

CONFIDENTIAL



# Nordion®

A Sotera Health company

## **NORDION (CANADA) Inc. CLASS 1B FACILITY**

License Number: NSPFOL-11A.01/2025

### **2021 ANNUAL COMPLIANCE AND OPERATIONAL PERFORMANCE**

**REPORT** to the Canadian Nuclear Safety  
Commission for the period JANUARY to  
DECEMBER 2021

### **Signatures**

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**2021 Annual Compliance and Operational Performance Report - Nordion Class 1B Facility**

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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 2021 Environmental, Health and Safety (EHS) Objectives

The key points of this report are as follows:

- All key measures were implemented to ensure continued 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.
- Nordion did not have any instances in which there was potential to exceed a regulatory limit or reach or exceed a regulatory action level.
- Nordion had zero lost time injuries and four medical treatment injuries.
- Nordion had five reportable, non-radiological exceedances of an environmental regulatory limit or action level in 2021. Four of these involved non-radiological by-law exceedances to the sanitary sewers and the fifth was the release of <100 kg of halocarbon. All releases were self-identified by Nordion and reported to the appropriate authorities.

In 2021, 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 five non-compliances with the NSC Act, the regulations or with Nordion's site license NSPFOL-11A.01/2025. Nordion had seven incidents that were reportable to the CNSC in 2021 (see 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
BH	Borehole
BWXT	BWXT Medical Ltd
CAM	Continuous Air Monitor
CAPA	Corrective Action/Preventative Action
COF	Cobalt Operations Facility
CNSC	Canadian Nuclear Safety Commission
CSA	Canadian Standards Association
DRL	Derived Release Limit
DU	Depleted Uranium
EHS	Environment, Health and Safety
EMS	Environmental Management System
EOC	Emergency Operations Centre
ER	Emergency Response
FSAR	Final Safety Analysis Reports
HEPA	High Efficiency Particulate Air
IAEA	International Atomic Energy Association
ICP	Incident Command Post
KOB	Kanata Operations Building
LCH	Licence Conditions Handbook
MDA	Minimum Detectable Activity
MSFS	Management System for Safety
NEW	Nuclear Energy Worker
NPRMI	Non-production Radioactive Material Inventory
NSC	Nuclear Safety and Control
NVS	Nuclear Ventilation System
OJT	On-The-Job Training
PDP	Preliminary Decommissioning Plan
PIP	Public Information Program
PIT	Physical Inventory Taking
PIV	Physical Inventory Verification
PTNSR	Packaging and Transport of Nuclear Substances Regulations
QA	Quality Assurance
RE	Roy Errington
SCA	Safety and Control Area
SCBA	Self Contained Breathing Apparatus
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 an indirect, wholly owned subsidiary of Sotera Health Company (Sotera Health), a recognized global leader in contract sterilization. Nordion's Class 1B Facility is dedicated to the manufacturing of sealed sources used in cancer therapy and irradiation technologies (Gamma Technologies).

Production operations for Gamma Technologies are housed in the Cobalt Operations Facility (COF) portion of the Kanata Operations Building (KOB).

On November 1<sup>st</sup>, 2021, BWXT Medical (formerly BWXT ITG) obtained a Class 1B license. BWXT Medical continues to conduct their licenced activities in leased space at Nordion's facility. Nordion licenced activities under license NSFPOL-11A.01/2025, related only to those associated with the COF. As directed by CNSC staff, this Annual Compliance Report covers only those Nordion licensed activities as they related to Nordion's current activities in the COF. Review and analysis of 2021 activities occurring within those areas of the facility leased to BWXT Medical are covered under the annual compliance report submitted by BWXT Medical.

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 Impacts and Response to COVID-19 Pandemic in 2021

On March 3<sup>rd</sup>, 2020, Nordion initiated its emergency operations centre (EOC) to respond to the COVID-19 pandemic. Nordion has a Communicable Disease Response Plan that formed the basis for the Nordion COVID-19 response plan. Nordion implemented various COVID protocols aligned with Provincial and local COVID health guidelines for workplaces.

The policies and protocols implemented by Nordion have ensured that Nordion has maintained the safety and security of personnel, the public, and the environment.

### 1.2 Compliance with Other Regulations

During 2021, Nordion self-reported four separate grab samples that exceeded of the City of Ottawa Sewer Use by-laws (2003-514). These included:

- March 2021 - Nonylphenol ethoxylates
- June 2021 - Phosphorous (total)
- September 2021 - Suspended Solids (total)
- December 2021 - Nonylphenols

The cause for these incidents could not be directly identified, however it is suspected they were likely the result of increased cleaning activities on-site for COVID as well as cleaning related to various construction activities.

In addition, there was one reportable halocarbon release of R-22 (18 kg) in October 2021. The investigation was unable to find a direct cause of this leak but, in consultation with the qualified Contractor, it was felt that it was likely due to either undercharging from the manufacturer at the time of purchase or that the release was due to previous servicing. The unit was working properly at the time and there were no indications of a leak from previous leak tests. The charge was pulled to do an unrelated repair and that is when the loss was noticed. Following the investigation, the reclaimed refrigerant was returned to the unit and another leak test was performed which confirmed the unit was operating properly.

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Nordion reports to the Workplace Safety Insurance Board (WSIB) whenever a reportable occupational injury or illness occurs. In 2021, Nordion reported four medical treatment incidents to WSIB. WSIB may inspect Nordion's Occupational Health and Safety programs at any time. In 2021, WSIB performed an inspection of Nordion's COVID-19 safety program and Nordion's harassment program. Nordion's programs were found to be in full compliance.

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 non-compliances related to the sealed and unsealed source reporting performed by Nordion to the Competent Authorities in France, Belgium, or Switzerland.

### 1.3 New Licensed Activities

There were no new licensed activities in 2021.

### 1.4 Significant Modifications or Changes to Site or Facility

Significant modifications and repairs that were carried out in 2021 include:

- Construction work continued for a new hot cell (Cell 1) in the COF that was started in 2020 and expected to be completed in 2022.

#### 1.4.1 Changes to Procedures Related to Operations Safety and Control

In 2021, the following changes were made to procedures related to operational safety and control:

- SE-EHS-009 "Regulatory Reporting of EHS Events"  
Implementation of flow charts for the regulatory reporting requirements outlined in SE-EHS-009.
- CPM-7-09 "Quality and EHS Records"  
Update to clarify requirements for translation of foreign licenses and to update records requirements to include electronic records.
- SE-LIC-016 "Safeguards Program"  
Update to clarify requirements for the review of the Daily Shipment Report and to include additional information for identifying sales orders at the time of receipt to ensure accurate depleted uranium (DU) reporting.
- SE-LIC-009 "Preliminary Decommissioning Plan Class 1B Facility (KOB)"  
Five-year update the Nordion Preliminary Decommissioning Plan (PDP) as required by the Nordion License Condition Handbook. Further updates to remove the decommissioning activities and associated costs for which BWXT Medical is responsible under their CNSC operating license.
- SE-EHS-007 "Fire Protection Program"  
Update to roles and responsibilities as a result of BWXT Medical obtaining their own operating license and to remove references to Vancouver Operations and the irradiator located in Laval, Canada.

### 1.5 Operational Challenges

In 2021, the following operational challenges were experienced by Nordion;

- Managing the response to the COVID-19 pandemic in 2021.
- Managing the on-going demolition/construction activities conducted throughout 2021 in the BWXT Medical facility.
- Managing the transition associated with BWXT Medical obtaining their own facility operating license from the CNSC.

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- Meeting the internal target for timely closure of Corrective Actions/Preventive Actions (CAPAs). A metric of 100% of CAPAs through Investigation phase in less than six months was implemented in 2021. The average for 2021 was 90% through effectiveness in six months.
- Nordion and CNSC held discussions regarding the Sealed Source Tracking System (SSTS) reporting requirements for the different forms of Co-60 raw material supplied to Nordion by strategic supply partners both within and outside of Canada. These discussions were on-going at the end of 2021.

