**$^{99}$Mo Topical meeting 2014, Washington**

# Status of the IRE LEU conversion program

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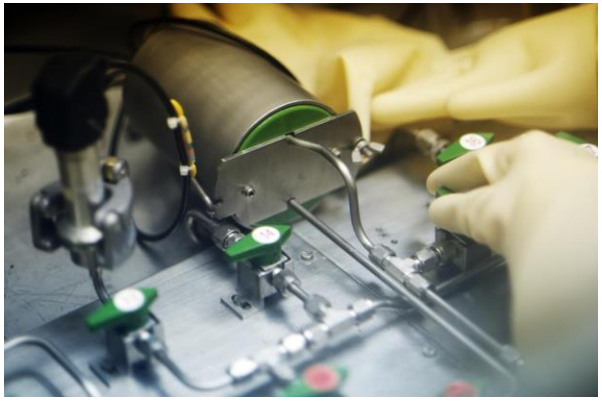
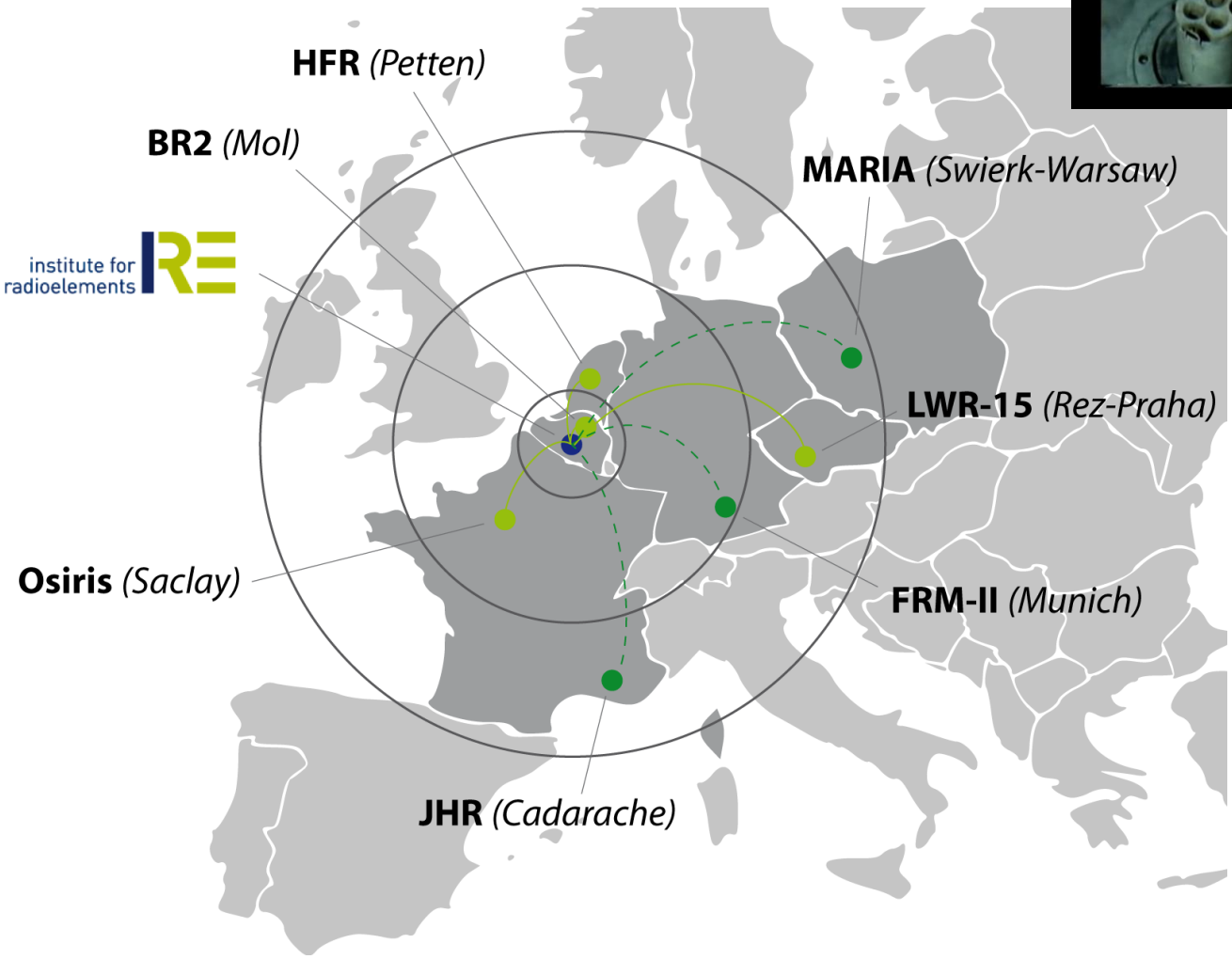
# *IRE, a world leader*

