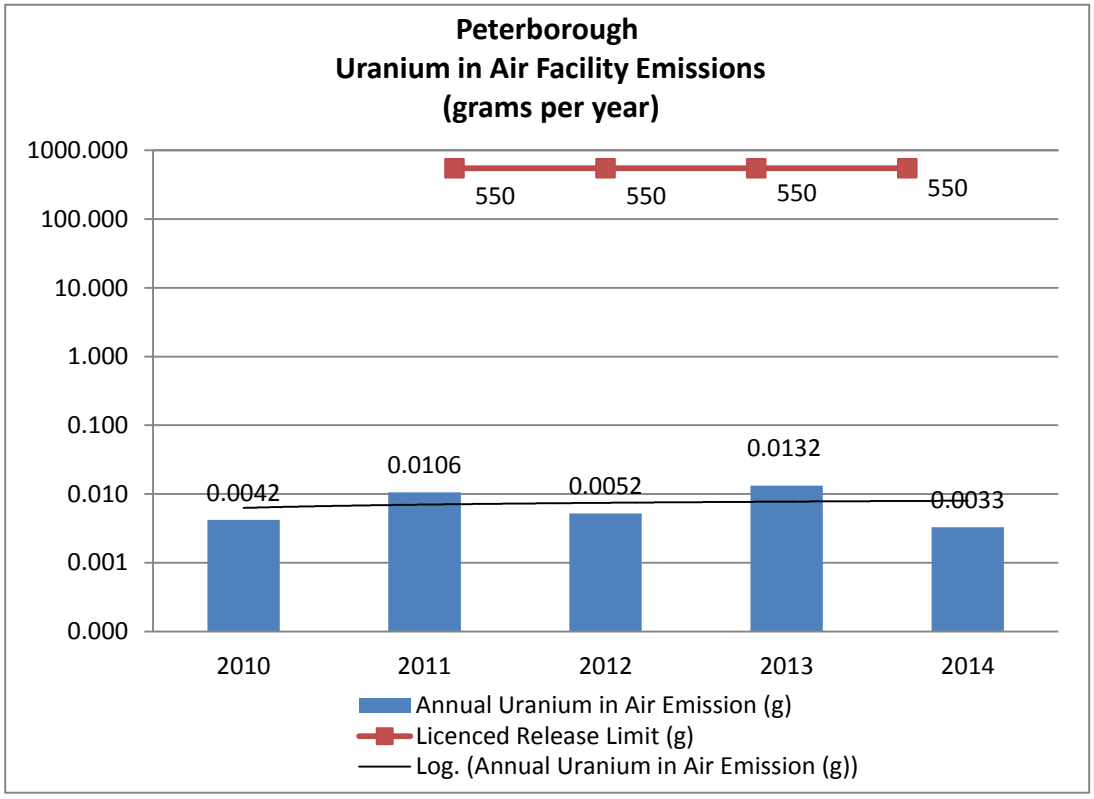

Figure 7: Peterborough Stack Air Emission Trending

Note: the above graph has a logarithmic scale

6.7.1.2.2 Toronto Trending

The Toronto stack air emission trend is decreasing. This is likely due to upgrades completed in 2010 to the rotoclone system and additional upgrades of air exhaust systems in 2012. 2012 stack air emissions were slightly higher than the previous year due to a 6H68 exhaust system filter change. During filter change outs, higher concentrations are expected because of the potential for disturbance of trapped material in the existing filters while the filters are removed from the housing. In addition, new filters require a break-in period with initial loading for filter performance to reach its optimum level. The total release of 6.30 g during the reporting period is well below the discharge limit of 760 g.

