

REVIEW ARTICLE—EDUCATIONAL TRACK: RADIATION SAFETY AND HANDLING PHYSICIANS SHOULD KNOW ABOUT

Safe Handling of Nuclear Cardiology Radioactive Shipments

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Abstract

Shipments of radioactive sources to Nuclear Cardiology facilities must be handled properly to avoid unintended radioactive contamination. Appropriate personnel must be involved in the ordering, receiving, surveying, and opening of radioactive shipments, and must record relevant information for each package. Action limits defining radioactive contamination include a wipe test result indicating removable activity from the exterior of a package exceeding 185 Bq (0.005 μ Ci) above background radiation levels for a surveyed area of 100 cm², or exposure meter readings exceeding 0.1 mSv/hr (10 mrem/hr) 1 meter from a package, or exposure rate readings at the package surface exceeding 2 mSv/hr (200 mrem/hr). Following standardized procedures will ensure personnel of Nuclear Cardiology facilities that shipments of radioactivity are handled properly and safely.

Keywords: Nuclear Cardiology, Radiation exposure, Radiation protection, Radionuclides

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Among the imaging technologies available for the diagnosis of cardiac disease, those that employ ionizing radiation require careful adherence to procedures designed to limit radiation exposure to patients, occupationally exposed personnel, and to the public at large (1). All Nuclear Cardiology facilities that receive shipments of radioactivity are faced with the possibility of receiving shipments that have been contaminated due to accidental breakage of the package contents, among other potential causes of radioactive contamination. For that reason, standardized procedures are recommended for assessing whether there is any removable contamination, and for measuring the amount of radiation exposure that is generated by the package itself. It is important that every radioactive package received at a Nuclear Cardiology facility be entered into the log of radioactive substances present at any given time at the facility, and that every package be assayed for possible radioactive contamination.

Ordering radioactive sources

A single individual should be designated who is authorized to order radioactive sources, and who is in position to assure that the isotopes and amounts to be ordered are allowed by the license. A system of written documentation must be established and followed to identify the department or location to which materials are to be shipped, the isotope, the physical and/or chemical form of the agent, the amount of activity, and the supplier of the isotope. Records also must be kept to confirm receipt of ordered materials. Agents who transport and deliver radioactive shipments must be informed clearly prior to deliveries of the exact location to which materials should be delivered during normal business hours, and to which specific security locations outside of normal business hours.

Handling of received radioactive packages

Within the facility to which a radioactive package has been delivered, there must be a designated hot lab within which to handle delivered radioactive packages. A hot lab is considered a restricted area, access to which must be strictly controlled by

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the holder of the radiation license in order to protect persons who are not occupationally exposed individuals from radiation exposure (2). Radioactive shipments should not be handled in any other room than in the hot lab. Within this hot lab:

- 1) Newly received radioactive packages should immediately be placed on an absorbent disposable material.
- 2) Only a licensed technologist should be the person to open radioactive packages, not an untrained individual. The technologist must wear a lab coat and disposable gloves while opening radioactive packages.
- 3) The condition of the package must be recorded. If the manufacturer or supplier has issued instructions for opening the package, these should be followed exactly.
- 4) Prior to opening the package, wipe tests must be performed and a previously calibrated survey meter must be used to measure exposure rates, which then must be recorded. The package should not be opened if the wipe test of a 100 cm² area of the outside of the box exceeds 185 Bq (0.005 µCi) above background radiation levels, or if the exposure meter reading exceeds 0.1 mSv/hr (10 mrem/hr) 1 meter (~3 feet) from the package, or if the exposure rate at the package surface exceeds 2 mSv/hr (200 mrem/hr); rather, the facility's radiation safety officer, lab manager and the carrier that delivered the shipment must be notified immediately (3). In performing a wipe test, an instrument with sensitivity of at least 185 Bq (0.005 µCi) must be used in order to have reliable measurements; dose calibrator ionization chambers are not sufficiently sensitive for this purpose.
- 5) So long as the exposure levels are not above those limits, the outer box may be opened. The packing slip should be retained. The inner package should be opened and the identity of the isotope and the stated activity verified as agreeing with the original ordering information. It must be verified that the activity of the isotope received does not exceed the limit allowed by the license.
- 6) Examine the contents of the inner package for possible breaks or leakage. Perform a wipe test of the external surface of the inner package, and measure and record the removable activity. If contaminated, immediately notify the facility's radiation safety officer, lab manager and the carrier that delivered the shipment.
- 7) After verifying that the shipment is not contaminated, destroy radiation labels and discard the packaging material as ordinary trash.

Radiopharmaceutical segregation

Once a radiopharmaceutical has been removed from the package, following a few simple procedures will help reduce

the likelihood of mis-administrations, such as administering the wrong isotope or wrong amount of activity. Most Nuclear Cardiology facilities will receive several different types of radioactive and non-radioactive shipments, the contents of which ultimately will be administered to patients, such as ²⁰¹Tl, ^{99m}Tc-pertechnetate, ^{99m}Tc-pyrophosphate, ^{99m}Tc-sestamibi, ^{99m}Tc-tetrofosmin, etc. Immediately sorting materials upon receipt can prevent various forms of accidental mis-administrations, such as by using separate drawers and separate locales within the hot lab for storing each radionuclide and each form of radiopharmaceutical.

Conclusion

If the standardized procedures described above are followed, the personnel of the Nuclear Cardiology facility can be confident that the shipments of radioactivity are being handled properly.

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