CONFIDENTIAL

NORDION (CANADA) Inc.
CLASS 1B FACILITY

License Number: NSPFOL-11A.01/2025

2019 ANNUAL COMPLIANCE AND OPERATIONAL PERFORMANCE REPORT to the Canadian Nuclear Safety Commission for the period JANUARY to DECEMBER 2019 (Amended August 14, 2020)

Signatures

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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.01/2025) and demonstrates that Nordion is operating in a safe and responsible manner.

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

- The operation and maintenance of the facility
- A summary of facility and equipment performance and changes
- Changes to operating policies and organization
- Occurrences and personnel radiation exposures
- Releases of nuclear substances and 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
- A summary of the Public Information Program activities
- The 2020 Environmental, Health and Safety Objectives

The key points of this report are as follows:

- The implementation of the key measures were taken to ensure compliance with Nordion's Licence Conditions Handbook (LCH).
- All measurable radiation doses received by personnel and the public were within the regulatory limits of 50 mSv/yr for (Nuclear Energy Worker) NEW personnel and 1 mSv/yr for non-NEW personnel and public, and no internal dose levels or limits were exceeded.
- There were no instances in which there was potential to exceed a regulatory limit or to reach or exceed an action level.
- Nordion had one lost time injury and no other medical treatment injuries.
- There was one lost time and no other medical treatment injuries for BWXT ITG employees who were contracted to work in the Medical Isotopes Facility.
- There were two reportable exceedances of an environmental regulatory limit or action level in 2019 involving non-radiological releases to the sanitary sewer which resulted in by-law limit exceedances. They were identified by Nordion during routine sampling and self-reported to the City of Ottawa. In addition, during 2019 one halocarbon release was reported to Environment Canada. (Refer to Section 1.1)

In 2019, Nordion's Class 1B Facility operated within the requirements of the Nuclear Safety and Control (NSC) Act, the applicable regulations and the conditions of the operating license issued by the CNSC with the exception of 5 non-compliances with the NSC Act, the regulations or with Nordion's site license NSPFOL-11A.01/2025. Four (4) of these instances were reportable to the CNSC (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
BOD	Biochemical Oxygen Demand
BWXT ITG	BWX Technologies Inc. Isotope Technologies Group Canada Inc.
CAD	Charcoal Adsorber
CAM	Continuous Air Monitor
CAPA	Corrective Action Preventative Action
COF	Cobalt Operations Facility
[redacted]	
CSA	Canadian Standards Association
DRD	Direct Reading Dosimeter
DRL	Derived Release Limit
EHS	Environment, Health and Safety
EMS	Environmental Management System
eQMS	Electronic Quality Management System
ER	Emergency Response
ERP	Emergency Response Plan
FMEA	Failure Modes Effects Analysis
FSAR	Final Safety Analysis Reports
HEPA	High Efficiency Particulate Air
HPGe	High Purity Germanium
HSA	High Specific Activity
IAEA	International Atomic Energy Association
ICP	Incident Command Post
IMS	Incident Management System
KRMF	Kanata Radiopharmaceutical Manufacturing Facility
KOB	Kanata Operations Building
LCH	Licence Conditions Handbook
MDA	Minimum Detectable Activity
NEW	Nuclear Energy Worker
NMPF	Nuclear Medicine Production Facility
NPRMI	Non-production Radioactive Material Inventory
NSC	Nuclear Safety and Control
NVS	Nuclear Ventilation System
PIP	Public Information Program
PIT	Physical Inventory Taking
PPE	Personal Protective Equipment
PTNSR	Packaging and Transport of Nuclear Substances Regulations
QA	Quality Assurance
RE	Roy Errington
SAHE	Systematic Approach to Hazards Evaluation
SCA	Safety and Control Area
SCBA	Self Contained Breathing Apparatus
SOP	Standard Operating Procedures
SSTS	Sealed Source Tracking System
SSC	Structures, Systems, and Components
TDG	Transportation of Dangerous Goods
TLD	Thermo-luminescent Dosimeter
US DOT	United States Department of Transportation
US NRC	US Nuclear Regulatory Commission
WSIB	Workplace Safety Insurance Board

1. INTRODUCTION

Nordion is a business unit of Sotera Health, a recognized global leader in contract sterilization and testing services for the medical device and pharmaceutical industries. Nordion's Class 1B Facility is comprised of two major production operations, one involving the processing of radioisotopes used in nuclear medicine (Medical Isotopes) and the other involving sealed sources used in cancer therapy and irradiation technologies (Gamma Technologies).

The production operations for Medical Isotopes are housed in the Nuclear Medicine Production Facility (NMPF) portion of the Kanata Operations Building (KOB) and in the Kanata Radiopharmaceutical Manufacturing Facility (KRMF). Production operations for Gamma Technologies are housed in the Cobalt Operations Facility (COF) portion of the KOB.

On July 30, 2018, Sotera Health sold the Medical Isotopes segment of Nordion's business to BWXT Technologies, Inc. (BWXT ITG). With the sale, BWXT ITG became the owner of Nordion's former medical isotope business, including the radiochemical manufacturing operations in Ottawa, Ontario and the isotope production facility in Vancouver, British Columbia. Nordion has retained ownership of the Gamma Technologies operations and of the Class 1B Facility. The transaction also involved the transfer of approximately 150 Nordion employees to BWXT ITG. Nordion and BWXT ITG also signed a long-term lease agreement that will allow BWXT ITG to operate from the Kanata, Ontario site once they obtain their own Class 1B licence.

Notwithstanding the sale of the Medical Isotopes segment July 2018, Nordion remains operator of the Class 1B Facility in Ottawa. Until such time as BWXT ITG obtains an operating license from the CNSC, BWXT ITG acts as a sub-contractor to Nordion for all Medical Isotopes related Class 1B activities under Nordion's Nuclear Facility Processing License (License NSFPOL-11A.01/2025). As such, the sale of the Medical Isotopes segment has no impacts on the 2019 ACOPR for the Class 1B Facility.

A summary of the organizational structure and key environmental, health and safety (EHS) personnel is provided in Section 2.1.5.

Throughout this report, the following EHS risk significance definitions are applied to incidents:

Low Risk – A finding or failure that will not result in negative impact to security, employee health and safety, the environment, registrations or licenses.

Medium Risk – A finding or failure that resulted, or could potentially result in a negative impact to security, employee health and safety, the environment, registrations or licenses.

High Risk – An event or occurrence which has a major negative impact, or potential major negative impact on security, employee health and safety, the environment, registrations or licenses.

1.1 Compliance with Other Regulations

During 2019, Nordion self- reported two exceedances of the City of Ottawa Sewer Use by-laws (2003-514) for total kjeldahl nitrogen, phosphorous (total), and oil & grease (animal & vegetable). For the oil & grease (animal & vegetable), it was found that a contractor who performed routine maintenance on Nordion's grease trap failed to reinstall it correctly leading to the exceedance. The causes for the total kjeldahl nitrogen and total phosphorous (total) exceedances appear to be the result of Nordion's low water use. Nordion continues to work closely with the City of Ottawa.

In addition, during 2019 one halocarbon release of 39 kg of R-22 was reported to Environment Canada. This leak was determined to be the result of a leaking valve at the compressor. The valve has been replaced and another leak test has been performed to ensure it is no longer leaking.

Nordion reports to the Workplace Safety Insurance Board (WSIB) whenever a reportable occupational injury or illness occurs. In 2019, two lost time injuries were reported to WSIB (one for Nordion and one for BWXT ITG) and one medical treatment claim; however the medical treatment claim was denied by WSIB. WSIB may inspect Nordion's Occupational Health and Safety programs at any time; however, no inspections were held in 2019.

In compliance with Part II of the Canadian Labour Code, three disabling injuries were reported to Employment and Social Development Canada (ESDC). One of these reports was related to the claim denied by WSIB. Further details of these injuries are provided in Section 2.8.4.

As part of the transportation program, Nordion must remain compliant with not only CNSC regulations and requirements but also those of other regulators, most prominently Transport Canada (Transportation of Dangerous Goods (TDG) regulations), US Department of Transport (US DOT) and US Nuclear Regulatory Commission (US NRC). There were no reported non-conformances with transport regulations 2019.

There were no non-compliances related to the sealed and unsealed source reporting performed by Nordion to the Competent Authorities in France, Belgium or Switzerland.

1.2 New Licensed Activities

Production of In-111 was started in 2019, within the licensing basis of the current facility license.

1.3 Significant Modifications or Changes to Site or Facility

Significant modifications and repairs that were carried out in 2019 include:

- Facility modifications and additions in the leased Medical Isotopes Facilities

1.3.1 Changes to Procedures Related to Operations Safety and Control

In 2019, the following changes were made to procedures related to operational safety and control:

- SE-TRN-006 “Systematic Approach to Training System”

  Revised to include a new section on Document Training and Assessment Tests.

- SE-ERP-002 “Emergency Response Plan”

  Revised to include an "Expected ERO Activation Times" table to define expected response times for key personnel and to update the "Inventory of ICP Position" to include BWXT ITG personnel.

- SE-LIC-007 “EHS Committee Approved Limits for Facilities”

  Updated activity limits for Fumehood-43 and Biohood 95.

- SE-LIC-015 “Radioactive Material Inventory”

  Revised to remove the requirement to perform cycle counting on all of the Cobalt-60 Quality Control standards that are sealed sources.

- SE-LIC-018 “Facility Description”

  Updated document and associated facility drawings (PEAE-61266, PEAE-61267, and PEAE-61278) to delineate the BWXT ITG leased areas, within the Nordion facility in support of the BWXT ITG Class 1B licence application.

- SE-OP-079 “Sealed Source Reporting”

  Minor updates were made to the responsibilities outline in the procedure and to the required response to certain system alerts.

1.4 Operational Challenges

In 2019, the following operational challenges were experienced by Nordion;

- Managing the on-going demolition/construction activities conducted throughout 2019 in the BWXT ITG Medical Isotopes facility,
- Nordion continues to investigate non-radiological sanitary sewer releases and ways to minimize such releases,
- Meeting the internal target for timely closure of CAPAs. The annual average closure rate of 68% was below the target of 80%. In recent years fewer CAPAs have been initiated, as other tools (change requests, VelocityEHS Action Items, etc) have been used to manage and address lower risk findings from audits and investigations. For example in 2019 only 29 EHS CAPAs were initiated compared to 44 in 2018 (a 36% reduction in number). This change in addressing the lower risk findings and subsequent 36% reduction in CAPAs has resulted in a lower average closure rate. The internal average CAPA closure rate target in and internal target and may need to be adjusted accordingly due to these changes.

2. SAFETY AND CONTROL AREA (SCA)

2.1 Management System

2.1.1 Applicable Activities

The Management System for Safety is applicable to all CNSC licensed activities conducted under the Class 1B nuclear substance and processing facility operating license. Licensed activities include those activities undertaken to operate a nuclear substance processing facility and to service prescribed equipment.

Nordion operates the facility to process nuclear substances for medical purposes, and manufactures sealed sources for medical and industrial applications. Nordion manufactures sealed sources that are installed in prescribed equipment that are either transported to another licensee, or packaged and transported to be installed in prescribed equipment at another location or licensee. In addition, Nordion services its own self-shielded irradiator that is used to support the operations of the facility.

Nordion also services, at the Class 1B nuclear substance and processing facility, prescribed equipment from other licensees and clients for which they have provided procedures to the CNSC.

2.1.2 Management System for Safety Program Effectiveness

The annual management review of the Environmental Management System (EMS) and the Management System for Safety was conducted May 10, 2019 by the EHS Committee.

At this meeting the status of actions from the previous meeting, the Environment, Health & Safety Policy, adequacy of resources, EHS objectives and targets, and changing circumstances are reviewed and recommendations for improvement are made.

Results of the 2019 annual management review are as follows:

1. 6 of 6 outstanding actions from the previous meetings were closed.
2. The Environment, Health and Safety Policy was reviewed and minor changes to the policy were proposed.
3. The 2018 EHS Performance Report was reviewed and discussed. This report assesses the performance related to the 14 Safety and Control Areas over the past three years where this information was available. Any trends identified are addressed and tracked via a Nordion non-conformance system (ex. CAPA, Velocity EHS Action Items).
4. The 2019 Environmental Objectives and Targets were reviewed by the Committee. At the time, the environmental objectives and targets were on track.

5. Resource requirements for the EMS and Management System for Safety were discussed. The EHS Committee agreed that the programs are resourced adequately to ensure that critical issues are being addressed. Financial and specialized skills resources were felt to be adequate.
6. Ten actions resulted from the meeting
    a. One action was related to updating the EHS Policy plaques in the facility,
    b. One action was related to the 2021 Safety Culture Survey,
    c. One action related to ensuring monitoring of action items entered into the VelocityEHS compliance software,
    d. Four actions were related to possible amendments of the Annual Performance Report,
    e. One action wad related to needed corrections to CFs,
    f. One action was related to training program continuous improvements,
    g. One action was related to ensuring the Annual Performance Report was posted internally for employees to access.

The Committee concluded that they were satisfied with the effectiveness of the EMS and the Management System for Safety.

2.1.3 Internal and External Audits

Nordion uses both internal and external audits as a key part of the Management System for Safety and the EMS.

In 2019, there were 6 audits/inspections of Nordion by external parties, 1 external audit conducted by Nordion of a supplier and 1 external audit by Nordion of a transport carrier. There were 16 internal audits completed by Nordion EHS in 2019. These audits included an audit of production areas and supporting functions as well as policy and program audits.

In addition, as part of its inspection program, Nordion conducted a total of 13 health and safety inspections, and 17 environmental and fire inspections.

Out of a total of 29 EHS related Corrective Actions/Preventative Actions (CAPAs) initiated in 2019, 2 CAPAs were a result of minor findings from internal audits and 1 CAPA was a result of an external audit of Nordion. Also, 10 CAPAs were initiated in 2020 to address findings from 2019 internal audits, see Appendix B. The remaining CAPAs resulted from investigations or were issued to address observed deficiencies. A list of the internal audits and associated EHS CAPAs and other corrective actions are provided and tabulated in Appendix B.

2.1.3.1 Internal Audits

The following internal audits were conducted in 2019 by Nordion:

1. Audit of Facilities Maintenance
2. Environmental Management System Audit
3. Emergency Response Program
4. Radiation Protection Program
5. Fire Protection Program
6. EHS Internal Audit Program
7. Audit of a Supplier
8. Non-production Radioactive Material Inventory (NPRMI)
9. Documentation of Management System; Information, Documents, Records, Control of Documents and Control of Records
10. Safeguarded Material Physical Inventory Taking (PIT)

11. Sealed Source Export Licenses
12. Process Safety Audit of Waste Labelling/Process
13. Conventional Health and Safety Program
14. Installation and Servicing Activities
15. Construction, Commissioning and Decommissioning
16. Design Control and Change Control

Refer to Appendix B for a summary of the findings associated with the internal audits conducted in 2019.

2.1.3.2 External Audits of Nordion

The following external audits of Nordion were conducted in 2019:

Date	Description	Result
February 26, 2019	The CNSC conducted a Type II Security Inspection	One recommendation
March 26 to March 27, 2019	The CNSC conducted an inspection of Nordion's Packaging and Transport Programs	One directive and one recommendation
May 29-31, 2019	A third party conducted an audit against the requirements from the ISO 14001:2015 standard (Environmental Management Systems)	Six opportunities for improvement.
June 21, 2019	The CNSC conducted an inspection of Nordion's Emergency Management and Fire Protection Emergency Exercise	One action notice and three recommendations
September 5, 2019	The CNSC conducted an inspection of Nordion's Packaging and Transport Programs	One action notice and one recommendation
October 9, 2019	The CNSC and IAEA conducted a Physical Inventory Verification (Complementary Access)	No findings – results satisfactory

2.1.3.3 External Audits Conducted by Nordion

Nordion conducted one EHS audit of a supplier and one EHS audit of a transport carrier in 2019.

There were four findings and two observations resulting from the supplier audit.

There were three findings and seven opportunities for improvement identified during the carrier audit.

2.1.4 Management System for Safety Program Improvements

Revisions were made to the procedure for management of work in the Medical Isotopes Facility to reflect that work is sub-contracted to BWXT ITG. The revisions capture the changes made for the management of documents, work procedures, drawings, software, dosimetry, and training.

Revisions made to the Radiation Protection Program, Conventional Health and Safety Program, and the Environmental Protection Program are discussed in Sections 2.7.8, 2.8.3 and 2.9.6, respectively.

In 2019 Nordion continued the implementation of a behavioural based safety awareness program to encourage safety discussions within the organization and to encourage employees to report near misses and hazard identifications.

2.1.5 Summary of Organizational Structure and Key EHS Personnel

Nordion is a business unit of Sotera Health, but operates as a stand-alone company. Historically, Nordion has been comprised of two business units; one involving the processing of radioisotopes used in nuclear medicine (the Medical Isotopes Business Unit) and the other involving production of sealed sources used in cancer therapy and irradiation technologies (the Gamma Technologies Business Unit).

On July 30, 2018, the Medical Isotopes segment of Nordion was sold to BWXT ITG. Nordion continues to operate and be responsible for the Class 1B Facility and compliance with the facility license. [redacted]

Nordion - Gamma Technologies – EHS Compliance

- Senior Vice President of Environmental, Health and Safety (Sotera Health)
- Director, Regulatory & EHS
- Administrative Assistant
- Manager, Corporate Security
- Contract Security Supervisor
- Contract Security Officers (15)
- Manager, Radiation Safety & Nuclear Transportation
- Senior EHS Compliance Specialist
- Senior Licensing Coordinator
- EHS Compliance Specialist
- EHS Specialist (currently vacant)
- Facility Nuclear Compliance & Training Specialist (currently vacant)
- Manager, EHS
- Senior Radiation Surveyor
- Radiation Surveyor

BWXT ITG- Medical Isotopes – EHS Compliance

- Vice President, QA, Regulatory & EHS Compliance
- Senior Manager, Nuclear Regulatory, EHS
- EHS Assistant
- Senior EHS Compliance Specialist
- EHS Compliance Specialist (2)
- EHS Specialist
- Occupational Health Specialist
- Senior Manager, Radiation Safety
- Senior Radiation Surveyor
- Radiation Surveyor (2)

- Senior Radiation & Contamination Monitor (3)
- Radiation and Contamination Monitor (3)
- Decontamination Helper/Operator (3)

2.1.6 Changes to the Organizational Structure and Roles and Responsibilities of Key Personnel in 2019;

Nordion Changes:

- In July 2019, the Sotera Health position of Sr. Vice President Environmental, Health and Safety was created and filled.

BWXT ITG Changes

- In December 2019, the VP, QA Regulatory & EHS Compliance retired. This position is currently vacant.
- In January 2019, the role of Senior EHS Compliance Specialist was added.
- In March 2019, an EHS Compliance Specialist was added.
- In September 2019, an EHS Compliance Specialist was added.
- In 2019, three Radiation and Contamination Monitors were added.

2.2 Human Performance Management

2.2.1 Overall Performance of Human Performance Management

Nordion's Change Control procedure, QAP AP-45, requires that training requirements be assessed and documented for procedural changes. These requirements include assessment of the roles assigned to the document, the level of training to be completed and the training completion time. Most controlled documents require "read and understand" training regardless of the impact of changes. Change Leaders are required to consult with relevant managers and record whether this read and understand training needs to be supplemented by instructor-led classroom training and/or On-The-Job-Training (OJT). For changes assessed to have a high or medium risk safety impact, a "Training Needs Analysis" must be completed and EHS must review and approve of the final training decision.

2.2.1.1 Training Attendance Rate

Nordion designed and maintains a variety of radiation safety training courses. New employees who are not classified as 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. In 2019, there were no radiation safety incidents attributed to employee radiation safety practices. This indicates that the radiation safety training was effective.

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, but are not limited to, such topics as “working with beat”, emergency response awareness, care and use of respirators, material handling training, and working safely with fume-hoods.

Employees who transport, handle, or offer dangerous goods for transport are trained in the 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.

A summary of the key training programs is provided in Table 1.

In 2019, the number of scheduled participants that required safety training was 823, and by the end of the year, 806 of the scheduled participants completed the training, which included refresher training. Therefore, the attendance completion rate in 2019 was 98%. Of the seventeen (17) courses not completed, nine (9) represent an employee being away on extended leave and another two (2) represent course that were completed in January 2020.

Table 1
2019 Safety Training Programs

Program	Duration	# of Participants Requiring Training in 2019	# of Participants who Completed Training in 2019	# Participants with Overdue Refresher Training at the End of 2019
Nuclear Energy Worker (NEW) Indoctrination[3]	4 Hours	47	47	0
NEW Refresher[3]	Self Study	64	64	0
Radiation Instrumentation Workshop[3]	3 Hours	93	92	1[1]
Radiation Safety Review for Operators[3]	Half Day	16	15	1
Radioiodine Handling[3]	2 Hours	26	25	1
Transport of Dangerous Goods Level I[3]	Self Study	6	6	0
Transport of Dangerous Goods Level II[3]	Self Study	14	13	1[1]
Transport of Dangerous Goods Level III[3]	Self Study	38	38	0
TDG for Contractors[3]	Full Day	21	21	0
Working with BETA[3]	1 Hour	53	52	1[1]
Crane	Half Day	42	42	0
Pallet	Half Day	49	46	3[1]
Forklift	Half Day	26	25	1[2]
Contractor Radiation Safety Protection Training[3]	Half Day	86	86	0

Contractor Radiation Safety Protection Refresher[3]	2 Hours	16	16	0
Contractor EHS Training Level I[3]	2 Hours	73	73	0
In-Depth Security Awareness[3]	2 Hours	4	4	0
Emergency Response Part 1[3]	2 Hours	60	56	1[1] + 1[2] + 2
Emergency Response Part 2[3]	2 Hours	15	13	1[1] + 1
Emergency Response Part 3[3]	2 Hours	4	4	0
Emergency Response: Security[3]	1 Hour	12	12	0
Emergency Response: Site Security Volunteer[3]	1 Hour	12	12	0
Emergency Response: Monitors[3]	1 Hour	10	10	0
SCBA Part 1[3] & 2[3]	1 Hour	36	34	1[1] + 1
TOTAL		**823**	**806**	**17**

[1] On extended leave
[2] Refresher training completed in January 2020
[3] Key EHS course

2.2.2 Evaluation of Training Effectiveness

2.2.2.1 Trainee Reaction

Trainee reaction is the degree to which participants find the training favourable, engaging and relevant to their jobs. These three components are evaluated by analyzing data collected through the completion of training evaluation forms for all internally developed key EHS training courses and delivered by EHS classroom instructors. The data is analyzed so that corrective actions can be taken, if necessary, to improve content and delivery. The degree to which trainees find the training favourable is evaluated by analyzing the overall training assessment rating for each course. Overall training is assessed as one of five ratings: Excellent, Very Good, Good, Poor or Very Poor. The training evaluation form allows the trainee to select which aspects related to training engagement and relevance they perceived as strengths or weaknesses. In addition, a review of the optional comments section is completed to identify any issues that would contribute to trainees discomfort and distraction that could have impacted employee engagement (such as room temperature, catering, lighting etc.).

For 2019:

- 100% of courses had an overall rating of good, very good or excellent. 0% of courses had an overall rating of poor or very poor. Therefore, overall trainee satisfaction is high.
- Training courses were perceived by trainees as engaging and relevant and trainees felt participation was encouraged.

2.2.2.2 Trainee Learning

Trainee learning is the degree to which trainees acquire the intended knowledge and skills based on their participation in the training. Learning is evaluated by the pass rate of tests written for key EHS training courses.

For 2019, 100% of trainees passed the assessment test for all key EHS training courses and there were no rescheduled tests due to failed attempts.

2.2.2.3 Training Results

Training results is the degree to which targeted outcomes occur as a result of the training. The effectiveness of training results are measured by the EHS significance (high, medium, low) and the frequency of unplanned events documented through processes such as the deviation process, the non-conformance process, investigations, and customer complaints where the root cause was determined to be related to human error or training. The targeted outcome is zero high risk unplanned events related to human error or training as well as no trend for recurrence (three or more) of the same unplanned event with the same human error or training root cause.

For 2019:

- There were no unplanned events in 2019 for which the root cause was determined to be related to human error or training

2.2.3 Confirmation of Sufficient Number of Qualified Workers

In 2019, Nordion ensured that at least the minimum number of responsible personnel was available to provide safety during overnight operations and during emergency situations. There were no changes to risk levels or available personnel.

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. The Incident Manager, or the person in charge of the response, can initiate a call-in of both on-call and regular emergency response personnel. Currently there are approximately 30 Fire Wardens and Marshalls and over 70 other 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 list 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).

There is a minimum of one and normally two Health Physicists on call who are qualified to establish and direct radiation safety activities to protect personnel, the public, and the environment from radiation hazards, and to develop safe work methods and procedures.

Nordion maintains a formal on-call roster that includes the Manager, Corporate Security (or designate) and the Director, Regulatory/EHS (or designate), who is also a qualified Health Physicist.

2.3 Operating Performance

2.3.1 Effectiveness in Carrying Out Licensed Activities

Licensed activities were carried out according to Nordion's programs, policies and procedures resulting in no significant unplanned events.

Nordion's programs that are in place for auditing and capturing non-conformances continue to identify issues in areas that require corrective actions. These processes functioned as expected.

The 2019 EHS program objectives are shown in Table 2. All of the EHS objectives listed in Table 2 were met in 2019 with the exception of Non-Radiological Releases, and timely closure of EHS CAPAs. The number of Medical Treatment Incidents (zero) met the target of ≤6 and the number of Lost Time Incidents (two) exceeded the target of zero. Further details of these incidents can be found in Section 2.8.4.

In 2019, the hazardous occurrences involved strain injuries one from performing routine work and one as an acute over-exertion. Nordion continues to provide increased focus on open safety discussions, ergonomic assessments, and awareness to Operations groups. Managers reinforce with their teams the importance of taking regular breaks to rest muscles and joints and rotating duties, as required, in an effort to avoid repetitive strain injuries.

Radioactive materials emissions (0.087% of the Derived Release Limit (DRL) the new DRL values from the January 2019 version of Nordion's LCH) continue to be well below the target of ≤ 5% DRL, but Non-Radiological releases were above the target of 0 with a total of three in 2019 (two sanitary sewer and one halocarbon release). The details of these releases are found in Section 1.1.