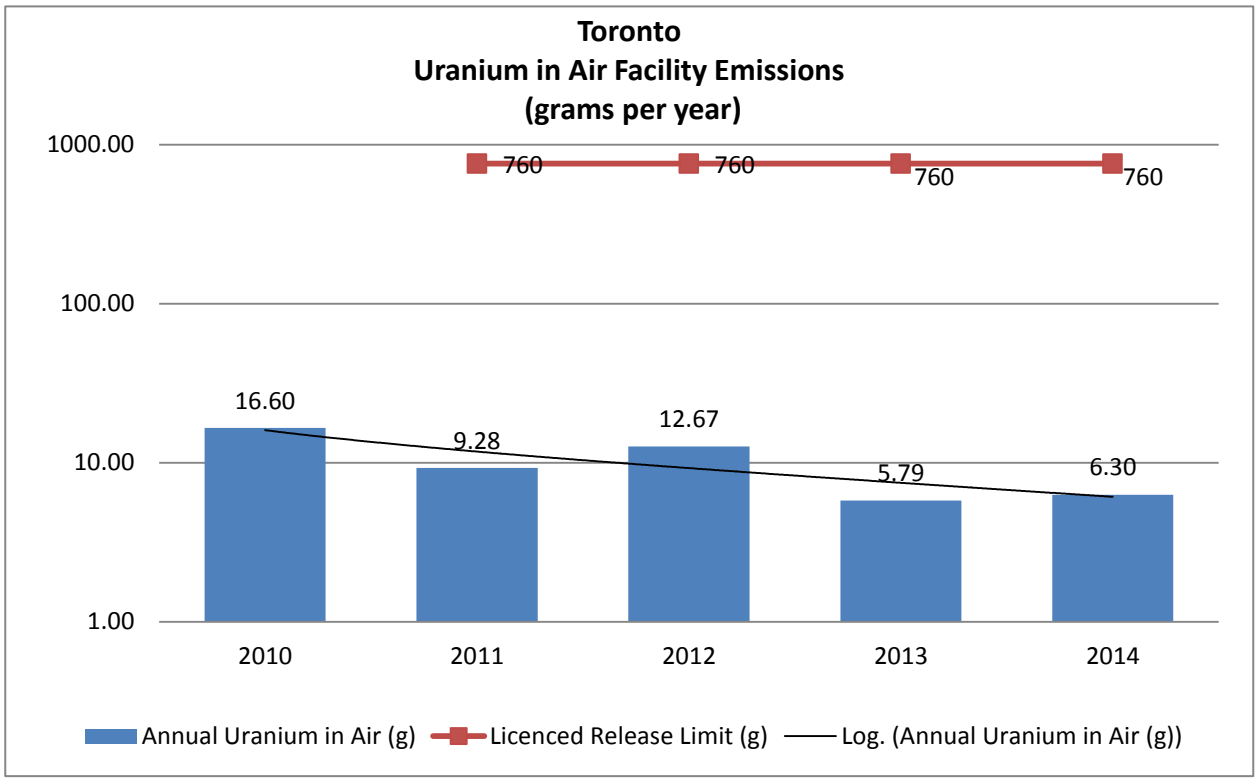

Figure 8: Toronto Stack Air Emission Trending

Note: the above graph has a logarithmic scale

The Toronto boundary air monitor maximum concentration measurements continue to remain low and well below the *Action Level* of 0.08 µg/m^3. Overall, the five year trend graph of boundary air monitor concentrations shows a slightly decreasing trend consisting of very low measurements.