## **2. SAFETY AND CONTROL AREA (SCA)**

### **2.1 Management System**

#### **2.1.1 Applicable Activities**

The Management System for Safety (MSFS) 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 for the manufacture of 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 may also service, 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 MSFS was conducted on June 3<sup>rd</sup>, 2021, by the EHS Committee to review the 2020 EHS Performance Report. This report assessed the performance related to the 14 Safety and Control Areas over the past three years where this information was available. Any trends identified were addressed and tracked via a Nordion non-conformance system (ex. CAPA, Velocity EHS Action Items). The 2021 Environmental Objectives and Targets were reviewed and were on track. Resource requirements for the EMS and MSFS were discussed. The EHS Committee agreed that the programs are resourced adequately to ensure that critical issues were being addressed. Financial and specialized skills resources were felt to be adequate. The committee made five recommendations for future reports and requested ten revisions and clarifications to the EHS Performance Report.

The Committee concluded that they were satisfied with the effectiveness of the EMS and the MSFS.

#### **2.1.3 Internal and External Audits**

Nordion uses both internal and external audits as a key part of the MSFS and the EMS.

In 2021, there was one audit of Nordion by external parties, one audit of supplier by Nordion and 18 internal audits completed by Nordion EHS. These audits included an audit of production areas and supporting functions as well as policy and program audits.

There were also six internal audits initiated during 2021 and will be completed in 2022.

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In addition, as part of the inspection program, Nordion conducted a total of 12 health and safety inspections, and 10 environmental and fire inspections.

Of the ten EHS related Corrective Actions/Preventative Actions (CAPAs) initiated in 2021, three CAPAs were a result of minor findings from internal audits (NPRMI, MSFS/EMS). Five CAPAs were the result of external audits (CNSC, ISO 14001). There were three CAPAs, initiated in early 2021, resulted from external audits/inspections of Nordion conducted in 2020. Remaining CAPAs were resulted from investigations or were issued to address observed deficiencies.

#### 2.1.3.1 Internal Audits

The following internal audits were conducted in 2021 by Nordion:

1. Environmental Management System (EMS) Audit
2. ASN Quote / PO Audit
3. New York State Audit
4. Safeguarded Physical Inventory Taking (PIT)
5. EHS Internal Audit Program
6. MSFS/EMS Audit – Research and Development
7. MSFS/EMS Audit – Resources, Financial Resources. Competence, training and awareness, Management Review 2
8. US NRC QA Program Approval for Radioactive Material Packages
9. Sealed Source Export Licences
10. Sealed Source Return Statements
11. MSFS/EMS Audit – Business Planning
12. Supplier Audit [REDACTED]
13. MSFS/EMS Audit – Work Management
14. Safety Culture
15. Environmental Protection Program
16. Safeguards, Non-proliferation and import/export Controls Program
17. Security Program
18. Package Model 3981
19. Sterigenics Package Handling

The following internal audits were initiated in 2021 and will complete in 2022:

1. Independent Assessment – Engineering
2. Non-Production Radioactive Material Inventory (NPRMI)
3. Supply Chain and Purchasing, Supplier Audit Program
4. (MSFS) Documentation of Management System; Information; Documents; Records, (EMS) Control of documents, Control of record
5. Packaging and Transport of Nuclear Substances Program
6. Waste Management



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2.1.3.2 External Audits of Nordion

The following external audit of Nordion was conducted in 2021:

Date	Description	Result
April 6 <sup>th</sup> to 9 <sup>th</sup> , 2021	A third party conducted an audit against the requirements from the ISO 14001:2015 standard (EMS)	There were two minor non-conformities and five opportunities for improvement.

2.1.3.3 External Audits Conducted by Nordion

Nordion conducted one EHS audit of a supplier in 2021. There were no findings resulting from the supplier audit.

2.1.4 Management System for Safety Program Improvements

Revisions were initiated in 2021 to MSFS Program to update the Program as a result of BWXT Medical obtaining an operating license and to update the associated procedures, roles and responsibilities within the stand-alone Nordion MSFS Program.

Improvements made to the Radiation Protection (RP) Program, Conventional Health and Safety Program, the Environmental Protection Program, the Emergency Preparedness Program, and the Fire Protection are discussed in Section 2.7.8, 2.8.3 and 2.9.7, 2.10.4 and, 2.10.8, respectively.

In 2021, Nordion continued to implement 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 an indirect, wholly owned subsidiary of Sotera Health Company and 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<sup>th</sup>, 2018, the Medical Isotopes segment of Nordion was sold to BWXT Medical (formerly BWXT ITG). On November 1<sup>st</sup>, 2021, BWXT Medical obtained their own CNSC operating license for the medical isotopes facilities. The list of EHS personnel for Nordion as of December 2021 is provided below.

**Nordion - Gamma Technologies – EHS Compliance**

- Senior Vice President of Environmental, Health and Safety (Sotera Health)
- Director, Regulatory & EHS
- Administrative Assistant
- Director, Global Security
- Manager, Security
- Contract Security Analyst
- Contract Security Supervisor
- Contract Security Officers (15)
- Manager, Radiation Safety & Nuclear Transportation
- Senior Radiation Surveyor
- Junior Radiation Surveyor

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- Senior EHS Compliance Specialist (2)
- Senior Licensing Coordinator
- Manager, EHS
- EHS Compliance Specialist
- EHS Specialist

**2.1.6 Changes to the Organizational Structure and Roles and Responsibilities of Key Personnel in 2021:****EHS Compliance Organization Changes:**

- In January 2021, a Senior Compliance Specialist was added to the group.
- Two radiation surveyors moved to other positions in 2021. Both positions were filled. There was no gap in radiation surveyor coverage for the facility.
- In June 2021, a contract Security Analyst was added to the Security group.

**2.2 Human Performance Management**

As per Section 1.1 and into second year of the COVID-19 pandemic, a deviation was initiated to defer any non-critical, in-class training due to the need to maximize social distancing. See Table 1 below for more information on EHS safety training courses that were deferred under our internal planned deviation.

**2.2.1 Overall Performance of Human Performance Management**

Employee training was provided in accordance with QAP AP-47 "Training Program and Management System" and SE-TRN-006 "Systematic Approach to Training System". Nordion provides EHS training for all employees as per SE-TRN-003 "Compliance Environmental, Health and Safety Training". In 2021, Nordion's training program continued to meet the requirements of CNSC REGDOC-2.2.2, "Personnel Training" and License Condition 3.1 of the Nordion LCH for the implementation and maintenance of a training program.

Nordion's Change Control procedure, QAP AP-45, required 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 were 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.

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**2.2.1.1 Training Attendance Rate**

Nordion designed and maintained a variety of radiation safety training courses. New employees who are not classified as Nuclear Energy Workers (NEWs) receive a basic course on EHS, Level I, which provides information on the facilities, emergency response procedures and alarms, and basic procedures for safety in the workplace. NEWs 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 2021, 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 not limited to topics such as "working with beta", emergency response (ER) 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 two-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 safety training programs is provided in Table 1.

In 2021, the number of participants that required safety training was 377 and by year end, 240 participants completed the training, which included refresher training. Of the 138 participants who did not complete the training, 103 were deferred due to COVID-19 under Nordion's internal deviation. The actual attendance completion rate for 2021 was 91% (343/377).

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**Table 1**  
**2021 Safety Training Programs**

Program	Duration	Number of Participants Requiring Training in 2021	Number of Participants Completed Training in 2021	Number of Participants Did Not Attend Scheduled Training in 2021
Nuclear Energy Worker (NEW) Indoctrination <sup>3</sup> and NEW Refresher	4 Hours / Self Study	81	74	7
Radiation Instrumentation Workshop <sup>3</sup>	3 Hours	29	22	7 <sup>1</sup>
Radiation Safety Review for Operators <sup>3</sup>	Half Day	10	6	3+1 <sup>1</sup>
Transport of Dangerous Goods Level I <sup>3</sup>	Self Study	4	4	0
Transport of Dangerous Goods Level II <sup>3</sup>	Self Study	6	1	1 <sup>1</sup>
Transport of Dangerous Goods Level III <sup>3</sup>	Self Study	14	14	0
TDG for Contractors <sup>3</sup>	Full Day	49	44	5
Crane	Half Day	16	13	3 <sup>1</sup>
Pallet	Half Day	6	5	1 <sup>1</sup>
Forklift	Half Day	10	8	2 <sup>1</sup>
Contractor Radiation Safety Protection Training <sup>3</sup>	Half Day	14	13	1
Contractor Radiation Safety Protection Refresher <sup>3</sup>	2 Hours	56	9	47 <sup>1</sup>
Contractor EHS Training Level I <sup>3</sup>	2 Hours	47	10	37 <sup>1</sup>
In-Depth Security Awareness <sup>3</sup>	2 Hours	10	8	2
Emergency Response Part 1 <sup>3</sup>	2 Hours	2	0	2
Emergency Response Part 2 <sup>3</sup>	2 Hours	0	0	0
Emergency Response Part 3 <sup>3</sup>	2 Hours	5	5	3 <sup>1</sup> +2
Emergency Response: Security <sup>3</sup>	1 Hour	17	4	13
Emergency Response: Site Security Volunteer <sup>3</sup>	1 Hour	0	0	0
Emergency Response: Monitors <sup>3</sup>	1 Hour	0	0	0
Self Contained Breathing Apparatus (SCBA) Part 1 <sup>3</sup> & 2 <sup>3</sup>	1 Hour	1	0	1 <sup>1</sup>
<b>TOTAL</b>		<b>377</b>	<b>240</b>	<b>138</b>
<sup>1</sup> Training deferred by internal deviation				
<sup>2</sup> Refresher training completed				
<sup>3</sup> Key EHS course				

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**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.

