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DNSR Newsletter

Shipping documents and their importance in assisting first responders by Mathieu Prévost

Mathieu Prévost has been a firefighter / HazMat technician since 2004. He is currently serving with the Ottawa Fire Services (Canada) hazardous material response team as their instrumentation coordinator. Mr. Prévost has been involved with the federal CBRNE First Responder Training Program (FRTP) and has been teaching hazardous material response since 2011. Help keep him and other first responders safe by properly completing your shipping documents.

Responding to an incident involving radioactive material can be quite challenging for first responders. Quite frankly, the trefoil tends to worry most emergency personnel. Fortunately, such an event is a rare occurrence, and strict regulation makes the transportation of radioactive material a safe process. The shipping document, a requirement for the transportation of dangerous goods, is one of the tools first responders can use during an incident.

Shipping documents must accompany all packages containing a radioactive material transported as per the *Transportation of Dangerous Goods Regulations* (TDGR) and the *Packaging and Transport of Nuclear Substances Regulations, 2015* (PTNSR). The purpose of the shipping documents is to communicate the potential hazards to first responders – for example, firefighters, police officers and paramedics – who respond to incidents involving dangerous goods. The first responders will be able to identify the isotope, request resources and use the United Nations (UN) number or the name along with the

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Emergency Response Guidebook to plan the initial response. In addition, these documents will provide valuable information that more specialized responders, like hazardous materials technicians, can use to better assess an emergency situation. For instance, the transport index and the form of the material will help them determine if there is an actual release.

Information that needs to be included on shipping documents includes:

- 24-hour phone number
- UN number
- ERAP (emergency response assistance plan) number if required
- proper shipping name
- class of dangerous goods
- radionuclides
- form of material
- activity
- category of package
- transport index
- number of packages in transport

Note: To ensure shipping documents are in compliance with the regulations, please refer to subsection 29(1) of the PTNSR and Part 3 of the TDGR.

This information is necessary for emergency personnel to initiate the proper protective actions if a transportation incident arises. Proper shipping documents will also help first responders quickly identify the material in the package should the vehicle carrying the package not be placarded.

It is also important to ensure that the shipping document is at the prescribed location during transport, as first responders are trained to look in these specific locations. Failure to ensure that the shipping document is in its proper place could delay the response and possibly have negative effects on the victims, the environment and/or the responders themselves.

CNSC expectations for EDO practical examinations

The CNSC has recently become aware that there is some confusion regarding the pass and fail criteria for the exposure device operator (EDO) practical examination. The EDO practical examination provided in appendix A of the CSA document PCP-09, Certified Exposure Device Operator Personnel Certification Guide, states the following at the top of page one:

> ALL sections or subsections identified by a (*) are MANDATORY requirements of the practical examination.

The CNSC considers any section or subsection (or step or sub-step) of the PCP-09 practical examination marked with an asterisk (*) to be mandatory. This means that in order to pass the EDO practical examination, a candidate must successfully complete all sections and subsections identified with an asterisk in appendix A of PCP-09.

The sections and subsections that are marked with an asterisk are mandatory because they are directly related to requirements specified in the *Nuclear Substances and Radiation Devices Regulations* or are directly relevant to the safe operation of an exposure device. The CNSC considers a candidate who fails one of these sections or subsections to have failed the practical examination, since the candidate has not demonstrated the required knowledge, skills and abilities to operate an exposure device in a safe and secure manner.

Please feel free to send a message to the CNSC EDO email account (cnsc.edo-oae.ccsn@canada.ca) if you have any questions about this information or about the EDO certification processes.

Biodosimetry can be used to confirm and measure individual radiation exposures

The following article provides a general overview of biodosimetry and biological mechanisms. Further information can be found in [1] and [2].

Canadian Nuclear Safety Commission (CNSC) licensees use many dosimetry methods to measure radiation exposure to workers. However, traditional dosimetry may not be adequate in some cases, such as when:

- workers are not wearing dosimeters when an exposure occurs
- workers are exposed to radiation doses from sources that are not measureable with the dosimetry methods available to the licensee
- there are questions about the validity of the dosimetry results

In these cases, biodosimetry may be performed to confirm or measure the radiation dose to a worker.

