GE-Hitachi Nuclear Energy Canada Inc.

January 1 to December 31

2013

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 28, 2014	EHS & Licencing Manager March 28, 2014

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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 and produce and test fuel bundles. 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 *Internal Control Levels*, *Action Levels* and regulatory limits. One *Action Level* was exceeded for a Urinalysis sample from a Toronto plant employee. The event was reported to the CNSC in accordance with licence conditions. A TapRoot® investigation into the incident was conducted and corrective actions implemented.

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 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.

The facility change process has been continuously improved throughout the reporting period. An electronic workflow process ensures that changes receive adequate review from process owners, quality assurance and the Environment, Health and Safety (EHS) department. The EHS department screens for potential impact to the Safety Analysis, Fire Hazards Analysis, licence conditions, radiation protection, environmental protection, health and safety, and ergonomics. Adequate mitigations can then be applied including modification of the proposed change, up to rejection of the modification.

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 of natural and depleted uranium (inventory changes) 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 fairly low, while public interest in the Toronto facility remained high during the reporting period. Enquiries were tracked and responded to in a timely manner. Significant improvements to the program continued during the reporting period, including the unveiling of a new dedicated web site. A community liaison committee (CLC) was initiated with a mandate to provide a forum for a cross-section of neighbours and other community stakeholders to share information and ideas.

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.

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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. GEH-C management 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	Achieved
Zero lost time injuries	Achieved	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, 60 days non-regulatory, all<120 days)	Not Achieved (100% Regulatory closed on-time)	Not Achieved (100% Regulatory closed on-time)
100% completion Environment Health and Safety regulatory training	Achieved	Achieved

Table 1: Primary Safety Goals

The primary facility potential hazard is the inhalation of airborne UO_2 particles. Measurements are performed of airborne and surface traces of uranium as an indicator of process containment efficiency. Urine samples donated 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. 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
ppm	Parts per million
RSI	Radiation Safety Instruction
SSC	Systems, structures and components
TDG	Transportation of Dangerous Goods
TLD	Thermoluminescent Dosimeter

Acronym	Definition
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 proposed changes to ensure safe plant operations. They are:

- *Workplace 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 ensure that as potential risks are identified, and corrective actions recommended, those actions are closed and verified for effectiveness

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

- In March and April 2013, a new role of Maintenance Team Leader was appointed in both Peterborough and Toronto. These positions report to the Manager Shop Operations and Plant Manager respectively and were created to refocus the maintenance teams and improve current processes and strategies to ensure production equipment is as robust, efficient and reliable as possible.
- In May of 2013, Toronto welcomed a new afternoon shift Manufacturing Supervisor to support afternoon shift productivity, reporting to the Plant Manager.
- In October of 2013, the Peterborough Shop Operations Manager was promoted to the new position of Plant Manager. The Plant Manager has complete oversight of the Peterborough Fuel Operations and manages fuel manufacturing, engineering, lab, sourcing, facilities, quality and materials.

In addition, in May of 2013, the new role of EHS Team Leader was appointed for Peterborough. This role serves to act as the primary Peterborough site EHS contact for health, safety and environment compliance and reports to the Manager EHS and Licencing.

During the reporting period, several machine guarding upgrades were completed at both facilities. The R2 berm was extended in Peterborough to include the area underneath the UO_2 pellet rack. There were fire safety and powder storage upgrades completed in Building 24. In Toronto, various upgrades to security were made which are considered security protected information.

As part of the EHS programs, registrations and certifications, internal audits are conducted annually to assess conformance to internal and external requirements. A total of 7 internal audits were conducted. There were 8 external agency inspections. This included the CNSC, IAEA, Technical Standards and Safety Authority (TSSA) 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 two 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 March 4, 2014 for the 2013 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. Trends in non-conformances (Gensuite Action Tracking System (ATS) items)
4. Trends in Incident and Measurement (Gensuite I&I) items for root cause
5. Extent to which Health and Safety and ALARA Committee (where applicable) objectives and targets have been met
6. Radiation exposure results
7. Changing circumstances and recommendations for improvement

8. Evaluation of the effectiveness and continuing suitability of the EHS Mission Statement and the Health and Safety Program
9. 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. A separate meeting to review management self-assessments conducted in 2013 is scheduled.

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. In 2013, improvements were made to management system program elements are follows:

- The Change Control procedure was updated to require periodic reviews of open change notice workflows.
- The Document and Record Control procedure was updated to define a quality record, clarify responsibilities for record management, and establish record storage requirements. A new procedure governing Document Use and Compliance was written, and specifies use of forms and templates, and compliance with directives stated in procedures and work instructions.
- The Management Self-Assessments and Annual Management Review procedure was updated to add more detail in the overview, scheduling and performance sections with respect to self-assessments.

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 Findings**	**Number of Audits**	**Number of Findings**
GEH-C Cross Business Audits	1	0	1	1
General Electric Cross Business Audits	0	0	0	0
GEH-C Compliance Audits	0	0	0	0
Quality Assurance for Licenced Activity	2	2	1	3
Environmental Internal Audit	1	0	1	4
TOTAL	4	2	3	8

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. Self-Assessments conducted during the reporting period included internal scorecard reviews of Health and Safety and Environmental Framework elements against General Electric expectations. 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**
Health and Safety Program Self Assessments	21	2	21	17
Environmental Self Assessments	6	0	6	5
TOTAL	4	2	3	8

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, in order 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. 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 during the reporting period. Their goal is to systematically define, design, develop, implement, evaluate, record and manage all training, including continuing training, for all workers who are employed in safety-sensitive occupations and/or safety-sensitive positions. Guidance documents were developed. In future, these objectives and criteria will be used by CNSC staff in the evaluation of training programs for all classes of licences issued by 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. Plant supervisors and 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.

As part of the EHS programs, registrations and certifications, internal audits are conducted annually to assess conformance to internal and external requirements. A total of 7 internal audits were conducted. Related licenced activity audits are summarized in Table 3 and section 6.1.1.2 above. All findings and corrective actions from the reporting period have been closed. There were 8 external agency inspections. This included the CNSC, IAEA, Ministry of Environment and the Technical Standards and Safety Authority.

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 was one modification in Peterborough that required an update to the facility safety analysis. This involved the creation of an area within Building 24 for periodic storage of UO_2 powder. The Facility Safety Analysis and Fire Hazard Assessment were both updated to reflect the change.

There were no modifications in Toronto requiring an update to the facility safety analysis.

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 in 2013:

- Bundle assembly welder control and guarding upgrade (Building 21 Peterborough)
- Cut-to-length control and guarding upgrade (Building 21 Peterborough)
- Coiner guarding and control upgrade (Building 21 Peterborough)

- R2 area berm extension (Building 21 Peterborough)
- Building 24 fire safety upgrades (Peterborough)
- Building 24 powder storage upgrades (Peterborough)
- Security improvements (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.

Preventive maintenance tasks deemed critical to safety are designated in the preventive maintenance systems as described in Health and Safety Manual Procedures 14.0 *Management of Change and Preventive Maintenance*. This list is reviewed annually and the preventive maintenance tasks are reviewed quarterly. In Peterborough, several new critical to safety tasks were added in 2013 associated with functional testing and inspection of new interlocks on machine guarding.

In the event of equipment failure, the preventive maintenance program for that equipment is reviewed. There were no such identified failures at the Peterborough facility. In Toronto, the preventive maintenance program for the bipel feed was reviewed and updated to include inspection of the bottom clamp as a result of a minor powder spill in that area. Also in Toronto, the preventive maintenance for the bipel was reviewed and updated to include additional inspection and maintenance as a result of a minor powder spill associated with a loose metal plate.

As part of the quarterly reviews of preventive maintenance tasks, there were four instances in the sampling of approximately 150 tasks that required follow-up due to the task not being completed by the scheduled date; one maintenance task was missed.

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 is underway 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 is underway in both Toronto and Peterborough. In addition, a new software system for managing maintenance tasks is being implemented through 2014.

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 donated 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. All 2013 dose measurement results for employees were below A*ction Levels* and regulatory limits. One *Action Level* was exceeded for urinalysis in Toronto. Details are provided in section 6.5.1.4.

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 quantities of UO_2 powder are 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 of a swipe measurement exceeds an *Internal Control Level*, the area is cleaned and re-swiped.

Surface contamination measurement results are summarized in Table 5.

	Classification and Area Description	Internal Control Level	2012		2013	
			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	596	0 (0%)	592	0 (0%)
	R1 - Bundle Assembly, Inspection, Receiving, Building 24	220 dpm/100 cm^2	197	0 (0%)	185	1 (<1%)
	Active - Met Lab	220 dpm/100 cm^2	114	0 (0%)	108	1 (<1%)
	Unclassified - Items, Main Hallway	220 dpm/100 cm^2	331	0 (0%)	348	2 (<1%)
Toronto	R3-Powder Preparation, Pressing, Grinding, Laboratory	22,000 dpm/100cm^2	492	3 (<1%)	480	3 (<1%)
	R2-Sintering, Sorting & Stacking, Laboratory	2,200 dpm/100cm^2	456	33 (7%)	456	19 (4%)
	Active - Plant Washrooms, Laundry Room	2,200 dpm/100cm^2	144	2 (1%)	144	1 (<1%)
	Unclassified	220 dpm/100cm^2	240	10 (4%)	240	6 (2%)

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 four exceedances of *Internal Control Levels*. Three areas were cleaned and re-swiped clean. One swipe was of the incoming UO_2 pellet skid plastic wrap. Following the exceedance, plastic wrap was diverted to the radioactive waste stream for the remainder of the reporting period. Corrective actions to storage practices in Toronto are being implemented.

Toronto surface contamination remains low and reducing. Surface contamination results are reviewed by EHS staff and discussed at Workplace Safety Committee Meetings. The increase in swipes above *Internal Control Levels* in 2012 is attributed to high turnover of Decontamination Operators. Improvements to the training program for decontamination operators have resulted. A goal of the Toronto ALARA committee in 2013 was to reduce the number of sample results above the *Internal Control Level* in R2 and R3 areas. This goal was achieved in 2013 with a 38.5% reduction. This goal continues into 2014.