In 2021:

- 100% of course evaluation forms had an overall rating of good, very good or excellent. Overall trainee satisfaction remains 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.

In 2021, 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 is measured by the EHS significance (high, medium, and 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.

In 2021, there were no unplanned events where the root cause was attributed to Nordion training or human error.

**2.2.3 Confirmation of Sufficient Number of Qualified Workers**

In 2021, Nordion ensured that at least the minimum number of responsible personnel were available to provide safety during overnight operations and during emergency situations. There were no changes to risk levels or available personnel.

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Nordion Security is always on-site. Radiation Surveyors are always on site when production involving radioactive materials is occurring. Nordion's key emergency response, Facilities and Production Managers are 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 60 Fire Wardens and Marshalls and over 100 other emergency response personnel. Due to the fact that both Nordion and BWXT Medical operate different portions of the same facility, the emergency response program and roles continue to include personnel from both Nordion and BWXT as needed.

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 (see Section 2.10).

There is at least 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 in accordance 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 2021 EHS program objectives and results are shown in Table 2. All the EHS objectives listed in Table 2 were met in 2021 except for Non-Radiological Releases, and timely closure of EHS CAPAs. The number of Medical Treatment Incidents (four) met the target of  $\leq 4$  and the number of Lost Time Incidents (zero) met the target of zero. Further details of these incidents can be found in Section 2.8.4.

Nordion's radioactive materials emissions (0.135% of the Derived Release Limit (DRL)) continue to be well below the target of  $\leq 2\%$  DRL. Non-Radiological releases were above the target of zero with five in 2021. The details of these releases are found in Section 1.2.

The target of 80% of generated CAPAs closed within 1 year was not met in 2021. The average CAPA closure rate for 2021 was 66%. 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. It will take some time to collect sufficient data and see progress on this metric. As well, Nordion has implemented a "CAPA Review Board" comprised of representatives of EHS and Quality Assurance. This group reviews aging CAPAs, the relative importance of the initiating issue(s), the planned corrective actions and the associated timelines and provides additional support and resources where required.

The remainder of the EHS Targets and Objectives were met for 2021. Nordion diverted 66.3% of waste from landfills, the maximum employee dose rates were well under the target of  $\leq 7.5$  mSv/yr and Nordion completed a supplier audit by the end of 2021.

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 EMS and MSFS review.

**Table 2**  
**2021 EHS Program Objectives and Results**

Objective	Measure/Target *	Result
Manage CAPAs and ensure timely closure of CAPAs	<ul style="list-style-type: none"> <li>• Close out aging CAPAs within your areas</li> <li>• Ensure timely updates and closure of CAPAs within 1 year (no late CAPAs and request extensions as required) = 80%</li> </ul>	<ul style="list-style-type: none"> <li>• 66% (average for 2021) CAPAs opened for &lt; 1 year</li> </ul>
Minimize the number and extent of occupational injuries, environmental and radiation incidents.	<ul style="list-style-type: none"> <li>• The number of Medical Treatment Incidents ≤ 4</li> <li>• Lost time Incidents = 0</li> </ul>	<ul style="list-style-type: none"> <li>• The number of Medical Treatment Incidents = 4</li> <li>• Lost time Incidents = 0 (See Section 2.8.4)</li> </ul>
Minimize the use and release of hazardous materials to the environment.	<ul style="list-style-type: none"> <li>• Radioactive materials emissions ≤ 2.0% DRL</li> <li>• Reportable releases of radioactive and non-radioactive hazardous materials to the environment (sanitary sewer, air, groundwater, land) = 0</li> </ul>	<ul style="list-style-type: none"> <li>• 0.135% DRL</li> <li>• Reportable releases = 5 (See Section 1.2)</li> </ul>
Maintain radiation doses to employees as per As Low As Reasonably Achievable (ALARA) principle.	<ul style="list-style-type: none"> <li>• Maximum employee dose rate ≤ 7.5 mSv/yr</li> </ul>	<ul style="list-style-type: none"> <li>• Maximum employee dose rate = 4.3 mSv/yr</li> </ul>
Maintain a healthy safety culture.	<ul style="list-style-type: none"> <li>• Safety is every employee's <u>highest</u> responsibility, therefore unacceptable to take risks to get the job done.</li> <li>• Provide/participate in regular safety discussions and training.</li> <li>• Immediately report near-misses, hazard identifications, suspected ergonomic symptoms and workplace injuries to your manager.</li> </ul>	<ul style="list-style-type: none"> <li>• Targets established to promote safety culture only (not measured)</li> </ul>

\*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 2021, 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.

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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

Nordion and CNSC held discussions regarding the SSTS reporting requirements for the different forms of Co-60 raw material supplied to Nordion by strategic supply partners both within and outside of Canada. These discussions were ongoing at the end of 2021.

2.3.4.2 Sealed Source Tracking Improvements

Various continuous improvements were completed in 2021, including but not limited to procedural changes to provide additional guidance to personnel for confirming sender information for SSTS reporting for received sources, and for confirming sender/recipient license information for SSTS reporting of domestic transfers of sources

2.3.5 Non-production Sealed and Unsealed Source Inventory

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

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.

2.3.6.1 Sealed Source Manufacturing/Radioisotope Processing

The 2021 data on sealed source manufacturing is shown in Table 3.

**Table 3  
Sealed Source Manufacturing  
Activity in PBq (kCi)**

<u>Radioisotope</u>	<u>Total Processed in 2021</u>	<u>Total Shipped in 2021</u>
Co-60	██████████ ██████████	██████████ ██████████

2.3.6.2 Processing >1 Petabecquerel (PBq)

Nordion has processed and shipped quantities of activity greater than 1 PBq of Co-60. In 2021, the quantities of Co-60 of both processed and shipped was ██████████ and ██████████ respectively.

2.3.6.3 Acquisitions of Finished Sealed Radioactive Sources

Sealed radioactive sources acquired by Nordion in 2021 included Co-60 double encapsulated sources that have been returned from customers for re-sale or disposal.



[REDACTED]

[REDACTED]

2.3.6.4 Sealed Sources/Devices >50 Megabecquerels (MBq)

[REDACTED]

## 2.4 Safety Analysis

### 2.4.1 Validation and Maintenance of Overall Safety Case

The overall Nordion safety case for the facility is effectively maintained in the overall primary Final Safety Analysis Reports (FSARs) for 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 2021, 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 2021, there were no significant design issues identified through these reviews. Overall, Nordion's facility design has been maintained.

Construction work for a new hot cell in the COF continued in 2021 and expected to be completed in 2022. This construction work did not impact the overall design basis for the facility.

The facility modifications and additions occurring in the leased areas (BWXT Medical) did not impact the ability of the facility structures, systems and components (SSCs) to meet and maintain their design basis.