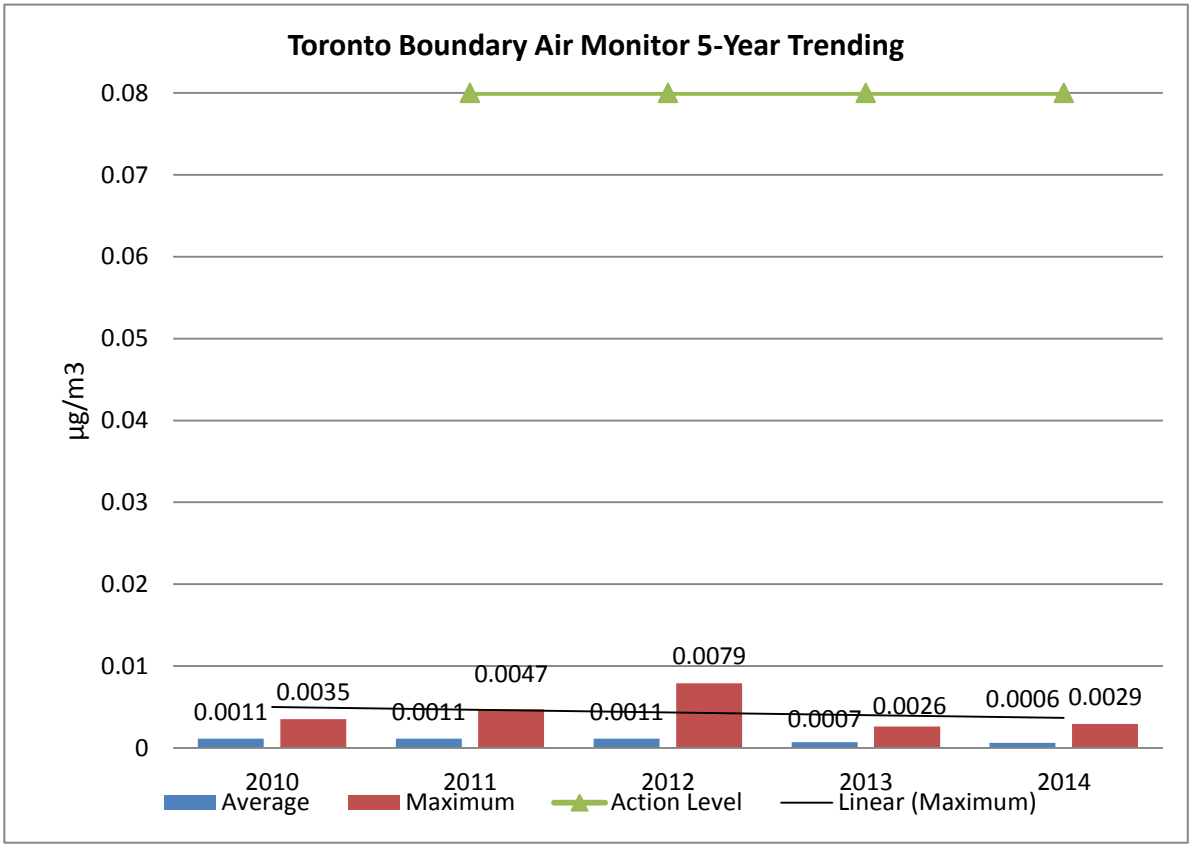

Figure 9: Toronto Boundary Monitor Air Emission Trending

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 and walls in the uranium pellet loading and end closure weld area, is held in a 205 Litre (45-gallon) drum stored in the maintenance area. The majority of 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 quantity is 0.000001 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 *Action Level* of 6 ppm (per batch) the wash water is filtered again during discharge to the sanitary sewer. The GEH-C 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 and washing. GEH-C has established an *Internal Control Level* of 4 µg/L, which is 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 level is 0.2 µg Be/L (0.0002 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, and floor 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 *Action Level* of 6 ppm (per batch). A weekly composite sample is prepared and sent for independent analysis at an external laboratory. The minimum detectable quantity 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 *Action 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 are trended in Figure 10 and Figure 11.

	Peterborough	**Toronto**
Total Amount of Liquid Discharged (L) from Uranium Processing Areas	820	1,500,470
Maximum Uranium Concentration in Water (ppm)	0.29	2.46
Average Uranium Concentration in Water (ppm)	0.17	0.61
Number of Samples Exceeding *Action Level* (6 ppm per batch)	0	0
Total Uranium Discharge to Sewer (g)	0.14	720
Minimum pH	N/A	7.0
Average pH	N/A	7.4
Maximum pH	N/A	7.8
Maximum Beryllium Concentration in Water µg/L	5.34	N/A
Average Beryllium Concentration in Water µg/L	1.34	N/A
Number of Samples Exceeding Internal Control Level (4 µg/L)	2	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 fairly stable five year performance consisting of low water releases. The sample batch number size is limited and trending is difficult due to small random fluctuations in low concentrations. Water release results continue to remain low and below the *Action Level* of 3 ppm (annual average). The total release of 0.14 g is a very small fraction of the derived release limit and of the discharge limit of 760 kg/year.