No personnel contamination events occurred at either facility during the reporting period. In Peterborough, employees leaving the R2 area are required to wash their hands. 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.

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. The 2011 average and maximum concentrations for Peterborough were changed from the values submitted in the 2011 Annual Compliance Report to reflect the external laboratory results, as opposed to the in-house results. External laboratory results are reported for subsequent years.

	Peterborough			Toronto		
	2011	2012	2013	2011	2012	2013
Number of Workstations Sampled	3	3	3	19	19	19
Total Number of Samples Collected	48	47	48	4733	4998	4979
Total Number of Samples Exceeding *Internal Control Level* (facility and area specific)	0	0	0	4	1	2
Total Number of Samples Exceeding *Action Level* (facility and area specific)	0	0	0	0	0	0
Average Concentration (dpm/m^3)	1.22	0.83	0.57	8.0	9.0	10.0
Maximum Value Recorded (dpm/m^3)	5.46	3.70	2.0	270	212	212

Table 6: Workstation Air Monitoring Summary

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

In Toronto, average and maximum workstation air monitoring results continue to remain steady. Two *Internal Control Level* exceedances occurred during the reporting period. One exceedance occurred in the bipel (pre-press) feed room on June 4, 2013. This room is classified as an R3; respirators are required for room entry. Employees had been performing add-back. A damper on the exhaust line was closed, and it should have been opened. Documentation was revised and Operators were re-trained on the requirement to conduct add-back with the damper open. The second exceedance occurred in the bipel (pre-press) room on December 5, 2013. This room is classified as an R3; respirators are not required for room entry. It was determined that a powder back-up had occurred the evening prior. The machine was cleaned out by Maintenance and an Operator. Appropriate corrective action(s) continue to be investigated.

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 rate results are summarized in Table 7. 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.

	Peterborough			Toronto		
	2011	2012	2013	2011	2012	2013
Total Number of Locations Surveyed	399	241	314	104	99	100
Average Dose Rate (uSv/h) on Shop Floor	2.5	2.1	2.0	2.4	3.1	3.4
Average Dose Rate (uSv/h) in Storage Areas	14.4	7.3	2.6	6.1	6.6	8.2

Table 7: Routine Dose Rate Survey Result Summary

In Peterborough, dose rates remain steady through 2013. The Peterborough facility improved the gamma survey procedure to conduct a survey of a room/area focusing on occupied locations, as opposed to the previous methodology to spot check at a specific location. This new methodology, introduced in 2012 resulted in higher recorded dose rates in occupied areas, and lower recorded dose rates in storage areas.

In Toronto, dose rates are fairly consistent with a slight increase in 2013 from 2012 and 2011. 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 primarily as an inhalation indicator that may initiate a more definitive Bioassay Measurement. Internal dose is not estimated based on urinalysis results. Internal dose is estimated based on air monitoring.

Urinalysis results are summarized in Table 8.

	Peterborough			Toronto		
	2011	2012	2013	2011	2012	2013
Number of urine samples analyzed	80	99	105	1600	1733	1961
Number of samples above *Internal Control Level* (5 µg U/L)	0	0	0	4	1	2
Number of samples above *Action Level* (10 µg U/L)	0	0	0	0	0	1
Maximum result (µg U/L)	0.2	<0.1	<0.1	7.2	9.3	13.5

Table 8: Urinalysis Results Summary

Of all urinalysis samples from Peterborough processed between 2005 and 2013, only three have measured above 0.1 µg U/L (less than 0.3 µg U/L). These occurrences were below the *Internal Control Level*. This

demonstrates that the inhalation hazards at this facility are minimal and that current engineered and administrative controls, where applicable, are adequately controlling the risk.

In Toronto, a total of 2 samples were above the *Internal Control Level* of 5 µg U/L during the reporting period. One of the two samples also exceeded the *Action Level* of 10 µg U/L. An investigation was in progress for the *Action Level* exceedance when the *Internal Control Level* exceedance occurred for the same employee. Details are provided in section 6.5.1.10.

6.5.1.5 Dose Control Data

All employees are classified as either Nuclear Energy Workers (NEWs) or Non-Nuclear Energy Workers (Non-NEW). 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 review the monitoring results, and compare them to associated *Internal Control Levels*, *Action Levels* and regulatory limits.

All measured radiation exposures received by personnel in the reporting period were within *Internal Control Levels*, *Action Levels* and regulatory limits. Regulatory limits are specified in the *Radiation Protection Regulations* with exception during the control of an emergency and the consequent immediate and urgent remedial work. Regulatory limits are listed in Table 9 and Table 10. 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
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	82	51	23	8	0	0	0	0	0
	Skin	82	46	18	2	13	3	0	0	0
	Extremity	56	30	7	1	7	8	3	0	0
Toronto	Whole Body Effective	67	31	33	3	0	0	0	0	0
	Skin	67	17	11	14	13	11	1	0	0
	Extremity	49	0	7	9	6	17	8	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 includes calculated internal dose. As Peterborough does not have any measurable internal dose, the effective dose is the TLD whole body dose.

	Year	Peterborough			Toronto	
		Operators	Technicians	Staff	Operators	Staff
Maximum (mSv)	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)	2013	2.70	0.43	0.66	2.30	0.29
	2012	3.32	0.54	0.93	2.75	0.16
Minimum (mSv)	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 whole body dose trend is showing steady. 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 from 2012 to 2013. Average Technician doses are showing steady from 2012 to 2013. Average Staff doses are slightly reduced from 2012 to 2013.

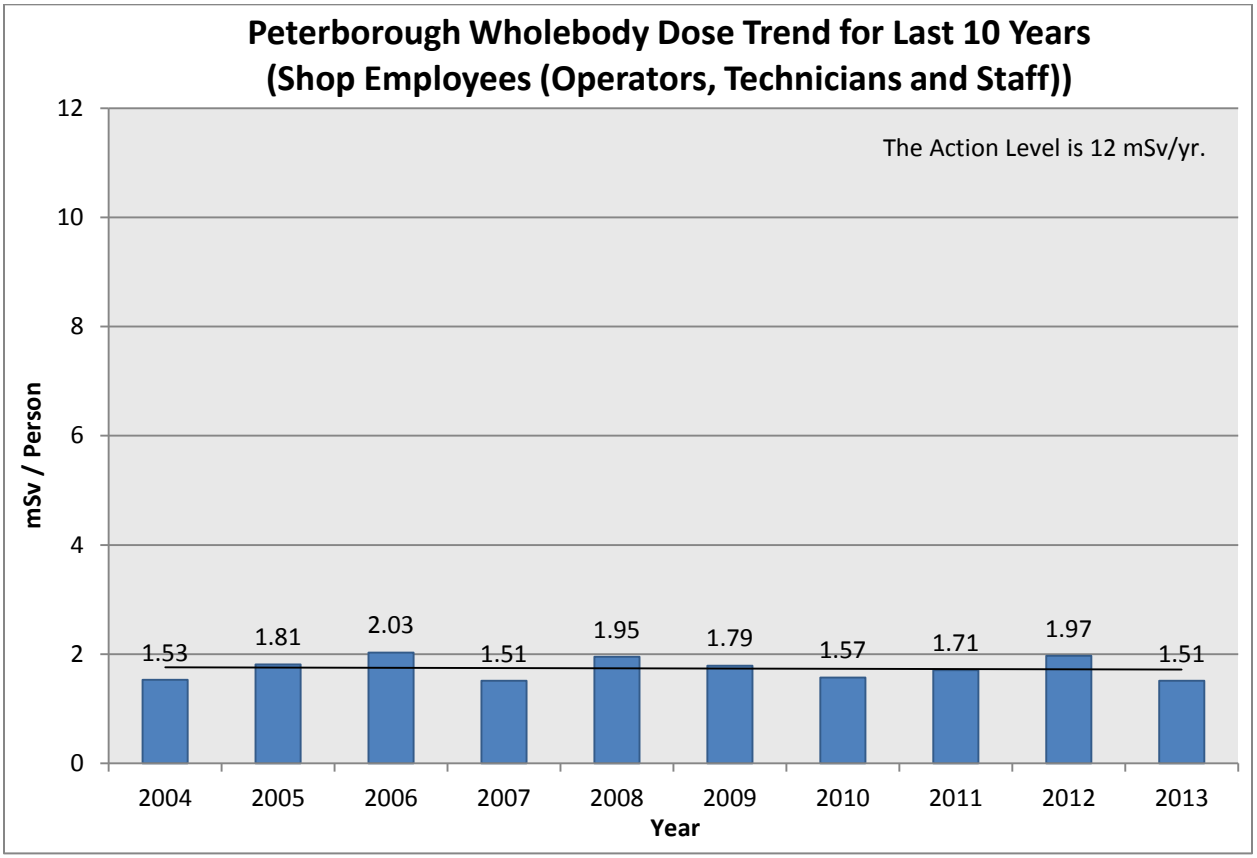

Figure 1: Peterborough 10-year Average Annual Whole Body Dose

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 for the previous years 2008-2011. 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 increase 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 Staff doses are also slightly reduced from 2012 to 2013.