## 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 using 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.

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This continues to prove effective as during 2021, 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 considers 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

Table 4 provides dosimetry data for employees grouped in various ranges of exposure. In 2021, a total of 107 employees were monitored. Only the Whole-Body and extremity doses are provided. The skin and lens of the eye doses are equivalent to the whole-body dose since Nordion processes Co-60, a high-energy gamma emitter. Of the 107 employees monitored, 55 were active area employees and 52 were non-active area employees. Of the 52 non-Active Area personnel, 8 support industrial irradiators (containing Co-60) work at customer sites. These individuals are included in the Class 1B licence dosimetry as they may also receive dose from work at the Nordion facility during the dosimetry year. The number of employees in all categories is less than in previous years since 2021 numbers include only those employees related to Nordion's Cobalt Operations activities. In 2020 and previous years, the numbers included employees working in what is now the BWXT licence activities associated with Medical Isotopes.

**Table 4  
Personnel Dosimetry**

Number of Employees					
Dose Range (mSv)	Whole Body				
	2017	2018	2019	2020	2021
0	39	60	47	70	18
0.01 - 1.00	192	151	190	219	61
1.01 - 5.00	31	37	41	35	28
5.01 - 10.00	1	0	0	0	0

Number of Employees										
Dose Range (mSv)	Right Hand					Left Hand				
	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
0	59	44	50	61	14	88	44	52	93	13

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0.01 - 1.00	44	35	35	50	7	18	34	40	23	7
1.01 - 5.00	22	35	39	38	15	16	35	33	33	16
5.01 - 10.00	3	2	5	3	2	2	3	4	3	2
10.01 - 20.00	0	0	0	1	0	1	0	1	1	0
>20	0	0	1	0	0	0	0	0	0	0

**Table 5**  
**Average, Maximum and Minimum Worker Effective Doses (mSv)**

		2017	2018	2019	2020	2021	CNSC Regulatory Limit
NEWs	Average	0.42	0.45	0.48	0.36	0.8	n/a
	Average*	0.49	0.6	0.57	0.46	0.96	n/a
	Maximum	5.49	4.23	4.79	4.92	4.3	50/yr 100/5yr
	Minimum	0	0	0	0	0	n/a
	Number of NEW monitored	263	248	278	324	107	
Contractors	Average	0.02	0.05	0.03	0.01	0.04	n/a
	Average*	0.04	0.06	0.06	0.03	0.06	n/a
	Maximum	0.2	0.25	0.26	0.29	0.30	1/yr
	Minimum	0	0	0	0	0	n/a
	Number of NEW monitored	55	45	123	381	53	

**Table 6**  
**Minimum, Maximum and Average Worker Extremity Doses (mSv)**

		2017	2018	2019	2020	2021	CNSC Regulatory Limit
NEWs	Average	0.53	0.96	1.14	0.93	1.56	n/a
	Maximum	16.4	9.08	20.93	16.48	7.73	500/yr
	Minimum	0	0	0	0	0	n/a
	Number of NEW monitored	125	116	130	153	38	

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Table 5 and 6 provides maximum and average doses to NEWs. There is an increase in the average dose. This is a result in the fact that the data now only pertains to those employees involved in Nordion's Cobalt Operations activities. In the past, the data included activities now associated with BWXT Medical's activities. Activities associated with Cobalt Operations has historically driven the higher employee doses, and as such, the average increases when only considering Cobalt operations employees. However, the maximum dose decreased from the last two years. The maximum dose has always historically been associated with Cobalt Operations.

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 and 2020. This increased is associated with construction activities in Medical Isotopes which is now reviewed under the annual compliance report for BWXT Medical. As such, the total number of contractors associated with Nordion's licensed activities has decreased to historic norms. These contractors are not considered NEWs.

Table 5 and 6 shows continued good performance in maximum whole-body and extremity dose relative to the CNSC Regulatory Limit.

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

#### 2.7.1.2 Internal Occupational Radiation Doses

Nordion's bioassay program includes whole-body counting if air contamination monitoring indicates a need. In 2021, Nordion had a non-reportable contamination event that had the potential for employee inhalation of Co-60. Five employees were sent for off-site whole-body bioassay monitoring. Of these five monitored employees, three were confirmed to have no uptake of Co-60. The remaining two employees had Co-60 inhalation doses of 1.42  $\mu$ Sv and 5.9  $\mu$ Sv. These doses are a fraction of the 100-200  $\mu$ Sv external dose these employees typically receive in a month.

#### 2.7.2 Significance of Results for the Dose Control Data

The group with the highest average dose (2.71 mSv/employee) is the Cobalt Monitoring Decontamination and Shipping group. This group is the group with the historic highest average. The 2021 average (2.71 +/- 1.11 mSv) is consistent with the 2020 average (2.4 +/- 1.5 mSv).

The other group that drives Nordion's doses are the production technicians. The average dose in 2021 to production technicians was 2.36 +/- 1.07 mSv. This is consistent with the 2020 value of 2.4 +/- 1.15 mSv.

Non-active area personnel include [REDACTED] personnel that are part of Nordion's installation and services team that performs work at customer sites. This group has the highest average dose for non-active area personnel. In 2021, the installation group had an average dose of 1.5 mSv, with a max dose of [REDACTED] mSv. The [REDACTED] mSv dose was for an employee that worked within the active area for most of 2021 and switched to the installation group late in 2021. As such, the [REDACTED] mSv is primarily related to active area work. The next highest dose for an installation employee was 1.6 mSv.

Results overall demonstrate continued and consistent high performance of Nordion employees in accordance with ALARA.

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### 2.7.3 Dose to the Public

Table 7 shows the doses to the public from 2017 - 2021. This dose represents the combined dose to the public from Nordion and BWXT activities that occur on the site. It is important to note that a new set of DRL values came into effect in Nordion's LCH in January 2019. Although dose to public increased in 2021, 2020 and 2019 relative to 2018, it is primarily due to the new DRL values. The slight increase in dose to public in 2021 versus 2020 is due to incremental increase in Co-60 facility contamination described in Section 2.7.4.

**Table 7**  
**Dose to Public**

Year	(mSv)
2017	0.000052
2018	0.000067
2019	0.00087
2020	0.00122
2021	0.00185

### 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, gloveboxes, 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 2021 operations, there were nine instances where contamination was found and subsequently contained within the Active Area. Of the nine contamination incidents, two were related to contamination found on clothing, five to contamination found on equipment or floors, and two where contamination was found directly on personnel. There was no significant increased dose to personnel as a result of these incidents.

The distribution of contamination incidents from 2017 to 2021 is shown in Table 8 and illustrated in Figure 1.

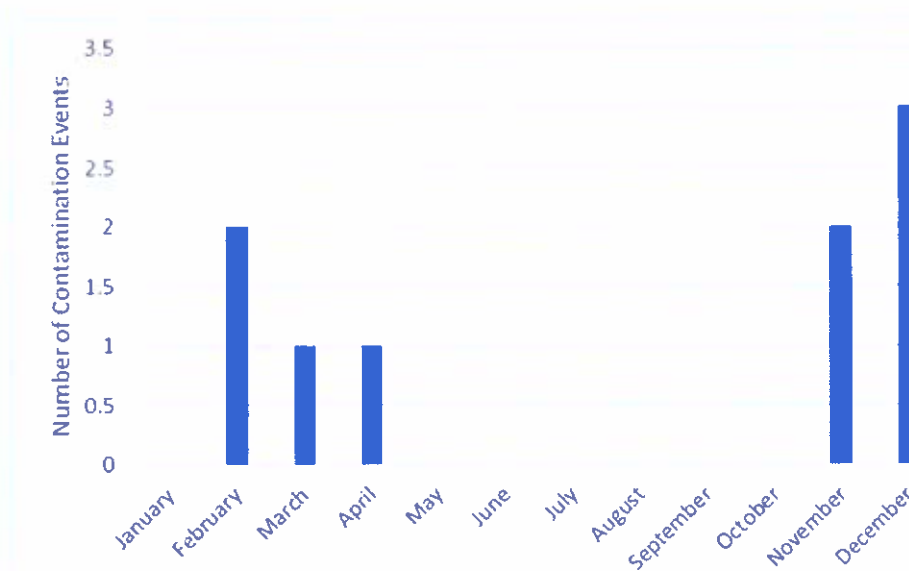
As this report covers only those activities relating to Nordion's Cobalt Operations, the number of contamination events is lower than in previous years. The only isotope identified during the contamination events is Co-60. Currently, Co-60 is the only isotope processed within the Cobalt Operations facility. The number of Co-60 contamination events in 2021 is higher than the Co-60 contamination events in previous years. Of the nine contamination events in 2021, five occurred between November 29<sup>th</sup> and December 31<sup>st</sup>, 2021. This corresponds to a time when Nordion was receiving raw Co-60 material from a supplier and identified higher than normal levels of contamination associated with the receipts. However, these findings did not result in any additional risk to personnel or the environment.