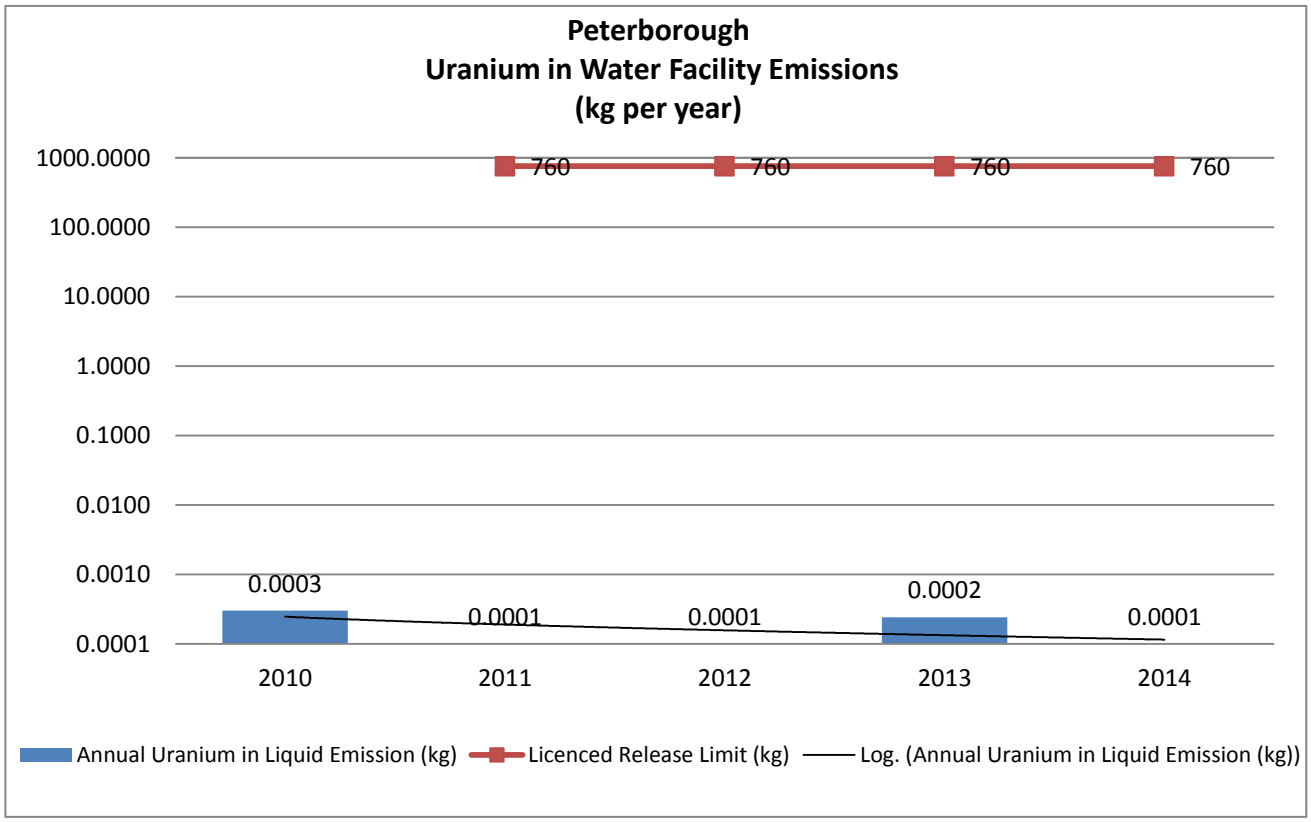

Figure 10: Peterborough Water Emission Trending

Note: the above graph has a logarithmic scale

6.7.2.2 Toronto Trending

Toronto liquid effluent releases are trending downward. In 2009 a six sigma project to drive down water releases in accordance with the ALARA principle was initiated. Upgrades included a water waste characterization study. They also included an optimization of water mixing and treatment processes and reduction in the *Internal Control Level*, which together reduced the average concentration of each batch and also the discharge quantity. In 2011 however, the facility saw a higher source term which was due to a higher decontamination load and grinder wash water output. The total release of 0.72 kg during the reporting period is well below the derived release limit of 9000 kg/year.

