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SCIENCE ADVANCING HEALTH

Nordion Class 1B Facility

License Number: NSPFOL-11A.05/2015

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Annual Compliance and Operational Performance Report to the Canadian Nuclear Safety Commission for the period JANUARY 2014 to DECEMBER 2014

Submitted: March 31st, 2015

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ABSTRACT

This Annual Compliance and Operational Performance Report (ACOPR) provides performance and operational information for Nordion's Class 1B Facility. It reports annual performance against the Nuclear Safety and Control (NSC) Act, applicable regulations, relevant safety and operational programs and the license conditions of the Nuclear Processing Facility Operating License issued by the Canadian Nuclear Safety Commission (CNSC) (License NSFPOL-11A.05/2015). It demonstrates that Nordion is operating in a safe manner.

As per Nordion's license condition on annual reporting, this report contains the following information:

- The operation and maintenance of the facility, a summary of facility and equipment performance and changes, changes to operating policies, organization, occurrences, personnel radiation exposures and releases of nuclear substances and releases of hazardous substances from the facility.
- Changes to the emergency procedures, changes that affect or may affect the facility's emergency response arrangements, training activities, drill and exercise activities and unplanned events in which the facility's emergency response organization was tested.
- The results of the effluent monitoring and personnel radiation exposures of the facility.
- The results of environmental monitoring.
- A summary of non-radiological health and safety activities, information on minor incidents and lost-time incidents.

The key points of this report are as follows:

- There were no major issues in 2014 with regard to the operating facility. The facility has operated according to applicable design criteria. There were no physical design changes to any structural areas of the building or changes to the designated Active Areas. The classification of Room 1308 within the licensed facility boundary was changed from a Radiation Area (an area where radioactive material is sealed and there is virtually zero probability of loose contamination) to an Active Area.
- Several milestones regarding Nordion's Systematic Approach to Training (SAT) program were completed in 2014 including Job Task Analysis (JTA) for the following positions where the core duties of the positions are safety related: Cobalt Monitors, Installation and Service Technicians, and Surveyors.
- Conformance to internal training requirements was high in 2014.
- At the end of 2014, there were 29 out of 822 survey meters past due for the internal frequency requirements, some due to them requiring repair. All of the 29 meters have since been calibrated or otherwise accounted for. Testing of all other radiation devices and instrument maintenance was performed at the required frequency and results were satisfactory. There were three pieces of equipment with multiple occurrences of non-routine maintenance in 2014 (refer to Section 2.3.4.11). However, these occurrences were not indicative of any malfunction of the major hardware or components of the systems because they were related to the replacement of consumables, the replacement of parts due to regular wear, and inconsequential faults.
- The Environment, Health and Safety (EHS) Committee met on a regular basis to review the environmental and safety aspects of the operations and to review and approve Final Safety Analysis Reports (FSARs).
- All measurable radiation dose received by personnel and the public were within the regulatory limit of 50 mSv/yr. and no internal dose levels or limits were exceeded.
- There were a total of 47 contamination incidents in 2014. All elevated levels of contamination were monitored and contained within the Active Area.
- There were no instances in which there was potential to exceed a regulatory limit or to reach or exceed an action level in 2014.
- Various improvements were made to the Radiation Protection, Conventional Health and Safety, Environmental Protection and Fire Protection Programs. These programs fall within the scope of the Quality Assurance (QA) Program for Safety.
- There were three lost time injuries that resulted in a total of 18 days of lost time and five medical treatment injuries in 2014.

- There were no instances of exceeding environmental regulatory limits or action levels in 2014. The maximum annual release of airborne from any one radionuclide was Xe-135m at 0.61% of the DRL.
- In 2014, Nordion received one EHS related external communication from a customer requesting information regarding Nordion's Environmental Health and Safety programs for a supplier questionnaire.
- Nordion hosted the general public at an information session to build public awareness about Nordion's products, services, operations and facility, and to obtain stakeholder feedback.
- In 2014, Nordion complied with each site-specific reporting requirement with the exception of seven instances regarding sealed source reporting. The instances were reportable under Section 6.1 (g) of the site license (NSPFOL-11A.05/2015). Nordion is conducting an in-depth review of the sealed source reporting process.

In 2014, Nordion's Class 1B Facility operated within the requirements of the Nuclear Safety and Control Act, the applicable regulations and the conditions of the operating license issued by the CNSC with the exception of 13 non-compliances with the Act, the regulations or with Nordion's site license NSPFOL-11A.05/2015 (refer to Appendix A).

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GLOSSARY

ACOPR	Annual Compliance and Operational Performance Report
ALARA	As Low As Reasonably Achievable
AMMS	Advanced Maintenance Monitoring System
AMP	Administrative Monetary Penalty
BH	Borehole
BMS	Building Monitoring System
CAD	Charcoal Adsorber
CAM	Continuous Air Monitor
CAPA	Corrective Action Preventative Action
CBRNE	Chemical Biological Radionuclear Explosive
CNSC	Canadian Nuclear Safety Commission
COF	Cobalt Operations Facility
[redacted]	
CSA	Canadian Standards Association
DRD	Direct Reading Dosimeter
DRL	Derived Release Limit
EC	Environment Canada
EHS	Environment, Health and Safety
EMS	Environmental Management System
EMU	Emergency Measures Unit
EOC	Emergency On Call
EQMS	Electronic Quality Management System
ER	Emergency Response
FAQ	Frequently Asked Questions
FSAR	Final Safety Analysis Reports
HEPA	High Efficiency Particulate Air
HEPCO	Hospital Emergency Planning Committee of Ottawa
HPGe	High Purity Germanium
HRSDC	Human Resource Skills Development Centre
HVAC	Heating, Ventilation and Air Conditioning
ICP	Incident Command Post
IMS	Incident Management System
KRMF	Kanata Radiopharmaceutical Manufacturing Facility
KOB	Kanata Operations Building
LLLW	Low Level Liquid Waste
MDA	Minimum Detectable Activity
MSDS	Material Safety Data Sheet
NCSP	Nuclear Critical Safety Program
NEW	Nuclear Energy Worker
NFPA	National Fire Protection Association
NMPF	Nuclear Medicine Production Facility
NPRMI	Non-production Radioactive Material Inventory
NSC	Nuclear Safety and Control
NVS	Nuclear Ventilation System
OMIS	Obligated Material Inventory Summary
OSL	Optically Stimulated Luminescent
PIP	Public Information Program
PIT	Physical Inventory Taking
PIT-E	Physical Inventory Taking – Evaluation
PPE	Personal Protective Equipment
PTNSR	Packaging and Transport of Nuclear Substances Regulations
QA	Quality Assurance
R&D	Research & Development

RE	Roy Errington
RP	Radiation Protection
SAT	Systematic Approach to Training
SCBA	Self Contained Breathing Apparatus
SOP	Standard Operating Procedures
SSTS	Sealed Source Tracking System
TDG	Transportation of Dangerous Goods
TLD	Thermo-luminescent Dosimeter
UPS	Uninterruptible Power Supply
WSIB	Workplace Safety Insurance Board

1. INTRODUCTION

1.1 General Introduction

Nordion is a major global supplier of radioisotopes used in nuclear medicine for diagnostic and therapeutic purposes, industrial applications, and research and development activities. The Class 1B Facility is comprised of two major production operations, one involving the processing of radioisotopes used in nuclear medicine and the other involving sealed sources used in cancer therapy and irradiation technologies.

1.1.1 Summary of Production and Operational Limits

Nordion's license NSPFOL-11A.05/2015 does not include any production and operational limits.

1.1.2 Summary of Performance

Nordion operated in compliance with the Nuclear Safety and Control (NSC) Act in 2014 with the exception of 13 non-compliances with the Act, the regulations or with Nordion's site license NSPFOL-11A.05/2015 (refer to Appendix A). In 2014, there were 21 incidents. Of the 21 incidents:

- Three were related to the reporting of an event only and did not involve a non-compliance.
- Five were non-compliances that were the responsibility of a carrier, supplier, or customer.
- 12 of the 13 non-compliances were of low significance as there was no impact to health, safety, the environment or security and one was medium significance which was related to export license notifications. Refer to Investigation 14-13 in Appendix A and Section 1.1.4). Although this event represented a loss of control in the implementation of Nordion procedures, work planning or work process practices, it did not represent any health, safety, or environmental risk.

In 2014, the number of occupational incidents (eight) was above the Environment, Health and Safety (EHS) target of six. However, this result is over a 14 month period due to the change in Nordion's fiscal year to January - December. Two of the incidents occurred in the last two months of the new fiscal year. The majority of the incidents were back injuries and/or ergonomics related. As a result, Nordion updated the Back Safety training and will be providing this to the Operations groups as well as providing an increased focus on ergonomics assessments and training. All other EHS objectives and targets were met in 2014.

The objectives are reviewed yearly at the Annual Joint Environmental Management System (EMS) and Quality Assurance (QA) Program for Safety Review. Refer to Section 2.3.1 for a summary of the EHS Objectives and Targets for 2014.

1.1.3 Summary of Activities

A number of facility modifications took place in 2014 including the replacement of the 600 ton cooling tower, refurbishment of the 1000 ton cooling tower, upgrade of the diesel fuel system to TSSA requirements, [redacted] and replacement of electrical switches and cradles for the power supply of the chillers in the Heating Plant.

There were no major structural changes or changes to the licensed facility boundary. The classification of Room 1308 within the licensed facility boundary was changed from a Radiation Area (an area where radioactive material is sealed and there is virtually zero probability of loose contamination) to an Active Area.

In April, Nordion posted on the Nordion website its Annual Compliance and Operational Performance Report to the CNSC for the period of January 2013 to December 2013. In November, Nordion posted the CNSC results on the organization's 2013 compliance performance. In December, Nordion hosted the general public at an information session to build public awareness about Nordion's products, services, operations and facility, and to obtain stakeholder feedback.

Several milestones regarding Nordion's Systematic Approach to Training (SAT) program were completed in 2014 including Job Task Analysis (JTA) for the following positions where the core duties of the positions are safety related: Cobalt Monitors, Installation and Service Technicians, and Surveyors. JTA was also completed for numerous positions that have embedded safety related tasks, but where their core role is not a safety function.

In August of 2014, Nordion was acquired by Sterigenics International, a global leader in contract sterilization services. They are a recognized global provider of contract sterilization services for the medical device and pharmaceutical industries with over 40 locations in North America, Europe and Asia. Sterigenics employs 1,300 employees worldwide and serves over 2,400 customers. Sterigenics offers technology in multiple sterilization methods including: gamma, ethylene oxide, electron beam and X-ray. Nordion (Canada) Inc. continues to operate as a stand-alone company. Nordion's management, safety, and compliance systems remain unchanged and there were no changes to personnel supporting operations or environment, health and safety as a result of the acquisition. Nordion's commitment to environmental, health and safety compliance has not changed as a result of the acquisition by Sterigenics.

Nordion continues to contract manufacture Y-90 for the existing owner of the Targeted Therapies business unit which was divested from Nordion in July 2013. Nordion now has two primary businesses: Gamma Technologies and Medical Isotopes, supported by centralized corporate functions.

For conventional health and safety, Back Safety and Ergonomic training was updated and will be provided to the Operations groups. In addition, Nordion changed to a new electronic Material Safety Data Sheet (MSDS) provider.

For radiation protection, the use of control charts for the thyroid bioassay unit and both radioxenon monitors was continued throughout 2014. A concrete wall was installed [redacted] to lower doses [redacted].

The Nordion emergency management program redesign was completed and was documented in final draft Emergency Response Plan (ERP) documents. These drafts were provided to the CNSC for review and approval.

1.1.4 Issues and Corrective Actions

There were no major issues in 2014 with regard to the operating facility. Refer to Appendix A for a summary of events.

There were two instances in 2014 of non-compliance with condition 2.2 of the export licenses issued to Nordion by the CNSC. Nordion was fined $24,760 under the Administrative Monetary Penalty (AMP) program. Nordion did not submit required notifications on numerous occasions over the span of several years to the CNSC after the completion of export shipments of cobalt-60. There was no health, safety or environmental risk associated with Nordion's failure to provide timely documentation. This matter is being taken very seriously by the organization. As a result of the CNSC's findings, interim corrective actions have been put in place while further corrective actions and changes to processes and procedures are being developed and implemented to prevent future occurrences.

1.1.5 Reportable Incidents

A list of reportable incidents, their causes and corrective actions are provided in Appendix A.

1.1.6 Compliance with Other Regulatory Agencies

Nordion applied to Environment Canada for Precautionary Permits to Charge a Fire Extinguishing System for in-cell fire suppression systems containing halon. These permits were approved and received in April 2014 and permit Nordion to refill halon fire extinguishing systems until April 2015.

Nordion submitted an application for amendment to Nordion's Environmental Compliance Approval from the Ontario Ministry of Environment in January 2013 as required by the Certificate of Approval 6063-8HSRMC. Nordion received a revised Compliance Approval (7601-9LTQQK) from the Ontario Ministry of Environment in July 2014.

Nordion reports to the Workplace Safety Insurance Board (WSIB) whenever a reportable occupational injury or illness occurs. In 2014, there were five medical treatments and three lost-time incidents reported to the WSIB. WSIB may inspect Nordion's Occupational Health and Safety programs at any time; however, no inspections were held in 2014.

In compliance with Part II of the Canadian Labour Code, four disabling injuries were reported to the Human Resource Skills Development Centre (HRSDC).

Nordion must comply with Transport Canada's Transportation of Dangerous Goods Regulations for the shipment of Class 7 Radioactive Material and any other class of dangerous goods that may be shipped. Nordion staff involved in transportation of dangerous goods are trained on all aspects of the regulations that apply.

1.2 Facility Operation

1.2.1 Facility Operation

The facility has operated according to applicable design criteria in 2014. There were no investigations in 2014 related to facility design.

1.2.2 Personnel Performance

The number and significance of corrective actions related to training would be an indication of how effectively personnel performed compared to their duties and how well personnel followed procedures. During 2014, one of the 31 EHS corrective actions (arising from internal audits and investigations or external regulatory compliance inspections) initiated was related to training. This information supports the conclusion that personnel effectively performed their duties and followed procedures.

1.2.3 Summary of Modifications and Repairs

Modifications and repairs that were carried out in 2014 included:

- Replacement of a boiler for facility hot water.
- Replacement of 600 ton cooling tower.
- Refurbishment of 1000 ton cooling tower.
- Upgrade of the diesel fuel system to TSSA requirements.
- Replacement of boiler feed water tank.
- Replacement of the KOB upper roof.
- [redacted]
- Replacement of electrical breakers and cradles for the power supply of the chillers in the Heating Plant.
- Replacement of Ethernet switches for the internal Building Monitoring System (BMS).
- Replacement of electrical breakers and cradles for the power supply for the Cobalt power distribution switchgear.

1.2.4 Internal and External Audits

As part of the QA Program for Safety and the Environmental Management System EMS), Nordion annually conducts internal audits to identify and correct potential environmental, health and safety related issues. In 2014, Nordion conducted a total of 13 internal EHS audits. These audits included an audit of production areas and supporting functions as well as policy and program audits. In addition, Nordion conducted a total of three safety inspections.

In 2014, there were a total of four external audits of Nordion and one external audit conducted by Nordion. Out of a total of 31 EHS related corrective actions initiated in 2014, 17 corrective actions were a result of internal audits and 14 were a result of external audits.

1.2.4.1 Internal Audits

The following internal audits were conducted in 2014:

1. Audit of the I-131 Process. Numerous EMS and QA safety elements were audited.
2. One EMS Program Audit. The audit included the EHS policy, communications, documentation, monitoring and measurement, evaluation of compliance, management review, environmental aspects, objectives, targets and programs, legal requirements, and emergency preparedness and response.
3. One QA Safety Program Audit. The following QA Program for Safety elements was reviewed: organization and responsibilities, manager self-assessment, use of experience, and program definition.
4. Physical Inventory Taking (PIT) of Safeguarded Material.
5. Non-production Radioactive Material Inventory (NPRMI) Audit.
6. Internal EHS Audit Program.
7. Process Safety Audit of the Cobalt F-231 Transport Package Unloading Process.
8. Process Safety Audit of the Mo-99 Waste Process.
9. Access Authorization Program (10CFR37).
10. Import/Export Controls Program (Cobalt-60 and Iridium-192).
11. Transportation Audit (Shipping Documents and Package Labelling).
12. Transportation Program Audit (10CFR37).
13. Audit of Carriers.

1.2.4.2 External Audits of Nordion

The following external audits of Nordion were conducted in 2014:

1. On February 24-26, 2014 the CNSC conducted a Radiation Protection Inspection. There were five recommendations identified during this inspection.
2. On April 8-9, 2014 the CNSC conducted an Export Controls Inspection. There were three actions and one recommendation identified during this inspection.
3. On June 16-18, 2014 BSI conducted an annual audit against the ISO 14001:2004 standard. There was one minor non-conformance and two opportunities for improvement identified during this audit.

4. On November 4-5, 2014 the CNSC conducted a Training Inspection. There were five recommendations identified during this inspection.

1.2.4.3 External Audits Conducted by Nordion

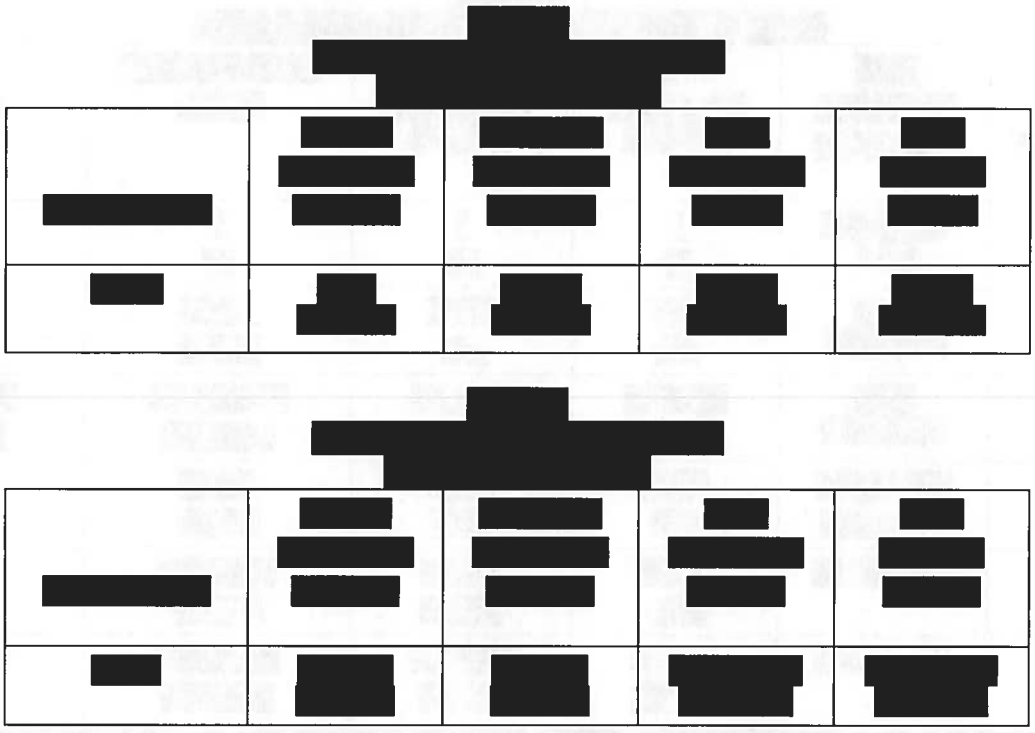
Nordion conducted one EHS Audit of a supplier in 2014. There were no corrective actions identified during this audit.

1.3 Production or Utilization

Activities conducted in the Kanata Operations Building (KOB) relating to the procurement, possession, processing and shipping of radioactive materials are conducted under Nuclear Substance Processing Facility Operating Licence, NSPFOL-11A.05/2015. The facility is comprised of the KOB, which houses the Nuclear Medicine Production Facility (NMPF) and the Cobalt Operations Facility (COF), and the Kanata Radiopharmaceutical Manufacturing Facility (KRMF).

1.3.1 Sealed Source Manufacturing/Radioisotope Processing

[redacted]



1.3.2 Processing > 1 Petabecquerel (PBq)

[redacted]

1.3.3 Acquisitions of Finished Sealed Radioactive Sources

[redacted]

1.3.4 Sealed Sources/Devices > 50 Megabecquerels (MBq)

[redacted]

1.4 Facility Modifications

1.4.1 Changes to the Facility Buildings, Processes and Equipment

1.4.1.1 Changes to Designated Active Area

In 2014, Nordion made no changes to designated Active Areas. The classification of Room 1308 within the licensed facility boundary was changed from a Radiation Area (an area where radioactive material is sealed and there is virtually zero probability of loose contamination) to an Active Area.

1.4.1.2 Structural/Functional Changes Affecting Emissions

In 2014, Nordion made no structural/functional changes that affected the emissions of the facility.

1.4.1.3 Structural/Functional Changes Affecting Active Area Ventilation

In 2014, Nordion made no structural/functional changes that affected the active area ventilation of the facility.

1.4.1.4 Structural/Functional Changes Affecting the Active Liquid Waste System

In 2014, Nordion made no changes that affected the active Liquid Waste System.

1.4.2 Changes to Procedures Related to Operations Safety and Control

Refer to Section 2.7.7 and Section 2.8.3 for changes to procedures related to operations safety and control.

1.4.3 Changes to the Training Programs

There were no changes to Nordion's existing EHS training courses in 2014. Nordion released one new EHS self-directed training course on Near-miss Reporting for managers of high and medium risk areas.

The Systematic Approach to Training (SAT) Job Task Analysis (JTA) was completed and the training programs revised for the following positions where the core duties of the positions are safety related: Cobalt Monitors, Installation and Service Technicians, and Surveyors. JTA was also completed for numerous positions that have embedded safety related tasks, but where their core role is not a safety function.

Two of Nordion's key radiation safety courses, Working with Beta, and Radioiodine Handling, were revised. In addition, an assessment of all key occupational health and safety courses was completed.

1.4.4 Changes to the Organizational Structure and Key Personnel

Nordion has two primary businesses: Gamma Technologies and Medical Isotopes, supported by centralized corporate functions. Nordion continues to contract manufacture Y-90 for the existing owner of the Targeted Therapies business unit which was divested from Nordion in July 2013. In August of 2014, Nordion was acquired by Sterigenics International, a global leader in contract sterilization services. They are a recognized global provider of contract sterilization services for the medical device and pharmaceutical industries with over 40 locations in North America, Europe and Asia. Sterigenics employs 1,300 employees worldwide and serves over 2,400 customers. Sterigenics offers technology in multiple sterilization methods including: gamma, ethylene oxide, electron beam and X-ray. Nordion (Canada) Inc. continues to operate as a stand-alone organization. Nordion's management, safety, and compliance systems remain unchanged and there were no changes to personnel supporting operations or environment, health and safety as a result of the acquisition. There were changes to senior management as a result of the acquisition. The Chief Operating Officer, Speciality Isotopes became the President, Gamma Technologies and Corporate Services, and the General Manager, Medical Isotopes became the President, Medical Isotopes. The position of Chief Operating Executive (CEO) was eliminated.

EHS personnel are organized into a Gamma Technologies – EHS Compliance Group and a Medical Isotopes – EHS Compliance Group. The personnel of these two groups are outlined below. All of the positions for Gamma Technologies - Compliance are corporate wide functions supporting both businesses, with the exception of the Administrative Assistant and the Senior Radiation Training & Safety Specialist.

There were no vacant key positions in 2014.

Gamma Technologies – EHS Compliance

- Director, QA EHS Compliance
- Administrative Assistant (1)
- Manager, Corporate Security & Emergency Management
- Information Security & Network Lead
- Contract Security Supervisor
- Contract Security Officers (14)
- Senior Manager, Compliance, Facility & Transportation Licensing
- EHS Assistant
- Nuclear Transportation Specialist
- Senior EHS Compliance Specialist
- Senior Licensing Coordinator
- EHS Compliance Specialist
- Training Specialist
- Safety Manager
- Manager, EHS and Documents & Corporate Records
- Occupational Health & Safety Specialist
- EHS Compliance Specialist (vacant as of November, 2014)
- Senior Radiation Training & Safety Specialist, Gamma Technologies

Medical Isotopes – EHS Compliance

- Vice-President, QA Regulatory & EHS Compliance
- Administrative Assistant (1)
- Senior Manager, Radiation Safety & Compliance
- Senior Radiation Surveyor (2)
- Radiation Surveyor (4)
- Senior Radiation & Contamination Monitor (3)
- Radiation and Contamination Monitor (5)

2. SAFETY AND CONTROL AREA

2.1 Management System

2.1.1 Review of Quality Assurance/Management Program Activities

In 2014, Nordion conducted a total of 13 internal EHS audits. These audits are described in Section 1.2.4.1.

2.1.2 Review of Quality Assurance/Management Program Effectiveness

The annual management review of the Environmental Management System and the QA Program for Safety was conducted August 6, 2014.

The management review involves the evaluation of actions from the previous meeting, the Environment, Health & Safety Policy (CPM-6-06), adequacy of resources, environmental health and safety objectives and targets, changing circumstances and recommendations for improvement.

Results of the 2014 annual review:

1. A majority of the outstanding actions from the previous meetings had been completed and closed.
2. The Environment, Health and Safety Policy (CPM-6-06) was reviewed and it was determined that the policy did not require further review and update.
3. Resource requirements for the Environmental Management System and QA Program for Safety were discussed. The Committee agreed that the most critical issues are resourced adequately. Financial and specialized skills resources were felt to be adequate.
4. There is one outstanding 2009 environmental objective and target related to the replacement of the halon fire suppression systems with a non-ozone depleting alternative. This objective is behind schedule due to the complexity of this project. These systems are unique and off-the-shelf solutions for nuclear applications like Nordion's were not available. This is due to the fact that continuous ventilation must be maintained during a fire event. Due to the complex nature of these systems, finding a qualified vendor to design such a system has been a challenge. In the interim, Nordion is using halon systems for cell fire suppression and annually receive precautionary permits to charge these systems.
5. The 2014 environmental objectives and targets were completed with the exception of the objectives regarding the reduction of hazardous and other environmentally harmful materials, and the reduction of non-hazardous and hazardous wastes, as they both have a target date of 2015.
6. The 2014 environmental objectives and targets were reviewed and it was determined that they were on target at the time of the meeting.
7. The 2015 EHS objectives were discussed.

There were 16 new actions identified during the meeting. The EHS Committee had no further recommendations for improvement. As such, the Committee concluded that the EHS management system (the Environmental Management System and the QA Program for Safety) are effective.

2.1.3 Summary of Quality Assurance/Management Program Improvements

In 2014, changes or revisions were made to the Radiation Protection Program, Conventional Health and Safety Program, and the Environmental Protection Program as discussed in Sections 2.7.7, 2.7.9, 2.8.3 and 2.9.6, respectively.

In 2014, the QA Program for Safety and the internal audit program were expanded to include other program areas following CNSC guidance.

2.2 Human Performance Management

2.2.1 Training Program Effectiveness

The number of scheduled participants for internal safety training was 496. By the end of 2014, 487 scheduled participants completed the training, including refresher training. Therefore, the attendance completion rate in 2014 was 98%. The details of the training are shown in Table 4. There were no incidents in 2014 that demonstrated a lack of effectiveness in these training programs.

Nordion has designed and maintains a variety of radiation safety training courses. New employees who are not classified as Nuclear Energy Workers (NEWs) receive a basic course on Health, Safety and Environment, Level I, which provides information on the facilities, emergency response procedures and alarms, and basic procedures to follow for safety in the workplace. Nuclear Energy Workers receive a NEW Indoctrination Course. To be authorized to enter the Active Area unescorted, the employee must complete and pass a written test, as evidence of understanding the principles of radiation protection and Nordion safe work practices. NEW retraining and retesting are conducted on a three year frequency. In addition, NEWs are provided with a half day Radiation Instrumentation Workshop, dealing specifically with the selection and use of radiation survey and contamination meters for the Active Area.

Supplementary training programs are provided to all personnel working on behalf of Nordion depending on the nature of the job and the requirements specified by their Manager. These programs include such topics as "Working with Radioiodines", emergency response awareness, care and use of respirators, material handling training, and working safely with fume-hoods. A summary of the training programs and the number of participants is provided in Table 4.

Employees who transport, handle, or offer dangerous goods for transport are trained in the Transportation of Dangerous Goods (TDG) requirements. The training program includes a one day classroom training course that is required once on employment or upon job change. Retraining is conducted on a 2-year frequency and is accomplished through self-study. The self-study program is separated into three levels. Employees are required to complete the self-study refresher training level that is appropriate for their job function. For each training course, participants must complete and pass a written test, as evidence of understanding the course contents.

Table 4
Safety Training Programs – 2014

Program	Duration	Number of Participants	Refresher Training Overdue at end of 2014
Nuclear Energy Worker Indoctrination	6 Hours	6	Not Applicable
Health, Safety and Environment Level II	Self Study	103	0
Radiation Instrumentation Workshop	3 Hours	58	4*
Radiation Safety Review for Operators	Half Day	18	3**
Safe Handling of Radioiodines	2 Hours	53	1***
Transport of Dangerous Goods Level I	Self Study	3	0
Transport of Dangerous Goods Level II	Self Study	15	0
Transport of Dangerous Goods Level III	All Day In-Class (Once Upon Employment Self Study thereafter)	44	0
TDG for Contractors	Full Day	37	0
Working with BETA	1 Hour	45	0
Crane	Half Day	12	1*
Pallet	Half Day	24	0
Forklift	Half Day	16	0
Contractor Radiation Safety Training	Half Day	4	0
Contractor Radiation Safety Update Training	2 Hours	24	0
HEGS Safety Training	2 Hours	0	0
In-Depth Security Awareness	2 Hours	25	0
TOTAL		496	9

* Employee is on leave.

** One (1) employee is on leave. Remaining two (2) employees completed refresher training in January 2015.

*** Employee completed refresher training in January 2015.

2.2.2 Verification of Minimum Number of Responsible Personnel During Operations and Similar Activities

Nordion has ensured that the minimum number of responsible personnel is available to provide safety overnight during operations and during emergency situations.

Nordion Security is on site at all times. Radiation Surveyors are always on site when production involving radioactive materials is occurring. Nordion has key emergency response, Facilities and Production Managers on-call at all times, including an Incident Manager. The Incident Manager can initiate a call-in of both on-call and regular emergency response personnel. Currently there are over 80 Fire Wardens and Marshalls and over 80 emergency response personnel.

Nordion routinely assesses the availability of qualified staff as part of the Emergency Response Program and through drills and exercises. Nordion tests its emergency call lists annually and the results have demonstrated year over year that within one hour of the onset of an emergency, adequate emergency response personnel and at least one representative from each of the key emergency response groups would be available on-site (refer to Section 2.10.4).

There are two Health Physicists qualified to establish and direct training and monitoring programs to protect personnel, the public, and the environment from radiation hazards, and to develop safe work methods and procedures.

2.3 Operating Performance

2.3.1 Effectiveness of Licensed Activities

The licensed activities were carried out according to Nordion's programs and procedures. There were no significant unplanned events and no major non-conformances. Nordion's programs in place for auditing and capturing non-conformances identified issues in areas that required corrective actions. These processes functioned as expected.

Summaries of the 2014 EHS Program Objectives and Health and Safety Objectives are shown in Tables 5 and 6. Each of the EHS Objectives listed in Table 5 were met in 2014 with the exception of the number of occupational incidents. The number of occupational incidents (eight) was above the EHS target of six; however, this result is over a 14 month period due to the change in Nordion's Fiscal Year (FY) to January - December. Two of the incidents occurred in the last two months of the new fiscal year. The majority of the incidents were back injuries and/or ergonomics related. As a result, Nordion updated the Back Safety training and will be providing this to the Operations groups and well as providing an increased focus on ergonomics assessments and training.

Table 6 shows Health and Safety Objectives that Directors and Managers and employees of high risk areas are expected to meet. A system is in place to ensure that the performance reviews are completed. CAPAs greater than twelve months are reviewed in the QA CAPA Review Board meetings and the EHS Committee meetings. They are also reviewed monthly by senior management. The completion of manager self-assessments is audited annually. Deviations, Change Forms and complaints are reviewed yearly at the Annual Joint Environmental Management System and QA Program for Safety review.