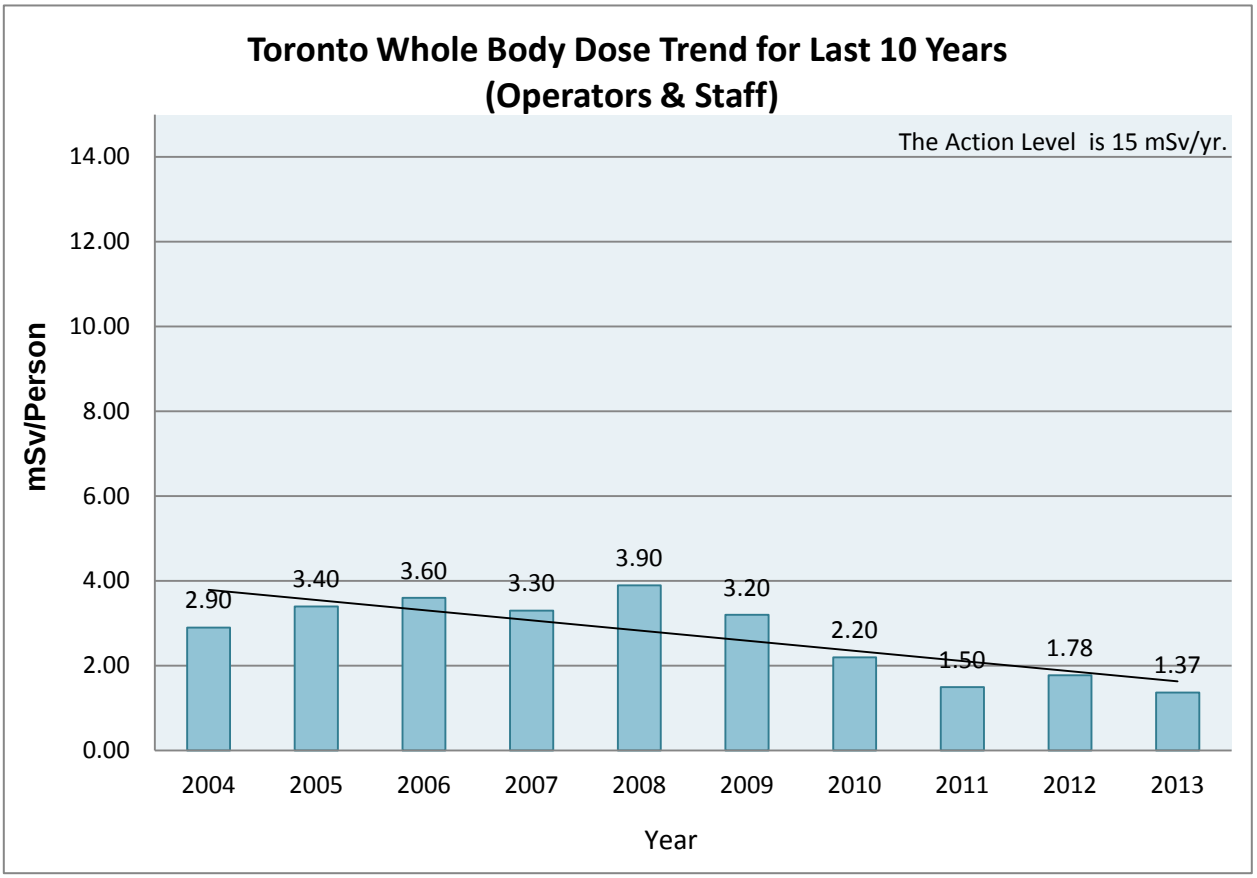

Figure 2: Toronto 10-Year Average Annual Whole Body Dose

6.5.1.8 Equivalent Skin Dose

Equivalent skin dose is summarized in Table 13.

	Year	Peterborough			Toronto	
		Operators	Technicians	Staff	Operators	Staff
Maximum (mSv)	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)	2013	7.57	0.60	0.71	13.81	0.71
	2012	9.55	0.77	0.95	17.38	0.67
Minimum (mSv)	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 doses are reduced from 2012 to 2013. Average Technician and Staff doses are slightly reduced from 2012 to 2013.

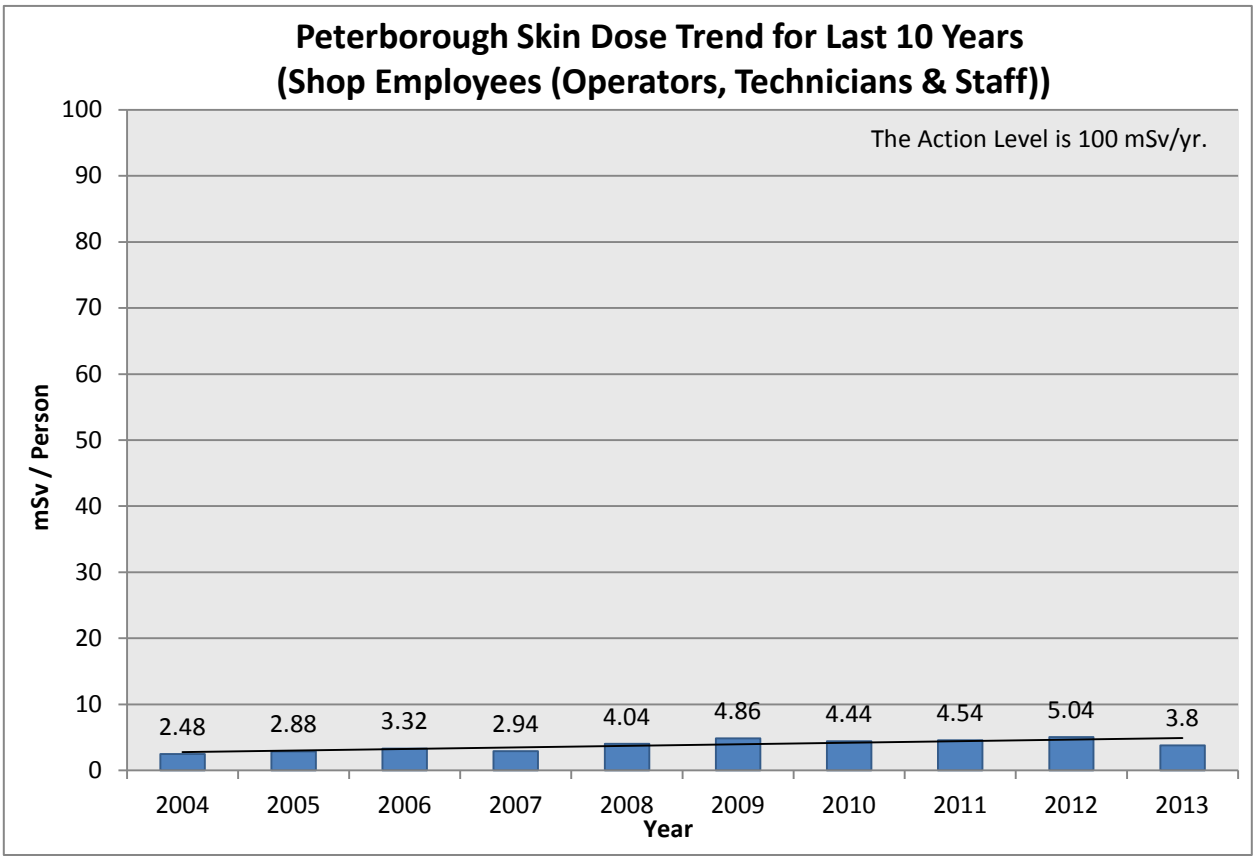

Figure 3: Peterborough 10-year Average Annual Skin Dose

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 for the previous years (2008-2011). 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 doses are reduced slightly from 2012 to 2013. Average Staff doses are steady from 2012 to 2013.

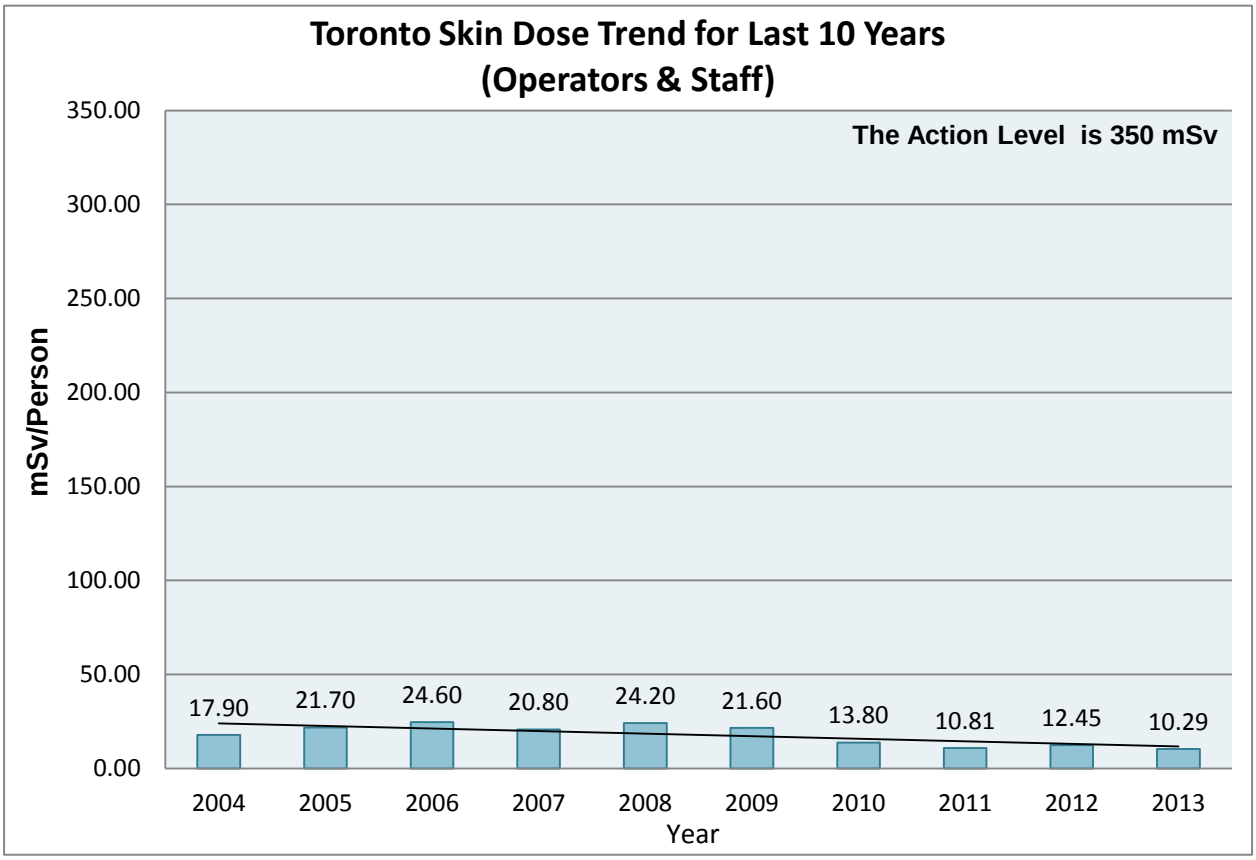

Figure 4: Toronto 10-Year Average Annual Skin Dose

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6.5.1.9 Equivalent Extremity Dose

Equivalent extremity dose is summarized in Table 14. Note: A revision to the Peterborough Staff extremity dose average from 0.26 mSv to 1.84 mSv was made; Only one staff employee participated in the program in 2012 and 2013.