Nordion's contamination control program continues to be well managed and meet the conditions of the licence.

**Table 8**  
**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	Total Co60 Contamination Incidents
2017	0	1	4	6	1	2	14	4
2018	0	5	4	6	3	0	18	4
2019	1	1	6	6	4	0	18	4
2020	0	6	8	4	3	1	22	5
2021	0	0	3	4	1	1	9	9

**Figure 1**  
**Contamination Incidents by Month in 2021**



**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 building. Within the Active Area, radiation surveys are generally conducted daily, 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, gloveboxes, 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.

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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 2021.

Breathing air was monitored at various locations in the facility. In addition to having the capability of alarming locally, Continuous Air Monitors (CAM) 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 daily.

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 2021, 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 2021. There were no fluctuations in 2021 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 2021, 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 2021.

**2.7.8 Radiation Protection Program Improvements**

There were no significant changes to the RP program in 2021. The RP program continued to operate effectively in 2021.

**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 2021. 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 EMS and MSFS Review. See Section 3.2 Table 18 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.

**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. Maintenance is performed for any tests that are out of specification.

In 2021, the following testing was performed:

Nuclear Ventilation System (NVS) High Efficiency Particulate Air (HEPA) filters are required to be test yearly. Testing at Nordion occurred twice annually, with the exception of one filter which was tested at the required annual frequency. HEPA specifications were met.

The emergency generators were tested monthly and confirmed to be operational.

The radiation evacuation alarm was tested weekly and confirmed to be fully functional.

The radiation alarms throughout the facility were tested on a weekly basis in 2021. The tests verified that the alarms sound at the pre-set alarm levels and that the alarms register on the Building Management System (BMS).

The sprinkler system fire system was tested monthly in 2021 and found to be operational. All dry systems were tested and verified in good operating condition in 2021 as required by the National Fire Protection Association.

The fire alarm panels were tested monthly and found to be fully functional.

Handheld contamination monitoring equipment was maintained twice a year. Hand & Foot and Whole-body area monitors are checked weekly. Area monitors are checked daily. Equipment continued to function properly in 2021.

Air sampling pumps were tested on a weekly basis.

Radiation survey instruments were tested on a monthly, bi-annual, or annual basis as required. Radiation instruments that do not meet the calibration check specifications are sent for repair and service. Nordion maintains an inventory of radiation survey instruments to ensure sufficient radiation instruments are available at all times.

There were no trends identified in 2021 relating to radiation instruments.

#### 2.7.12 Radiation Protection Training Program and Effectiveness

See 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 year that are used to monitor the effectiveness of the safety program.

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

Process safety audits are conducted annually.

See Section 2.1.3 for a description of audits and inspections for 2021.

### 2.8.2 Conventional Health and Safety Committee

The Nordion Workplace Health and Safety Committee is represented by union and management and typically meets monthly.

The Nordion Workplace Health and Safety Committee met 12 times in 2021. The 2021 accomplishments for these Committees were their continued review of new or changes to applicable EHS policies and programs. In addition, the Workplace Committees 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 2021 included the following:

- Continued to implement behavioural based safety awareness campaign
- Continued focus on the COVID-19 related programs/processes (education, response, decontamination)
- Hosted Safety Week (in June 2021) to raise safety awareness
- Installed new Safety Boards in key locations throughout the site



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2.8.4 Conventional Health and Safety Occurrences

During 2021, there were four medical treatment incidents and no lost time injuries. 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.

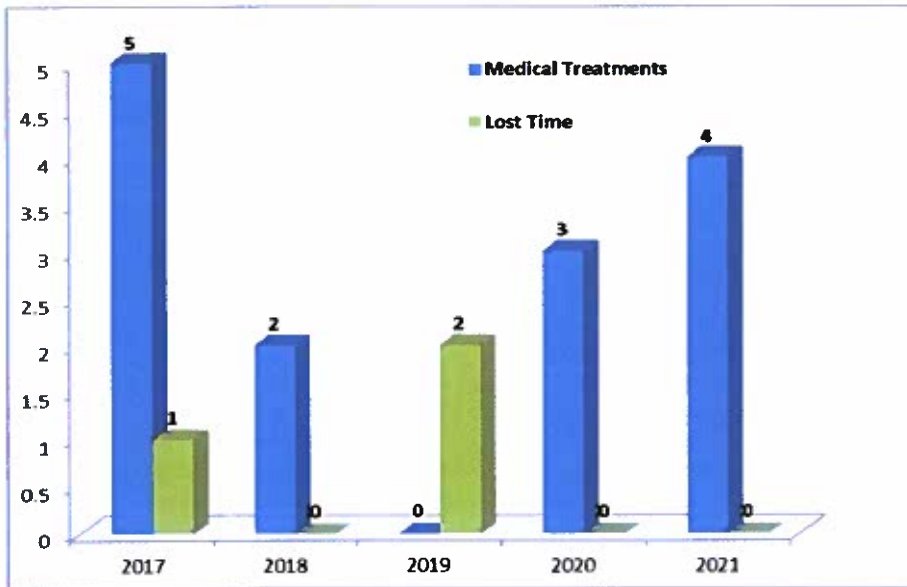
Lost Time Incidents: None to report

Medical Treatment Incidents:

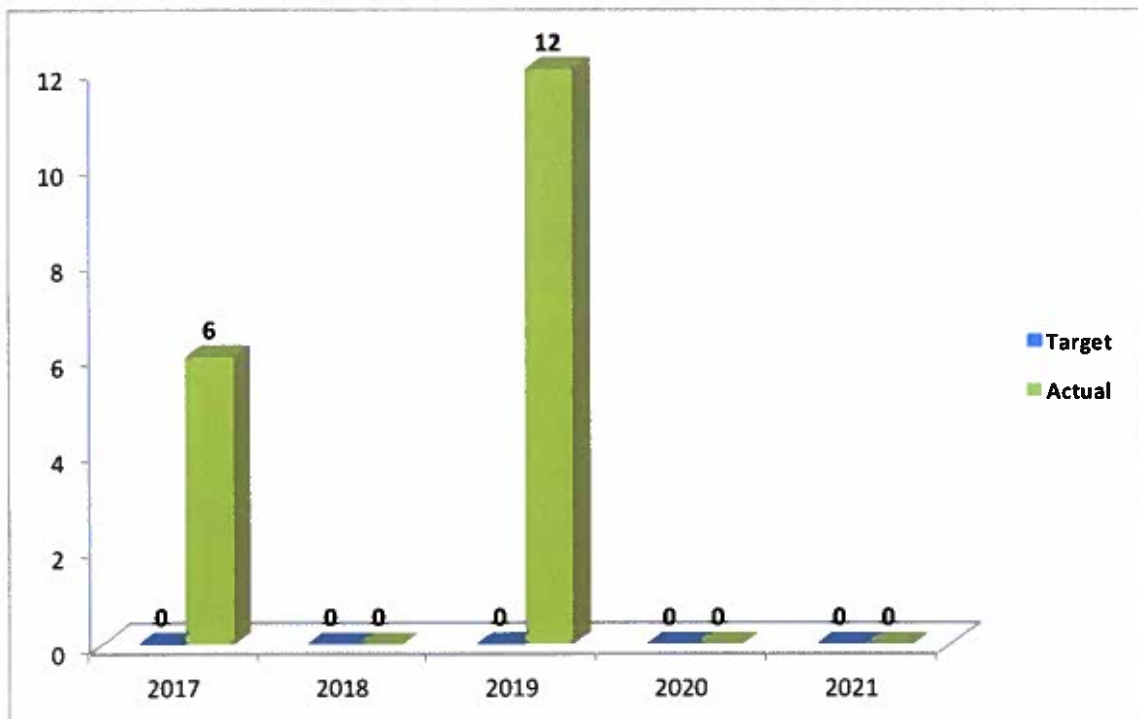
Medical Treatment Injury	Action Taken
<p>An employee was welding sources and by the end of the day realised left shoulder was sore. The Employee indicated that the twisting motion to rotate and position the source to inspect the weld was the motion that hurt.</p> <p>Medical Treatment/Modified duties</p>	<p>Reviewed prevention actions with employee. Discussed the importance of immediately stopping when any pain is felt.</p>
<p>Shipping and Receiving Employee was tightening chains on a trailer and felt a sharp pain in their lower back when pulling the ratchet.</p> <p>Lost time denied by WSIB, Medical treatment was approved.</p>	<p>Nordion contracted a Third Party to conduct an ergonomic assessment of role.</p>
<p>At the end of the day, while working at a Customer Site, the Employee climbed down the frontside of the scaffolding, missed one of the last few rungs and fell backwards. They indicated they either stumbled on the keel guides or just tripped and fell on the keel guides and lost their hard hat and hit their head.</p>	<p>Although hard hats were worn at the time of this incident, it fell off during fall. As a result, chin straps were purchased for all hard hats to be worn during installation work.</p>
<p>Employee was handling a heavier item on a table before moving it to a lift truck and then a cart. They indicated that after moving it from the table, they felt their back was a bit tight. It got progressively worse before the end of the day. This was not reported to management at the time.</p> <p>Lost time denied by WSIB, medical treatment was approved.</p>	<p>Nordion contracted a Third Party to conduct an ergonomic assessment of role.</p>