- **Major producer of fission $^{131}I$**
- **Major producer of $^{99}Mo$**
  - 3 productions/week ; 365 days/year
  - 50 % of European needs,
  - 350 000 procedures /month
  - Exportation
    - Europe
    - USA
    - Asia
    - Middle east
  - Other Isotopes: Y-90, Re-188, ...



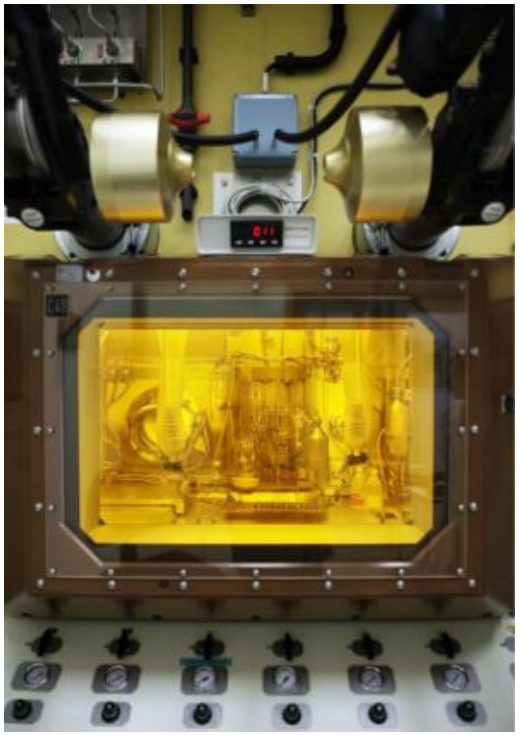
# Target irradiation



# LEU conversion commitment

- **Currently running with HEU**
- **Fully committed to LEU conversion**
- **Security of supply**

- **Project fully staffed since 2011**
- **> 25 IRE persons involved**
- **> 15 M€ total budget**



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# IRE specific LEU challenges

- Increase overall process safety
- Reduction of gaseous releases
- Production capacity : 3500Ci/week – 6D calibration
- No interruption of HEU process
- Stress test results compliance