	Year	Peterborough			Toronto	
		Operators	Technicians	Staff	Operators	Staff
Maximum (mSv)	2013	76.03	13.57	4.78	143.59	Not monitored
	2012	58.82	19.60	1.84	357.29	71.38
Average (mSv/person)	2013	16.40	1.39	4.78	32.92	Not monitored
	2012	17.15	2.19	1.84	45.83	71.38
Minimum (mSv)	2013	0.00	0.00	4.78	1.21	Not monitored
	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 continue to show a decreasing average dose since 2006. 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 doses are slightly reduced from 2012 to 2013. Average Technician doses are slightly reduced from 2012 to 2013. Average Staff dose is increased from 2012 to 2013 for the single monitored employee.

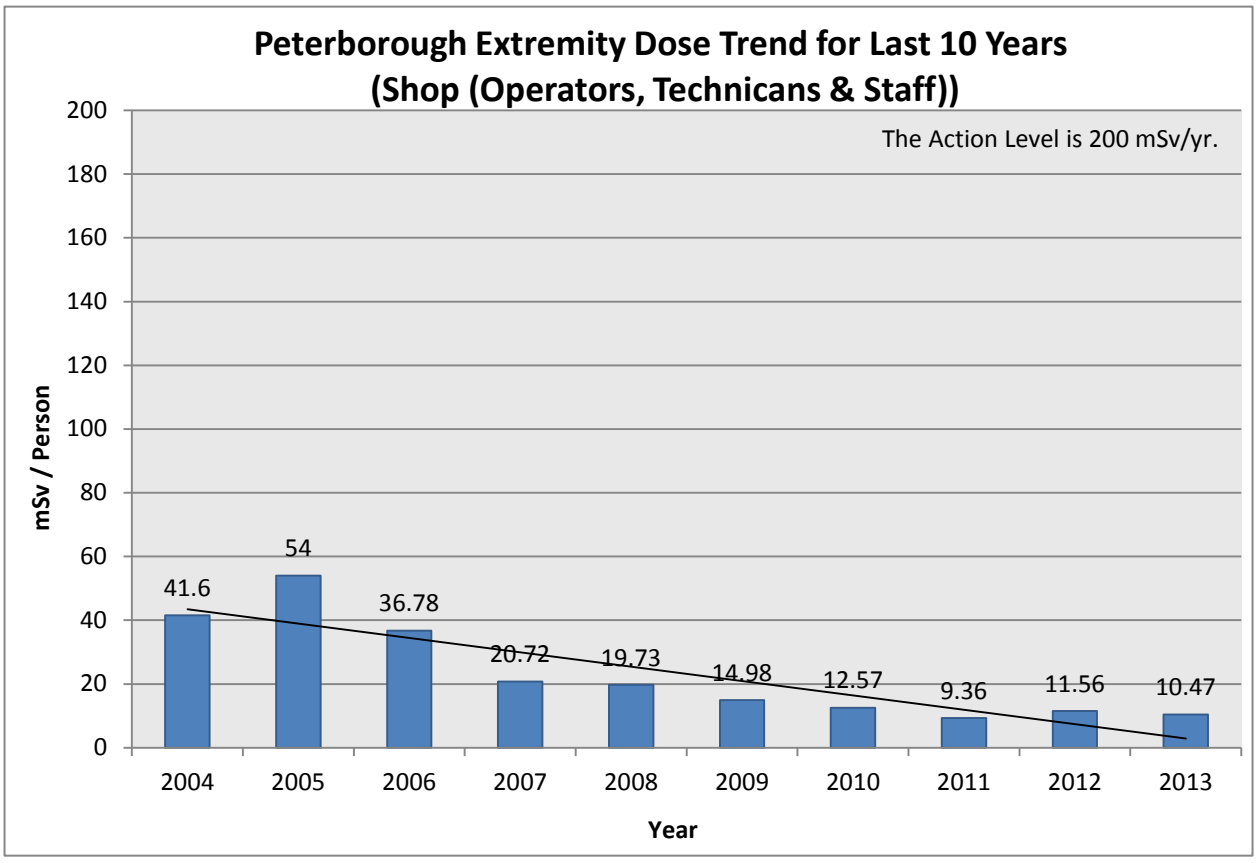

Figure 5: Peterborough 10-year Average Annual Extremity Dose

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 2012 to 2013.

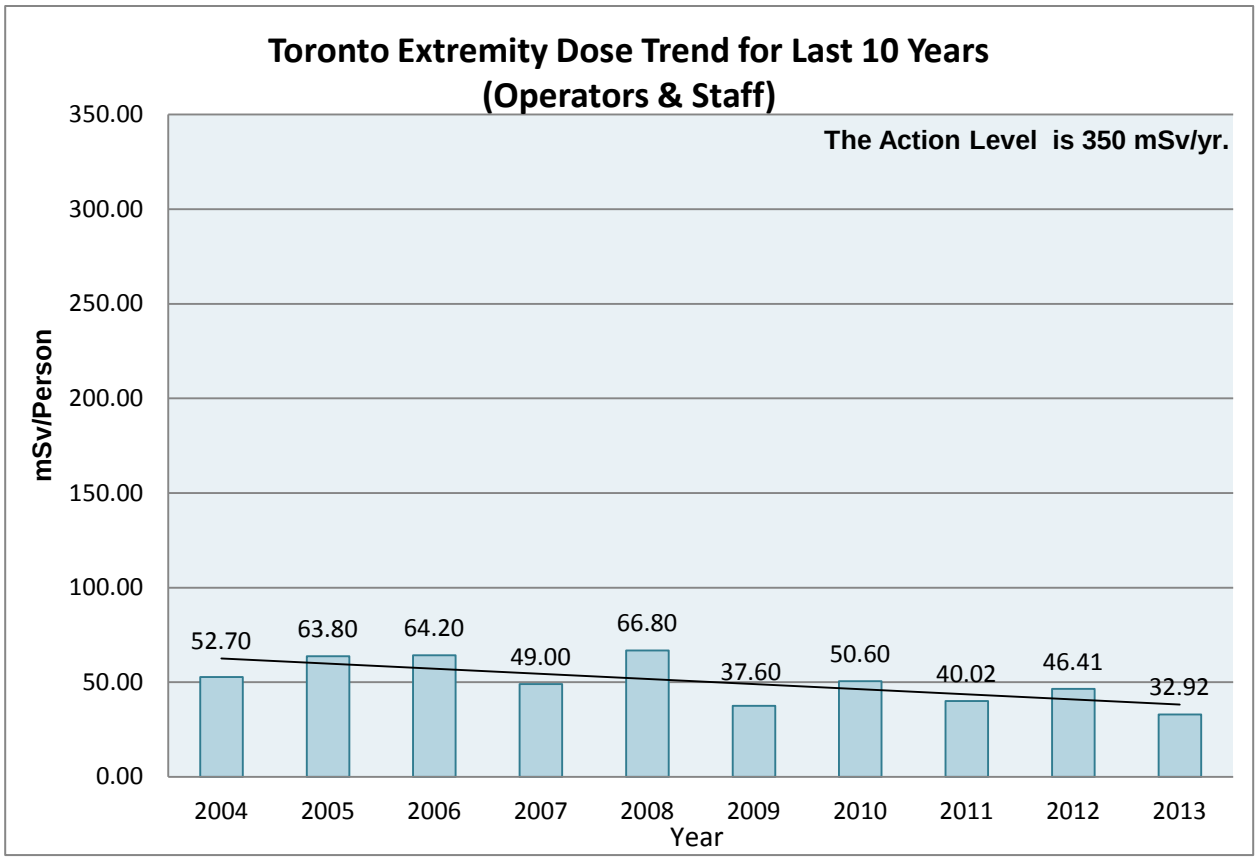

Figure 6: Toronto 10-Year Average Annual Extremity Dose

6.5.1.10 Exceedances of Regulatory Limits or Action Levels

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

In Toronto, one urine sample donated on March 6, 2013 was analyzed by a third party laboratory in accordance with routine monitoring. The sample indicated 13.5 µg U/L, which exceeded the *Action Level* of 10 µg U/L. This event was reported to the CNSC in accordance with licence conditions. Follow-up urine samples were donated on March 13th and March 20th and yielded results of approximately 0.5 µg U/L. A

Tap Root® investigation into the incident was conducted. The investigation identified three causal factors as follows:

1. A qualitative fit test was not performed.
2. Hair was not tied up during the incident, and
3. The respirator was stored with other personal protective equipment.

Five corrective actions were identified. The corrective actions are as follows:

1. An improved description and graphic of the qualitative check was incorporated into the work instruction to show who, what why and how of the check.
2. Operators were trained on the qualitative fit testing and include testing to understand the requirement.
3. A new policy requiring long hair to be tied up or restrained using other means.
4. Upgrade the work instruction to include all required steps to clean respirator and proper storage measures.
5. Train all operators in respirator storage requirements.

All corrective actions were implemented by the required due dates.

6.5.1.11 Radiation Protection Program Effectiveness

The radiation protection program is effectively implemented. One *Action Level* exceedance occurred for urinalysis at the Toronto 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 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. A copy of the report is provided to the CNSC separately.