The target of 80% of generated CAPAs closed within 1 year was not met in 2019. The average CAPA closure rate for 2019 was 68%, with the monthly closure rate ranging from 55 to 83% in 2019. In recent years, fewer CAPAs have been initiated because of other EHS tools have been used to manage and address lower risk findings from audits and investigations. In 2019, only 29 EHS CAPAs were initiated compared to 44 in 2018. This change in addressing the lower risk findings and subsequent 36% reduction in CAPAs has resulted in a lower average closure rate. The internal average CAPA closure rate target may need to be adjusted accordingly due to these changes

The remainder of the EHS Targets and Objectives were met for 2019. Nordion diverted 65.1% of waste from landfills, the maximum employee dose rates well under the target of ≤ 7.5 mSv/yr and Nordion completed a supplier audit by the end of 2019.

A system is in place to ensure that the manager self-assessment performance reviews are completed twice a year. The self-assessment process is audited annually. Deviations, Change Forms and complaints are reviewed yearly at the Annual Joint Environmental Management System and Management System, for Safety review.

Table 2
2019 EHS Program Objectives and Results

Objective	Measure/Target *	Result
Manage CAPAs and ensure timely closure of CAPAs	• Close out aging CAPAs within your areas • Target 80% of generated CAPAs within your areas are closed (Actions complete, excluding CAPA effectiveness/verification) within 1 year	• 68% (average for 2019)
Minimize the number and extent of occupational injuries, environmental and radiation incidents.	• The number of Medical Treatment Incidents ≤ 5 • Lost time Incidents = 0	• The number of Medical Treatment Incidents = 0 • Lost time Incidents = 2
Minimize the use and release of hazardous materials to the environment.	• Radioactive materials emissions to < 4.0% of the Derived Release Limits (DRL) • Zero reportable releases of radioactive and non-radioactive hazardous materials to the environment (sanitary sewer, air, etc.)	• 0.087 of the DRL using the new values in the January 2019 version of Nordion's LCH • Three Reportable Releases - Two reportable releases of non-radioactive hazardous materials to the environment (sanitary sewer) and one Halocarbon release.

Maintain radiation doses to employees as per ALARA principle.	• Maximum employee dose rate ≤ 7.5 mSv/yr	• Maximum employee dose rate was 4.79 mSv/yr.
Maintain a healthy safety culture.	• It is unacceptable to take risks in order to get the job done. Personal safety is every employee's highest responsibility. • Provide/participate in EHS Safety Talks during team meetings. • Ensure EHS information and concerns are discussed regularly at team meetings. • Ensure near-misses, hazard identifications, hazardous conditions, and workplace injuries are reported to your Manager, so that they are entered into VelocityEHS in a timely manner and appropriate corrective action(s) are taken. • Report any suspected symptoms (e.g. ergonomic or repetitive strain) to your Manager immediately or identify potential physical concerns before they become injuries. • Wear all applicable personal protective equipment (PPE). • Submit all dosimeter(s) and rings for monitoring on time. • Follow Nordion values, EHS policies, training and procedures and coach co-workers who are observed to be working unsafely.	• Targets established to promote safety culture only (not measured).

*Average taken over the year.

2.3.2 Effectiveness in Implementing Operational Controls and Improving Safety Culture

EHS operational controls are documented in a specific series of documents (SE-OP and SE-HS series) and safety critical steps are added into routine production procedures. These procedures are routinely updated using Nordion's change control process when safety improvements are identified or during the document's scheduled periodic review.

In 2019 Nordion continued the practice of monthly behavioural based safety awareness campaigns to encourage safety discussions within the organization and to encourage employees to report near misses and hazard identifications.

2.3.3 Reportable Events

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

2.3.4 Sealed Source Tracking

Nordion has a process for reporting the transfer, receipt, export or import of sealed sources if the activity exceeds the threshold limits and within the specified timeframes as detailed in Nordion's LCH.

2.3.4.1 Sealed Source Tracking Activities

Activities which took place in 2019 included the following:

- On-the-Job training for backup personnel.
- Corrective actions and continuous improvement actions from the sealed source reporting process review are on-going. 40% of actions have been completed. The completion of 30% of the actions is contingent on the transition from the existing software platform to a more reliable platform.

2.3.4.2 Sealed Source Tracking Improvements

There were no specific improvements to the sealed source tracking process in 2019.

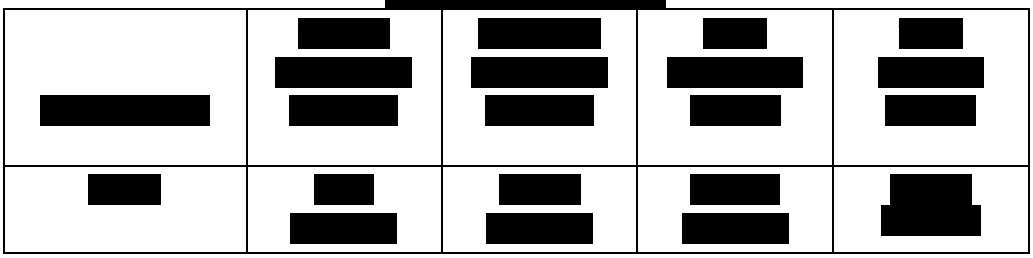
2.3.5 Non-production Sealed and Unsealed Source Inventory

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

2.3.6 Annual Production

Activities relating to the procurement, possession, processing and shipping of radioactive materials are conducted under Nuclear Substance Processing Facility Operating Licence, NSPFOL-11A.01/2025.

[redacted]



[redacted]

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

2.4 Safety Analysis

2.4.1 Validation and Maintenance of Overall Safety Case

The overall safety case for the facility is effectively maintained in the overall primary Final Safety Analysis Reports (FSARs) for Nuclear Medicine, Cobalt Operations, and the Cobalt Pools. When modifications are made, an assessment is performed and details are captured in the primary FSARs for the facility. The overall safety case for the facility is then validated by the EHS Committee.

2.4.2 Modifications and Changes to Facility that May Affect Safety Analysis

In 2019 there were no modifications that affected the facility's safety analysis.

2.5 Physical Design

The FSAR review process identifies areas of continuous improvement to ensure that the overall design basis for the facility is both validated and maintained. In 2019, there were no significant design issues identified through these reviews. Overall, Nordion's facility design has been maintained.

The facility modifications and additions occurring in the leased Medical Isotopes facility areas did not impact the ability of the facility structures, systems and components (SSCs) to meet and maintain their design basis. As noted in Section 1.2, production of Indium 111 (In-111) was started in 2019. Validation activities were completed as per the Nordion Master Validation Plan to qualify the In-111 production facility, including equipment and processes that are used in the manufacturing. Validation activities were performed to ensure equipment and facilities were installed correctly and operating as intended. Performance qualifications were conducted and captured in validation summary reports. The results of these validations indicated that the process and equipment were installed correctly and operated as intended. The hazard risk assessment for the facility was completed to ensure that all hazards related to the use and maintenance of the facility were identified and mitigated. This hazard risk assessment is an input to the associated safety analysis report (FSAR).

2.6 Fitness for Service

2.6.1 Effectiveness of Maintenance and Testing Programs

Nordion has a system in place for the maintenance and control of equipment that supports the facility. The program provides guidelines for the documentation and maintenance of the system to ensure responsibilities are identified, filing systems are maintained, and all necessary controls are in place for facility calibration and maintenance.

Nordion uses an Advanced Maintenance Management System (AMMS) to control Nordion's calibration and maintenance activities. The AMMS is used to catalogue all equipment requiring calibration or maintenance, record equipment information, schedule maintenance, and issue work orders.

Detailed processes and rules governing the preventative maintenance program are available in Facilities Master Plan documents.

The AMMS provides the necessary oversight to ensure equipment integrity. All equipment inspections and preventative maintenance schedules are dictated by the use of the AMMS.

Unscheduled repairs are reviewed on an annual basis by Facilities to assess for trends in equipment failures. Recurring failures are reviewed by EHS Compliance for the determination of any additional corrective actions.

This continues to prove effective as during 2019, there were no major equipment failures.

2.6.2 Effectiveness of Aging Management Strategies

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. When approved, the work identified during the aging equipment review is executed as a project. Projects are prioritized into three categories and funds are allocated as required. This aging equipment review process, because of the link to the Senior Management team and Finance, has been effective in keeping the Nordion facility up-to-date with current technology.

2.7 Radiation Protection

2.7.1 Dose Control Data

2.7.1.1 Occupational External Dosimetry

Tables 5 and 6 provide dosimetry data for employees grouped in various ranges of exposure. In general, most contractors are considered non-NEWs. The exception is BWXT ITG personnel who are considered NEWs. For the purposes of the data analysis in section 2.7.1 and 2.7.2, BWXT ITG personnel are considered as employees along with Nordion personnel and are not included within the contractor category. This ensures data remains consistent to previous years and allows for appropriate trending in relation to the NEW tasks and expected doses. In the analysis of the doses in this section, NEW roles undertaken by BWXT ITG personnel are denoted as such for further clarity. Data on the minimum, maximum and average doses for all employees are shown in Tables 7, 8 and 9. In Table 9.1, the data for 2019 is shown for Nordion and BWXT ITG NEWs. In 2019 there were 154 Active Area personnel monitored and 124 non-Active Area personnel, as shown in these tables. Of the 124 non-Active Area personnel, 13 support industrial irradiators (containing Co-60) at customer sites. These individuals are included in the Class 1B licence dosimetry as they may also receive dose from work at KOB during the dosimetry year.

Table 5

Personnel Dosimetry

Number of Employees														
Dose Range (mSv)	Whole Body					Skin					Eye			
	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	2017	2018	2019	2020
0	12	39	60	47		11	42	69	44		39	62	45	
0.01-1.00	218	192	151	190		208	187	142	191		192	149	191	
1.01-5.00	37	31	37	41		47	33	37	43		31	37	42	
5.01 - 10.00	0	1	0	0		1	1	0	0		1	0	0	
10.01 - 20.00	0	0	0	0		0	0	0	0		0	0	0	
>20.00	0	0	0	0		0	0	0	0		0	0	0	

Number of Employees										
Dose Range (mSv)	Right Hand					Left Hand				
	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
0	59	94	44	50		52	88	44	52	
0.01-1.00	44	16	35	35		47	18	34	40	
1.01-5.00	22	13	35	39		25	16	35	33	
5.01 - 10.00	3	1	2	5		3	2	3	4	
10.01 - 20.00	0	1	0	0		0	1	0	1	
>20.00	0	0	0	1		0	0	0	0	

Table 6
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
2015	1	0	0	0
2016	0	0	0	0
2017	1	0	0	0
2018	0	0	0	0
2019	0	0	0	0

Table 7
Average, Maximum and Minimum Worker Effective Doses (mSv)

		2015	2016	2017	2018	2019	CNSC Regulatory Limit
NEWs [redacted]	**Average**	0.39	0.49	0.42	0.45	0.48	**n/a**
	Average*	0.43	0.51	0.49	0.60	0.57	
	Maximum	5.24	4.9	5.49	4.23	4.79	**50/yr; 100/5yr**
	Minimum	0	0	0	0	0	**n/a**
	Number of NEWs Monitored	264	267	263	248	278	
Contractors (non-NEWs)	**Average**	0.03	0.07	0.02	0.05	0.03	**n/a**
	Average*	0.03	0.08	0.04	0.06	0.06	
	Maximum	0.13	0.36	0.2	0.25	0.26	**1/yr**
	Minimum	0	0	0	0	0	**n/a**
	Number of Contractors Monitored	46	53	55	45	123	

***** This average is calculated excluding zero dose values.

Table 8
Average, Maximum and Minimum Worker Skin Exposure Doses (mSv)

		2015	2016	2017	2018	2019	CNSC Regulatory Limit
NEWs	Average	0.42	0.59	0.42	0.45	0.49	n/a
	Maximum	5.21	5.20	5.52	4.26	4.78	500/yr
	Minimum	0	0	0	0	0	n/a
	Number of NEWs Monitored	264	267	263	248	278	
Contractors (non-NEWs)	Average	0.03	0.07	0.02	0.05	0.03	n/a
	Maximum	0.12	0.39	0.18	0.22	0.25	50/yr
	Minimum	0	0	0	0	0	n/a
	Number of Contractors Monitored	46	53	55	45	123	

Table 9
Minimum, Maximum and Average Worker Extremity Doses (mSv)

		2015	2016	2017	2018	2019	CNSC Regulatory Limit
NEWs	Average	0.46	0.79	0.53	0.96	1.14	n/a
	Maximum	9.3	8.3	16.4	9.08	20.93	500/yr
	Minimum	0	0	0	0	0	n/a
	Number of NEWs Monitored	137	128	125	116	130	

Table 7 shows a relatively flat trend over the five years for maximum and average effective doses to NEWs. Contractor dosimeters and doses continue to be well managed and controlled. There was a large increase in the number of contractors being monitored in 2019; this increase is associated with the construction activities in Medical Isotopes. These contractors are not considered NEWs.

It is worthwhile noting that the five 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 1.11 – 1.79 mSv. The next highest dose to a Nordion non-Active Area worker was 0.74 mSv. The workers that install Co-60 in off-site irradiators are included in the breakdown for effective, extremity and skin dose. One set of dosimetry data is used for those individuals working under both the Class IB processing facilities license and Nordion's Class II servicing licence.

[redacted]

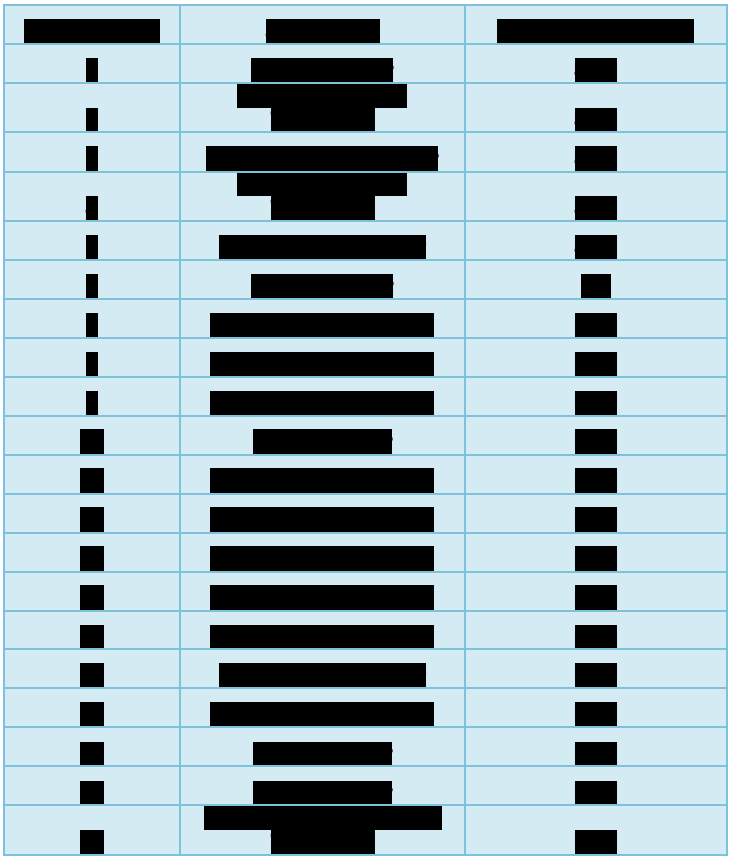


Table 8 shows similar results to Table 7 for skin exposure in 2019. In Appendix D similar values for dose to the lens of the eye are observed.

[redacted]

[redacted]

The above analysis of trends demonstrates doses are well managed at Nordion and adherence to the ALARA principle in the execution of duties by Nordion personnel.

Table 9.1 Summary of Employee doses broken down between [redacted] personnel.

Dose Range (mSv)	Effective Dose		Lens of Eye Dose		Skin Dose		Left Hand		Right Hand	
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
0	9	38	8	37	11	33	10	42	10	40
0.01-1.00	74	116	75	116	72	119	6	34	6	29
1.01-5.00	33	8	33	9	33	10	15	18	14	25
5.01 - 10.00	0	0	0	0	0	0	3	1	3	2
10.01 - 20.00	0	0	0	0	0	0	0	1	0	0
>20.00	0	0	0	0	0	0	0	0	1	0

	Effective Dose		Lens of Eye Dose		Skin Dose		Left Hand		Right Hand	
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Average (mSv)	0.88	0.20	0.88	0.20	0.88	0.21	2.02	0.78	2.35	0.76
Maximum (mSv)	4.81	1.88	4.81	1.88	4.78	1.90	9.94	12.92	20.93	9.37
Minimum (mSv)	0	0	0	0	0	0	0	0	0	0
# Monitored	116	162	116	162	116	162	34	96	34	96

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 2019, there were no cases of employees exceeding Nordion's administrative investigation level of 1000 Bq I-125 or I-131. [redacted] Monitoring continues for Bulk QC, Waste/Shipping, Monitoring/ Decontamination and Tech Support personnel. Due to the reduction in number of personnel monitored, thyroid attendance is no longer used as a useful leading indicator for safety culture.

Whole body counting was not performed in 2019. No urinalysis was required in 2019. In 2019 no internal doses were assigned as no radioactivity was detected during thyroid bioassay.

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 Appendix E (Figures E.1 to E.19). The graphical trends show group average, individual maximum and group cumulative doses. This trend data is reviewed yearly at the EHS Committee and the Annual Joint Environmental Management System and Management System for Safety Review. There are a few general observations in the trend data: Maximum individual and average doses remain [redacted]

Maximum doses in the non-active area personnel are from the subgroup of five Co-60 installers, whose doses are also accounted for in the Class II servicing licence [redacted]

Table 10
Analysis of Radiation Doses and Trends

[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

2.7.3 Dose to the Public

Table 11 shows the doses to the public from 2015 - 2019. It is important to note that a new set of DRL values came into effect in Nordion's LCH in January 2019. So although dose to public increased in 2019 relative to 2018, it is solely due to the new DRL values. As shown in Section 2.9.1.1, the activities released in 2019 were less than in 2018.

Table 11
Dose to Public

Year	(mSv)
2015	0.0057
2016	0.0021
2017	0.000052
2018	0.000067
2019	0.00087

2.7.4 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 and personnel leaving the Active Area is monitored for contamination.

During 2019 operations, there were 18 instances where contamination was found and subsequently contained within the Active Area. Of the 18 contamination incidents, ten were related to contamination found on clothing, four to contamination found in limited areas of the facility (i.e. floors or other structures and equipment), two where contamination was found on clothing and areas of the facility, and two to contamination found directly on personnel. No increased dose to personnel was received as a result of these incidents.

The distribution of contamination incidents from 2015 to 2019 is shown in Table 12 and Table 13 and illustrated in Figure 1.

The number of contamination events in 2019 was the same as 2018, less than in each of 2016 and 2015, but slightly higher than the number in 2017. In 2019, there were more contamination incidents in the second half of the year. This was due to the ramping up of demolition activities of the Moly cells, as well as increased production activity in Medical Isotopes. The level of these contaminations was low therefore, dose to personnel was negligible.

[redacted] The number of contamination events for "other" isotopes in Table 14 has increased over previous years. These "other" isotopes primarily correspond to various long-lived waste isotopes found that related to the [redacted]

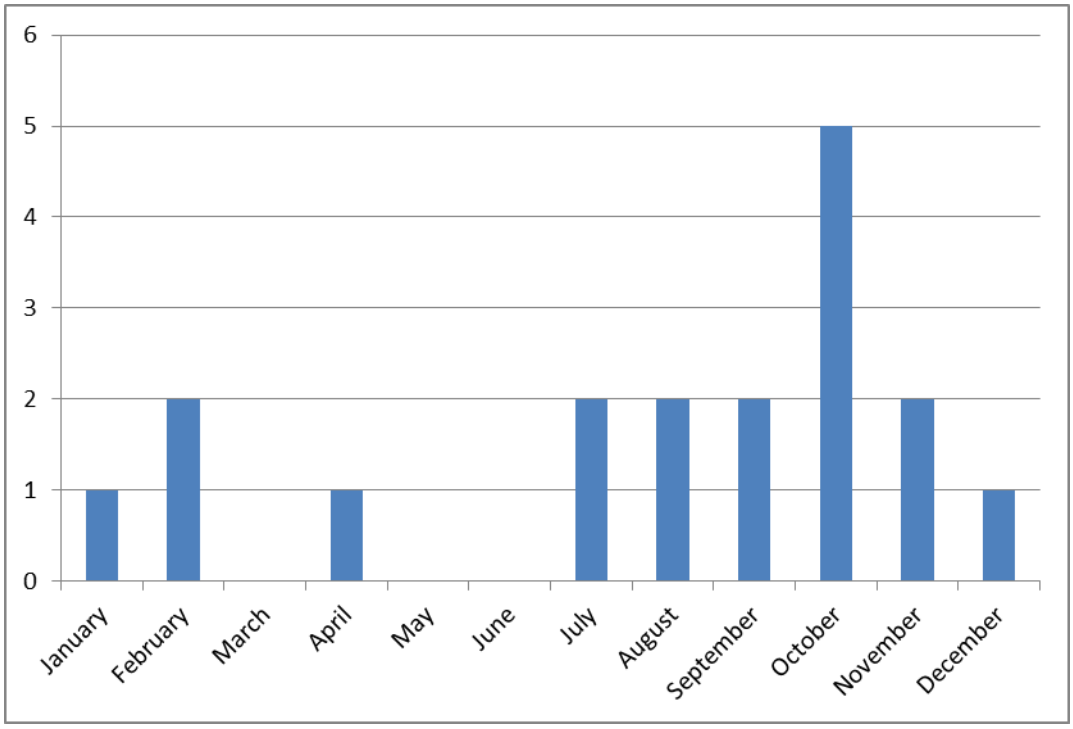
Table 12
Contamination Incidents by Contamination Level

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
2015	1	2	15	12	6	7	43
2016	0	2	10	8	4	2	26
2017	0	1	4	6	1	2	14
2018	0	5	4	6	3	0	18
2019	1	1	6	6	4	0	18

Table 13
Contamination Incidents by Radionuclide

Contamination Radionuclide	2015	2016	2017	2018	2019
Not recorded/unknown	0	0	2	1	0
C-14	1	0	0	0	0
C-60	12	6	4	4	4
I-125	1	2	0	0	0
I-131	5	6	0	1	0
Mo-99	11	6	0	0	0
Y-90	5	0	2	8	4
Ir-192	1	1	1	0	1
Xe-133	4	0	0	0	0
Sr-82	0	0	0	0	0
In-111					3
Radon	2	1	0	0	0
Other	1	4	5	4	6
Total	**43**	**26**	**14**	**18**	**18**

Figure 1: Contamination Incidents by Month in 2019



2.7.5 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 generally 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. In 2019, detailed cell survey was conducted for hot cells in Cobalt Operations. No non-conformance was observed from the survey.

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 2019.

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. During 2019 some of the rooms monitored were under construction on the Medical Isotope Radiochemical area, air sampling continued in these areas but with fewer 24 hour monitoring points (for example when walls were removed making three rooms into one air sampling space instead of three).

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 2019, all breathing air sampling was performed in accordance with procedures and results indicated that processes were in control. Facility radiological conditions were very stable and routine in 2019. There were no fluctuations in 2019 radiological conditions beyond the routine movement of containers through the facility when required. Contamination incidents are discussed in Section 2.7.4.

2.7.6 Exceeding Regulatory Limits or Action Levels

In 2019, there were no exceedances of either regulatory limits or actions limits.

2.7.7 Radiation Protection Program Effectiveness

The Radiation Protection (RP) Program is reviewed by conducting process audits and process safety audits. Data and performance of the RP Program is also reviewed regularly at EHS Committee meetings. The RP Protection program continued to operate effectively in 2019.

2.7.8 Radiation Protection Program Improvements

Improvements to the RP Program in 2019 included the following:

An analysis of doses to Cobalt operations personnel was performed to determine if there were any trends that could lead to further improvements. The analysis found that doses are well controlled.

Hot Cell URS design documents for the 9 new hot cells being designed for delivery to Medical Isotopes in 2020 have a dose rate at 6” from the operating surface of 1 mrem/h, which is lower than the 3 mrem/h requirement listed in Nordion documentation (CPM6-20).

2.7.9 Radiation Protection Program Performance

The objectives, goals and targets of the RP Program are shown in Table 2 of Section 2.3.1. The targets for maximum NEW dose and environmental releases were met in 2019. 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 Management System for Safety Review. Refer to Section 3.2 Table 23 for a summary of the initiatives and targets for the upcoming year.

2.7.10 Continuous Improvements under ALARA Performance

ALARA objectives and performance is reviewed at EHS Committee meetings and all activities in the ALARA program are outlined in Nordion’s internal procedure “Keeping Radiation Exposures and Doses as Low as Reasonably Achievable” (SE-RP-002). Safety is integrated into the design aspects of new builds, from design objectives, design review and to performing Hazard Risk Analysis and Third Party Reviews of process flows. In addition, Hot Cell URS design documents for the 9 new hot cells being designed for delivery to Medical Isotopes in 2020 have a dose rate at 6” from the operating surface of 1 mrem/h, which is lower than the 3 mrem/h requirement listed in Nordion documentation (CPM6-20). Radiation Safety being an integral part of the design, demolition, construction and commissioning teams ensures a strong performance ALARA for future years of production.

2.7.11 Radiation Devices and Instruments Performance

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.

2.7.11.1 Ventilation

Duplex fan tests are conducted every 6 months. This involves testing of more than 100 fans which form part of the Nuclear Ventilation System (NVS). During 2019, all High Efficiency Particulate Air (HEPA) and CAD filters were tested at the required frequency. HEPA filters were tested once, which meets the minimum testing frequency of once annually.

Table 14 details the results of the NVS Filter testing and replacement. The filters summarized in Table 14 are credited with mitigating releases in Nordion's Safety Analysis reports.

Table 14
NVS Filter Efficiency Testing/Replacements

	Q1/Q2 HEPA	Q1/Q2 CAD	Q3/Q4 HEPA	Q3/Q4 CAD
Filters in fleet	**240**	**73**	**240**	**73**
Number tested	**0**	**67**	**230**	**67**
Filters which met specification	**N/A**	**67**	**230**	**67**
Filters out of specification	**N/A**	**2**	**0**	**0**
Out of specification filters replaced during test cycle	**N/A**	**2**	**0**	**0**
Not tested	**240**	**6**	**10**	**6**
Total replaced during this cycle	**0**	**4**	**0**	**1**
Filters (systems) removed from service	**0**	**0**	**0**	**0**
New Filters (systems) Added	**0**	**0**	**0**	**0**

Comments Q1/Q2 HEPA: The HEPA test equipment was unavailable for testing purposes in the first half of 2019, so no filters were tested. The HEPA test equipment was sent externally for annual calibration as per routine. Due to unforeseen circumstances, the testing equipment did not return before the end of June. So HEPA testing was performed only in the second half of 2019. This meets the minimum required testing frequency.