What is biodosimetry?

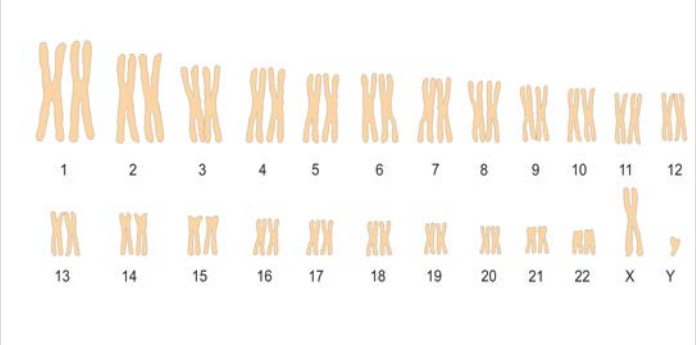
Biodosimetry is the use of biological markers to measure radiation exposure. It is similar to having a standard blood test where the sample is taken in a blood clinic and the analysis is performed at an external laboratory. The CNSC has a memorandum of understanding with Health Canada that enables the CNSC to recommend that biodosimetry tests be conducted by the Consumer and Clinical Radiation Protection Bureau (CCRPB).

The CCRPB can perform two types of biodosimetry that can measure radiation exposure to an individual by counting the number of chromosomal aberrations in white blood cells. The two tests are:

- dicentric chromosome assay (DCA)
- fluorescent *in situ* hybridization (FISH) test to measure stable chromosome translocations

Chromosomes

A chromosome is a package of genetic material (DNA). Human cells have 46 chromosomes (23 pairs). These chromosomes are generally X-shaped, although biological males have one Y-shaped chromosome.



Centromeres

The point where the two arms of a chromosome come together is called a centromere. Normal chromosomes have one centromere and appear as an X (although some can look more like a V when the centromere is near the end).

Dicentric chromosome assay

The dicentric chromosome assay (DCA) measures the presence of damaged chromosomes in white blood cells. Undamaged chromosomes in white blood cells have a

[1] IAEA. Cytogenetic Dosimetry: Applications in Preparedness for and Response to Radiation Emergencies. EPR-Biodose 2011. (Vienna: IAEA) (2011).

[2] Beaton-Green, L. A., Barr, T., Ainsbury, E. A., Wilkins, R. C., Retrospective Biodosimetry of an Occupational Overexposure Case-Study. Radiat Prot Dosimetry 172 (1-3), 254-259 (2016).

single constriction point (centromere). Following significant radiation exposure, double strand breaks of the individual cell DNA are occasionally "repaired" incorrectly to form a chromosome with two centromeres from two different chromosomes. Dicentric chromosomes also occur naturally, and the background rate of dicentric chromosomes in human populations is well established.

The validity of this technique is dependent on the level of dose received and the time since the exposure. It is most valid when the blood sample is drawn within three months of the suspected irradiation. The test becomes less accurate as time passes after the exposure. The minimum detectable dose is approximately 100 mSv. The DCA is the most commonly used biodosimetry test because the presence of dicentric chromosomes is specifically linked to radiation exposures.

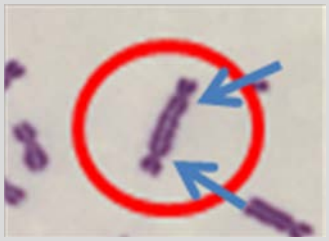
FISH test to measure stable chromosome translocations

The FISH test for stable chromosome translocations also measures the presence of damaged chromosomes in white blood cells. Chromosome translocations occur when double-strand DNA breaks are repaired incorrectly. In this case, the resulting chromosome has only one centromere but consists of parts of two different chromosomes. Stable chromosome translocations occur naturally and build up over time. The background rate of stable translocations is less well established than the background rate of dicentric chromosomes.

