ACHIEVEMENTS OF THE IRE LEU CONVERSION PROGRAM

Mo-99 International symposium, Vienna

Valery Host, R&D Manager

October 6th, 2022

2 entities, 3 business lines

Currently more than **260** employees

Our priority?

Promoting the beneficial use of radioisotopes for medical purposes whilst ensuring the absence of harmfulness

Management team

Public Utility Foundation
founded in **1971**

Limited company
founded in **2010**

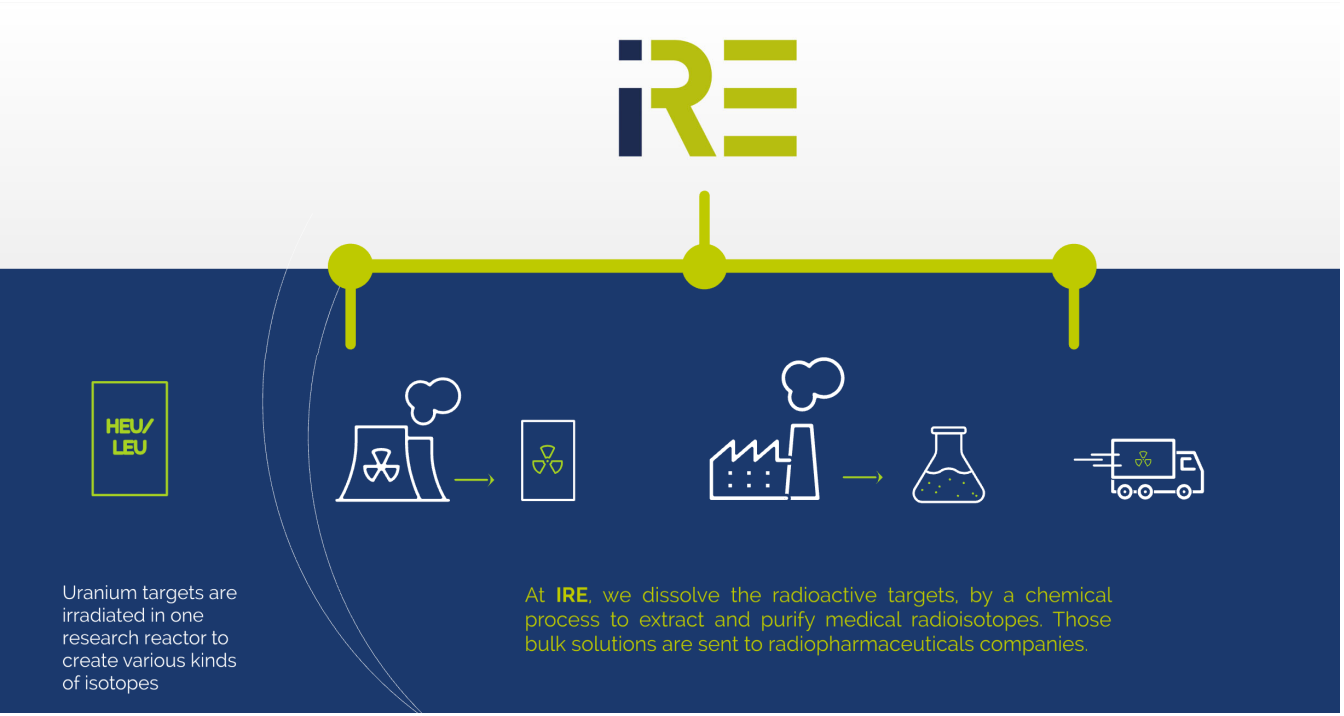
Analysis and control of radioactivity

Radioisotopes

Radiopharmaceuticals

IRE

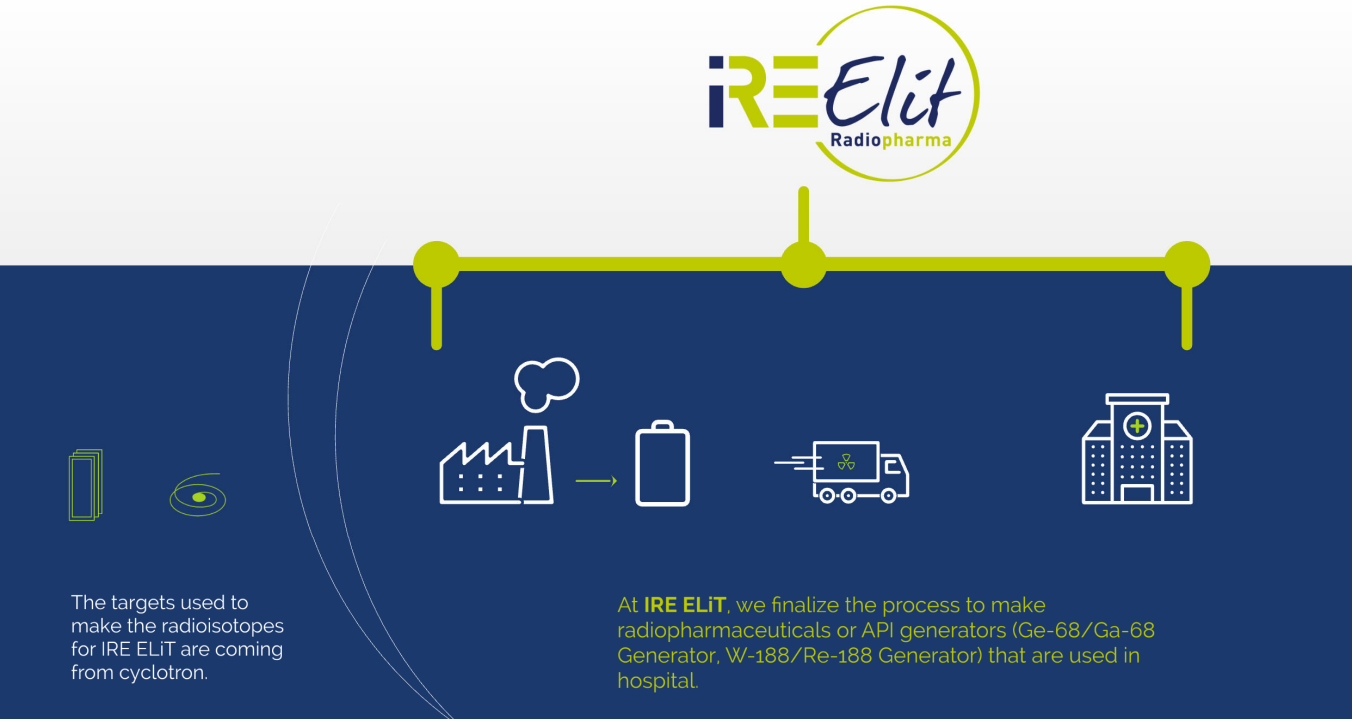