Comments Q1/Q2 CAD: Six trench filters were not tested, but are changed every three years as per procedure. Four filters were replaced. Two trench filters were changed out due to shelf life expiration (were tested and passed prior to installation) and two filters were replaced due to one being out of specification and the other being close to the failure criteria and being replaced as preventative maintenance. Due to lack of radioiodine processing and storage in the KRMF/Radiopharmaceutical facilities, 21 CADs servicing those areas are not tested against the performance criteria, but continue to be tested regularly to research the filter performance. 2 CAD filters failed testing and were

replaced; successful in-situ tests were performed on these filters.

Comments Q3/Q4 HEPA: Two filters were not tested as one of them is not in service and the other is inaccessible. There were an additional 8 HEPA filters that were not tested, these were all trench filters. The trench filters are in the construction zone and not accessible because of construction activities. There was no processing of radioactive materials in the construction zone in 2019 and all Mechanical Room filters downstream of the trenches were tested. 230 filters were tested and all passed.

Comments Q3/Q4 CAD: Six trench filters were not tested, but are changed every three years as per procedure. Due to lack of radioiodine processing and storage in the KRMF/Radiopharmaceutical facilities, 21 CADs servicing those areas are not tested against the performance criteria, but continue to be tested regularly to research the filter performance. One CAD filters was changed out due to its shelf life expiring. This filter had a successful in-situ test performed on it after installation.

Nuclear Medicine in-cell charcoal roughing filters are on a preventative maintenance schedule and replaced typically every six months. These filters are not credited with mitigating releases in Nordion's Safety Analysis reports. None of the cells were used for processing in 2019, and as the area is a construction site in-cell filters were not changed this year.

2.7.11.2 Back-up Power Facilities

The emergency generators, which supply emergency power to the KOB, KRMF and the Heating Plant, are tested monthly. Testing in 2019 was performed at the required frequency.

2.7.11.3 Radiation Evacuation Alarms

Radiation evacuation alarms are tested weekly and quarterly by the Radiation Surveyors. They are additionally tested biannually by Facilities. Testing in 2019 was performed at the required frequency and results were satisfactory.

2.7.11.4 Radiation Alarms

The radiation alarms are scheduled for testing on a weekly basis and were tested every week in 2019. The tests verify that the alarms sound at the pre-set 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.

2.7.11.5 Sprinkler System Fire Alarms

The sprinkler system fire alarms in KOB, KRMF and the Heating Plant are tested every month. Testing in 2019 was performed at the required frequency and results were satisfactory. All dry systems were tested and verified in good operating condition in 2019 as required by the National Fire Protection Association (NFPA).

2.7.11.6 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 2019 was performed at the required frequency and results were satisfactory.

2.7.11.7 Contamination Monitoring Equipment

Handheld contamination monitoring equipment is maintained twice a year. Area monitors are checked on a daily basis. Testing in 2019 was performed at the required frequency and results were satisfactory.

2.7.11.8 Contamination Control Equipment

The hand and foot monitors are calibrated twice a year, tested weekly and serviced on a routine basis. They are also repaired as required, which is typically two to three times a year. Testing in 2019 was performed at the required frequency and the results were satisfactory.

2.7.11.9 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 or in some instances the Surveyor. In 2019, a total of 15 work orders were generated for issues that were identified during weekly equipment testing.

Five work orders were due to issues with barrier monitors (Hand and Foot or Whole Body Contamination Monitors). The issues with the barrier monitors were typically due to faulty probes or software/hardware issues causing the monitor to go “Out of 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.

Two work orders involved issues with air sampling pumps; however, these issues were at locations considered to be of secondary importance and alarms on the Building Management System (BMS) are not triggered for failure of these pumps. There are several spare pumps and they are replaced typically within 24 hours.

Three work orders were generated for an alarm signal not registering at the BMS. The issues were corrected.

Three work orders were generated due to meter or probe faults. As probes begin to fail the number of counts detected will begin to decrease over time. The weekly testing helps identify failing probes so they can be changed prior to complete failure.

There were two other issues which generated work orders, one involved a worn cable the other was a failure to register an alarm on the Cobalt panel, but the device registered locally and on the BMS.

Overall the results were very good and demonstrate the value of continuing weekly performance checks, but also that failures of components are not compromising safety.

2.7.11.10 Radiation Survey Instruments

Radiation Survey Instruments are tested on a monthly, bi-annual, or annual basis as required. In 2019, for all of the 825 calibrations performed, the “As Found” results did not constitute a safety or regulatory concern. Testing in 2019 was performed at the required frequency and the results were satisfactory. At the end of 2019, there were five out of 825 survey meters past due for the internal frequency requirements. The majority of meters are calibrated every six months. The regulatory requirement for calibration frequency is 12 months.

2.7.11.11 Trends

There were no trends identified.

2.7.12 Radiation Protection Training Program and Effectiveness

Refer to Section 2.2.1 and 2.2.2.

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 Workplace Health & Safety Committee. The Workplace Health & Safety Committee is also responsible for reviewing the Hazard Prevention Program. In addition, the EHS Committee sets targets each fiscal year that are used to monitor the effectiveness of the safety program.

Targets were established for less than 5 Medical Treatment Incidents and zero Lost Time incidents. In addition, Near Miss Reports and Hazard Identification Reports are tracked and are reported monthly to senior management and are provided to the EHS Committee for review.

An internal audit of the Conventional Health and Safety Program was conducted by a third party in 2019, see Appendix B.

Process safety audits are conducted annually.

Refer to Section 2.1.3 and Appendix B for a description of audits and inspections for 2019.

2.8.2 Conventional Health and Safety Committee

The KOB Workplace Health and Safety Committee is represented by union and management and typically meets on a monthly basis. The duties of the Nordion Ottawa site Health & Safety Policy Committee were rolled over to the Workplace Committees as stipulated by the Canada Labour Code as the number of employees in Nordion and BWXT ITG Kanata respectively fell below 300 (the point at which a Policy Health and Safety Committee is required).

The Nordion Workplace Health and Safety Committee met eleven times in 2019, with BWXT ITG separating into its own Committee starting April 2019. The 2019 accomplishments for this Committee was its continued review of new or changes to applicable EHS policies and programs. In addition, the Workplace 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 2019 included the following:

- Continuation of a behavioural based safety awareness campaigns,
- Roll out of Canada Labour Code Part II training for managers
- Initiatives related to safety of Installation and Services group and work done globally
- Implementation of a Working Alone procedure
- Implementation of a Bio-Safety procedure
- Update to the departmental Job Hazard Analysis and Risk Assessment process
- Improvements made to documents for reporting of occupational injuries, and work reintegration.
- Improvements made to the Work Permit procedure
- Improvements made to the Manual Material Handling procedure

2.8.4 Conventional Health and Safety Occurrences

During 2019, there were no medical treatment incidents and two lost time incidents (one Nordion and one for BWXT ITG contracted employees). The details are summarized below. Figures 2 and 3 illustrate the number of Incidents by year and the Number of Days Lost by year respectively.

Lost Time Incidents:

Business Unit	Medical Treatment Injury	Action Taken
BWXT ITG (Operations)	Employee sustained a low back injury when trying to open double lead doors on cell 34. Employee was pulling the doors with force on several attempts door wouldn't open. (issue with doors). 5 lost time days incurred.	An investigation into the incident was performed by the manager and it was determined that the door status was in a "fault condition" which would not allow the door to open. Technicians need to check status of cell doors before attempting to open them.
Nordion (Operations)	Employee was removing wood bracing from a sea crate container. When they bent over to pick up a piece of wood they had an immediate pain to lower back. Wood was located at ground level. This was a routine task.	Nordion will no longer be removing the blocking and bracing from the ocean containers. Blocking and bracing materials will remain in the containers once the Nordion flasks are removed, with the trucking company now responsible to remove the blocking and bracing materials.

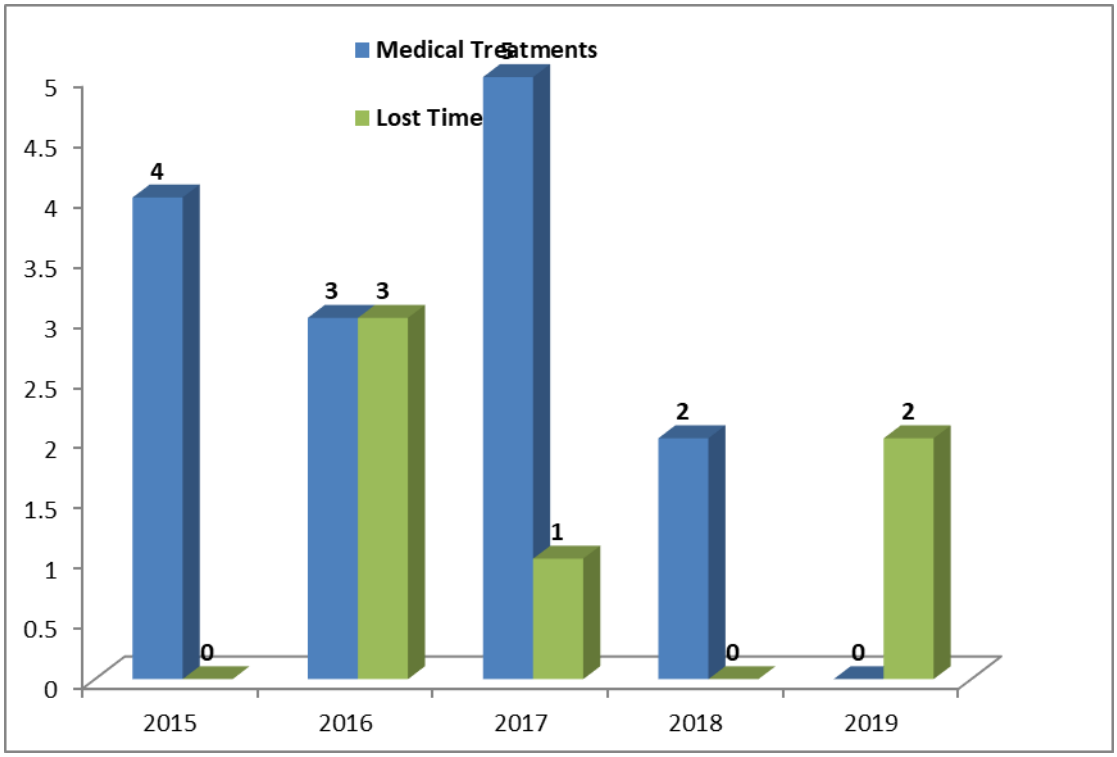


Figure 2: Number of Medical Treatments and Lost Time Incidents by Year

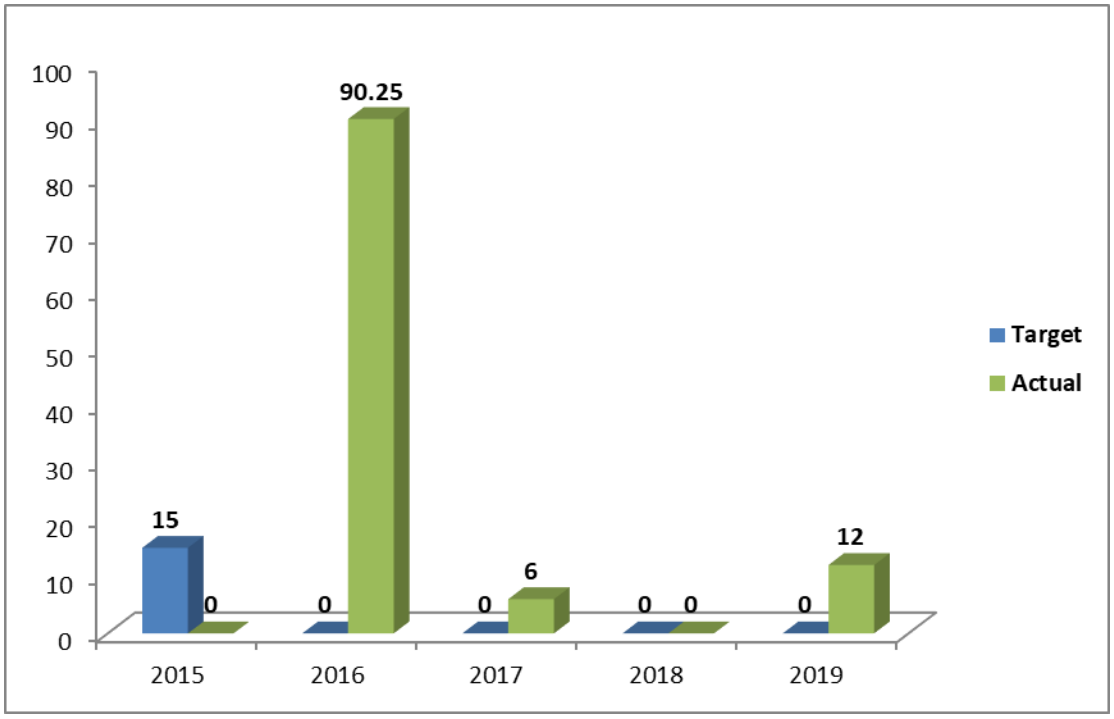


Figure 3: Number of Lost Time Days by Year

Nordion Lost Time Injury Statistics for 2019

	2019
# Lost-Time Injuries[1]	2
Severity Rate[2]	4.15
Frequency Rate[3]	0.69

1 An injury that takes place at work and results in the worker being unable to return to work for a period of time. 2 The accident severity rate measures the total number of days lost to injury for every 200,000 person-hours worked at the site. Severity = [(# of days lost in last 12 months) /(# of hours worked in last 12 months)] x 200,000. 3 The accident frequency rate measuring the number of LTIs for every 200,000 person-hours worked at the site. Frequency = [(# of injuries in last 12 months) / (# of hours worked in last 12 months)] x 200,000

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

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 Nuclear Ventilation System (NVS) has been designed and is maintained to prevent the unnecessary release of radioisotopes to the atmosphere.

2.9.1.1 Airborne Effluent

A revised LCH was issued to Nordion in January 2019 containing the DRL values submitted by Nordion in 2016 and approved by CNSC.

In 2019, the maximum annual release of airborne effluent from any one radionuclide was from Co-60 at 0.00001% of the DRL. These values are based on two instances where Co-60 was detected, but at the Minimum Detectable Activity level (see Section 2.9.2 for a further discussion of MDA values). The total air release was 0.00001% of the DRL. No Action Levels were exceeded in 2019. Dose to public using the 2019 LCH DRL values was 0.1 nSv.

[redacted] I-125 with its longer half-life is still present in some waste and Nuclear Ventilation Systems but no releases were detected.

Note that air release activity measurements have an uncertainty of ±25% for radioiodines and particulates and ±6% for radioxenons.

Table 15
Airborne Releases

Year	Co-60 (GBq/yr)	I-125 (GBq/yr)	I-131 (GBq/yr)	Xe-133 (GBq/yr)	Xe-135 (GBq/yr)	Xe-135m (GBq/yr)
2015	0.005	0.12	0.15	11,916	8,237	10,758
2016	0.006	0.21	0.35	7,277	4,299	5,421
2017	0.0034	0.0012	0.0008	0	0	0
2018	0.002	0	0.006	0	0	0
2019	0.00002	0	0	0	0	0
Action Levels (GBq/week)	0.001	0.1	0.2	3,000	N/A	N/A

	Co-60	I-125	I-131	Xe-133	Xe-135	Xe-135m
DRL (GBq/yr)	250	952	686	677,000,000	102,000,000	69,000,000
% DRL	0.00001	0	0	0	0	0

[redacted]

2.9.1.2 Liquid Effluent

A revised LCH was issued to Nordion in January 2019 containing the DRL values submitted by Nordion in 2016 and approved by CNSC.

Allowable liquid effluent releases to the environment are also limited to values in SE-OP-013, “Water Effluent Monitoring”. The five year variation in activities released is listed in Table 16. Each release of liquid effluent in 2019 was well below the values in SE-OP-013 (exceedance of which would be Action Level reporting). 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 16.

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.

Note that liquid release activity measurements have an uncertainty of ±10%.

Table 16
Liquid Releases (GBq/yr)

Year	Litres	β<1MeV	β>1MeV	I-125	I-131	Mo-99	Co-60	Nb-95	Zr-95	Cs-137
2015	590570	0.191	0.044	0.111	0.006	0.06	0.019	0.001	0.001	0.0004
2016	680559	0.222	0.051	0.144	0.006	0.052	0.026	0.001	0.0015	0.0007
2017	661376	0.212	0.048	0.145	0.006	0.049	0.022	0.001	0.002	0.0007
2018	713224	0.243	0.055	0.146	0.007	0.055	0.027	0.001	0.0017	0.0007
2019	576800	0.162	0.038	0.063	0.004	0.036	0.020	0.002	0.0019	0.0007

Nordion SE-OP-013 (19) Constraints on each delay tank release (pH or GBq/Release)									
pH	**β<1MeV***	**β>1MeV***	**I-125**	**I-131**	**Mo-99**	**Co-60**	**Nb-95**	**Zr-95**	**Cs-137**
6-9.5	<0.086	<0.021	<0.006	<0.003	<0.132	<0.015	<0.047	<0.047	<0.0024

	β<1MeV*	β>1MeV*	I-125	I-131	Mo-99	Co-60	Nb-95	Zr-95	Cs-137
DRL (GBq/yr)	763	35,000	1,190	389	10,200	35.4	3,250	2,060	24.8
% DRL	2.13E-02	1.07E-04	5.30E-03	1.14E-03	3.51E-04	5.58E-02	5.25E-05	9.42E-05	2.98E-03

*β<1MeV Ni-63 DRL value used, β>1MeV Y-90 DRL used

Liquid releases are listed in Table 16 against both the DRL limits as well as the constraints Nordion places on every delay tank before it can be released from the building. [redacted] Meaning that less than 7% of the reported releases to liquid are real values and the rest are the reported MDA values instead of using zeroes. This is typical for every year in Table 17, therefore releases and subsequent dose to public are significant, conservative overestimates.

If the critical receptor was the same group for all radionuclides the dose to public would be 0.087 µSv. This value is a conservative over estimate because the critical receptor has been used as the same receptor and the DRLs are conservatively calculated.

In early 2016, Nordion made a change to the calculations used to determine the MDA for Zr-95. As the level of Zr-95 in the liquid effluent is low, often below the MDA, this has resulted in the appearance of an increase in the Zr-95 liquid releases compared to previous years.

2.9.1.3 Environmental TLDs

The locations of environmental TLDs are shown in Appendix G and listed in Table 17. 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.

All environmental TLD readings for 2019 were well below the public limit of 1 mSv. 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 17 – Environmental TLDs

[redacted]	2015 (mSv)	2016 (mSv)	2017 (mSv)	2018 (mSv)	2019 (mSv)
[redacted]	0.094	0.133	0.032	0.086	0.096
[redacted]	0.177	0.241	0.169	0.132	0.164
[redacted]	-0.024	0.035	-0.052	-0.071	-0.086
[redacted]	0.065	0.128	0.037	0.08	0.039
[redacted]	*	0.078	0.061	0.079	0.093
[redacted]	0.02	0.037	-0.041	0.031	-0.011
[redacted]	-0.02	0.003	-0.057	0.036	-0.004
[redacted]	*	0.161	0.036	0.082	0.078
[redacted]	-0.008	0.004	-0.047	0.003	-0.018
[redacted]	0.065	0.149	0.046	0.144	0.140

* missing TLD

2.9.2 Significance of Air and Water Release Monitoring Results

[redacted]

[redacted] It has been the practice of Nordion to only quantify air releases which have been identified first by reports generated by multi-channel analyzers, then on annual review all spectra are reviewed visually for evidence of peaks which were not correctly identified or quantified. This was found to be an issue with I-125 quantification, as software looked for the 35.5 keV low yield gamma peak and not the more abundant low energy x-rays at ~27 keV. Therefore, an annual correction was performed. However, in 2018 and 2019 there was no evidence of an I-125 release from any of the stacks. If Nordion were to apply MDA values to Co-60 releases in 2019 would be 0.0022 GBq of Co-60. This is still several orders of magnitude lower than the releases via liquid (both in %DRL or dose to public). [redacted]

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 generally proportional to activities released. Nordion employs a conservative practice of assuming the MDA is always released in liquid effluent. This explains why the year over year trend very closely follows the number of litres released.

In fact, only less than 7% of the total measurements done on liquid effluent in 2019 were above the MDA. Therefore, the liquid effluent monitoring results indicate a dose to the public that is based on activity values which were over-estimated by a factor of fifteen (15). Due to the conservative approach used by Nordion, the estimated dose to the public from liquid effluent is greatly over estimated.

2.9.3 Exceeding Regulatory Limits or Action Levels

There were no instances of exceeding CNSC environmental regulatory limits or action levels in 2019.

2.9.4 Spills to the Environment

Aside from the unplanned releases reported in Section 1.1, there were no spills to the environment in 2019.

2.9.5 Environmental Protection Program Effectiveness

A review of the performance related to the Environmental Protection Program and the Environmental Management System is conducted on an annual basis. In 2019, this review was held during the Annual EHS Program Review on May 10, 2019. The results of the review are summarized in Section 2.1.2.

Refer to Section 2.1.3 for a summary of internal and external inspections, audits and reviews. A list of the internal audits and associated findings and opportunities for improvement are provided in Appendix B.

2.9.6 Environmental Protection Program Activities

Activities which took place in 2019 included the following:

- Conducting a total of 17 fire and environmental inspections to identify areas for improvement and/or concerns,
- Conducting a supplier audit of a supplier whose goods/services could have a significant impact on the environment,
- Nordion was subject to an ISO 14001:2015 maintenance audit. No non-conformances were identified and six opportunities for improvement were identified during the course of this audit.

2.9.7 Environmental Protection Program Improvements

In 2019, Nordion made the following improvements to the Environmental Protection Program:

- Updated risk assessments for lead, silica, and mercury.

2.9.8 Environmental Protection Program Performance

A description of the Environmental Protection Program Initiatives is provided in Table 18, along with the results/outcomes.

A summary of initiatives and targets for the upcoming year is provided in Table 19.

Table 18

2019 Environmental Objectives

Objective	Result / Outcome
Assess opportunities to reduce releases to water. Investigate and implement (as feasible) opportunities to reduce releases to water from the Gamma Technologies area	• Work was completed to reduce waste water releases from unloads. • It was identified that further work is required to reduce potential releases from the delay tank.
Conduct an audit of a supplier whose goods and/or services could have a significant impact on the environment.	An audit of supplier whose services could have a significant impact on the environment was completed in 2019.
Investigate energy reduction opportunities	In 2019, Nordion replaced lighting to LED in the following areas: • Mechanical rooms # 3, 7 and 9 and the tunnel areas between the KRMF-KOB-Heating plant resulting in a savings of 6500 kWh annually • All exterior perimeter lighting (wall packs) changed from 1000W metal halide to 100W LED lights resulting in a savings of 36000 kWh annually. This resulted in a total energy savings of 42,500 kWh annually
Assess opportunities to reduce particulate matter emissions from the Glass Blowing Lab (continued from 2016)	In 2019 Nordion conducted testing and identified an appropriate filter. The exhaust system was modified to fit the filter. The only outstanding item is filter installation. This was delayed due to filter availability but is expected to be in place by the end of March 2020.

Table 19
2020 Environmental Objectives and Targets

Objective	Target
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 December 2020.
Investigate energy reduction opportunities	Estimated savings of 7,500 kWh per year
Assess opportunities to reduce releases to water.	Investigate and implement (as feasible) opportunities to reduce releases to water from the Gamma Technologies area
Investigate possible opportunities for using less environmentally harmful chemical products and/or reducing chemical use in processes, product support, facility operation and maintenance activities where feasible	Investigate and implement (as feasible) opportunities to reduce, remove or replace hazardous chemicals with less harmful ones
Investigate energy reduction opportunities	Investigate implementation of “Behind the Meter” energy storage.
Investigate potential options for reducing the volume of Cobalt waste by 2022	Complete investigation and implement viable options by the end of 2021

2.9.9 Groundwater and Soil Sampling and Monitoring

2.9.9.1 Soil Sampling

Soil samples were taken at 19 locations around the Nordion site in October 2019, as shown in Figures G.4 and G. 5 in Appendix G. Samples were placed in plastic bags, labeled with the site location, and then analyzed on the MCA for 8 hrs as per Nordion’s procedure. Background measurements (no sample, empty chamber) were also taken for reference. The radioisotope primarily analyzed was Co60. The MDA is determined for each sample individually and ranged between 0.56 – 1.83 Bq. When accounting for background Co60 fields present in the facility, all 19 samples were determined to be less than the MDA. As such, no radionuclides attributable to licensed activities were detected in the soil samples.

2.9.9.2 Groundwater Sampling

Figure G.3 (Appendix G) shows current groundwater well locations.

Nordion has completed a gap analysis against the requirements of CSA N288.7-15, *“Groundwater protection programs at Class I nuclear facilities and uranium mines and mills”* and is continuing toupdate internal procedures and programs to meet these requirements and fill gaps identified.

2.9.9.2.1 Non-Radiological Sampling

Non-radiological groundwater samples were taken on June 19, 2019. Results, including those from the recent analysis, from five years previous and from the original sampling in 2005 are provided in Appendix F 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 2019 compared to past years. This indicates that Nordion's operations have not had a significant impact on the groundwater.

2.9.9.2.2 Radiological Sampling

Nordion monitors groundwater at least once per year.

Samples are taken in 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.

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.

Nordion completed all of its scheduled activities for 2019.

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 2019, a number of Emergency Response (ER) exercises were conducted to test these emergency response plans and response personnel.

Activities which took place in 2019 included:

- A full-scale exercise was conducted that tested a full mobilization of the response organization in a fire and possible contamination scenario. Ottawa Fire Services participated in the exercise and it was inspected by the CNSC. It was a successful test of the response plans and responders.
- Testing of the Fire Safety Plan in each of the three buildings (KOB, RE Building, and Heating Plant), including alarm activation and full evacuation,
- Testing of the ER Contact List to ensure accuracy of telephone numbers listed, to determine availability of personnel, and to estimate response times.

2.10.3 Emergency Preparedness Program Performance

The emergency preparedness program performance was tested during the exercises and drills noted in the previous section. During these exercises and drills, Nordion executed an effective response and demonstrated good interoperability with city first responders.

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

There were no deficiencies with the Emergency Management Program systems or equipment in 2019.