Table 5
2014 EHS Program Objectives and Results

Applicable Nordion Job Function	Objective	Measures and Targets	Result
All Directors and Managers All Directors and Managers of Operations, Facilities, or Nuclear Energy Worker employees	Minimize the number and extent of occupational injuries, environmental and radiation incidents.	• The number of Incidents ≤ 6	8 (14 month period due to change in start of FY to January)*
		• Lost Time Injuries ≤ 0.5 per 200,000 hours worked (3-yr rolling)	0.3 (3-yr rolling)*
		• The severity of lost-time injuries to ≤ 4 days per 200,000 hours worked (3-yr rolling)	3.5 (3-yr rolling)*
	Minimize the use and release of hazardous materials to the environment.	• Radioactive materials emissions to ≤ 5.0% of the Derived Release Limits (DRL)	0.96 % DRL
		• No non-compliant sanitary sewer emissions of non-radioactive hazardous materials	0
		• Reduction in the use of hazardous materials (by 5%) and the generation of hazardous and non-hazardous waste (by 5%)	80% reduction in use of hazardous materials since 2010 73% reduction in non-hazardous waste since 2010 60% reduction in hazardous waste since 2010
	Maintain radiation doses to employees as per ALARA principle.	• Average Active Area employee dose rate ≤ 1.3 mSv/yr	0.65 mSv (Rolling 12)
		• Maximum employee dose rate ≤ 7.5 mSv/yr	6.03 mSv (Rolling 12)
		• Radiation Incidents ≤ 5/year	0

*Based on fiscal year.

Table 6
2014 Health and Safety Objectives

Applicable Nordion Job Function	Objective	Measures and Targets
All Directors and Managers All Directors and Managers of Operations, Facilities, or Nuclear Energy Worker employees	Timely closure of EHS CAPAs.	• Meet all CAPA target dates. • Ensure timely closure of EHS CAPAs.
	Ensure all managers of high risk areas conduct / document regular self-assessments of their management processes and safety performance.	• Mid-Year and Year-End performance reviews. • Ensure the departmental job hazard analysis is kept up-to-date.
	Ensure all managers actively consider impacts to the environment and health and safety	• Environment, health and safety impacts are assessed as part of product realization planning and risks are mitigated through application of ALARA and pro-active planning. • Opportunities for minimizing waste (hazardous and non-hazardous) are assessed and implemented as feasible. • Ensure all near-misses are reported and appropriate corrective action(s) are taken. • Maintain control of non-production radioactive material.
	Communicate monthly with teams about environment, health and safety performance and impacts. Openly evaluate employee environment, health safety concerns and encourage reporting of near misses.	• Environment, health & safety information and concerns are discussed regularly at team meetings. • Health and safety concerns are assessed with the results of the evaluation communicated to the employee(s). • Deviations, CF's, Non-conformances and Complaints are assessed for EHS risks against targets and reported accordingly. • Routinely invite EHS Representatives to team meetings to discuss EHS topics and/or concerns.
All High Risk Employees	Work safely at all times. It is unacceptable to take risks in order to get the job done.	• Work follows applicable Nordion EHS standards and procedures, and is performed with care and attention to safety principles. • Wear all applicable personal protective equipment (PPE). • Submit all dosimeter(s) and rings for monitoring on time (i.e. no later than one month following end of monitoring period without good reason, i.e. extended illness or company travel, etc.).
	Report the occurrence of workplace injuries, unsafe conditions and near misses.	• All workplace injuries and observed unsafe conditions & near misses are reported immediately to the direct Supervisor.

Applicable Nordion Job Function	Objective	Measures and Targets
All High Risk Employees	Correct co-workers who are working unsafely.	• Following Nordion values, coach co-workers who are seen working unsafely.
	Identify opportunities to reduce environmental impacts.	• Identity opportunities for reducing waste, and using less harmful materials where feasible. • Ensure EHS reviews and approves all new hazardous materials or chemicals prior to ordering.
	Timely closure of EHS CAPAs.	• Meet all CAPA target dates. • Ensure timely closure of EHS CAPAs.

2.3.2 Effectiveness in Implementing Operational Controls

EHS operational controls are documented in a specific series of documents (SE-OP series) and added to routine production documents for safety critical steps. These procedures are routinely updated using Nordion's change control process when safety improvements are identified.

2.3.3 Summary of Safety Inspections and Audits

Refer to Section 1.2.4 for a summary of the safety inspections and audits.

2.3.4 Radiation Devices and Instruments Maintenance

Performance of the following equipment, alarms and monitoring devices is checked at various frequencies throughout the year. Test results are indicated to be satisfactory if the tested item functioned within acceptable parameters.

2.3.4.1 Ventilation

Duplex fan tests are conducted every 6 months. This involves testing of more than 100 fans which form part of the NVS. During 2014, all HEPA filters were tested at the required frequency. CAD filters were tested once which meets the minimum testing frequency is once annually.

Table 7 details the results of the Nuclear Ventilation System Filter testing and replacement. The filters summarized in Table 7 are credited with mitigating releases in Nordion's Safety Analysis reports.

Table 7
NVS Filter Efficiency Testing/Replacements

	Q1/Q2 HEPA	Q1/Q2 CAD	Q3/Q4 HEPA	Q3/Q4 CAD
Filters in fleet	239	74	239	73
Number tested	237	0	237	67
Filters which met specification	237	N/A	237	61
Filters out of specification*	0	0	0	6
Out of specification filters replaced during test cycle	0	0	0	6
Not tested	2	74	2	6
Total replaced during this cycle	4	0	0	8
Filters (systems) removed from service	0	0	0	1
New Filters (systems) Added	0	0	0	0

* The CAD filters that were out of specification were on System 13. The failures did not result in any apparent increase to releases.

Comments Q1/Q2 HEPA: Two filters were not tested because they were not in service. Four filters in Cobalt were replaced due to flow issues and had successful in-situ tests performed afterwards.

Comments Q1/Q2 CAD: In early 2014 it was apparent that there were technical problems with the CAD testing equipment. The column was ageing and in need of repair, and the injection collar required replacement. A decision was made to upgrade the column to one ideally suited for the challenge agent Nordion uses. Another upgrade to the equipment that was deemed necessary was an upgrade to the data storage connections. The repair/upgrade was done at one location and calibration at another. Due to the time required for these repairs/upgrades it was not possible to perform the 1st half of the years testing.

Comments Q3/Q4 HEPA: Two filters were not tested because they were not in service.

Comments Q3/Q4 CAD: Six trench filters were not tested, but are changed every three years as per procedure. One CAD filter on System 5 that is not tested as it is not in use was removed, bringing the total in-situ CAD fleet to 73. Six CAD filters did not meet the testing criteria. These filters were replaced and the new filters had successful in-situ tests performed afterwards. Two CAD filters were changed out due to their shelf life expiration. An in-situ/lab test was performed after/prior to installation of the new filter and was successful.

Nuclear Medicine in-cell charcoal roughing filters are on a preventative maintenance schedule and replaced by Technicians typically every 6 months. A summary of the replacement of these filters is shown in Table 8. These filters are not credited with mitigating releases in Nordion's Safety Analysis reports.

Table 8
Roughing Filter Change-outs

Filter Type	Total Number of Filters	Results
Nuclear Ventilation System Roughing Filters	145 roughing 51 charcoal/roughing/HEPA 34 in-cell roughing	100 roughing filter replacements 35 charcoal/roughing/HEPA filter replacements
Cobalt Production In-cell Filters	16 in-cell HEPA 23 in-cell roughing	0 in-cell HEPA filters replacements 60 in-cell roughing filters replacements

2.3.4.2 Back-up Power Facilities

The emergency generators which supply emergency power to the KOB, KRMF and the Heating Plant are tested monthly. Testing in 2014 was performed at the required frequency. The results were satisfactory. A crack in the muffler for the KOB generator was identified in November and is scheduled for replacement. The generator can still be used in this condition.

2.3.4.3 Radiation Evacuation Alarms

Radiation evacuation alarms are tested weekly and quarterly by the Radiation Surveyors. They are additionally tested annually by Facilities. Testing in 2014 was performed at the required frequency and results were satisfactory.

2.3.4.4 Radiation Alarms

The radiation alarms are scheduled for testing on a weekly basis and were tested every week in 2014. The tests verify that the alarms sound at the preset alarm levels and that the alarms register on the Metasys monitoring system. If the alarms do not function as required, adjustments to the alarm levels and/or the Metasys are conducted immediately by Facilities. The results were satisfactory.

2.3.4.5 Sprinkler System Fire Alarms

The sprinkler system fire alarms in KOB, KRMF and the Heating Plant are tested every month. Testing in 2014 was performed at the required frequency and results were satisfactory. All dry systems were tested and verified in good operating condition in 2014 as required by the National Fire Protection Association (NFPA).

2.3.4.6 Fire Alarm Panels

The fire alarm panels for KOB, KRMF and the Heating Plant are tested and verified by the manufacturer once a year.

The fire alarm panels that monitor the KOB, KRMF and the Heating Plant are tested monthly. Testing in 2014 was performed at the required frequency and results were satisfactory.

2.3.4.7 Contamination Monitoring Equipment

Handheld contamination monitoring equipment is maintained twice a year. Area monitors are checked on a daily basis. Testing in 2014 was performed at the required frequency and results were satisfactory.

2.3.4.8 Contamination Control Equipment

The hand and foot monitors are calibrated twice a year, checked daily, tested weekly and serviced on a routine basis. They are also repaired as required; typically two to three times a year. Testing in 2014 was performed at the required frequency and the results were satisfactory.

2.3.4.9 Environmental Monitoring Equipment

Environmental monitoring equipment is tested on a weekly basis. If required, repairs to equipment are carried out immediately after the testing by Facilities personnel. There were 14 work orders generated in 2014 from weekly testing. 13 involved issues with barrier monitors and air sampling pumps. Air sampling pumps were sourced with fuses that were at amperages lower than the maximum permissible. The fuses were replaced with the correct sized fuses. Barrier monitors (Hand and Foot or Whole Body Contamination Monitors) accounted for 10 of the work orders. Most of the barrier monitor work orders were generated when a fault occurred, placing the unit in "Out of Service" mode. Barrier monitor faults occur for a variety of reasons (electronic noise, temporary high background, etc.). Typically, all that is required is acknowledgement of the faults and re-initiation of background to return the barrier monitor to working service. In the event that a barrier monitor is malfunctioning, Nordion employees will perform checks using an adjacent barrier monitor or a handheld contamination monitor.

2.3.4.10 Radiation Survey Instruments

Radiation Survey Instruments are tested on a monthly, bi-annual, or annual basis as required. There were no instruments in 2014 that tested outside of the acceptable range. Testing in 2014 was performed at the required frequency and the results were satisfactory. At the end of 2014, there were 29 out of 822 survey meters past due for the internal frequency requirements, some due to them requiring repair. The majority of meters are calibrated every 6 months. The regulatory requirement for calibration frequency is 12 months, and though Nordion employees are not to use meters past the calibration due date (typically 6 months), only two of the 29 meters where past due for longer than 12 months. All of the 29 meters have since been calibrated or otherwise accounted for.

2.3.4.11 Trends

There were three pieces of equipment with multiple occurrences of non-routine maintenance in 2014; however, these occurrences were not indicative of any malfunction of the major hardware or components of the systems. One piece of equipment was a Water for Injection (WFI) system which required multiple non-routine maintenance to replace consumables. The second piece of equipment was an autoclave that required replacement of parts because of regular wear. The third piece of equipment was an infrequently used Hand and Foot barrier monitor in Room 1542 (radiopharmaceutical packaging room exit) which was "Out of Service" four or more times in 2014 (refer to Section 2.3.4.9).

2.3.5 Non-Production Sealed and Un-Sealed Source Inventory

The inventory of non-production sealed and unsealed sources is provided in Appendix B.

2.3.6 Effectiveness of the Nuclear Criticality Safety Program (NCSP)

Not applicable.

2.3.7 Emergency Drills Related to Nuclear Criticality

Not applicable.

2.4 Safety Analysis

Nordion has an established EHS Committee comprised of senior management and technical professionals and is chaired by the Director, Quality Assurance Environment Health and Safety Compliance, or designate. The EHS Committee reviews new/amended processes which might have an impact on health, safety, and environment. Activities that relate specifically to CNSC licensing and the radiation protection of workers, the public and the environment, are addressed in the EHS Committee meetings typically held on a bi-monthly basis with ad hoc meetings arranged as required. Typical agendas include Safety Analysis Reports, significant changes (repairs/modifications) to existing facilities, Radiation Incident Report reviews, safety procedures, and review of CNSC licensing requirements (radiation monitoring, As Low As Reasonable Achievable (ALARA) program, emissions, dosimetry, project approval, etc.). In 2014, the EHS Committee met on eight occasions (six regular meetings and two ad hoc meetings).

Final Safety Analysis Reports (FSARs) are prepared by EHS and/or project leaders to encompass risk analysis and safety and environment reviews. FSARs must be approved by the EHS Committee before a new process goes into full production. Primary focus is placed on the Nuclear Medicine Production Facility (NMPF) FSAR and the Cobalt Operations FSAR, since these are the two main documents covering the production operations. Revisions to these documents are reviewed and approved internally, and submitted to the CNSC for approval. Secondary FSARs (for each individual production process and operational support areas) are reviewed and approved internally as per an established review schedule.

[redacted]

Summaries of the activities and modifications and repairs are provided in Sections 1.1.3 and 1.2.3 respectively.

Nordion evaluates over time the effectiveness of the preventative measures and strategies implemented as operational experience is gained with each of the facilities.

[redacted]

2.5 Physical Design

In 2014, Nordion made a number of modifications (refer to Section 1.2.3). In 2014, within the boundaries of the Active Area for Nordion's production facilities, there were no physical design changes to any structural areas of the building. In 2014, the classification of Room 1308 within the licensed facility boundary was changed from a Radiation Area (an area where radioactive material is sealed and there is virtually zero probability of loose contamination) to an Active Area.

2.6 Fitness for Service

The management structure of Nordion's Preventative Maintenance Program was not altered in 2014. Nordion continues to use an "Advanced Maintenance Management System" (AMMS) to control Nordion's maintenance activities. Maintenance performance is reviewed monthly for outstanding activities and is acted on by team leaders. This continues to prove effective as during 2014, there were no major equipment failures.

Every year a detailed review is carried out at the Senior Management level to discuss aging equipment at the site. This annual business plan review takes into account three criteria: safety of the facility, regulatory requirements and site improvements. Projects are prioritized into three categories and funds are allocated as required to approved projects. This aging equipment review process, because of the link to the Senior Management team and Finance, has worked very well in keeping the Nordion facility up-to-date with current technology.

The work identified during the 2014 review included the following:

- Replacement of the KOB generator
- Continuation of the KOB roof replacement program
- Installation of an additional Muira Boiler to service the Cobalt area
- Securing of external institutional waste bins
- Installation of additional fire suppression for the Information Technology Rooms
- Resurfacing of Active Area floors
- Seismic Upgrade of Nuclear Ventilation System
- Replacement of manual transfer switch for stack 2 back-up power
- Installation of a manual transfer switch to allow the KRMF generator to provide back-up power to the Heating Plant emergency power distribution supply
- Retrofit of 1000 ton cooling tower with a variable speed drive
- Replacement of breakers and cradles in KOB power distribution centre

When approved, the work identified during the aging equipment review is executed as a project.

In 2014, the required equipment was available to perform its intended design function when needed. Refer to Section 2.3.

In 2014, there were two pieces equipment requiring multiple non-routine maintenance. Refer to Section 2.3.4.11.

2.7 Radiation Protection

2.7.1 Dose Control Data

2.7.1.1 Occupational External Dosimetry

Currently Nordion is using Luxel+ or Optically Stimulated Luminescent (OSL) dosimeters as Thermo-luminescent Dosimeter (TLD) technology. Nordion's Radiation Protection Manual states that the traditional term "TLD" may be used interchangeably with OSL or other CNSC approved dosimeters.

All employees who regularly work in the Active Area are classified as NEWs and are assigned monthly TLDs. NEWs are trained to work in various production processes and move from one production area to another during the year. In the Nuclear Medicine Operations, personnel may receive exposure from working with more than one radionuclide. Those working with radionuclides where there is concern for extremity exposure to radiation are assigned extremity TLDs. Other employees who normally work outside the Active Area and visit the Active Area on a regular basis are also classified as NEWs, but are assigned quarterly TLDs.

All measurable radiation dose received by personnel were within the regulatory limit of 50 mSv/yr in 2014.

Contractors who are given access to the Active Area are called "Contractor NEWs" at Nordion. They are trained as NEWs, tested and have security clearance, but are subject to the regulatory dose limit and Action Levels of non-NEWs. For accuracy of review, their doses are reported in a separate group and their results are not broken down in Tables 9 and 10. In 2014, two Contractors declared that they were occupationally exposed at sites other than Nordion. Dose records for these two Contractors were obtained in 2015 from the National Dose Registry of Health Canada, but in both cases there was no detectable dose from other sites above the detection limit. Minimum, maximum and average body and skin doses for Contractor NEWs are listed in Table 11 and Table 12.

Tables 9 and 10 provide dosimetry data with employees grouped in various ranges of exposure. Data on the minimum, maximum and average doses for all employees are shown in Tables 11, 12 and 13.

Table 9
Personnel Dosimetry

Number of Employees										
Dose Range (mSv)	Whole Body					Skin				
	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014
< 0.2	169	192	187	197	175	152	180	186	184	173
0.2 - < 0.5	49	39	41	25	34	60	48	40	37	30
0.5 - < 1.0	39	30	28	24	21	39	30	30	25	24
1.0 - < 5.0	52	49	36	36	37	58	52	36	36	40
5.0 - < 20.0	0	1	1	2	2	0	1	1	2	2
20.0 - < 50.0	0	0	0	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0	0	0	0
Number of Employees										
Dose Range (mSv)	Right Hand					Left Hand				
	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014
< 0.2	101	111	105	103	98	104	110	106	102	100
0.2 - < 0.5	13	15	15	6	5	17	12	15	7	2
0.5 - < 1.0	14	9	5	10	10	11	15	4	7	5
1.0 - < 5.0	35	28	16	17	15	30	28	15	19	22
5.0 - < 20.0	9	8	5	4	7	8	5	4	3	5
20.0 - < 50.0	0	0	0	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0	0	0	0

Table 10
Breakdown of Whole Body Radiation Doses 5.0 to < 20 mSv

Year	Dose Range			
	5<8 mSv	8<10mSv	10<15 mSv	15<20 mSv
2010	0	0	0	0
2011	1	0	0	0
2012	1	0	0	0
2013	2	0	0	0
2014	2	0	0	0

Table 11
Minimum, Maximum and Average Worker Effective Doses (mSv)

		Active Area Personnel (NEWs)	Non-Active Area Personnel (NEWs)	Non-NEWs (Contractors)
Minimum	2010	0	0	0
	2011	0	0	0
	2012	0	0	0
	2013	0	0	0
	2014	0	0	0
Average	2010	0.65	0.12	0.05
	2011	0.64	0.06	0.05
	2012	0.56	0.13	0.03
	2013	0.59	0.12	0.03
	2014	0.65	0.14	0.09
Maximum	2010	4.86	1.48	0.36
	2011	5.08	0.79	0.45
	2012	5.19	1.36	0.21
	2013	6.39	1.48	0.27
	2014	6.03	1.73	0.31
CNSC Regulatory Limits		50/yr; 100/5yr	50/yr; 100/5yr	1/yr

Table 12
Minimum, Maximum and Average Skin Exposure Doses (mSv)

		Active Area Personnel (NEWs)	Non-Active Area Personnel (NEWs)	Non-NEWs (Contractors)
Minimum	2010	0	0	0
	2011	0	0	0
	2012	0	0	0
	2013	0	0	0
	2014	0	0	0
Average	2010	0.81	0.17	0.06
	2011	0.72	0.12	0.05
	2012	0.61	0.12	0.04
	2013	0.60	0.15	0.03
	2014	0.69	0.15	0.07
Maximum	2010	5.53	3.56	0.38
	2011	6.09	1.58	0.48
	2012	5.19	1.41	0.23
	2013	6.39	2.89	0.28
	2014	6.11	1.78	0.31
CNSC Regulatory Limits		50/yr; 100/5yr	50/yr; 100/5yr	1/yr

Table 13
Minimum, Maximum and Average Extremity Doses (mSv)

		Active Area Personnel (NEWs)	Non-Active Area Personnel (NEWs)	Non-NEWs (Contractors)
Minimum	2010	0	0	N/A
	2011	0	0	
	2012	0	0	
	2013	0	0	
	2014	0	0	
Average	2010	1.48	0.02	
	2011	1.14	0	
	2012	0.54	0	
	2013	0.54	0	
	2014	0.73	0	
Maximum	2010	25.9	0.3	
	2011	18.3	0	
	2012	10.3	0	
	2013	7.4	0	
	2014	9.5	0	
CNSC Regulatory Limits		500/yr	500/yr	500/yr

2.7.1.2 Internal Occupational Radiation Doses

Nordion's bioassay program includes thyroid monitoring on a scheduled routine basis and whole body counting or urine analysis if air/contamination monitoring indicates it is needed.

During 2014, there were no cases of employees exceeding Nordion's administrative investigation level of 1000 Bq I-125 or I-131.

No whole body counting or urinalysis was required in 2014.

There were no employees who recorded internal doses exceeding any of the dose limits in Sections 13 and 14 of the Radiation Protection Regulations.

2.7.2 Significance of Results for the Dose Control Data

A further breakdown of dose trends by group, for the last five years is provided in Figures 1 to 19 at the end of this report. The graphical trends show group average, individual maximum and group cumulative doses. This trend data is reviewed yearly at the Annual Joint Environmental Management System and QA Program for Safety Review. There are a few general observations in the trend data: Cobalt (Sterilization) groups have either stable or increasing doses, whereas Medical Isotope production doses are either stable or trending downward. These two observations closely follow increases in Co-60 production and shipments and decreases in Medical Isotope production and shipments. A detailed analysis, by group, is provided in Table 14. There were some changes in function and composition to groups which changed how Figures 8, 9, 17, and 19 were prepared from previous years. In addition, to provide clarity, doses for non-Active Area NEWs have been removed from this year's data.

Table 14
Analysis of Radiation Doses and Trends (if individual doses exceed 1 mSv/yr)

Figure #	Group	Analysis of Radiation Doses and Trends
1	**Cobalt Production Technicians**	There is an overall slight increase in cumulative dose for the group; however, individual maximum and group average dose is stable. This is consistent with an increased number of personnel and increased production activities in 2014.
2	**Cobalt Monitoring, Decontam and Shipping**	Doses are very closely managed in this group. Refer to Section 2.7.7 for improvements. Cobalt Shippers maximum doses were stable in spite of increased production in 2014. The increase in cumulative dose is due to the addition of one Monitor position to this team to accommodate increased production.
3	**Cobalt Development**	Individual doses are low - less than 1 mSv/yr over 5 years.
4	**Cobalt QC**	Doses are fairly stable in this group. Maximum individual doses are less than 1.5 mSv/yr. All trends are increasing, consistent with increased production and personnel in recent years
5	**Radiopharm Development**	Doses are low and have remained low in 2014. Doses are trending downward, in great part due to reduced development activities.
6	**Technical Support**	Individual doses are low - less than 1 mSv/yr over 5 years.
7	**Nuclear Medicine Shippers, Waste, Containers**	Doses are relatively stable over the last five years. Doses are closely managed for this group due to the nature of their work.
8	**I-125, I-131 & Ir-192 Production Technicians**	Doses are relatively stable with a slight downward trend.
9	**Mo-99, Xe-133 & Sr-82 Production Technicians**	Doses are trending downward. For the last two years maximum individual doses were below 1 mSv/yr.
10	**Radiopharm Production Technicians**	Doses are low and have remained low in 2014. Production levels reduced from 2010-2012, but have remained stable in 2013-2014 and this is directly reflected in the dose trends.
11	**Machinists**	Average and cumulative doses have been trending downward as most Machinists support Medical Isotope production where processing has decreased. The exception is higher individual doses to Machinists supporting Cobalt Sterilization where processing has been increasing.
12	**Nuclear Medicine QC**	Individual doses are low in this group - less than 1 mSv/yr over 5 years. The reductions seen since 2011 are due to reduced processing and the introduction of a new cell used for testing in late 2011.
13	**Surveyors**	Doses have been fairly stable over the last five years. Reduced processing in Medical Isotopes has not resulted in a significant decrease in doses due to increased production of Co-60.
14	**Nuclear Medicine Operators, Helpers**	Doses were stable over the last three years and the trends mirror processing levels.
15	**Nuclear Medicine Radiation and Contamination Monitors**	Doses were stable over the last three years and the trends mirror processing levels.

16	**Facilities, Motor Pool**	Maximum individual doses have been ~1 mSv for the last four years. Group cumulative and average doses lowered in 2014 due to management initiatives
17	**Facilities, Mechanical**	Individual doses are low - less than 1 mSv/yr over 5 years.
18	**Radiopharm QC**	Doses are low and have remained low in 2014, and are trending downward. The earlier trend is due to reduced processing and staff reductions
19	**Facilities, Electricians & Electronic Calibration Lab**	Individual doses are low - less than 1 mSv/yr over 5 years.

Table 9, Personnel Dosimetry, shows the distribution of dosimetry results for Nordion workers. The distribution of whole body doses year over year is similar between 2012 - 2014. This demonstrates continued high performance of Nordion employees in accordance with ALARA, especially in light of increased Co-60 production in 2013 and even higher levels in 2014. The highest effective doses received in 2014 by employees are listed below. This demonstrates that the higher dose work at Nordion mainly involves personnel dedicated to Co-60 production activities. The 20 employees with the highest effective doses account for 47.4% of the cumulative dose at Nordion in 2014.

2014 Effective Dose (mSv)	Nordion Role
6.03	Sr. Cobalt Shipper
5.79	Cobalt Decontam Operator/Shipper
4.36	Cobalt Monitor
3.59	Sr. Cobalt Monitor
3.5	Cobalt Production Technician
3.48	Sr. Cobalt Monitor/Production Support
2.73	Cobalt Production Technician
2.65	Cobalt Production Technician
2.44	Medical Isotope Shipper
2.37	Cobalt Production Technician
2.3	Cobalt Monitor
2.23	Cobalt Production Technician
2.18	Medical Isotope Shipper
2.1	Cobalt Production Technician
2.01	Sr. Cobalt Production Technician
1.77	Surveyor
1.73	Surveyor
1.72	Sr. Surveyor
1.6	Medical Isotope Shipper
1.6	Cobalt Production Technician

Table 10 shows very similar trend results to previous years except that in 2013 and 2014 there are two employees in the 5-8 mSv/y range vs. one or zero employees in the previous four years. However, compared over a longer timeframe (the previous six years, as shown in Table 15), it is clear that these are normal fluctuations.

Table 15
Breakdown of Whole Body Radiation Doses 5.0 to < 20 mSv
(2004 to 2009)

Year	Dose Range			
	5<8 mSv	8<10mSv	10<15 mSv	15<20 mSv
2009	0	0	0	0
2008	1	0	0	0
2007	1	0	0	0
2006	3	0	0	0
2005	6	0	0	0
2004	6	0	0	0

[redacted]

Table 11 shows a decrease in maximum effective dose to Active Area personnel in 2014 compared to 2013. Contractor dosimeters and doses continue to be well managed and controlled. It is worthwhile noting that the four highest doses to non-Active Area personnel involve employees who travel to customer sites with their Nordion dosimeters to work on installing Co-60 in Industrial Irradiators. These doses were 1.73, 1.44, 1.38 and 1.31 mSv, the next highest dose to a Nordion non-Active Area worker was 0.74 mSv. At times, the dosimeters of Nordion employees who travel are inadvertently x-rayed in the airport security scanning system and results in doses that are inconsistent with the Direct Reading Dosimeter results for these employees. These dose results are not the subject of requests for revision at the National Dose Registry.

Table 12 shows similar results to Table 11 in 2014.

Table 13 shows continued good performance in maximum extremity dose. The same employee received the maximum hand dose in 2012, 2013, and 2014. This employee is a Medical Isotopes Monitor who performed the majority of the removal of Y-90 orders and the cleaning of the Y-90 hot cell in those years. [redacted] Y-90 processing has the potential to cause high extremity doses in a short period of time. The continued low extremity doses speaks to the strong safety culture at Nordion.

The above analysis of trends demonstrates continuously improving performance at Nordion and adherence to the ALARA principle in the execution of duties by Nordion personnel.

2.7.3 Contamination Control Data

The contamination control program for the Active Area includes routine sampling and monitoring on a daily basis of the floors, benches, fume-hoods, glove-boxes, support/service areas, and on a weekly basis, change-rooms and inactive floors. Regular sampling, by wipe testing, of the corridors and office areas is conducted several times daily to ensure areas are maintained contamination free and, should contamination be found, to decontaminate immediately to the levels specified in the decontamination procedure. In addition, equipment leaving the Active Area is monitored by wipe test and/or direct measurement to provide assurance that it meets administrative and regulatory requirements.

During 2014 operations, there were instances where elevated levels of contamination (above "clean on swipe") were found and subsequently contained within the Active Area. Most were due to routine operations such as the replacement of cell manipulators and associated boots, decontamination of materials/equipment and shielding containers, and tracking of contaminants from a cell, glove-box, or fume-hood when product or samples were being removed.

There were a total of 47 contamination incidents in 2014 (Table 16). This increase in contamination incidents as compared to 2013 reflects the increase in the amount of material processed into customer orders in 2014.

The distribution of contamination incidents in 2014 is shown in Table 16 and 17 and is illustrated in Graph 1.

There does not appear to be a discernible trend in the contamination incidents by month.

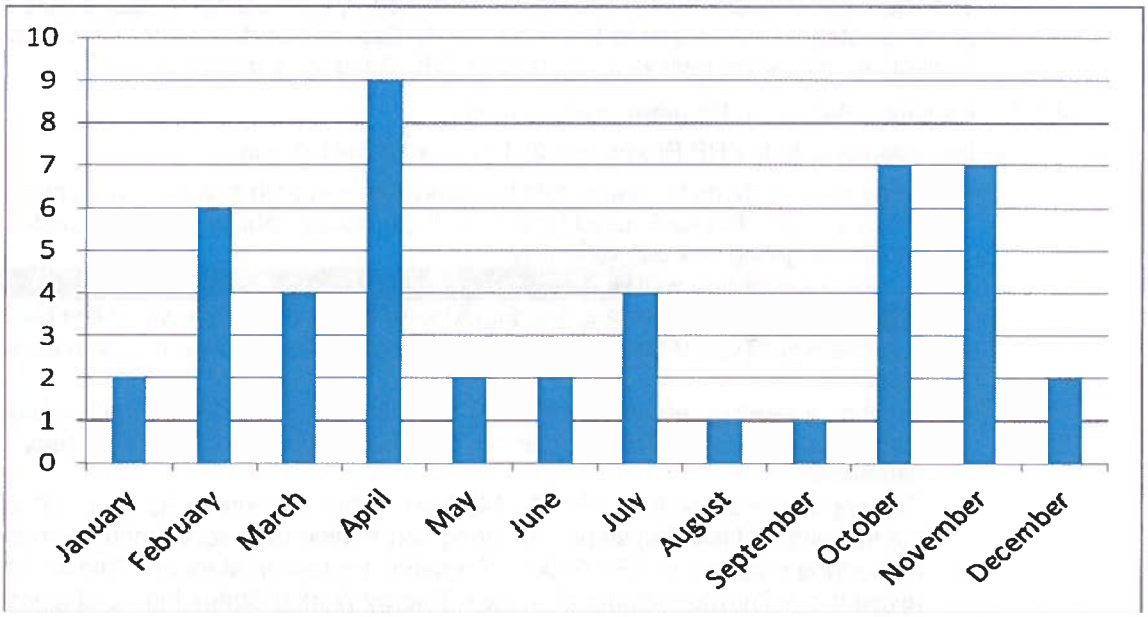
Table 16
Contamination Incidents by Contamination Level

Year	Not recorded	<500 cpm	>500 cpm, <2,000 cpm	>2,000 cpm, <10,000 cpm	> 10,000 cpm, < 50,000 cpm	>50,000 cpm	Annual Total
2010	1	2	18	15	4	3	43
2011	0	11	11	9	3	3	37
2012	1	1	7	13	6	4	32
2013	0	1	12	8	6	5	32
2014	1	2	16	12	12	4	47

Table 17
Contamination Incidents by Radionuclide

Year	Not recorded	C-14	Co-60	I-125	I-131	Mo-99	Y-90	Decayed Mo-99
2010	0	0	3	1	13	3	8	5
2011	1	0	7	3	6	12	3	0
2012	1	0	5	2	7	10	5	0
2013	1	0	9	1	10	5	4	0
2014	0	2	12	3	5	13	7	2
Year	**Ir-192**	**In-111**	**Lu-177**	**Xe-133**	**Sr-82**	**I-123**	**Eu-152**	**Annual Total**
2010	2	0	0	1	7	1	0	43
2011	0	2	2	0	0	2	1	37
2012	1	0	0	0	0	1	0	32
2013	1	0	0	1	0	0	0	32
2014	0	0	0	2	1	0	0	47

Graph 1: Contamination Incidents by Month, 2014



2.7.4 Facility Radiological Conditions

The radiation survey program involves radiation measurements within the Active Area, and on the perimeter and exterior of the KOB. Within the Active Area, radiation surveys are conducted on a daily basis, throughout all the labs and rooms. Areas where radiation fields are above 2.5 mrem/hr (0.025 mSv/hr) are posted with radiation warning signs, indicating the radiation fields. In addition, surveys are conducted at employee work areas, at cells, glove-boxes, and fume-hoods, during production and test operations, to ensure radiation fields during processing are within acceptable levels. Special surveys are conducted on new processes/equipment to provide information on the safety performance of new operations. Detailed surveys are conducted on each of the Cobalt Operations cells every three years, to check for integrity of the cells and ensure radiation levels are within acceptable levels.