Since translocations are stable in time, the test can be used for up to 30 years after the suspected radiation exposure. This test is rarely used because it is very costly and the presence of translocations is not specific to radiation exposure (many factors other than radiation can influence the number of chromosomes with translocations such as age and other environmental toxins). However, in conjunction with the DCA and with convincing information regarding potential radiation exposures, it can be used to measure radiation exposures a long time after the suspected exposure. The minimum detectable dose is approximately 100 to 200 mSv.

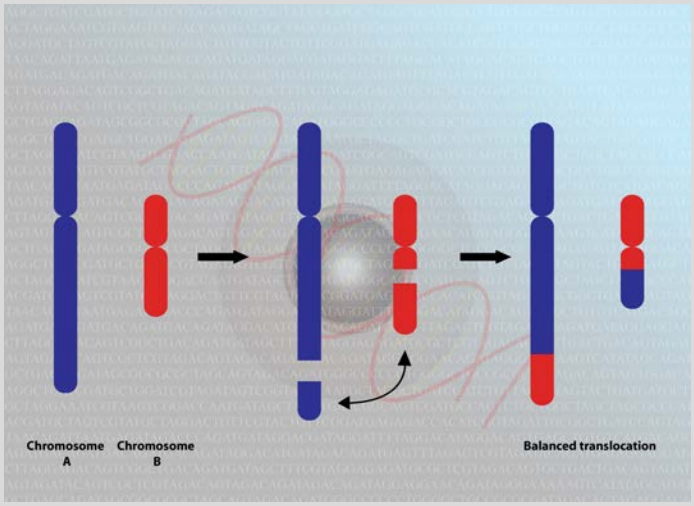
Dicentric chromosome

A dicentric chromosome has two centromeres, and the presence of many dicentric chromosomes in a blood sample can indicate radiation damage.



Chromosome translocations

Parts of chromosomes may be separated and then recombined with other chromosomes. This is called a chromosomal translocation.



When can biodosimetry be used to measure radiation doses?

The CNSC may recommend biodosimetry through the CCRPB in the following situations when a dose above 100 mSv is suspected:

- radiation dose monitoring in the event of an unplanned nuclear or radiological event
- verification of suspected occupational exposures (for example, industrial radiography exposures from failure to wear / inappropriate handling of a dosimeter)
- measuring radiation doses to workers who were not assessed using occupational dosimetry

A practising medical physician must request the biodosimetry by completing a special form. This is to ensure that the appropriate medical history (i.e., all medical procedures that would involve the receipt of radiation doses) is included in the dose assessment, and to ensure that physicians participate in the interpretation of the test results and can consider any additional follow-up required.

Summary

In situations where normal dosimetry is insufficient or when the results are suspect, it may be possible to measure the radiation dose after a suspected exposure using biodosimetry techniques. These tests may be made available through the CNSC and CCRPB in cases where they are warranted. In the event of a suspected exposure or an incident that might involve significant radiation exposures, please communicate with your licensing specialist, who may initiate this testing.

New security requirements for licensees with Category 3, 4 and 5 sealed sources

The CNSC published REGDOC-2.12.3, *Security of Nuclear Substances: Sealed Sources*, in May 2013 to set out the minimum security measures required to prevent the loss, sabotage, illegal use, illegal possession or illegal removal of sealed sources while the sources are in use or storage, and during transportation. This document includes requirements for both technical and administrative physical security and provides guidance on how to meet the outlined requirements.

This regulatory document is specific to radioactive sealed sources. The requirements in REGDOC-2.12.3 apply to Category 1, 2 and 3 sources and provide recommended practices for Category 4 and 5 sources (i.e., prudent management practice) to ensure that sealed sources are secured to prevent illegal use, theft or sabotage, and that a periodic inventory is carried out to ensure sealed sources are at their designated location and are secure.