2.10.4 Emergency Preparedness Program Improvements

In 2019, Nordion completed program enhancements to address minor items identified in exercises and drills and other continuous improvements. As noted above, these included:

- Addition of “expected ERO activation times” to better define expected response times from key ERP personnel,
- General updates to program documentation to include BWXT ITG personnel and associated contact information in the program where required,
- Minor updates to contact information for key personnel as required,
- Designing and implementing minor revisions to the program to address items identified during the 2019 major exercise,
- Holding a tabletop exercise involving the Incident Command Post personnel pool as participants or observers.

2.10.5 Fire Protection Program Effectiveness

Fire exercises/evacuations were conducted in the Heating Plant, the RE Building and the KOB in 2019. There were no significant findings identified as a result of these exercises.

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 2019. An annual facility condition inspection was conducted by a third party in 2019 with one minor finding and two observations identified.

2.10.6 Fire Protection Program Activities

The Fire Protection Program Activities that took place in 2019 include:

- Testing of the fire safety plans. This test involved evacuation of the KOB and Heating Plant buildings by activation of the building fire alarm system,
- Conducting 17 fire and environmental inspections,
- Conducting an annual facility condition inspection with one minor finding related to fire stopping and two observations noted.

A fire protection program audit was conducted in 2019 and is conducted every three years as required by CSA standard N393, “Fire protection for facilities that process, handle, or store nuclear substances”.

2.10.7 Fire Protection Program Performance

Overall, compliance with the Fire Protection Program was satisfactory.

2.10.8 Fire Protection Program Improvements

Improvements to the Fire Protection Program in 2019 included:

- Updating the Fire Safety Plan and Fire Warden and Fire Marshall Responsibilities procedures.
- Updating the Work Permit Authorization program to meet new requirements of the National Fire Code 2015.
- Replaced all combustible strapping for compressed air tanks to a non-combustible alternative.

There were no changes to training, methods, instrumentation, or equipment in 2019.

2.11 Waste Management

2.11.1 Effectiveness of Waste Segregation and Minimization

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 is generated through the production operations is 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. [redacted] Space is also designated for storage of containers and management of waste being prepared for shipment to the external waste management facilities.

Nordion's non-radiological waste diversion rate in 2019 was 65.1%. This is lower than the 2018 diversion rate of 74.3%, owing mainly to the demolition activities occurring in 2019 in the BWXT ITG leased facilities.

2.11.2 Identification and Characterization of Waste Streams

[redacted]

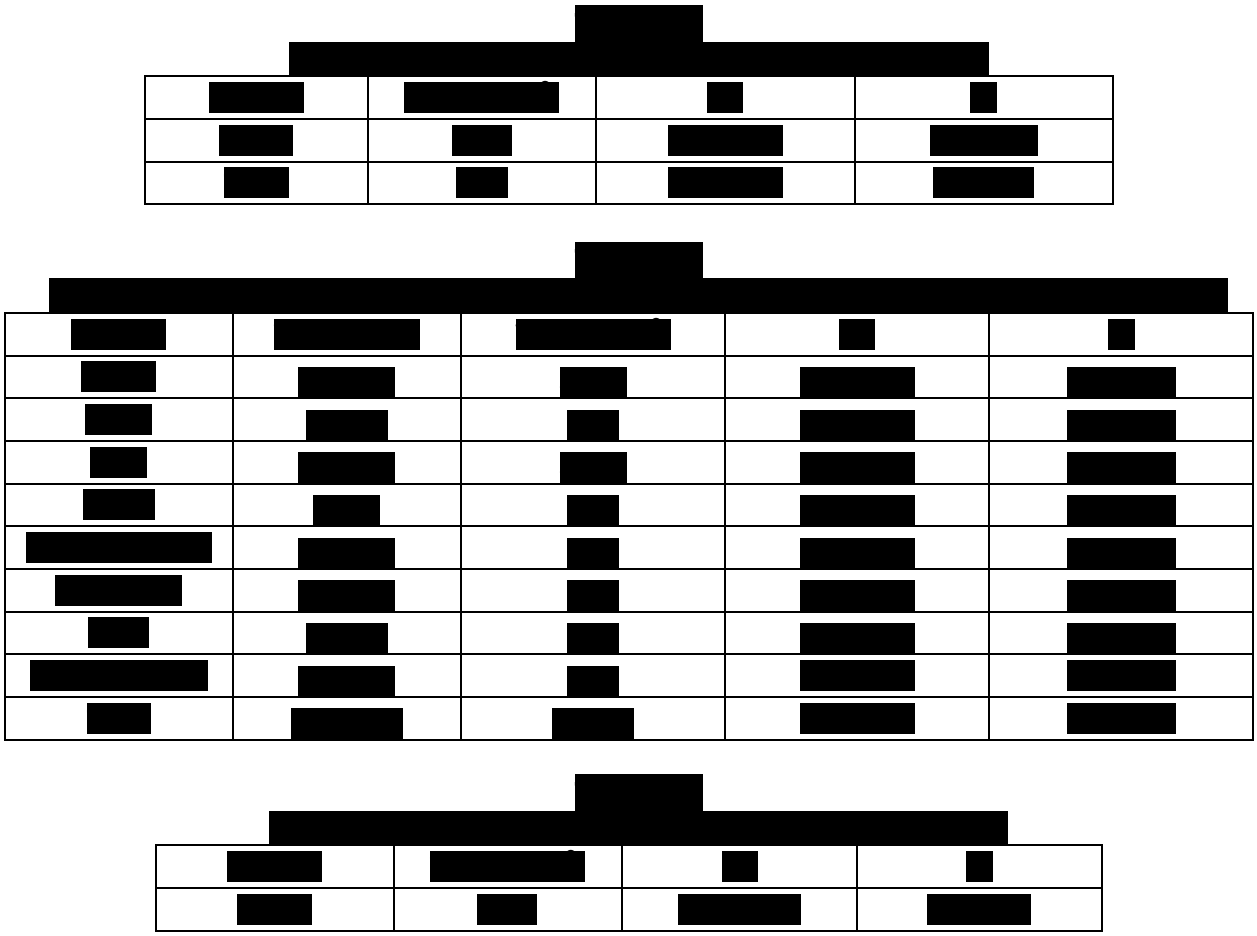
2.11.3 Waste Shipments

[redacted] In 2019, there were no shipments to CNL of radioactive liquid waste from Nordion's Class 1B Facility.

[redacted]

In 2019, approximately [redacted] of solid and liquid hazardous (chemical) waste was disposed of [redacted] via a licensed waste disposal company. [redacted] disposed of approximately [redacted] of solid and liquid hazardous (chemical) waste via a licensed waste disposal company in 2019.

In 2019, [redacted] that met CNSC unconditional clearance levels was disposed of to a landfill as part of the waste diversion program.



2.11.4 Waste Management Program Performance

- Nordion diverted an estimated 65.1% of waste from landfill in 2019,
- The amount of waste diverted from licensed radioactive waste facilities – [redacted] that met CNSC unconditional clearance levels was disposed of to landfill as part of the waste diversion program.

The waste management program was audited in 2018 and is on a three year frequency for internal auditing. Nordion has an annual waste audit conducted by a third party (non-hazardous waste only). The results of this annual third party audit are summarized below:

- 65.1% diversion rate,
- 90%+ diversion rate for:
    - Aluminum food/beverage cans & foil,
    - Scrap Metal,
    - Cardboard,
    - Fine Paper,
    - Newsprint/Packing Paper,
    - Wood/Skids,
    - Spent lighting tubes/bulbs/ballasts,
    - Shredded Paper.
    - Glass food and beverage bottles

2.11.5 Waste Management Program Improvements

Improvements to the Waste Management Program in 2019 included the following:

- [redacted] of returned Cobalt sources were cut back to raw material and recycled into new source manufacturing,
- [redacted] of returned Cobalt sources were re-encapsulated into new sources for resale.
- [redacted] of returned Cobalt sources were cut back to raw material and added to inventory in 2019 to support the recycling program.

2.12 Nuclear Security

Details of Nordion security and any security improvements of 2018 were provided in the Nordion Physical Security Report and Security Plan for 2019, submitted in February 2019. These safeguards and improvements are prescribed information and were reviewed and accepted by CNSC Security as part of the 2019 Type ll Security Inspection.

2.13 Safeguards and Non-proliferation

2.13.1 Safeguards Program Effectiveness

Nordion has a safeguards program that meets the safeguards requirements of the CNSC regulatory document REGDOC 2.13.1-Safeguards and Nuclear Material Accountancy, CNSC *Nuclear Non-Proliferation Import and Export Control Regulations*, the *Nuclear Safety and Control Act* and *General Nuclear Safety and Control Regulations*.

2.13.2 Safeguards Program Performance

In 2019, Nordion performed accounting and reporting of nuclear material as required by REGDOC 2.13.1-Safeguards and Nuclear Material Accountancy. Nordion completed a PIT of safeguarded material from which there was one minor finding and four observations opportunities for improvement (refer to Appendix B).

In October 2019, the IAEA performed a Physical Inventory Verification (PIV) and a Complementary Access Inspection. There were no outstanding actions at the conclusion of the inspection. The IAEA statement of results was received by Nordion and confirmed the results of the inspection were satisfactory.

2.13.3 Safeguards Program Improvements

There were no specific improvements to the safeguards program in 2019.

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 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.

In 2019, Nordion shipped approximately [redacted] packages containing various radioactive materials.

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 2015*, Transport Canada *Transportation of Dangerous Goods Regulations*, IAEA *SSR-6* Regulations for the Safe Transport of Radioactive Material (2018 Edition), US DOT 49 CFR, and US NRC 10 CFR part 71.

In 2019, Nordion reported three non-conformances related to packaging and transport of nuclear substances. Thee three reportable non-conformances were reported as "dangerous

occurrences" pursuant to subsection *37(1) of the Packaging and Transportation of Nuclear Substances Regulations*. All three of the non-conformances were the result of other parties (carriers or customers) handling Nordion packages. Refer to Appendix A for further information regarding these incidents.

2.15 Public Information Program (PIP)

2.15.1 Public Information Program Activities

Nordion is committed to fully disclosing its activities to the public in an effort to maintain transparency to the surrounding community and to the City of Ottawa. Nordion's website is the primary communications vehicle. In 2019, 34 775 unique users visited Nordion.com 45 121 times looking at a total of 101 535 pages.

In absence of offering on-site facility tours to the general public, Nordion offers the general public a glimpse into our campus through an online Nordion Virtual Tour.

Every two years, Nordion hosts a community event with the general public. Such an event was held in 2018. There was no general public event in 2019.

On May 14, Nordion hosted a delegation from the Algonquins of Pikwakanagan First Nation at our facility in Ottawa. This was a joint meeting with BWXT ITG and arranged by OPG to support BWXT ITG's project to produce Mo-99 in the OPG reactor as part of the supply chain for future production of Tc generators in the Medical Isotopes facility. Nordion used this opportunity to describe Nordion, our work, and our facility to the Algonquins of Pikwakanagan First Nation.

In 2019, Nordion published the following information in their "Public Disclosure" web page:

- November: evacuation of administrative building due to power outage.
- September: Construction work began for a new construction entrance to support renovation activities.
- June: Nordion conducted an emergency response exercise. As part of this training exercise, the building was evacuated.
- June: Members of the Ottawa Fire Services were on site for planned meetings with Nordion to discuss joint emergency response plans.
- April: Evacuation of an administrative building due to a false fire alarm
- March and April: Local emergency response teams (such as law enforcement and paramedics) were on site for familiarization visits. These visits allow Ottawa emergency response teams better respond should the need ever arise.
- Q1, Q2, Q3, and Q4: 2019 Event reports posted.

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 learn how the public would like the program to evolve. A copy of the feedback survey form is provided in Appendix I. There were no feedback forms submitted by members of the public in 2019. Nordion also allows the public to contact it through a contact form on our website. Two questions pertaining to Nordion's public information program were received through the general contact form. One was an inquiry into whether Nordion had a newsletter service. Nordion does not have a newsletter service at this point. The second was a request from a local teacher inquiring about a tour of the facility.

Nordion regularly issues news releases to inform the public of company initiatives, achievements, and issues that the business may be facing. In 2019, 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, there was no media analysis of public opinion.

Nordion uses social media programs such as Facebook, Twitter, and LinkedIn to inform the public of the company's initiatives. In 2019, there were no negative comments pertaining to events or questions related to environment, health and safety.

On December 12, 2019, Nordion published an ad in the *Community Voice*, a bi-weekly newspaper distributed to 46,230 homes and businesses in the Kanata/Stitsville area. A copy of the ad is provided in Appendix I. The ad underlined Nordion's ongoing commitment to protect the safety of employees, the community and the environment, referred to the Kanata facility as a Class 1B nuclear facility, noted that Nordion is certified to ISO 14001, an international standard for environmental management systems; and encouraged the public to contact Nordion with any questions, comments, or concerns.

2.15.2 Public Information Program Summary of Questions/Concerns Raised by the Public

There were no specific questions or concerns raised by members of the public in 2019, outside of those already noted.

2.15.3 Public Information Program Improvements

Through the year, Nordion updates its website content to keep it current. There were no significant changes to Nordion's public information program.

2.16 Financial Guarantee

The Financial Guarantee, as approved by the Commission and based on the Facility's Decommissioning Plan, remains valid and in effect.

2.17 Site Specific Information

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

- Nordion shall submit a written notification of changes to the facility or its operation, including deviation from design, operating conditions, policies, programs, and methods, referred to in the licensing basis,
- Nordion shall, when aware that an action level has been reached, notify the Commission within seven days,
- Nordion shall prepare and submit to the Commission an Annual Compliance Report by March 31st of each year,
- Nordion shall report the transfer, receipt, export or import of sealed sources if the activity exceeds the threshold limits and within the specified timeframes as detailed in the LCH,
- Nordion shall report annually to the CNSC on the status of the financial guarantee, to inform that it remains valid, in effect and adequate to fund decommissioning of the facility.

In 2019, Nordion submitted written notification of changes to programs and documents to the CNSC.

In 2019, there was one event with regard to sealed source reporting:

- Nordion reported the incorrect number of sealed source received at the facility. Nordion provided a subsequent correction to the CNSC for this issue. In response to the occurrence, Nordion updated the communication processes for returned shipments and revised internal work instructions to provide increased guidance how to obtain information on returning sources when the information is not available in the SAS Reporting platform.

This event was not reportable to the CNSC. There were no trends identified in 2019 with regard to SSTS-related events. Over the three-year period from 2017-2019 it was identified that reporting issues most often occur for non-routine and/or return shipments. These continue to be the focus for sealed source reporting process reviews and related process improvements.

Nordion continues to work on the improvements to the sealed source reporting process.

Nordion complied with all other site-specific reporting requirements. In 2019, there were no exceedances of action levels. Nordion reported on August 29, 2019 to the CNSC on the status of the financial guarantee.

3. FUTURE PLANS AND CONCLUDING REMARKS

3.1 Improvement Plans and Future Outlook

Nordion continues to plan the installation of an additional cell (Cell 1) in Nordion's Cobalt Operations Facility.

Nordion began to implement a new electronic Quality Management System (eQMS) to replace the existing software for management and training on documents. The new system is anticipated to go-live in early 2020.

Nordion has initiated a multi-year project to transition to an Oracle business system for the existing work processes that support electronic reporting to the CNSC Sealed Source Tracking System (SSTS).

The forecasted plans for next year that would require CNSC regulatory oversight are as follows:

[redacted]

3.2 Safety Performance Objectives for 2020

Nordion's 2020 EHS Program Objectives and Targets and Health and Safety Objectives are shown in Table 23.

3.3 Concluding Remarks

Based on the information provided in this report, Nordion continues to demonstrate its capacity to operate in a manner that protects the safety of employees and causes no adverse effects to the public or the environment.

Table 23
2020 EHS Program Objectives and Targets

Objective	Measure/Target *
Manage CAPAs and ensure timely closure of CAPAs	• Ensure timely updates to and closure of CAPAs (no late CAPAs and request extensions as required)
Close out Quality/EHS Management Systems in a timely manner (where applicable to your areas)	- Ensure documents under your ownership are maintained and reflect current practices - Complete Complaint Investigations within the target of 14 days from initiation and closure within 60 days - Ensure target dates are set for all Change Control forms - Overall percentage of overdue training ≤2%
Minimize the number and extent of occupational injuries	• The number of Medical Treatment Incidents ≤ 4, • Lost time Incidents = 0.
Minimize the use and release of hazardous materials to the environment.	• Radioactive materials emissions to < 2.0% of the Derived Release Limits (DRL) (Ottawa), • No reportable releases of radioactive and non-radioactive hazardous materials to the environment (sanitary sewer, air, groundwater, land)
Maintain radiation doses to employees as per ALARA principle.	• Maximum employee dose rate ≤ 7.5 mSv/yr. (Ottawa)
Maintain a healthy safety culture. *	– It is unacceptable to take risks in order to get the job done. Safety is every employee's **highest** responsibility. – Actively participate in regular safety discussions and training. – Immediately report near-misses, hazard identifications, suspected ergonomic symptoms and workplace injuries to your Manager.

***Note: Some Health and Safety Targets have been established to promote safety culture only and are therefore not measureable.**

APPENDIX A
Reportable Events

Date of Occurrence	Incident No.	Description	Regulation/Requirement to which the Event is Non-compliant and/or Reporting Requirement	Causes	Corrective Actions
19-Apr-04	**19-06**	A Type A package was damaged during loading by the shipper. The radioactive contents remained intact.	Reportable under Section 37 (1) of PTNSR as the package shows evidence of damage as per Section 35 (b) of the PTNSR	The package was damaged while being handled by the shipper. Root cause determination is the responsibility of the shipper.	No corrective actions by Nordion as the shipper is responsible for implementing corrective actions. The contents of the package were unloaded without issue. The package was quarantined and repaired.
19-Jul-26	**19-09**	Nordion received a shipment of Co-60 from [redacted] in which one of the sources, model TC-239, had an abnormality in the weld. This order was received with a slightly higher level of contamination than typical. Given the visual inspection and elevated contamination level, Nordion deemed this source to have the potential for leakage.	The incident was reported to the CNSC on July 26, 2019 even though it was unclear if the source was leaking.	Nordion has received regular shipments of Co-60 in the TC-239 capsule from [redacted]. This is the first incident in which an incomplete weld was observed. The shipment in question was the second last shipment of Co-60 from [redacted]. Co-60 production has ceased at [redacted]. The final shipment was received at Nordion on August 2nd. There were no issues with those sources.	No corrective actions by Nordion. Shipments from [redacted] have ceased.
19-Dec-10	**19-18**	A Type A package was damaged during handling by the carrier. The radioactive contents remained intact.	Reportable under Section 37 (1) of PTNSR as the package shows evidence of damage as per Section 35 (b) of the PTNSR	The package was damaged while being handled by the carrier. Root cause determination is the responsibility of the carrier.	No corrective action by Nordion as the carrier is responsible for implementing corrective actions. The Package was removed from inventory and will not be repaired.

Date of Occurrence	Incident No.	Description	Regulation/Requirement to which the Event is Non-compliant and/or Reporting Requirement	Causes	Corrective Actions
19-Dec-19	**19-19**	A Type A package was damaged during handling by the carrier. The radioactive contents remained intact.	Reportable under Section 37 (1) of PTNSR as the package shows evidence of damage as per Section 35 (b) of the PTNSR	The package was damaged while being handled by the carrier. Root cause determination is the responsibility of the carrier.	No corrective action by Nordion as the carrier is responsible for implementing corrective actions. The Package was removed from inventory and will not be repaired.

Appendix B
Summary of Corrective Actions Associated with the Internal Audits Conducted in 2019

CAPA = Corrective Action Preventive Action
Gensuite ID# = BWXT ITG Gensuite Compliance Action
CHR = Change Request in EQMS
AC-CMP = Velocity EHS Compliance Action
CF = Change Form
OFI – Opportunity for Improvement

	Audit Title	# of Findings/ OFIs	Action Reference No.	Finding/Observation/OFI	Corrective Action	Status
1	Process & EMS Audit – Facilities Maintenance	2 Minor Findings	CAPA 191102	Two historic contract service providers were not included on the Critical Supplier List.	Perform a review of the Approved Supplier List and the Critical Supplier List to and address any historic gaps.	Open
			CAPA 191103	Eight (8) EHS courses were overdue for Facilities employees.	Corrective Actions currently being developed.	Open
		6 Observations	AC-CMP-20191108-001 CF#9233	The Facilities Training Coordinator did not prepare and approve the latest version of 8564 (3) as required by procedure.	Change Form 9233 has been initiated to update the document (8564) and remove the requirement that the Training Coordinator must perform all revisions.	Open
			AC-CMP-20191108-002	Several documents in EQMS, owned by Facilities, were not approved by the Senior Facilities Manager. In all these cases, the Senior Facilities Manager did approve corresponding Change Control Forms.	Corrective Actions currently being developed.	Open

			AC-CMP-20191108-003	The Periodic Review document list for the Facilities department included 65 overdue documents.	The Periodic Review for these overdue documents will be completed.	Open
			AC-CMP-20191108-004	Minor deficiencies were noted with Facilities related CAPAs.	Corrective Actions currently being developed.	Open
			CHR-3553-NUM	Examples of “Maintenance Not Performed” forms had “N/A” completed in the field where the “Process Equipment Technician” signature was required.	The procedure will be updated to allow the Process Equipment Technician or designate to sign this form if required.	Open
			AC-CMP-20191108-005	QA and EHS approvals were not completed two suppliers.	The QA and EHS review and approval for these suppliers will be completed. The issue will also be brought to the attention of BWXT ITG’s procurement team.	Open
		11 OFI’s	CHR-3543-NUM	The document R-Master refers to the position of Equipment Manager but there is no current role of “Equipment Manager” at Nordion.	The document will be updated to reflect the current practices and organization.	Open
			AC-CMP-20191108-006	Some supplier history files could not be located by Procurement at the time of the audit but were produced the next day.	Procurement will review their practices for filing and retrieving supplier history files.	Closed
			CHR-3544-NUM	The location of the EHS Critical Supplier List is incorrect in SE-ENV-019.	The reference will be updated.	Open
			AC-CMP-20191108-007	Minutes of the annual review by Procurement did not indicate who attended the meeting.	Procurement will consider implementing the use of a template for recording the minutes of annual reviews.	Open

			AC-CMP-20191108-009	Radiation Safety had signed a work permit but had not indicated (yes or no) if personal protective measures were required, as required by procedure.	The requirements for signing work permits and indicated whether personal protective equipment is required will be reviewed with the Radiation Protection employees.	Open
			AC-CMP-20191108-010	A work permit was found with “Inspection completed by” checked off as “N/A”, but was also signed, initialed and dated. It was unclear whether verification was required, or not.	Corrective Actions currently being developed.	Open
			AC-CMP-20191108-008	Consider methods for verification to ensure Contractors inform their staff of the facility emergency equipment, such as eye wash stations, fire extinguishers, etc.	Methods to verify that Contractors have informed their staff of the facility emergency equipment will be considered for implementation.	Open
			CHR-3545-NUM	000501.SMP contains references to the “Facilities Administrative Assistant” but this position no longer exists.	The document will be updated to reflect the current practices and organization.	Open
			CHR-3546-NUM	The responsibilities outlined in SE-ENV-001 need to be updated to reflect the current organization structure.	The document will be updated to reflect the current practices and organization.	Open
			CHR-3547-NUM	The responsibilities outlined in SE-TRM-202 need to be updated to reflect the current organization structure.	The document will be updated to reflect the current practices and organization.	Open
			CHR-3548-NUM	The responsibilities outlined in 000501.SMP need to be updated to reflect the current organization structure.	The document will be updated to reflect the current practices and organization.	Open

2	EMS Audit	2 OFIs	AC-CMP-20190620-001	To improve the demonstration of leadership and commitment, it is suggested that Top Management become more actively involved in the EMS.	Actions to demonstrate the active involvement of Top Management in the EMS will be assessed.	Open
			AC-CMP-20190620-002	Procedure SE-OP-045 could be more prescriptive to better communicate EMS information to staff continually with content and frequency commensurate with the risk to the environment.	SE-OP-045 will be reviewed for opportunities to add more prescriptive language regarding the communication of EMS information.	Open
3	Safeguarded Physical Inventory (PIT)	1 Minor	N/A	A DU source carrier from the Group 1A LII could not be physically located.	It was determined that the source carrier had been shipped and EHS had not been notified. An Inventory Change Document (ICD) was submitted to the CNSC	Closed
		4 Observations	N/A	DU Transport Container [redacted] was noted as [redacted] on the DU Group 1A LII.	EHS determined that this information could not be changed but added a note on the LII to correct the identification number.	Closed
			Gensuite Action #29	Source [redacted] from Group 1A was found to have its label in poor condition.	The label has been replaced.	Closed
			Gensuite Action #30	The CBS inventory report of DU containers in transit or at customer sites included containers that had been sent for disposal or no longer in use by Nordion. It is recommended that the In-Field Container List should not show these items when provided for the PIT.	An Item Master Request Form was sent to the Inventory Manager to have the items removed from the Oracle Form in question.	Closed

			N/A	The on-hand inventory report from the CBS Container Management System (CMS) indicated container [redacted] as being on site instead of [redacted].	The CMS was corrected. No further action is required.	Closed
4	Non-Production Radioactive Material Inventory (NPRMI)	1 Observations	N/A	Sources were found in a different room than specified in the cycle counts.	The locators were updated during the audit.	Closed
		2 OFIs	Gensuite ID# 69	Review [redacted] Inventory and dispose of the three unneeded sources.	The inventory will be reviewed and the unneeded sources will be disposed of as needed.	Open
			CHR-3583-NUM	Cycle counts are returned to the [redacted] for [redacted] sources, not the [redacted] Procedure needs to be updated.	The procedure, SE-LIC-015, will be updated to reflect that the cycle counts are returned to the [redacted]	Open
5	QA Audit of EHS Audit Program	1 Minor	Gensuite Action#: 54	The checklist used for the Calibration and Maintenance audit does not list the requirements to be assessed. This checklist is a collection of equipment information reviewed as part of the audit**.**	Assessment was made however not documented in the audit report. A memorandum has been added to the audit file indicating the requirements assessed during the audit.	Closed
		4 OFI's	CF 9190	There is no evidence of communications with management prior to certain audits reviewed. CPM-7-03 states that communications "should" be had and that records of such "will" be included.	CF 9190 was initiated to correct this discrepancy.	Open

