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European Joint Programme on Radioactive Waste Management

D. Rochman, on behalf of the EURAD WP 8

EURAD WP 8: Spent Fuel Characterization and evolution until disposal

TM on Spent Fuel Characterization, IAEA, Vienna, Austria,
12-14 November 2019

Zertifiziertes Managementsystem STARS ISO 9001

Summary

- What and why
- How and who
- Tasks 1 to 4
- Kick-off meeting

EUropean Joint Programme on RADioactive Waste Management

EURAD

5-year implementation phase 1 – EURAD-1

This project receives funding from the Euratom research and training programme under grant agreement No 847593.

These slides were prepared based the presentation for the General Assembly in Sept. 2019 and reviewed by P. Jansson (WP leader).

What and why ? 1/2

- To produce experimentally verified procedures to reliably estimate the isotopic content of SNF, including realistic uncertainties.

- To establish beyond state-of-the-art characterization techniques for spent nuclear fuel during its evolution from reactor unloading until disposal.

- To establish beyond state-of-the-art uncertainty quantification of the characteristics of the spent fuel during its evolution during pre-disposal activities.

- To contribute to education, training and building of competence in the subject.

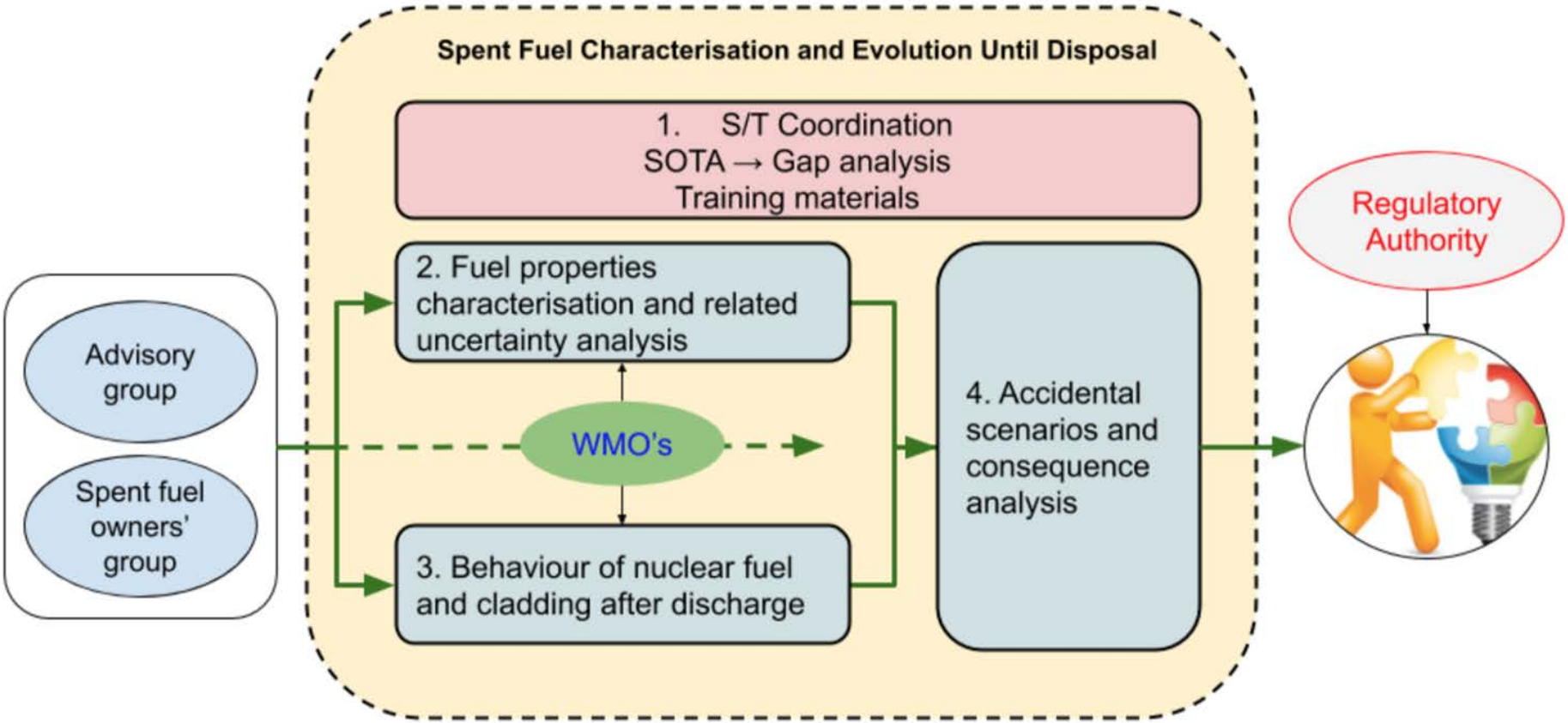
What and why ? 2/2

- To understand the performance of the spent fuel during pre-disposal, in order to build the capability for ensuring the safety of all safety relevant operations.