On a monthly basis, radiation surveys have been conducted on the perimeter of the Active Areas, and within the Inactive Office Areas. The monthly survey also includes measurement of radiation fields outside the KOB to ensure conditions have not changed in the operations that may impact the environment/exterior exposure. All the monthly surveys were conducted in 2014.

Breathing air was monitored at 12 Continuous Air Monitor (CAM) stations and at over 50 locations with 24 hour air filters. In addition to having the capability of alarming locally, CAMs are monitored and logged at the Surveyor's control panel and on the building monitoring system. The 24 hour air filters are measured at the end of the day shift on a daily basis.

For work known to have the possibility of creating radioactive contamination of the breathing air, a zone is demarcated and signage is posted requiring respirators to be worn. Respirator requirements are removed only once air monitoring measurements are below the required levels. In 2014, all breathing air sampling was performed in accordance with procedures and results indicated that processes were in control.

2.7.5 Exceeding Regulatory Limits or Action Levels

There were no incident investigations completed where a regulatory limit was exceeded or an action level was reached or exceeded in 2014.

2.7.6 Radiation Protection Program Effectiveness

The Radiation Protection (RP) Program is reviewed by conducting process audits and process safety audits. Refer to Section 1.2.4.1. Data and performance of the Radiation Protection Program is reviewed regularly at EHS Committee meetings.

2.7.7 Radiation Protection Program Improvements

Improvements to the RP Program in 2014 included the following:

- Using control charts for the thyroid bioassay unit and both radioxenon monitors. Control charts are effective tools used for monitoring process stability as well as understanding and investigating process variability.
- Installing a concrete wall [redacted] to provide a designated area for inactive work with a low background.
- Purchasing of Type B Cobalt shipping container shields to lower doses to Cobalt Shippers.
- Creating a new procedure SE-OP-083, "Nordion's External Dosimetry Database" to outline the necessary steps to maintain and use Nordion's external dosimetry databases.
- Creating a new procedure SE-OP-084, "Non-routine Storage in Room 1359" to outline the tracking and labeling steps for storing non-routine radioactive material in this room.
- Procedural revisions to SE-RP-001, "Radiation Protection Manual – Ottawa Site" to revise the Acknowledgement of Nuclear Energy Worker Status form and to indicate Room 1308 is considered part of the Action Area.
- Procedural revisions to SE-RP-003, "Investigations", SE-OP-007, "Daily Workstation Air Monitoring", and SE-OP-043, "Procedure for Boot and Manipulator Removal/Replacement" to include requirements to perform contamination checks of water fountains.
- Procedural revisions to SE-OP-027, "Weekly Environmental Equipment Testing" to include instructions regarding the weekly recording of stack velocity continuous monitors.

Efforts to monitor and track unreturned dosimeters continued in 2014, including maintaining awareness with employees and Managers. The submission of dosimeters has improved by 83% (from 24 dosimeters returned later than one month in 2013 to four in 2014).

2.7.8 Radiation Protection Program Performance

The objectives, goals and targets of the Radiation Protection Program are shown in Table 5 of Section 2.3.1. The targets average and maximum NEW dose and environmental releases were met in 2014. These targets are tracked as key performance indicators at EHS Committee meetings and in Monthly Operational reports. The targets are reviewed yearly at the Annual Joint Environmental Management System and QA Program for Safety Review. Refer to Section 3.2 Table 24 for a summary of the initiatives and targets for the upcoming year. In Medical Isotopes a new target was added regarding thyroid testing attendance.

2.7.9 Continuous Improvements Under ALARA Performance

ALARA objectives and performance is reviewed at EHS Committee meetings and all activities in the ALARA program. This procedure was followed in 2014, and performance against targets is demonstrated in Table 5 of Section 2.3.1.

2.7.10 Radiation Protection Training Program and Effectiveness

Refer to Section 2.2.1.

2.8 Conventional Health and Safety

2.8.1 Conventional Health and Safety Program Effectiveness

The Conventional Health & Safety Program is reviewed by conducting program audits, process audits, regular inspections by both employees and management, and a review of revised safety programs is performed by the Policy Health & Safety Committee. The Policy Health & Safety Committee is also responsible for reviewing the Hazard Prevention Program. In addition, the EHS Management Committee sets targets each fiscal year in the areas of Medical Treatment Incidents, Lost Time Incidents and Severity Rates. Refer to Sections 1.2.4.1 and 1.2.4.2 for a description of audits and inspections.

2.8.2 Conventional Health and Safety Committee Performance

The Kanata Operations Building (KOB) Workplace Health and Safety Committee is represented by union and management and typically meets on a monthly basis. The KOB Health & Safety Policy Committee is represented by union and management and typically meets on a quarterly basis.

The KOB Workplace Health and Safety Committee met nine times in 2014. The KOB Health & Safety Policy Committee met on five occasions in 2014. The accomplishments for 2014 were that the Policy Committee continued to review the Hazard Prevention Program and participated in the review of the Safety Objectives and Targets. In addition, the Policy Committee continued to review operational ergonomics as a standing agenda item for each meeting.

2.8.3 Conventional Health and Safety Program Improvements

Improvements to the Conventional Health and Safety Program in 2014 included the following:

- Creating and implementing a daily inspection booklet for identified overhead cranes. This booklet identifies parts of the crane which the operator is to inspect once daily and prior to use of the crane. This helps to protect the safety of employees and prevents damage to property and product.
- Updating Back Safety training for the Operations groups.
- Creating a new form for Near-miss Reporting which can now be completed electronically and includes EHS in the discussion related to corrective actions. It also contains a section to rank the hazard to determine if a Root Cause Analysis is required.
- Conducting of a campaign to provide education on near-miss reporting. This has resulted in a 50% increase in near-miss reporting to date, as compared to previous years.
- Completing the review of the Workplace Violence Program.
- Changing to a new electronic Material Safety Data Sheet (MSDS) provider. This provider allows for easier tracking of chemicals per location, ability to print reports on hazardous ingredients and has other features which can be drawn upon if Nordion decides to utilize.

2.8.4 Hazardous Occurrences

During 2014, there were three lost time injuries that resulted in a total of 18 days of lost time and five medical treatment injuries. These injuries are summarized below.

Lost Time Injuries (total of 18 days of lost time):

1) An employee was dismounting from the back of a Nordion truck when he lost his footing causing him to grab a rope and twist his torso.

2) An employee was attempting to pull a manual lift truck out from under a pallet. The forks of the truck were not at the lowest setting and got caught on the pallet. The employee jarred their neck and upper back.
3) An employee used force to close a lead door of a hot cell causing low back pain.

Medical Treatment Injuries:

1) An employee developed an infection to his finger that was thought to be caused by a puncture wound from grinding stainless steel containers or polishing brass. Medication was required.
2) An employee sustained a strain to his left forearm and elbow from work related to manipulator use. Physiotherapy was required.
3) An employee sustained a repetitive strain injury to his right thumb. Physiotherapy was required.
4) An employee had left arm discomfort related to pool work and manipulator work. Physiotherapy was required.
5) An employee suffered a low back injury when he was part of a four man lift to move a 300 lb. glove-box from a counter to a skid. Modified duties and physiotherapy was required.

2.9 Environmental Protection

2.9.1 Air and Water Release Monitoring

The environmental monitoring program is designed to monitor and measure effluent releases to the environment and to determine radiation levels in areas exterior to the KOB. The program includes the following elements:

a) Continuous monitoring of process ventilation, exhausts ductwork, and stack emissions by use of in-situ detectors and samplers and computerized recording

b) Weekly air sampling and analyses for KOB exhaust stack emissions

c) Holding tanks for Active Area liquid effluent to allow sampling, analysis, and authorized release of liquid effluent

d) Environmental TLD program

e) Soil sampling (which is performed every two years and was performed in 2012).

f) Groundwater sampling

Ventilation and stack sampling is conducted by using particulate and/or activated charcoal filters, depending on the physical and chemical nature of the radionuclide. Radioiodine sampling involves the use of activated charcoal filter cartridges, and analyses by gamma measurement. Particulates are sampled by use of cellulose filter papers and analyzed by gamma measurement.

All production operations are contained within cells, glove-boxes and/or fume-hoods. Ventilated air from these containment systems is filtered through roughing and HEPA filters and, where appropriate, activated charcoal adsorbers. These systems are designed with redundant fan/motor and filtration units that include pre-filters, primary and secondary filtration units. The NVS has been designed and is maintained to prevent the unnecessary release of radioisotopes to the atmosphere.

2.9.1.1 Airborne Effluent

Allowable releases to the environment are limited to the values in SE-OP-029 (4), "Derived Release Limits". A revised version of SE-OP-029 (5) was submitted to the CNSC for approval, and these values had been used to compare releases of radionuclides which were not in SE-OP-029(4). In January 2015, a final version of SE-OP-029(6) was submitted to the CNSC which follows CSA N288.1-08. Air release values in version 6 are similar to those contained in version 5. Nordion first submitted draft SE-OP-029 (6) to the CNSC in 2013. Version 5 values will be compared in this report to be consistent with reporting since 2007. A summary of airborne releases is provided in Table 18. The total percentage of the Derived Release Limit (DRL) per year is presented in Graph 2.

In 2014, the maximum annual release of airborne from any one radionuclide was from Xe-135m at 0.61% of the Derived Release Limit (DRL). The total air release was 0.96% of the DRL. No Action Levels were exceeded in 2014.

Releases of radioxenons have lowered in 2014, in part due to new calibration factors. Calibration factors used in 2012 and 2013 were more conservative, indicating higher releases. In 2014, new calibration equipment was used to calibrate radioxenon monitors which resulted in slower releases with dead times in the same range as releases from Xe-133 and Mo-99 production. The previously used calibration apparatus could allow for sudden, rapid release with significant dead times and the calibration values were not corrected for dead time.

Table 18
Airborne Releases

Year	C14 (GBq/yr)	Co-60 (GBq/yr)	I-125 (GBq/yr)	I-131 (GBq/yr)	Xe-133 (GBq/yr)	Xe-135 (GBq/yr)	Xe-135m (GBq/yr)
2010	43.1	0.006	0.37	0.99	9,066	6,407	9,366
2011	67.9	0.006	0.38	0.29	34,967	17,239	27,688
2012	15.7	0.006	0.46	0.40	36,153	23,943	39,498
2013	N/A*	0.005	0.23	0.39	30,735	28,193	43,383
2014	N/A*	0.005	0.14	0.46	15,018	13,075	18,170

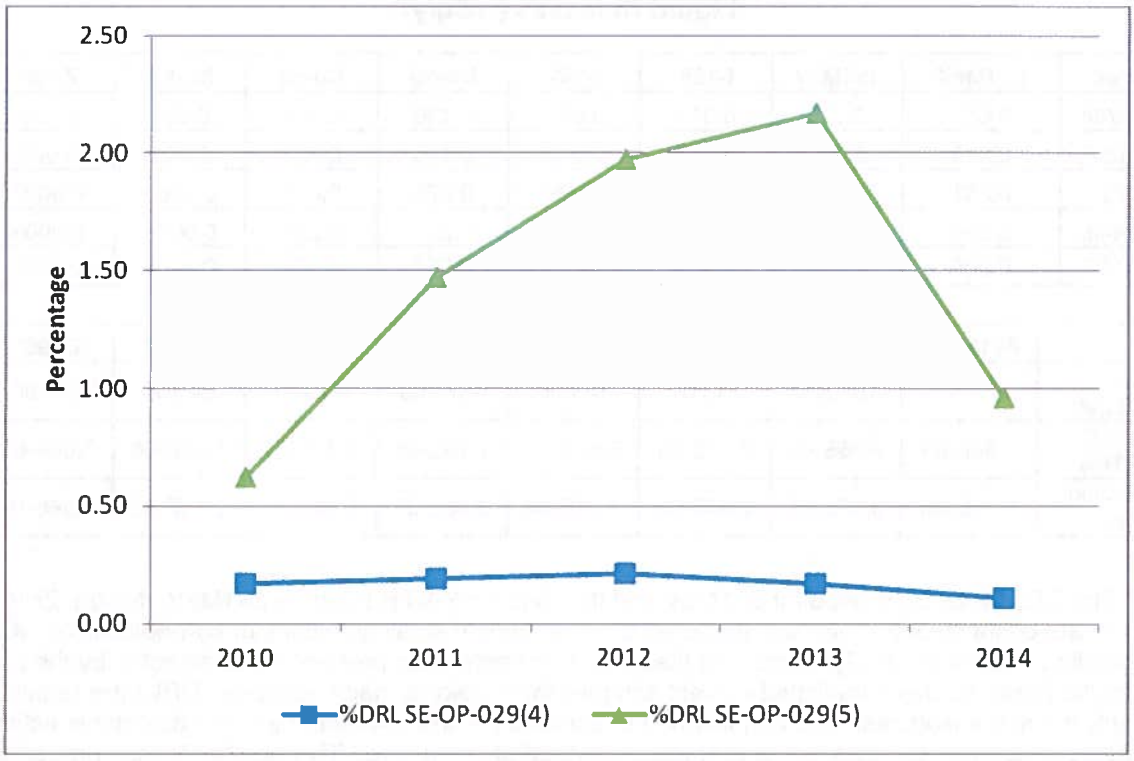
	C14	Co-60	I-125	I-131	Xe-133	Xe-135	Xe-135m
DRL (GBq/yr) Using SE-OP-029 (4)	*	78	990	1110	2.90E+07	*	*
% DRL (2014)	*	0.01%	0.01%	0.04%	0.05%	*	*
% Action Level (2014)	*	0.01%	0.03%	0.08%	0.10%	*	*

* No limit established for these isotopes in SE-OP-029 (4)

	C14	Co-60	I-125	I-131	Xe-133	Xe-135	Xe-135m
DRL (GBq/yr) Using Draft SE-OP-029 (5)	9.95E+04	1.17E+04	1.22E+03	1.13E+03	4.27E+07	5.00E+06	3.00E+06
% DRL (2014)	N/A**	0.00%	0.01%	0.04%	0.04%	0.26%	0.61%
% Action Level (2014)	N/A**	0.00%	0.02%	0.08%	0.07%	0.52%	1.21%

** C-14 production stopped toward the end of 2008, and measurement of C-14 was stopped in 2012.

Graph 2: Total %DRL per Year



2.9.1.2 Liquid Effluent

Allowable liquid effluent releases to the environment are also limited to values in SE-OP-029 (4), "Derived Release Limits". The five year variation in activities released is listed in Table 19. The volume and total percentage of the DRL per year is presented in Graph 3.

No Action Levels or Administrative Levels were exceeded in 2014. All liquid effluent releases have been below the Nordion action levels and well within CNSC licensed limits. A summary of liquid releases, expressed as a % DRL, is provided in Table 19.

The City of Ottawa is informed whenever a release to the sanitary sewer takes place. In addition, a monthly summary report of the activity levels released is provided to the City of Ottawa.

In 2014, the Minimum Detectable Activity (MDA) for I-125 was raised, due to the replacement of an aging NaI(Tl) (sodium iodide activated with thallium) detector with a new low energy window HPGe (high purity germanium) detector. The low energy window HPGe detector has lower efficiency than the obsolete NaI(Tl) detector. Nordion continues to report liquid releases as equal to the MDA even when it is suspected that nothing was released. This change accounts for the increase in the I-125 liquid release from 2013 to 2014.

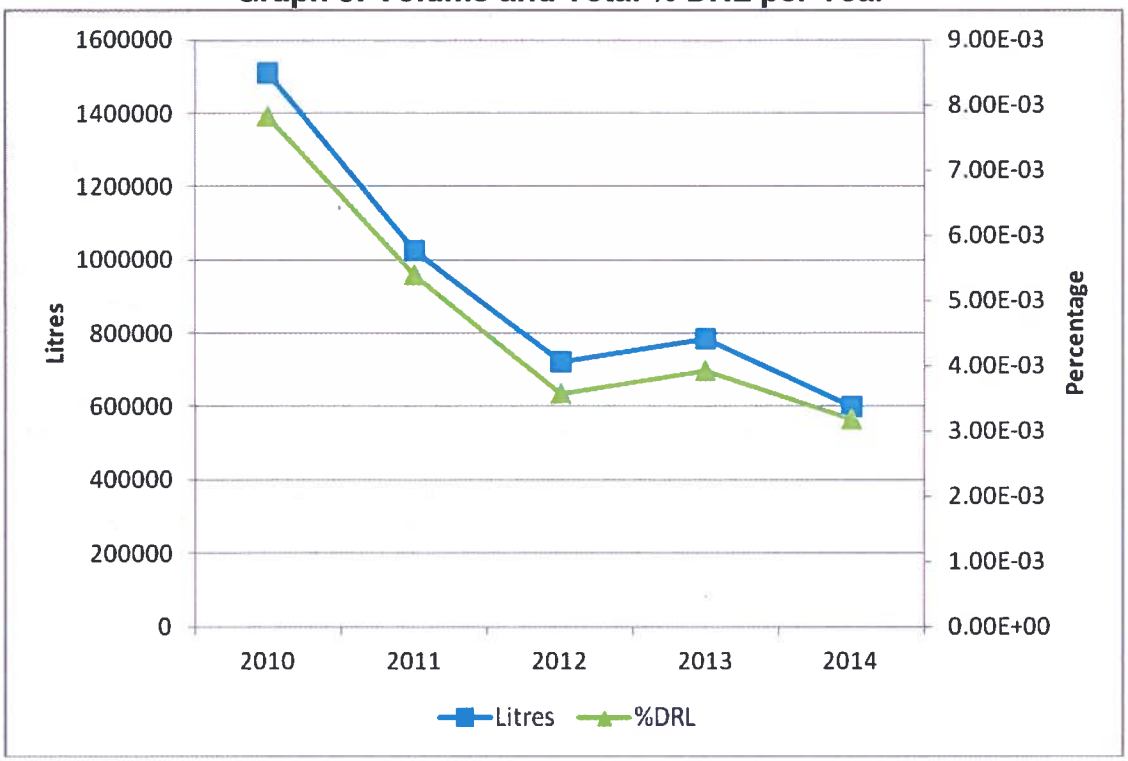
Table 19
Liquid Releases (GBq/yr)

Year	Litres	β<1MeV	β>1MeV	I-125	I-131	Mo-99	Co-60	Nb-95	Zr-95	Cs-137
2010	1510764	0.569	0.129	0.011	0.021	0.180	0.044	0.001	0.001	0.001
2011	1024391	0.395	0.088	0.007	0.013	0.116	0.027	0.001	0.001	0.0004
2012	720821	0.261	0.060	0.005	0.009	0.075	0.017	0.0002	0.0003	0.0004
2013	782848	0.288	0.065	0.005	0.009	0.077	0.022	0.0006	0.0006	0.0005
2014	600162	0.209	0.050	0.051	0.006	0.055	0.018	0.0007	0.0005	0.0004

	β<1MeV*	β>1MeV*	I-125	I-131	Mo-99	Co-60	Nb-95*	Zr-95*	Cs-137*
DRL (GBq/yr)	7,780	105,000	14,700	10,800	467,000	64,100	64,100	64,100	64,100
% DRL (2014)	2.69E-03	4.76E-05	3.47E-04	5.56E-05	1.18E-05	2.81E-05	1.09E-06	7.80E-07	6.24E-07
% Action Level	5.37E-03	9.52E-05	6.94E-04	1.11E-04	2.36E-05	5.62E-05	2.18E-06	1.56E-06	1.25E-06

* The DRL for Sr-90 is used for β<1MeV and the DRL for Y-90 is used for β>1MeV. Nb-95, Zr-95 and Cs-137 are contaminants which are expected to be present in small quantities or non-detectable. Although Nordion does not formally monitor for these contaminants, their presence was detected by the analysis method used to check the liquid effluent samples for Nordion's major isotopes. DRLs are required for only the major isotopes. The majority of the recorded releases are the minimum detectable activities being conservatively reported as real values instead of using zero. This number is then proportional to volumes released, which explains the lower reported releases in 2012 to 2014.

Graph 3: Volume and Total % DRL per Year



2.9.1.3 Environmental TLDs

The locations of environmental TLDs are shown on Figures 20 and 21 and listed in Table 20. The Environmental TLD results are shown in Table 20 and presented in Graph 4. The existing environmental TLD placement corresponds roughly to the historical locations of these dosimeters. The dosimeters are deployed to generally cover the points of a compass and preferentially to the east of the facility, which is the direction of the prevailing winds. The TLDs are also placed in residences of Nordion employees.

Locations 17 and 20 are locations that are representative of the model population for air effluent from the facility. Soil samples at these locations have not shown any radionuclides attributable to Nordion's licensed activities. The similarity in the recorded dose in these locations year over year, taken with the absence of any contamination found in soil illustrates that the variation between locations is due to variations in natural background radiation at these different times and locations.

Table 20
Environmental TLD Results

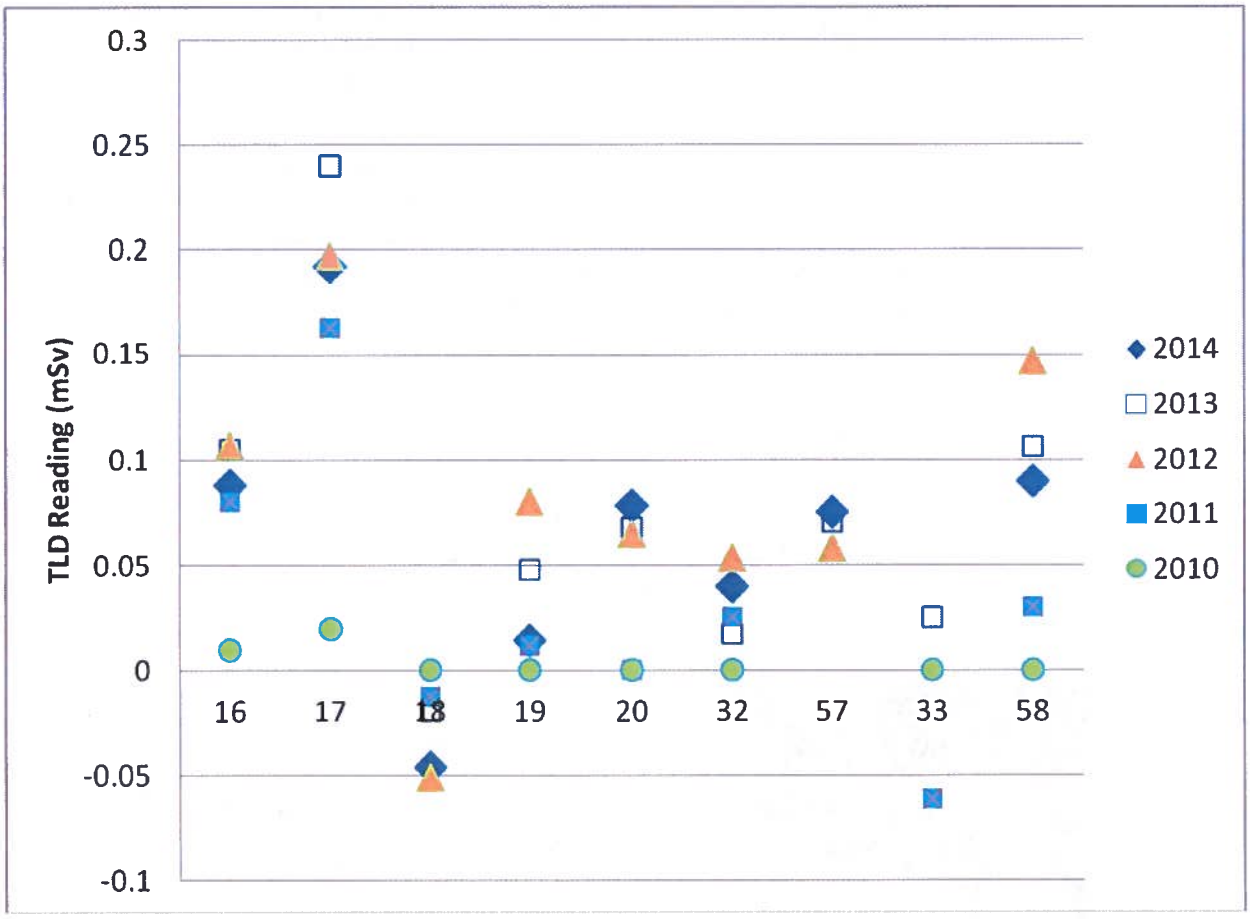
Location		Totals				
		2014 (mSv)	2013 (mSv)	2012 (mSv)	2011 (mSv)	2010 (mSv)
16	[redacted]	0.088	0.105	0.107	0.08	0.01
17	[redacted]	0.192	0.240	0.197	0.163	0.02
18	[redacted]	-0.046	-0.019	-0.051	-0.0124	m
19	[redacted]	0.014	0.048	0.08	0.012	m
20	[redacted]	0.078	0.068	0.065	0.0	m
32	[redacted]	0.04	0.017	0.053	0.025	m
33	[redacted]	*	0.025	ND	-0.061	m
57	[redacted]	0.075	0.070	0.058	ND	*
58	[redacted]	0.09	0.106	0.147	0.03	m

* missing TLD

m = less than 0.01 mSv

ND = not deployed

Graph 4: Environmental TLD Results (mSv)



2.9.2 Significance of Air and Water Release Monitoring Results

Processing of Co-60 increased significantly as did Y-90 in 2014; however, due to the particulate nature of these processes there was no impact on releases due to these increases. [redacted], but releases have been lowered due to a change in the calibration factor (as detailed in Section 2.9.1.1). [redacted]. There were no particulate releases of C-14 during the dismantling of the C-14 production glove-boxes and fume-hoods in 2014. [redacted] air releases decreased by a larger amount, 40%, which is primarily due to less degradation of activated charcoal filters due to lowered use of Cells 17 and 18. Cells 17 and 18 were used to process I-131 in the past, but were only used by Research & Development (R&D) in 2014 for minor and infrequent work.

As in previous years, liquid releases closely followed liquid release volumes due to Nordion's practice of assuming the MDA is the level of the release. No other specific trends were noted.

Trends in changes in volumes of water released from the facility continue to be roughly proportional to activities released. Nordion employs a conservative practice of assuming the MDA is always released. This explains why the year over year trend very closely follows the number of litres released. In 2014, Nordion switched from a NaI(Tl) detector to a low energy window HPGe detector with slightly less efficiency in the I-125 range, which on paper will contribute to higher releases being reported in the future (if water volumes are stable). The next largest factor is variation in the MDA between the Cobalt Operations Facility and the Nuclear Medicine Production Facility. A small percentage of the release reported is activity detected over the MDA.

2.9.3 Exceeding Regulatory Limits or Action Levels

There were no instances of exceeding environmental regulatory limits or action levels in 2014.

2.9.4 Environmental Protection Program Effectiveness

The Environmental Protection Program is evaluated on an annual basis. In 2014, this review was held during the Annual Joint Environmental Management System and QA Program for Safety Review on August 16, 2014. The results of the review are summarized in Section 2.1.2 items 3, 4, 5 and 6.

Refer to Section 1.2.4 for a summary of internal and external inspections, audits and reviews.

2.9.5 Environmental Protection Program Activities

Activities which took place in 2014 included the following:

- Conducting a total of 14 fire and environmental inspections to identify areas for improvement and/or concerns. These were completed as part of a process to conduct routine environmental inspections implemented in 2011. Significant improvements have been observed as a result of these inspections.
- Conducting a supplier audit of a supplier whose goods/services could have a significant impact on the environment.
- Nordion was subject to an annual maintenance audit for Nordion's ISO 14001 certification. One minor non-conformance and two opportunities for improvement were identified during the course of this audit.

2.9.6 Environmental Protection Program Improvements

The Environmental Protection Program was revised in 2014 to include information regarding radiological groundwater sampling and spill containment.

2.9.7 Environmental Protection Program Performance

A description of the Environmental Protection Program Initiatives is provided in Table 21, along with the results/outcomes.

A summary of initiatives and targets for the upcoming year is provided in Table 22.

Table 21
2014 Environmental Objectives

Objective	Result / Outcome
Reduce the use of hazardous and other environmentally harmful materials*	Reduction of 5% by 2015 (refer to Table 5 for 2014 results)
Reduce Waste*	Reduction of non-hazardous waste by 5% by 2015 (refer to Table 5 for 2014 results) Reduction of hazardous waste by 5% by 2015 (refer to Table 5 for 2014 results)
Conduct an audit of a supplier whose goods and/or services could have a significant impact on the environment	Completed one supplier audit in accordance with SE-ENV-019 "External Supplier Environmental Audits

** Standardized by revenue to allow for growth. Baseline year of 2010. Hazardous material refers to hazardous chemicals and excludes radiological materials.*

Table 22
2015 Environmental Objectives and Targets

Objective	Target
Reduce non-hazardous waste to landfill.	Increase waste diversion rate to 60% by the end of 2016 (baseline year – 2013 waste audit results).
Conduct an audit of a supplier whose goods and/or services could have a significant impact on the environment.	Complete one supplier audit in accordance with SE-ENV-019 "External Supplier Environmental Audits by the end of 2015.
Objectives also under consideration:	
Reduce hazardous waste (glycol)	Reduce waste glycol from air handling units
Reduce Energy	Investigate opportunities for reducing energy
Reduce particulate matter air emissions	Reduce particulate matter air emissions from the glass blowing process

2.9.8 Well and Soil Sampling and Measuring/Monitoring

2.9.8.1 Soil Sampling

Soil sampling is conducted at least every two years to determine the presence or absence of radioactive materials in the soil. Soil sampling was performed in 2014. No radionuclides attributable to licensed activities were detected in the soil samples.

2.9.8.2 Groundwater Sampling

Figure 22 shows current groundwater well locations.

2.9.8.2.1 Non-Radiological Sampling

Since 2005, Nordion has been monitoring the groundwater at least once a year for non-radioactive contaminants. The results are monitored to ensure there are no significant shifts or trends in the sample results that could indicate a change to the groundwater. Results are also compared to the background well which represents the water quality as it enters the property. As a conservative reference, results are compared against limits from the following requirements:

- Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act
- Ontario Drinking Water Standards, Objectives and Guidelines

The samples are sent to an accredited laboratory for analysis and parameters for analysis are chosen with consideration to past sampling.

Non-radiological groundwater samples were taken in October 2014. Results, including those from the recent analysis, from four years previous and from the original sampling in 2005 are provided in Appendix C by borehole, with borehole two (2005-BH2) representing background conditions.

The results of this analysis demonstrated that there were no significant changes in the groundwater in 2014.

2.9.8.2.2 Radiological Sampling

Since 2013, Nordion has been monitoring groundwater at least once a year for radiological contaminants.

Samples were taken in November 2014 from the following boreholes to assess potential radiological contaminants:

- 1991-BH1
- 1991-BH2
- 1991-BH3
- 1991-BH4
- 2012-BH1

It was determined that only naturally occurring radionuclides which are not processed at this site were detected. The results were submitted to the CNSC in December 2014.

2.10 Emergency Management and Fire Protection

2.10.1 Emergency Preparedness Program Effectiveness

Management has assessed the existing program and deemed it effective through historical success in meeting the response objectives during exercises. However, continuous improvement opportunities have been identified based on internal and external feedback to exercises and discussion with Ottawa first responders. As a result, Nordion management has chosen to re-develop the program.

In 2014, Management continued efforts to redevelop the Emergency Management Program focusing on a revision of the incident management governance model. This included the complete revision of the Emergency Response Plan and all sub-plans. These changes are to align the plan with Incident Management Systems and to incorporate other continuous improvements identified.

Objectives for 2014 included:

- Maintaining baseline preparedness under the current program by executing emergency response exercises and drills. In 2014, fire evacuation drills were conducted for all buildings as well as an emergency fan-out exercise. Some exercises and drills were deferred to 2015 in anticipation of completion under the revised plans.
- Completing the redevelopment and rewrite of the Emergency Response Plan and sub-plans for submission to the CNSC for review. Throughout 2014, significant improvements were made to the Emergency Response Plan model to incorporate elements of the Incident Management Systems and other continuous improvements that were identified.
- Participation in a Queensway Carleton Hospital exercise of their Chemical Biological Radionuclear Explosive (CBRNE) emergency department triage and decontamination plans.
- Nordion met the majority of their scheduled activities for 2014. A number of activities were delayed as the revised Emergency Response Plans had not been approved by the CNSC. Some emergency response drills were re-scheduled to be conducted in 2015 upon approval of the revised plans.