6.5.1.12 Radiation Protection Program Improvements

Several improvements to the Radiation Protection Manual were instituted:

- Twelve work instructions between the two sites were updated to specify the *Internal Control Levels* at the working level for those reviewing sample results. Because they are in work instructions, the *Internal Control Levels* are no longer specified in the Volume I Radiation Protection Manual, which was submitted to the CNSC for review in early 2014. *Action Levels* remain in the RPM Volume I, which is the document referred to in the facility operating licence.
- Six radiation protection work instructions between the two sites were updated with administrative edits and clarifications of current requirements.
- Peterborough generated a Nuclear Energy Worker (NEW) management work instruction to facilitate the NEW designation process. NEW information brochures and fundamentals of radiation hand-outs were generated to provide to newly designated NEWs.

- Peterborough generated a new work instruction summarizing radiation protection qualifications and training requirements.
- Peterborough's TLD work instruction was updated to include the assignment of spare TLDs using the online system provided by the dosimetry service provider. This was intended to reduce the administrative burden from the previous method of assignment.
- Peterborough's radiation field monitoring work instruction was updated to clarify responsibilities, and routine and non-routine survey requirements. In addition, the work instruction now specifies that surveys are done at the nearest accessible location to the source(s).
- Peterborough's ALARA Committee charter was updated to begin annually trending whole body dose with employee hours, and production amounts.
- Peterborough's radiation safety precautions in radiation classified areas work instruction was updated to allow collets and electrodes to be removed from the R2 Area without contamination verification, following a study indicating that cleaning methods are effective.
- Peterborough's radiation safety instruction work instruction was updated to clarify the responsibility for ensuring that work site inspections are completed as required.
- Peterborough's radiation safety precautions work instruction for nuclear services was updated to reflect new radiation protection training qualifications.
- Toronto's internal dose assignment work instruction was updated to include additional sampling locations, and indirect workers in the program.
- Toronto's exhaust system verifications work instruction was improved with respect to velometer use, current equipment and tracking methods.
- Toronto's soil sampling work instruction and sampling plan were updated to include reference to current guidelines, and improve collection location and sample preparation instructions.

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 six 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 meetings.

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)	18% reduction	Achieved
	ALARA training for committee members	Conducted	Achieved
	Recognition of ALARA committee members	Completed	Achieved
	Complete previous shielding projects	1 project remains open	Not Achieved
Toronto	Downward trend of employee dose results	3.2 mSv/person and <11 mSv maximum	Achieved
	Ventilation improvements with average uranium in air below 10 dpm/m^3	Average unchanged at 10 dpm/m3	Not Achieved
	Reduce surface contamination results that exceed the *Internal Control Level* by 10% from 2012	38% reduction from 2012	Achieved
	ALARA training for committee members	Conducted	Achieved

Table 15: ALARA Committee Goals and Results

2014 goals for Peterborough are established as follows:

- 5% reduction in collective whole body dose for the fuel shop (corrected for production)
- 5% reduction to average whole body dose for final inspection operators
- Review current surface contamination monitoring locations
- Recognition of ALARA Committee members

2014 goals for Toronto are established as follows:

- Reduction in employee whole body dose results compared to 2013
- Average annual concentration of workstation air monitoring results <10 dpm/m^3
- 10% reduction in surface contamination monitoring results that exceed the *Internal Control Level* compared to 2013
- 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	99%
Toronto	Radiation Safety (Initial and Refresher)	48	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

Each site completed self-assessments on 21 health and safety framework element including Site Health and Safety Policy, Hazard Analysis and Regulatory Compliance, Employee Involvement, Accident Reporting, Investigation and Follow-up. All 21 health and safety elements continue to be maintained and improved upon since the business audit in 2012.

6.6.1.1 Peterborough

In 2013, Peterborough Workplace Safety Committee (WSC) conducted a total of 78 investigations and inspections. These investigations and inspections led to a total of 179 health and safety hazards being identified and logged into Action Tracking System (ATS) to track corrective action to closure. The top 5 finding categories were housekeeping, electrical safety, fire protection, walking/working surfaces and material handling.

6.6.1.2 Toronto

In 2013, Toronto conducted a total of 42 investigations and inspections. This includes WSC inspections, and first-aid/near-miss investigations. These investigations and inspections led to a total of 199 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 housekeeping, emergency, equipment, radiation, and unsafe condition. The top two categories of findings in ATS from incident investigations were industrial hygiene and equipment safety.

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, twelve meetings were held and quorum was met at all twelve meetings. In Toronto, ten 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	0	Achieved
	Zero days away from work	0	Achieved
	Inspection completion 85% and at least each area quarterly	100%	Achieved
	Accident/incident investigation exercise	Conducted	Achieved
	Joint meeting with EHS teams (Ergonomics, ALARA)	Conducted	Achieved
	Pelleting tour and attend WSC meeting	Conducted	Achieved
	Review a section of the CLC part II at meetings	Conducted	Achieved
	Confined Space Risk Assessment review	Conducted	Achieved
Toronto	Increased committee unity/involvement	Completed	Achieved
	Increase inspections by 10% from 2012	37% Increase	Achieved
	100% completion of regulatory training	100% Completed	Achieved
	Conduct training of committee members	Conducted	Achieved
	Joint meeting with ALARA and Ergonomics team	Conducted	Achieved

	Goal	Actual	Result
	Peterborough tour and attend WSC meeting	Conducted	Achieved

Table 17: Workplace Safety Committee Goals and Results

2014 goals for Peterborough are established as follows:

- 0 recordable injuries
- 0 days away from work
- Meet at least 9 times/year
- Every area inspected at least quarterly
- 100% regulatory training completed by Dec. 31
- Review and validate WSC Peterborough Charter
- Review a section of the CLC part II at every meeting
- Accident/Incident investigation exercise
- Joint meeting with ALARA and Ergonomics team
- Identify opportunities for continued training throughout the year
- Support Fuel Assembly Operations with continued guarding upgrades

2014 goals for Toronto are established as follows:

- Increase shop floor involvement - target 50 communications
- Conduct 3 shop floor meetings
- Complete electrical safety training
- Conduct group inspections: >1 inspection per team
- Conduct a joint meeting with the ALARA and Ergonomics team

6.6.3 Health and Safety Program Improvements

6.6.3.1 Peterborough

In 2013 there was continued focus on upgrading machine guarding in the services operation that was identified as medium to low risk. At the end of 2013 services has completed upgrades on all except one machine, which is scheduled to be completed by the end of Q1 2014.

The fuel assembly operation developed a multiyear strategy to implement machine guarding upgrades and began execution. 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. An entire system upgrade at the bundle assembly welder was completed. This included enhancements to the physical guarding, installation of a category 3 safety system including interlocks, the

deployment of safety mats and a safety rated programming logic controller. Similar safety overhaul of other processes including coiner 28, 35 and cut to length 65 occurred.

In November 2013 a near miss occurred whereby an engineer repeatedly crossed over an arc flash boundary during testing of a product for the customer. The outcome of the investigation found several opportunities for improvements to our electrical safety program. Since the incident the program has been enhanced to systematically identify and demarcate test bays and test cells, a formalized pre-job briefing is required for any employee/visitor/customer to enter into the test bay, and all engineering have gone through electrical testing awareness informing them of the reasons and expectations when there is live electrical testing occurring on the shop floor. These program improvements were documented in our electrical safety program.

6.6.3.2 Toronto

In 2013 there was a focus on training of shop floor employees. As more Operators are cross trained into various productions roles, the need to ensure training is current and adequate is critical. Changes in roles are identified in daily team meetings, and training requirements/completion is monitored. A new Toronto site training committee was established in 2013. The committee is focused on program upgrades to comply with the systematic approach to training methodology.

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 taken off-line in December 2013 to begin the upgrade to necessary controls and components. In the first quarter of 2014, the first furnace will be completely upgraded to meet NFPA 86, as well as bringing supporting systems into compliance with applicable technical standards (TSSA) and electrical codes (ESA). A plan has been established to upgrade a second furnace by the end of 2014, and financial commitments have been established for the remaining furnaces approximately every 6 months thereafter.

6.6.4 Hazardous Occurrences

No hazardous occurrences occurred at either facility during the reporting period.

There were a total of 10 first aids in Peterborough and 12 first aids in Toronto. There were no medical aids at either facility. There were a total of 37 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 also 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 I*nternal Control Levels* for various environmental parameters that are set even lower than A*ction Levels* to act as an early warning system. *Internal Control Level* exceedances trigger an internal investigation and corrective actions; however they are not CNSC reportable events.

The Peterborough facility also uses beryllium as part of the fuel bundle manufacturing process. Beryllium use in a federally regulated facility is governed by the *Canada Labour Code Part II* and the *Canada Occupational Health and Safety Regulations*. The Environmental Protection Act of Ontario (R.S.O. 1990, c. E. 19) and Ontario Regulation 419/05 *Air Pollution – Local Air Quality Regulation* determine the permitted concentration of contaminant release. The release limit at the Point of Impingement (POI) for Beryllium is currently set at 0.03 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 natural 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 A*ction 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	48	744
Number of Uranium Samples > *Action Level* (1 µg/m^3)	0	0
Average Uranium Concentration (µg U/m^3)	0.0012	0.002
Highest Uranium Value Recorded (µg U/m^3)	0.0046	0.62
Total Uranium Discharge to Air (g)	0.0132	5.794
Number of Beryllium Air Exhaust Samples Taken	150	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)	0.0001	N/A
Highest Beryllium Value Recorded (µg Be/m^3)	0.0069	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	0.0007
Highest Value Recorded (µg U/m3)	N/A	0.0026

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 ug/m^3. The five year trend graph of 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 0.0132 g in the reporting period is well below the discharge limit of 550 g.

