The Belgian Nuclear Research Centre

60 Years of R&D for Peaceful Applications of Radioactivity

Hildegarde Vandenhove
Institute Director Environment Health and Safety

INTERNATIONAL NUCLEAR GRAPHITE SPECIALISTS’ MEETING

16 September 2019
Cradle of nuclear research, applications and energy development in Belgium
Created in 1952

SCK•CEN has more than 65 years hands-on experience on innovative research & development in peaceful nuclear applications
Innovative pioneering is our strength
>50% with academic degree out of which 150 PhD’s and 15 professors

~90 PhD students

~200 trainees
Research foundation under governmental auspices

Advanced Nuclear Systems

Environment Health & Safety

MINERVA Design & Build

Nuclear Material Sciences
Research foundation with horizontal programmes

Institute for Nuclear Materials Science

Institute for Environment Health Safety

Institute for Advanced Nuclear Systems

Institute for MINERVA Design & Build

NURA

RECUMO

MURHMA

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SCK•CEN is worldwide recognised for performing safety studies for existing and future nuclear power plants
BR2: a multipurpose research reactor

- Up to 100% of the world’s need for medical radioisotopes
- 25% of the world demand for semiconductors for renewable application
- Material irradiation and post irradiation tests for safety and integrity
SCK•CEN invests heavily in radiation protection, nuclear medicine and space research
SCK•CEN is a major player in decontamination, decommissioning, waste research and site remediation.
SCK•CEN investigates sustainable solutions for low and high level radioactive waste

Exploits with NIRAS/ONDRAF a unique underground research lab in clay layers
Advanced Nuclear Systems: the MYRRHA ADS-system
MINERVA Design & Build: 100 MeV accelerator

Belgian Government decided on 7 Sept 2018 to invest 558 M€ in MYRRHA

Multipurpose flexible Irradiation facility

Spallation source

Fast neutron source

Lead-Bismuth coolant

Reactor
subcritical mode (50–100 MWth)
critical mode (~100 MWth)
MYRRHA: a multipurpose flexible irradiation facility

- Multipurpose hybrid reactor for high-tech applications
- Fission GEN IV
- Fusion
- Spent nuclear fuel & high level waste
- Radio-isotopes
- Small and medium sized reactors
- Lead fast reactor
- Fundamental research
- Radio-isotopes
- Fusion
- Spent nuclear fuel & high level waste
- Radio-isotopes
- Fusion
Research & Development needs Education & Training
Major international player in the field of nuclear R&D
SCK•CEN performs research and contractual work worldwide in most of its disciplines

Europe
Belgium, France, Germany, UK, Italy, Norway, Russia, Spain, Sweden, Switzerland, The Netherlands, ....

Asia
Japan, South Korea, Kazakhstan, China, ....

Americas
USA, Argentina, Brazil, Mexico,....

Africa
Algeria, Tanzania, Gambia, South-Africa, .....
SCK•CEN actively participates in international organisations and committees

IAEA, OECD/NEA, ASTM, USNRC, ...

European Community programs:

Euratom; FP4 thru FP7, Horizon2020: 75% success rate!
BR1 at SCK•CEN

- **Air-cooled, graphite-moderated reactor** with metallic uranium as fuel.
- Contains **492 tons of irradiated graphite**
- In operation since **1956**, but still enough fuel left to run the reactor for several decades
- Mostly **material irradiation** and **neutron activation** for prompt gamma analysis
- **Annealed in 1962**; since then regular measurement of **Wigner energy**
- **Studies** on **future management** of i-graphite (start development of technique and **procedures for measuring** $^{14}$C and $^{36}$Cl activities)

*Monitoring Programme of the Wigner Energy at the BR1 Reactor  G. Vittiglio et al., SCK•CEN (Session 2)*
Thetis reactor at University of Ghent

- Small **open pool-type reactor** (max 250 kW) used as neutron source for **production of isotopes and for activation analysis**.
- Contained **3.2 tons of i-graphite**
- Operational between **1967 and 2003**
- Dismantling and official **declassification, 2015**
- **Treatment of i-graphite at Belgoprocess**

Treatment of Thetis Reactor Graphite at Belgoprocess  
*D. Van Herck et al., Belgoprocess (Session 1)*
Graphite and carbon materials in ISOL applications

- ISOL = Isotope Separation On Line - method for production and study of radionuclei with very low or no natural abundance.
- Carbon materials because of good combination of thermal, structural and nuclear properties → Recent applications currently under study at SCK•CEN
3 Belgian presentations on graphite (all today)

Session 1 – Mngt. and charact. of irradiated graphite waste #1

- Treatment of Thetis Reactor Graphite at Belgoprocess
  Diete Vanherck, Robin Tuerlinckx, Thomas Huys, Myriam Monsieurs and Isabelle Meirlaen; Belgoprocess

Session 2 – Mngt. and charact. of irradiated graphite waste #2

- Graphite and Carbon Materials in ISOL Applications
  Donald Houngho, Marc Dierckx and Lucia Popescu; SCK•CEN

- Monitoring Programme of the Wigner Energy at the BR1 Reactor
  Guido Vittiglio, Bart Van Houdt, Koen Van Aken, Elie Valcke and Frank Druyts; SCK•CEN