Chalk River Resumes; Other Isotope Producers Announce Shutdowns

As of November 22 the Chalk River facility, run by Atomic Energy of Canada Limited (AECL) was back in operation to supply ^{99}Mo, used to produce technetium for many nuclear medicine facilities worldwide. This comes soon after a November 15 announcement outlining a temporary closure for major isotope generators in The Netherlands, including the Petten High Flux Reactor (HFR), also a major world supplier of ^{99}Mo. The closure of reactors in The Netherlands is expected to continue for up to 3 months. Also halted is the SAFARI-1 research reactor in Pelindaba, South Africa, which supplies as much as 25% of global demand for molybdenum and is also a source for ^{131}I.

The unexpected shutdown of the Chalk River reactor was announced on November 19, with AECL officials citing the need for maintenance on a fuel rod flask. Three days later the reactor was back online, and AECL announced intentions to begin once again supplying ^{99}Mo to Nordion Inc. for distribution. Isotope production at the SAFARI-1 reactor stopped on November 2 as a result of an apparently short-lived leak of iodine and noble gases, per a November 11 statement from NTP Radioisotopes, a subsidiary of the South African Nuclear Energy Corporation. The leak remained within levels of regulatory compliance and was isolated to the Pelindaba facility. As of this printing, NTP officials had not yet set a date for restored production.

An Ongoing Challenge

Twelve nuclear reactors are currently used mainly for production of research isotopes or are in the process of initiating medical isotope production, but many of these are used only to supply the countries in which they are located. Six nuclear reactors provide most of the world's supply of medical isotopes. The Canadian National Research Universal (NRU) Chalk River facility and the Dutch Petten HFR together provide 80% of the world's molybdenum and 100% of the North American supply. The remaining 4 are the Belgian BR-2 reactor, the OSIRIS in France, the SAFARI-1 in South Africa, and the Australian OPAL reactor.

Ensuring a reliable supply of medical isotopes has been an ongoing issue for almost a decade, as both maintenance and unplanned shutdowns have led to significant temporary shortages, most notably in the supply of molybdenum. This year has been particularly challenging, with 3 reactors down at different points since May. The Chalk River reactor was closed for 1 year in 2009, and in 2007 a cluster of shutdowns, including Chalk River, resulted in an 80% shortfall of U.S. technetium and widespread procedure cancellations. The Dutch HFR, BR-2, and OSIRIS facilities have also experienced serial closures.

Most of the reactors are approximately 50 years old and have functioned well beyond their intended lifetimes. Questions remain about lasting alternatives to short-term fixes. Construction of the AECL's 10 MW MAPLE reactors was discontinued in 2008, and the NRU facility is scheduled to be decommissioned in 2016. The HFR, OSIRIS, and BR-2 are expected to close within 5 years.

Promises and Failures to Launch

Covidien and Babcock & Wilcox announced an agreement in 2009 to produce about half of the U.S. molybdenum demand using low-enriched uranium and aqueous homogeneous reactor technology, but continued challenges led to a disclosure that Covidien was no longer engaged in the project. The University of Missouri had also announced intentions to begin production of molybdenum at an active research reactor that also uses low-enriched targets, but these plans have not progressed.

Still on the horizon is a potential isotope production facility in Russia for international distribution. The Research Institute of Atomic Reactors in Dimitrovgrad is expected to ramp up production, and a South Korean facility is also scheduled for 2016 operation.

Innovations in Technetium Production

^{99}Mo is produced by irradiating ^{235}U targets. One issue with implications for international relations is that the aging reactors producing ^{99}Mo use highly enriched uranium targets. Initiatives to use low-enriched targets are gaining momentum, but these methods are challenged by increased production costs. The SAFARI-1, OPAL, and other reactors are moving toward or are already converting to use of low-enriched uranium targets.

Technetium kits and other generator-based preparations are more attractive for widespread distribution than navigating the logistics of cyclotron-based medical isotopes. Conventional cyclotron preparations typically have a half-life that is much shorter—such as ^{11}C's 20-minute half-life. Industry reports suggest that the widespread adoption and availability of PET in recent years may be driving down the cost of in-house hospital cyclotron. Some alternative production methods include the use of linear accelerators to produce ^{99}Mo by photonuclear reaction.