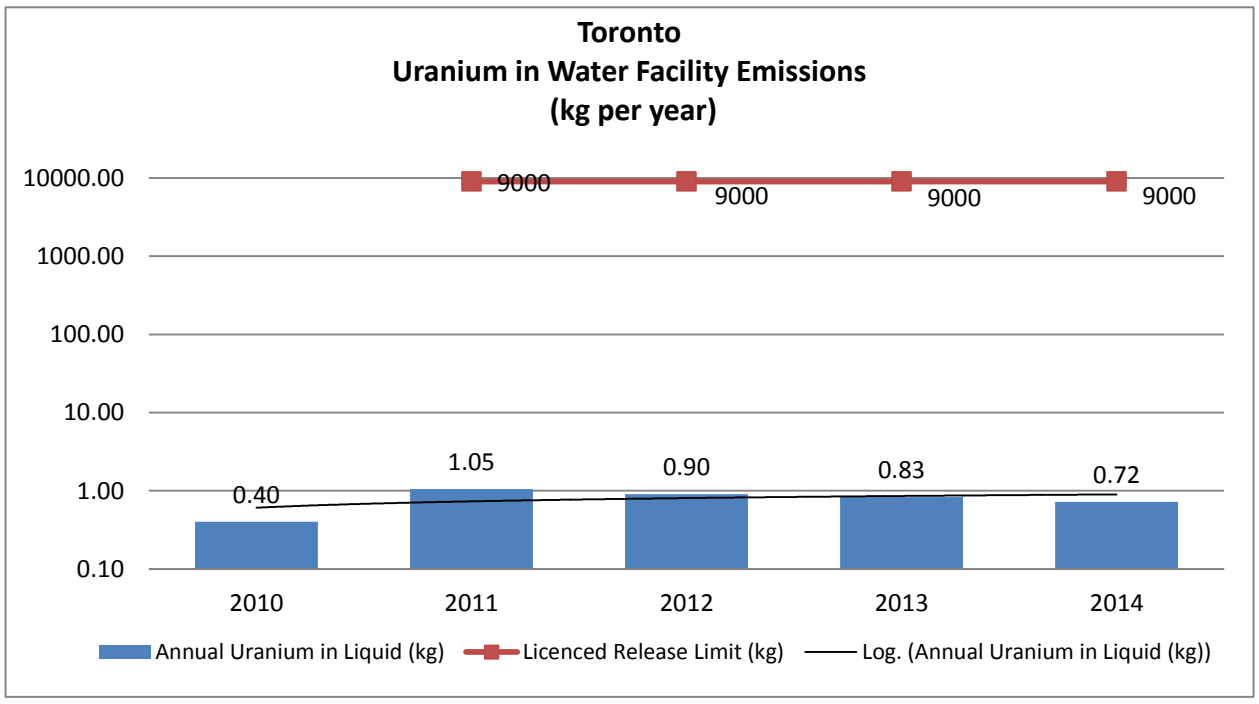

Figure 11: Toronto Water Emission Trending

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. Soil sampling is not conducted at the Peterborough facility due to the negligible air release amounts.

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. If soil analysis indicates rising natural uranium levels, emissions have increased and investigation is made into the cause(s).

Soil sampling is conducted annually at the Toronto facility. Samples are taken of surface soil retrieved from 49 locations around the Toronto facility according to a documented plan. Samples are analyzed by an independent laboratory by delayed neutron activation analysis for the amount of natural uranium in parts per million, (1 µg U/g). The minimum detectable limit is 0.1 parts per million (0.1 µg U/g). Results are compared to previous years and the Canadian Council of Ministers of the Environment (CCME) guidelines. The 2014

summary of results are listed in Table 21. Each individual soil sampling result is listed in Table 22. Locations are colour coded according to their area classification as shown in Table 21: GEH-C 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 as a result of inaccessibility due to construction activities.

	Location Description		
	On GEH-C 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	2.3	5.0	0.6
Maximum concentration µg U/g	2.3	22.1	2.1

Table 21: Toronto Soil Sampling Result Summary

Sample Location ID	Uranium Content (ppm/µg/g)	% of guideline
1	0.5	2.2
2	0.6	2.6
3	2.3	0.8
4	0.5	1.5
5	1.2	3.6
6	8.0	24.2
7	7.7	23.3
8	7.9	23.9
9	22.1	67.0
10	4.1	12.4
11	4.7	14.2
12	6.6	20.0
13	7.6	23.0
14	13.5	40.9
15	11.9	36.1
16	17.4	52.7
17	20.1	60.9

Sample Location ID	Uranium Content (ppm/µg/g)	% of guideline
18	5.1	15.5
19	2.3	7.0
20	1.4	4.2
21	1.2	3.6
22	2.3	7.0
23	1.3	3.9
24	1.0	3.0
25	4.9	14.8
26	2.3	7.0
27	1.9	5.8
28	1.3	3.9
29	2.3	7.0
30	2.0	6.1
31	2.2	6.7
32	1.7	5.2
33	1.2	3.6
34	0.8	2.4
35	1.0	3.0
36	0.9	2.7
37	2.1	9.1
38	0.6	2.6
41	0.5	1.5
42	0.6	2.6
43	0.5	2.2
44	0.5	2.2
45	0.5	2.2
46	0.5	2.2
47	0.5	2.2
48	0.5	2.2
49	0.5	2.2
50	0.5	2.2

Sample Location ID	Uranium Content (ppm/µg/g)	% of guideline
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
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
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

