EXCELLENCE FOR LIFE

SMART takes critical step towards the production of medical isotope Mo-99 without uranium

2022 marks a turning point in the future of this new technology for a more sustainable nuclear medicine

Fleurus, 22 February 2022 – Since 2018, the National Institute for Radioelements (IRE) has been working with the Dutch company ASML on the SMART project. Its goal: to develop a new technology to produce a radioisotope that is crucial to nuclear medicine, without using uranium. February 2022 marks a turning point in the future of this ambitious project since a proof of concept test has recently validated the main principles of this unprecedented technology. This is a major step in the design and engineering phase, the success of which will allow confirmation of technical choices during 2022 in preparation for the Board of Directors' decision regarding investment in an industrial facility.

Nuclear medicine less dependent on uranium

One of IRE's flagship products, Molybdenum-99 (or Mo-99) is fundamental to imaging in nuclear medicine. Following a purification process, the IRE extracts this radioisotope and sends it to pharmaceutical companies to manufacture generators of Technetium-99m (or Tc-99m) – i.e. the radioisotope used today in 80% of diagnostics in nuclear medicine for many examinations (such as for scintigraphy which explores disorders of the bones, heart, lungs, kidneys, liver, thyroid, brain, gastrointestinal system, etc.).

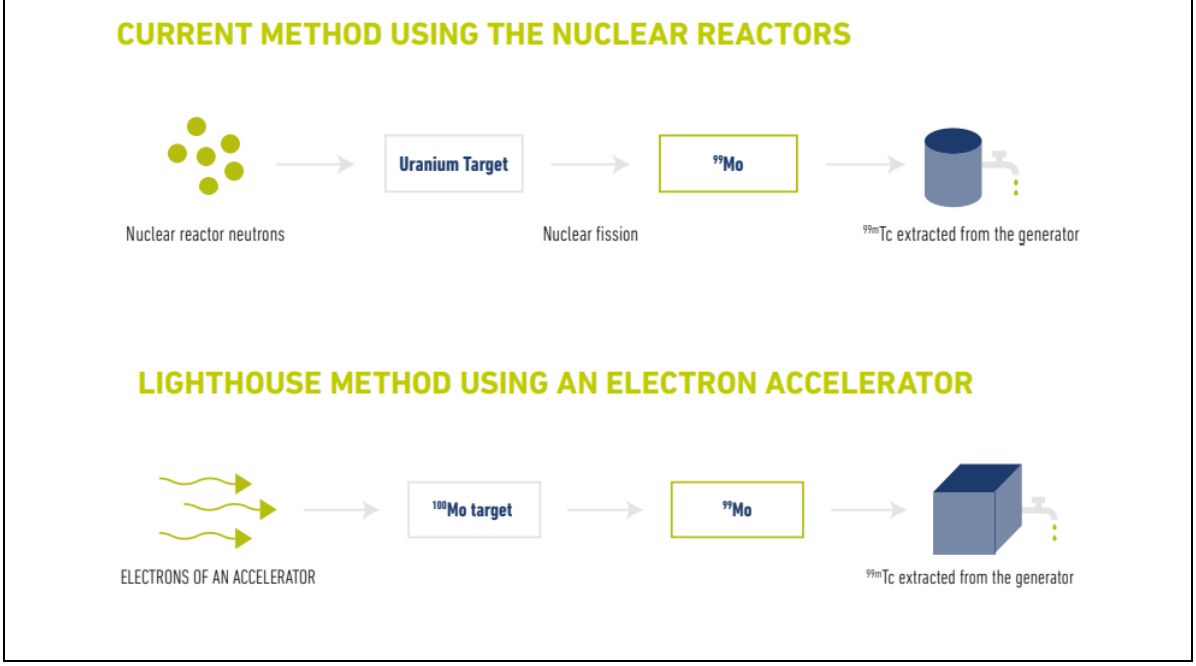
The current method of production of Molybdenum-99, harvested from nuclear fission products however faces a major difficulty: it is based on Uranium-235. Ageing reactors, management of irradiated waste, the geopolitical context, transportation and handling of materials from abroad: the challenges related to uranium are many and growing. Hence the creation of SMART ("Source of MedicAl RadioisoTopes"): an innovative project carried out in partnership with the Dutch company ASML, which aims to develop a new production technology for Molybdenum-99, no longer based on Uranium-235 but on non-radioactive Molybdenum-100.

