

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS
WASHINGTON, DC 20555-0001

December 31, 2019

NRC INFORMATION NOTICE 2019-12: RECENT REPORTED MEDICAL EVENTS
INVOLVING THE ADMINISTRATION OF
YTTRIUM-90 MICROSPHERES FOR
THERAPEUTIC MEDICAL PROCEDURES

ADDRESSEES

All U.S. Nuclear Regulatory Commission (NRC) medical-use licensees and NRC master materials licensees that are authorized for yttrium-90 (Y-90) microspheres in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 35.1000, "Other Medical Uses of Byproduct Material or Radiation from Byproduct Material." All Agreement State Radiation Control Program Directors and State Liaison Officers.

PURPOSE

The NRC is issuing this information notice (IN) to inform licensees of recent reported medical events that involved the administration of Y-90 microspheres. The NRC expects that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar medical events. INs may not impose new requirements, and nothing in this IN should be interpreted to require specific action. The NRC is providing this IN to the Agreement States for their information and for distribution to their medical licensees, as appropriate.

DESCRIPTION OF CIRCUMSTANCES

From 2016-2018, the NRC received reports of 71 medical events involving NRC or Agreement State licensees regarding the administration of Y-90 microspheres. Although 2019 data is not yet available, these medical events continue and are monitored. These reported medical events resulted from a variety of causes, such as errors with the written directive; clogging and kinking in the catheters causing the administration of a reduced amount of microspheres to the patient; and treatment of the wrong location, such as the wrong lobe of the liver. Events involving treatment of the wrong location were identified when licensees used post-treatment imaging. It is important to note that some of the events are associated with the inherent risks of the treatment such as shunting to wrong treatment sites and may not be prevented by using the current standard of care. The NRC requires reporting of events that meet medical events criteria per 10 CFR 35.3045 and licensee's approved conditions per 10 CFR 35.1000.

Of the reported medical events, seven events involved dose or activity going to the target organ that exceeded the written directive by more than 20 percent as a result of human errors not related to the physical delivery of the microspheres. The causes of these medical events involved errors in measuring the activity before administration, improper control of vials containing the microspheres, and failure to consult the written directive. One example occurred on June 14, 2017, when the licensee delivered an activity of 8.55 gigabecquerels (GBq) (231 millicurie (mCi)) to a patient instead of the prescribed activity of 1.71 GBq because the

licensee did not verify the measured activity of the dosage with the written directive (Event Notification [EN] 52807). Another example occurred on December 29, 2016, when a licensee delivered an activity of 816.85 megabecquerels (MBq) (22.1 mCi) to a patient instead of the prescribed activity of 90.76 MBq because the licensee used a vial intended for treatment of a different area of the patient's liver (EN 52473).

Of the Y-90 microspheres medical events that occurred from 2016 through 2018, 27 appear to have involved blockages of the microspheres in the delivery system. Specifically, five events involved kinks or dents in the catheter. In these events, the Y-90 microspheres built up and caused a blockage around the kink or dent. The majority of the remaining 22 events occurred because of suspected clumping of the Y-90 microspheres in the catheter. Clumping is a known phenomenon which can occur for both of the Y-90 microsphere manufacturers (SIR-Spheres® and TheraSphere®). Many events occurred during unique administrations, such as unusually large or small doses or use of a slower flow rate. In one example, on October 27, 2017, a licensee delivered an activity of 0.4255 GBq to a patient instead of the prescribed activity of 2.22 GBq because the microcatheter apparently clogged as a result of the large number of microspheres being administered (EN 53040). Another example occurred on April 12, 2016, when the licensee delivered an activity of 0.04 GBq to a patient instead of the prescribed activity of 1.29 GBq because of apparent clumping of the microspheres in the microcatheter (EN 51868).

In addition, there were eight other events that involved treatment to the wrong location, such as the wrong lobe of the liver. Of these events, four involved an administrative error that caused the microspheres to be delivered to a site other than prescribed location. In another event that occurred on June 6, 2018, the interventional radiologist delivered the microspheres through the wrong hepatic artery. A different interventional radiologist had previously performed pretreatment mapping and identified the patient had atypical hepatic arterial anatomy, however, this was not reported to the radiologist performing the treatment. This event resulted in a dose of 11,086 centigray (rad) to the wrong liver lobe (EN 53448). The remaining three events involved microspheres that traveled to the wrong liver lobe for unknown reasons. The four events not associated with administrative errors were identified through post-treatment imaging. Although the NRC regulations do not require post-treatment imaging, licensees must report medical events identified by these images per 10 CFR 35.3045 and licensee's approved conditions per 10 CFR 35.1000.

DISCUSSION

Administrative errors involving the written directive for several of the above examples of medical events, demonstrate the importance of licensees having a signed and dated written directive as described in the Y-90 microsphere licensing guidance document, and licensees reviewing the written directive before the administration of the Y-90 microspheres. The written directive shall include the name of the patient or human research subject, the treatment site, the radionuclide including the physical form (Y-90 microspheres), the model of spheres (i.e., TheraSphere® or SIR-spheres®) or manufacturer (i.e., Nordion or Sirtex) and the prescribed dose or activity as described in the Y-90 microsphere licensing guidance document. In addition, licensees should determine and record the activity of the dosage before use, and only use it if it falls within 20 percent of the prescribed dosage. Finally, these medical events demonstrate the importance of licensees developing, implementing, and maintaining written procedures to provide high confidence that each administration is in accordance with the written directive. The NRC recommends the use of timeouts in these procedures to ensure that planned administration aligns with the written directive immediately before administration for Y-90 microspheres.

In summary, this IN is intended to provide licensees with a heightened awareness of numerous medical events involving incorrect administration of a prescribed dose or activity of Y-90 microspheres in the past several years. Licensees should be aware that small kinks in the catheter can lead to an underdose, and the NRC recommends visual inspection of all tubing before starting the procedure. Licensees should review manufacturer recommendations to avoid clumping. Licensees are encouraged to communicate with their peers in the industry or Y-90 microsphere vendors to identify best practices with respect to the administration of the microspheres, especially in unique administrations such as when unusually large or small doses or use of a slower flow rate is necessary for the patient.

CONTACTS

This information notice requires no specific action or written response. Please direct any questions about this matter to the technical contact listed below or to the appropriate regional office.

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INFORMATION NOTICE 2019-12, "RECENT REPORTED MEDICAL EVENTS INVOLVING THE ADMINISTRATION OF YTTRIUM 90 MICROSPHERES FOR THERAPEUTIC MEDICAL PROCEDURES," DATE: DECEMBER 31, 2019

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EPIDS No.

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