			Gensuite Action#: 54	CPM-7-03 requires that the auditor identify and review the applicable standard and regulatory requirements as they apply to the scope of the audit. Reference to standards and regulations is not clear on the checklist for the Calibration and Maintenance audit. Standards and regulations are listed in the audit report, however they are not included in the checklist.	Assessment was made however not documented in the audit report. A memorandum has been added to the audit file indicating the requirements assessed during the audit.	Closed
			CF 9190	Although not required specifically required in CPM-7-03, Auditors should periodically communicate the progress of the audit and any concerns to the Auditee. As well, communications shall be recorded in the audit file as appropriate. With the exception of one audit, there was no record of communication with auditees in the files.	CF 9190 was initiated to correct this discrepancy.	Open
			Gensuite ID#: 55 AC-20191205-001	CPM-7-03 states that actions taken to address opportunities for improvement (OFI) noted during the audit shall be recorded unless action taken during the audit to address the OFI. In several of the audit files reviewed, there is a comment supporting opportunities for improvement, however it is not clear if these opportunities are presented to management or if they are tracked elsewhere.	The QA was reminded to track this OFI within the appropriate system at a team meeting held on January 20, 2020.	Closed

6	Emergency Response Program	1 Minor Findings	CAPA 200409	For the six (6) ERP training courses audited, three (3) had employees whose training was past due and shown as “expired”.	The overdue training will be completed and actions will be assessed to ensure ERP Training is completed within the required timeframes.	Open
		5 Observations	CHR-3527-NUM	There is no scheduled and documented annual review conducted for the accuracy of the plans. Plans are reviewed before/after drills or when there are significant changes within the company.	SE-ERP-034 will be revised to indicate that plans are reviewed before/after drills and exercises or when there are significant changes within the company.	Open
			CHR-3531-NUM	SE-ERP-034 makes reference to “The Nordion Emergency Management Policy” but there is no such Policy document at Nordion.	SE-ERP-034 will be update to remove this historic reference.	Open
			AC-CMP-20191118-007	The Chemical Spill Response Plan was tested in 2016 then not included in the drill schedules until 2020. This does not meet the SE-ERP-010 requirement of “Once every three years”.	The required 2019 test of the Chemical Spill Response Plan was completed on December 10, 2019 to meet the “once every three years” requirement.	Closed
			CHR-3534-NUM CHR-3529-NUM	SE-ERP-004 (6) contains only one (1) reference to the “Communicable Disease Response (CDR) Committee” and does not detail either the membership or responsibilities of the CDR Committee as stated in SE-ERP-010.	SE-ERP-004 will be updated to review the reference to the CDR Committee and SE-ERP-010 will be revised to remove the specific reference to the CDR Committee	Open Open

			CHR-3535-NUM	SE-ERP-010 states that SE-TRN-003 F1 is used to record in-class emergency response training, but SE-TRN-003 does not contain a Form F1 for recording in-class training. QAP AP-47 F1 is used to record in-class training at Nordion.	SE-ERP-010 will be revised to make reference to QAP AP-47 Form F1.	Open
		7 OFI's	CHR-3528-NUM	The emergency response plan associated with the [redacted] facility, as this is no longer part of Nordion.	SE-ERP-034 will be updated to remove reference to the Vancouver Operations facility.	Open
			CHR-3530-NUM	SE-ERP-034 Section 4.2.1 states "Production Manager" while Appendix A states "Production Advisors"	SE-ERP-034 will be revised to align these references.	Open
			CHR-3532-NUM	While Section 4.2 of SE-ERP-010 states "Appendix A" the drill/exercise frequency is actually shown in a table in Appendix B.	SE_ERP-010 will be revised to correct this reference.	Open
			CHR-3533-NUM	Nordion does not engage the entire organization in the exercise process via a set communication strategy, as stated in SE-ERP-034.	SE-ERP-034 will be revised to accurately reflect Nordion's communications to employees for drills and/or exercises.	Open
			CHR-3484-NUM	In Appendix C the phone number for an employee (Site Security Volunteer) is incorrect.	SE-ERP-010 has been updated to correct this phone number.	Closed

			CHR-3536-NUM	The "Emergency Management Room Inventory Checklist – [redacted] was noted to not have a section for the Surveyors to sign-off the completion and review of the inventory checklist (unlike the other inventory checklists). The Surveyors commented that this likely got missed when the checklist was last revised.	This checklist has been updated to include a section for the Surveyors to sign-off the completion and review of the inventory check.	Closed
			CHR-3537-NUM	The Crisis Communication Kit is now located inside the [redacted] and not [redacted]	SE-ERP-006 has been updated to indicate the correct location of the Crisis Communication Kit.	Closed
7	Radiation Protection Program	4 Observations	Gensuite ID# 13676	A work permit reviewed during the audit was found to have a number of deficiencies compared to procedural requirements.	Additional [redacted] have been hired for the Kanata site. The employee responsible for sponsoring external IT has been trained by [redacted] in September 2019 on the responsibilities of a sponsor, external contractor supervision, the work permit procedure, and was trained on initiating work permits.	Closed
			AC-CMP-20200228-001	There is currently no formal process for ensuring that a summary of environmental monitoring data is presented to Executive Management on an annual basis.	Nordion will assess the implementation of a formal process for ensuring a summary of environmental monitoring data is presented to Executive Management annually.	Open

			AC-CMP-20200228-002	A number of discrepancies between procedural requirements and practice for DRD reporting/monitoring were noted during the audit.	Procedure SE-RP-004 will be reviewed and modified as needed to provide clarification around responsibilities for contractors / visitors.	Open
			AC-CMP-20200228-006	Two investigation reports reviewed for the audit did not contain all of the information prescribed by SE-RP-003.	A review of requirements in SE-RP-003 will be performed and investigation templates adjusted accordingly.	Open
		4 OFIs	AC-CMP-02020228-003	SE-RP-002 allows the Surveyor to indicate the permitted time in a given radiation field when approving a work permit. Since this is an exceptional circumstance, as worker are not typically permitted to work in a radiation field, it is recommended that SE-RP-002 be revised to better specify when the time permitted in a radiation field must be specified.	SE-RP-002 will be revised to better specify when the time permitted in a radiation field must be specified on work permits.	Open
			AC-CMP-20200228-004	A target date of 60 days for closure of ALARA and non-reportable investigations is recommended. One report audited had been open for greater than one year.	The open report will be finalized and closed.	Open

			Gensuite ID# 85	It is recommended to revise 070534.SOP to remove the requirement to check clothing on a weekly basis and to remove the "N/A" boxes from the Routine Check Form. A separate clothing check is no longer required with the use of the wholebody monitor.	Procedure 070534.SOP will be revised to remove the clothing check requirement and the "N/A" boxes from the Routine Check Form.	Open
			AC-CMP-20200228-005	It is recommended to revise CO-MD/OP-0018 to better align with the requirements of SE-RP-004 (see Observation #3)	Procedure CO-MD/OP-0018 will be revised to better align with SE-RP-004.	Open
8	Fire Protection Audit	1 Minor	CAPA 200301	Although the FPP includes the required reference to the control of impairments and the implementation of compensatory measures, an impairment procedure is not identified in the FPP.	Develop a procedure for managing impairments outside of the work permit program which is currently used for managing impairments.	Open
		4 OFI's	AC-CMP-20200416-001	A revision table is not included in the FPP.	Revision tables/information is currently available within Nordion's EQMS and Change Control systems. No further action required.	Closed
			AC-CMP-20200416-002	One minor editorial error was observed in the section of the FPP where the "Fire Prevention Officer [redacted] is included under [redacted] responsibilities. This provides some potential confusion as to who is responsible for the tasks.	Update procedure as required	Open

			AC-CMP-20200416-003	The following are not considered gaps with respect to the housekeeping element, however are identified as potential AFI: 1. The 'Nordion Ottawa Site Workplace Safety Inspection Checklist' (CPM-6-19 F1) is attached to the CPM-6-19 procedure, however is not referenced within the procedure. This form is not referenced in any other Nordion procedures either, and as such there is no documented requirement for anyone to complete this form. 2. Section 4 of the CPM-6-19 procedure does not provide the responsibility for completing this form to any of the identified roles, nor does it state which role has the responsibility to review and accept/reject this form. 4.5.3 Element Recommendations The following recommendations are in relation to the observations identified above. 1. Add a reference in the CPM-6-19 procedure to provide a direct link to CPM-9-19 F1. 2. Allocate the responsibility of completing and reviewing the CPM-6-19 F1 form to one of the roles identified in the procedure. If the intent was not to have a reviewer as this is only a checklist, then it is also recommended to add some clarification within the procedure as well.	Update procedure as required	Open

			AC-CMP-20200416-005	The following gaps have been identified with respect to the impairments to fire protection systems: 1. Although the FPP includes the required reference to the control of impairments and the implementation of compensatory measures, an impairment procedure is not identified in the FPP. 4.12.3 Element Recommendations The following recommendations are in relation to the gaps identified above: 1. Develop an impairment procedure so that impairments are addressed in a consistent manner meeting all the requirements of CSA N393 Clause 10.12.4.2.	Procedure requires update	Open
9	Conventional Health and Safety	7 Minors	CAPA 200401	Equipment-specific LOTO procedures were observed for most equipment sampled, however some exceptions were noted. Equipment specific LOTO procedures were not posted in the [redacted] by most equipment including the lathes, drill presses, shearer, etc. Also, no procedures were posted in [redacted], a LOTO procedure for Door 9-7 was posted at Door 9-3, and no other bay doors had procedures posted.	As necessary, develop and post equipment-specific LOTO procedures in areas required	Open

			CAPA 200402	Records on the total number of drums of lead waste shipped were not available with Stores during the audit.	Investigate and as required develop a process for tracking drums of lead	Open
			CAPA 200403	No job-specific SOPs for working in hot environments have been developed. The Control Program (SE-HS-20) provides general guidance however the program requires job specific SOPs to be developed.	Investigate and as necessary develop job-specific SOPs for working in hot Environments	Open
			CAPA 200404	No pre-use inspection records could be located for the Kubota tractor, Kubota RTV or lawnmowers. The tractor was observed in use at the time of the Audit. The Kubota tractor had a daily log, but an inspection had not been completed on the day of use. Daily pre-use checklists must be generated for riding lawnmowers and RTVs	Investigate and as necessary develop pre-use inspection records for applicable equipment	Open
			CAPA 200405	Gamma Cell workers had not completed the read and understand Safe Handling of Cryogens (SE-HS-035) training at the time of the Audit. Workers must be trained on the risks associated with cryogens, safety practices, personal protective equipment requirements, transfer and transport procedures, storage, maintenance and emergency procedures, as outlined in the Safe handling of Cryogens Program.	Training to be provided	Open

			CAPA 200406	The Site does not have anchor system in place at the docks for its trailers. A requirement that trailers must be anchored so they cannot move and are stabilized to ensure they do not tip if necessary was added to SE-HS-036 in the version dated September 11, 2019.	Investigate and implement an anchor system as required	Open
			CAPA 200407	Select Docks in BWXT Active Area have physical barriers along the side but not all docks are equipped with this feature, as required.	Investigate and implement physical barriers as required	Open

		10 OFI's	AC-20200424-001	Section 4.2 of the Hearing Protection program indicates that EHS will conduct sound surveys throughout Nordion facilities, as required. Several sound surveys have been conducted by the EHS department to assess potential personnel noise exposure; reports for the [redacted] were readily available and were reviewed during the audit. The internal sound survey ("Assessment of Light and Sound Taken as Part of FSAR 5 Year Review Process" conducted February 3rd and 8th and March 4th, 2016), which relied on a type two sound level meter, conducted for the cobalt active area recommended follow-up noise dosimetry for grinding operations due to the potential for worker over-exposure to noise. Noise dosimetry is yet to be completed. As a best management practice, Nordion should consider retaining a third-party contractor to conduct noise dosimetry for the grinding operations	Investigate and conduct additional assessments as required.	Open

			AC-20200427-001	Section 4.3 of the Hearing Protection program indicates that Annual audiometric tests are to be performed on the following personnel: [redacted] Audiometric testing is to be performed annually for all workers potentially exposed to periodic noise more than 87 dBA. Areas of the facility have been identified as having intermittent, continuous or periodic noise in excess of 87 dBA. These locations have been posted, and workers in these areas are provided with hearing protection, training and are subject to annual audiometric testing. At least one facility area, [redacted], is subject to noise intermittent, continuous or periodic in excess of 87 dBA (based on posted warning signs), but the Impacted worker in this area does not currently receive audiometric testing (or the associated annual training).	Assess the facility areas identified as noisy against the audiometric testing list, to ensure all workers potentially exposed to significant noise levels are being appropriately tested.	Open

			AC-20200427-002	The Asbestos Management Program, section 6.2.2., states that employees are required to comply with all applicable training and procedures for working in the proximity of Type 1, 2 and 3 asbestos and/or where the material may be disturbed. The SE-HS-013 program indicates that Type 2 Asbestos Precautions may be performed by Nordion personnel but based on a review of sample records and interviews it is understood that third-party contractors are retained for all such operations. Nordion should consider updating the Asbestos Management Program (SE-HS-013) to reflect current Site practices.	Investigate the recommendation and change as implement appropriate.	Open

			AC-20200427-003	Section 6.2 of the Asbestos Management Program requires that where work is to be done above the ceiling tiles in the REB, then the employee should also be given a "Checklist of Precautions Required for Work above ceiling tiles in RE Building." WPHCA is completed for all asbestos related work. The work permit references the Asbestos Management Program (SE-HS-013) and precautions therein. Appendix A of the Asbestos Management Program contains a list of precautions for work above ceiling tiles in the REB, but is not currently structured, documented or used as checklist during work. Records to demonstrate that the precautions listed in Appendix A have been taken were not available for review and are not understood to be generated. As a best management practice, Nordion may consider the internal generation and completion of checklists to document the completion of type 2 and type 3 precaution ACM work as specified. Alternatively, a third-party consultant may be retained to provide oversight of ACM work, to ensure and provide documentation that required precautions have been abided.	Investigate and implement changes to the Asbestos Management Program (SE-HS-013) as applicable.	Open

			AC-20200427-004	Section 4.1 of the lead control program indicates that lead welding is to be performed in an area equipped with mechanical ventilation. Welding is performed in the [redacted] with downdraft tables for local exhaust ventilation. Lead machining is also performed in [redacted] with local exhaust ventilation. Based on interviews with EHS personnel and a machinist, it is understood that lead welding is not performed. Nordion should consider revising the Lead Program to reflect the operations actually performed on Site	Investigate and consider revising the Lead Control Program	Open
			AC-20200427-005	Section 8.3 of the Ladder Safety programs addresses requirements for scaffolding, and states that scaffolds should be inspected upon receipt, prior to each use, and after set-up for use. No scaffolding inspection records were available for review. It was reported that the site rarely uses scaffolding and if it were required a qualified contractor would be retained. As Site practices have changed, consider updating SE-HS-026 to reflect current practices. Consider discarding any existing scaffolding that will not be used.	Investigate and implement changes to SE-HS-026 as required. Existing scaffolding will be reviewed and disposed of if not required.	Open

			AC-20200427-006	The Racking and Shelving Guidelines section 4.9 addresses pallet rack inspections and the states that pallet rack inspections must consider the following areas of concern: Any posts out of plumb damaged, or corroded Damaged/ missing horizontal and/or diagonal braces, sheared or missing anchors, damaged or permanently deflected (yielded) beams or improper beam track engagement, missing or improper safety pins, missing row or wall spacers, misplaced, missing/ damaged safety bars, any post guards not in place or securely anchored, any damaged in rack sprinkler system heads or protective cages, missing weight capacity labels, rack shelving made of open mesh and should also address any poor operating practices observed. Pallet racking inspections are completed annually by ARLO Material Handling Limited. The report from ARLO does not specifically address the 11 items in the work order from Nordion for each racking bay. Nordion should consider requiring a more detailed inspection report from ARLO. No repairs were required by a qualified person	Review this finding with the Contractor and ensure future reports contain relevant information.	Open

			AC-20200427-007	As a best management practice, the site should maintain liquid nitrogen transfer equipment in good operating condition. Liquid nitrogen handling was not observed; however, the following deficiencies were noted for the portable dewar transfer system: - The transfer hose insulation connected to the portable dewar was in poor condition during the audit (cracking and covered with tape. - The connection between the portable dewar hose and Gamma cell dewars during filling is made by tygon tubing taped to the transfer hose. Tygon tubing is not an appropriate material for liquid nitrogen transfer.	Equipment will be reviewed and necessary corrective actions will be taken.	Open

			AC-20200427-008	The Safe Handling of Cryogens program, section 4.2.2., addresses the transport of cryogenic liquids at site, at states among other requirements that large mobile dewars used for transport should be equipped with a braking mechanism. Transport of liquid nitrogen was not observed during the audit. However, the large portable dewars observed during the audit were not equipped with a braking mechanism. As a best management practice, it is recommended that only dewars with a breaking mechanism be used at Site.	Equipment will be reviewed and necessary corrective actions will be taken.	Open

			AC-20200427-009	The Safe Handling of Cryogens, per section 4.3, requires that cryogenic liquids be defined per the defined safe work practices. This includes proper ventilation where liquid nitrogen is stored and used, and may include, at the discretion of EHS, oxygen detection system and alarms. Dewars were observed in the [redacted] The ventilation rates in these areas were not provided at the time of the assessment. The ventilation rate in areas where liquid nitrogen is stored should be reviewed to ensure the minimum requirements established in SE-HS-035 are being met. As a best management practice, an oxygen detection system should be installed in the [redacted], as well as any other area where liquid nitrogen is routinely stored.	Investigate and implement oxygen detection systems as required.	Open
10	Sealed Source Export Licenses	No findings	N/A	N/A	N/A	N/A
11	Installation and Servicing Activities	4 Minors	CAPA 200102	Instances where IN/OP 2627 F000 is not being followed as written were observed.	Update procedure(s) to reflect current practices	Open
			AC-CMP-20200123-001	It was determined during interviews that not all locations provide CSA approved and rated ladders or equivalent.	Review options for providing proper ladders at customer sites	Open
			AC-CMP-20200123-002	Training gaps/deficiencies were identified.	Update and complete training	Open

			AC-CMP-20200124-001	The contracted driver began working on the truck, with the truck turned on, while packages were being loaded onto the truck. This could have resulted in injury to a Technician.	Communicate with drivers that this is not acceptable practice.	Open
		6 OFI's	AC-CMP-20200123-003	There were numerous cords for portable lighting in the work area.	Ways to reduce/eliminate slip/trip hazards from cords will be investigated.	Open
			AC-CMP-20200123-004	Investigate options to reduce the potential hazard of having Technicians standing too close to packages as they are hoisted.	Investigate and implement changes as applicable	Open
			CHR-3591-NUM	A document referenced in IN/IM 0293 F000 is obsolete.	IN/IM 0293 F000 will be updated.	Open
			CHR-3589-NUM CHR-3590-NUM	Consider making reference to the fact that although all the steps of the SOP's are satisfied the steps are not always performed in the order listed due to the differences in site configurations from site to site. It would not be feasible to create specific SOP's for each site.	Update document to include the recommended statement.	Open
			AC-CMP-20200123-005	Encourage the use of Good Documentation Practices, specifically with respect to fields on forms left blank.	Discuss with employees the need to follow good documentation practices.	Open
			CHR-3586-NUM CHR-3587-NUM CHR-3588-NUM	In all SOPs update the current practice of not retaining swipes taken during installation activities.	Update documents to reflect current practices.	Open

12	MSFS – Documentation, Information, Records	2 Observations	Gensuite ID# 88 Gensuite ID# 89	Minor Good Documentation Practice deficiencies were found with some of the records audited.	Emails were sent with to the teams responsible for the records in question, with examples taken from the audit, to remind staff of the need to follow Good Documentation Practices.	Closed
			N/A	Copy Set 182 did not have 000007.SOP in Binder when reviewing. A copy was printed, perforated and filed during the audit.	No further action is required.	Closed
13	MSFS – Construction, Commissioning, Decommissioning	2 Observations	CHR-3575-NUM	Annual reports to the CNSC on the status of Nordion's Financial Guarantee (FG) are being performed as required, however there is no procedure in place describing the requirements for the FG and the annual report to the CNSC.	SE-LIC-009 "Preliminary Decommissioning Plan for Class 1B Facility" will be revised to include requirements for the FG and the requirement to provide annual reports to the CNSC on the FG.	Open
			AC-CMP-20191217-002	Examples of work permits were found that indicated a post-work inspection was not required, but the "inspection Completed By" field did not have the "N/A" box checked.	Action to be developed.	Open
		4 OFI's	N/A	Evidence of a memo summarizing the actions taken and the supporting evidence for the EHS Requirements Checklist was not found for one decommissioning related Change Form.	It was determined that the Change Form has been initiated at a time when the closure memo was not required by internal procedure. A memo and required attachments were added prior to the end of the audit. No further action required.	Closed.

			N/A	Current procedures require that the EHS Requirements Checklist be closed prior to the Change Form (CF) to which it relates being closed. For on CF related to decommissioning it was found that that CF was closed prior to the EHS Requirements Checklist.	It was determined that the Change Form has been initiated at a time when it was not a requirement to file the EHS Requirements Checklist with the closed CF documents. During the audit it was verified that the EHS Requirements Checklist was filed with the closed CF. No further action required.	Closed
			CHR-3576-NUM	It is recommended that the task of having the Permit Initiator consult daily with the Work Area Manager for permits issued to cover longer than one day.	SE-HS-009 will be updated to clarified the requirements for this task.	Open
			AC-CMP-20191217-003	It is recommended that Nordion conduct an internal gap analysis to ensure Nordion's PDP and FG comply with the guidance of G-206 and G-219 and the requirements of CSA N294-09.	A gap analysis will be conducted by Nordion as recommended.	Open
14	Process Safety Audit – Cobalt Waste Processing	1 OFI	AC-20200417-001	A long-term study of waste pail activity and F339 dose rate is needed to establish better guidelines for disposing of Co-60 sources in waste pails.	A project to support waste pail measurement in Cobalt will be raised.	Open
15	Design and Change Control	5 Observations	AC-CMP-20200427-001	One of the CFs audited had 3 Pending Change requests that were not addressed and had no reason/decision documented in the CF file as required by QAP AP-45.	Actions to be developed. The Pending Changes are still recorded in Nordion's electronic Quality Management System (eQMS).	Open
			AC-CMP-20200427-002	Two CFs audited were related to design drawings, but did not have a Pending Change Notice form in the CF file, as required by QAP AP-45.	Actions to be developed.	Open

			AC-CMP-20200427-001	One CF audited had a Category of “Compliance” but the EHS section for closure of the CF had been checked as “N/A”. Non-administrative CFs are to obtain the signature of EHS for closure according to QAP AP-45.	Actions to be developed.	Open
			AC-CMP-20200427-	During the audit there was found to be no evidence of use of certain forms stipulated in 000069.SOP “Guidelines and Requirements for Control of Design”, such as Forms F3 and F4 However, there was evidence that the requirements of these forms were met in other ways, such as meeting minutes, reviewed/approved third party reports ec. The requirements around making direct use of the forms stated in 000069.SOP should be reviewed and clarified.	The requirements for the use of forms set in 000069.SOP and/or the use of reasonable substitutes that meet the requirements of 00069.SOP will be reviewed and the procedure updated as needed.	Open
			CHR-3633-NUM	The requirements for the submission of the Configuration Release Report to the Document Control Coordinator or designate, need to be revised in IN/OP 0368 Z000 to match existing practice	IN/OP 0368 will be revised to reflect current practices.	Open
		4 OFI’s	CHR-3634-NUM	The responsibilities in IN/OP 0349 Z000 do not reflect the current organization structure and practices of Engineering and the Design Office.	IN/OP 0349 will be updated to reflect the current organization structure and responsibilities.	Open

			CHR-3635-NUM	Procedure 8551 “Nordion Application Change Control”, should be revised to include the requirement to follow the procedure for completion of changes related to Enhancement Request Forms (ERFs) completed by IT.	Procedure 8551 will be updated.	Open
			CHR-3635-NUM	At the time of the audit Revision 3 of Procedure 8551 “Nordion Application Change Control” was effective. The Change Control Form referenced in this revision was no longer in use by IT at the time of the audit.	Procedure 8551 will be updated.	Open
			N/A	Nordion no longer owns/operates the Vancouver Operations Facility and reference to this facility should be removed from CPM-6-19.	CPM-6-19 has undergone revision since the time of the audit and reference to the Vancouver site has been removed.	Closed.

NOTE: The actions from the Supplier audit (listed in Section 2.1.3.1) have not been included in the above table however findings are being managed in accordance with internal procedures.

Appendix C
Non-Production Sealed and Unsealed Source Inventory

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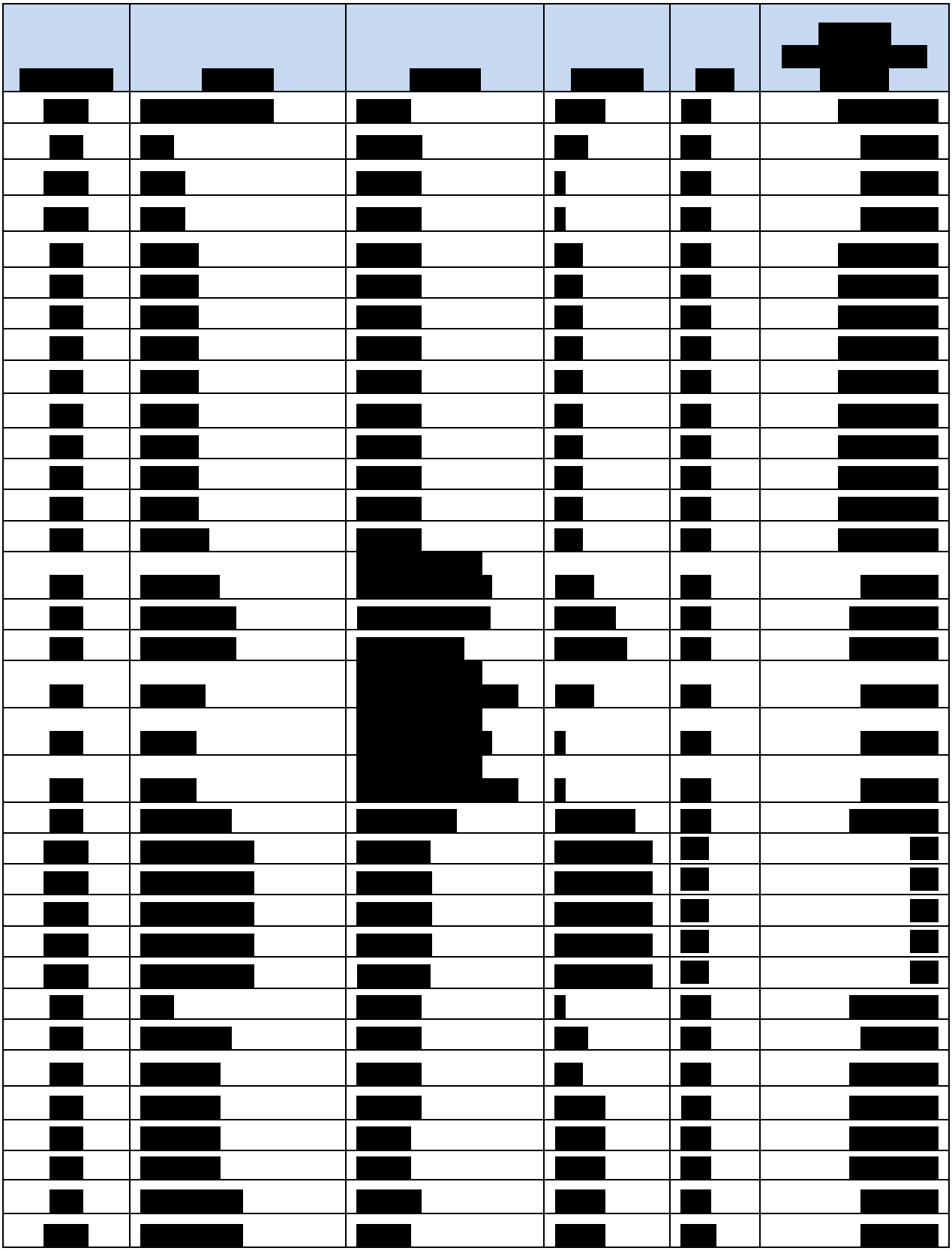

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Appendix D
Additional Radiation Dose Data – Effective and Equivalent Dose and Lens of the Eye

Note: For consistency in data report with previous years NEW data in the appendix includes data for both Nordion and BWXT NEWs.