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 Canadian Nuclear Safety Commission's regulatory dose limit as defined in the *Radiation Protection Regulations*. The Derived Release Limits assume that a member of the public occupies the GEH-C 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. 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 0.41 µSv. Beginning in 2014, 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 4.8 µSv for a total estimated critical receptor dose of 5.2 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)
2014	0.00	0%	5.2*	0.5%
2013	0.00	0%	0.38	<0.1%
2012	0.00	0%	0.83	<0.1%

Table 24: Estimated Annual Public Dose

* NOTE: Beginning in 2014, GEH-C Toronto implemented environmental gamma exposure monitoring using TLDs and began to include this result in the estimated annual public dose.

6.7.6 Environmental Protection Program Effectiveness

GEH-C'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. Our Environmental Management System meets the requirements of both ISO 14001 and GE's internal environmental framework.

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 applicable personnel. 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 GEH-C's Action Tracking System.

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 QMI-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 GEH-C's Action Tracking System.

In the reporting period, there were 39 environmentally related findings for Peterborough. These findings were identified from internal and external audits, and self-assessments. The top five finding categories were Waste, Documents/Procedures, EHS Management, ISO 14001 and Water/Training/Chemical Management. There were no major non-conformances. Five of these findings remain open and are tracking to completion.

In the reporting period, there were 39 environmentally related findings for Toronto. These findings were identified from internal and external audits, and self-assessments. The top five finding categories were Documents/Procedures, ISO 14001, Waste, Radiation/Nuclear Safety and Wastewater. Twelve of these findings were from a GE cross-business audit to GE health & safety and environmental framework requirements. There were no major non-conformances. All corrective actions are closed.

6.7.7 Environmental Protection Program Improvements

No significant changes or improvements were made to the Peterborough or Toronto environmental protection program. The Toronto site is currently reviewing the feasibility of ceramic filtration as a technology to treat wastewater.

6.7.8 Environmental Protection Program Performance

2014 goals and results are summarized in Table 25.

	Goal Description	Goal Achieved
Peterborough	Reduce water usage by 5% from previous year	Not achieved
	Waste diversion rate increased by 5% from previous year	Achieved: 25% increase in waste diversion rate from 2013
	Reduce quantity of asbestos throughout building services (pipe insulation, floor tile, etc.)	Not Achieved: Project deferred
	100% of regulatory training completed	Achieved: 100% regulatory training completed
Toronto	Zero reportable releases	Achieved
	Reduce air emissions from the 5 year average by >5%	Achieved
	Greenhouse gas reduction – Undertake Treasure Hunt initiative	Not Achieved
	Reduce on-site chemical inventory by 5%	Achieved
	Reduce average water effluent release per tank to < 1.0 ppm	Achieved

Table 25: EMS Program Goals

2015 goals for Peterborough are established as follows:

1. Zero violations, penalties, exceedances or reportable spills/releases
2. Conduct 100% of required emergency drills
3. Implement waste reduction initiative to divert 75% of paper towel waste from landfill to organics stream by end of the third quarter
4. Complete one asbestos removal project by year end

2015 goals for Toronto are established as follows:

1. Removal of historical waste
2. Reduction in soft metal drums
3. Zero reportable releases (air/water)
4. Zero ISO-14001 non-conformances

5. Average water effluent tank releases <0.9 ppm
6. >5% reduction over the 5 year average in uranium air emissions
7. Undertake a treasure hunt initiative for greenhouse gas reduction
8. Reduce on-site chemical inventory by 5%
9. Conduct a feasibility study on new water technology

6.8 Emergency Management and Response

Each facility has established emergency response plans that describe the actions to be taken in order 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:

- CAD/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:

Peterborough:

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

Toronto:

1. Fire/Evacuation (two)
2. Hydrogen Shut-Off System (once)
3. Security/Crisis Management (once)
4. Lone worker safety system (once)