2.10.2 Emergency Preparedness Program Activities

Nordion has an extensive emergency preparedness program to respond to various types of emergency situations, including on-site and off-site emergencies. During 2014, a number of Emergency Response (ER) exercises were conducted to test these emergency response plans and provide employees having responsibilities within the plans the opportunity to practice.

Activities which took place in 2014 included:

- Testing of the Fire Safety Plan in each of the three buildings (KOB, Roy Errington (RE) Building, and Heating Plant), including alarm activation and full evacuation.
- Testing of the Emergency Response Contact List to ensure accuracy of telephone numbers listed, to determine availability of personnel, and to estimate response times.
- On-going emergency response training (refer to Section 2.10.3 for additional information).
- Participation in a Queensway Carleton Hospital exercise of their CBRNE emergency department triage and decontamination plans. Nordion had a Radiation Surveyor accompany mock casualties with simulated contamination.

2.10.3 Emergency Preparedness Program Improvements

In 2014, Nordion completed significant draft revisions of the emergency program documents. These included:

- Completion of a 1st draft of a new Emergency Management Program document and submission for CNSC review. CNSC comments were received.
- Reformatting of the previously submitted document into four separate documents ech with a specified purpose and audience for training and use. Revisions to reflect CNSC comments and additional improvements were made.
- Redevelopment and rewriting of the sub-plans such as the Fire Safety Plan and Radiation Emergency Response Plan to align with the new ERP and to address other areas for improvement, such as common formats.

The Emergency Preparedness Program, Emergency Response Plan, Emergency Response Checklists, Incident Management System (IMS) Forms for the Incident Command Post (ICP) and Emergency On Call (EOC), and the revised sub-plans were submitted to the CNSC for review.

Throughout the redevelopment, vetting, and initial training of the new programs, the Incident Managers and others gained new exposure and understanding of emergency management that have positioned them to respond move effectively, even under the current program.

2.10.4 Emergency Preparedness Program Performance

In 2014, equipment checks and work conducted to ensure readiness related to the Emergency Management Program included:

Equipment	Frequency
Emergency Response Kit Inspections	Quarterly
Emergency Generators Test	Monthly
Communications Emergency On Call (EOC) Test	Quarterly
Radiation Evacuation Test	Annual
Self Contained Breathing Apparatus (SCBAs) Hydrostatic Testing	Every 5 years
SCBA Air Replacement	Once / year
Emergency Response Gear Inventory	Quarterly

Overall compliance with the Emergency Management Program was proven satisfactory. There were no events (planned or actual) demonstrating non-compliance with the existing Emergency Management Program.

There were no impairments to the Emergency Management Program systems in 2014.

2.10.5 Emergency Preparedness Training Program Effectiveness

All new employees and contractors are provided with emergency response training prior to being issued a security badge.

During 2014, the following emergency response training was provided to employees and those working on behalf of Nordion:

- Fire Warden and Marshall Training – 91 Participants
- ER Personnel – 41 Participants
- New Employee/Contractors Emergency Alarm and Response Training – 49 Participants
- Emergency Alarms & Response Training – 11 Participants

As a result of the pending initiation of Nordion's revised emergency response program and the implementation of SAT, training requirements for the Emergency Preparedness Program are currently under review. In the interim, existing training program requirements are being maintained.

2.10.6 Fire Protection Program Effectiveness

As a result of the full-scale emergency response drill conducted in 2011 Nordion has undertaken a thorough review of all emergency response plans, including the fire safety plans with the goal of aligning these plans with an Incident Management System model.

Fire Drills were conducted in the Heating Plant, the RE Building and the KOB in 2014. There were no significant findings identified as a result of these drills.

Nordion's Inspection, Testing and Maintenance report which is conducted by a Third Party is submitted to the CNSC annually. This report was submitted to the CNSC in December 2014. There was one minor observation identified during this review regarding storage of non-combustible material in electrical rooms. This issue has since been corrected.

In 2014, Management review of the Emergency Management Program focused on the redevelopment of the incident management governance model and revision of the Site Emergency Response Plan. When the revisions to the plan are complete, the sub-plans, including the Fire Safety Plans will be modified to align with these changes.

The objective of the fire protection program is to promote life safety, the conservation of property and essential equipment, the protection of the environment and the continuity of operations through provisions of fire prevention and fire protection measures. Nordion met all scheduled activities related to the fire protection program in 2014.

2.10.7 Fire Protection Program Activities

Activities that took place in 2014 included:

- Testing of the fire safety plans. This test involved evacuation of the three buildings (KOB, RE Building and Heating Plant) by activation of the building fire alarm system.
- Conducting 14 fire and environmental inspections.
- Continuing work on the project to replace fire suppression in hot cells with argon.

2.10.8 Fire Protection Program Improvements

Improvements to the Fire Protection Program in 2014 included:

- Revising Nordion's Fire Safety Plan (SE-ERP-001) to align with Incident Management System protocols. This plan has been drafted and is with the CNSC for review.
- Developing training on Fire Prevention and Safety which will be rolled out in 2015. There were no changes to training, methods, instrumentation, or equipment in 2014.

2.10.9 Fire Protection Program Performance

In 2014, equipment checks and work conducted to ensure readiness related to the Fire Protection Program included:

Equipment	Frequency
Fire Pump Test	Monthly
Sprinklers Inspection	Monthly
Fire Extinguishers Inspection	Monthly
Fire Protection System Verification (Third Party)	Annual

Generally, compliance with the Fire Protection Program is satisfactory. A review of Inspection, Testing and Maintenance conducted by a third party demonstrated compliance with requirements; however, there was one minor issue identified related to storage of non-combustible material in electrical rooms. This issue has since been corrected. Fire suppression for Cell 7 (used for handling and storage of waste from the Mo-99 process) has been impaired as a result of a leaking cylinder. As a result, there is currently no fire suppression in this cell. Impairments are typically managed through the work permit process; however, due to the nature of this impairment, the removal of fire suppression was also assessed and approved by a third party prior to removing it from the cell to ensure the impairment would not significantly impact fire safety or the environment.

2.11 Waste Management

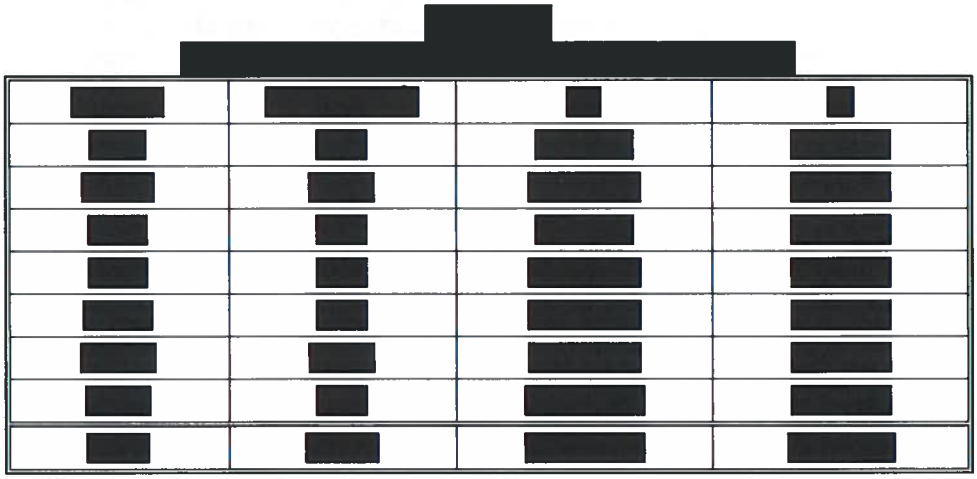
Nordion production facilities have been designed and operated in a manner to prevent radioactive waste being released to municipal garbage or sewer systems and to ensure that releases to the environment via air or water emissions are within limits approved by the CNSC. All radioactive waste that was generated through the production operations was collected and sent to a CNSC approved radioactive waste management facility.

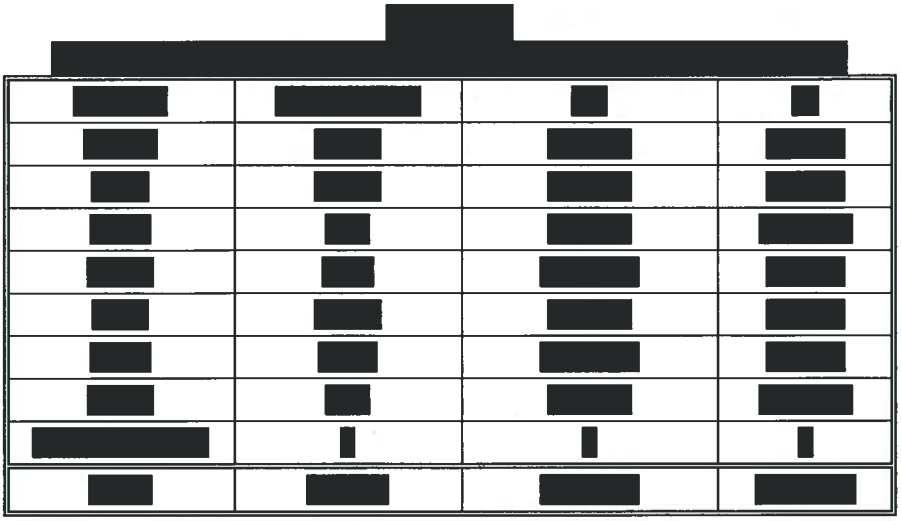
Nordion has designated space and processes to store and segregate radioactive waste that is generated in Operations. Primary long term decay storage areas are located in the [redacted] facility. Additional space for long term storage of divertible waste, (i.e. waste generated within the Active Area at Nordion that has been deemed safe to divert and dispose of by conventional waste disposal methods, such as landfill), exists in the [redacted] facility, if needed. These areas are segregated rooms or bays that are designated for this purpose. Space is also designated for storage of containers and management of waste being prepared for shipment to the external waste management facilities.

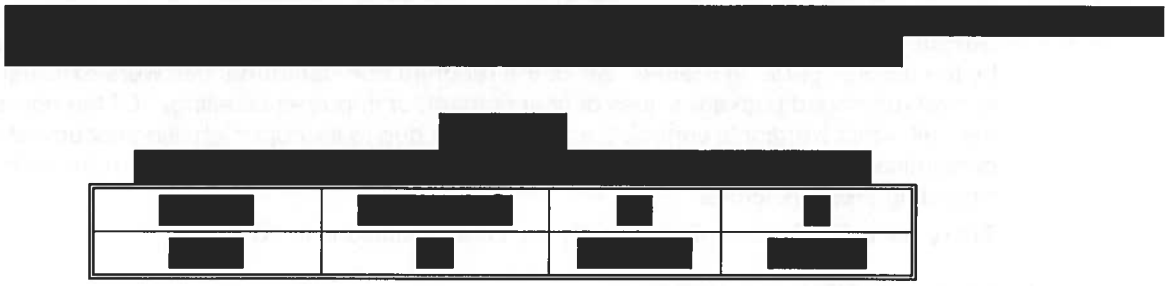
In 2014, the C-14 facility, which has not been in use since 2008, was decommissioned and associated non-routine waste was shipped to licensed nuclear waste disposal facilities. This non-routine waste was made up of fume-hoods, glove-boxes and associated ventilation ductwork, plus cleaning supplies such as rags, suits, floor covering, etc.

In 2014, [redacted] kg of waste that met CNSC unconditional clearance levels was disposed of to landfill as part of the waste diversion program. Nordion frequently reviews the waste diversion program to increase opportunities for reducing waste sent for active waste disposal.

In 2014, there were no shipments of radioactive low-level liquid waste by Nordion. In 2014, approximately [redacted] kg of hazardous liquid waste was disposed of by Nordion via a licensed waste disposal company.







2.12 Nuclear Security

Details of Nordion security and all of the security improvements of 2013 were provided in the Nordion Physical Security Report and Security Plan for 2013, submitted in 2014. These safeguards and improvements are prescribed information and were reviewed and accepted by CNSC Security April 14th, 2014. Additional enhancements were made in 2014 following the inspection that will be reviewed by CNSC Security in 2015.

2.13 Safeguards and Non-proliferation

Nordion has a program in place for the management of safeguarded material at the Nordion Ottawa site. The program meets the safeguards requirements of specified license conditions, CNSC regulatory document RD-336, "Accounting and Reporting of Nuclear Material", CNSC *Nuclear Non-Proliferation Import and Export Control Regulations*, the *Nuclear Safety and Control Act* and *General Nuclear Safety and Control Regulations*.

In 2014, Nordion performed accounting and reporting of nuclear material as required by RD-336. Nordion completed a Physical Inventory Taking (PIT) of safeguarded material from which there were two findings. These two findings were related to the identification and staging of out-of-service containers with DU as shielding.

In 2014, one safeguards inspection was conducted by the CNSC. This safeguards inspection was the Physical Inventory Taking - Evaluation (PIT-E) conducted on October 7, 2014. There were no follow-up items required as a result of this inspection.

2.14 Packaging and Transport of Nuclear Substances

Nordion routinely ships both sealed and unsealed sources of nuclear substances in Type B, Type A and Excepted packages. Nordion also routinely ships waste materials (sealed and unsealed) in these same package types. Shipments of Nordion's products are made via road, air and sea. Shipments of waste are routinely made via road transport.

The Packaging and Transportation Program at Nordion provides a high level overview of Nordion's transportation of radioactive materials program. The program applies to employees involved in design, production, use, inspection, maintenance and repair of packages, and the preparation, consigning, handling, loading, carriage, storage during transport, receipt at final destination, and unloading of packages. It applies to various types of packages including Type A, Type B, and Excepted packages. The content of the program was modeled on regulatory requirements listed in the CNSC *Packaging and Transportation of Nuclear Substances Regulations*, Transport Canada *Transportation of Dangerous Goods Regulations*, IAEA *TS-R-1* Regulations for the Safe Transport of Radioactive Material (1996 Revised Edition), US DOT 49 CFR, and US NRC 10 CFR part 71.

In 2014, Nordion reported 10 non-conformances related to packaging and transport of nuclear substances. Three were non-conformances with the Packaging and Transportation of Nuclear Substances Regulations (Section 19 (1)). The remaining seven events were reported as required by the facility operating license. Six of the reported non-conformances were external to Nordion's control (damaged packages, loss of containment, or improper labelling). Of the non-conformances that fell within Nordion's control, the issues were due to improper labelling/documentation (two), contamination (one), and water retained in cavity (one). Refer to Appendix A for further information regarding these incidents.

There were no non-compliances with the TDG regulations in 2014.

2.15 Public Information Program

2.15.1 Public Information Program Activities

Nordion is committed to communicating activities to the public. Nordion's website is the primary communications vehicle. In 2014, 1105 unique users visited nordion.com 1761 times looking at a total of 4363 pages. On average, the duration of a visit was 2:01 minutes.

In 2014, Nordion published the following public disclosures:

- February 14: Evacuation of the facility as a result of a fire alarm. The alarm proved to be false and the evacuation was suspended. The communication continued with an explanation of Ottawa Fire Services practices and Nordion's Emergency Management Program practices.
- April 23: Nordion's 2013 Annual Compliance and Operational Performance Report. While some portions of the report were redacted on the grounds of commercial confidentiality, the posting provided the public with a detailed overview of Nordion's compliance and operational performance.
- May 22: Q1 2014 Event Report.
- September 4: Q2 2014 Event Report.
- November 14: CNSC Results on Nordion's 2013 Compliance Performance noting that under the 14 categories in which Nordion was rated, the company met or exceeded all compliance requirements and CNSC expectations.
- November 19: Q3 2014 Event Report.
- December 10: Nordion Community Café (refer to Section 2.15.2 for further details).
- December 18: Placement of an ad in the *Kanata Kourier* (refer to Section 2.15.1 for further details).

Nordion's website includes a feedback survey form in the Social Responsibility section as a mechanism to invite the public to provide feedback on Nordion's Public Information Program and to gather how the public would like the program to evolve. Nine unique users visited the survey. One survey was completed. A copy of the feedback survey form is provided in Appendix D.1.

Nordion received one external communication. It was from a customer requesting information regarding Nordion's Environmental Health and Safety programs for a supplier questionnaire.

Nordion regularly issues news releases to inform the public of company initiatives, achievements, and issues the business may be facing. In 2014, there were no media articles related to Nordion environment, health and safety issues or topics. As the context of media coverage referring to Nordion was business-oriented in 2014, there was no media analysis of public opinion.

Nordion uses social media such as Facebook, Twitter, and LinkedIn to inform the public of the company's initiatives. In 2014, Nordion received questions from the public regarding job opportunities and Nordion products. There were no questions received related to environment, health and safety.

Nordion published ads in the October and December 2014 issues of the *Kanata Kourier*, a free weekly distribution newspaper that has a distribution of 27,408 papers, and serves the communities surrounding Nordion's Kanata site. Copies of the two ads are provided in Appendix D.2. The ads:

- Conveyed Nordion's ongoing commitment to protect the safety of employees, the community, and the environment.
- Stated that Nordion is certified to ISO 14001, an international standard for environmental management systems.
- Invited the public to contact Nordion through nordion.com and provide feedback to help ensure Nordion is providing information that is timely, useful, and relevant to them.

In both ads, the Kanata facility was referred to as a "Class 1B nuclear facility".

Nordion plans to conduct public opinion polls every two years. In 2014, we contracted a third-party consultant to survey and poll the public. Between October 30th and November 1st, random telephone calls were made to obtain 500 respondents who lived within a 10km radius of the Nordion Ottawa facility. The results are provided in Appendix D.3.

2.15.2 Public Information Program Improvements

On December 10, 2014, Nordion hosted the Kanata general public, Kanata Community Leaders and Kanata Area Community Associations at an information session called Nordion's Community Café. There were several goals: 1) to build public awareness about Nordion products, services, operations and facility, 2) to proactively engage stakeholder to foster ongoing public awareness and outreach, and 3) to obtain stakeholder feedback to continuously improve Nordion's Public Information Program. The 90-minute Community Café included 30 minutes of networking, a 30-minute information session, and 30-minute Q&A.

Nordion used the following vehicles to promote the Community Café to these stakeholders:

- Nordion.com
- KanataNorthBIA.ca
- Social Media
- *Kanata Kourier*
- Canada Post Unaddressed Mail
- Email

Samples of the promotional material have been provided in Appendix D.4. Nordion used a visual Microsoft PowerPoint presentation during the 30-minute information session, which has been providing in its original digital version.

Nordion used a survey to gather public opinion and consult on the disclosure protocol. Results gathered at the Community Café appear in Appendix D.5.

Nordion updated the Social Responsibility content on Nordion.com and gave the section greater prominence in the navigation. Although the "refreshed" website did not go live until January 2015, all of the work was done from September to December 2014. The key drivers to update the website were to:

1. Comply with CNSC regulations such as explicitly referring to the Kanata facility as a Class 1B nuclear facility.
2. Deliver content more visually and concisely.

3. Give the feedback survey more prominence (i.e. by offering the survey on every page within the Public Information Program section).
4. Improve the navigation so that the public would find information more easily.
5. Present the information in a manner that is more easily understood using plain language, images and info-graphics.

2.16 Site Specific Information

Nordion's site-specific reporting requirements are as follows:

- Nordion shall prepare and submit to the Commission an Annual Compliance Report by March 31st of each year.
- Nordion shall make and submit reports to the Commission regarding safeguarded material in accordance with RD-336, "Accounting and Reporting of Nuclear Material".
- Nordion shall annually update and submit the Annual Physical Security Report by March 31, of the following calendar year.
- Nordion shall report the transfer, receipt, export or import of sealed sources if the activity exceeds the threshold limits as indicated in the site license and within the specified timeframes as detailed in the site license.

In 2014, there were seven instances regarding sealed source reporting. These events were documented in the following investigation reports: 14-06, 14-08, 14-14, 14-17, 14-18, 14-21, and 14-23. These instances were reportable under Section 6.1 (g) of the site license (NSPFOL-11A.05/2015). Refer to Appendix A for further details. As a result of the number and nature of the incidents related to sealed source reporting, and as a result of a trend identified in the 2013 Nordion performance review, an in-depth process review is being conducted to identify if additional corrective actions are required. Nordion complied with all other site-specific reporting requirements.

The Financial Guarantee, as approved by the Commission and based on the Facility's Decommissioning Plan, is still valid.

3. FUTURE PLANS AND CONCLUDING REMARKS

3.1 Improvement Plans and Future Outlook

[redacted]

Nordion is in the process of implementing the next module in its Electronic Quality Management System (EQMS) - the issues management module. Nordion continues to work towards aligning the existing health and safety management system with OHSAS 18001, the standard for Occupational Health and Safety Management Systems, and best practices.

In 2015, Nordion will request CNSC approval for changes to the FSAR for Nuclear Medicine and the FSAR for Cobalt Operations as well as a new FSAR for the Cobalt Pools.

3.2 Safety Performance Objectives for Following Year

The completion of the replacement of the in-cell halon fire suppression system with a more environmentally friendly argon fire suppression system is planned for 2015.

The only projected change to the organizational structure for 2015 is that the Gamma Technologies – EHS Compliance Group will be recruiting an additional EHS Compliance Specialist.

Nordion's 2015 EHS Program Objectives and Targets and Health and Safety Objectives are shown in Tables 26 and 27. For 2015, the following changes were made:

- In Medical Isotopes a new target was added regarding thyroid testing attendance. This is an existing measure that has been tracked and reported to managers. It will now be reported corporately in the monthly reports.
- The EHS CAPA targets will now be tracked in the same way as Quality Assurance (QA) CAPAs. The target is that 80% of CAPAs will reach effectiveness within twelve months. All CAPAs greater than twelve months will continue to be reported and reviewed in the QA CAPA Review Board and the EHS Committee meetings.

The other targets remain unchanged for the 2015 fiscal year.

Table 26
2015 EHS Program Objectives and Targets

Applicable Nordion Job Function	Objective	Measures and Targets
All Directors and Managers All Directors and Managers of Operations, Facilities, or Nuclear Energy Worker employees	Minimize the number and extent of occupational injuries, environmental and radiation incidents.	• The number of Incidents ≤ 6 • Lost Time Injuries ≤ 0.5 per 200,000 hours worked (3-yr rolling) • The severity of lost-time injuries to ≤4 days per 200,000 hours worked (3-yr rolling)
	Minimize the use and release of hazardous materials to the environment.	• Radioactive materials emissions to ≤ 5.0% of the Derived Release Limits (DRL) • No non-compliant releases of radioactive or non-radioactive hazardous materials to the environment (sewer, air, etc.) • Reduction in the use of hazardous materials and the generation of waste (hazardous and non-hazardous)
	Maintain radiation doses to employees as per ALARA principle.	• Average Active Area employee dose rate ≤ 1.3 mSv/yr • Maximum employee dose rate ≤ 7.5 mSv/yr • Radiation Incidents ≤ 5/year • Thyroid testing attendance >90% (Medical Isotopes)
	Manage EHS CAPAs and ensure timely closure of CAPAs	• Target 80% of generated CAPAs within your areas are closed (Actions complete, excluding CAPA verifications) within 1 year • Meet all CAPA target dates • Prioritize high risk EHS CAPAs

Table 27
2015 Health and Safety Objectives

Applicable Nordion Job Function	Objective	Measures and Targets
All Directors and Managers All Directors and Managers of Operations, Facilities, or Nuclear Energy Worker employees	Ensure all managers of high risk areas conduct / document regular self-assessments of their management processes and safety performance.	• Ensure the departmental job hazard analysis is kept up-to-date.
	Ensure all managers actively consider impacts to the environment and health and safety.	• Environment, health and safety impacts are assessed as part of product realization planning and risks are mitigated through application of ALARA and pro-active planning. • Opportunities for minimizing waste (hazardous and non-hazardous) are assessed and implemented as feasible. • Ensure all near misses are reported in a timely manner and appropriate corrective actions(s) are taken. • Maintain control of non-production radioactive material.
	Communicate monthly with teams about environment, health and safety performance and impacts. Openly evaluate employee environment, health safety concerns and encourage reporting of near misses.	• Environment, health & safety information and concerns are discussed regularly at team meetings. • Health and safety concerns are assessed with the results of the evaluation communicated to the employee(s). • Deviations, CFs, Non-conformances and Complaints are assessed for EHS risks against targets and reported accordingly. • Routinely invite EHS Representatives to team meetings to discuss EHS topics and/or concerns.
All High Risk Employees	Work safely at all times. It is unacceptable to take risks in order to get the job done.	• Work follows Nordion applicable EHS standards and procedures, and is performed with care and attention to safety principles. • Wear all applicable personal protective equipment (PPE). • Submit all dosimeter(s) and rings for monitoring on time (i.e. no later than one month following end of monitoring period without good reason, such as extended illness or company travel, etc.).
	Report the occurrence of workplace injuries, unsafe conditions and near misses.	• All workplace injuries and observed unsafe conditions & near misses are reported immediately to the direct Supervisor.
Applicable Nordion Job Function	**Objective**	**Measures and Targets**
All High Risk Employees	Correct co-workers who are working unsafely.	• Following Nordion values, coach co-workers who are seen working unsafely.

3.3 Concluding Remarks

The key points of this report are as follows:

- There were no major issues in 2014 with regard to the operating facility. The facility has operated according to applicable design criteria. There were no physical design changes to any structural areas of the building or changes to the designated Active Areas. The classification of Room 1308 within the licensed facility boundary was changed from a Radiation Area (an area where radioactive material is sealed and there is virtually zero probability of loose contamination) to an Active Area.
- Several milestones regarding Nordion's Systematic Approach to Training (SAT) program were completed in 2014 including Job Task Analysis (JTA) for the following positions where the core duties of the positions are safety related: Cobalt Monitors, Installation and Service Technicians, and Surveyors.
- Conformance to internal training requirements was high in 2014.
- At the end of 2014, there were 29 out of 822 survey meters past due for the internal frequency requirements, some due to them requiring repair. All of the 29 meters have since been calibrated or otherwise accounted for. Testing of all other radiation devices and instrument maintenance was performed at the required frequency and results were satisfactory. There were three pieces of equipment with multiple occurrences of non-routine maintenance in 2014 (refer to Section 2.3.4.11). However, these occurrences were not indicative of any malfunction of the major hardware or components of the systems because they were related to the replacement of consumables, the replacement of parts due to regular wear, and inconsequential faults.
- The Environment, Health and Safety (EHS) Committee met on a regular basis to review the environmental and safety aspects of the operations and to review and approve Final Safety Analysis Reports (FSARs).
- All measurable radiation dose received by personnel and the public were within the regulatory limit of 50 mSv/yr. and no internal dose levels or limits were exceeded.
- There were a total of 47 contamination incidents in 2014. All elevated levels of contamination were monitored and contained within the Active Area.
- There were no instances in which there was potential to exceed a regulatory limit or to reach or exceed an action level in 2014.
- Various improvements were made to the Radiation Protection, Conventional Health and Safety, Environmental Protection and Fire Protection Programs. These programs fall within the scope of the Quality Assurance (QA) Program for Safety.
- There were three lost time injuries that resulted in a total of 18 days of lost time and five medical treatment injuries in 2014.
- There were no instances of exceeding environmental regulatory limits or action levels in 2014. The maximum annual release of airborne from any one radionuclide was Xe-135m at 0.61% of the DRL.
- In 2014, Nordion received one EHS related external communication from a customer requesting information regarding Nordion's Environmental Health and Safety programs for a supplier questionnaire.
- Nordion hosted the general public at an information session to build public awareness about Nordion's products, services, operations and facility, and to obtain stakeholder feedback.
- In 2014, Nordion complied with each site-specific reporting requirement with the exception of seven instances regarding sealed source reporting. The instances were reportable under Section 6.1 (g) of the site license (NSPFOL-11A.05/2015). Nordion is conducting an in-depth review of the sealed source reporting process.

In 2014, Nordion's Class 1B Facility operated within the requirements of the Nuclear Safety and Control Act, the applicable regulations and the conditions of the operating license issued by the CNSC with the exception of 13 non-compliances with the Act, the regulations or with Nordion's site license NSPFOL-11A.05/2015 (refer to Appendix A).