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**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 2021**

# Lost-Time Injuries <sup>1</sup>	0
Severity Rate <sup>2</sup>	0
Frequency Rate <sup>3</sup>	0

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. Particulates are sampled by use of cellulose filter papers and analyzed by gamma measurement.

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

**2.9.1.1 Airborne Effluent**

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

In 2021, there were air release of Co-60 material equal to 0.000017% of the DRL (see Table 9). No Action Levels were exceeded. There was no significant contribution to dose to public from air releases in 2021.

**Table 9**  
**Airborne Releases**

Year	Co-60 (GBq/yr)
2017	0.0034
2018	0.002
2019	0.00002
2020	0
2021	0.00004
Action Levels (GBq/week)	0.001

	Co-60
DRL (GBq/yr)	250
% DRL	0.000017

#### 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 10. Each release of liquid effluent in 2021 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 10.

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  $\pm 10\%$ .

Liquid releases are listed in Table 10 against both the DRL limits as well as the constraints Nordion places on every delay tank before it can be released from the building. In 2021, delay tanks were held on ■ occasions for sampling, analysis and verification against the constraints in Nordion procedure SE-OP-013 "Water Effluent Monitoring" before release was permitted.

In 2021, there were ■ releases from Cobalt delay tanks (versus ■ in 2020) and were measured against the four radionuclides on the table – only Co-60 was detected above the MDA, meaning that less than 10% 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 10, therefore releases and subsequent dose to public are significantly conservative overestimates.

If the critical receptor was the same group for all radionuclides potentially released by Nordion, the dose to public would be 0.00135 mSv. This value is a conservative over-estimate because the critical receptor has been used as the same receptor and because the DRLs are conservatively calculated.

**Table 10  
Liquid Releases (GBq/yr)**

Year	Litres	Co-60	Nb-95	Zr-95	Cs-137
2017	661376	0.022	0.001	0.002	0.0007
2018	713224	0.027	0.001	0.0017	0.0007
2019	576800	0.020	0.002	0.0019	0.0007
2020	747902	0.031	0.0015	0.0013	0.00076
2021	152762	0.0046	0.002	0.002	0.001
Nordion SE-OP-013 (19) Constraints on each delay tank release (pH or GBq/Release)					
pH	Co-60	Nb-95	Zr-95	Cs-137	
6-9.5	<0.015	<0.047	<0.047	<0.0024	

	Co-60	Nb-95	Zr-95	Cs-137
DRL (GBq/yr)	35.4	3,250	2,060	24.8
% DRL	0.13	7.23E-05	9.35E-05	4.08E-03

2.9.1.3 Environmental TLDs

The locations of environmental TLDs are shown in Appendix C and listed in Table 11. 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 2021 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 and between years is due to variations in natural background radiation at these different times and locations.

**Table 11  
Environmental TLDs**

		2016 (mSv)	2017 (mSv)	2018 (mSv)	2019 (mSv)	2020 (mSv)	2021 (mSv)
	██████████						
16	████████████████████	0.133	0.032	0.086	0.096	*	0.2
17	████████████████████	0.241	0.169	0.132	0.164	0.103	0.096
18	████████████████████	0.035	-0.052	-0.071	-0.086	-0.092	0.04
19	████████████████████	0.128	0.037	0.08	0.039	-0.044	0.074
20	████████████████████	0.078	0.061	0.079	0.093	0.081	0.065

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32	██████████	0.037	-0.041	0.031	-0.011	-0.04	-0.03
33	██████████	0.003	-0.057	0.036	-0.004	-0.083	-0.04
38	██████████	0.161	0.036	0.082	0.078	0.067	0.109
57	██████████	0.004	-0.047	0.003	-0.018	-0.061	-0.037
58	██████████	0.149	0.046	0.144	0.140	0.068	-0.048

\* Missing TLD

2.9.2 Significance of Air and Water Release Monitoring Results

As in previous years, air releases remain several orders of magnitude lower than liquid effluent releases.

Nordion's releases remain well below the allowed DRL and do not present a negative impact to people or the environment.

2.9.3 Exceeding Regulatory Limits or Action Levels

There were no instances of exceeding CNSC environmental regulatory limits or action levels in 2021.

2.9.4 Spills to the Environment

Aside from the unplanned releases reported in Section 1.2, there were no spills to the environment in 2021.

2.9.5 Environmental Protection Program Effectiveness

A review of the performance related to the Environmental Protection Program and the EMS is conducted on an annual basis. In 2021, this review was held during the Annual EHS Program Review on June 3<sup>rd</sup>, 2021.

See Section 2.1.3 for a summary of internal and external inspections, audits, and reviews.

2.9.6 Environmental Protection Program Activities

Activities which took place in 2021 included the following:

- Conducting a total of 10 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. Two non-conformances were identified and five opportunities for improvement were identified during this audit.

2.9.7 Environmental Protection Program Improvements

In 2021, Nordion made the following improvements to the Environmental Protection Program.

- Third party quality control assessment of liquid effluent and stack filters was conducted in 2021.

2.9.8 Environmental Protection Program Performance

A description of the Environmental Protection Program Initiatives is provided in Table 12, along with the results/outcomes.

A summary of initiatives and targets for 2022 is provided in Table 13.

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**Table 12  
2021 Environmental Objectives and Targets**

Objective	Target	Status
New - 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 2021.	Audit of a supplier whose goods and/or services can have a significant impact on the environment was completed.
New - Investigate energy reduction opportunities	Estimated savings of 7,500 kWh per year	Complete, an estimated 7,500 kWh energy savings annually as a result of lighting retrofits.
Continued from 2021 - Assess opportunities to reduce releases to water.	Investigate and implement (as feasible) opportunities to reduce releases to water from the Gamma Technologies area	This objective has been temporarily put on hold. This is a direct result of COVID-19 and resource constraints. The management and response to COVID-19 at the facility took priority in 2020 and 2021. As such, resources required to work on this project were not available.  The intent is to revisit this project again in 2022.
Continued from 2021 - 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	Investigation complete. As a result of this investigation, potential alternatives for replacement of hazardous chemicals were identified and quantities of hazardous chemicals were also reduced.
Continued from 2021 - Investigate energy reduction opportunities	Investigate implementation of "Behind the Meter" energy storage.	This objective has been temporarily put on hold to allow sufficient time to determine/assess current demand and assess future electrical load that may impact the economic viability of this project. There is also additional work underway to determine if there are other potential opportunities to include in this project plan e.g. solar options. The intent is to revisit this objective in 2023.

