PAUL SCHERRER INSTITUT

PSI

D. Rochman, on behalf of the aiSFC team

aiSFC: Advanced and innovative Spent Fuel Characterization

Overview EURAD-2 WP proposals, Pitch session, online

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Zertifiziertes Managementsystem STARS ISO 9001

aiSFC: advanced and innovative Spent Fuel Characterization

EURAD SRA:

- Pre-disposal (Theme 2)
- Engineered Barrier Systems (Theme 3)
- Disposal facility design and optimization (Theme 4)
- Safety case (Theme 5)

29 supporting organizations:

- Sweden: SKB, UU, Studsvik, Lund
- Germany: BAM, KIT, HZDR
- Finland: VTT
- Spain: UPM, CIEMAT, ENRESA, IDOM
- Switzerland: PSI, Nagra, EPFL
- Bulgaria: ELKH, TUS
- Hungary: EK
- France: IRSN, CNRS
- International: JRC, IAEA
- Slovenia: JSI
- Belgium: SCK CEN
- Greece: NTUA
- Czech Republic: CTU
- Norway: IFE
- Lithuania: LEI, FTMC

Optimization, safety and risk assessment of spent fuel (SF) management and disposal operations by characterizing their physical and thermo-mechanical-chemical behaviour following state-of-the-art techniques.

➢ **Spent Fuel: unique safety challenge, unmatched hazard (dose, radiation, heat, criticality) over 100s thousands of years.**

Accurate characterisation of spent fuel (SF) properties is essential to ensure safe and cost-effective operations during SF (extended) interim storage, transport (after storage) and disposal.

- Development of **methods for numerical and experimental investigation** of the thermo-mechanical-chemical properties of SF during extended interim storage and transport after storage.
- **Novel digital techniques** to support safety analyses methods, e.g.
  - Machine learning for classification of SF properties and associated uncertainties,
  - Numerical consequence analyses of accident scenarios by means of digital twins.
- **Verification and validation** of data and methods for SF characterisation by state-of-the-art computer codes with available experimental data and development of characterization instrumentation.

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Currently available experimental data and previous studies focus on a subset of the expected SF inventory in Europe. Identified technical and experimental gaps should be the subject of further investigation (e.g., high burnup, MOX fuels).

- Assessment and research of back-end properties of all fuel types used and intended for use in the EU.
- VVER, CANDU, PWR, BWR, UO_2, MOX, high enrichment, high burnup

Accident tolerant fuels (ATF) will be mandatory in European taxonomy from 2025. Small modular reactors (SMRs) are under discussion for the near future.

- Assessment of impact of various reactor designs on the spent fuel management and identification of needed knowledge.
- Many types of SMRs, many types of ATF

Knowledge management and knowledge transfer to future generations of scientists in SF characterisation are a must and a challenge.

- Knowledge management and knowledge transfer.
- Unique challenge over many generations, multi-society information (language, science, knowledge…)