First commercial LEU production Feb 2016

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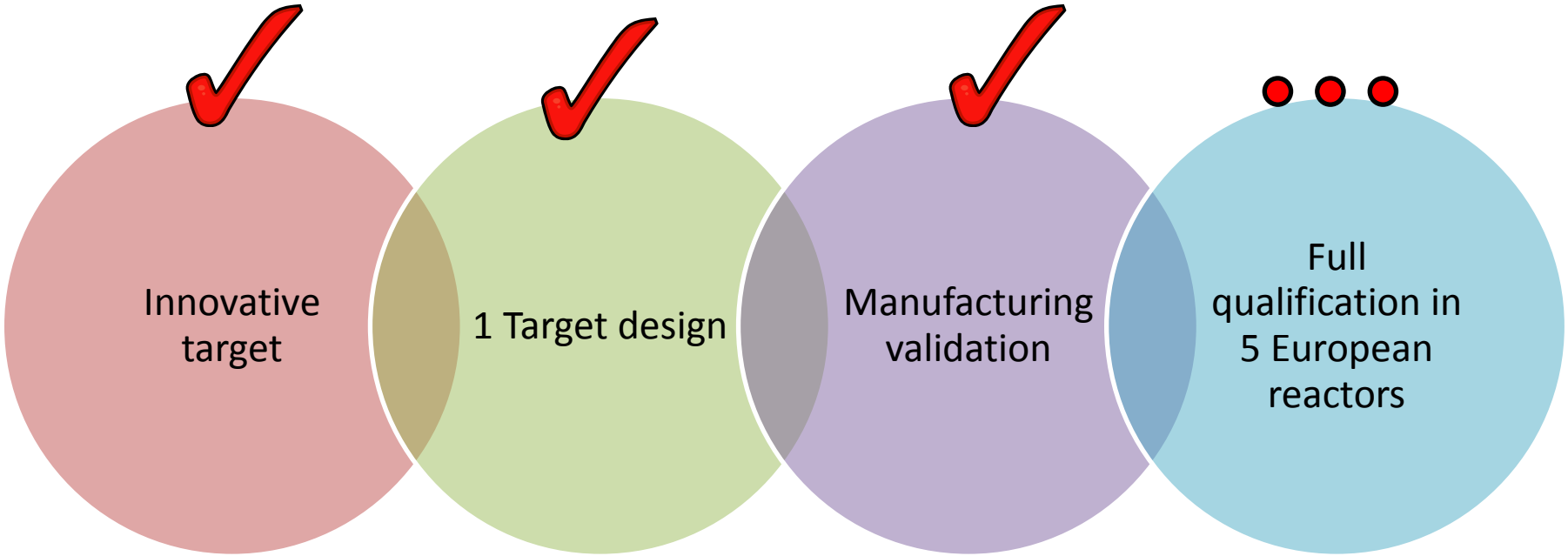
# IRE specific LEU challenges

- High impact on the purification process while minimizing the changes and the losses
  - Innovative way to trap iodine
  - Xenon trapping and decay
- Hot cell refurbishment and modifications
  - According to stress tests
  - Management of both HEU and LEU batches
- High impact on the Safety Analysis Report

# Target specifications




- Maintain the U-235 content
- Increase the uranium loading
- Al alloy cladding

Fits all reactors

**Reliable supply of $^{99}$Mo**

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# Target irradiation

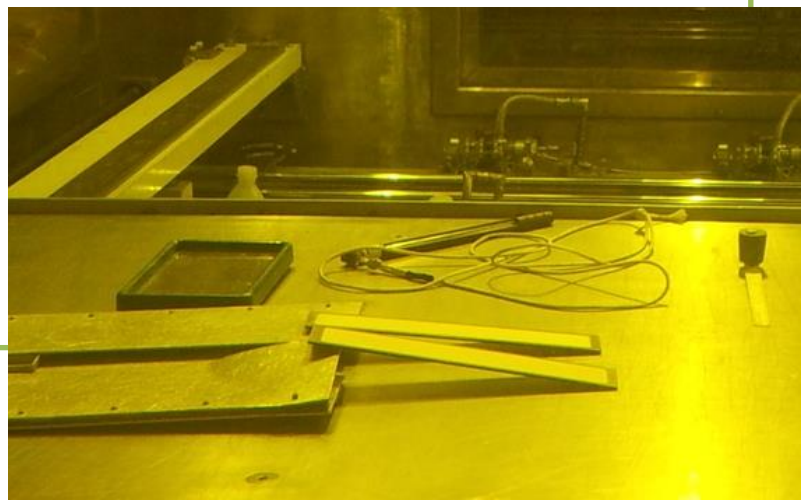
- In BR2 reactor first
  - Highest neutron flux
- Several irradiation cycles
- Boundary conditions have been explored
  - Long irradiation time
  - High power

Courtesy SCK-CEN

- ✓ Nothing unusual was noted during visual inspections
- ✓ No blistering
- ✓ No particular color

# Target qualification

- On going non destructive tests
  - Visual inspection
  - Swelling measurements
  - Oxide layer thickness
  - Gamma spectroscopy



Courtesy SCK-CEN

**Safe use of targets**

# Transport container

- Modifications of inner parts to fit plates
- Design validated for remote operations
- Simulation of dry and underwater target loading
- Applying for a new transport license