Table D.1
Minimum, Maximum and Average Worker Effective Doses (Active Area and Non-Active Area Personnel) (mSv)

		2015	2016	2017	2018	2019	CNSC Regulatory Limit
Active Area Personnel (NEWs)	**Average**	0.56	0.75	0.67	0.71	0.76	n/a
	Maximum	5.24	4.9	5.49	4.23	4.79	50/yr; 100/5yr
	Minimum	0	0	0	0	0	n/a
	Number Monitored			141	137	154	
Non-Active Area Personnel (NEWs)	**Average**	0.16	0.2	0.13	0.14	0.13	n/a
	Maximum	1.88	2.06	1.5	2.07	1.79	50/yr; 100/5yr
	Minimum	0	0	0	0	0	n/a
	Number Monitored			122	111	124	

Table D.2
Minimum, Maximum and Average Equivalent Skin Exposure Doses (mSv)

		2015	2016	2017	2018	2019	CNSC Regulatory Limit
NEWs [redacted]	Average	0.42	0.59	0.42	0.45	0.49	n/a
	Maximum	5.21	5.2	5.5	4.26	4.78	500/yr
	Minimum	0	0	0	0	0	n/a
	Number Monitored	264	267	263	248	278	
Contractors (non-NEW)	Average	0.03	0.07	0.02	0.05	0.03	n/a
	Maximum	0.12	0.39	0.18	0.28	0.25	50/yr
	Minimum	0	0	0	0	0	n/a
	Number Monitored	46	51	55	45	123	
Active Area Personnel (NEWs – both [redacted])	Average	0.58	0.92	0.67	0.7	0.78	n/a
	Maximum	5.21	5.2	5.52	4.26	4.78	500/yr
	Minimum	0	0	0	0	0	n/a
	Number Monitored			141	137	154	
Non-Active Area Personnel (NEWs – both [redacted])	Average	0.16	0.22	0.13	0.14	0.13	n/a
	Maximum	1.9	2.09	1.59	2.06	1.80	500/yr
	Minimum	0	0	0	0	0	n/a
	Number Monitored			122	111	124	

Table D.3
Minimum, Maximum and Average Equivalent Extremity Doses (mSv)
Data includes both Nordion and BWXT NEWs.

		2015	2016	2017	2018	2019	CNSC Regulatory Limit
NEWs	Average	0.46	0.79	0.53	0.96	1.14	n/a
	Maximum	9.3	8.3	16.4	9.08	20.93	500/yr
	Minimum	0	0	0	0	0	n/a
	Number Monitored	137	128	125	116	130	
Active Area Personnel (NEWs)	Average	0.48	0.86	0.58	1.03	1.21	n/a
	Maximum	9.3	8.3	16.4	9.08	20.93	500/yr
	Minimum	0	0	0	0	0	n/a
	Number Monitored			109	106	121	
Non-Active Area Personnel (NEWs)	Average	0	0	0.2	0.23	0.17	n/a
	Maximum	0	0	1.8	1.66	0.81	500/yr
	Minimum	0	0	0	0	0	n/a
	Number Monitored			16	10	10	

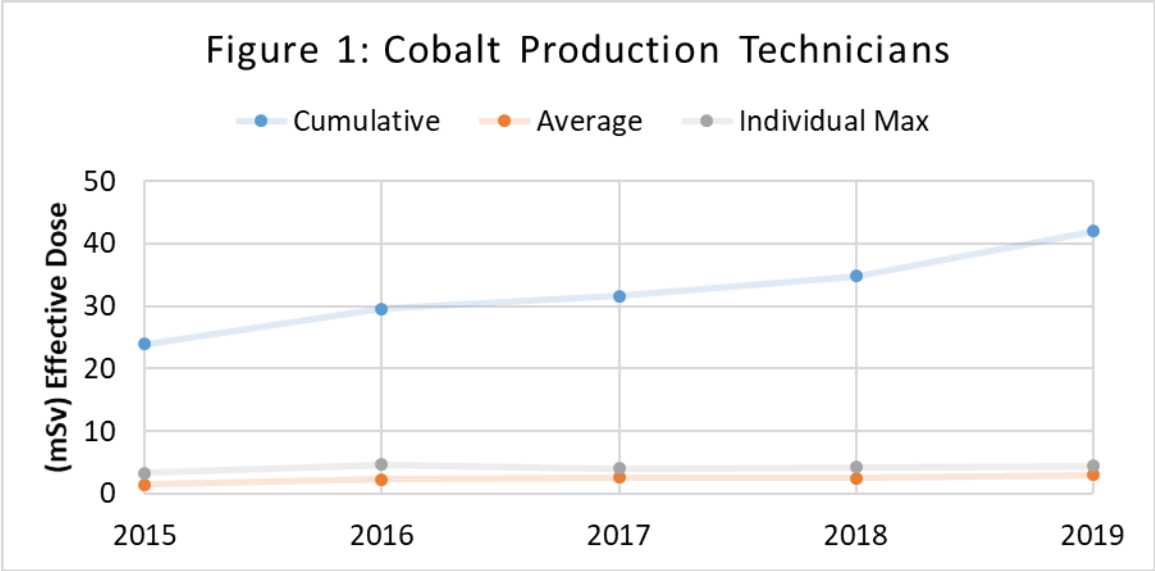
Note: Contractors are not monitored for extremity dose.

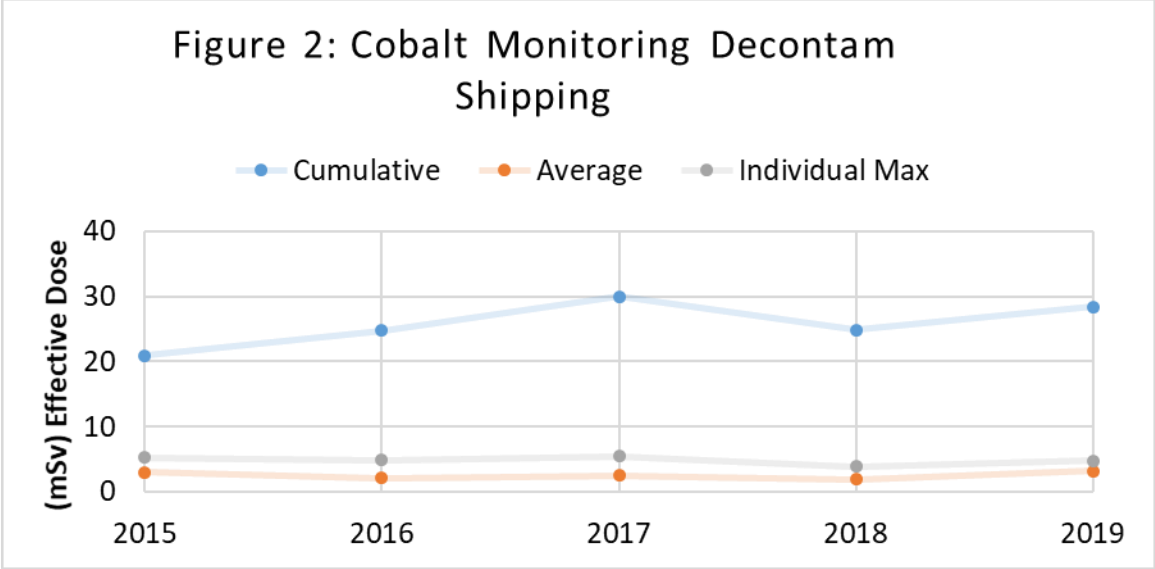
Table D.4

Minimum, Maximum and Average Equivalent Dose for Lens of the Eye (mSv)

		2017	2018	2019	CNSC Regulatory Limit
NEWs [redacted]	**Average**	0.42	0.45	0.49	**n/a**
	Maximum	5.52	4.27	4.81	**50/yr; 100/5yr**
	Minimum	0	0	0	**n/a**
	Number Monitored	263	248	278	
Contractors (non-NEW)	**Average**	0.022	0.05	0.03	**n/a**
	Maximum	0.2	0.26	0.26	
	Minimum	0	0	0	**n/a**
	Number Monitored	55	45	123	
Active Area Personnel (NEWs – both [redacted]	**Average**	0.67	0.71	0.77	**n/a**
	Maximum	5.52	4.27	4.81	**50/yr; 100/5yr**
	Minimum	0	0	0	**n/a**
	Number Monitored	141	137	154	
Non-Active Area Personnel (NEWs- both [redacted]	**Average**	0.13	0.14	0.13	**n/a**
	Maximum	1.61	2.06	1.80	**50/yr; 100/5yr**
	Minimum	0	0	0	**n/a**
	Number Monitored	122	111	124	

APPENDIX E
5-Year Trending of Whole Body Doses for NEW Groups at Nordion





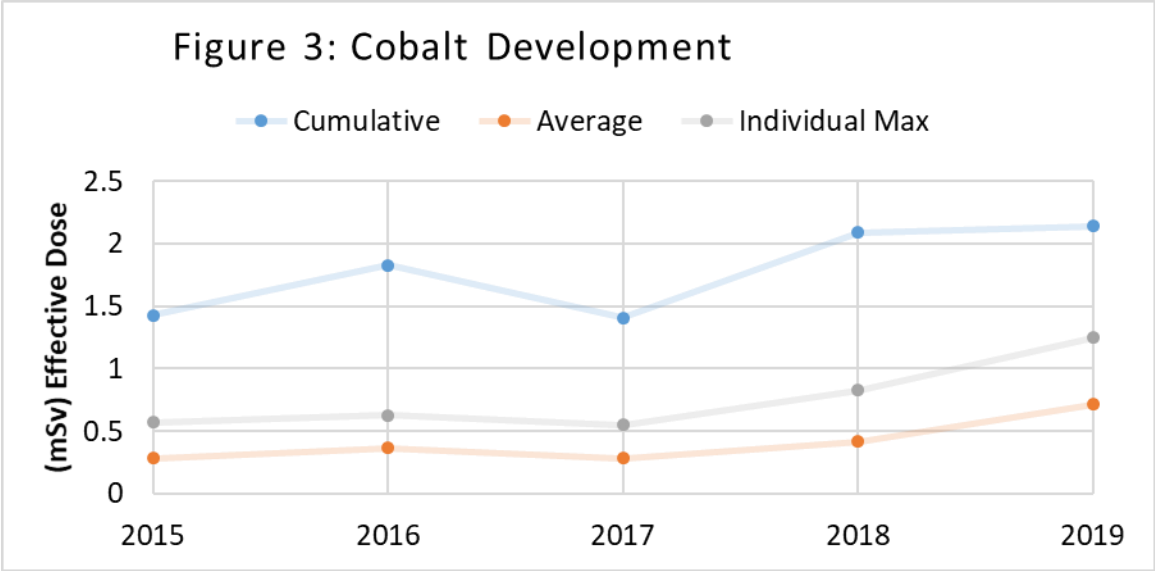


Figure 3: Cobalt Development
Cumulative
Average
Individual Max
(mSv) Effective Dose
2.5
2
1.5
1
0.5
0
2015
2016
2017
2018
2019

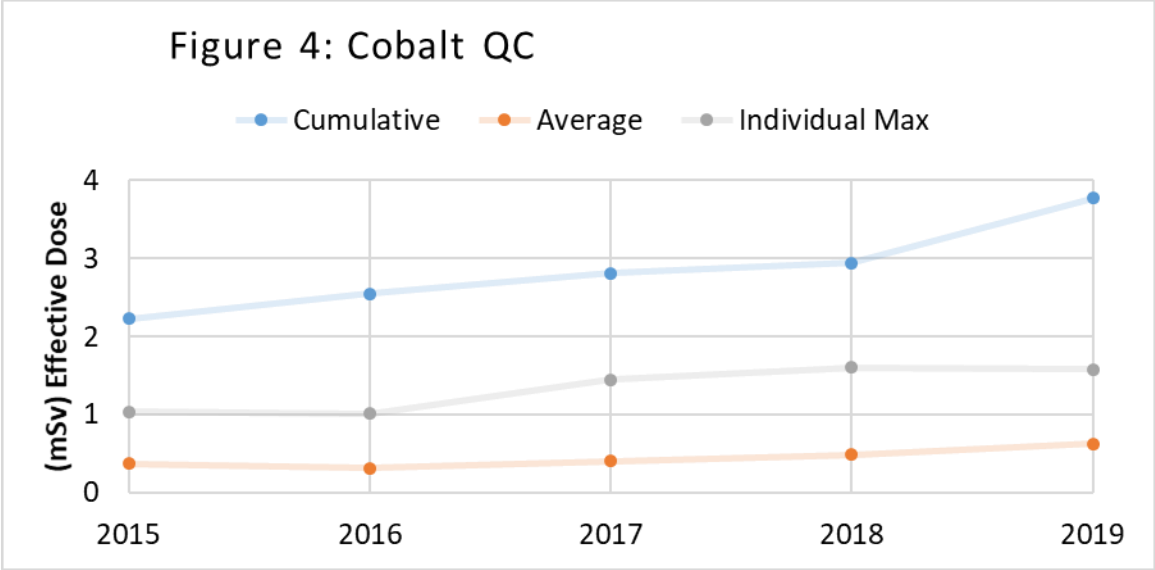


Figure 4: Cobalt QC
Cumulative
Average
Individual Max
(mSv) Effective Dose
4
3
2
1
0
2015
2016
2017
2018
2019

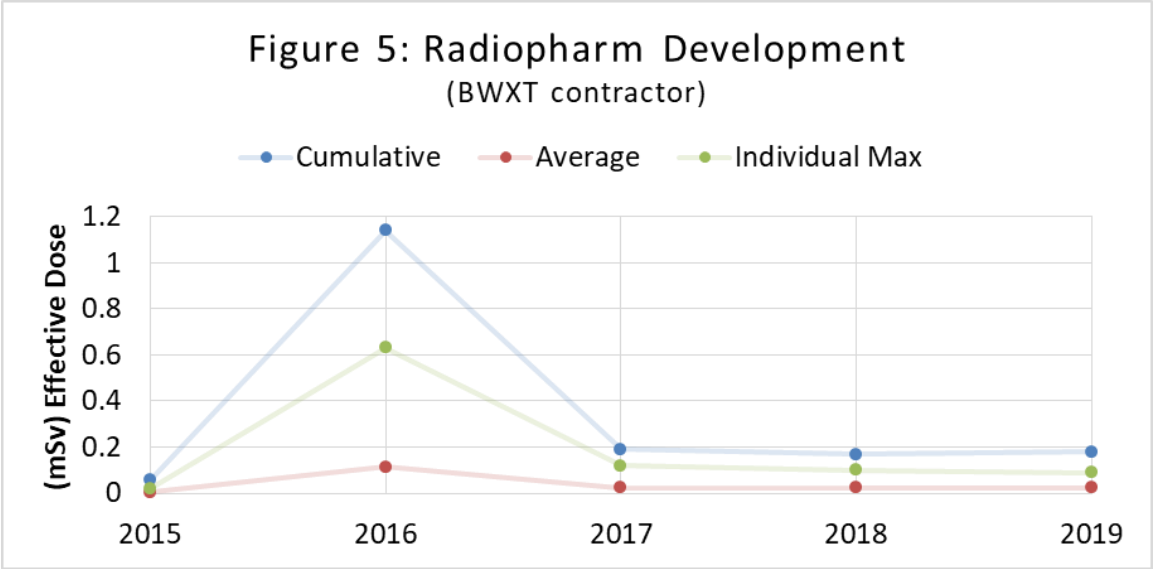


Figure 5: Radiopharm Development
(BWXT contractor)
Cumulative
Average
Individual Max
(mSv) Effective Dose
1.2
1
0.8
0.6
0.4
0.2
0
2015
2016
2017
2018
2019

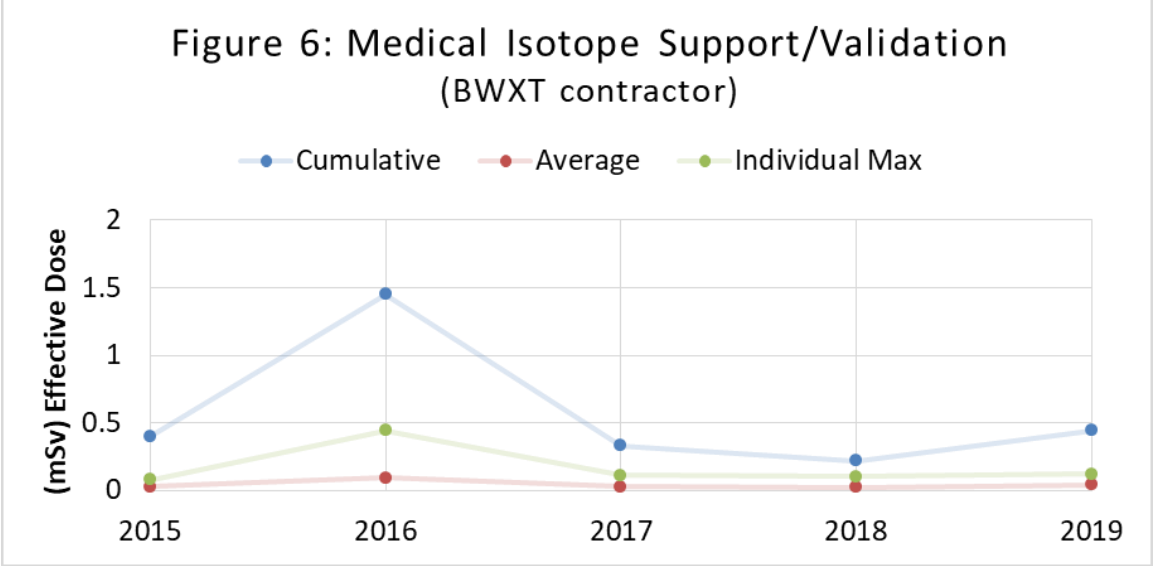


Figure 6: Medical Isotope Support/Validation
(BWXT contractor)
Cumulative
Average
Individual Max
(mSv) Effective Dose
2
1.5
1
0.5
0
2015
2016
2017
2018
2019

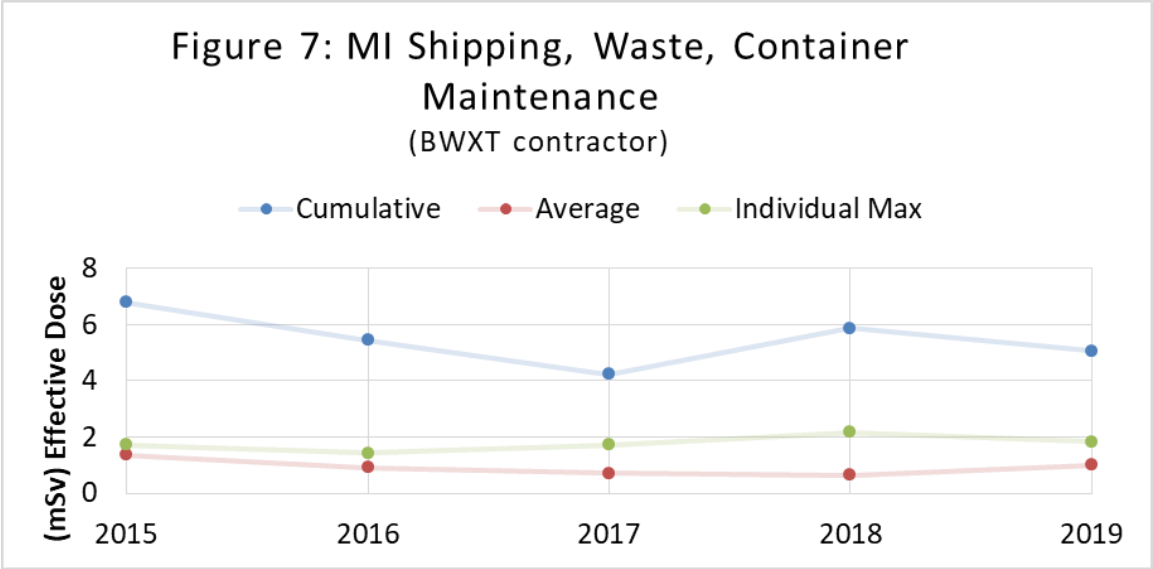


Figure 7: MI Shipping, Waste, Container Maintenance
(BWXT contractor)
Cumulative
Average
Individual Max
(mSv) Effective Dose
8
6
4
2
0
2015
2016
2017
2018
2019

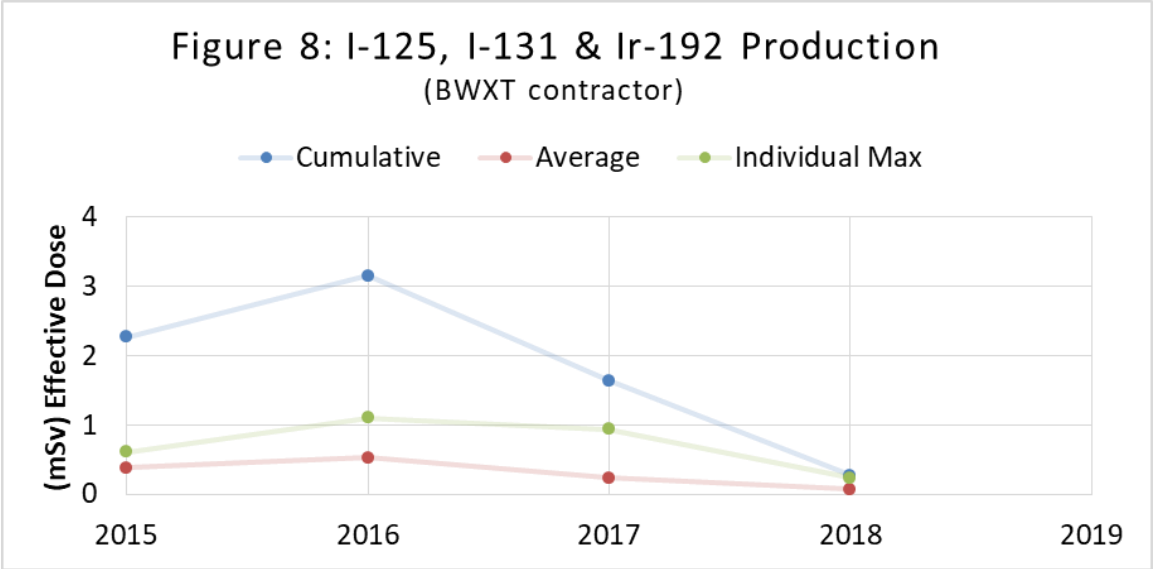


Figure 8: I-125, I-131 & Ir-192 Production
(BWXT contractor)
Cumulative
Average
Individual Max
(mSv) Effective Dose
4
3
2
1
0
2015
2016
2017
2018
2019

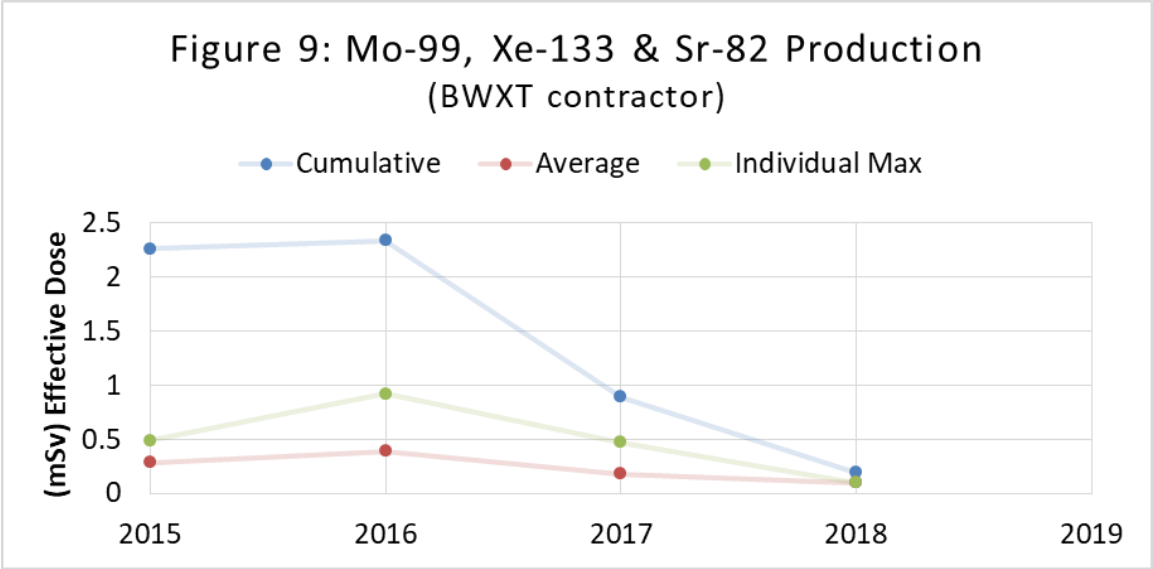


Figure 9: Mo-99, Xe-133 & Sr-82 Production
(BWXT contractor)
Cumulative
Average
Individual Max
(mSv) Effective Dose
2.5
2
1.5
1
0.5
0
2015
2016
2017
2018
2019

