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Technische Universität München

Press Release

Garching, June 30, 2009

Press briefing at the Technische Universität München:

Garching Neutron Source can supply Europe with Radioisotopes

Cancer diagnoses and organ tests have to be postponed all over the world. The radioisotopes necessary for these procedures are scarce, as one of only five neutron sources in the western world has been idled unexpectedly. At a cost of only 5.4 million euros, The FRM II neutron source at the Technische Universität München (TUM) can be upgraded to produce the urgently required radioisotope molybdenum-99.

This is the finding of a feasibility study carried out by the TUM and the Institute for Radioelements in Belgium, which was presented at a press briefing in the Grosser Senatsaal of the TUM on June 30. “The world’s five biggest molybdenum-99 production plants are all 40 years old or older and are reaching the end of their life-span,” says TUM President Professor Wolfgang A. Herrmann. “We have a brand new high-flux neutron source in Garching which, despite needing authorization under the German nuclear safety legislation, can be upgraded for molybedenum-99 production quickly and simply, and therefore contribute to the global supply of the radioisotope for decades to come.”

Molybdenum-99 is the parent isotope to the isotope technetium-99m, which is used in radiology. This substance is required for the production of images known as scintigraphs that can be used to diagnose of cancer and organ dysfunction. “Seventy thousand patients undergo scintigraphic tests every day throughout the world and technetium-99m is used in 70 percent of these tests,” says Professor Andreas Bockisch, President of the Deutsche Gesellschaft für Nuklearmedizin (German Association of Nuclear Medicine). Around three million tests are carried out using technetium-99m in Germany every year and over 100,000 treatments are administered using technetium-99m or other radioisotopes.“ As a result, Germany is Europe’s biggest consumer of this medicine. We have a moral duty to produce this radioisotope, not only as its main consumer but also in view of the global undersupply,” says Professor Bockisch. “Global demand for radioisotopes is currently increasing annually at a high single-digit rate,” adds TUM President Herrmann. This is due, in part, to the improvements in medical care in threshold countries and to the increasing number of elderly people in Europe and the USA who require more frequent radiological tests.

With the images produced in this way, scintigraphy can show, for example, sources of infection or cancer metastases. To produce a scintigraph, the radioisotope technetium-99m is bound to selected molecules. These then transport the radioisotope to a targeted location in the body, for example cancer metastases in the skeleton. There, the technetium-99m accumulates along with the transporter molecules. It emits gamma waves which can then be

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detected by a special camera. In this way, the radioactive technetium-99m can be relied on to make undesired tissue or the structure of organs visible. Molybdenum-99, the parent isotope of technetium-99m, is generated throughout the world through the fission of uranium by neutrons.

According to the new feasibility study, the TUM's research neutron source can be upgraded for the production of molybdenum-99 within a period of five years. To this end, an existing thimble located near the fuel element that releases the neutrons will be converted in such a way that the targets to be irradiated fit into it perfectly. The cost of upgrading FRM II would come to a total of 5.4 million euros spread over a period of five years. "That is an extremely small sum in terms of the costs shouldered by our healthcare system in Germany. It should also be considered in the context of the cost of constructing a new neutron source, which would total at least 300 million euros," says Professor Winfried Petry, Scientific Director of FRM II. The Federal State of Bavaria has already authorized 1.2 million euros to finance the upgrade. This funding is needed for engineering costs, as well as the upgrading of the reactor pool and internal transport system, for example for the extension of a freight elevator.

It is planned that the specimens will be irradiated at FRM II within six days, then deactivate for a few hours, and, finally, be packed in thick-walled shielding containers. From Garching they will then be transported to a plant that processes the molybdenum chemically to enable its use by doctors in devices known as technetium generators. Henri Bonet, long-time CEO of such a plant at the Institute for Radioelements in Belgium, presents the math: "The FRM II will be able to produce enough molybdenum-99 during one week of operation to supply almost all of Europe for one week. It will be possible to carry out almost five million radiological tests with technetium-99m, thanks to the TUM neutron source."

At a mean annual operating period of 240 days, the FRM II would produce approximately 65 percent of the annual European requirements, which corresponds to just over one eighth of the current global requirement. This would support the world's existing five neutron sources (in Belgium, France, Holland, South Africa, and Canada) and secure the international supply of molybdenum-99. At the same time, FRM II would also replace the three European neutron sources which ceased operation in recent years (DIDO in Great Britain, Siloe in France, and FRJ-2 in Jülich, Germany).

The FRM II research neutron source is also particularly suitable for the production of radioisotopes as it generates a high neutron flux. This is necessary to ensure that sufficient quantities of the source material for the medicine are produced. Moreover, the necessary expertise in radioisotope production is also already available at the FRM II in the person of Dr. Ingo Neuhaus: the Technical Director of the research reactor gained experience at the FRJ-2 neutron source in Jülich, which produced molybdenum-99 until it ceased operation in 2006.

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He is already in charge of the production of other medical radioisotopes at FRM II, for example rhenium-188, which is used to treat the vasoconstriction.

TUM President Professor Herrmann also announced that, in view of the future production of molybdenum-99 at FRM II, the university's distinguished Chair of Radiochemistry, which is located in the direct vicinity of the neutron source, will adopt a modern medical-pharmaceutical orientation.

The biggest producer of medical radioisotopes in Canada recently malfunctioned once again. Production has been halted since mid-May and will not resume for at least three months. This also has consequences for Germany, as Professor Bockisch, President of the German Association of Nuclear Medicine, stresses: "The NRU neutron source in Canada mainly supplies the US with isotopes. The Americans will now obtain more molybdenum-99 from Europe." The radioisotopes became extremely scarce as recently as last autumn due to the simultaneous unavailability of all three European molybdenum-producing neutron sources. "Many colleagues had to send their patients home because there were no more radioisotopes," reports Bockisch. In the first quarter of 2009, German radiologists only received two thirds of the required volumes.

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