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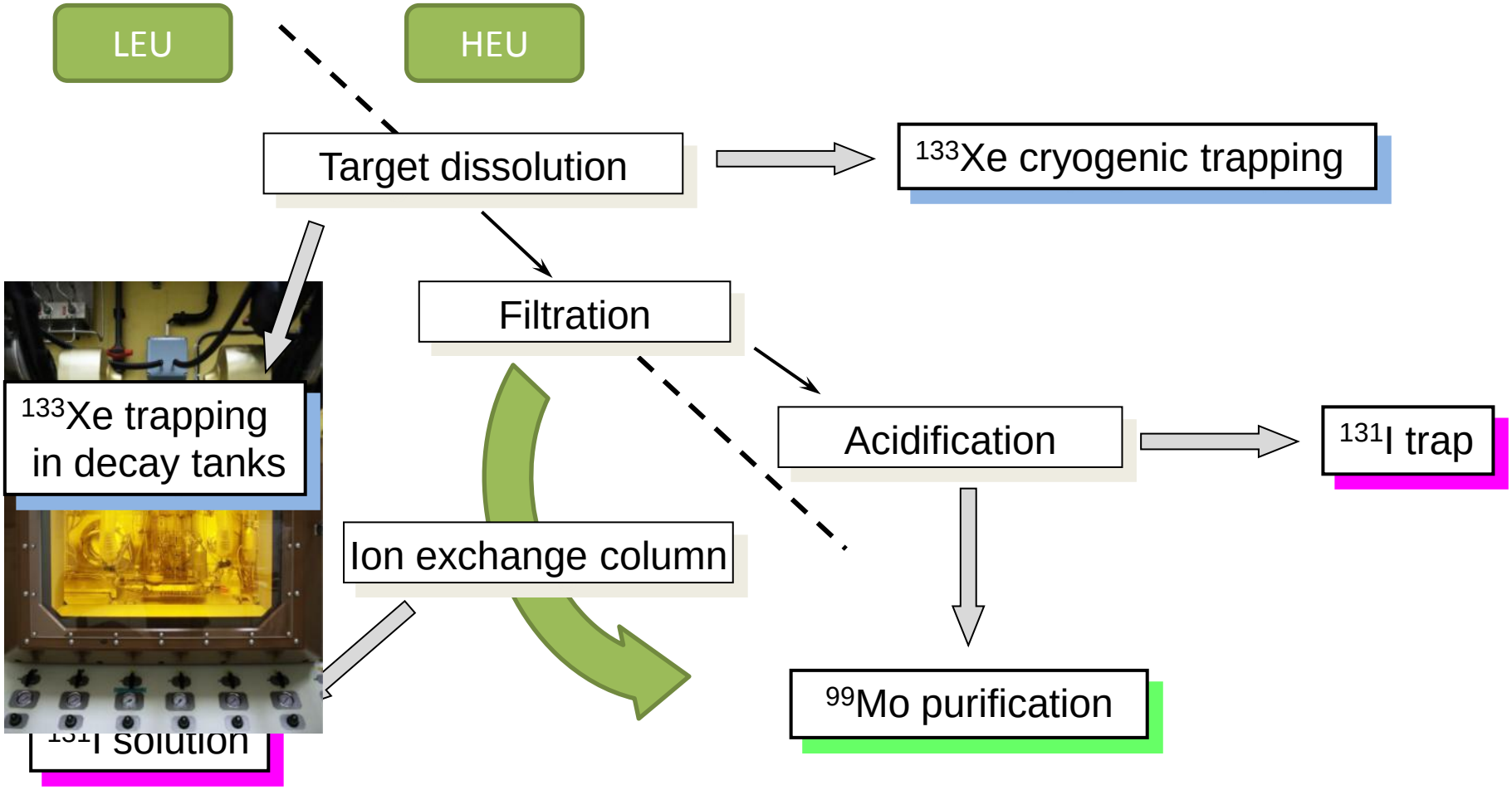
# Target processing



# Chemical process modifications

- A unique solution
- An additional barrier in the defense-in-depth system will be provided
- On going
  - High activity test on iodine process
  - Tests on depleted uranium targets
- Processing time could be impacted

