TECHNETIUM-99M

Canada backs three new production projects

Struggling to remain a major supplier of the medical radioisotope Tc-99m through reactor production, the Canadian government is funding efforts that use accelerators instead.

On February 28, Joe Oliver, Canada's minister of natural resources, announced that the Canadian government has chosen three organizations to receive funding to develop new production capability for the radioisotope technetium-99m, the most widely used isotope in nuclear medicine procedures. Having been one of the world's leading suppliers of Tc-99m through production reactors, Canada is now turning to particle accelerator technology, with two of the projects based on cyclotrons and the other on a linear accelerator. Canada's ability to export Tc-99m—especially to the United States, which has had no production capacity of its own for years—was hampered first by long outages at its National Research Universal (NRU) reactor, and then by design issues that blocked the completion of the MAPLE-X reactor, which was intended to take over production.

Not only is Canada moving away from reactor production, but all three projects are in western Canada, far from the Chalk River reactor establishment in Ontario. The University of Alberta in Edmonton will receive Can$7 million ($6.8 million) for work to be done at a 24-MeV cyclotron. Another Can$7 million will go to TRIUMF, Canada's national particle physics laboratory in Vancouver, British Columbia, as part of a consortium called CycloTech99, which asserts that it has demonstrated Tc-99m production on medical cyclotrons. And Can$7.46 million will go to the Prairie Isotope Production Enterprise (PIPE), based at the University of Winnipeg in Manitoba, which is using linear electron accelerator technology. PIPE maintains that it is working only to supply Canadian patients with Tc-99m, rather than to uphold Canada's position as an exporter.

The key materials in Tc-99m production have short half-lives, with the precursor molybdenum-99 at about 66 hours, and the beta-decayed daughter Tc-99m with a half-life of about six hours in the medically useful "m" isomer form before it decays to ordinary Tc-99, which has a half-life of more than 200 000 years. As such, both the production of Tc-99m and its elution into a medically applicable form must be carried out quickly, and Tc-99m has virtually no shelf life. When Tc-99m production was limited by long outages at both NRU and a production reactor in the Netherlands, medical procedures in the United States and elsewhere were either delayed or canceled.

Meanwhile, efforts to create new production capability started up in other countries, with numerous initiatives in the United States currently being encouraged by the Department of Energy's National Nuclear Security Administration. None of this has been lost on Canadian officials, including the fact that some of the NNSA-backed programs are based on accelerators rather than reactors. Canada's Economic Action Plan 2012, adopted last year, included the four-year, Can$25-million Isotope Technology Acceleration Program through which the three new programs are being funded.

Whatever comes along later, it is clear that NRU cannot be expected to continue producing Tc-99m in substantial quantities. During the last long outage, the Canadian Nuclear Safety Commission (CNSC) initially declined to allow the reactor to restart because of safety concerns based on its condition. Parliament then intervened, passing emergency legislation in December 2007 that essentially directed the CNSC to allow NRU to restart without restrictions or modifications (*NN,* Jan. 2008, p. 17). It appears now that if Canada continues to be a significant Tc-99m producer, it will be because of accelerators, not an aging reactor.

Isotopes & Radiation Briefs

A NEW CONTRACT TO CONTINUE CF-252 PRODUCTION at Oak Ridge National Laboratory is now in effect. The six-year contract between the Department of Energy's Isotope Program and industry is based on the irradiation of curium targets in the High Flux Isotope Reactor. Californium-252 decays by spontaneous fission, making it a portable neutron source for a variety of applications in analysis and detection. ORNL meets about 70 percent of world demand for Cf-252. The only other reactor capable of producing the isotope is in Dimitrovgrad, Russia.

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A THIRD RADIATION BELT AROUND THE EARTH WAS DISCOVERED recently by the National Aeronautics and Space Administration's Van Allen Probe satellites. What had previously been thought of as a single outer belt has been found at times to be two separate zones of charged particles with a gap between them, according to a February 28 announcement by NASA. Because the Van Allen belts are constantly losing and gaining material from solar and cosmic sources, and the boundaries between the belts can shift and overlap, it may be preferable to think of the belts as tendencies rather than structures, governed by solar activity and the Earth's magnetic field and ionosphere. The Van Allen Probes were launched last August (*NN,* Oct. 2012, p. 98). NN