6.8.2 Emergency Preparedness Training Program and Effectiveness

The Peterborough Emergency Response Team was trained on fire extinguishers, and first aid/cardio-pulmonary resuscitation/automatic external defibrillator. 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, blood-borne pathogens and emergency spill response. 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)	83	100%
	Emergency Preparedness and Fire Prevention (Initial)	10	100%
	Emergency Preparedness and Fire Prevention (Refresher)	71	100%
	Portable Fire Extinguisher Training (Practical)	10	100%
	Portable Fire Extinguishers	295	100%
	Spill Response (Practical)	0	100%
	Blood borne Pathogens Awareness (Initial)	0	100%
	Blood borne Pathogens Awareness (Refresher)	0	100%
	First Aid/CPR/AED	4	100%
Toronto	EHS Overview for Manufacturing (includes accident prevention, emergency preparedness and fire prevention)	49	100%
	Emergency Preparedness and Fire Prevention (Initial)	3	100%
	Emergency Preparedness and Fire Prevention (Refresher)	6	100%
	Portable Fire Extinguisher Training (Practical)	0	100%
	Portable Fire Extinguishers	72	100%
	Spill Response (Practical)	0	100%
	Blood borne Pathogens Awareness (Initial)	0	100%
	Blood borne Pathogens Awareness (Refresher)	9	100%
	First Aid/CPR/AED	9	100%

Table 26: Emergency Preparedness and Fire Prevention Training Summary

6.8.3 Fire Protection Program Activities and Effectiveness

An internal compliance audit is conducted annually at each site, as well as a self-assessment to GE's Health and Safety Framework requirements. Internal Fire Protection Inspections are performed as per the National Fire Code, 1995.

In Peterborough, ten Action Tracking System findings were raised related to emergency response and fire protection. Findings entered into this category originated from site safety inspections, self-assessments and third-party audits. There were no regulatory or major non-conformances. All corrective actions have been implemented and all findings closed.

In Toronto, twenty-eight Action Tracking System findings were raised related to emergency response and fire protection. Findings entered into this category originated from site safety inspections, third party audits, incident investigations and emergency drill lessons learned. Two of the findings were regulatory and resulted from a CNSC fire audit. These were related to combustible material storage in areas where uranium was located. To address the issue, employees were trained in storage requirements and a third-party fire assessment was conducted with a scope to include combustible materials storage. Fifteen of these findings were as a result of this third party fire audit. All were recommendations for continuous improvement. There were no regulatory or major non-conformances. All corrective actions have been implemented and findings closed.

6.8.4 Fire Protection Program Improvements

In Peterborough, a standalone sprinkler monitoring system was added to the GE-Hitachi buildings. Previously, building 24, 26 and 28 were monitored through a system managed by the Large Motors division of GE. GE-Hitachi buildings are now monitored by an external call centre linked directly to the GE-Hitachi emergency call tree.

In Toronto, no significant physical changes were made to the fire protection system. Minor improvements included a new pull station near the shipping door, new non-combustible material radioactive waste boxes and the purchase of a vacuum pump for spill containments.

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 under separate cover.

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.

Nuclear security is described and summarized in Appendix D, submitted to the CNSC under separate cover.

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. GEH-C 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 daily and as required.

In Peterborough, A Physical Inventory Taking Evaluation was conducted by the CNSC on July 14, 2014. No major non-conformances were noted. In addition, a Short Notice Random Inspection was conducted by the CNSC and IAEA on November 17, 2014. The scope concerned book examination and verification of nuclear material. An evaluation of the quality and performance of the measurement system was conducted including samples removed for destructive analysis. No major non-conformances were noted.

In Toronto, A Physical Inventory Taking Evaluation was conducted by the CNSC and IAEA on July 16, 2014. The scope concerned book examination and physical verification of nuclear material. No major non-conformances were noted. A Short Notice Random Inspection was conducted by the CNSC and IAEA on September 15, 2014. The scope concerned shipments of natural uranium pellets to GE-Hitachi in the United States. 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. On January 16, 2014, a drum of GEH-C grinder sludge was observed to have a puncture at the Cameco Port Hope Facility. Trace contamination was noted on the outside of the drum along the chine. There was no contamination detected on the floor of the trailer. All unusual incidents are reportable under CNSC Regulations for Transport and Packaging of Nuclear Substances. The CNSC was notified with preliminary information on the incident January 17, 2014 by email. Although it was initially reported that the drum hole was observed while offloading the scrap shipment, it was since determined that the drum hole may have been first observed during drum weighing at Cameco. This raises the possibility the hole may not have been caused at GEH-C Toronto. Nevertheless, a full investigation of the incident with identification of three preventive actions was completed. There are no impacts to workers, the public or the environment from this incident. The drum has since been cleaned and was over packed for transport by Cameco to their Blind River facility for recycle.

Shipments to and from both facilities was conducted safely and in accordance with regulations during the reporting period.

