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Making Molybdenum

By Joyce Ward, CNMT

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With the current world shortage of molybdenum-99 (Mo-99) and the aging of the research reactors that produce this vital precursor of the technetium-99m (Tc-99m) used in about 80 percent of nuclear medicine procedures, two American companies have come forward with unique concepts for producing this isotope. Advanced Medical Isotope Corp. (AMIC), in Kennewick, Wash., is proposing to create Mo-99 using compact systems similar to the proton linear accelerator it is now using to produce fluorine-18. Meanwhile, Lynchburg, Va.-based Babcock and Wilcox Technical Services Group, which operates nuclear facilities throughout the U.S., has teamed with Covidien Ltd. of St. Louis, one of only two U. S. manufacturers of the Mo-99/Tc-99 generators, to develop production of Mo-99 in a series of compact liquid fuel reactors.



An Mo-99 generator that produces Tc-99m and vials for elution of Tc-99m to prepare radiopharmaceuticals. *Courtesy Covidien Radiopharmaceuticals*

AMIC proposal

AMIC is exploring six different solutions to the isotope shortage, according to Robert Schenter, PhD, chief science officer. The one that is furthest along involves working with scientists and researchers at the University of Missouri to make Mo-99 in a compact fission system.

"Our expertise is in compact systems to make medical isotopes," Dr. Schenter explained to *ADVANCE* in an interview last fall. "We already have a proton LINAC compact system in Kennewick, where we are making fluorine-18 and PET isotopes. We are also going to be making indium isotopes in Buffalo, N.Y. on a cyclotron, so our expertise is compact systems to make all major therapeutic and diagnostic isotopes."

An advantage of the University of Missouri device is that it uses electrons that hit a target, creating gammas that in turn produce neutrons, so the device can be turned off and on as needed, he said. At the time of the interview, however, the device had not yet produced any Mo-99.

Another option under consideration is the use of a compact neutron generator developed at the Lawrence Berkeley National Laboratory in California.

"What the Berkeley people have done is miniaturize a fusion device down to smaller than room size, where you make high energy neutrons," Dr. Schenter said. "These neutrons then hit a target and the target produces Mo-99, with no fission products. It is a faster process." (For more on this system, visit http://ndt.net/article/wcndt2004/html/htmltxt/706_leung.htm.)

This January, AMIC announced that it was partnering with the U.S. Department of Energy (DOE), through the Pacific Northwest National Laboratory, on a two-year project with the Kharkiv Institute of Physics and Technology in the Ukraine. The project's goal is to develop and bring to market a compact system using the Alternative Method for Producing Medical Isotopes being developed at the Kharkiv Institute. This method will

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generate an intense neutron beam under controlled conditions to produce neutron-rich medical isotopes.

While individual compact systems would not produce as much Mo-99 as the current research reactors in Europe and Canada, their smaller size and lesser cost would allow several to be stationed around the U.S. producing the isotopes closer to potential users, Dr. Schenter said.

The ability to site multiple small systems in various areas of the country will also be useful for the production of carbon-11 (C-11), an important PET isotope with a short (20.3 minute) half-life that is being used to label radioisotopes under research for imaging prostate cancer and Alzheimer's plaques.

According to a company spokesperson, the high production rates of the LINAC in the Kennewick facility may make it possible to ship C-11 within an 80- to 100-mile radius of the LINAC production facility.

Partnering for production

Although close proximity to users would reduce the amount of isotopes lost by decay during shipping, any Mo-99 thus produced will either need to be shipped to the Covidien facilities in St. Louis or the Lantheus Medical Imaging facilities in N. Billerica, Mass. These are the only FDA-approved Mo-99/Tc-99m generator manufacturers in the U. S.

This January, Covidien announced that it had signed an agreement with Babcock and Wilcox (B&W) Technical Services Group to develop technology to make Mo-99.

"What attracted us to B&W is their specialty in providing nuclear energy and technical services around nuclear energy products," said Dale Simpson, BS, manager of research and development for Covidien. Thus, they have expertise in dealing with government licensing and regulations, Simpson said. Covidien brings its expertise in the radiopharmacy business and dealing with FDA approval processes. The company has also been purifying Mo-99 from targets irradiated at the NRG facility in Petten and shipping that material to its facilities in St. Louis.

Making Molybdenum

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