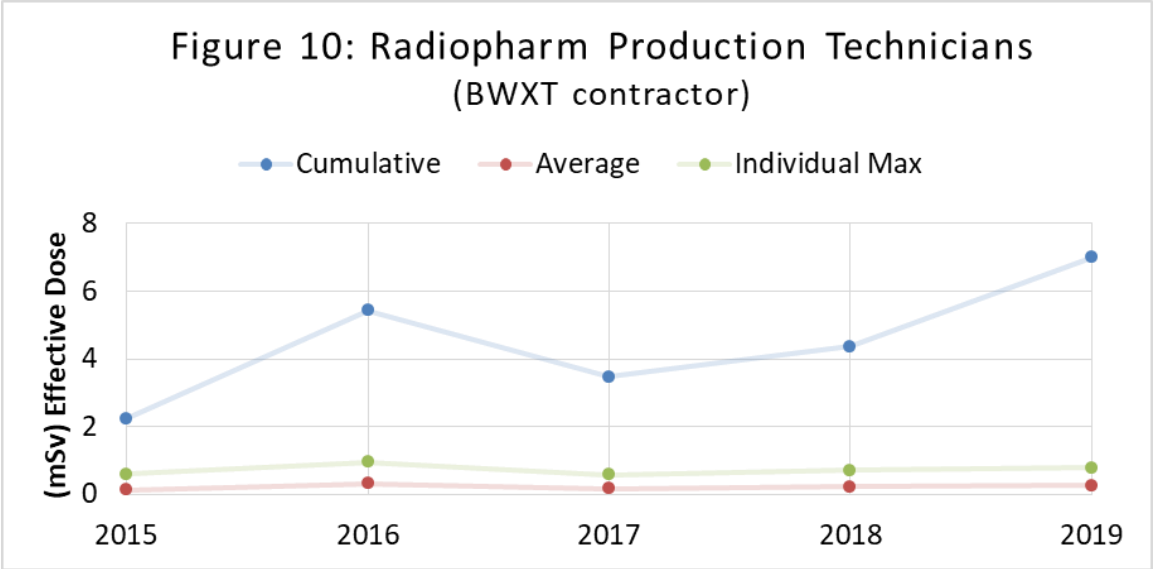


Figure 10: Radiopharm Production Technicians
(BWXT contractor)
Cumulative
Average
Individual Max
(mSv) Effective Dose
8
6
4
2
0
2015
2016
2017
2018
2019

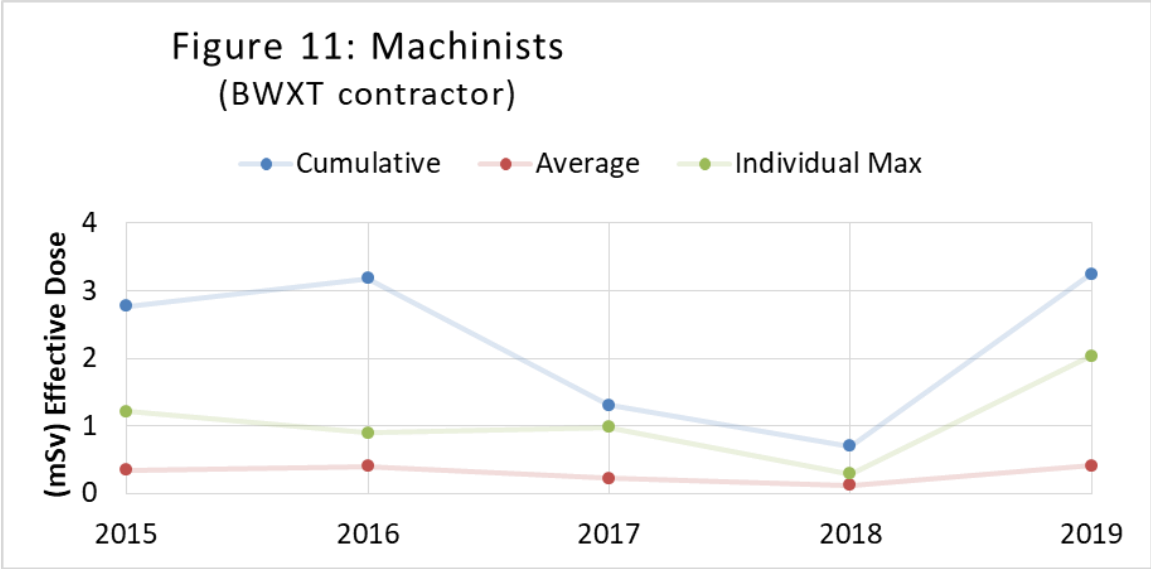


Figure 11: Machinists
(BWXT contractor)
Cumulative
Average
Individual Max
(mSv) Effective Dose
4
3
2
1
0
2015
2016
2017
2018
2019

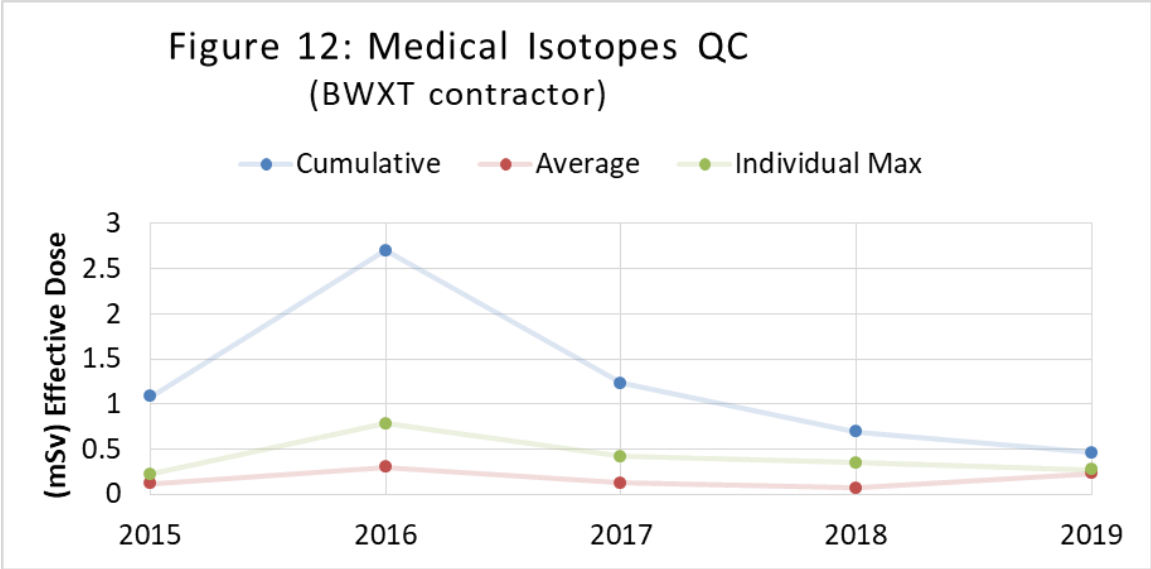


Figure 12: Medical Isotopes QC
(BWXT contractor)
Cumulative
Average
Individual Max
(mSv) Effective Dose
3
2.5
2
1.5
1
0.5
0
2015
2016
2017
2018
2019

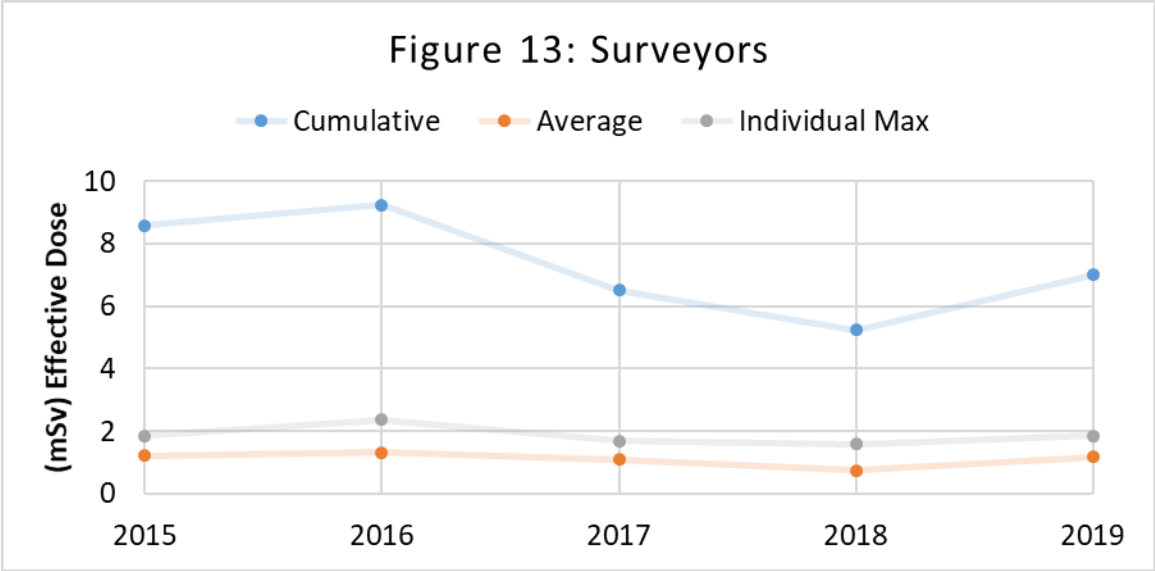


Figure 13: Surveyors
Cumulative
Average
Individual Max
(mSv) Effective Dose
10
8
6
4
2
0
2015
2016
2017
2018
2019

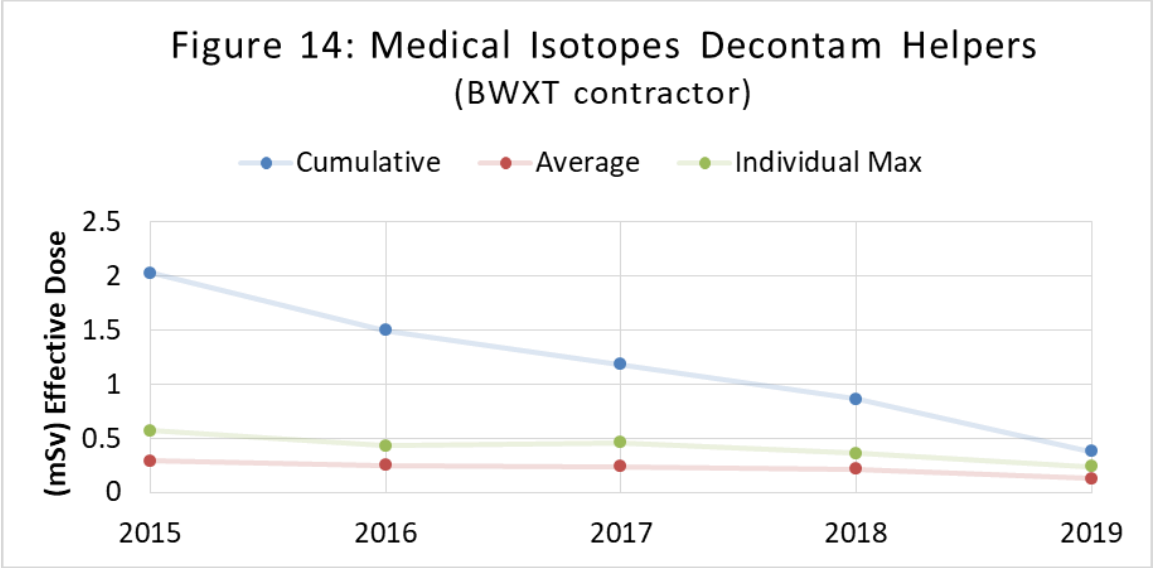


Figure 14: Medical Isotopes Decontam Helpers
(BWXT contractor)
Cumulative
Average
Individual Max
(mSv) Effective Dose
2.5
2
1.5
1
0.5
0
2015
2016
2017
2018
2019

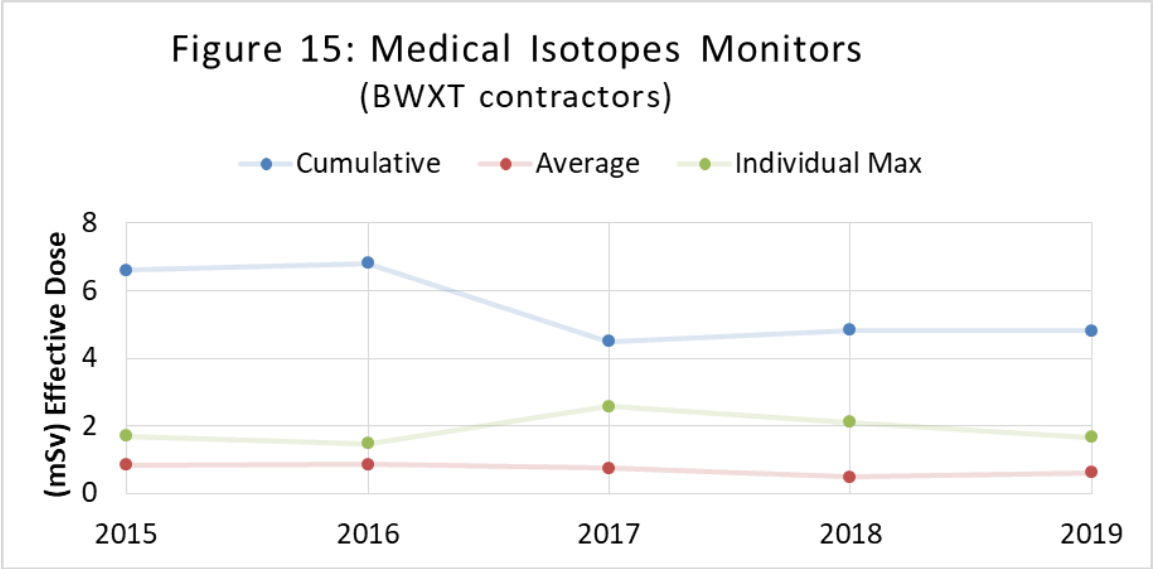


Figure 15: Medical Isotopes Monitors
(BWXT contractors)
Cumulative
Average
Individual Max
(mSv) Effective Dose
8
6
4
2
0
2015
2016
2017
2018
2019

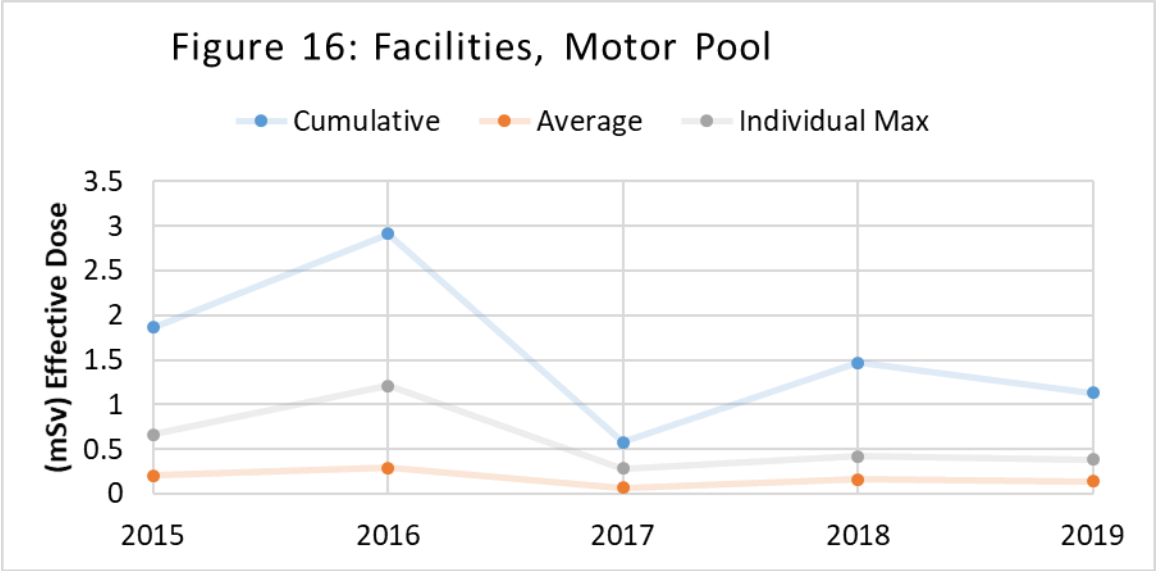


Figure 16: Facilities, Motor Pool
Cumulative
Average
Individual Max
(mSv) Effective Dose
3.5
3
2.5
2
1.5
1
0.5
0
2015
2016
2017
2018
2019

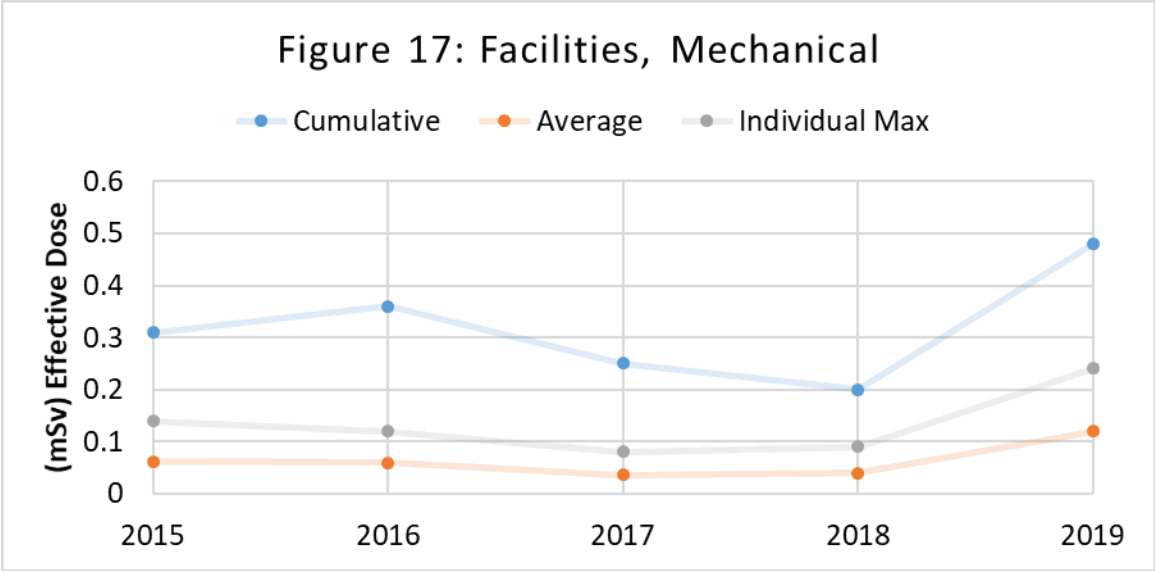


Figure 17: Facilities, Mechanical
Cumulative
Average
Individual Max
(mSv) Effective Dose
0.6
0.5
0.4
0.3
0.2
0.1
0
2015
2016
2017
2018
2019

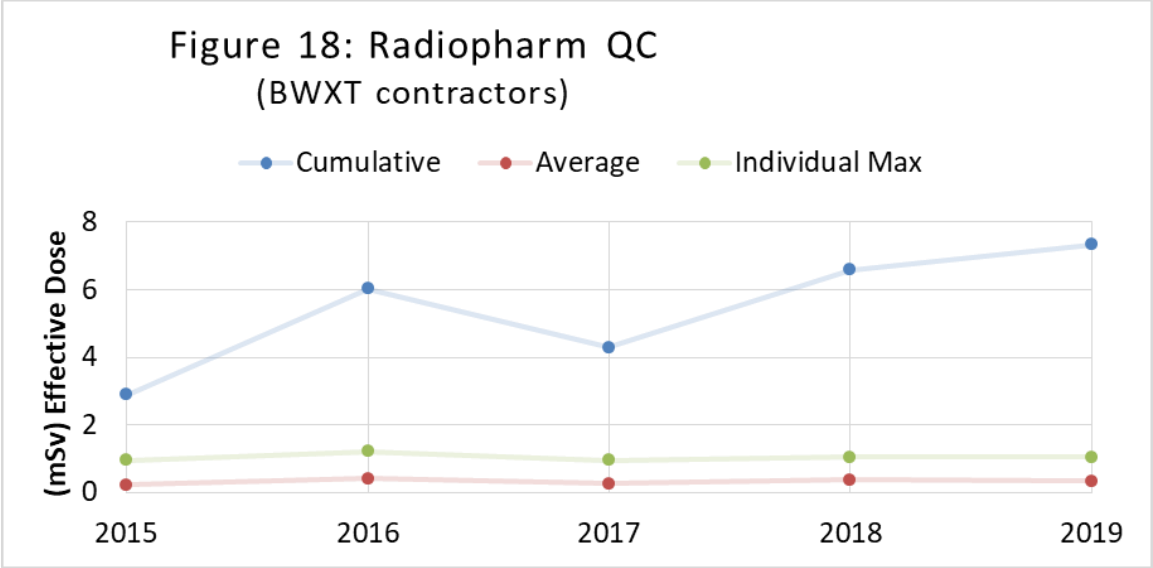


Figure 18: Radiopharm QC
(BWXT contractors)
Cumulative
Average
Individual Max
(mSv) Effective Dose
8
6
4
2
0
2015
2016
2017
2018
2019

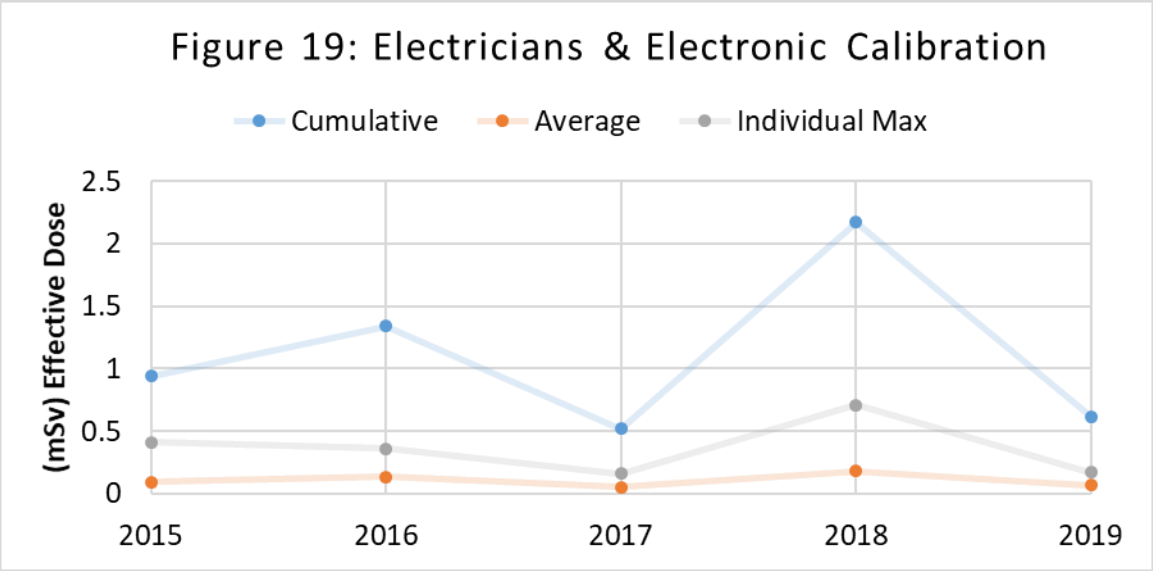


Figure 19: Electricians & Electronic Calibration
Cumulative
Average
Individual Max
(mSv) Effective Dose
2.5
2
1.5
1
0.5
0
2015
2016
2017
2018
2019

Appendix F
Groundwater Sampling (Non-radiological)
Borehole #1 (2005-BH1)

		Sample Date:	2019-08-19	2018-06-08	2017-10-06	2016-11-02	2015-10-05	2014-10-29	2005-04-07 (initial Sample)
		Sample ID:	**2005-BH1**	**2005-BH1**	**2005-BH1**	**2005-BH1**	**2005-BH1**	**2005-BH1**	**2005-BH1**
Parameter	**UNITS**	**MDL**							
Alkalinity as CaCO3	mg/L	5	359	440	448	336	337	329	278
Biochemical Oxygen Demand	mg/L	1	<3	<3	<3	<3	<1	<1	<1
Chemical Oxygen Demand	mg/L	5	13	<5	83	<5	9	8	7
Chloride (Cl)	mg/L	1	16.8	48	68.2	176	141	139	40
Conductivity	µS/cm	5	766	1010	1110	1200	1100	1080	676
Dissolved Organic Carbon	mg/L	0.5	2.6	2.3	5.0	0.7	2.8	2.2	1.6
N-NH3 (Ammonia)	mg/L	0.02	0.07	0.03	0.05	<0.01	<0.025	0.13	0.02
N-NO3 (Nitrate)	mg/L	0.1	0.05	<0.05	<0.05	1	0	0	0.53
pH			8.04	8.02	7.96	7.88	7.77	7.96	7.71
Sulphate (SO4)	mg/L	1	28	51	35	25	24	24	22
TDS (COND - CALC)	mg/L	5	408	623	634	816	715	702	439
Total Suspended Solids	mg/L	2	286	304	<3	<3	81	58	1390
Calcium (Ca)	mg/L	1	66.3	125	133	134	124	125	80
Magnesium (Mg)	mg/L	1	30.0	53.2	61.3	50	48	44	29
Sodium (Na)	mg/L	2	45.1	70.8	54.4	47	36	38	18
Barium (Ba)	mg/L	0.01	0.053	0.190	0.195	0.02	0.03	0.02	0.02
Boron (B)	mg/L	0.01	0.016	0.054	0.084	0.01	0.03	0.03	0.07
Iron (Fe)	mg/L	0.03	<0.005	2.12	1.82	0.09	0.62	0.27	<0.01
PHC F1 (C6-C10)	mg/L	0.2	<0.02	<0.02	<0.02	<0.02	<0.2	<0.2	<0.2
PHC F2 (C10-C16)	mg/L	0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.2	<0.2
PHC F3 (C16-C34)	mg/L	0.5	<0.4	<0.4	<0.4	<0.4	<0.5	<0.5	<0.2
PHC F4 (C34-C50)	mg/L	0.5	<0.4	<0.4	<0.4	<0.4	<0.5	<0.5	<0.2

* 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).