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Investigate potential options for reducing the volume of Cobalt waste by 2022	Complete investigation and implement viable options by the end of 2021	The investigation was completed. It was determined that opportunities were feasible with regards to optimizing total density of the waste in each can. As a result, actions were taken to increase weights in waste cans and, as such, reduce the number of total cans required. By the end of 2021, the average can weight was increased by approximately 3.2 lbs or approximately 12% since this objective as initiated.
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**Table 13**  
**2022 Environmental Objectives and Targets**

<u>Objective</u>	<u>Target</u>
New – 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 2021
New – 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

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 2021. Samples were placed in plastic bags, labeled with the site location, and then analyzed on the multi-channel analyzer for eight hours as per Nordion’s procedure. Background measurements (no sample, empty chamber) were also taken for reference but not subtracted from the measurements directly. The radioisotope primarily analyzed was Co-60. The MDA is determined for each sample individually and ranged between 1.1 – 1.9 Bq. When accounting for background Co-60 fields present in the facility, 18 of the 19 samples were determined to be less than the MDA. For the one sample that was above background, it was determined through further analysis that this was also attributed to background influence and not representative of the sample itself. As such, no radionuclides attributable to licensed activities were detected in the soil samples.

2.9.9.2 Groundwater Sampling

Figure C.3 (in Appendix C) shows current groundwater well locations.



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**2.9.9.2.1 Non-Radiological Sampling**

Non-radiological groundwater samples were taken on September 29<sup>th</sup>, 2021.

The results of this analysis demonstrated that there were higher than expected Total Suspended Solids in one borehole (BH). As a result, subsequent purging and sampling resulted in the Total Suspended Solids returning to a normal value. No other parameters were found to have any significant changes in the groundwater when 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 a year.

Samples are taken in June 2021 from the following boreholes (BH) to assess potential radiological contaminants:

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

Samples were placed in 1L Nalgene bottles and analyzed on the MDA for eight hours as per Nordion procedure. The radioisotope primarily analyzed was Co-60. The MDA was determined for each sample individually and ranged between 1.2 – 1.8 Bq. When accounting for background Co-60 fields present in the facility, all five samples were determined to be less than the MDA. As such, no radionuclides attributable to licensed activities were detected in the water samples.

**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 its scheduled activities for 2021, as well as drills that had been deferred in 2020 as a result of impact by COVID-19 and the need for physical distancing. Several of the exercises that were held were modified to limit risk to participants.

**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 2021, a number of Emergency Response (ER) exercises were conducted to test these emergency response plans and response personnel. In addition to these exercises, one false alarm acted as "real-world" exercises.

Activities which took place in 2021 included:

- A building evacuation of the Heating Plant on July 19<sup>th</sup>, 2021, as a result of improper ventilation around new equipment being installed in an area equipped with heat detectors.
- A hybrid desktop and Incident Command Post (ICP) activation exercise was conducted with Ottawa Fire Services participation on October 17<sup>th</sup>, 2021.
- Testing of the Fire Safety Plan in each of the RE Building and Heating Plant including alarm activation and full evacuation.

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- A tabletop exercise involving an emergency at a customer's industrial irradiator site.
- A tabletop exercise involving an off-site transportation emergency of a Nordion shipment of Type B packages.
- 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 2021.

#### 2.10.4 Emergency Preparedness Program Improvements

The response to the COVID-19 pandemic remained a significant focus in 2021.

Significant effort was required to maintain a safe facility and to reduce any impacts.

Continuous adaptation was required as the external situation and guidelines changed very frequently. These adaptations were active program improvements and Nordion was very successful in its continued efforts towards mitigating the pandemic's impact.

#### 2.10.5 Fire Protection Program Effectiveness

Fire exercises/evacuations were conducted in the Heating Plant, the RE Building and the KOB in 2021. 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 2021. An annual facility condition inspection was conducted by a third party in 2021.

#### 2.10.6 Fire Protection Program Activities

The Fire Protection Program Activities that took place in 2021 include:

- Testing of the fire safety plans. This test involved evacuation of the Heating Plant and RE buildings by activation of the building fire alarm system, and a test of the KOB fire safety plan and emergency response plan which included participation with Ottawa Fire Services.
- Conducting ten fire and environmental inspections
- Conducting an annual facility condition inspection

A fire protection program audit was conducted in 2019 and is conducted every three years as required by Canadian Standards Association (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 2021 included:

- Conducting a revised Code Compliance Review and Fire Hazard Assessment
- Updating the Fire Safety Plan
- Updating the Fire Protection Program

There were no changes to training, methods, instrumentation, or equipment in 2021.

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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 separate radioactive waste that is generated in Operations. Long term decay storage areas are located in the KOB active shipping/receiving facility. 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 2021 was 66.3% which is slightly higher than 2020 diversion rate of 63.9%.

2.11.2 Identification and Characterization of Waste Streams

Due to the nature of radioisotope production that involves decay and contamination products, identification of individual isotopes and their respective quantities in waste material is difficult. Nordion has worked with a radioactive waste management facility to identify waste streams that are determined by the major isotope product in a given facility. Data for the actual waste activity levels are estimated from activity in the production volume and waste streams.

2.11.3 Waste Shipments

Table 14 provides a summary of solid waste material shipped to [REDACTED]. In 2021, there were no shipments to [REDACTED] of radioactive liquid waste from Nordion's Class 1B Facility.

Table 15 provides a summary of solid waste, shipped to [REDACTED] in 2021. Solid waste sent to [REDACTED] is no longer compacted, as compacted wastes are unfavourable for this disposal route, and the waste volumes shown in Table 15 represent uncompacted waste volumes.

Spent Co-60 sealed sources may be returned to Nordion from customers where they may be reprocessed or included with other product material for disposal. In 2021, 186 low activity sources totalling [REDACTED] were disposed at [REDACTED] in routine waste shipments (included in the values shown in Table 14).

**Table 14**  
**Radioactive Solid Waste Shipments to [REDACTED] for 2021**

Isotope	Volume (m <sup>3</sup> )	Bq	Ci
Co-60	[REDACTED]	[REDACTED]	[REDACTED]

**Table 15**  
**Radioactive Solid and Low-level Liquid Waste Shipments to [REDACTED] for 2021**

Isotope	Weight (kg)	Volume (m <sup>3</sup> )	Bq	Ci
Co-60	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

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**2.11.4 Waste Management Program Performance**

- Nordion diverted an estimated 66.3% of waste from landfill in 2021,

The waste management program was audited in late 2021 (finalized in 2022) 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).

**2.11.5 Waste Management Program Improvements**

Improvements to the Waste Management Program in 2021 included the following:

- No sources shipped to [REDACTED] for disposal due to Nordion's increased recycling program.

[REDACTED]

**2.12 Nuclear Security**

Details of Nordion security and any security improvements of 2020 were provided in the Nordion Physical Security Report and Security Plan for 2021, submitted in February 2021. These safeguards and improvements are prescribed information and were reviewed and accepted by CNSC Security.

**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 2021, 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 were no findings.

Nordion was not selected for an International Atomic Energy Association (IAEA) Physical Inventory Verification (PIV) in 2021.

**2.13.3 Safeguards Program Improvements**

In 2021, Nordion initiated the process to exempt transport containers model number 3300 and 3750 that contained DU. As of December 31<sup>st</sup>, 2021, eight containers were granted exemption by the IAEA: one of model number 3300 and seven of model 3750.

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**2.14 Packaging and Transport of Nuclear Substances**

Nordion routinely ships 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 2021, Nordion shipped approximately [REDACTED] packages containing 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 2021, Nordion reported two non-conformances related to packaging and transport of nuclear substances. These reportable non-conformances were reported as "dangerous occurrences" pursuant to subsection 37(1) of the *Packaging and Transportation of Nuclear Substances Regulations*. These two events were reported separately but were later identified as the same incident with a common root cause (residual water/steam present after package loading). 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 to maintain transparency to the surrounding community and to the City of Ottawa. Nordion's website is the primary communications vehicle. In 2021, 9,859 unique users visited the Nordion.com website.

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.

Nordion hosted a virtual community event with the general public on April 7<sup>th</sup>, 2021. Approximate 18,000 invites were sent through Canada Post to the local community. In addition, email invitations were sent to local community leaders, community associations and indigenous group. No response was received from the Indigenous groups. A total of 24 people registered for the event and a total of 17 participated in the virtual meeting, which included an opportunity for the public to ask questions.

In 2021, Nordion also collaborated with Darlington on engagement with the Curve Lake First Nation.

In 2021, Nordion published the following information in their "Public Disclosure" web page:

- February: on-site familiarization visits for Ottawa Fire Services Personnel.
- July: two false fire alarm on the same evening, both times triggered by the same heat sensor. A fire truck was dispatched twice to Nordion's facility. This was a combination of weather related and poor positioning of a heat sensor.
- September: notice of an emergency response plan training exercise, including participation of Ottawa Fire Services.
- Q1, Q2, Q3, and Q4: 2021 Event reports posted.

