Special Inventory Control Edition

DNSR Newsletter

Canada's Nuclear Regulator

The Importance of Maintaining Control of Sealed Sources

The Canadian Nuclear Safety Commission (CNSC) has recently received a number of reports from licensees that reveal the loss of control of sealed sources. Sealed sources are radioactive substances encased in a sealed capsule or in a cover to which the substance is bonded, and are used for a variety of activities such as medical, industrial, academic and research, as well as commercial applications. Although these reports involved disused sealed sources (stored sources that are no longer being used and that present a low safety risk), they highlight the importance of inventory control for all radioactive sealed sources.

This special newsletter edition outlines key factors that contributed to these loss of control events, as well as suggested measures licensees should take to prevent them from happening again in the future.

Recent examples of how licensees lost control of sources

A recent example includes an event at a major hospital, resulting in the loss of 25 sealed sources containing small amounts of radioactive substances. Despite efforts by the hospital, most of these sources have not been recovered or otherwise located. Another example was the discovery of two disused brachytherapy sources in the machine shop of a major cancer treatment center.

These events shared many similarities:

- They involved the loss of historic, disused sources.
- In both cases, several cascading failures took place:
  - Normally adequate access control measures (such as locked doors and cabinets) failed to prevent the unauthorized removal of sources from their respective storage locations.
  - Licensee staff did not have adequate understanding of what was contained in the source storage rooms, nor were they aware that they were not permitted to remove materials from these rooms.
  - The losses were not detected until several months after the sources were removed from their storage locations, and were only discovered incidentally as a result of other activities.
  - Regular physical inventory checks were either not performed properly, or with insufficient frequency to detect the losses in a timely manner.

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Canada

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In each of these recent cases, the licensee was required by the CNSC to take extensive corrective actions to prevent such events from reoccurring. These actions included:

- conducting a physical inventory verification of all sealed sources
- contacting all persons involved, to determine if they have any information about the event
- submitting written procedures for access control to source storage areas, including provisions requiring authorization from the radiation safety officer (RSO) for access to those areas
- conducting a physical search of the entire site, to ensure that all nuclear substances were properly stored and accounted for
- identifying any nuclear substances that are no longer required, and ensuring that these were stored and/or disposed of appropriately
- retraining all staff, to ensure that everyone has a level of awareness and knowledge of CNSC regulatory requirements commensurate with their duties at the facility

Each licensee was required to report to the CNSC on these corrective actions. These events were also reported to the Commission during the August 21, 2014 public meeting. Both licensees appeared before the Commission to address these events and respond to questions posed by Commission members.

Commission proceedings available online

All Commission meetings are webcast live, and archived webcasts are available online for a limited time.

Complete transcripts of meeting proceedings are also available online.

Effectively managing sealed-source inventories

These and other recent events involving the loss of disused sealed radioactive sources at CNSC-licensed locations have highlighted the importance of effective inventory control. Despite the fact that the actual radiological consequences of these events were minimal, they indicated serious lapses in sealed-source access control and security; either one could have had potentially more serious consequences.

Reporting requirements

CNSC regulations require all licensees to immediately report lost or stolen nuclear substances to the CNSC. In their final report, licensees are required to provide detailed information such as a description of the situation and circumstances, as well as the probable cause and actions taken by the licensee. The licensee must investigate all events involving lost or stolen sealed sources and the CNSC will follow up to ensure that the licensees have taken all necessary actions to mitigate the impacts of the event and to prevent a recurrence of the situation.

Disposal of disused sources, maintenance of an up-to-date inventory, regular inventory verification checks, awareness training for all staff, and periodic review of physical security measures are all key elements of an effective radiation safety program that will help prevent the loss of control of sealed sources. All persons who provide oversight for radioactive sealed sources at various sites and institutions should review the information provided in this article and establish a plan of action, specific to their licensed activities, to effectively manage their sealed-source inventories.

If you would like more information, please contact your CNSC Licensing Specialist or Licensing Project Officer.

How to Prevent Loss of Control

Licensees are accountable for any radioactive sealed source in their possession. Older, historic sources that are no longer used tend to get tucked away in storage rooms or other locations and forgotten. The higher the number of these sources a licensee has in storage, the more likely it is that something will go missing, get dropped off an inventory, or end up somewhere it should not be. The CNSC recommends that all licensees review and amend their operational processes to prevent loss of control of sealed sources, paying particular attention to elements such as disposal of disused sources, physical control measures, personnel training, as well as inventory control and verification.

Disposal of disused sources
To minimize the probability of loss of control, licensees are strongly encouraged to dispose of sources they no longer need in a timely way. When sources have decayed to less than one (1) exemption quantity of activity, they can be defaced and discarded as normal, non-radioactive waste.

Physical control measures
Normal control measures for low-risk sealed sources were already in place at the two affected locations. This included locked rooms (with a limited number of keys issued to authorized personnel), as well as warning signs and labels on doors, storage cabinets and source containers.

Rooms, containers or cabinets that are used exclusively for storing disused sources (or sources used very infrequently) may not be visited regularly, which increases the possibility that unauthorized access or removal will go unnoticed. Licensees should develop a practice of consolidating the storage of disused sources into areas that are under the exclusive control of the RSO. Licensees should perform physical inventory verification of their storage locations at a frequency that would allow them to identify inventory discrepancies in a reasonable amount of time. The frequency may vary depending on the physical locations of a licensee's storage locations and the licensee's patterns of use.