REGDOC-2.12.3 came into effect for licensees with Category 1 and/or 2 radioactive sources in May 2015, and came into effect for licensees with Category 3, 4 and 5 radioactive sources in May 2018. This change resulted in large changes for licensees in possession of Category 3 sources, whose licences now require them to comply with the majority of the requirements laid out in REGDOC-2.12.3. For example, licensees in possession of Category 3 sources are required to protect their sealed sources with at least two physical barriers, maintain and test their security system at least once every six months, and conduct and refresh criminal record name checks for all staff on a five-

Update – Research project on tracking technologies used for Category 2 and Category 3 sources – industrial radiography and well-logging industry

CNSC staff in the Nuclear Security Division would like to thank everyone, particularly licensees, who contributed to the research project on tracking technologies used for Category 2 and 3 sources in industrial radiography and well-logging. The results of this project have been accepted for publication by *The Journal of Physical Security*. The article can be found in Volume 11, Issue 1 on pages 36–65. An abstract of the article can also be found on the CNSC website. If you have any questions regarding the article, please contact Courtney Hynes at 613-995-1954 or courtney.hynes@canada.ca.

year basis. As per section 3.3.1 of REGDOC-2.12.3, all licensees in possession of a Category 1, 2 or 3 sealed source must also have a valid site security plan that has been reviewed and accepted by the CNSC. When licensees possess multiple sealed sources in one location, the sum or aggregate of the source activity must be considered when determining what measures to implement. This requirement also applies for licensees with aggregate quantities of Category 4 sources that fall into Category 3. The Categorization and Aggregation Tool was developed by the CNSC to assist licensees in determining the correct risk categorization for the aggregate activity of their sealed sources. Licensees can obtain this tool by contacting cnsc.categorization.ccsn@canada.ca.

REGDOC-2.12.3, *Security of Nuclear Substances: Sealed Sources and Category I, II and III Nuclear Material*, Version 2, is currently in development. Once published, it will supersede the 2013 Edition of REGDOC-2.12.3, *Security of Nuclear Substances: Sealed Sources*. This document has two parts and combines the original version of REGDOC-2.12.3 and revised content from CNSC guidance documents G-208, *Transportation Security Plans for Category I, II or III Nuclear Material*, and G-274, *Security Programs for Category I or II Nuclear Material or Certain Nuclear Facilities*. Part A of the updated document consists of the text from REGDOC-2.12.3, Version 1 and continues to set out the minimum security measures that licensees must implement to prevent the loss, sabotage, illegal use, illegal possession or illegal removal of sealed sources during their entire lifecycle, including while the sources are in storage, transport or being stored during transportation. Part B will contain the revised content from CNSC guidance documents G-208 and G-274 and will set out guidance on the submission of security information and transportation security plans for Category I, II and III nuclear material. These documents have been merged into REGDOC-2.12.3, Version 2 as part of the CNSC's commitment to create a regulatory document framework that combines all of its existing documents clearly and logically, according to regulated facilities and activities, safety and control areas, and other areas of regulatory interest.

If you have any questions, please do not hesitate to contact LeeZa Duval at 613-996-8535 or leeza.duval@canada.ca.

Things you need to know when a portal monitor alarm is triggered

On June 30, 2015, the CNSC published the *Packaging and Transport of Nuclear Substances Regulations, 2015* (PTNSR 2015), at which point they came into force. The new set of regulations clarified existing requirements and aligned with revised international regulations to ensure the continued safe and efficient transport of nuclear substances. In addition, they introduced a new exception that allows for the transport of nuclear substances that have triggered a radiation monitor alarm for the purpose of conducting a proper characterization when these substances have not been classified as radioactive material prior to the transport.

The exception may be used if certain conditions are met, as per 2(2)(o) of the PTNSR 2015. The exception is associated with characterization as well as notification and reporting requirements to the CNSC, to ensure that the nuclear substances have been safely disposed of in accordance with the applicable regulations.

The person who performs the characterization must file a report summarizing the radiation detections with the CNSC on an annual basis. The report should include:

- the circumstances surrounding the detection (date, location of detection, information on consignor, carrier, consignee)
- the alarm level and background radiation level
- the measured dose rate at the external surface of the vehicle
- the isotope and activity

- the method of disposal of the substance
- confirmation that it was not of a licensable quantity and that there was no loss or dispersal of the substance

This report must be submitted by April 30 for the radiation detections found during the previous calendar year. The report can be emailed to cnsc.transport.ccsn@canada.ca. Situations reported to the CNSC at the time of detection do not need to be included in the annual report since they have already been reported.