B to B model for nuclear medicine



- Major producer of fission I-131
- Major producer of Mo-99 for Europe
- Xe-133

IRE ELiT

B to C model to best serve hospitals and radiopharmacies



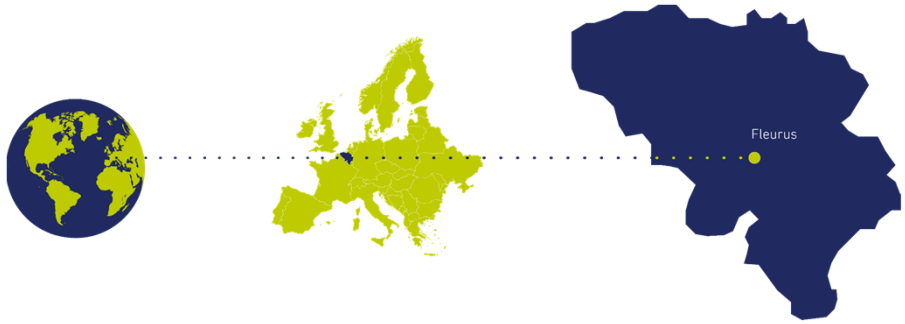
“Doing PET as simply as SPECT”

- Approved in Europe in 2018 (13 countries), US and Canada

What makes us unique

- An **ideal geographical location** for logistics

  Fleurus is located at the heart of a road network, less than 350 km from 4 international airports, less than 300 km from 2 research reactors and less than 1000 km for the 3rd one.