The SMART project "s based on LightHouse technology: what is that?

SMART is set to enable the use of the LightHouse technology via a superconductive, high-power linear electron accelerator. The innovation lies in its ability to produce large volumes of high specific activity Mo-99.

The production begins with the irradiation of Mo-100 targets, without any nuclear fission operation. This innovative accelerator produces a high-energy electron beam (to exceed the energy needed for the reaction of Mo-100 to Mo-99) with a high current (to produce the required quantity of Mo-99). Technically, this beam is divided and then used to expose both

sides of a target composed of Mo enriched in Mo-100. The high-energy electrons are stopped in the target and produce rays that transform the Mo-100 into Mo-99.



The main principles of the technology validated by a "Mini LightHouse"

Launched in 2018, this ambitious project obviously requires a long development and engineering phase before a first production facility, with a unique accelerator, can be implemented on the IRE site in Fleurus.

IRE and ASML are today proud to announce an important step forward in this process. As part of the proof of concept test, an experiment with a "Mini Lighthouse" was successfully completed in February. Carried out at the German Helmholtz Dresden Rossendorf Centre (HZDR), the test consisted of irradiating and cooling part of the target (1,000 times smaller than projected in the final installation) during a complete production cycle and under circumstances similar to those of the future facility.

Veerle Van de Steen, SMART Project Director at IRE, explains: "*The main technological challenge of our installation is to keep our target intact during the irradiation cycle. It may seem trivial, but the challenge is actually multiple: It is a matter of designing and producing a small target, creating a high-power beam and extracting the residual power after conversion of the target. The combination of these three elements allows a record power density on this target and produces a quality of Mo-99 that guarantees an unchanged use of Tc-99m from the medical point of view.".*

Thanks to this successful irradiation experiment, IRE and ASML were thus able to confirm various mathematical models: the design of the target and its robustness to withstand the future beam, the cooling method and the impact of the daily harvesting cycle on the target.

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Next steps before a potential market launch in 2028

Erich Kollegger, General Manager of IRE, is delighted with this achievement: "*These results give us the confidence, energy and enthusiasm we need to continue along our path to ensure that we can produce and bring to market by 2028 the isotope that helps so many patients, and in a sustainable way*".

Before a possible market launch by 2028, however, other important steps remain to be achieved. The Board of Directors of IRE will have to give its final go-ahead for the construction of the installation. Other important milestones will also be achieved in the coming months, since the continuation of tests, the application for building and environmental permits and the preparation of authorizations with the AFCN are all in store in 2022.

The SMART project could represent a total investment of more than €300 million. For the [1]phase of Research & Development of the technology, the Federal Government granted a subsidy of €52 million in 2018, supplemented last year by €20 million allocated under the European economic recovery plan. The investment for the construction of the production line will come from the IRE's own funds.

About IRE – IRE ELiT

IRE, the Institut National des Radioéléments, is a public utility foundation whose main activity is the production of radioisotopes for diagnostic and therapeutic applications in the area of nuclear medicine. It is a global leader in the production of Molybdenum-99, the “parent” isotope of metastable Technetium-99m and the most widely used in nuclear medicine for numerous examinations (heart, bones, lungs, thyroid, brain, kidneys, etc.).

Besides its production activities, IRE contributes via its IRE Lab entity, to protecting and monitoring the environment thanks to its many services: measurement of radioactivity in various samples, radiological characterization of contaminated waste and elements, technical consultancy and support in the radiological and nuclear fields.

IRE ELiT is the innovation subsidiary of IRE which was created in 2010 in order to develop radiopharmaceuticals used in imaging and treatment of some cancers as well as for palliative care. In 2020, IRE ELiT allocated 15% of its turnover to R&D. This percentage is steadily growing ever since the company was created. IRE and IRE ELiT employ 250 people at the moment.