If the dose rate from the surface of the vehicle is greater than 5 μSv/hr or if the nuclear substance is found to be of licensable quantity per the CNSC's *Nuclear Substances and Radiation Devices Regulations*, then the situation needs to be immediately reported to the CNSC duty officer at 1-844-879-0805.

If it has been determined that the nuclear substance in question is exempted from regulations, characterization results may still be reported to the CNSC even though there is no obligation to do so.

Resources are available to help with characterization efforts. The Canadian Radiation Protection Association website has a business directory of radiation safety experts. These experts may be able to dispose of the material on a fee-for-service basis. If the alarm was triggered by radium dials or other such historic artefacts, the Historic Waste Program Management Office at Canadian Nuclear Laboratories may dispose of the material for free. As the CNSC is responsible for oversight of the nuclear industry in Canada, our staff has the expertise to provide guidance throughout the process. In fact, the CNSC has published a brochure and a poster to assist waste management and scrap metal facility workers in responding appropriately to radiation portal monitor alarms.

The Operations Inspection Division has recently changed its inspections survey. The Type I and Type II Inspections – Licensee Feedback Survey will be used to gather comments and feedback from all licensees regarding the planning and execution of Type I and Type II inspections.

The survey will now feature fewer questions and cover both inspection types, and will be completely anonymous. The results will be used to help CNSC staff improve the inspections process. If you have time, please consider filling out the survey here.

Did you know the new 2018 *Working Safely with Portable Gauges* booklet is now up on the CNSC website along with a short safety video? Both resources can be found here.

Update on CNSC's regulatory framework

The following information is provided to inform nuclear substances and radiation devices licensees, as well as Class II licensees, of the latest activities related to the CNSC's efforts to modernize its regulatory framework. The projects listed below either contain requirements or provide useful guidance and information.

Recently published:

- REGDOC-2.5.5, *Design of Industrial Radiography Installations* (March 2018) – **guidance**

This regulatory document provides guidance for the design of industrial radiography installations. This information will assist in the design and construction of installations that are safe to use, and that help to ensure that doses to certified exposure device operators and all persons in the vicinity of the work being performed are within regulatory limits and kept as low as reasonably achievable (ALARA).

- REGDOC-2.1.2, *Safety Culture* (April 2018) – **guidance**

This regulatory document sets out requirements and guidance for Class I licensees and uranium mines and mills. This document provides more specific guidance related to safety culture, elaborating on the management system requirements contained in CSA Group standard CSA N286, *Management system requirements for nuclear facilities*.

- REGDOC-2.7.3, *Radiation Protection Guidelines for Safe Handling of Decedents* (June 2018) – **guidance**

This regulatory document provides guidance to death-care professionals and the public on handling decedents who have undergone therapeutic procedures involving nuclear substances to ensure that radiation exposure is kept below the limits that have been set to protect the public.

- REGDOC-3.5.3, *Regulatory Fundamentals* (August 2018) – **information**

This regulatory document outlines the CNSC's regulatory philosophy and approach to applying the *Nuclear Safety and Control Act*.

Soon to be published:

- REGDOC-1.4.1, *Licence Application Guide: Class II Nuclear Facilities and Prescribed Equipment* – **guidance**

This regulatory document provides information to applicants on preparing and submitting applications for a licence to carry out activities related to Class II nuclear facilities and prescribed equipment. This guide will help applicants prepare the information the CNSC uses to determine if they are qualified, have made adequate provision for the protection of the environment and health and safety of persons, and otherwise meet the requirements of the provisions of the NSCA and its regulations.

- REGDOC-2.1.1, *Management Systems* – **guidance**

This regulatory document consolidates CNSC expectations for the "management system" safety and control area (SCA), as well as applicable references in the legislation. This regulatory document contains supplemental information on CNSC expectations for meeting requirements in CSA N286-12, *Management system requirements for nuclear facilities*. REGDOC-2.1.1 will also be used as supplemental information on various and emerging issues in the management system area.