Another consideration is access control to storage locations. Over time, as workers transition through a facility, the likelihood of more keys or magnetic access cards coming into circulation increases. The licensee's security team (and possibly other departments, such as maintenance) may also have a master key, granting access to the storage locations. Licensees should keep track of all personnel with access to the storage locations, and consider revoking access rights for anyone who no longer needs it. It is the responsibility of the licensee to ensure all staff understand their obligations under the radiation safety program, and that staff are trained appropriately and regularly.

There are many simple and inexpensive ways to enhance security, which can make it a lot easier to monitor access to a licensee's sealed sources. For example, use tamper-evident stickers on safes and at entrances to locations that are not frequently visited. If access is controlled by magnetic card, the security team may have an access log that can be periodically reviewed. Most importantly, a licensee should not become complacent about its security measures.

Security requirements

In May 2013, the CNSC published REGDOC-2.12.3, *Security of Nuclear Substances: Sealed Sources*. This regulatory document applies to Category 1, 2, and 3 sources, and provides "prudent management practices" for Category 4 and 5 sources. Every licensee should review REGDOC-2.12.3 to ensure that their security provisions meet its expectations.

Personnel training
Ensuring that all staff at a licensee's site are appropriately trained will help reduce the likelihood of losing control of a radioactive sealed source at the facility. Every person working at

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the facility or site who has access to areas where radioactive sealed sources are stored should be appropriately trained, and should be able to recognize and understand a radiation warning sign. Over time, changes may occur to a licensee's radiation safety program or to the inventory stored in its locations. Training provided years ago to a worker who only accesses the storage location once or twice a year might no longer be current. Workers may not be aware of which sources are in the storage location at any given time, or any special rules or obligations they should follow when accessing the storage location. A licensee's training program needs to consider any special information that should be provided to workers, and ensure that workers are retrained at an appropriate frequency.

In addition, any staff authorized to access radioactive sealed sources should be familiar with the protocols for removing sealed sources from the storage location. Licensees should establish a periodic internal verification, to ensure that staff adhere to the approved protocol. If security, maintenance or other departments have master keys to the storage areas, they absolutely MUST know not to enter or remove items from these areas without authorization from the Radiation Safety Officer (RSO) unless it is absolutely necessary (such as for an emergency). Staff in these departments may change regularly, and this type of information has to be part of the initial training for every new employee.

Inventory control and verification

Every licensee is required to maintain an inventory of all sealed sources in their possession. In accordance with section 36 of the *Nuclear Substances and Radiation Device Regulations*, this inventory must include the name, quantity, form and location of the nuclear substance, as well as the model and serial number (or other identifier) of the sealed source.

Inventory information must be up-to-date. If a source is removed from a storage location to be used, the inventory must be updated to reflect where the source is used, and then updated again once it has been returned to its storage location. CNSC regulations prescribe that detailed records must be maintained for any transfer, receipt or disposal of a source. An inventory is not useful and does not comply with the regulatory requirements if it is not updated every time there is a change in location.

CNSC Inspectors verify a licensee's inventory

Inventories of radioactive sealed sources, including stored sealed sources, should be verified regularly. In addition to being under normal CNSC regulatory oversight, inventories of

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thorium, uranium and plutonium-239 (irrespective of their quantities) are also subject to international control as part of Canada's international obligations to ensure peaceful use of nuclear energy. It is therefore important to keep good inventory control of these substances as they may be subject to additional verification by the CNSC and the International Atomic Energy Agency to satisfy Canada's obligations.

The CNSC was one of the first nuclear regulators in the world to implement a modern Sealed Source Tracking System (SSTS) and National Sealed Source Registry (NSSR). The NSSR contains detailed information on categories 1 and 2 sealed sources in Canada and some information on sources on categories 3, 4 and 5. Licensees report the movement of category 1 and 2 sources via the SSTS as each movement occurs. Category 3, 4 and 5 source information is updated annually through licensee annual compliance reports submitted to the CNSC. Inventories on all categories of sealed sources at licensee locations are verified during CNSC compliance inspections. For more information on the SSTS and NSSR, readers are invited to consult the CNSC website.

As the recent events indicate, verifications performed only once a year before submitting an annual compliance report to the CNSC may not be sufficient in all situations, and licensees should not rely solely on these verifications. In one of these two events, the licensee did not realize the sources were lost until almost one year after they were removed. In the second event, it took several months for the licensee to become aware of the incident. A simple and regular physical verification could have indicated much earlier that the sources were missing.

If a licensee has many sources in its inventory, it should consider developing an electronic tracking mechanism, such as putting barcodes on sources (where practical) and using a barcode scanner to assist in performing physical inventory verifications. These systems are now remarkably inexpensive, and can even be used, in combination with radiation detection equipment, as a quick and effective way of logging sources in and out of storage locations when someone needs to use them. It's also an effective way of reducing staff exposure time and keeping doses as low as reasonably achievable.

More information

For more information on the performance results of Canadian licensees using nuclear substances, readers are invited to consult the annual safety performance reports on the CNSC website.

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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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