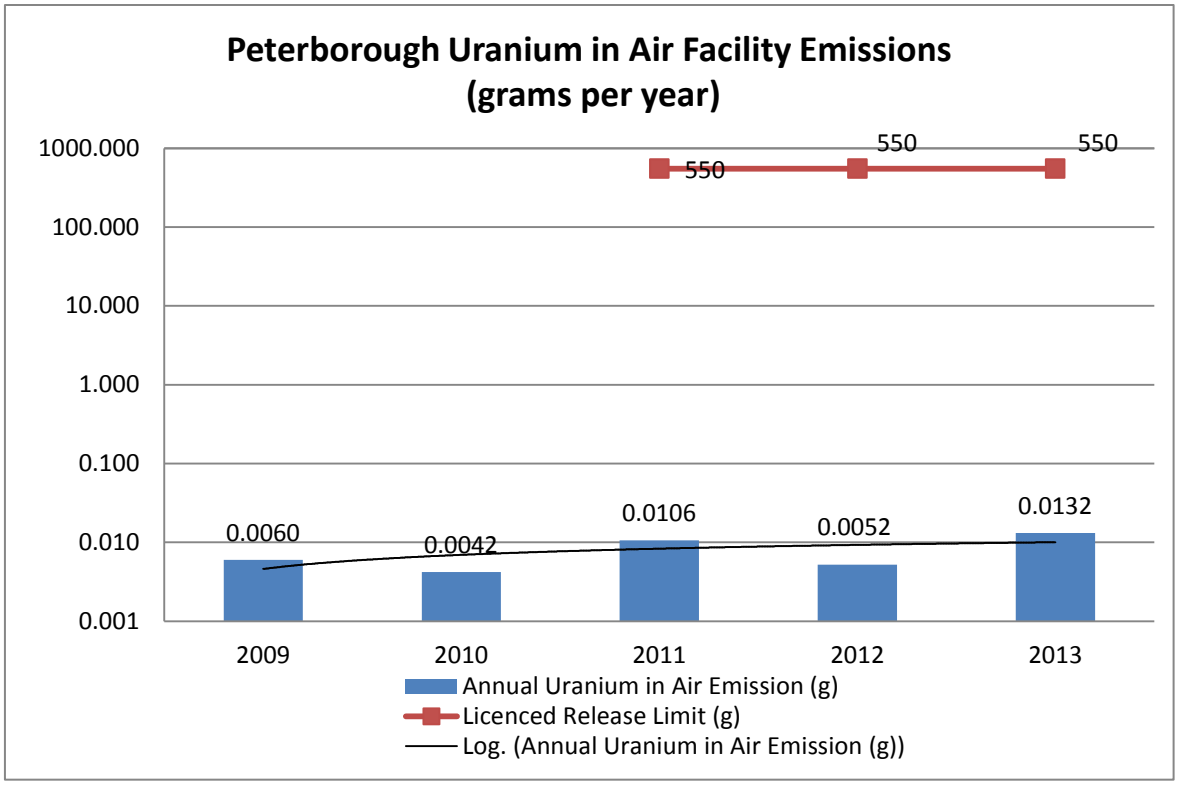

Figure 7: Peterborough Stack Air Emission Trending

Note: the above graph has a logarithmic scale

6.7.1.2.2 Toronto Trending

The Toronto stack air emission trend up until 2010 was fairly flat, i.e. within the range of measurement uncertainties. However, there is a noted decreasing trend year over in 2011. This is likely due to upgrades completed in 2010 to the rotoclone system. 2012 stack air emissions were slightly higher than the previous year due to a 6H-68 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 5.79 g in 2013 is well below the discharge limit of 760 g. This is a significant reduction from last year believed to be in large part due to a major upgrade of air exhaust systems completed in 2012.

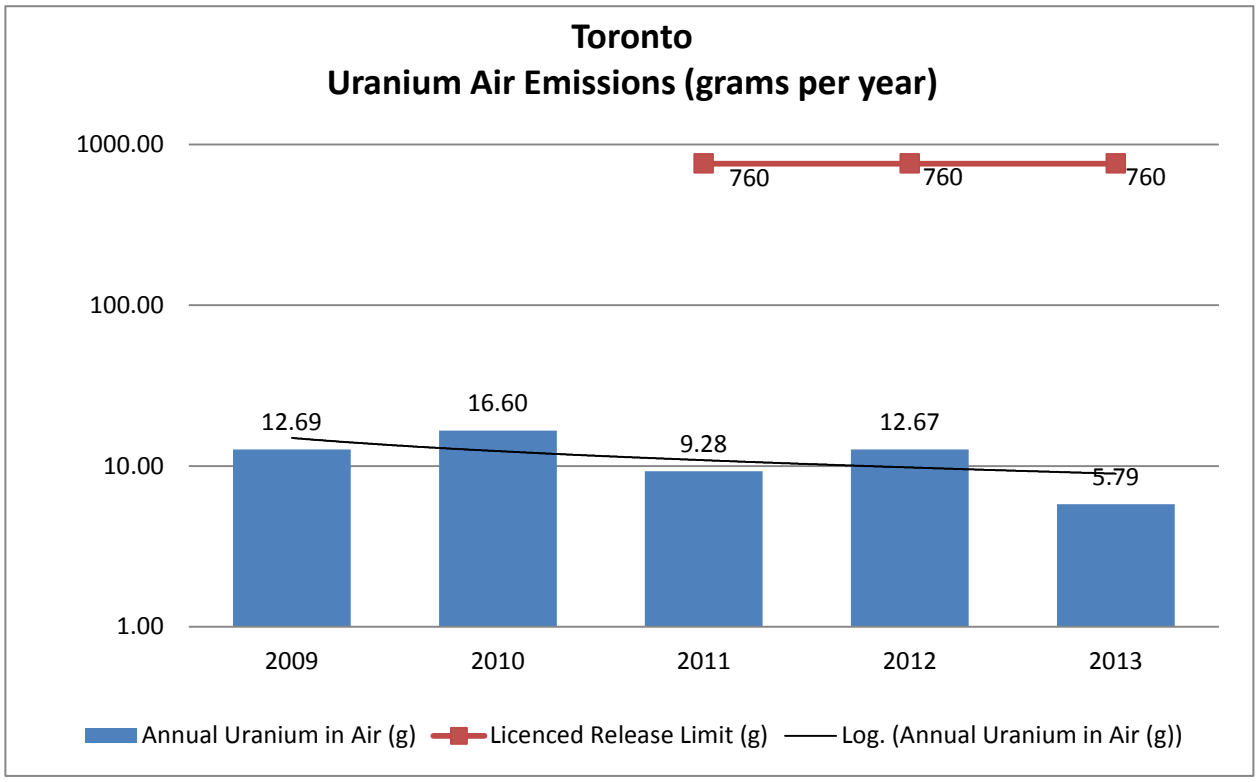

Figure 8: Toronto Stack Air Emission Trending

Note: the above graph has a logarithmic scale

The Toronto boundary air monitor average and 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.

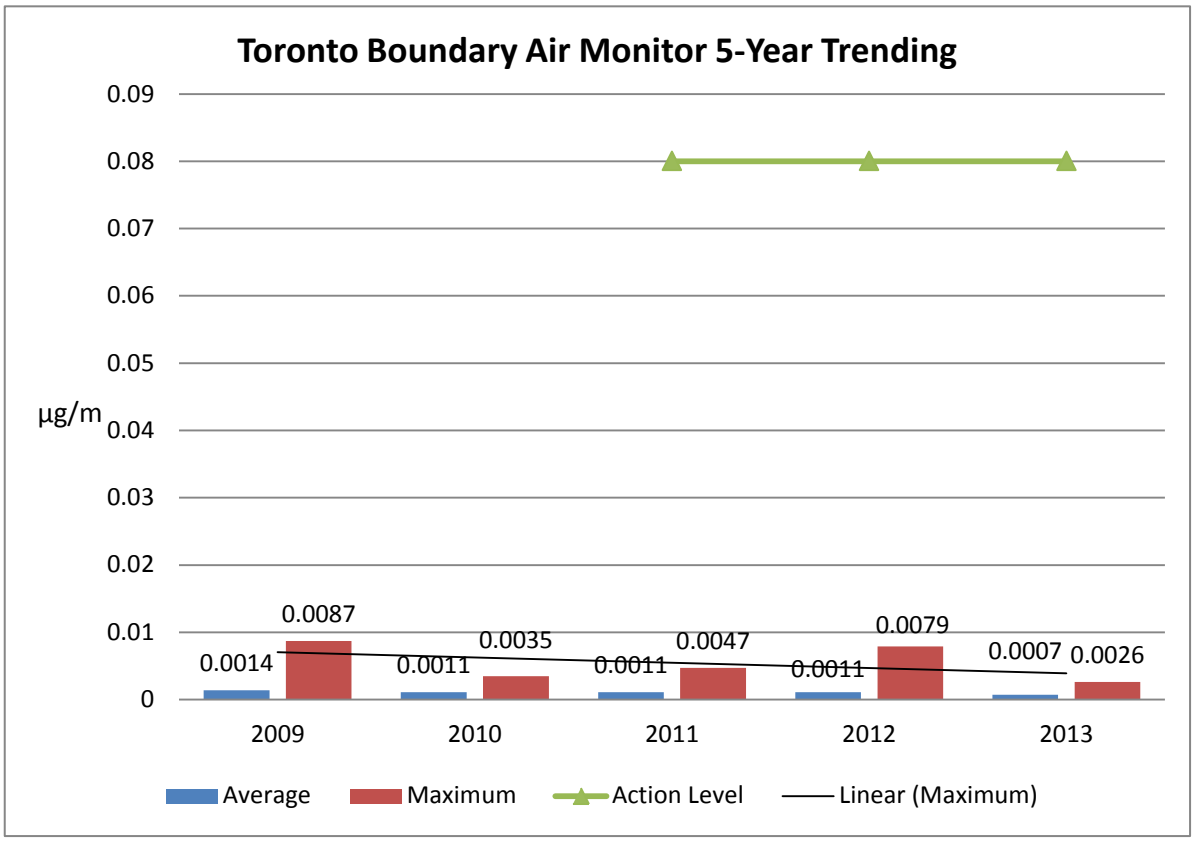

Figure 9: Toronto Boundary Monitor Air Emission Trending

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 the weekly 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 A*ction Level* of 6 ppm (per batch). A weekly composite sample is prepared and sent for independent analysis at an external laboratory. The minimum detectable 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 A*ction Level* for a batch is 6 ppm)
4. The released water mixes with sanitary water
5. Dilution factors range from 4 to about 12; the resulting volume discharges to a combined sanitary/storm city sewer
6. Reported results do not include dilution, i.e., sample measurements are taken prior to mixing with non-process water

Results from water effluent monitoring are summarized in Table 20. Annual discharges are trended in Figure 10 and Figure 11.

