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Sustaining the Future of Nuclear Medicine

The Netherlands continues to be at the centre of debate regarding the continued supply of medical isotopes worldwide. Molybdenum-99, the parent generator of technetium-99m, is a crucial tool used by nuclear medicine departments to pinpoint cancer. The substance is regularly in short supply because only five large commercial producers exist worldwide, mainly via older reactors nearing the end of their lifecycle. The High Flux Reactor (HFR) in Petten, the Netherlands, a property of the Joint Research Centre (JRC) of the European Union, is Europe's largest supplier and was therefore one of the key catalysts for concern for supply of this agent. In August 2008, a jet of gas bubbles was discovered in the primary cooling water system in the Petten HFR during a standard inspection and the Nuclear Research and Consultancy Group (NRG), operator of the HFR and nuclear expert body in The Netherlands took the reactor out of service on 19 February so that localised repairs could be made. This reactor is only recently back in operation, following completion of repairs but is nevertheless planned to finish its lifecycle in 2015.

NRG states that the facility currently supplies around 60 percent of European and 30 percent of global demand for medical isotopes and over 24,000 patients are treated with isotopes produced in Petten every day. Also, one of its neutron beam channels, originally installed for performing research, was modified for the direct irradiation of patients. When the facility broke down earlier this year, it prompted a crisis as it, and several other worldwide reactors reach the end of their lifecycle. Stakeholders realise that now, more than ever, alternate strategies will need to be developed in the likely reoccurrence of such a crisis to ensure that patients can continue to benefit from nuclear medicine.

Said Rob Stol, General Director of NRG "We are very much aware of our great social responsibility. As you can imagine, we are delighted that the reactor is back in action so that we can resume our work. The first isotopes are being produced right now and our research into materials and fuels for nuclear power stations and recycling of nuclear waste is up and running again."

New Reactor Planned to Replace HFR

NRG is currently raising funds and seeking tenders for the construction of a new reactor in The Netherlands to replace the HFR, which will inevitably wind down. First generation research reactors in the EU are approaching operational retirement, as maintenance costs increase and materials and components age. NRG therefore plans to build a new research reactor called PALLAS which is estimated to cost up to a total of 500 million euros. This will be a state-of-the-art reactor equipped to meet the growing world demand for both nuclear knowledge and services and the production of essential medical isotopes. It will have the capacity to be the world's biggest producer of such isotopes.

The tender process for PALLAS began in 2007 and will continue through 2010 - 2011.
The licensing process began in Autumn 2009 with a "Notification of Intent to conduct an Environmental Impact Assessment" (EIA) for PALLAS. Public hearings have been held to inform the national EIA committee's approach to consideration of the Impact Assessment. This summer past, NRG received the 'Richtlijnen Milieueffectrapport', the final guidelines for the Environmental Impact Assessment. The PALLAS project team in Petten will guide design and construction processes, is responsible for the licensing and commissioning and will manage the design and construction of the reactor infrastructure. Depending on the success of fundraising, the facility could be constructed in 2014 or 2015 and become operational in 2016.

Alternate Strategies

Meanwhile the Technical University (TU) of Delft's nuclear research reactor will be used as a back-up facility for the production of the radioactive isotope molybdenum-99, when supplies run out. TU Delft's research reactor is used for scientific research in the fields of health, energy and materials. The Oyster Programme (which stands for 'Optimised Yield - for Science, Technology & Education - of Radiation') will enable the reactor to meet new scientific challenges and respond to societal issues. The production for molybdenum-99 is one example of this.

The programme will enable the production of molybdenum to be increased as it will make more neutrons available.
TU Delft had announced earlier this year that its reactor could act as back-up facility when supplies run out. The Ministry of Health, Welfare and Sport has officially accepted this offer and asked the university to adapt its reactor for the production of this isotope. The Delft research reactor will now be adapted so that it can start to produce molybdenum-99. As soon as safety standards have been met and approved, the reactor will be able to produce molybdenum when required. 'The Reactor Institute Delft wishes to improve the care for cancer patients by helping to ensure that there are sufficient supplies of isotopes for medical use,' says Prof. Tim van der Hagen, director of the Reactor Institute Delft.

Perhaps the most recent of these developments is a cooperation between Dutch public utility Delta and French state-owned electricity group EDF, which will build a second nuclear reactor at Borssele (an existing one in this town already produces electricity) in the southwest of the Netherlands.

Delta has signed Memorandum of Understanding to explore the appropriate contractual structure to incorporate a Joint Development Company (JDC), which may be established at a later stage for the development of the project.

Further Reading

1. The economic structure of the medical isotope supply chain: the underlying explanation for the shortage. Report by OECD-NEA: The Supply of Medical Radioisotopes: An Economic Study of the Molybdenum-99m Supply Chain (http://www.nea.fr/med-radio)
2. The options for the future production of the medical isotope 99Mo - European Journal of Nuclear Medicine and Molecular Imaging Volume 37, Number 10 (http://www.pallasreactor.eu/fileadmin/ pallasreactor/user/docs/2010_ Future_of_Mo99_production.pdf)

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