Figure 1: Cobalt Production Technicians

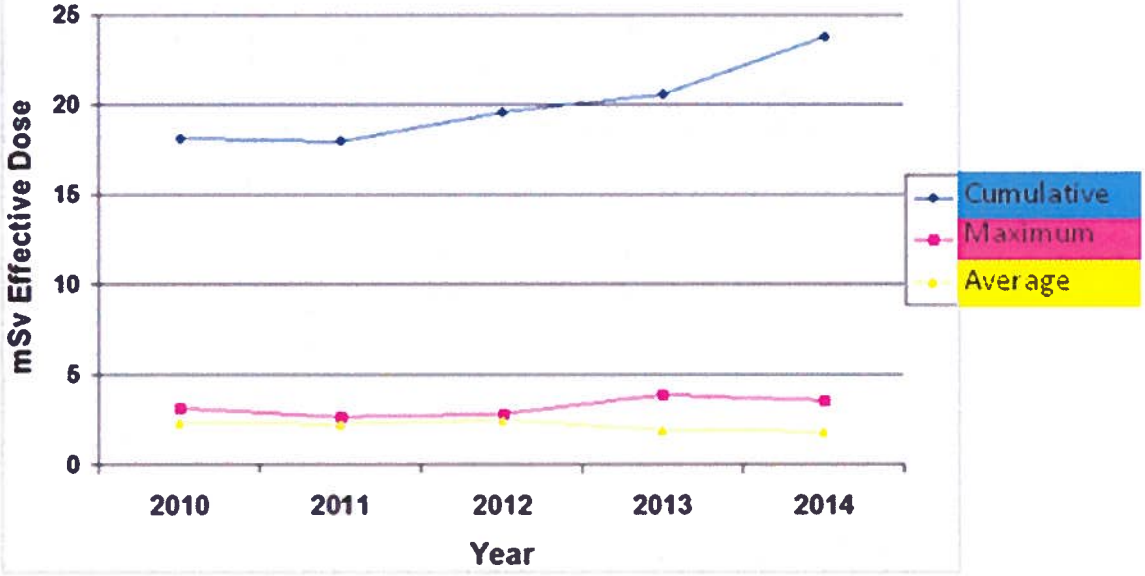


Figure 2: Cobalt Monitoring, Decontam and Shipping

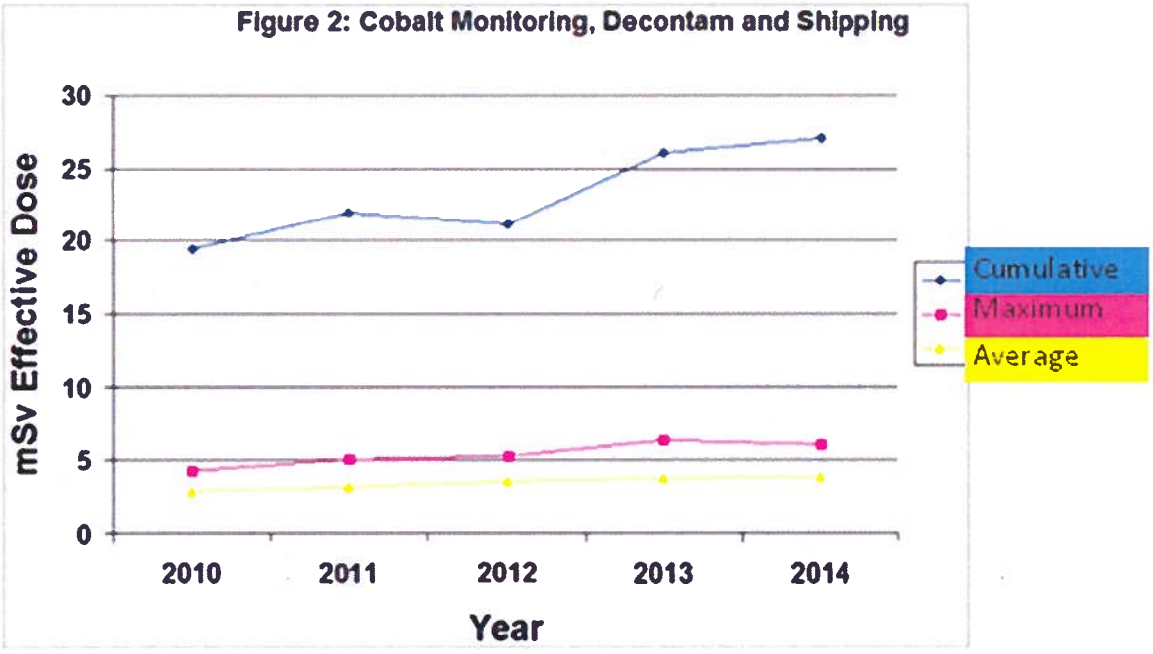


Figure 3: Cobalt Development

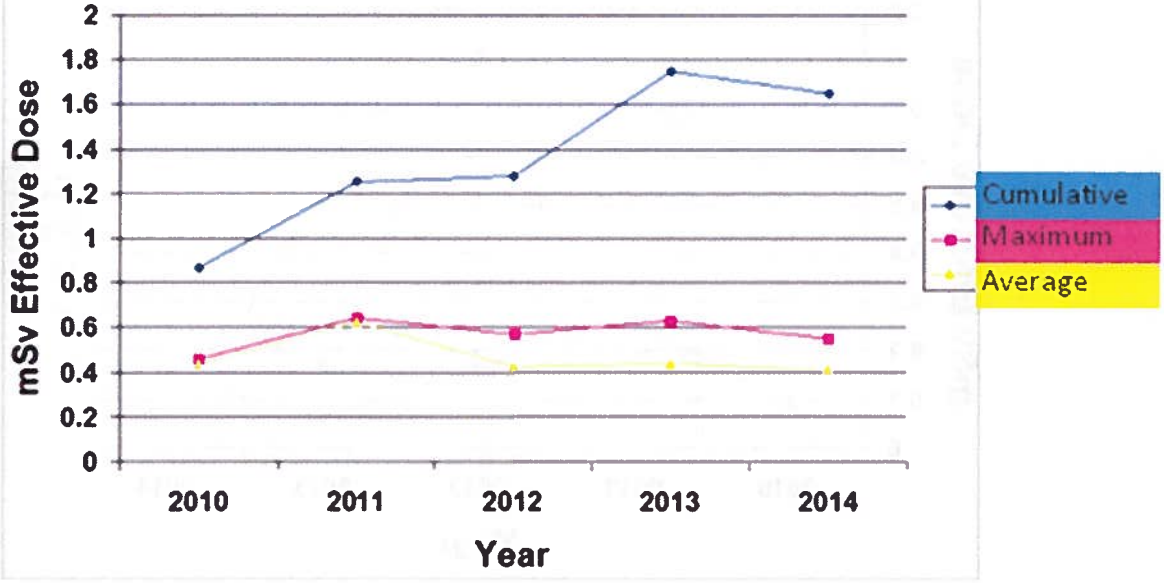


Figure 4: QC Cobalt

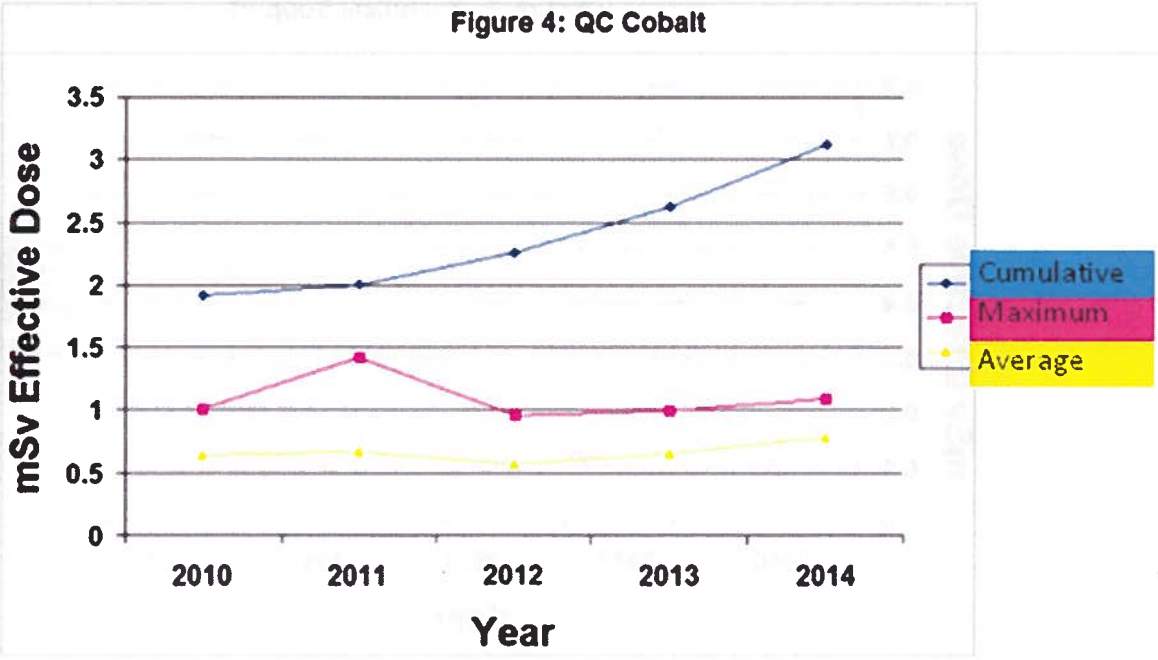


Figure 5: Radiopharm Development

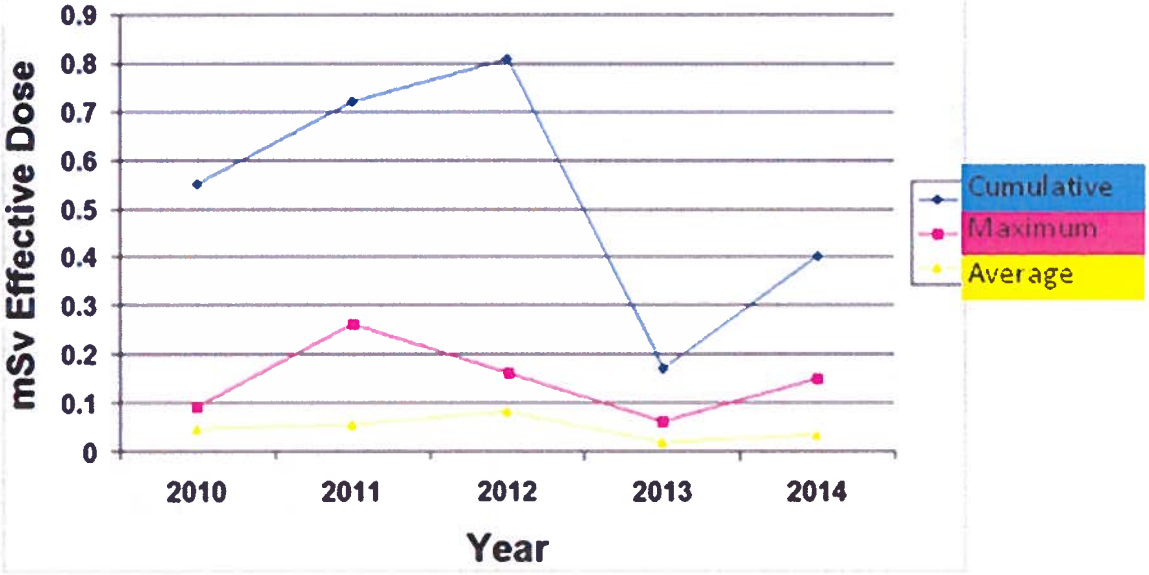


Figure 6: Technical Support

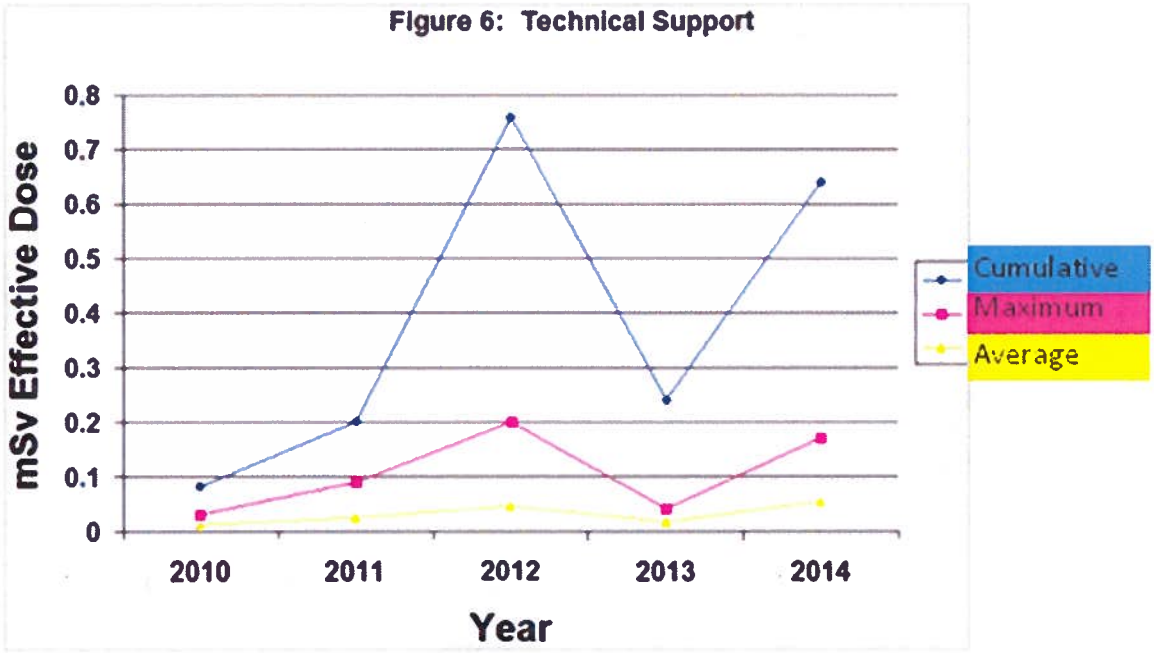


Figure 7: Nuclear Medicine Shippers, Waste, Containers

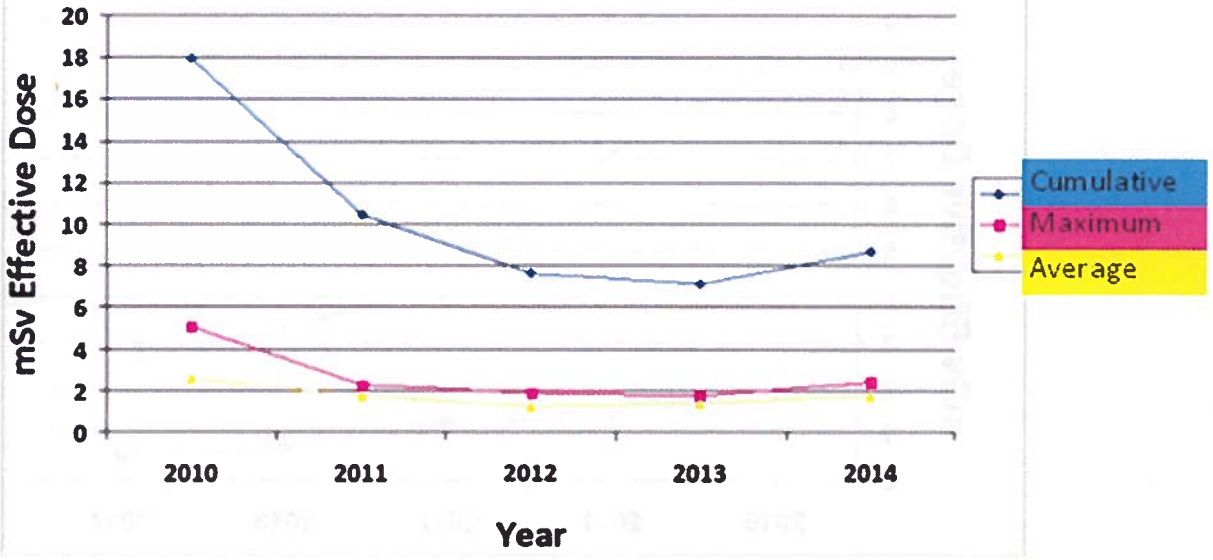


Figure 8: I-125, I-131 & Ir-192 Production Technicians

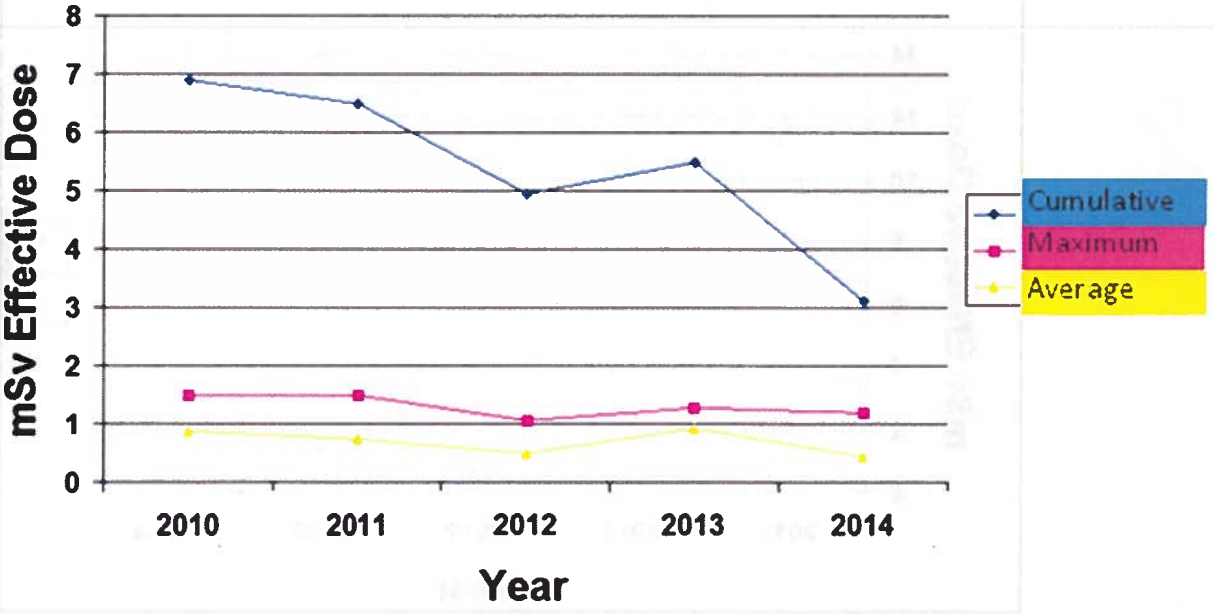


Figure 9: Mo-99, Xe-133 & Sr-82 Production Technicians

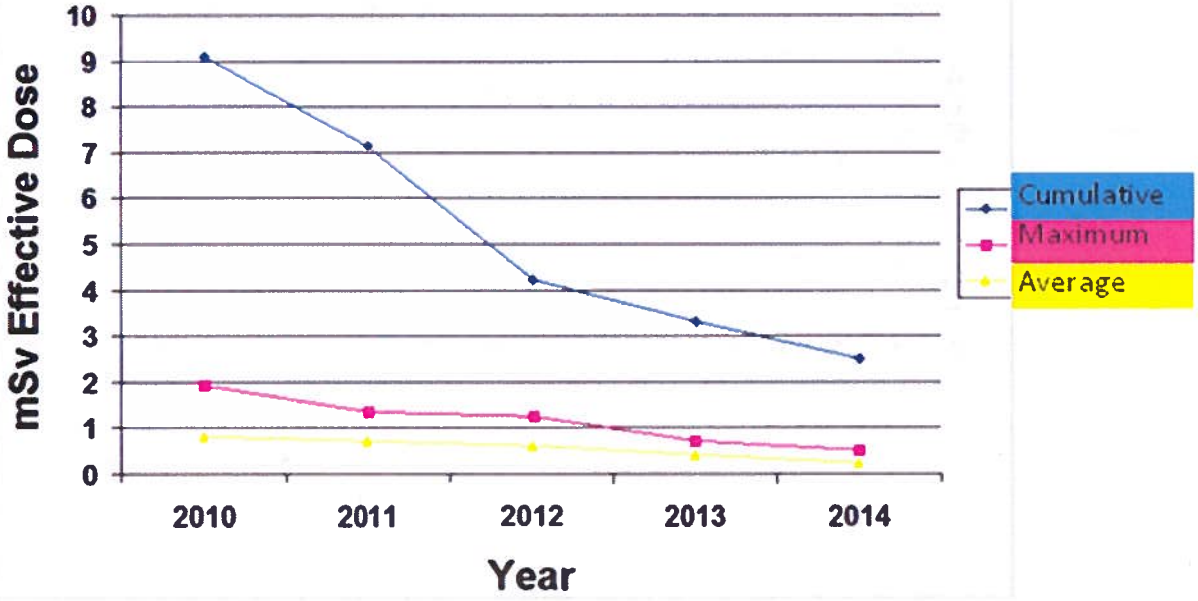


Figure 10: Radiopharm Production Technicians

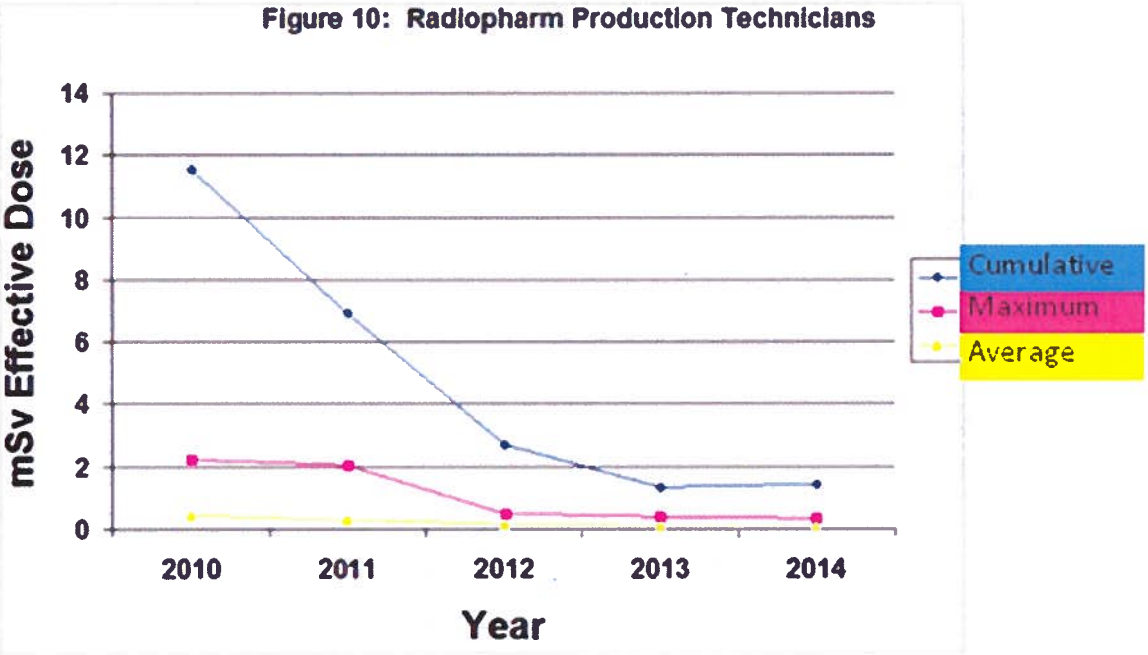


Figure 11: Machinists

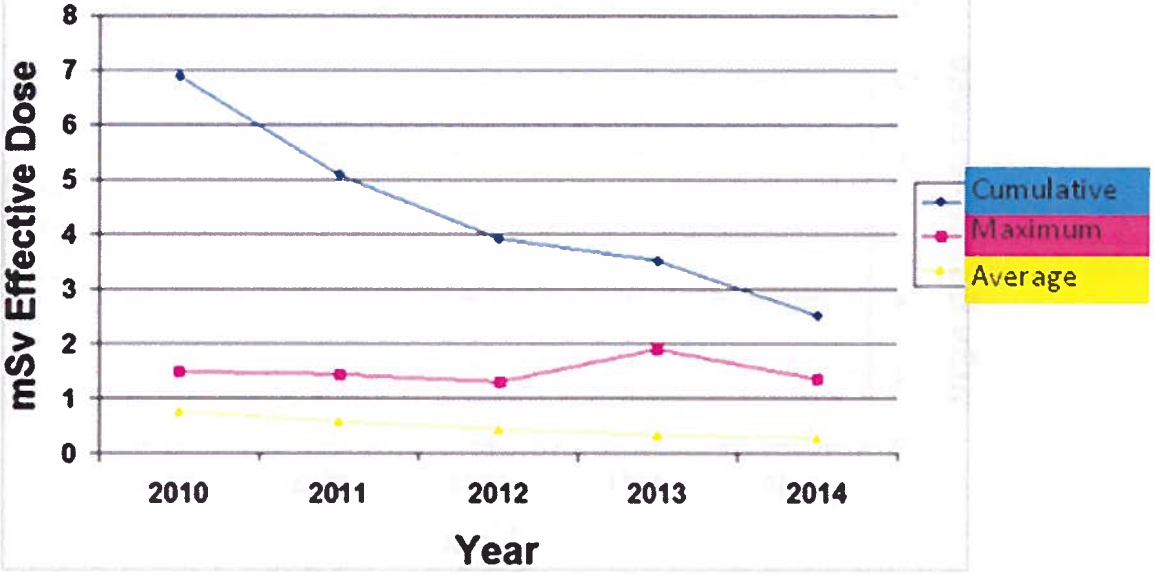


Figure 12: Nuclear Medicine QC

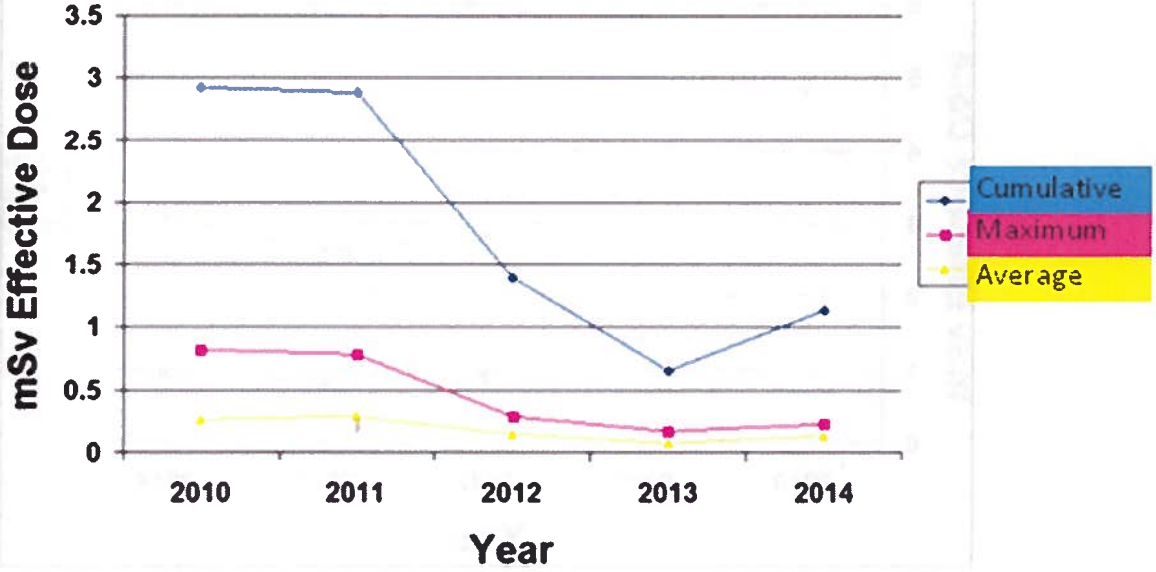


Figure 13: Surveyors

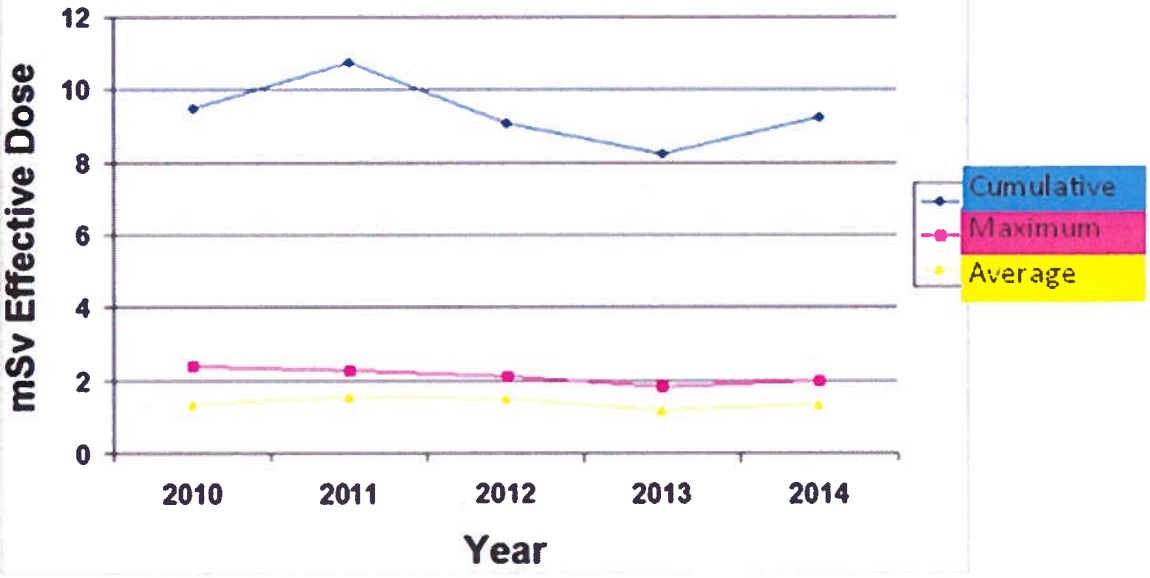


Figure 14: Nuclear Medicine Operators, Helpers

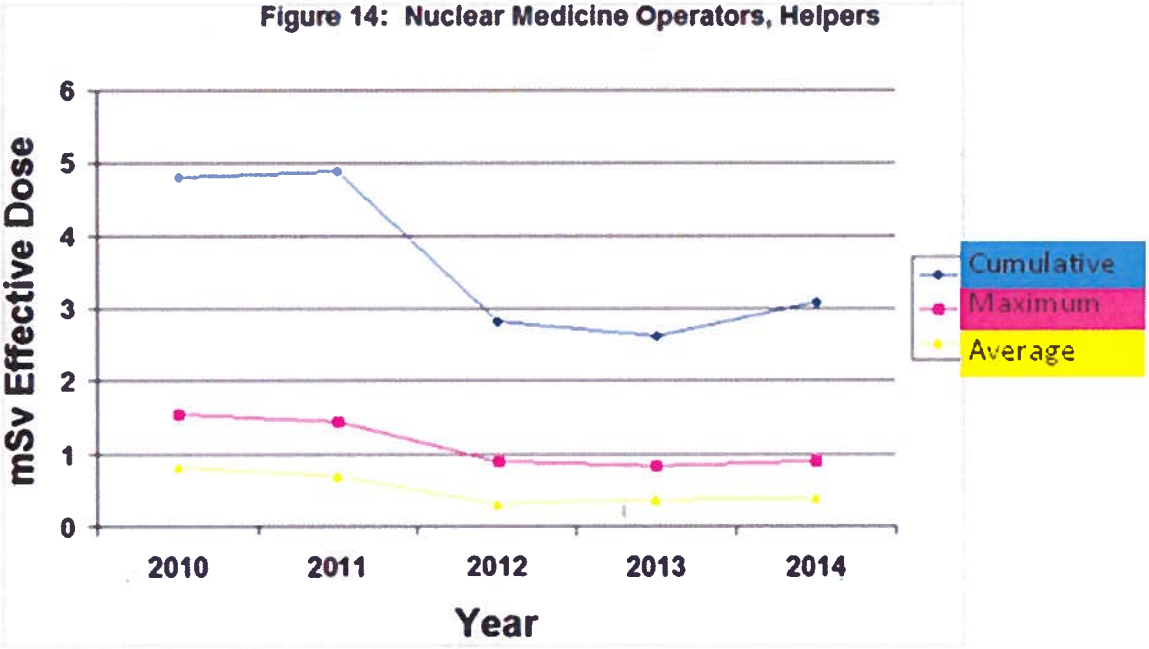


Figure 15: Nuclear Medicine Radiation and Contamination Monitors

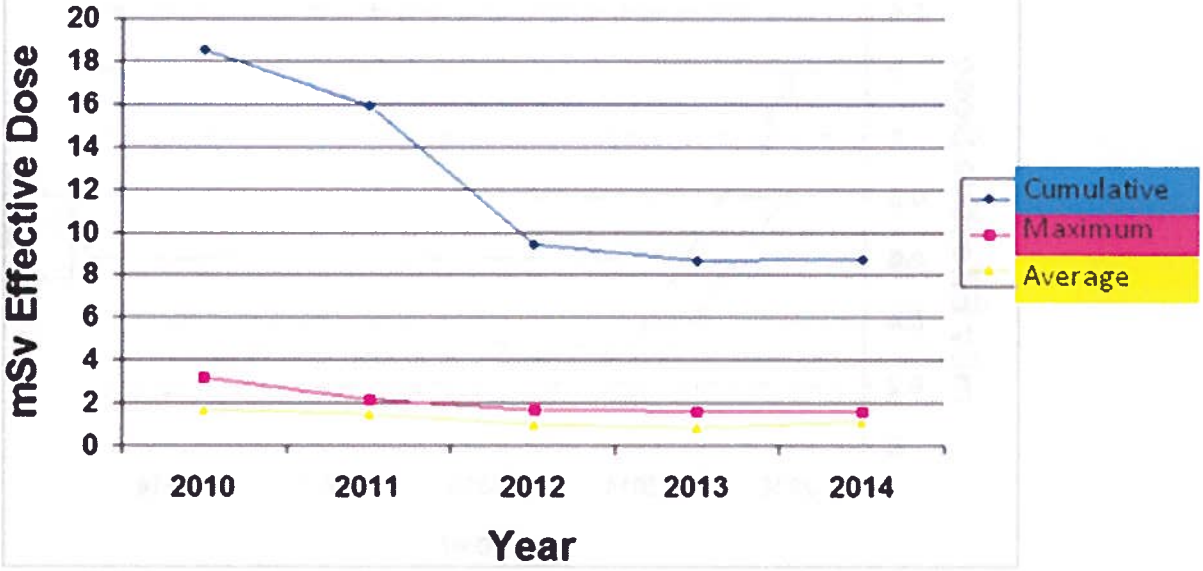


Figure 16: Facilities, Motor Pool

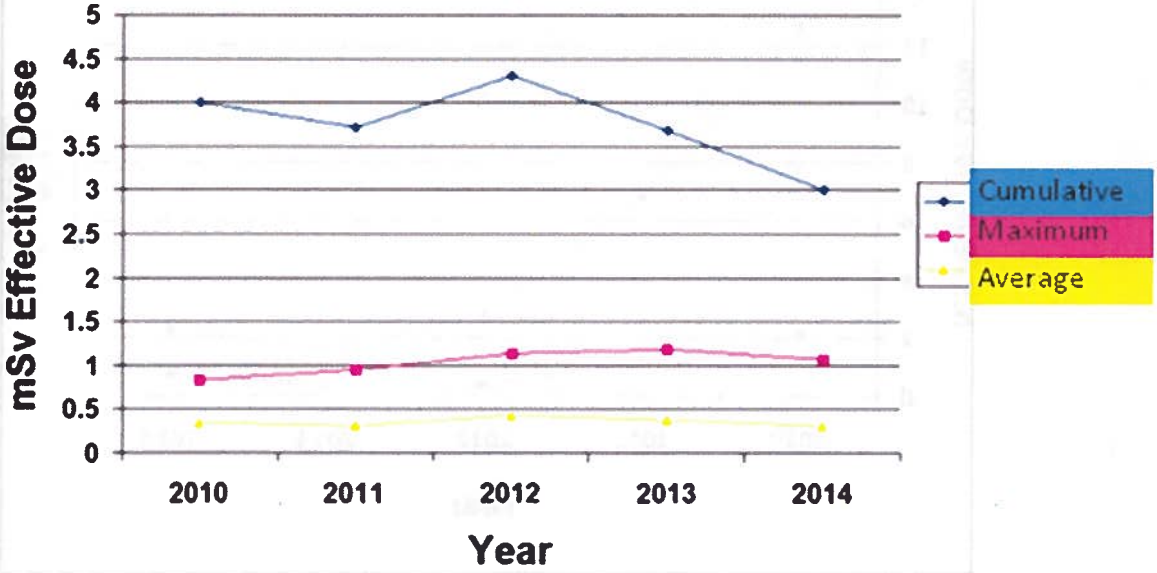


Figure 17: Facilities, Mechanical

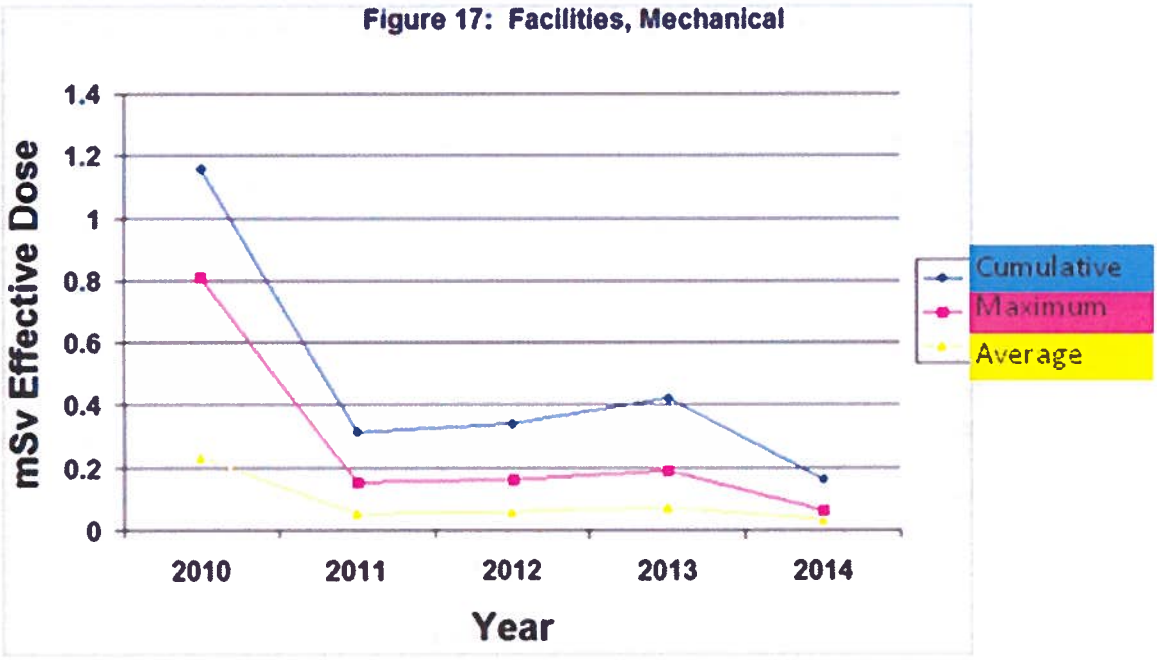
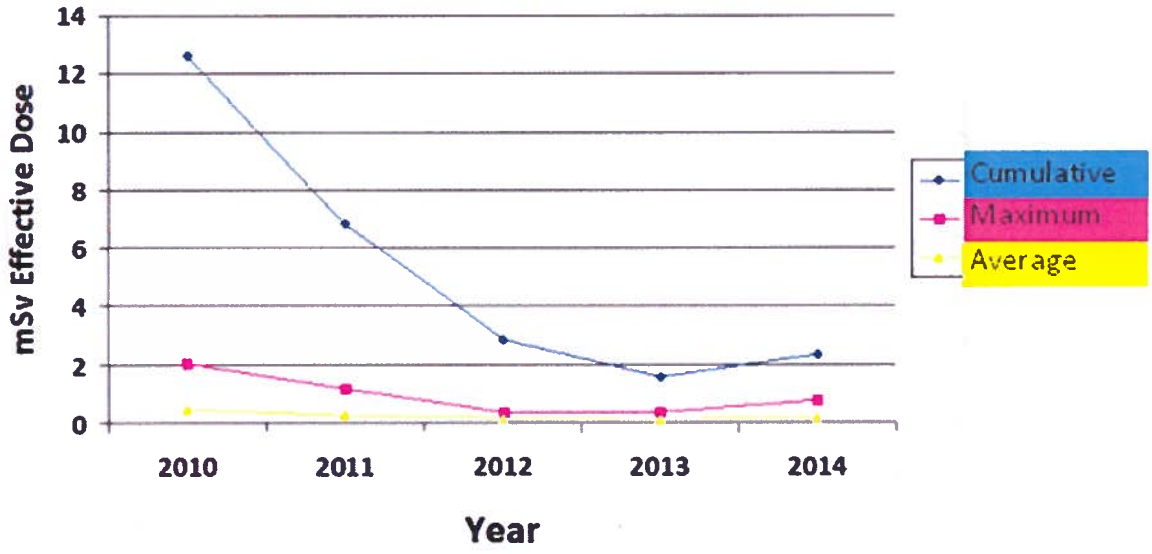