6.13 Other Matters of Regulatory Interest

6.13.1 Public Information Program

GEH-C continued to improve its public information web page. The address of the standalone, microsite web page is http://geh-canada.ca/.

2014 public information web page additions and improvements include the following:

1. A new video was posted which is aimed at the key concern themes raised in the public meeting: rail safety near the Toronto plant, fire safety, hazardous material transport and emergency response
2. The home page layout was redesigned to make it more user friendly
3. The third party stack inter-comparison summary was posted
4. Public Information brochures were updated with the latest performance data
5. One event (lost time injury) was posted as part of our public disclosure protocol
6. The Volunteers section under "Community" was updated with recent updated employee volunteer activities.
7. An updated mission statement was posted
8. The November 25, 2014 virtual public meeting notice was posted
9. Ongoing performance data and information was also posted including the annual compliance report, community newsletters and other information of interest to the public.

Comments and concerns from the public are received through various media including the toll-free telephone line, e-mail address, mail, from community or GEH-C meetings, or other means. Inquiries were received, tracked and responded to in a timely manner. A total of 107 emails and 35 phone calls from the toll free line and general email address were responded to in 2014.

Public interest in the Peterborough facility remained relatively low with no significant public issues or media activity in the period. Public interest in the Toronto facility decreased in 2014. There has been no major media coverage of either facility during the period.

Social media that included discussion of the GEH-C facility were routinely monitored. Anti-nuclear groups continue to have postings to social media with negative sentiment toward GEH-C. However, the frequency of postings declined significantly in 2014. There were no demonstrations at either facility in 2014.

Based on participation in community meetings, the GEH-C open house, media coverage, interactions with local politicians and the solicitation of questions from individuals nearby to the Toronto plant, the prevailing public view is one of decreased interest in Toronto plant operations and the associated safety of the plant.

GEH-C participated in a number of community meetings and conducted a virtual public meeting in 2014. During these events, feedback has been solicited from neighbours and information provided.

In 2013, a Community Liaison Committee was initiated. As per the Community Liaison Committee charter, its mandate is to provide a forum for a cross-section of neighbours and other community stakeholders to share information and ideas. GEH-C seeks to learn more about community priorities, interests and activities, and improve how the company shares information about work at our Lansdowne Avenue facility in Toronto, health & safety initiatives and citizenship activities. The Committee met twice in 2014.

Meetings were held with elected officials representing the area in which the Toronto plant is located. Copies of communication to members of the public such as newsletters and open house invitations were also sent to elected officials and other stakeholders. Meetings with Peterborough stakeholders were also held in 2014.

6.13.2 Site-Specific

6.13.2.1 Nuclear Criticality

GEH-C does not have an active Nuclear Criticality Program since neither facilities process enriched uranium. This section is not applicable.

6.13.2.2 Financial Guarantee

In 2014, the CNSC accepted GEH-C's revised preliminary decommissioning plans, which incorporated comments on the initial preliminary decommissioning plans. Plan updates are required every 5 years. The cost estimate increased as a result of these changes and a revised financial guarantee is to be secured and will be submitted to the CNSC in 2015.

6.13.3 Improvement Plans and Future Outlook

There are no significant operational changes planned for 2015.

6.13.4 Safety Performance Objectives for the Following Year

Facility operations are expected to remain fairly constant in 2015. Fuel production levels are projected to be similar to the amount processed in 2014. No significant changes are currently forecasted for either the Fuel or Services operations. The facility operating licence remains valid until 2020. As no significant changes are expected outside of continuous improvement, no licence document submissions or changes are expected.

7 CONCLUDING REMARKS

At GEH-C, 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. GEH-C management recognizes, reviews, prioritizes and controls workplace hazards and ensures compliance with the pertinent regulatory requirements, applicable codes and GE 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 incident. Health and safety programs were well implemented. Radiation protection programs were well implemented. Skin and extremity radiation dose measurement results for employees in uranium handling areas were all below *Action Levels* and regulatory limits. A single *Action Level* exceedance occurred in Peterborough for a quarterly whole body dose with the investigation results reported to the CNSC. Environmental protection programs were well implemented. Both facilities maintained ISO 14001:2004 Environmental Management System registrations. Facility emission results were all below 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 GEH-C has successfully met the requirements of the Nuclear Safety and Control Act, Regulations and CNSC Class 1B nuclear facility operating licence requirements.