- An **exceptional supply chain**, which allows uninterrupted production.

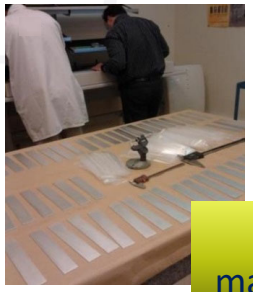
- A **partnership with the transport company** Transrad, on our site.

- A reactive and close **customer service**.

LEU conversion

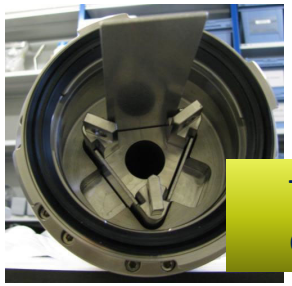
IRE LEU conversion challenges

- **Important modifications of target specifications**
- **Safety improvements required**
  - Important chemical process modifications
  - Production equipment modifications
  - Production environment updates : hot cells and ancillaries
- **3 processes to convert**
  - Mo-99 I-131 Xe-133
- **<u>No interruption of supply !</u>**



Target manufacturing

Irradiation



Transport container

LEU Conversion

- **New impurity profile**
- **Unique specification**

- **Reactors to accomodate new specifications**
- **Lower yield**

- **Modifications of design**
- **Revision of Transport License**

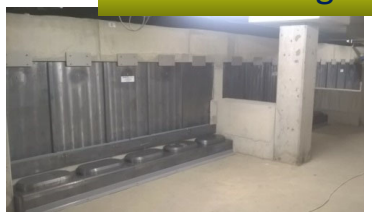
- **Modified chemical process**
- **Hydrogen risk management**
- **Uranium filtration**
- **Iodine trapping**