Figure 18: Radiopharm QC



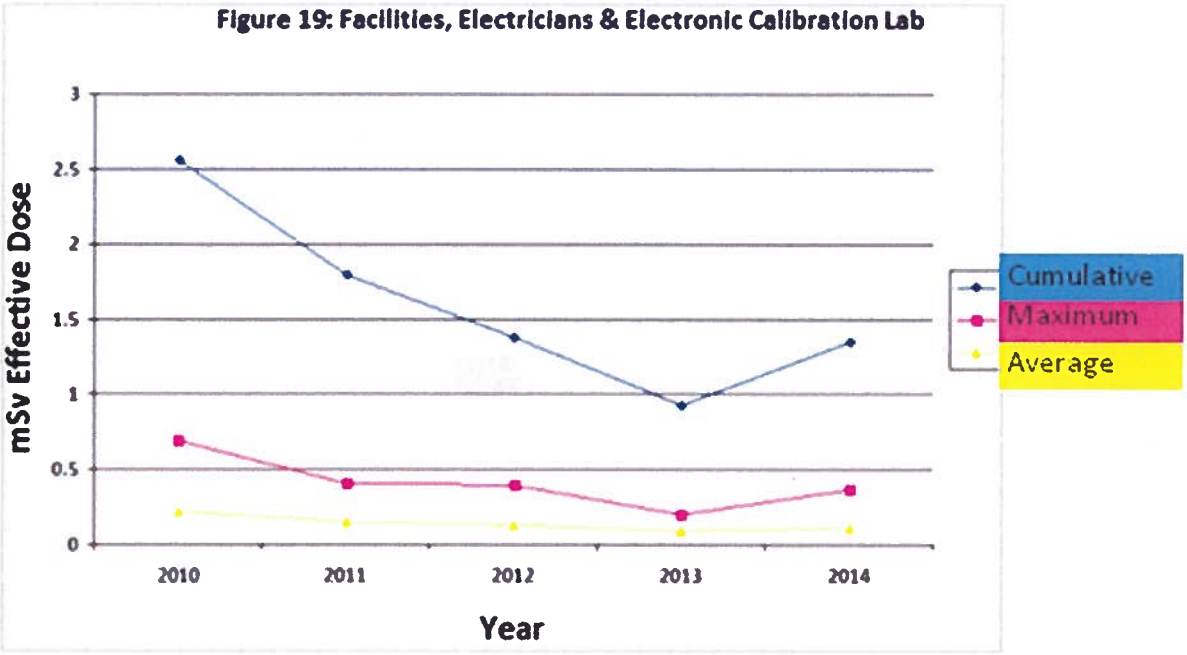


Figure 19: Facilities, Electricians & Electronic Calibration Lab
mSv Effective Dose
3
2.5
2
1.5
1
0.5
0
2010
2011
2012
2013
2014
Year
Cumulative
Maximum
Average

Figure 20 - Location of "Off Site" TLDs

Figure 21 - Location of "On Site" TLDs

Figure 22: Groundwater Well Locations

Appendix A
Table of Incidents

Date of Occurrence	Incident Number	Description	Reporting	Causes	Corrective Actions
16-Dec-13	14-01	A shipment of Y-90 was delivered to an end-user site. The activity of the dose exceeded the allowable activity on the site license.	Non-compliance with Section 13 of the General Nuclear Safety and Control regulations. Reportable as required by Section 6.1 (g) of Class 1B site license NSPFOL-11A.05/2015.	The shipment was supposed to be held at the carrier site; however, it was delivered early. There was not enough time for the dose to decay below the allowable possession limit.	This was the only such incident. No further corrective action required.
27-Jan-14	14-02	Export License Notifications were not submitted to the CNSC Nuclear Proliferation and Export Control Division (NPECD).	Non-compliance with condition 2.2 of export licenses issued to Nordion by the CNSC. Non-compliance with Section 48. (c) of the NSC Act. Reportable as required by Section 27(b)(ii) of NSC Act.	An incorrect date was entered on the Global Logistics Check Sheet as to when the PSV needed to be submitted.	Nordion instituted a second verification check of the shipping data for the notification.
13-Dec-14	14-03	A customer reported receiving a package with damage to the category labels.	Reportable as required by Section 19 (1)(b) of the Packaging and Transport of Nuclear Substances Regulations (PTNSR).	The labels were damaged in transit.	Feedback was provided to the carrier.

Date of Occurrence	Incident Number	Description	Reporting	Causes	Corrective Actions
19-Mar-14	14-04	Package containment was breached.	Non-compliance with condition of approval of transport certificate. Reportable as required by Section 6.1 (g) of Class 1B site license NSPFOL-11A.05/2015.	The amount of torque used for closure was too high and the insert caps were not adequately inspected prior to closure.	The supplier was notified. There was no leakage or contamination as a result of this issue.
24-Jan-14	14-05	Upon review of shipping documents an error was found where the total activity of the shipment was overstated.	Non-compliance with Section 17 (1) of PTNSR. Reportable as required by Section 6.1 (g) of Class 1B site license NSPFOL-11A.05/2015.	There was a calculation error when the shipping documents were prepared.	Technicians were made aware of the error.
09-May-14	14-06	The export of Co-60 sealed sources was not reported to the CNSC Sealed Source Tracking System (SSTS) within the required timeframe.	Non-compliance with Class 1B site license NSPFOL-11A.05/2015. Reportable as required by Section 6.1 (g) of Class 1B site license NSPFOL-11A.05/2015.	1) Human Engineering - The tracking systems prevent Global Logistics personnel from entering information when they are ready. 2) Communications - Improved verbal or written turnover of information between Global Logistics personnel could have prevented the issue.	Nordion is currently reviewing the reporting process.
06-May-14	14-07	Carrier made an error during delivery and mixed up two shipments. One shipment was delivered to a customer who was not licensed to receive the contents delivered.	Non-compliance with General Nuclear Safety and Control regulations - Section 13. Reportable as required by Section 6.1 (g) of Class 1B site license NSPFOL-11A.05/2015.	Mix-up of the carrier's secondary label, as a secondary routing label is used for some of Nordion's shipments.	Nordion notified the carrier. The carrier will no longer use a secondary label on Nordion packages.

Date of Occurrence	Incident Number	Description	Reporting	Causes	Corrective Actions
09-May-14	14-08	The import of Co-60 sealed sources was not reported to the CNSC SSTS within the required timeframe.	Non-compliance with Class 1B site license NSPFOL-11A.05/2015. Reportable as required by Section 6.1 (g) of Class 1B site license NSPFOL-11A.05/2015.	1) The policy regarding the timely notification of returns needs to be simplified. 2) The Decontamination Operator/Shipper did not realize the importance of correcting the error in the email notification of the return in a timely manner and of the importance of his role and responsibility for compliance with the policy.	1) The manual step of transcribing information from the paperwork into an email message will be removed. 2) The Sealed Source Reporting policy was reviewed with Nordion staff to reinforce the importance of timely communications to ensure accurate reporting to the CNSC SSTS.
23-Jun-14	14-11	Nordion was notified by a supplier that contamination was found on a transport package. The contamination was in excess of regulatory limits.	Reportable as required by Section 19 (1)(g) of PTNSR.	Nordion and the supplier reviewed the package handling requirements. The source of the contamination was undetermined. It originated either from loading at the supplier site, or through handling at Nordion.	Nordion and the supplier will continue to monitor the contamination level.
22-Aug-14	14-12	Customer returned a radioactive transport package without proper labeling and documentation.	Non-compliance with Section 16(4) and 17(1) of PTNSR. Reportable as required by Section 6.1 (g) of Class 1B site license NSPFOL-11A.05/2015.	Customer prepared package incorrectly.	Notifications with customer and freight forwarder have taken place. No further corrective action is required by Nordion.

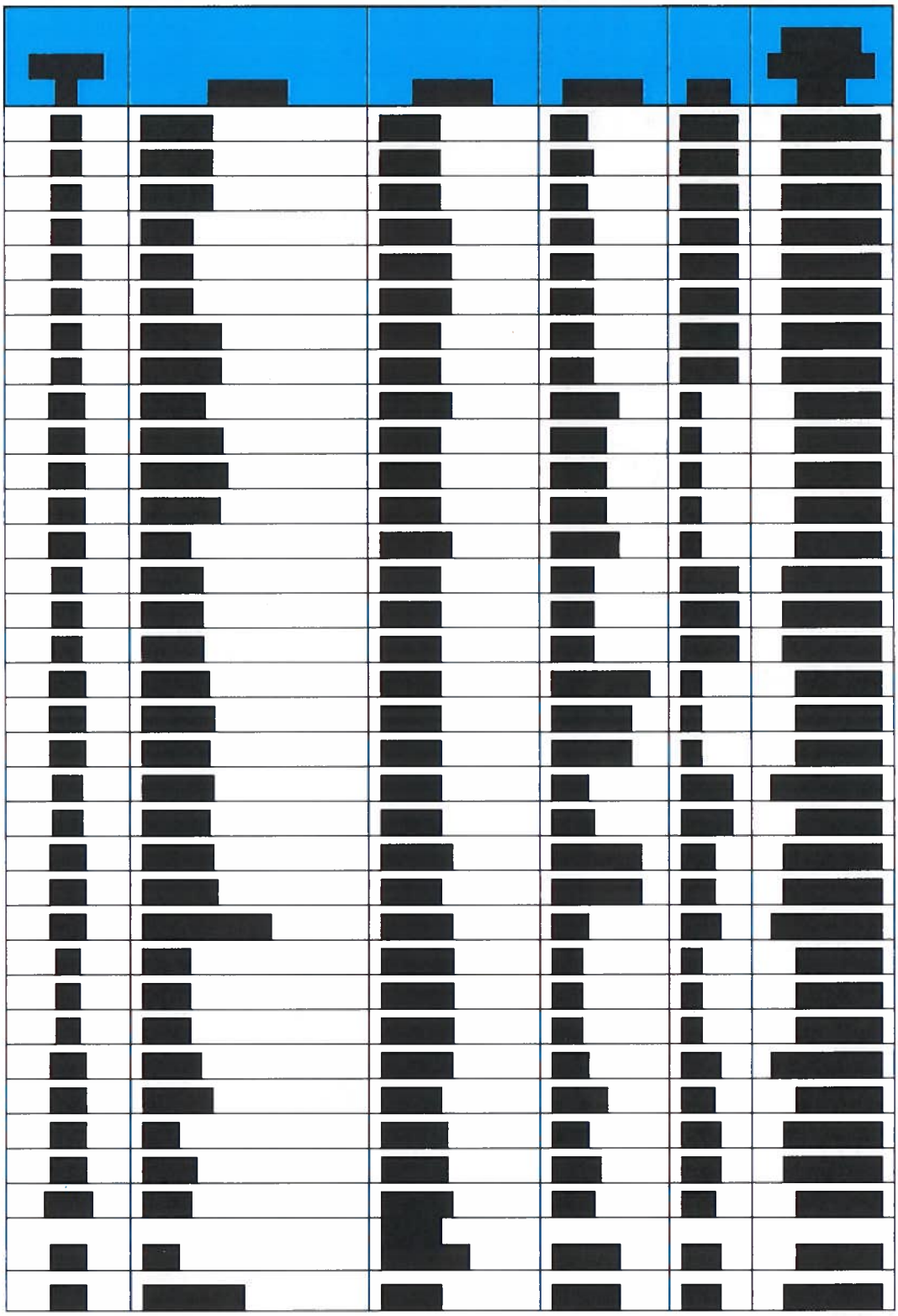
Date of Occurrence	Incident Number	Description	Reporting	Causes	Corrective Actions
28-Jul-14	14-13	Nordion did not submit Export License Notifications to the CNSC Nuclear Proliferation and Export Control Division (NPECD).	Non-compliance with condition 2.2 of export licenses issued to Nordion by the CNSC. Non-compliance with Section 48. (c) of the NSC Act. Reportable as required by Section 27(b)(ii) of NSC Act.	1) Standards, Policies or Administrative Controls Need Improvement - The process for tracking Post-shipment Verifications (PSVs) is manual. 2) Second Checker Needed - There is no verification of PSV completion. 3) Human Engineering - Better tools, alarms and displays are required. 4) Corrective Action Needs Improvement - Previous corrective actions were ineffective. 5) Work Package Needs Improvement - Workload and staffing levels to be assessed. 6) Training Needs Improvement - The training program for regulatory notifications needs improvement.	Improvements have been made to Nordion's processes and systems to perform and verify the required notifications to the CNSC for exports of sealed sources.
25-Aug-14	14-14	The import of Co-60 Sealed Sources to the CNSC SSTS within the required timeframe.	Non-compliance with Class 1B site license NSPFOL-11A.05/2015. Reportable as required by Section 6.1 (g) of Class 1B site license NSPFOL-11A.05/2015.	1) The display within the tracking system is set-up in such a way that makes it difficult to recognize that the status for all sources has been changed. 2) There is no policy requiring a second checker for this procedure. This step of the procedure has significant compliance risk to warrant having a second checker.	The process is being reviewed to identify areas where detection and correction of errors and/or verifications are needed.

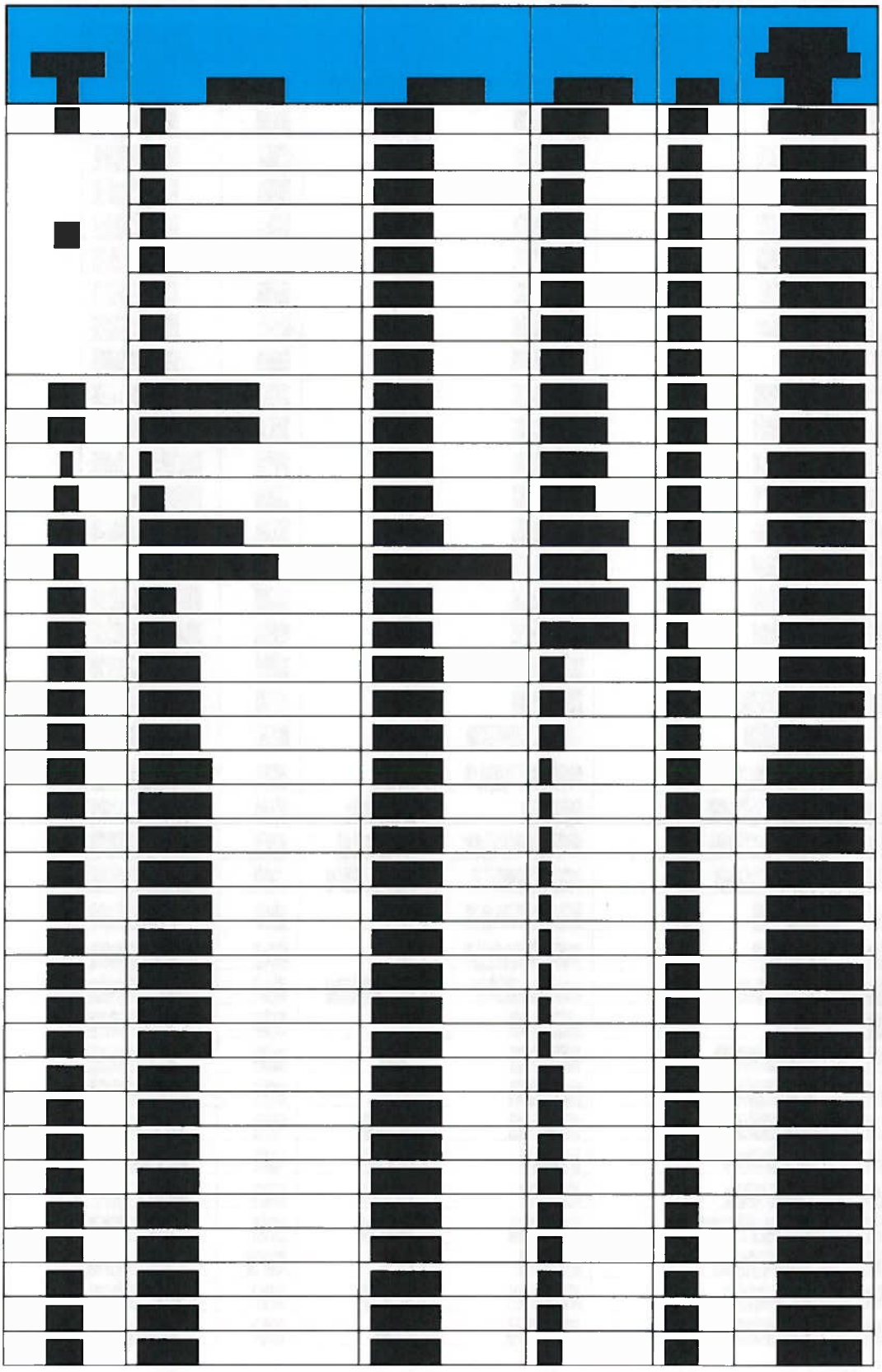
Date of Occurrence	Incident Number	Description	Reporting	Causes	Corrective Actions
16-Sep-14	14-15	The incorrect radiation category was stated on Nordion's shipping paperwork; however, the transport package was labeled appropriately.	Non-compliance with Section 16(4) and 17(1) of PTNSR. Reportable as required by Section 6.1 (g) of Class 1B site license NSPFOL-11A.05/2015.	Operator error.	Nordion personnel were retrained on company policies and procedures.
26-Sep-14	14-17	The date of transfer reported for the domestic transfer of Co-60 sealed sources was reported incorrectly to the CNSC SSTS.	Non-compliance with Class 1B site license NSPFOL-11A.05/2015. Reportable as required by Section 6.1 (g) of Class 1B site license NSPFOL-11A.05/2015.	Investigation is underway.	Nordion has assessed that there is no immediate impact to safety or security. Further investigation is underway to identify if corrective actions are required.
09-Oct-14	14-18	The transfers of Co-60 sealed sources were not reported to the CNSC SSTS within the required timeframe.	Non-compliance with Class 1B site license NSPFOL-11A.05/2015. Reportable as required by Section 6.1 (g) of Class 1B site license NSPFOL-11A.05/2015.	1) The process for ensuring source transfer records for sealed sources in waste are received by Forecasting & Planning is not adequate. 2) Production Operations does not have a process that requires verification that reporting to the CNSC SSTS has occurred prior to shipment.	A process will be implemented to ensure proper recording of sealed sources in waste and verification of reporting to the CNSC SSTS of shipment of sealed sources to waste disposal facilities prior to shipment.
20-Oct-14	14-19	Upon receipt of a transport package from a supplier, an amount of steam escaped when the vent line was opened.	Non-compliance with condition of approval of transport certificate. Reportable as required by Section 6.1 (g) of Class 1B site license NSPFOL-11A.05/2015.	Design issue.	Implementation of "jack bolts" to allow water to drain during loading.

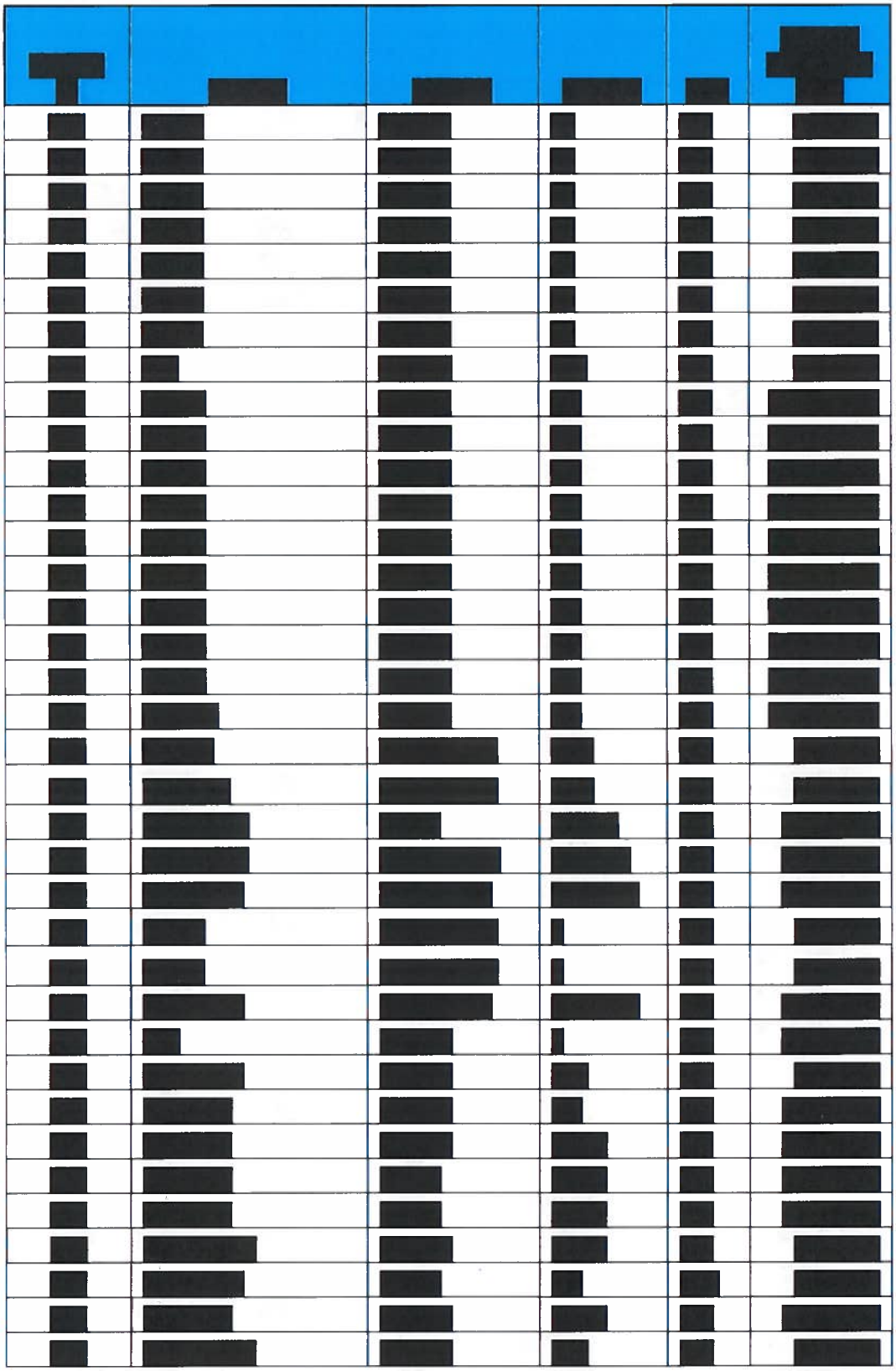
Date of Occurrence	Incident Number	Description	Reporting	Causes	Corrective Actions
10-Nov-14	14-20	Type A package showed evidence of tampering upon arrival at customer site. A customer noted that the tamper proof seal was broken upon arrival at their site.	Reportable as required by Section 19 (1)(b) of PTNSR.	Root cause was unknown.	Feedback was provided to the carrier.
Historical Issue	14-21	The export of Co-60 sealed sources was not reported to the CNSC SSTS.	Non-compliance with Class 1B site license NSPFOL-11A.05/2015. Reportable as required by Section 6.1 (g) of Class 1B site license NSPFOL-11A.05/2015.	Investigation is underway.	Nordion has assessed that there is no immediate impact to safety or security. Further investigation is underway to identify if corrective actions are required.
18-Dec-14	14-22	Leak testing not performed at the required frequency.	Non-compliance with Section 18 (1)(d) of the Nuclear Substances and Radiation Devices Regulations. Reportable as required by Section 6.1 (g) of Class 1B site license NSPFOL-11A.05/2015.	1) Quality Control –There is no check within the Access database, nor is there a manual verification of data. 2) Human Engineering – Errors are not detectable within the database.	The entry errors were corrected. Nordion will assess whether changes can be made to the current Leak Testing tracking system to ensure that any data entry errors are detectable. An alternate system will be implemented as required.

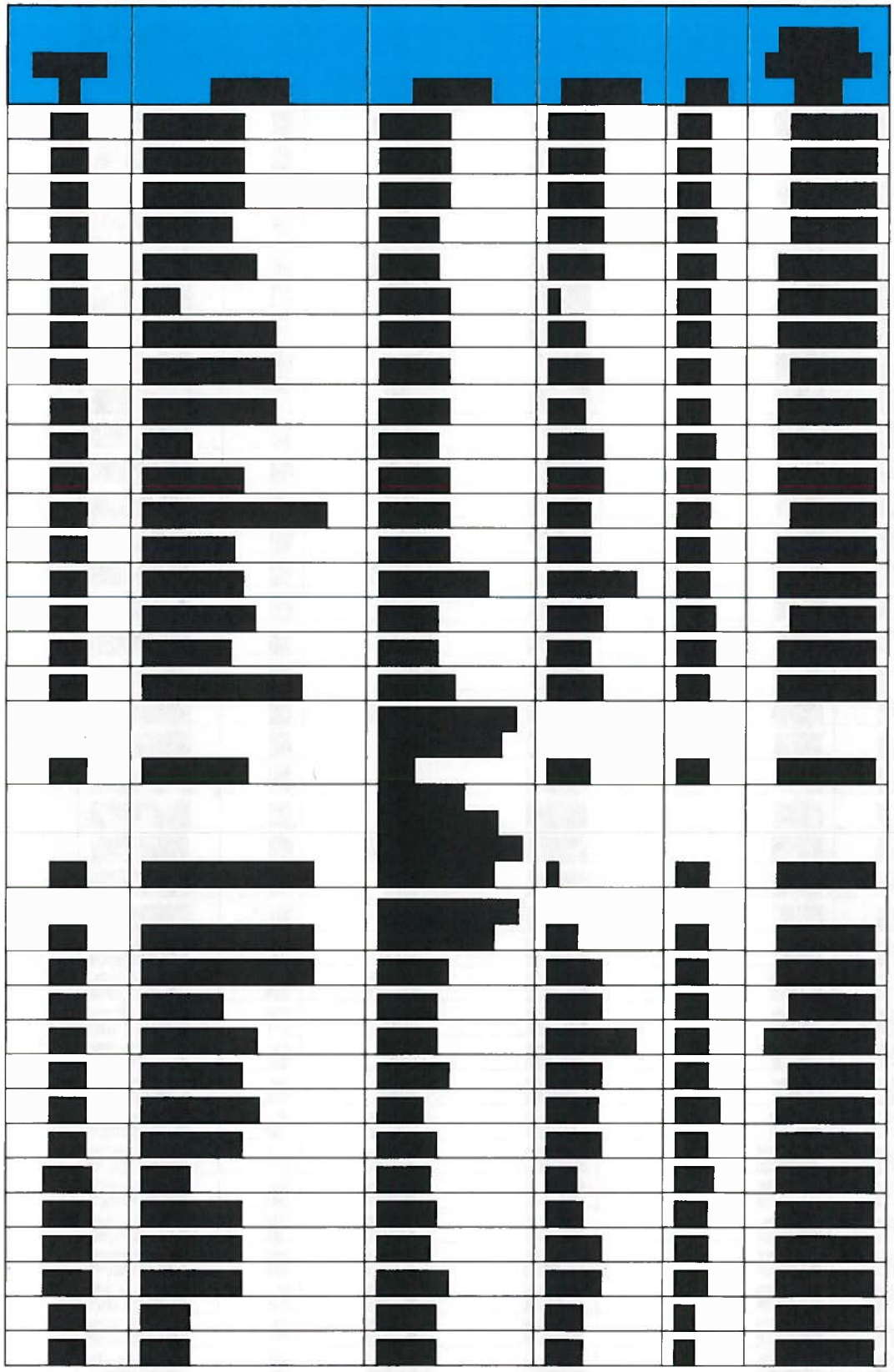
Date of Occurrence	Incident Number	Description	Reporting	Causes	Corrective Actions
16-Dec-14	14-23	The transfer of Co-60 sealed source was not reported to the CNSC SSTS within the required timeframe.	Non-compliance with Class 1B site license NSPFOL-11A.05/2015. Reportable as required by Section 6.1 (g) of Class 1B site license NSPFOL-11A.05/2015.	1) Standards, Policies or Administrative Controls Need Improvement - The process for checking and recording the waste pail number is not documented and is prone to error. The process used by Production to provide information to Forecasting & Planning does not ensure the correct information is provided and that errors are detectable. Production does not have a process that requires verification that reporting to SSTS has occurred prior to shipment of sealed sources to waste disposal facilities. 2) Quality Control - The process for verifying the waste pail number is prone to error. 3) Corrective Action Not Yet Implemented - Previous corrective actions had not yet been identified or implemented.	A physical inventory of all waste pails to identify presence of any sealed sources was conducted. The processes for the initial check and recording and the independent verification of the waste pail number will be assessed and modification implemented and documented, as required. A documented process will be put in place to ensure that the presence of sealed sources in waste pails is adequately recorded and communicated and to verify that SSTS reporting has been completed.
29-Dec-14	14-24	Information was missing from one category label on the outside of a transport package.	Non-compliance with Section 15 (1) of PTNSR. Reportable as required by Section 6.1 (g) of Class 1B site license NSPFOL-11A.05/2015.	The supplier did not correctly fill out the information on the label.	Nordion advised the supplier of the error.