- REGDOC-2.7.2, *Dosimetry, Volume II: Technical and Management System Requirements for Dosimetry Services* – **requirements and guidance**

This regulatory document sets out requirements and guidance to ensure that licensed dosimetry services meet technical requirements and implement quality assurance measures, in accordance with the purpose of the *Nuclear Safety and Control Act* (NSCA) and the *Radiation Protection Regulations*.

- REGDOC-2.12.3, *Security of Nuclear Substances: Sealed Sources and Category I, II, and III Nuclear Material,* Version 2 – **guidance**

In addition to providing guidance on the implementation of security measures for Category 1 to 5 sealed sources, this regulatory document also sets out guidance to help applicants for a CNSC licence in respect of Category I or II nuclear material or a nuclear facility consisting of a nuclear reactor that may exceed 10 MW thermal power during normal operation, to prepare and submit the security information to be included with the application, pursuant to the *Nuclear Safety and Control Act*. This document also sets out guidance to help applicants for a CNSC licence to transport Category I, II or III nuclear material to prepare and submit a "written transportation security plan" that meets the requirements of section 5 of the *Nuclear Security Regulations*. Category I, II and III nuclear material are defined in appendix E of this guide.

- REGDOC-3.1.3*, Reporting Requirements for Class II Nuclear Facilities and Users of Prescribed Equipment, Nuclear Substance and Radiation Devices* – **requirements and guidance**

This regulatory document consolidates and clarifies requirements found in the NSCA and regulations made under the NSCA. It provides guidance for reports and notifications that licensees must submit to the Commission. It also provides details on the events, situations and dangerous occurrences that licensees of Class II nuclear facilities, and users of prescribed equipment, nuclear substances and radiation devices, must submit to the CNSC. The document presents the types of reports and the applicable time frame for reporting.

- REGDOC-3.5.2, *Compliance and Enforcement, Volume II: Orders Under the Nuclear Safety and Control Act* (2019) - **information**

This regulatory document describes the processes surrounding making, reviewing, receiving, appealing and redetermining orders under the NSCA.

Soon to consult:

- *Radiation Protection Regulations* – **proposed requirements**

The CNSC is proposing several amendments to harmonize the *Radiation Protection Regulations* (RPR) with updated recommendations by the International Commission on Radiological Protection and the International Atomic Energy Agency, to clarify requirements and to reflect lessons learned through regulatory operational experience since the Regulations first came into force in 2000. The proposed amendments are outlined in the What We Heard Report for discussion paper DIS-13-01, *Proposals to Amend the Radiation Protection Regulations.*

- REGDOC-1.6.2, *Developing and Implementing an Effective Radiation Protection Program for Users of Nuclear Substances and Radiation Devices* – **proposed guidance**

This regulatory document provides guidance to licence applicants for nuclear substances and radiation devices on the best practices for the development, implementation, management and assessment of their radiation protection programs. This document will supersede G-121, *Radiation Safety in Educational, Medical and Research Institutions*.

- REGDOC-2.5.6, *Design of Nuclear Substance Laboratories and Nuclear Medicine Rooms* – **proposed information**

This regulatory document provides information for a recommended approach for meeting the requirements related to site description and room design in accordance with the *Nuclear Substances and Radiation Devices Regulations*. This document also provides information on performing shielding design analyses as a component of keeping doses ALARA, as described in the *Radiation Protection Regulations*.

- REGDOC-2.7.1, *Radiation Protection* **– proposed requirements and guidance**

This regulatory document sets out requirements and guidance for the application of the *Radiation Protection Regulations*.

- REGDOC-2.7.2, *Dosimetry, Volume I: Ascertaining Occupational Dose* **– proposed requirements and guidance**

This regulatory document sets out requirements and guidance for ascertaining doses.

- REGDOC 2.8.1, *Conventional Health and Safety* **– proposed information and guidance**

This regulatory document provides information concerning conventional health and safety (CHS) legislative

requirements for applicants and licensees and guidance for implementing and maintaining a CHS program.