- **Increased quantities**

LEU Conversion

Processing

Waste management

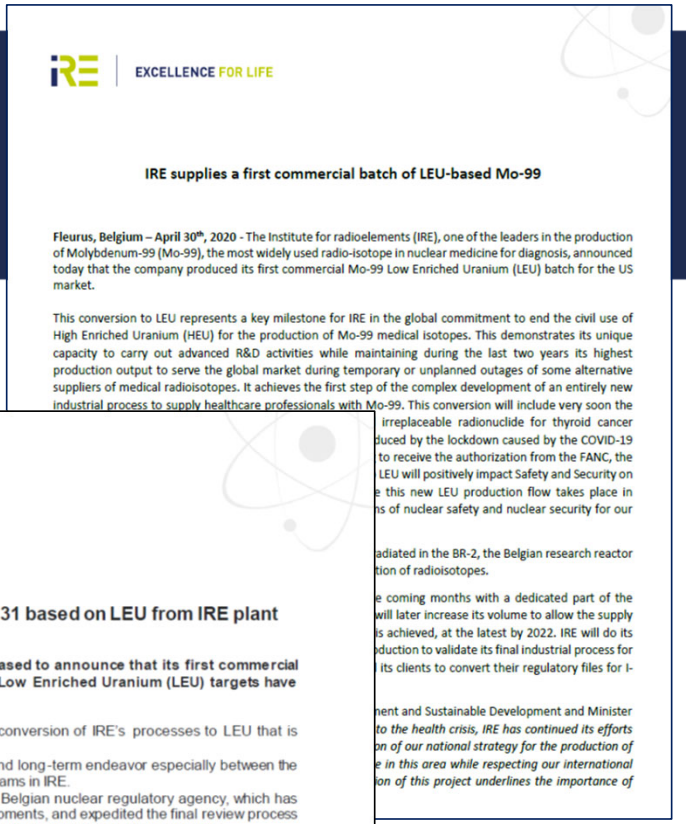


Hot cells

- **Post Fukushima stress tests**
- **New processing equipements**

Commercial productions

- Mo-99 since April 30rd, 2020
- I-131 since February 1st, 2022

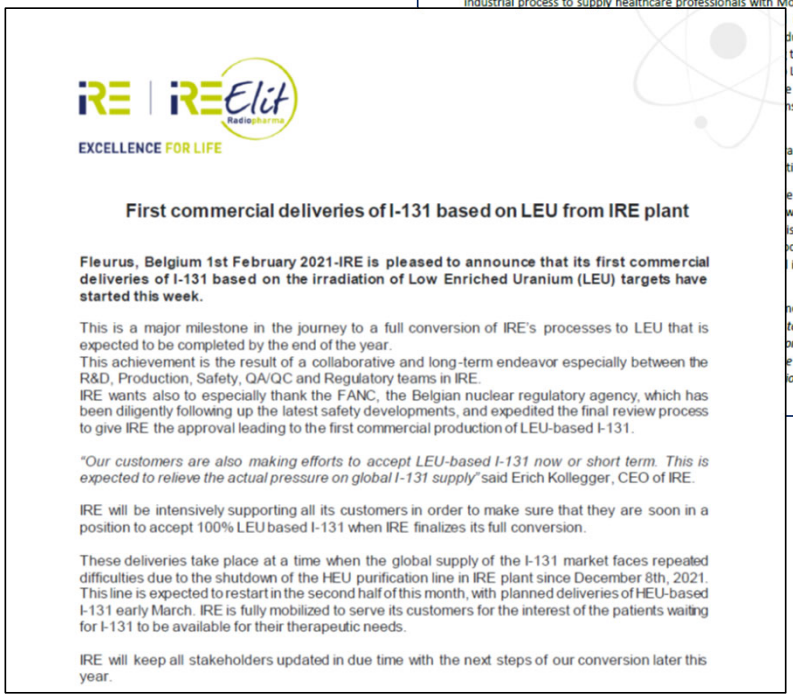


IRE | EXCELLENCE FOR LIFE

IRE supplies a first commercial batch of LEU-based Mo-99

Fleurus, Belgium – April 30th, 2020 - The Institute for radioelements (IRE), one of the leaders in the production of Molybdenum-99 (Mo-99), the most widely used radio-isotope in nuclear medicine for diagnosis, announced today that the company produced its first commercial Mo-99 Low Enriched Uranium (LEU) batch for the US market.

This conversion to LEU represents a key milestone for IRE in the global commitment to end the civil use of High Enriched Uranium (HEU) for the production of Mo-99 medical isotopes. This demonstrates its unique capacity to carry out advanced R&D activities while maintaining during the last two years its highest production output to serve the global market during temporary or unplanned outages of some alternative suppliers of medical radioisotopes. It achieves the first step of the complex development of an entirely new industrial process to supply healthcare professionals with Mo-99. This conversion will include very soon the



IRE | IRE Elit Radiopharma

EXCELLENCE FOR LIFE

First commercial deliveries of I-131 based on LEU from IRE plant

Fleurus, Belgium 1st February 2021-IRE is pleased to announce that its first commercial deliveries of I-131 based on the irradiation of Low Enriched Uranium (LEU) targets have started this week.

This is a major milestone in the journey to a full conversion of IRE's processes to LEU that is expected to be completed by the end of the year.
This achievement is the result of a collaborative and long-term endeavor especially between the R&D, Production, Safety, QA/QC and Regulatory teams in IRE.
IRE wants also to especially thank the FANC, the Belgian nuclear regulatory agency, which has been diligently following up the latest safety developments, and expedited the final review process to give IRE the approval leading to the first commercial production of LEU-based I-131.

"Our customers are also making efforts to accept LEU-based I-131 now or short term. This is expected to relieve the actual pressure on global I-131 supply" said Erich Kollegger, CEO of IRE.

IRE will be intensively supporting all its customers in order to make sure that they are soon in a position to accept 100% LEU based I-131 when IRE finalizes its full conversion.