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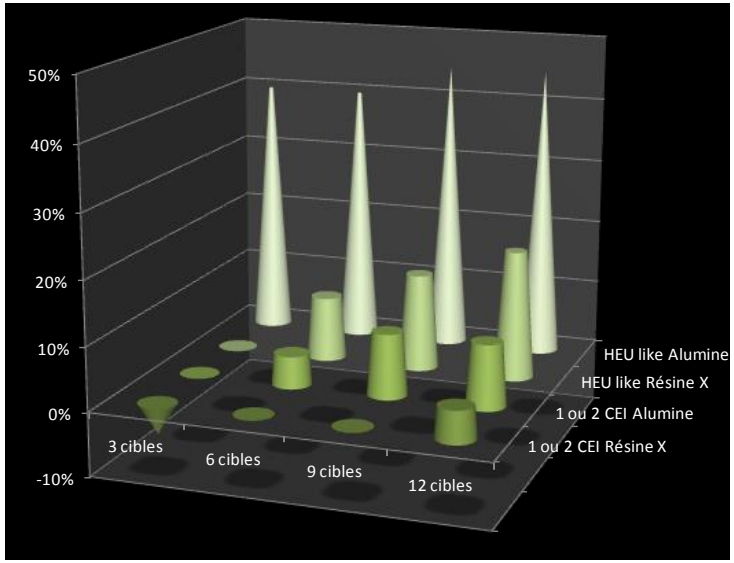
# Waste management

- Uranium waste
  - A capacity problem  due to new filtration conditions
  - Long term management issue

- Liquid waste
  - New waste composition
  - Increased  volume of waste
  - Exisiting waste management facility
  - A licensing and efficiency issue

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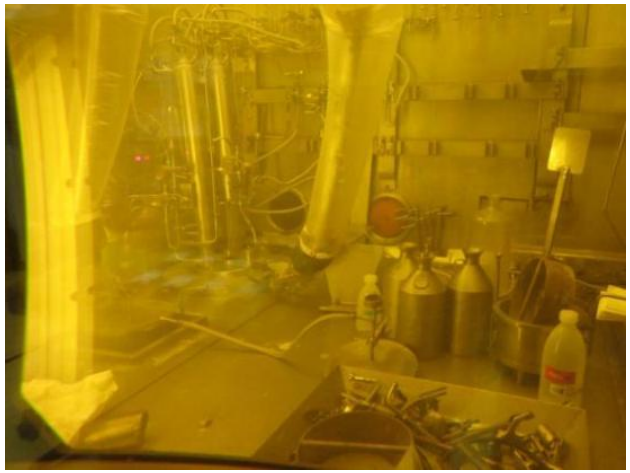
# XeMo1 refurbishment

- Experience feed back of the XeMo2 renovation
- Decontamination finished in July 2013
- End of renovation of hot cells: Q3 2014

# XeMo1 refurbishment

- Dedicated Hot cell for the process upstream
  - Dissolution
  - $^{99}$Mo-$^{131}$I separation step
- Common hot cells for API purifications
- Guaranty of the security supply



# Risk Analysis

- ✓ Target qualification failure
- ✓ Chemical process and filtration
- ✓ Availability of appropriate production conditions
- ✓ Xe storage facility
- ✓ Reactor availability
- ✓ Regulatory approval
  - ✓ Nuclear safety
  - ✓ Pharmaceutical inspection

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# Next steps

- Target qualification : destructive tests
  - Radiochemical measurment of burnup
  - Electronic microscopy

→ **Irradiation safety margin**

- Cold and hot commissioning

- Process validation

- Ensuring a reliable, long term $^{99}$Mo supply
  - Target qualification in LVR15, HFR and FRM2 reactors

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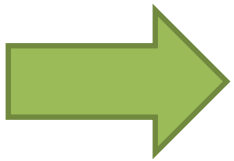
# Conclusions

- Significant steps have been already achieved
- Significant investment have been made in LEU production environment
- Tight schedule with multiple important tasks on the critical pathway
  - High impact on IRE organization

# Conclusions

- Possible conflicts with HEU productions during hot commissioning
- Higher Mo cost expected due to lower efficiency



**But no compromise on the security of supply**

# LEU conversion project. IRE Belgium

## Quarterly report n°6

Under the BOA 188839 contract

# Thank you for your attention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