Borehole #2 (2005-BH2)
(Background Well)

Sample Date:			2019-08-19	2018-06-08	2017-10-06	2016-11-02	2015-10-05	2014-10-29	2005-04-07 (initial Sample)
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	285	322	322	336	337	329	278
Biochemical Oxygen Demand	mg/L	1	<3	<3	<3	<3	<1	<1	<1
Chemical Oxygen Demand	mg/L	5	5	<5	<5	<5	9	8	7
Chloride (Cl)	mg/L	1	215	184	139	176	141	139	40
Conductivity	µS/cm	5	1250	1200	1140	1200	1100	1080	676
Dissolved Organic Carbon	mg/L	0.5	1.4	0.8	1.9	0.7	2.8	2.2	1.6
N-NH3 (Ammonia)	mg/L	0.02	0.03	<0.01	<0.01	<0.01	<0.025	0.13	0.02
N-NO3 (Nitrate)	mg/L	0.1	1.410	0.950	1	1	0	0	0.53
pH			8.01	7.94	7.96	7.88	7.77	7.96	7.71
Sulphate (SO4)	mg/L	1	26	27	21	25	24	24	22
TDS (COND - CALC)	mg/L	5	635	651	581	816	715	702	439
Total Suspended Solids	mg/L	2	140	5	<3	<3	81	58	1390
Calcium (Ca)	mg/L	1	121	137	126	134	124	125	80
Magnesium (Mg)	mg/L	1	47	51	49	50	48	44	29
Sodium (Na)	mg/L	2	48	51	46	47	36	38	18
Barium (Ba)	mg/L	0.01	0.01	0.02	0.03	0.02	0.03	0.02	0.02
Boron (B)	mg/L	0.01	0.01	0.02	0.03	0.01	0.03	0.03	0.07
Iron (Fe)	mg/L	0.03	<0.005	0.194	0.81	0.09	0.62	0.27	<0.01
PHC F1 (C6-C10)	mg/L	0.2	<0.02	<0.02	<0.02	<0.02	<0.2	<0.2	<0.2
PHC F2 (C10-C16)	mg/L	0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.2	<0.2
PHC F3 (C16-C34)	mg/L	0.5	<0.4	<0.4	<0.4	<0.4	<0.5	<0.5	<0.2
PHC F4 (C34-C50)	mg/L	0.5	<0.4	<0.4	<0.4	<0.4	<0.5	<0.5	<0.2

Borehole #3 (2005-BH3)

Sample Date:			2019-08-19	2018-06-08	2017-10-06	2016-11-02	2015-10-05	2014-10-29	2005-04-07 (initial Sample)
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	433	474	467	493	484	481	471
Biochemical Oxygen Demand	mg/L	1	<3	<3	<3	<3	2	<1	<1
Chemical Oxygen Demand	mg/L	5	12	6	6	<5	12	11	10
Chloride (Cl)	mg/L	1	67	76	60	63	69	66	64
Conductivity	µS/cm	5	1110	1180	1160	1170	1150	1170	1170
Dissolved Organic Carbon	mg/L	0.5	3.4	2.7	4.4	2.5	4.6	3.2	3.3
N-NH3 (Ammonia)	mg/L	0.02	0.04	0.03	0.13	<0.01	0.07	0.26	0.09
N-NO3 (Nitrate)	mg/L	0.1	0.42	0.82	0.55	0.40	0.31	0.35	<0.10
pH			8.05	8.02	7.98	7.94	7.81	8.00	7.49
Sulphate (SO4)	mg/L	1	61	66	56	73	63	70	81
TDS (COND - CALC)	mg/L	5	608	693	653	796	748	760	761
Total Suspended Solids	mg/L	2	7	6	<3	<3	22	18	496
Calcium (Ca)	mg/L	1	89	122	119	114	109	112	121
Magnesium (Mg)	mg/L	1	46	57	56	52	50	47	51
Sodium (Na)	mg/L	2	77	77	72	85	84	87	63
Barium (Ba)	mg/L	0.01	0.05	0.07	0.09	0.08	0.08	0.09	0.06
Boron (B)	mg/L	0.01	0.198	0.193	0.21	0.24	0.24	0.28	0.14
Iron (Fe)	mg/L	0.03	<0.005	0.067	0.14	0.05	0.07	0.12	<0.01
PHC F1 (C6-C10)	mg/L	0.2	<0.02	<0.02	<0.02	<0.02	<0.2	<0.2	<0.2
PHC F2 (C10-C16)	mg/L	0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.2	<0.2
PHC F3 (C16-C34)	mg/L	0.5	<0.4	<0.4	<0.4	<0.4	<0.5	<0.5	<0.2
PHC F4 (C34-C50)	mg/L	0.5	<0.4	<0.4	<0.4	<0.4	<0.5	<0.5	<0.2

Borehole #4 (2005-BH4)

Sample Date:			2019-08-19	2018-06-08	2017-10-06	2016-11-02	2015-10-05	2014-10-29	2005-04-07 (Initial Sample)
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	243	263	259	297	271	272	279
Biochemical Oxygen Demand	mg/L	1	<3	<3	<3	<3	1	2	<1
Chemical Oxygen Demand	mg/L	5	<5	5	9	<5	11	13	6
Chloride (Cl)	mg/L	1	22	25	22	25	28	22	15
Conductivity	µS/cm	5	641	663	665	670	701	665	646
Dissolved Organic Carbon	mg/L	0.5	3.0	2.2	3.6	3.3	3.2	3.4	2.1
N-NH3 (Ammonia)	mg/L	0.02	0.18	0.17	0.14	0.06	0.18	0.35	0.17
N-NO3 (Nitrate)	mg/L	0.1	0.080	<0.05	<0.05	<0.1	<0.10	<0.10	<0.10
pH			8.08	8.18	8.03	7.99	7.85	8.10	7.84
Sulphate (SO4)	mg/L	1	52	49	43	54	56	58	41
TDS (COND - CALC)	mg/L	5	354	395	371	450	456	432	420
Total Suspended Solids	mg/L	2	3	4	<3	<3	<2	4	175
Calcium (Ca)	mg/L	1	27	41	45	49	54	45	39
Magnesium (Mg)	mg/L	1	14	18	20	21	22	18	18
Sodium (Na)	mg/L	2	84	96	75	71	70	78	76
Barium (Ba)	mg/L	0.01	0.04	0.07	0.08	0.08	0.08	0.08	0.07
Boron (B)	mg/L	0.01	0.222	0.26	0.26	0.20	0.21	0.27	0.19
Iron (Fe)	mg/L	0.03	<0.005	0.48	0.48	0.43	0.69	1.26	0.16
PHC F1 (C6-C10)	mg/L	0.2	<0.02	<0.02	<0.02	<0.02	<0.2	<0.2	<0.2
PHC F2 (C10-C16)	mg/L	0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.2	<0.2
PHC F3 (C16-C34)	mg/L	0.5	<0.4	<0.4	<0.4	<0.4	<0.5	<0.5	<0.2
PHC F4 (C34-C50)	mg/L	0.5	<0.4	<0.4	<0.4	<0.4	<0.5	<0.5	<0.2

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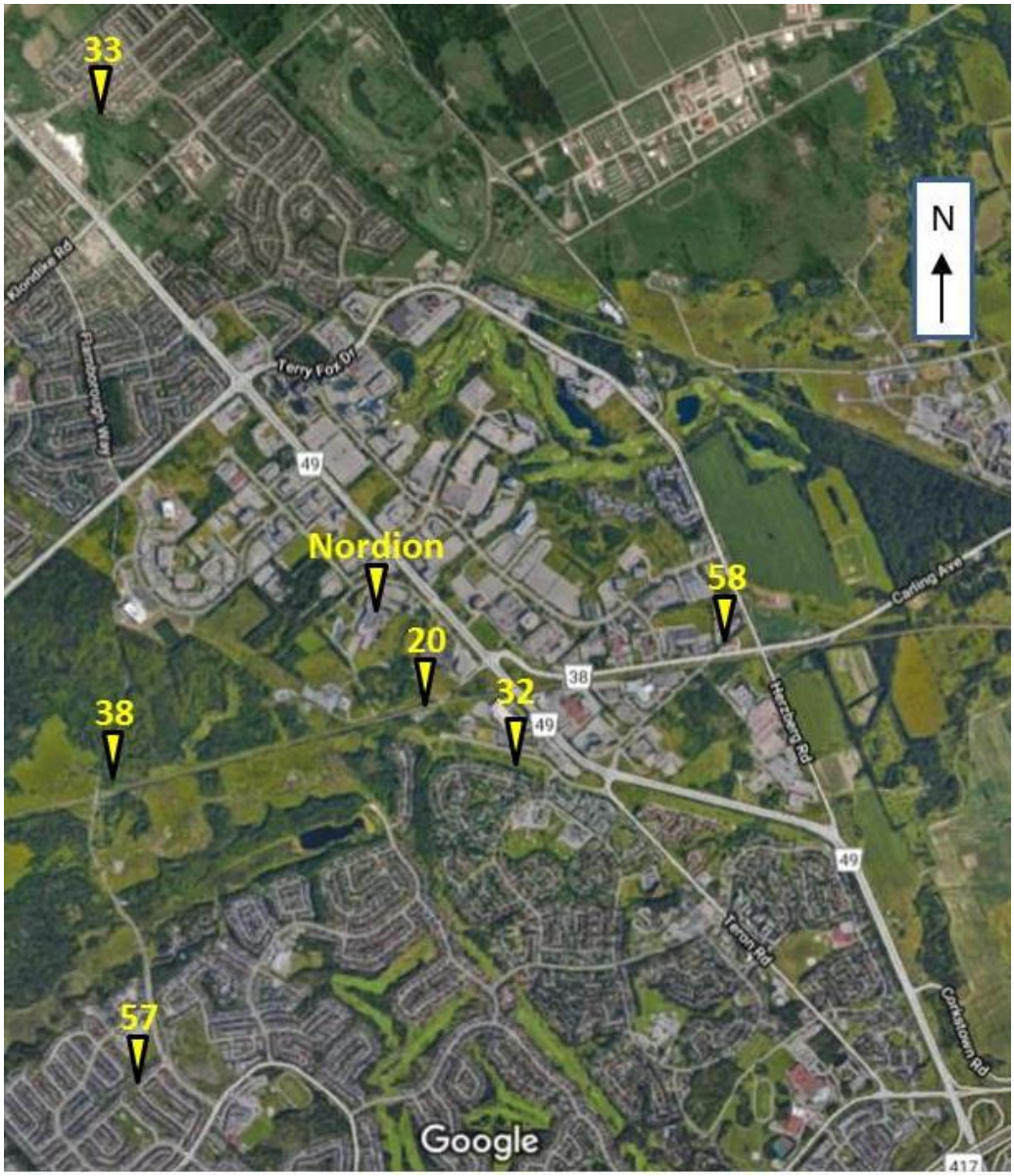

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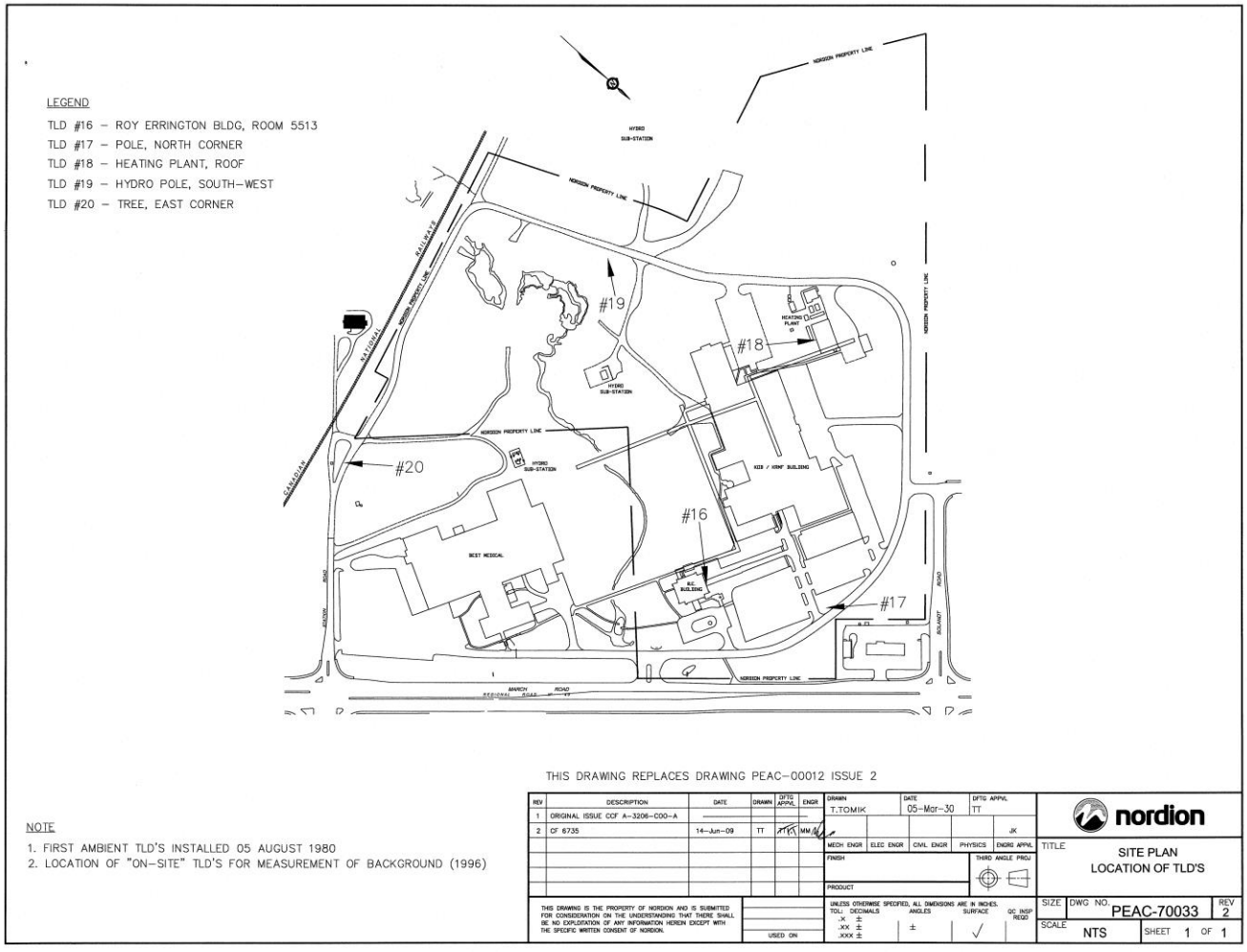
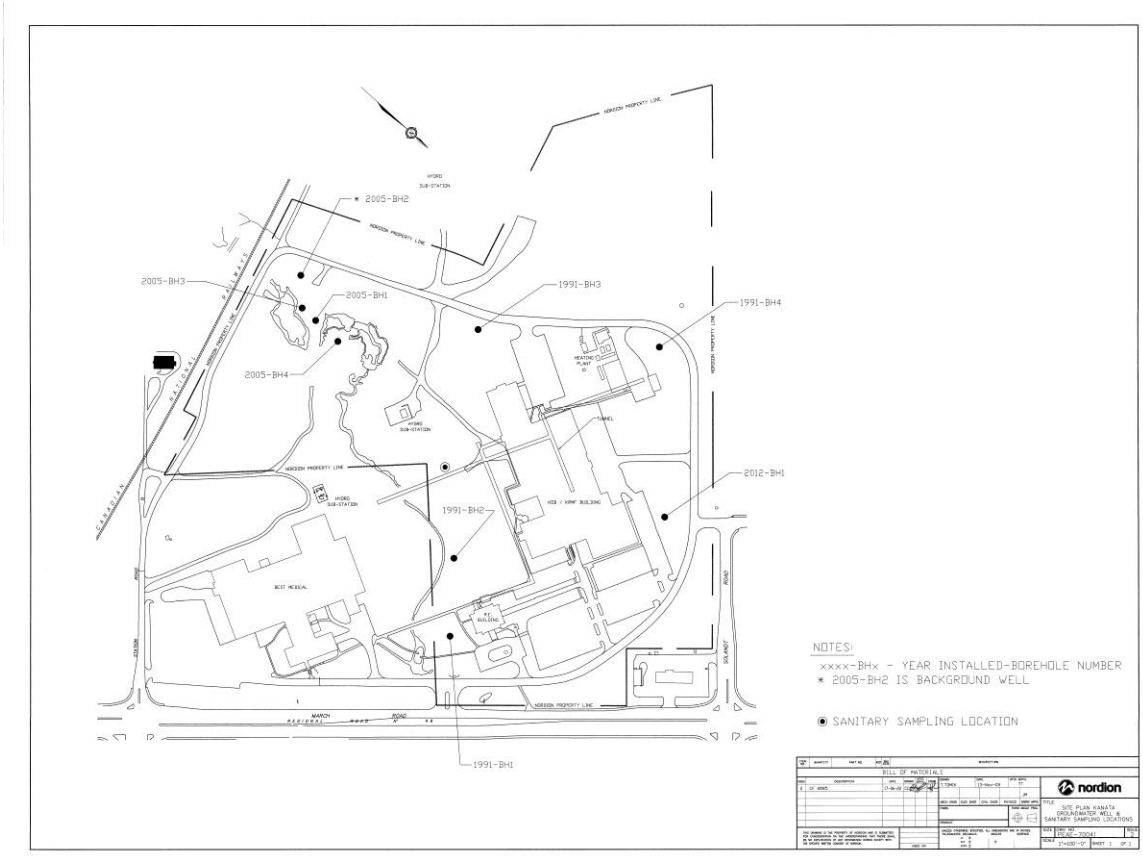
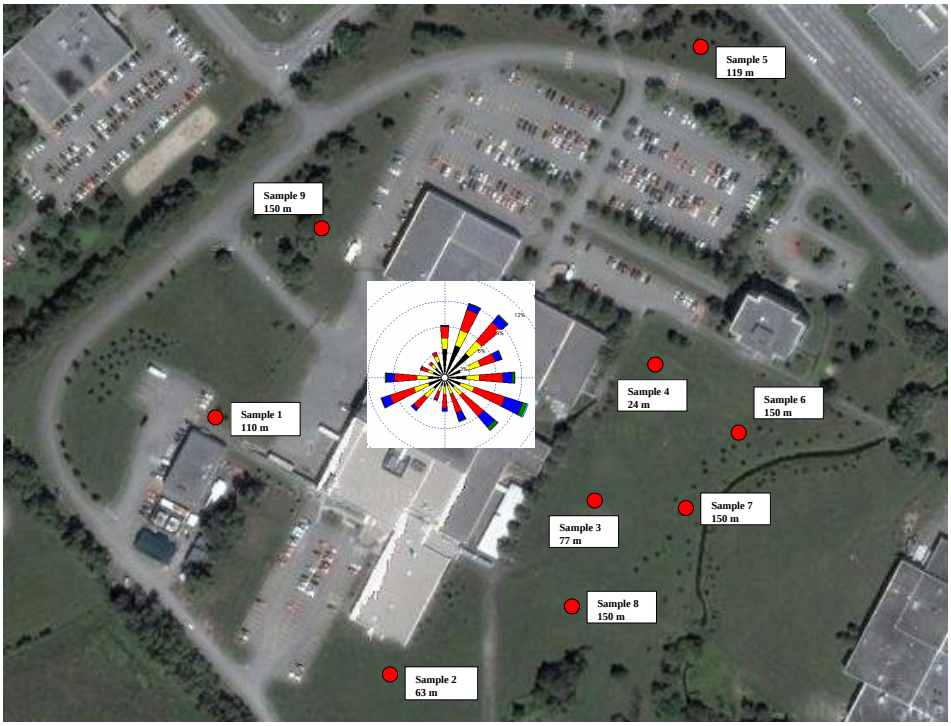

LEGEND
TLD #16 – ROY ERRINGTON BLDG, ROOM 5513
TLD #17 – POLE, NORTH CORNER
TLD #18 – HEATING PLANT, ROOF
TLD #19 – HYDRO POLE, SOUTH–WEST
TLD #20 – TREE, EAST CORNER
NORDION PROPERTY LINE
HYDRO SUB-STATION
#19
#18
#20
#16
#17
HEATING PLANT
BEST MEDICAL
RC BUILDING
KDI / KMF BUILDING
CANADIAN NATIONAL RAILWAYS
MARCH ROAD
IRONSIDE ROAD
NOTE
1. FIRST AMBIENT TLD'S INSTALLED 05 AUGUST 1980
2. LOCATION OF "ON–SITE" TLD'S FOR MEASUREMENT OF BACKGROUND (1996)
THIS DRAWING REPLACES DRAWING PEAC–00012 ISSUE 2
REV 1 ORIGINAL ISSUE CCF A–3206–COO–A
REV 2 CF 6735 14–Jun–09 TT MM
DRAWN T.TOMIK
DATE 05–Mar–30
DFTG APPVL TT
MECH ENGR ELEC ENGR CIVIL ENGR PHYSICS ENGRG APPVL
FINISH
PRODUCT
THIRD ANGLE PROJ
THIS DRAWING IS THE PROPERTY OF NORDION AND IS SUBMITTED FOR CONSIDERATION ON THE UNDERSTANDING THAT THERE SHALL BE NO EXPLOITATION OF ANY INFORMATION HEREIN EXCEPT WITH THE SPECIFIC WRITTEN CONSENT OF NORDION.
USED ON
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES.
TOL: DECIMALS .X ± .XX ± .XXX ±
ANGLES ±
SURFACE √
QC INSP REQD
nordion
TITLE
SITE PLAN
LOCATION OF TLD'S
SIZE
DWG NO. PEAC-70033
REV 2
SCALE NTS
SHEET 1 OF 1

[redacted]


2005-BH2
2005-BH3
2005-BH1
2005-BH4
1991-BH3
1991-BH4
2012-BH1
1991-BH2
1991-BH1
NOTES:
xxxx-BHx - YEAR INSTALLED-BOREHOLE NUMBER
* 2005-BH2 IS BACKGROUND WELL
SANITARY SAMPLING LOCATION
nordion
SITE PLAN KANATA
GROUNDWATER WELL &
SANITARY SAMPLING LOCATIONS

[redacted]



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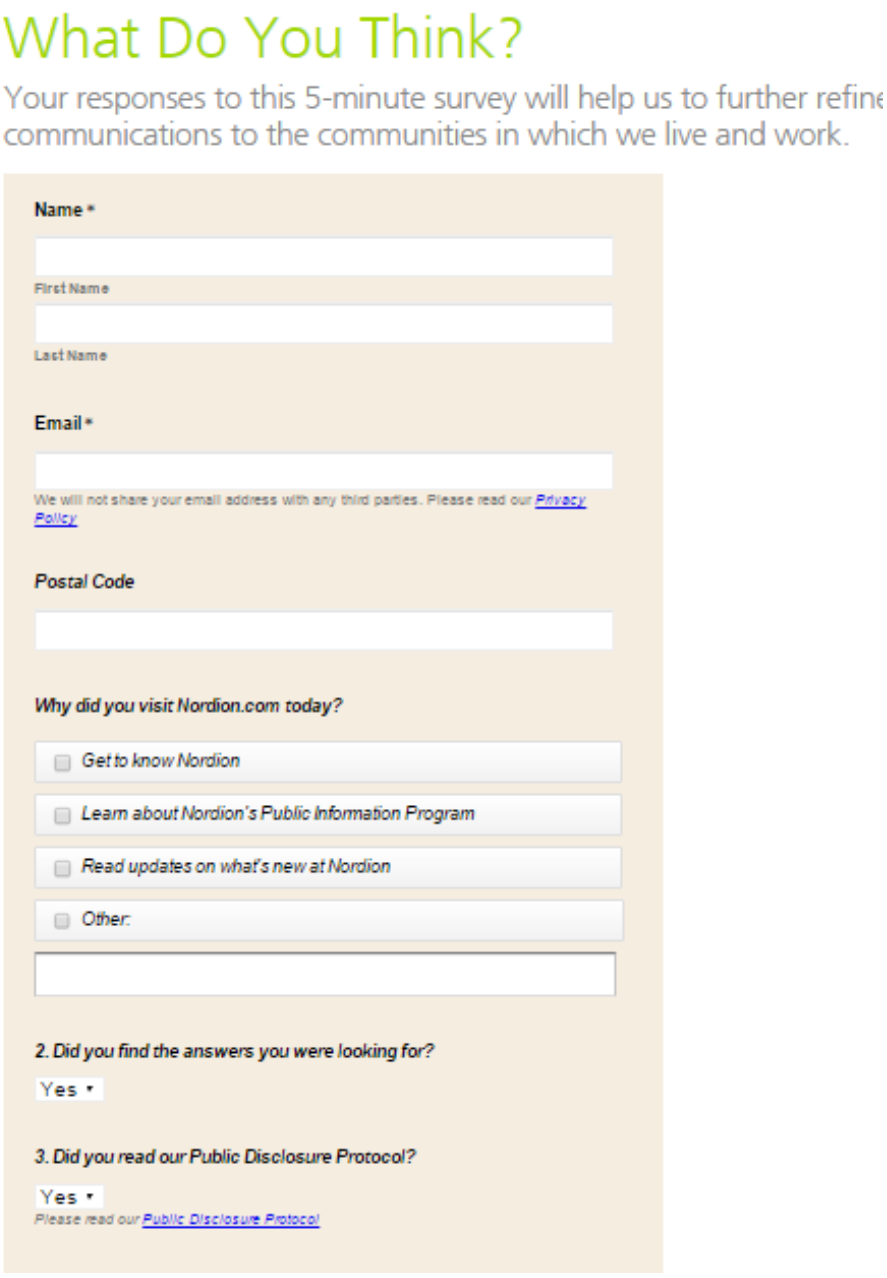
Appendix H
Copy of Nordion Feedback Survey on nordion.com - Public Disclosure Protocol Consultation



What Do You Think?

Your responses to this 5-minute survey will help us to further refine communications to the communities in which we live and work.

Name *

First Name

Last Name

Email *

We will not share your email address with any third parties. Please read our *Privacy Policy*

Postal Code

Why did you visit Nordion.com today?

- ☐ *Get to know Nordion*
- ☐ *Learn about Nordion's Public Information Program*
- ☐ *Read updates on what's new at Nordion*
- ☐ *Other:*

2. Did you find the answers you were looking for?

Yes

3. Did you read our Public Disclosure Protocol?

Yes

Please read our Public Disclosure Protocol

4. If you answered "Yes" to #3, was there anything you think we could add or change to make the information more clear?

5. What was your level of understanding of Nordion's Public Information Program before you visited Nordion.com today?

High

6. What was your level of understanding of Nordion's Public Information Program before you visited Nordion.com today?

High

7. How do you prefer to receive updates from Nordion?

- *Twitter*
- *Facebook*
- *Nordion.com*
- *Email*
- *Any of the above*
- *Other:*

8. Please provide any additional comments you have on our Public Information Program.

Appendix I
Annual Advertisement to the General Public

Copy of ads placed in the December 2019 issue of the *Community Voice.*