- REGDOC 3.3.1, *Financial Guarantees* – **proposed requirements and guidance**

This regulatory document sets out requirements and guidance for applicants and licensees regarding the establishment and termination of activities licensed by the CNSC.

For more information on regulatory documents, please consult the regulatory documents index on our website.

In keeping with the CNSC's commitment to stakeholder engagement, comments and suggestions on any regulatory document may be submitted at any time to the CNSC through our consultation account (cnsc.consultation.ccsn@canada.ca). As part of ongoing efforts to enhance and clarify the CNSC's regulatory framework, the CNSC will use these comments to inform future reviews of its regulatory tools. Comments received outside the formal consultation period will not be publicly dispositioned.

Canadian Nuclear Safety Commission Cost Recovery Fees Regulations

The CNSC is opening the cost recovery regulations for amendments. A discussion paper will be published in the coming months detailing proposed changes to the regulations. At that time, you will be invited to comment on the discussion paper.

CNSC Regulatory Actions

To protect the health and safety of workers, the public and the environment, the CNSC issues regulatory actions to non-compliant licensees. The following enforcement actions were issued between March 1 and August 31, 2018: eight orders and three administrative monetary penalties (AMPs).

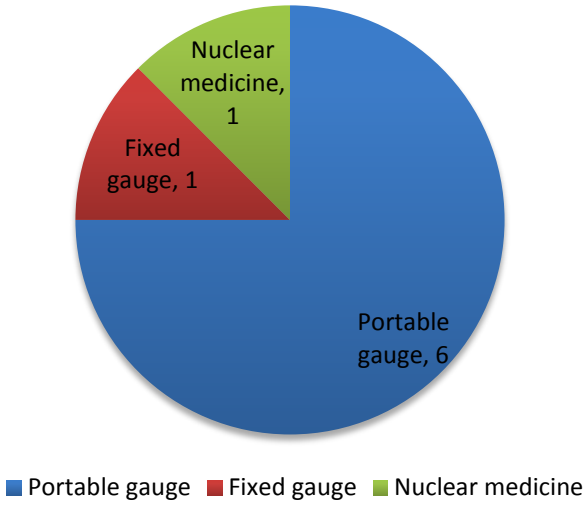
The eight orders issued were primarily for inadequate oversight of radiation protection programs, management of prescribed records and radiation instrumentation, worker training and transport of portable gauges. The breakdown of the orders issued is as follows:

- seven orders issued to industrial-sector licensees
- one order issued to a medical-sector licensee

Three AMPs were issued to DNSR licensees between March 1 and August 31, 2018; the breakdown is as follows:

- One AMP was issued to ARLANXEO Canada Inc., a fixed nuclear gauge licensee, as a result of the licensee's failure to comply with licence conditions for vessel and hopper entry.
- One AMP was issued to 20/20 NDT Technology Inc., an industrial radiography licensee, as a result of the licensee's failure to immediately report an event regarding a stuck sealed source.
- One AMP was issued to Quantum Petrophysics Inc., a well-logging licensee, as a result of the licensee's failure to meet the requirement for safe transport of a sealed source requiring a Type A package design.

Orders issued to DNSR licensees, March 1–August 31, 2018



Industrial sector – portable gauge
Qualitest Canada
Soil-Mat Engineers & Consultants Ltd.
Kamit Group Ltd.
Stantec Consulting Ltd.
Peterson Contracting Ltd.
Parkland Geotechnical Consulting Ltd.

Industrial sector – fixed gauge
ARLANXEO Canada Inc.

Medical sector – nuclear medicine
Waterloo Nuclear and Radiography Inc.

AMPs issued March 1, 2018–August 31, 2018

Industrial sector – fixed gauge
ARLANXEO Canada Inc.

Industrial sector – industrial radiography
20/20 ND Technology Inc.

Industrial sector – well logging
Quantum Petrophysics Inc.

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The *DNSR Newsletter* is a CNSC publication. If you have any suggestions on topics or issues that you would like to see covered, please do not hesitate to contact us.

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