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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. In 2021, there were no questions pertaining to Nordion's public information program received through the general contact form.

Nordion issues news releases to inform the public of company initiatives, achievements, and issues that the business may be facing. In 2021, 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.

On December 10<sup>th</sup>, 2021, Nordion published an ad in the *Community Voice*, a bi-weekly newspaper distributed to 85,000 homes and businesses across Ottawa and the surrounding areas. 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 2021.

**2.15.3 Public Information Program Improvements**

There were no significant changes to the Public Information Program in 2021.

**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 31<sup>st</sup> 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 2021, Nordion submitted written notification of changes to programs and documents to the CNSC as required.

In 2021, there were no exceedances of action levels.

Nordion submitted its Annual Compliance Report to the CNSC on March 31<sup>st</sup>, 2021.

In 2021, there were three events with regards to sealed source reporting:

- On two instances in 2021, Nordion inadvertently reported the incorrect sender information for the receipt of Co-60 sealed sources. The sender information was subsequently corrected when the inadvertent errors were noted.

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- In April 2021, Nordion received a shipment of Co-60 raw material from a foreign supplier in the form of irradiation capsules. The receipt of these capsules was not reported to the CNSC through SSTS. In response to this occurrence Nordion met with the CNSC to clarify SSTS reporting requirements for Co-60 raw material and continues to work with the CNSC in this area. Nordion also provided CNSC with the required information related to the receipt.

These events were not reportable to the CNSC. There were no trends identified in 2021 with regards to SSTS-related events.

Nordion continues to work on continuous improvements to sealed source reporting processes.

Nordion complied with all other site-specific reporting requirements. Throughout 2021, the Nordion decommissioning financial guarantee remained effective and compliant with CNSC requirements. Nordion submitted a 5-year update to its PDP as required in 2020. In December 2021, Nordion received the CNSC comments on the 2020 PDP submission. In early 2022, Nordion submitted a response to these comments as well as an updated revision to the 2020 submission to remove the decommissioning activities and costs for which BWXT Medical is responsible under their CNSC operating license (issued in November 2021). Nordion continues to work with the CNSC to have the updated PDP accepted.

### **3 FUTURE PLANS AND CONCLUDING REMARKS**

#### **3.1 Improvement Plans and Future Outlook**

In 2020, work was initiated for the installation of an additional cell (Cell 1) in Nordion's COF. This work is expected to be completed in 2022.

Nordion is planning to implement increased storage rack capacity within the Cobalt Operations Facility in 2021.

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

- License amendment due to the sale of Nordion's Medical Isotopes business to BWXT Medical, when BWXT Medical obtained an operating license from the CNSC.
- The installation of an additional cell (Cell 1) in Nordion's COF.

#### **3.2 Safety Performance Objectives for 2022**

Nordion's 2022 EHS Program Objectives and Targets and Health and Safety Objectives are shown in Table 16.

#### **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 16**  
**2022 EHS Program Objectives and Targets**

Objective	Measure/Target *
Timely Regulatory Action Closure	<ul style="list-style-type: none"> <li>• Ensure timely closure of regulatory actions (90% completed within 60 days)</li> </ul>
EHS Management System Effectiveness	<ul style="list-style-type: none"> <li>• Ensure documents under your ownership are maintained and reflect current practices</li> <li>• Overall percentage of overdue training ≤ 2%</li> </ul>
Minimize the number and extent of occupational injuries	<ul style="list-style-type: none"> <li>• The number of Medical Treatment Incidents ≤ 1</li> <li>• Lost time Incidents = 0</li> </ul>
Minimize the use and release of hazardous materials to the environment and ensure adherence to permissible levels	<ul style="list-style-type: none"> <li>• Radioactive materials emissions to ≤ 2.0% DRL (Ottawa)</li> <li>• Reportable releases of radioactive and non-radioactive hazardous materials to the environment (sanitary or storm sewer, air, groundwater, land) = 0</li> </ul>
Actively limit radiation doses to employees as per ALARA principle	<ul style="list-style-type: none"> <li>• Maximum employee dose rate &lt; 7.5 mSv/yr</li> </ul>
Maintain a healthy safety culture. *	<ul style="list-style-type: none"> <li>• Actively participate in the behavioural based safety culture program (Fullmark and other safety discussions and training)                             <ul style="list-style-type: none"> <li>○ Target: 90% participation rate</li> </ul> </li> <li>• Immediately report, and where possible, correct near-misses and hazard identifications                             <ul style="list-style-type: none"> <li>○ Target: Safety Improvement Rate – 110 (includes near miss reports, hazard identifications, etc).</li> <li>○ Target: 30 safety walkthroughs over the year</li> </ul> </li> <li>• Immediately report injuries and suspected ergonomic symptoms to your manager</li> </ul>

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



**APPENDIX A  
2021 Reportable Events**

Date of Occurrence	Incident No.	Description	Causes	Corrective Actions
March 17, 2021	21-04	Import of zircaloy without a licence	The supply team missed informing EHS to apply for zircaloy license on sample zircaloy tubes prior to its arrival at Nordion site.	The supply team will revise their process and engaged EHS on future bulk purchases.
April 8, 2021	21-05	Late filing of annual report for a zircaloy import	An annual report for a zircaloy import was inadvertently missed during submission of multiple import reports.	Review of zircaloy licenses will be added to the monthly EHS review of licensing, SSTS and safeguards.
July 19, 2021	21-10	False fire alarms due to overheated compressors	The high heat sensor was activated due to heat build-up from the compressor and outside temperature. One of the compressors was cycling more than expected causing the room to heat up. Air exchange duct in the Heating Plant was not complete therefore hampering fresh air exchange.	The heat detector was moved out of the direct line of exhaust. Facility worked with project Alpha leaders to plan the new equipment and the timing of the new duct.
July 13, 2021	21-11	[REDACTED] device had a stuck sample chamber	The sample chamber failed to travel to the fully up position because of a minor deformation of the corner of the removable aluminum chamber door.	It was recommended to the users of the device to routinely inspect the chamber door for signs of damage.
April 22, 2021	21-18	Late notification on imported sources	Failed to report the receipt of C-451 capsules containing raw material from [REDACTED] into SSTS.	Nordion initiated discussions with CNSC in 2021 to clarify reporting requirements of raw materials from foreign and domestic suppliers. Discussions to continue into 2022.

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Date of Occurrence	Incident No.	Description	Causes	Corrective Actions
October 22, 2021	21-21	Halocarbon release of refrigerant from Nordion site chiller.	When the contractor pulled the charge for the unit to complete a repair (the repair was not refrigerant related), he identified that on one circuit it was missing 20 lbs (9.1 kg) of halocarbon and the other was missing 19 lbs (8.6 kg) of halocarbon, when compared against the nameplate quantities (what was expected to be present). The unit may have been undercharged from the manufacturer since 2002. The refrigerant loss was undetected since the unit continued to perform as expected.	Continue with semi-annual leak tests to ensure unit is not leaking and submitted semi-annual report to Environment Canada in January 2022.
December 4, 2021	21-22 and 21-23	Nordion received a F-231 with Co-60 from a supplier. When the package was opened, a large amount of steam emitted from the package. There was also higher than expected contamination on the exterior of the package.	The jack bolt on the F-231 package used during preparation for shipment to remove any water was trapped between the package plug and cavity did not fully engage.	Revised tooling and procedures in support of the jack bolt process were implemented.

Appendix B
Non-Production Sealed and Unsealed Source Inventory

Table with 6 columns: Unique ID, Serial #, Isotope, Activity, Unit, Activity Reference Date (M/D/Y). The table contains multiple rows of data, many of which are redacted with black boxes.





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**Nordion Depleted Uranium Transport Containers**

SN	Activity (GBq)	SN	Activity (GBq)
[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]

**APPENDIX C**

**Nordion Environmental TLD and Groundwater Sampling Well Locations**

**Figure C.1**

**Location of "Off-Site" TLDs**

**Figure C.2**  
**Location of "On-Site" TLDs**



**Figure C.3  
Groundwater Well Locations**

**Figure C.4  
KOB Area Soil Sampling Locations**

**Figure C.5**  
**Nordion Site Perimeter Soil Sampling Locations**