	Peterborough	**Toronto**
Total Amount of Liquid Discharged (L) from Uranium Processing Areas	820	1,649,195
Maximum Uranium Concentration in Water (ppm)	0.46	2.7
Average Uranium Concentration in Water (ppm)	0.29	0.76
Minimum pH	N/A	6.9
Average pH	N/A	7.1
Maximum pH	N/A	7.6
Number of Samples Exceeding *Action Level* (6 ppm per batch)	0	0
Total Uranium Discharge to Sewer (g)	0.24	830
Maximum Beryllium Concentration in Water µg/L	1.55	N/A
Average Beryllium Concentration in Water µg/L	0.38	N/A
Number of Samples Exceeding Internal Control Level (4 µg/L)	0	N/A

Table 20: Liquid Effluent Monitoring Results

6.7.2.1 Peterborough Trending

In Peterborough, the five year trend graph of 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 0.24 g is a very small fraction of the derived emission limit and of the discharge limit of 760 kg/year.

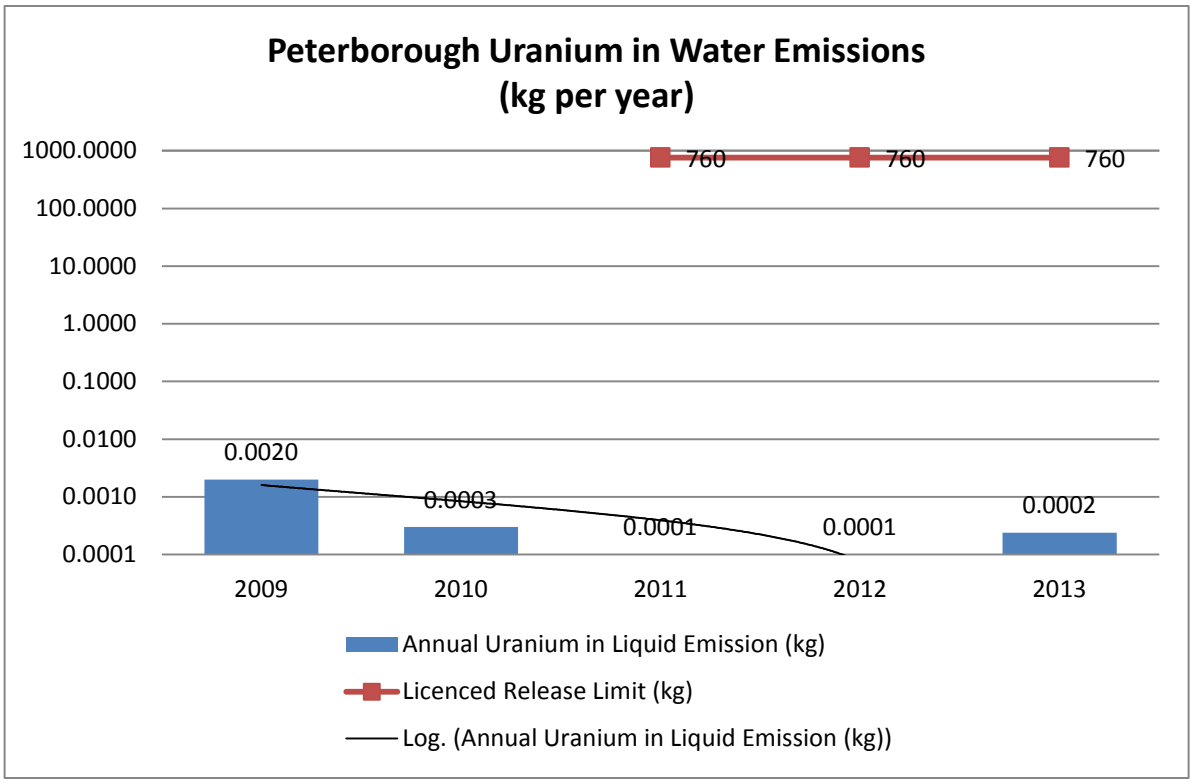

Figure 10: Peterborough Water Emission Trending

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 0.83 kg is well below the derived emission limit of 9000 kg/year.

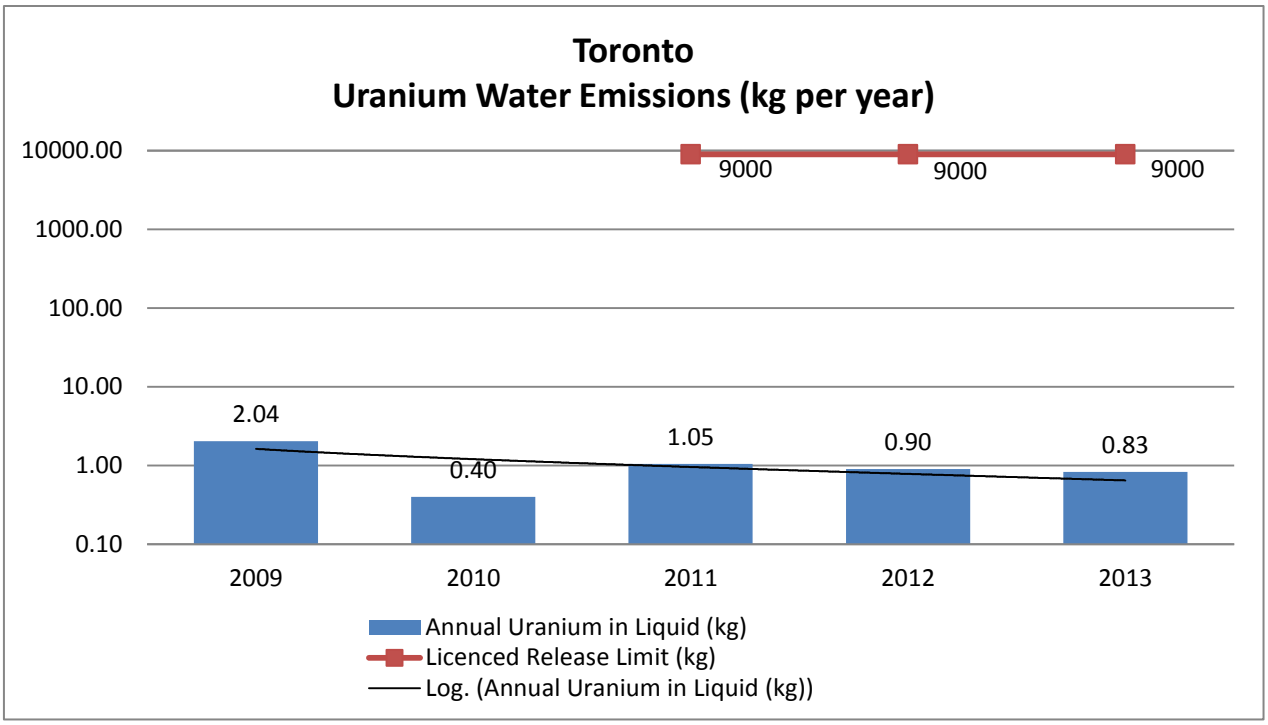

Figure 11: Toronto Water Emission Trending

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 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 2013 summary of results is 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 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	24	24
Average concentration µg U/g	2.3	3.9	1.1
Maximum concentration µg U/g	2.3	24.9	3.1

Table 21: Toronto Soil Sampling Result Summary

Sample Location ID	Uranium Content (ppm/ug/g)	% of guideline
1	0.8	3.5%
2	1.3	5.7%
3	2.3	0.8%
4	0.6	2.6%
5	1.1	3.3%
6	1.5	4.5%
7	9.3	28.2%
8	3.0	9.1%
9	4.2	12.7%
10	2.4	7.3%
11	9.8	29.7%
12	2.9	8.8%
13	2.7	8.2%
14	4.5	13.6%
15	3.7	11.2%
16	4.3	13.0%
17	24.9	75.5%

Sample Location ID	Uranium Content (ppm/ug/g)	% of guideline
18	2.0	6.1%
19	1.7	5.2%
20	2.1	6.4%
21	1.1	3.3%
22	1.7	5.2%
23	1.2	3.6%
24	3.2	9.7%
25	2.1	6.4%
26	0.5	1.5%
27	2.0	6.1%
28	0.9	2.7%
29	0.7	3.0%
30	3.1	13.5%
31	2.2	9.6%
32	1.8	7.8%
33	1.0	4.3%
34	1.0	4.3%
35	0.8	3.5%
36	0.8	3.5%
37	1.9	8.3%
38	0.9	3.9%
41	0.7	3.0%
42	1.0	4.3%
43	0.7	3.0%
44	0.8	3.5%
45	1.1	4.8%
46	1.1	4.8%
47	1.3	5.7%
48	0.8	3.5%
49	1.2	5.2%
50	0.8	3.5%

Sample Location ID	Uranium Content (ppm/ug/g)	% of guideline
51	0.7	3.0%

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
A	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 Emission Limits
C1	Soil deposition gamma ground shine	Gamma ground shine dose from direct radiation This is accounted for in the Toronto Derived Emission Limit
C2	Soil deposition beta ground shine	Beta ground shine dose from direct radiation This is accounted for in the Toronto facility Derived Emission Limit
C3	Soil re-suspension and inhalation	Soil re-suspension and inhalation dose This is accounted for in the Toronto facility Derived Emission Limit
E	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 Emission Limits

Table 23: Radiological Exposure Pathways

The facility Derived Emission Limits account for the exposure pathways as described in the facilities Radiation Protection Manual to restrict dose to a member of the public to 1mSv (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 Emission 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 Emission Limits, the estimated effective dose as a result of air releases in 2013 is estimated to be 0.00 µSv. In Toronto, through direct correlation with the facility Derived Emission Limits, the estimated effective dose as a result of air releases in 2013 is estimated to be 0.38 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)
2013	0.00	0%	0.38	<0.1%
2012	0.00	0%	0.83	<0.1%

Table 24: 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 registration an Environmental Management System (EMS) is in place. Our Environmental Management System meets the requirements of both ISO 14001 and GE's internal 6 Element E-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 for each of the 6 E-framework elements

Following an audit, the findings are documented, corrective actions identified and tracked to completion in GEH-C's Action Tracking System.