These deliveries take place at a time when the global supply of the I-131 market faces repeated difficulties due to the shutdown of the HEU purification line in IRE plant since December 8th, 2021. This line is expected to restart in the second half of this month, with planned deliveries of HEU-based I-131 early March. IRE is fully mobilized to serve its customers for the interest of the patients waiting for I-131 to be available for their therapeutic needs.

IRE will keep all stakeholders updated in due time with the next steps of our conversion later this year.

IRE | IRE Elit Radiopharma

Lessons learned

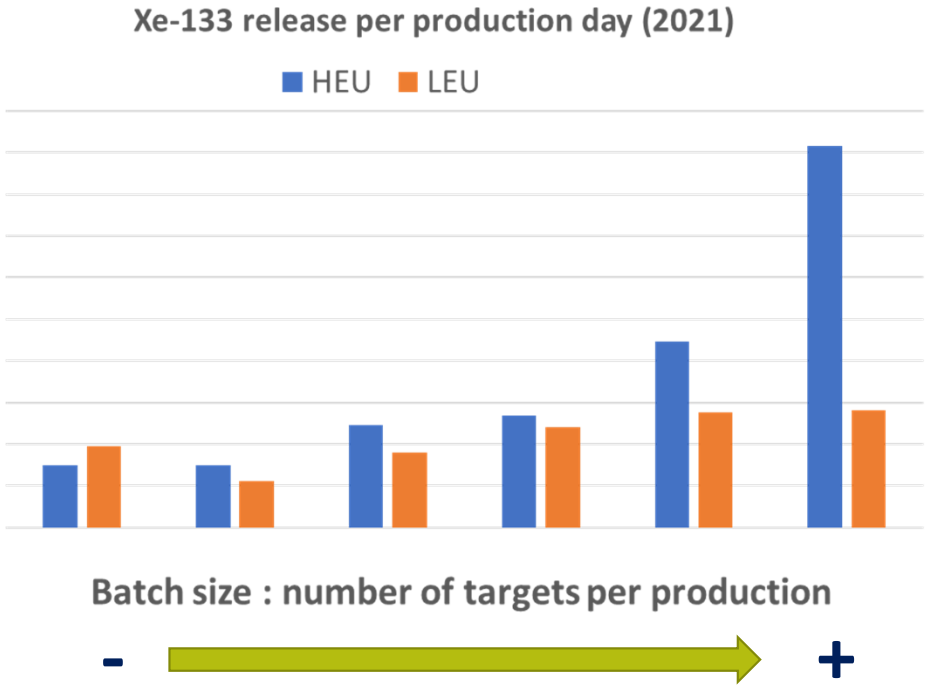
- R&D full scale tests
  - R&D in GMP production environment
  - People management
- 3 HEU productions per week in parallel
  - Preserve Mo-99 and I-131 supply
- Weekly LEU run
  - According to irradiation position availability

Lessons learned

- Increased safety but more complex to run
  - Operator training, supervision
- Processing time identical but steps distributed differently
  - Delivery schedule unchanged
- Loss of efficiency is confirmed with additional waste produced

Lessons learned

- Xe-133 emission reduction



Mo-99 and I-131 customer validations

- Mo-99
  - All customers validated
  - All customers are LEU Mo-99 ready
- I-131
  - Commercially available, all regulatory files filed
  - 75% of customers ready to accept LEU iodine
  - Full IRE support

Phase out and I-131 market

- We need to support customers that have not yet validated LEU I-131
  - Complete HEU phase out by Q1-2023
- Guarantee enough supply to the market during planned Maria shutdown, scheduled to end by 28 February 2023
- Dedicated productions for I-131 if necessary

Summary

- A lot of technical and radiochemical challenges were overcome
- All LEU high active tests were performed without any interruption of Mo-99 and I-131 supply
- Loss of efficiency is confirmed with additional waste produced
- Lower Xe-133 emissions
- Continuous improvements to ensure a reliable and high quality supply of radioelements from LEU

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