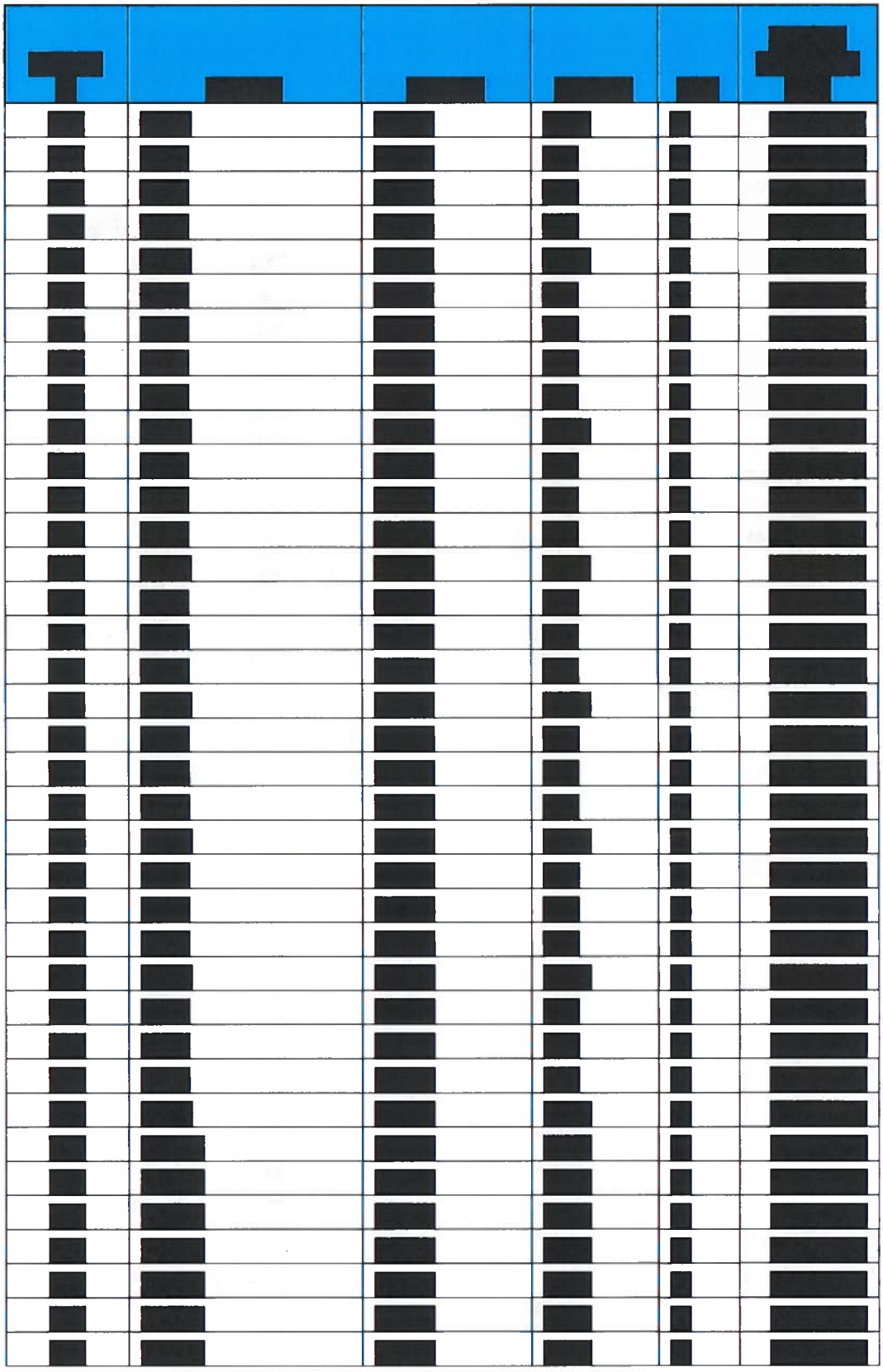
Appendix B
Non-Production Sealed and Unsealed Source Inventory

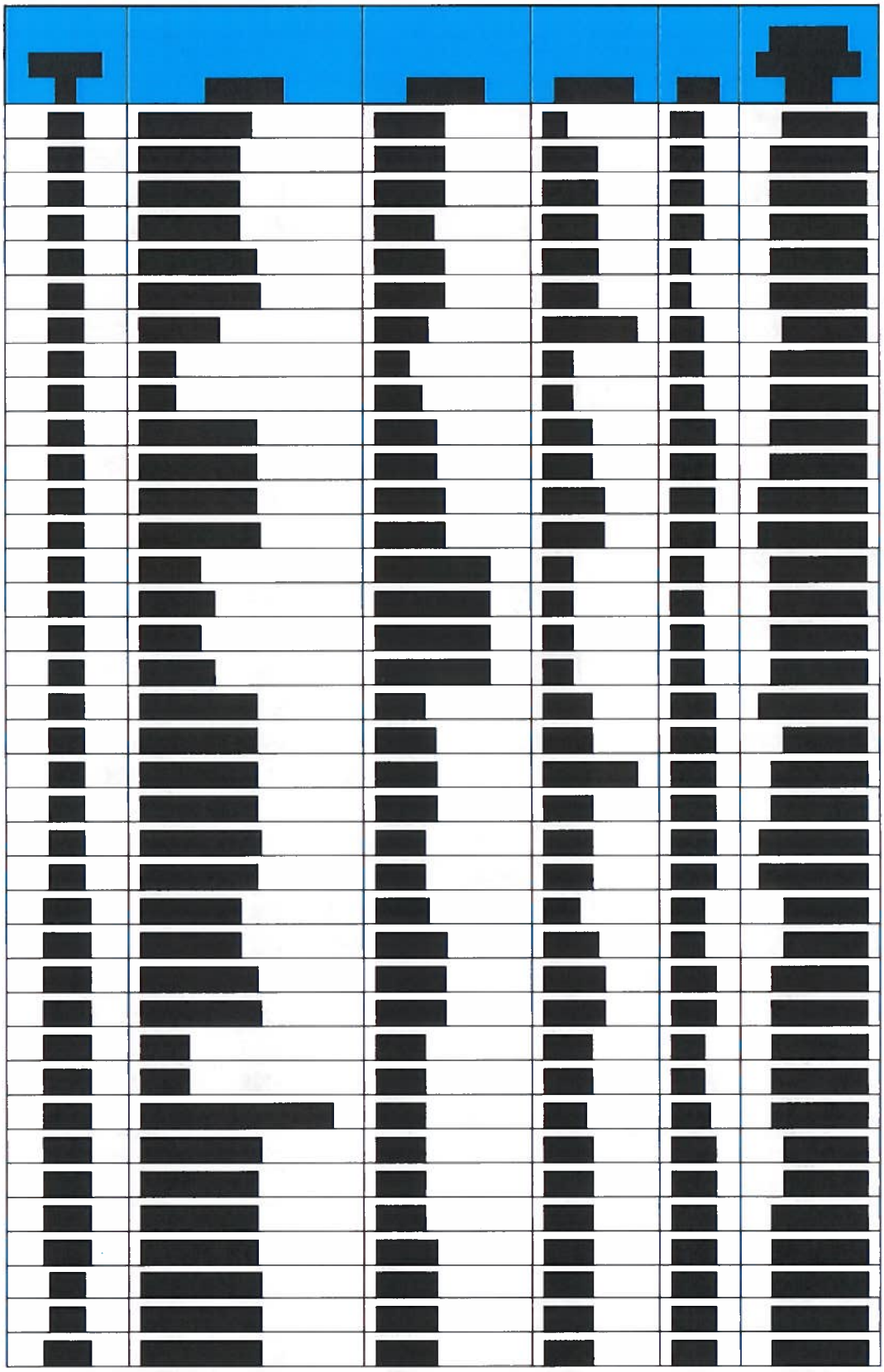


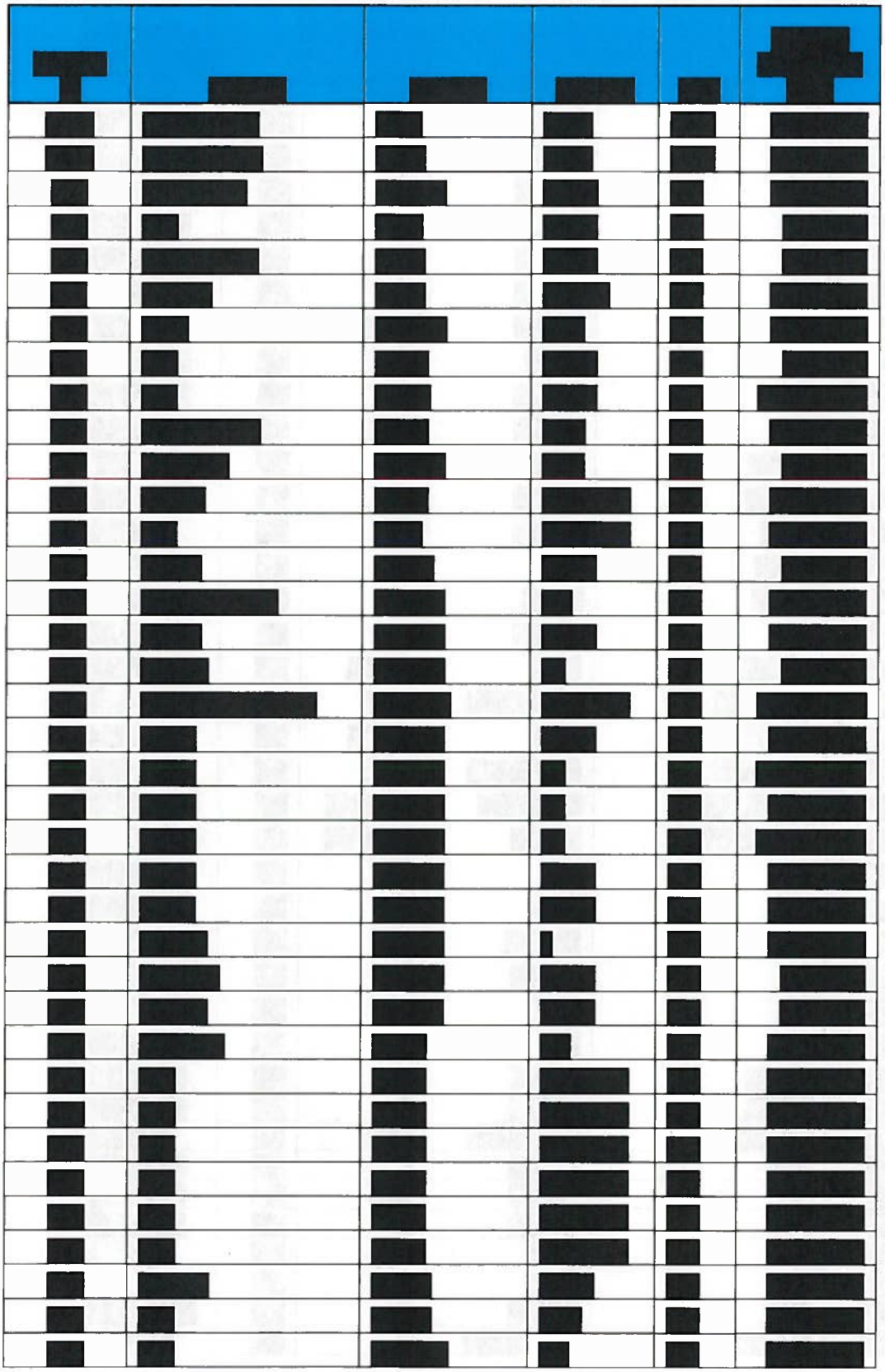


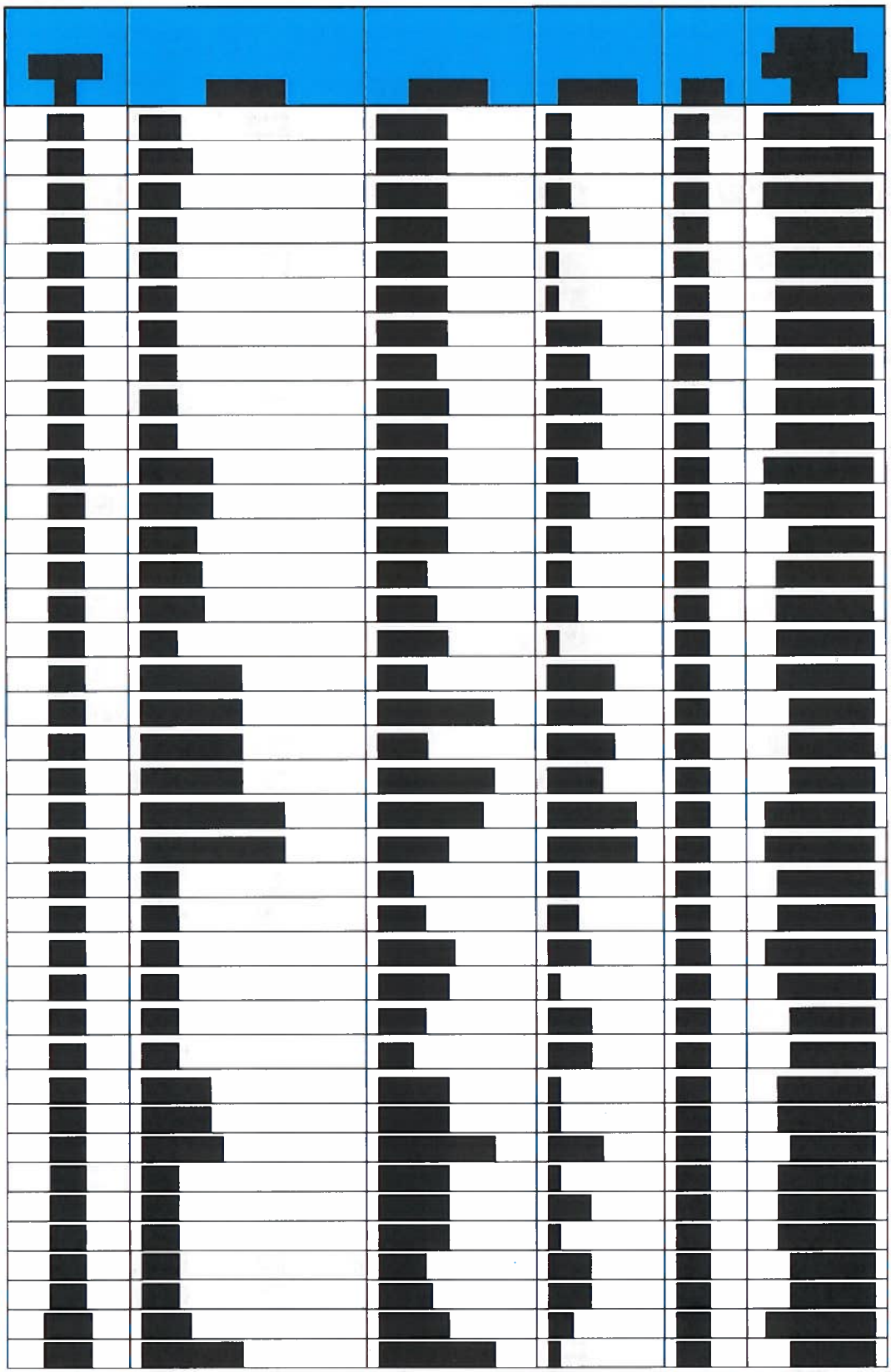


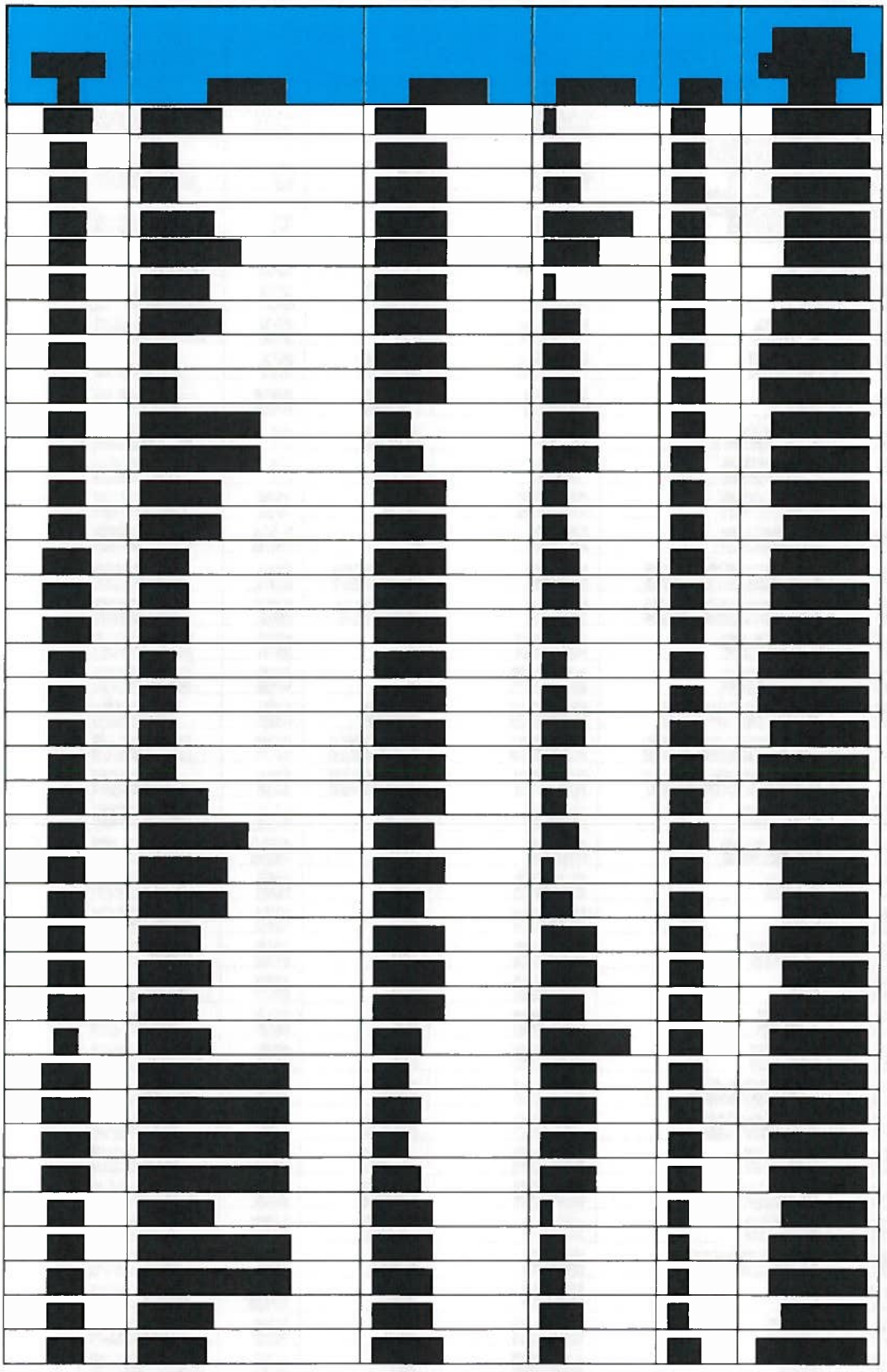


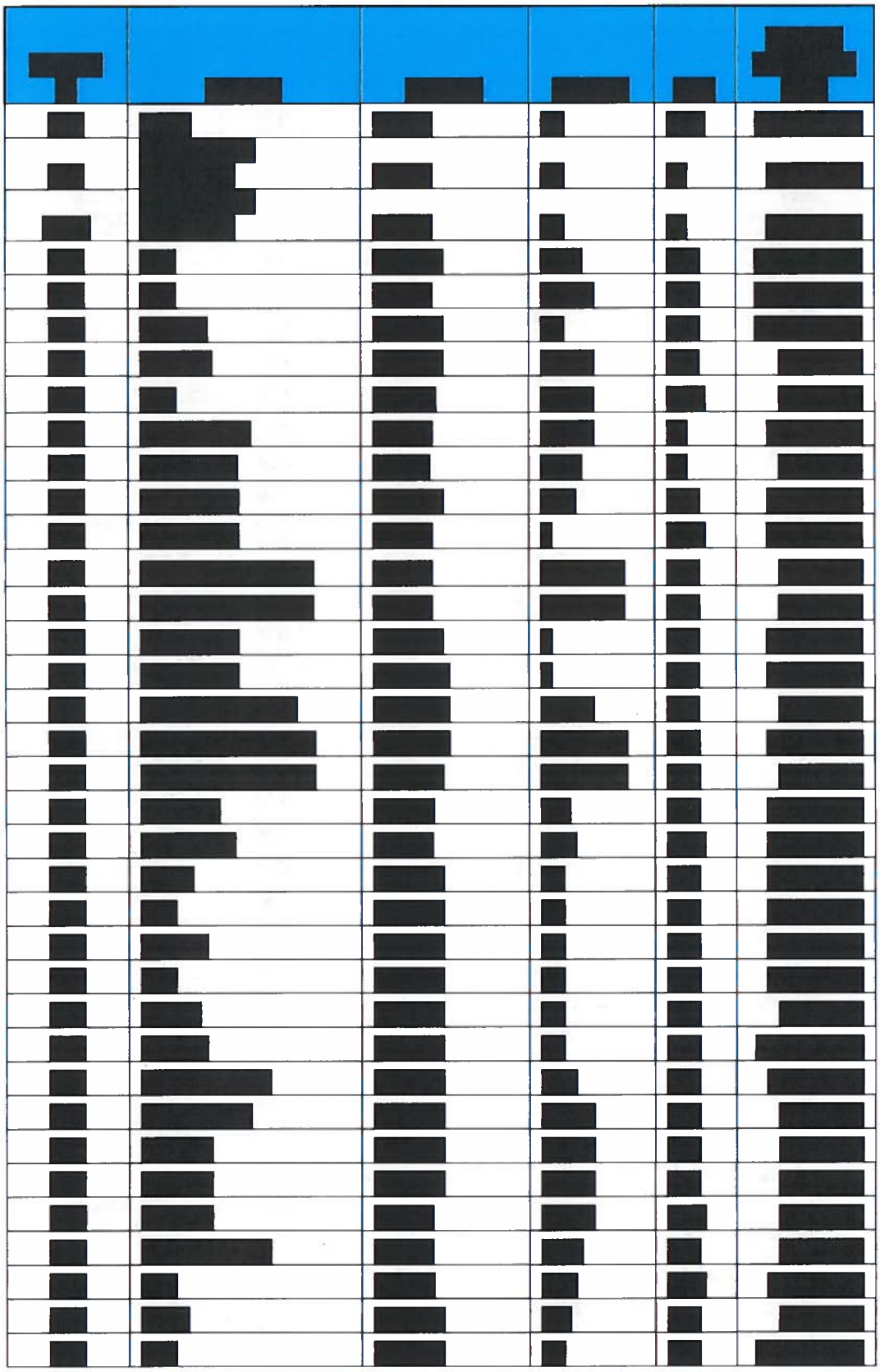


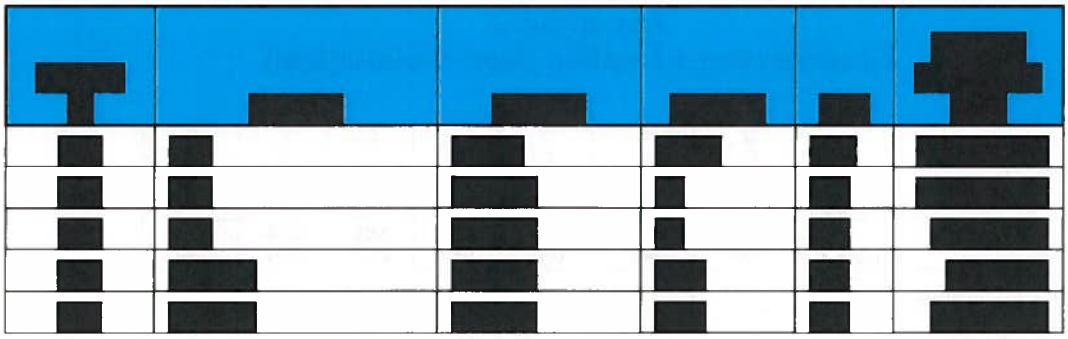












Appendix C
Groundwater Sampling (Non-radiological)

			Sample Date:	2013-09-18	2012-11-16	2011-11-01	2010-10-18	2009-10-06	2005-04-07
			Sample ID:	2005-BH1	2005-BH1	2005-BH1	2005-BH1	2005-BH1	2005-BH1
Parameter	**UNITS**	**MDL**							
Alkalinity as CaCO3	mg/L	5	507	493	536	505	496	207	409
Biochemical Oxygen Demand	mg/L	1	<1	2	12	1	<1	3	<1
Chemical Oxygen Demand	mg/L	5	13	5	25	15	15	6	29
Chloride (Cl)	mg/L	1	77	46	97	78	53	49	76
Conductivity	µS/cm	5	1200	1110	1320	1190	1170	1200	1130
Dissolved Organic Carbon	mg/L	0.5	4.0	3.0	6.5	3.8	3	3.5	8.8
N-NH3 (Ammonia)	mg/L	0.02	0.18	0.12	0.12	0.1	0.07	0.07	0.09
N-NO3 (Nitrate)	mg/L	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
pH	n/a	n/a	7.89	7.76	7.69	7.72	7.77	7.76	7.58
Sulphate (SO4)	mg/L	1	51	60	59	62	77	86	92
TDS (COND - CALC)	mg/L	5	780	722	858	774	761	780	735
Total Suspended Solids	mg/L	2	62	36	51	36	52	41	1820
Calcium (Ca)	mg/L	1	120	90	115	108	86	87	118
Magnesium (Mg)	mg/L	1	52	39	61	52	38	40	60
Sodium (Na)	mg/L	2	70	102	68	66	101	106	33
Barium (Ba)	mg/L	0.01	0.12	0.07	0.08	0.07	<0.1	0.06	0.08
Boron (B)	mg/L	0.01	0.09	0.05	0.1	0.09	0.1	0.07	0.12
Iron (Fe)	mg/L	0.03	0.76	0.35	0.69	0.19	<0.3	0.56	<0.01
CCME Total Petroleum Hydrocarbons									
F1 (C6-C10)	mg/L	0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2
F2 (C10-C16)	mg/L	0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2
F3 (C16-C34)	mg/L	0.5	<0.5	0.5 <0.2*	<0.2	<0.2	<0.2	<0.2	<0.2
F4 (C34-C50)	mg/L	0.5	<0.5	<0.2	<0.2	<0.2	<0.2	<0.2	0.4

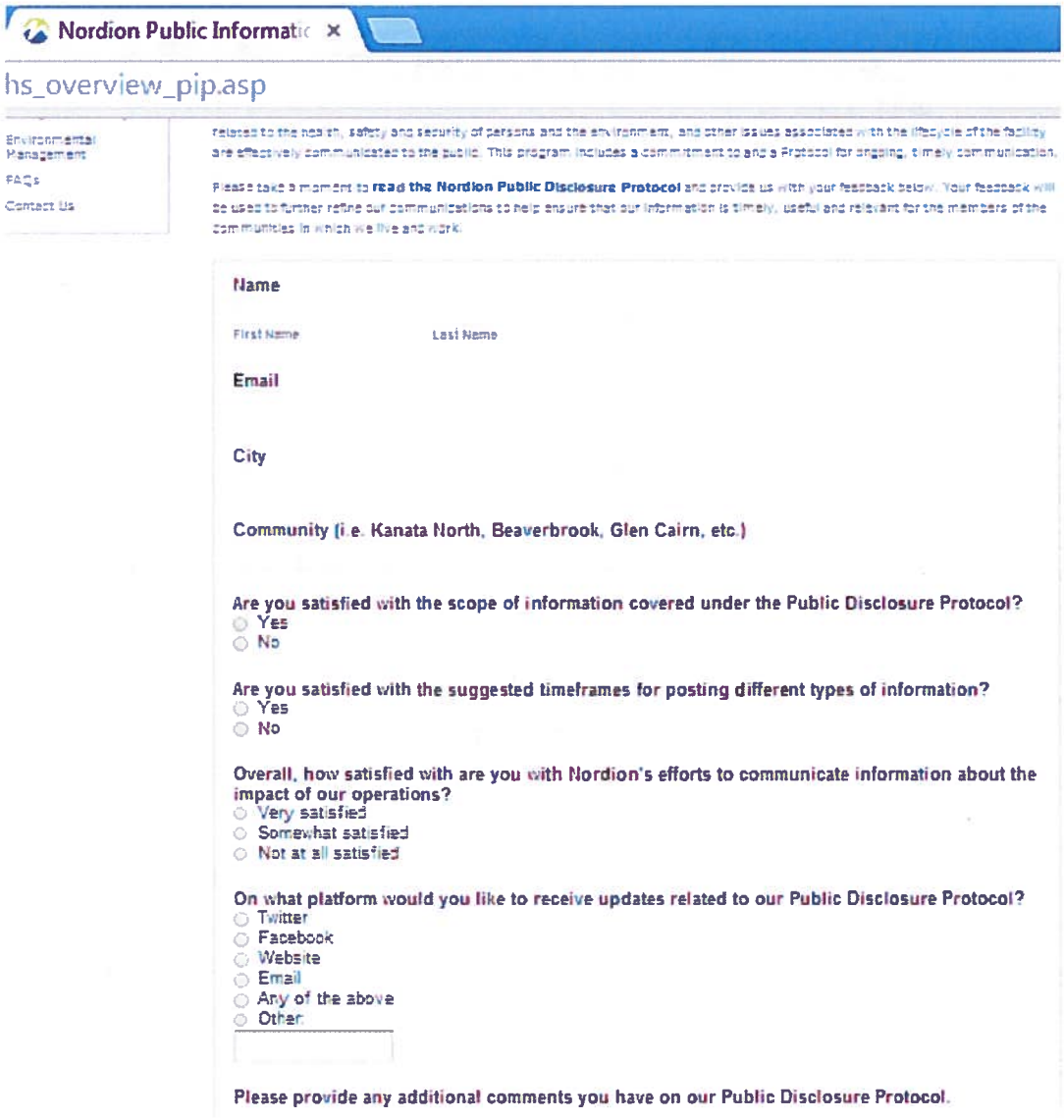
* Note: The initial sample from 2005-BH1 taken September 18, 2013 indicated 0.5 mg/L of F3 (hydrocarbon). As a result, a second sample was taken from 2005-BH1 November 16, 2013. Results from the second sample indicated that F3 was below detectable limits (< 200 µg/L).