In 2013, there were 49 environmentally related audit findings for Peterborough and 15 for Toronto. All corrective actions were implemented and closed within 120 days of the finding.

6.7.7 Environmental Protection Program Improvements

No significant changes or improvements were made to the Peterborough environmental protection program.

No significant projects were undertaken in 2013 affecting Toronto's environmental protection program.

6.7.8 Environmental Protection Program Performance

2013 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 10% from previous year	Achieved: 11.7% increase in waste diversion rate over 2012
	Reduce quantity of asbestos throughout building services (pipe insulation, floor tile, etc.)	Achieved: Completely removed asbestos from Test Rig area of Building 21
	100% of regulatory and non-regulatory training completed	Achieved: All training completed
	100% of emergency drills held	Achieved: quarterly emergency drills held
Toronto	40% reduction in liquid drum inventory (based on January 2013 inventory)	Achieved: 49 drums (Jan. 2013) reduced to 15 by Dec. 2013 and remaining liquid material put in plastic drums and/or spill skids. Continue to operate band heater.
	Zero reportable spills or releases	Achieved
	Maintain ISO-14001 certification	Achieved: No non-conformances during audit
	5% reduction in emissions from 2012	Achieved: Air and water emissions reduction > 5%.
	Educational campaign on green-house gases	Achieved
	Reduce on-site chemical inventory	Achieved
	Achieve GE environmental excellence award	Not Achieved: Initiative placed on hold by GE during transition to a new scorecard

Table 25: EMS Program Goals

2014 goals for Peterborough are established as follows:

1. Reduce water usage by 5% from previous year
2. Waste diversion rate increased by 5% from previous year.
3. Reduce power consumption by 2,000 kWh
4. Reduce quantity of asbestos in facility
5. 100% of regulatory and non-regulatory training completed
6. 100% of emergency drills held

2014 goals for Toronto are established as follows:

1. Reduce average water effluent release per tank to < 1.0 ppm

2. Reduction Air Emissions from the 5 year average by > 5%
3. Greenhouse gas reduction - Undertake Treasure Hunt initiative
4. Reduce on-site chemical inventory by 5%
5. Zero reportable releases

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:

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

6.8.1 Review of Emergency Preparedness Program Activities

Emergency drills were performed in the following areas:

Peterborough:

- Medical (once)
- Evacuation (twice)
- Spill (once)

Toronto:

- Fire (three)
- Medical (one - with participation from Toronto Fire Services)
- Hydrogen shut-off (once)

6.8.2 Emergency Preparedness Training Program and Effectiveness

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

	Course Name	Number of Employees who Required Course	% Required Completed
Peterborough	Emergency Preparedness and Fire Prevention (Initial)	8	100%
	Emergency Preparedness and Fire Prevention (Refresher)	75	100%
	Portable Fire Extinguisher Training (Practical)	11	100%
	Portable Fire Extinguishers	332	100%
	Spill Response (Practical)	10	100%
	Blood borne Pathogens Awareness (Initial)	0	100%
	Blood borne Pathogens Awareness (Refresher)	11	100%
	First Aid	5	100%
Toronto	Emergency Preparedness and Fire Prevention (Initial)	17	100%
	Emergency Preparedness and Fire Prevention (Refresher)	45	100%
	Portable Fire Extinguisher Training (Practical)	0	100%
	Portable Fire Extinguishers	65	100%
	Spill Response (Practical)	0	100%
	Blood borne Pathogens Awareness (Initial)	0	100%
	Blood borne Pathogens Awareness (Refresher)	15	100%
	First Aid	15	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, Peterborough Fire Services conducted familiarization tours July 15-19, 2013.

Thirty-nine Action Tracking System items were raised in 2013 in regards to emergency response and fire protection. All items are closed.

In Toronto, twenty-three Action Tracking System items were raised related to emergency response and fire protection. All corrective actions have been implemented and closed within 120 days of the finding. Findings entered into this category originate from site safety inspections, third party audits, incident investigations and emergency drill lessons learned.

6.8.4 Fire Protection Program Improvements

In Peterborough, a fire separation was constructed between Building 26 and the rest of the non-nuclear facility. Electrical supervision was added to two fire protection valves located in Building 24. No significant program improvements or revisions were made.

In Toronto, no significant physical changes were made to the fire protection system. The fire safety plan was updated to include pre-incident plans and resubmitted to the local fire department.

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 and IAEA on July 15, 2013. 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. There were no findings or major concerns noted.

In Toronto, a short notice random inspection was conducted by the CNSC and IAEA on April 19, 2013. The scope concerned shipments of natural uranium pellets to GE-Hitachi in the United States. There were no findings or major concerns 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. 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

In March 2013, GEH-C unveiled a new public information web page with the creation of a standalone, microsite. The web page is at http://geh-canada.ca/ . Previously, the public information web site was within the General Electric Company's web site hierarchy and this made it more difficult to locate information specific to GEH-C. The new web site was designed to be much more user friendly and included interactive features such as the "*Talk to Us*" button that allows the user to submit questions directly to the company. In addition, to compliance reports that had been on the previous web page, the new web site includes a video on how the manufacturing process works and other internal and external reports of interest to a member of the public. Historical air and water emission results are posted. On an ongoing basis, reports of events occurring at the facility, which have potential to impact members of the public, are now promptly posted on the web site.

Based on the number of visits to the new web site, this initiative has been very successful at increasing public awareness of our facilities and in communicating information about the safety of our facilities to the public. Between March and mid-December 2013, there were over 14,000 page views. Viewing of our web site was primarily by people located in Toronto. Of the visitors to the site, ¾ of them were first time visitors and they spent on average, more than 2 minutes on the web site.

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 140 emails and 36 phone calls from the toll free line and general email address were responded to in 2013.

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 remained fairly high in 2013. Media coverage included print, television, radio, and social media. Media coverage occurred during the following events:

1. A February 3, 2013 protest at the Toronto plant and on the Canadian Pacific rail line
2. An announcement of the Ministry of the Environment soil study in the area of the Toronto plant
3. Ministry of the Environment final report release, which concluded there was no significant impact from the Toronto plant operations on neighbourhood soil
4. An announcement and completion of the CNSC public meeting held on December 9 and 10, 2013 at the Holiday Inn, Toronto

Social media that included discussion of the GEH-C facility were routinely monitored. Anti-nuclear groups continue to have active postings to social media with negative sentiment toward GEH-C. There were protests by a small number of representatives of anti-nuclear groups at the Toronto facility in February 2013 and both the Toronto and Peterborough facilities in June 2013.

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 raised interest in Toronto plant operations and the associated safety of the plant. Areas of concerns include soil quality near the plant, transportation of uranium dioxide, rail use, site security, safety and environmental emissions.

GEH-C participated in a number of community meetings and conducted its own open house in close proximity to the Toronto plant. During these events feedback has been solicited from neighbours and information provided. The open house conducted on November 19, 2013, included sections on the operations, history and safety record of the facility. Approximately 30 people attended this year's open house which included the participation of the Ministry of the Environment. These meetings have provided feedback and an opportunity to address questions stakeholders may have about the facility.

In 2013, a community liaison committee (CLC) was initiated. As per the CLC 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, health & safety initiatives and citizenship activities. The CLC meets about once per quarter and in 2013 met three times. Prior to the initiation of the CLC, meetings were held with residents who live on Brandon Avenue on March 4 and March 6, 2013. A plant tour for residents was also held April 24, 2013.

An elected official tour of the Peterborough facility was conducted on September 26, 2013. Meetings were also 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.

6.13.1.1 Public Information Program Initiatives

As a result of the continuing high level of interest in our Toronto facility we upgraded our written public Information Program. The updated program establishes an annual newsletter, requests for regular communication with local municipal councillors, expansion of public advertisement, and additional outreach, including a community liaison group. GEH-C initiated the community liaison committee in 2013, which met on three occasions.

In 2013, GEH-C also completed its own dedicated micro-site in order to present information to the public in a more user-friendly way and to provide more information of interest. Regular updates were posted to the web site throughout the year including reports for a loss of power and a smoke alarm incident. Updates were also posted about the MOE soil study results and the CNSC public meeting about our Toronto facility. A new video is under preparation which specifically addresses some of the questions and concerns raised in the public meeting. This video is expected to be posted on our web site in the second quarter of 2014.

The signage on the Toronto facility was updated to indicate the full company name of "GE Hitachi Nuclear Energy Canada" to make clearer the purpose of the facility.

A follow-up GEH-C public meeting was held November 19, 2013. Other stakeholder meetings will be held going forward.

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 2013, CNSC comments on our revised preliminary decommissioning plans for both facilities were received. Plan updates are required every 5 years. The plans are now being revised to incorporate all CNSC comments. 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 2014.

6.13.3 Improvement Plans and Future Outlook

Operational changes planned for 2014 are summarized in Appendix C, submitted to the CNSC under separate cover.

6.13.4 Safety Performance Objectives for the Following Year

Facility operations are expected to remain fairly constant in 2014. Fuel production levels are projected to be similar to the amount processed in 2013. 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. Whole body, 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 Toronto for urinalysis 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.