2005 - Borehole 2 (Background Well)									
		Sample Date:	2014-10-29	2013-09-18	2012-11-16	2011-11-01	2010-10-18	2009-10-06	2005-04-07
		Sample ID:	2005-BH2	2005-BH2	2005-BH2	2005-BH2	2005-BH2	2005-BH2	2005-BH2
Parameter	UNITS	MDL							
Alkalinity as CaCO3	mg/L	5	329	314	308	309	296	304	278
Biochemical Oxygen Demand	mg/L	1	<1	1	8	1	<1	2	<1
Chemical Oxygen Demand	mg/L	5	8	<5	29	5	5	<5	7
Chloride (Cl)	mg/L	1	139	89	76	84	76	91	40
Conductivity	µS/cm	5	1080	888	834	828	822	887	676
Dissolved Organic Carbon	mg/L	0.5	2.2	1.6	5.7	1.6	1.4	2.8	1.6
N-NH3 (Ammonia)	mg/L	0.02	0.13	0.08	<0.02	<0.02	<0.02	<0.02	0.02
N-NO3 (Nitrate)	mg/L	0.1	0	0	0	0.24	0.52	0	0.53
pH			7.96	7.82	7.80	7.65	7.80	7.85	7.71
Sulphate (SO4)	mg/L	1	24	23	23	21	22	22	22
TDS (COND - CALC)	mg/L	5	702	577	542	538	534	577	439
Total Suspended Solids	mg/L	2	58	24	18	56	6	43	1390
Calcium (Ca)	mg/L	1	125	97	92	94	97	96	80
Magnesium (Mg)	mg/L	1	44	37	33	32	34	32	29
Sodium (Na)	mg/L	2	38	30	29	25	26	22	18
Barium (Ba)	mg/L	0.01	0.02	0.02	<0.01	0.02	<0.1	0.02	0.02
Boron (B)	mg/L	0.01	0.03	0.03	0.03	0.02	<0.1	0.03	0.07
Iron (Fe)	mg/L	0.03	0.27	0.24	0.19	<0.03	<0.3	0.25	<0.01
CCME Total Petroleum Hydrocarbons									
F1 (C6-C10)	mg/L	0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2
F2 (C10-C16)	mg/L	0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2
F3 (C16-C34)	mg/L	0.5	<0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
F4 (C34-C50)	mg/L	0.5	<0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

2005 - Borehole 3									
	Sample Date:		2014-10-29	2013-09-18	2012-11-16	2011-11-01	2010-10-18	2009-10-06	2005-04-07
	Sample ID:		2005-BH3	2005-BH3	2005-BH3	2005-BH3	2005-BH3	2005-BH3	2005-BH3
Parameter	**UNITS**	**MDL**							
Alkalinity as CaCO3	mg/L	5	481	471	481	484	471	479	471
Biochemical Oxygen Demand	mg/L	1	<1	2	>21	1	<1	3	<1
Chemical Oxygen Demand	mg/L	5	11	8	61	10	13	7	10
Chloride (Cl)	mg/L	1	66	59	57	56	49	43	64
Conductivity	µS/cm	5	1170	1140	1150	1120	1110	1110	1170
Dissolved Organic Carbon	mg/L	0.5	3.2	3.0	9.5	3.0	3.0	3.8	3.3
N-NH3 (Ammonia)	mg/L	0.02	0.26	0.06	0.06	0.03	0.13	0.07	0.09
N-NO3 (Nitrate)	mg/L	0.1	0.35	<0.10	0.15	0.18	0.29	0.34	<0.10
pH			8.00	7.81	7.88	7.81	7.79	7.84	7.49
Sulphate (SO4)	mg/L	1	70	77	78	74	83	74	81
TDS (COND - CALC)	mg/L	5	760	741	748	728	722	722	761
Total Suspended Solids	mg/L	2	18	8	8	6	9	16	496
Calcium (Ca)	mg/L	1	112	97	104	96	104	95	121
Magnesium (Mg)	mg/L	1	47	45	46	41	45	39	51
Sodium (Na)	mg/L	2	87	84	87	76	84	76	63
Barium (Ba)	mg/L	0.01	0.09	0.09	0.07	0.05	<0.1	0.06	0.06
Boron (B)	mg/L	0.01	0.28	0.25	0.28	0.17	0.20	0.20	0.14
Iron (Fe)	mg/L	0.03	0.12	0.04	<0.03	<0.03	<0.3	0.03	<0.01
CCME Total Petroleum Hydrocarbons									
F1 (C6-C10)	mg/L	0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2
F2 (C10-C16)	mg/L	0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2
F3 (C16-C34)	mg/L	0.5	<0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
F4 (C34-C50)	mg/L	0.5	<0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

2005 - Borehole 4									
	Sample Date:		2014-10-29	2013-09-18	2012-11-16	2011-11-01	2010-10-18	2009-10-06	2005-04-07
	Sample ID:		2005-BH4	2005-BH4	2005-BH4	2005-BH4	2005-BH4	2005-BH4	2005-BH4
Parameter	UNITS	MDL							
Alkalinity as CaCO3	mg/L	5	272	264	245	275	278	275	279
Biochemical Oxygen Demand	mg/L	1	2	2	5	1	<1	5	<1
Chemical Oxygen Demand	mg/L	5	13	<5	18	5	13	9	6
Chloride (Cl)	mg/L	1	22	18	15	32	27	18	15
Conductivity	µS/cm	5	665	657	611	684	679	676	646
Dissolved Organic Carbon	mg/L	0.5	3.4	2.5	4.7	2.9	3.4	3.0	2.1
N-NH3 (Ammonia)	mg/L	0.02	0.35	0.29	0.12	0.14	0.19	0.21	0.17
N-NO3 (Nitrate)	mg/L	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
pH			8.10	7.97	7.92	7.53	7.90	7.97	7.84
Sulphate (SO4)	mg/L	1	58	55	56	52	45	58	41
TDS (COND - CALC)	mg/L	5	432	427	397	445	441	439	420
Total Suspended Solids	mg/L	2	4	<2	10	4	<2	5	175
Calcium (Ca)	mg/L	1	45	36	36	56	41	35	39
Magnesium (Mg)	mg/L	1	18	16	14	21	17	16	18
Sodium (Na)	mg/L	2	78	81	78	47	76	81	76
Barium (Ba)	mg/L	0.01	0.08	0.07	0.05	0.08	<0.1	0.06	0.07
Boron (B)	mg/L	0.01	0.27	0.22	0.24	0.11	<0.1	0.19	0.19
Iron (Fe)	mg/L	0.03	1.26	0.29	0.71	0.23	<0.3	0.25	0.16
CCME Total Petroleum Hydrocarbons									
F1 (C6-C10)	mg/L	0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2
F2 (C10-C16)	mg/L	0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2
F3 (C16-C34)	mg/L	0.5	<0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
F4 (C34-C50)	mg/L	0.5	<0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

Appendix D.1
Copy of Nordion Feedback Survey on nordion.com - Public Disclosure Protocol Consultation



Nordion Public Informatic ×

hs_overview_pip.asp

Environmental Management

FAQs

Contact Us

related to the health, safety and security of persons and the environment, and other issues associated with the lifecycle of the facility are effectively communicated to the public. This program includes a commitment to and a Protocol for ongoing, timely communication.

Please take a moment to **read the Nordion Public Disclosure Protocol** and provide us with your feedback below. Your feedback will be used to further refine our communications to help ensure that our information is timely, useful and relevant for the members of the communities in which we live and work.

Name

First Name Last Name

Email

City

Community (i.e. Kanata North, Beaverbrook, Glen Cairn, etc.)

Are you satisfied with the scope of information covered under the Public Disclosure Protocol?
- Yes
- No

Are you satisfied with the suggested timeframes for posting different types of information?
- Yes
- No

Overall, how satisfied with are you with Nordion's efforts to communicate information about the impact of our operations?
- Very satisfied
- Somewhat satisfied
- Not at all satisfied

On what platform would you like to receive updates related to our Public Disclosure Protocol?
- Twitter
- Facebook
- Website
- Email
- Any of the above
- Other

Please provide any additional comments you have on our Public Disclosure Protocol.

Appendix D.2
Ads Placed in Local Newspaper

nordion
SCIENCE ADVANCING HEALTH

Committed to Health and Safety of our Class 1B Nuclear Facility

Our Work

Nordion is a global health science company that provides market-leading products used for the prevention, diagnosis and treatment of disease. We are a leading provider of sterilization technologies and medical isotopes that benefit the lives of millions of people in more than 40 countries around the world.

Our products are used daily by pharmaceutical and biotechnology companies, medical-device manufacturers, hospitals, clinics and research laboratories.

Our Commitment

Nordion's core company purpose is to make a distinctive contribution to the health and well-being of people. This extends to protecting the safety of our employees, our community and the environment. For over 60 years, Nordion has been an industry leader in safe work practices and environmental protection. Nordion's Class 1B nuclear facility in Kanata is certified to ISO 14001, an international standard for environmental management systems.

Nordion is currently reviewing its Public Information Program (PIP), which includes a commitment to and a Protocol for ongoing, timely communication. We want to hear from you to help ensure that the information we share is timely, useful and relevant to the members of the communities in which we live and work.

To provide your feedback or for more information, please visit: **nordion.com/pip**

Figure D.1: Copy of ad placed in the October 2014 Issue of the *Kanata Kourier*

Appendix D.2, continued
Copy of Ad Placed in the December 2014 Issue of the *Kanata Kourier*

Figure D.2: Copy of ad placed in the December 2014 issue of the *Kanata Kourier*

Appendix D.3
Results of Formal Polling

Nordion has positive image in community

There is a considerable awareness gap but an interest in learning more

Many people who live within 10km of the facility are not familiar with it. In fact, only 16% are familiar and 29% are somewhat familiar. For those that are familiar, 35% know it for medical isotopes and 28% merely know where the facility is located.

Less than one in five (18%) have definitely (10%) or maybe (8%) heard something about Nordion in the news. For those that have heard something in the news, the most recalled topics are Rezoning property/School property and development (21%), ownership changes (21%), and isotope shortages (15%).

Favourable views considerably outnumber unfavourable ones. Almost half (46%) of local residents are positive and another 18% are somewhat positive. There are, however, 31% who are unsure. For those who are positive, Nordion's role in health care is critical. The importance of the products (19%), their perceived involvement in cancer research (12%), and help for the medical community (11%) are most mentioned as reasons for feeling positive.

Over half (53%) of local residents rate the Nordion facility in Kanata as safe (8-10 out of 10) compared with only 2% who consider it not safe (1-3). Many are, however unsure (28%).

Thirty-one percent are interested and 38% somewhat interested in learning more about Nordion. Interest is highest for what Nordion does (37%) and the effects on community safety (14%), The news (31%) and a printed leaflet or brochure distributed in the community (30%) are the methods most preferred for learning about the facility.

Appendix D.4
Promotion of December 10 Community Café

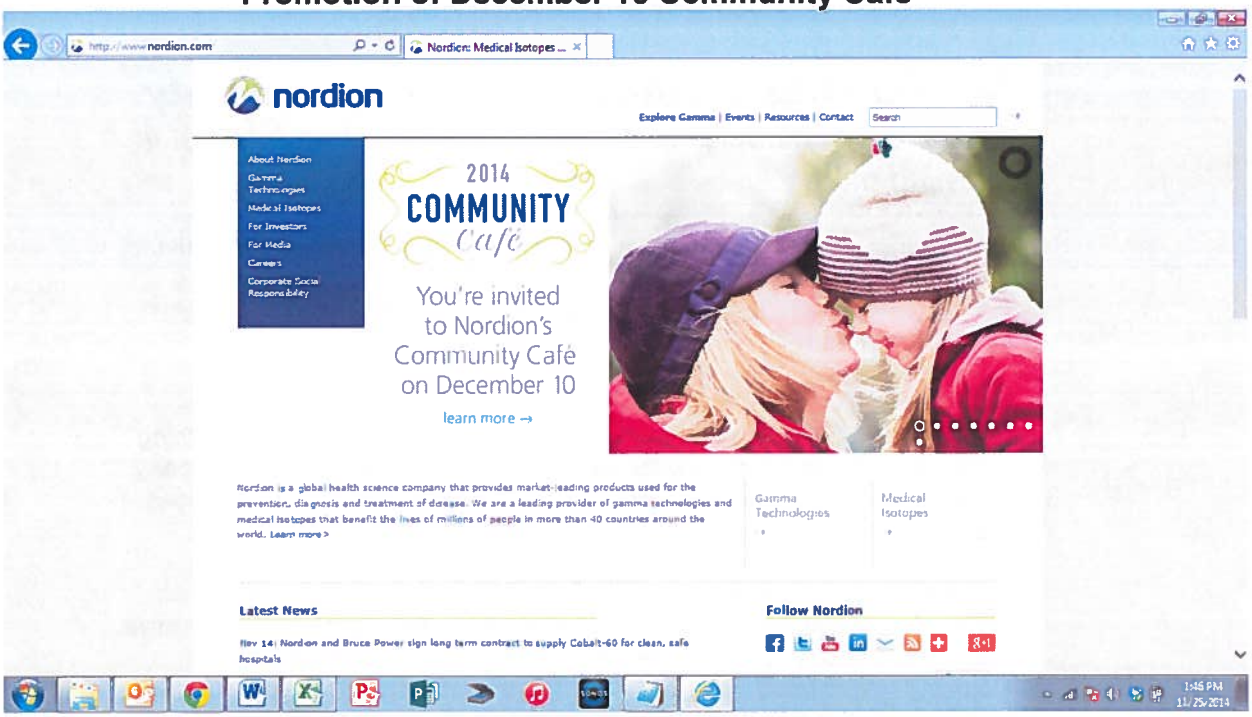


Figure D.3: Banner placed on the nordion.com home page to promote the December 10 Community Café

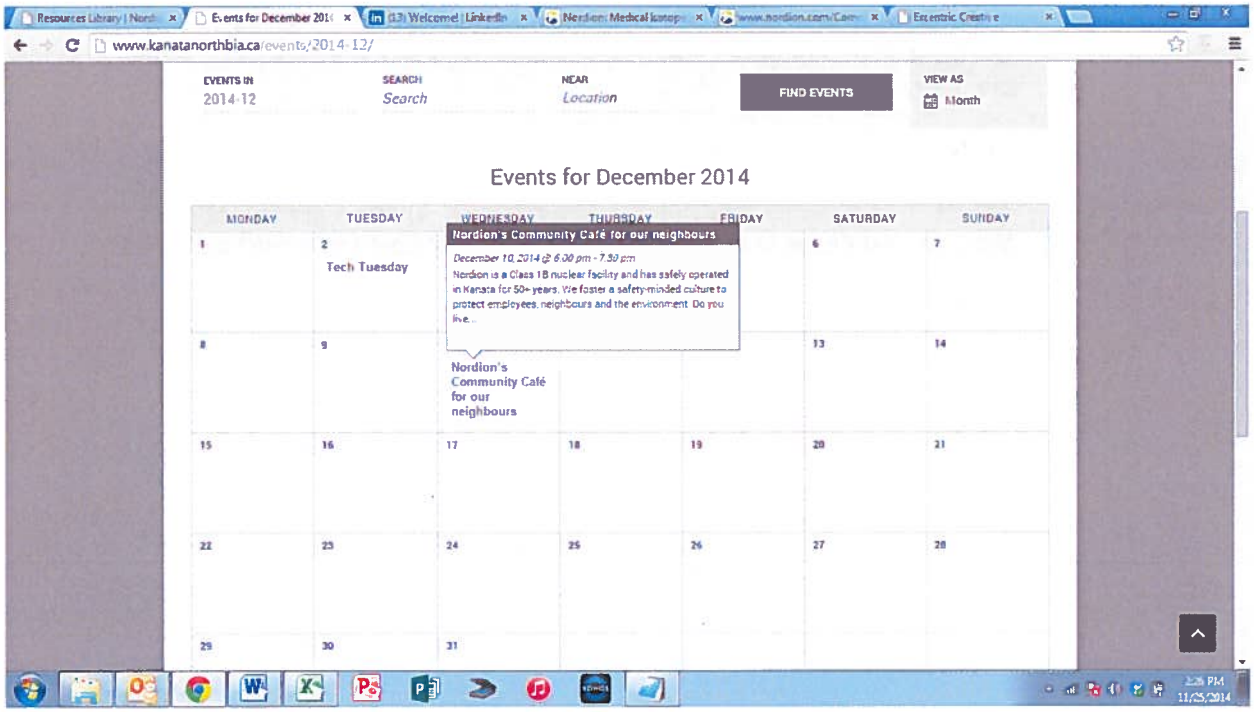


Figure D.4: Event area of the KanataNorthBIA.ca website promoting Nordion Community Café

Appendix D.4, continued
Promotion of December 10 Community Café

Figure D.5: Copy of promotions of Community Cafe on Twitter (similar promotions were posted on Facebook and LinkedIn)

Figure D.6: Copy of ad placed in the November 27 and December 4 issues of *Kanata Kourier*

Appendix D.4, continued
Promotion of December 10 Community Café

(Front) (Back)

Figure D.7: Copy of 4x6 postcard invitation delivered by Canada Post to 12,020 houses and apartments within a 4m radius of Nordion

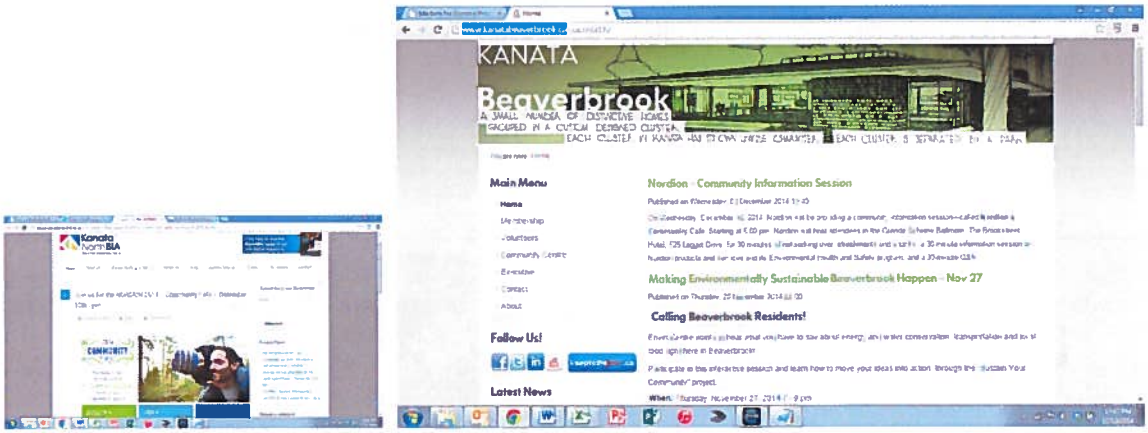


Figure D.8: Copy of promotions to the public regarding the Nordion Community Café as a result of emails sent to the Kanata Community Leaders and Kanata Area Community Associations

Appendix D.4, continued
Promotion of December 10 Community Café

Figure D.9: Copy of promotions to the public regarding the Nordion Community Café as a result of emails sent to the Kanata Community Leaders and Kanata Area Community Associations

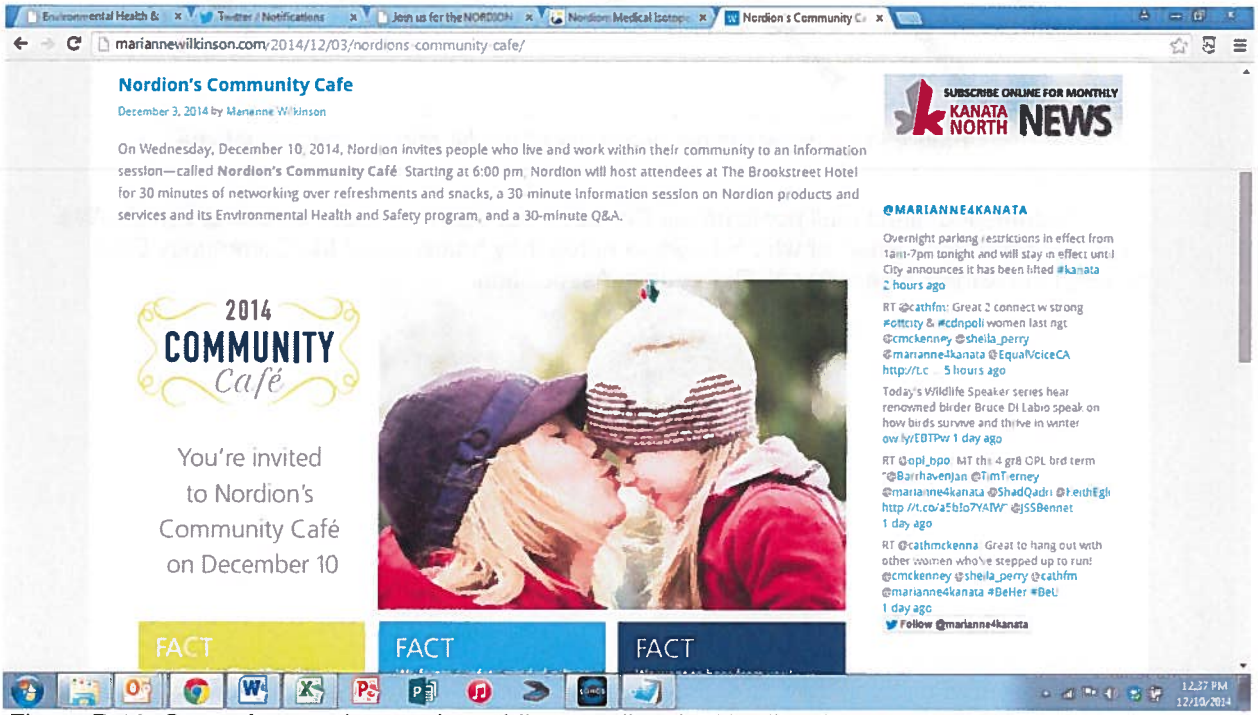


Figure D.10: Copy of promotions to the public regarding the Nordion Community Café as a result of emails sent to the Kanata Community Leaders and Kanata Area Community Associations

Appendix D.5
Results of Nordion's Community Café

Below are the results from the survey used to gather public opinion and consult on the disclosure protocol from the Nordion Community Café. The data was gathered from 26 public guests.

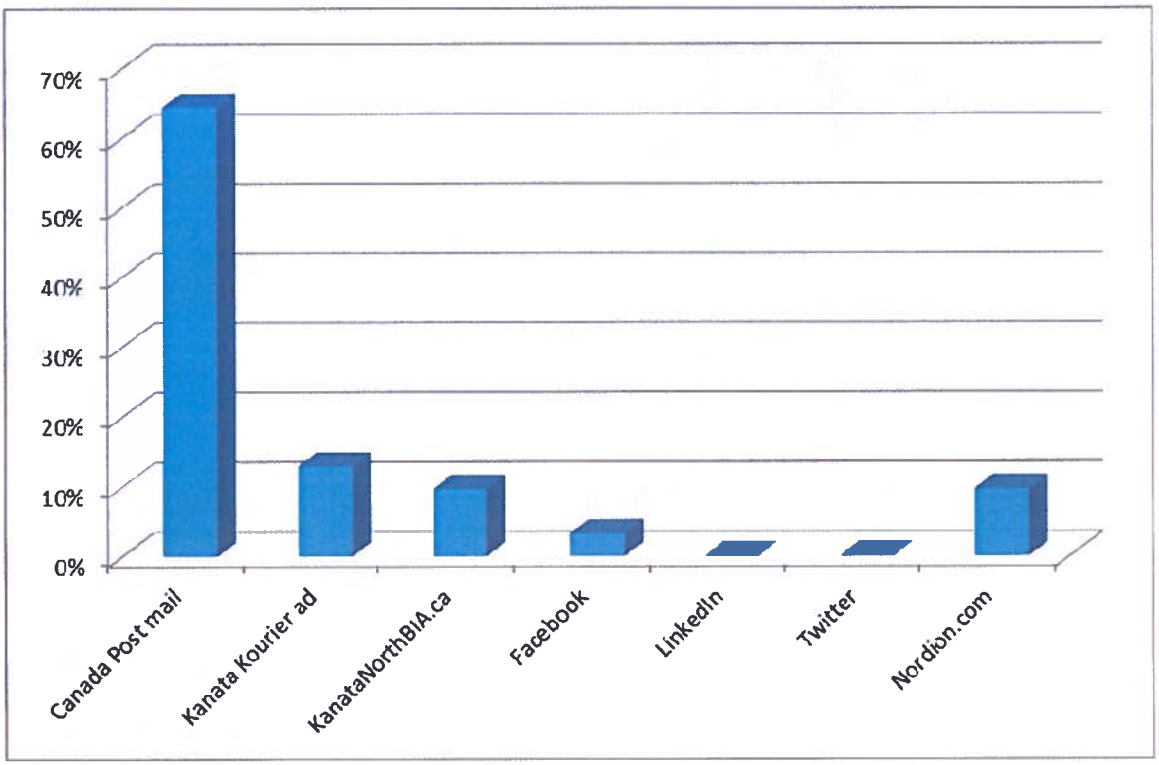


Figure D.11: How people heard about the Nordion Community Café

The unaddressed direct mail postcard via Canada Post was the most successful vehicle. We included a field for "Other" of which 4 people noted they heard about the Community Café through the Kanata Beaverbrook Community Association.

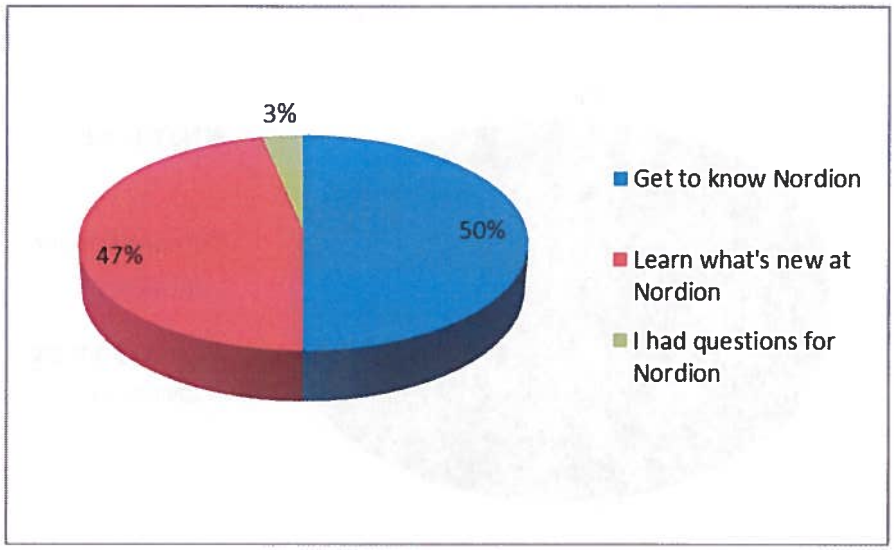


Figure D.12: Why people attended

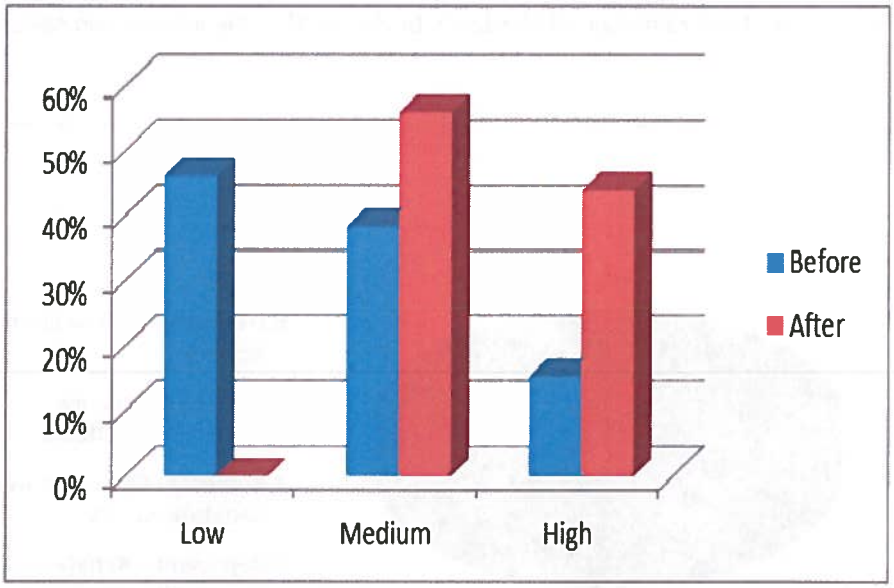


Figure D-13: Understanding of Nordion's business before the information session and after the session

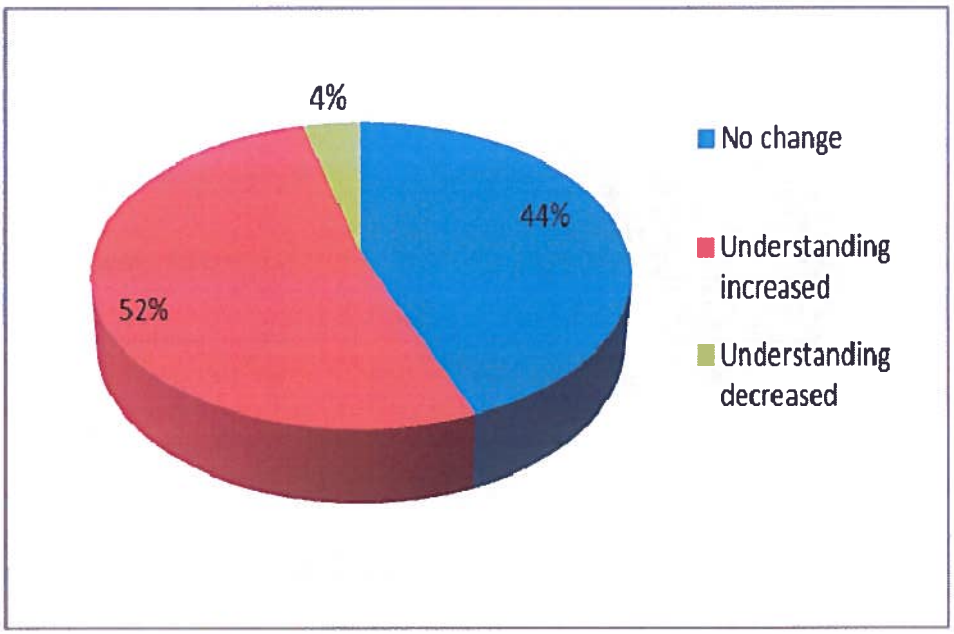


Figure D-14: Understanding of Nordion's business after the information session

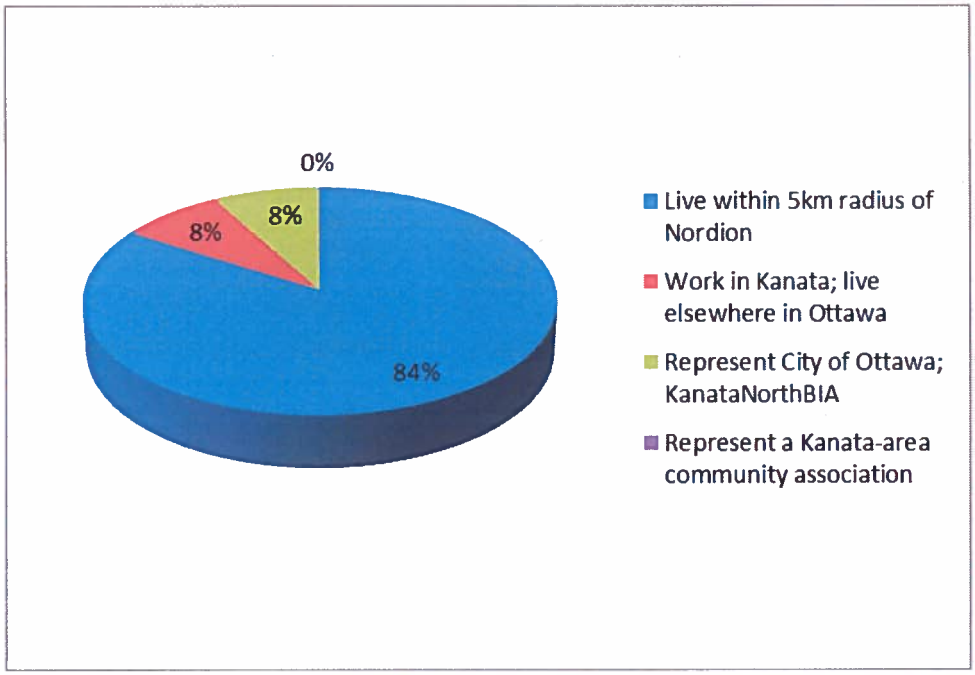


Figure D.15: Proximity to the Nordion facility

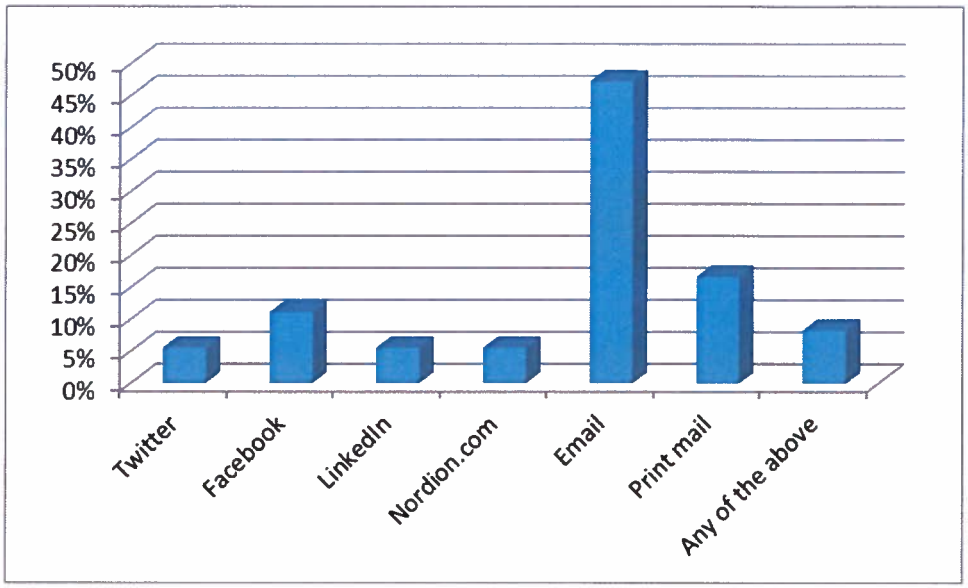


Figure D.16: Preferred communication vehicles

Qualitative results:

We asked: What additional information about Nordion's safety performance would you like to know more about?

The community said:

2 persons stated they wanted emergency procedure information:

- "Emergency procedure for the community."
- "Should community residents be aware of the emergency plans that Nordion has in place?"

We asked: How could we improve communications to the community in general?

The community said:

- 4 respondents suggested a video or slideshow tour of the facility or actual onsite tours; e.g. "Love the idea of a video tour showing community your premises."
- 5 respondents referred to information sessions; e.g. "Repeat the Community Café experience."