- To understand the behavior of fuel, cladding, fuel-cladding interaction (PCI) and ageing effect under normal and postulated accident scenarios until disposal, in order to identify relevant or typical bounding cases at time of re-conditioning and pre-disposal activities.

- To give contribution to operational safety concepts for fuel handling at SNF packaging facilities.

How and who ? 1/4



How and who ? 2/4

Partner number and short name	WP8 effort
5 - CEA	10.90
6 - CIEMAT	160.27
IDOM	14.21
UPM	
7 - ChRDI	
8 - CNRS	
UMontpellier	
10 - FTMC	
14 - ENRESA	

Partner number and short name	WP8 effort
15 - JUELICH	0.00
HZDR	36.00
22 - JSI	10.80
23 - JRC	63.48
24 - KIT	19.34
PEL	2.10
BAM	30.00
25 - LEI	7.00
26 - MTA EK	22.00
27 - NAGRA	8.84
34 - PSI	30.10
38 - SCK•CEN	15.54
39 - SKB	0.00
UU	54.72
40 - SSTC NRS	3.12
42 - SÚRAO	0.00
CTU	0.44
46 - TUS	16.97
50 - VTT	10.00
Total	653.65

How and who ? 3/4

- **Task 1** – S/T coordination, State-of-the-art and training material
  - Task Leader: [SKB (UU)]
  - Task contributors: [CIEMAT] [JRC] [KIT-BAM] [NAGRA] [SKB (UU)]

- **Task 2** – Fuel properties characterization and related uncertainty analysis
  - Task Leader:[JRC]
  - Task Contributors: [CIEMAT] [CPST] [SURAO (CTU)] [ENRESA (ENUSA)] [JRC] [JSI] [KIT (PEL)] [LEI] [NAGRA] [SSTC NRS] [PSI] [SCK•CEN] [TUS] [SKB (UU)] [VTT]

How and who ? 4/4

- **Task 3** – Behavior of nuclear fuel and cladding after discharge
  - Task Leader: [KIT (BAM)]
  - Task contributors: [CIEMAT (UPM)] [CNRS-ICSM/CEMHTI (UMontpellier)] [FZJ (HZDR)] [JRC] [KIT (BAM)] [MTA EK] [NAGRA] [PSI] [TUS] [VTT]

- **Task 4** – Accidental scenarios and consequence analysis
  - Task Leader: [CIEMAT]
  - Task contributors: [CEA] [ChRDI] [CIEMAT (IDOM)] [NAGRA] [TUS]

S/T coordination, State-of-the-art and training material

Status:

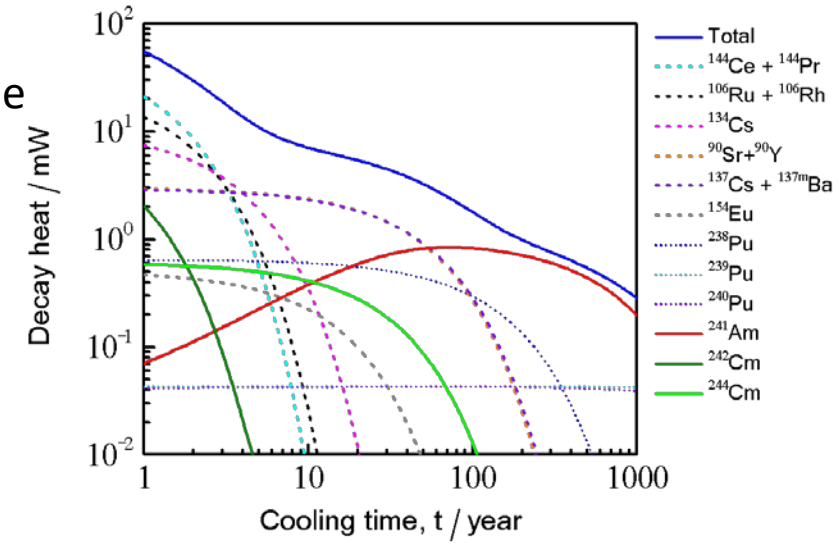
- Collection of materials for the SOTA report from tasks 2-4 is on-going. To be done by end of September.
- Results from the Blind Test to be input to the SOTA report and Task 2.
- First draft in November. Finalization in December.
- Distribution in January 2020.

Task 2

Fuel properties characterisation and related uncertainty analysis

Subtasks:

- Theoretical study of SNF source terms
- Develop, improve and demonstrate NDA methods/systems for SNF characterization
- Determine the inventory of activation and fission products in cladding material
- Define and verify procedures to determine the source terms of SNF assemblies with realistic confidence limits

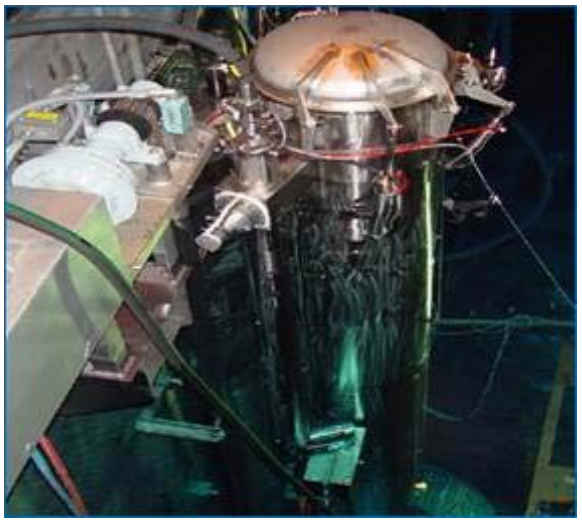


Task 2

Fuel properties characterisation and related uncertainty analysis

Status:

- SNF's have been selected - to be used as the basis in the code comparison, including sensitivity and covariance analysis.
- Existing experimental data to be used for statistical analysis is being collected from participants. (ɣ spectroscopic, DDA & DDSI neutrons and calorimetric data)



Task 3

Behaviour of nuclear fuel and cladding after discharge

Subtasks:

- Thermo-mechanical-chemical properties of the SNF rods and cladding
- Behavior of SNF pellets under interim storages conditions
- Pellet-cladding interaction under conditions of extended storage, transport and handling of SNF rods

Behaviour of nuclear fuel and cladding after discharge

Status:

- is planning a request of the first steps and actual status of work from the partners (Beneficiaries and LTP). The partners should describe the state-of-the-art and then identify the lack of knowledge and planned actions to fill the gap. We collect this information as input to the SOTA report.

- is planning the collection of information about experiments and expected experimental results as input for Task 4 to feed and validate codes applied to accident scenarios.

Accidental scenarios and consequence analysis

Subtasks:

- Consequence analysis of postulated accidents
  → Using input from tasks 2 and 3

Status:

- Will start later in the programme.

Kick-off meeting

- Kick-off meeting was held August 7-8 at SKB headquarters in Stockholm.

- 29 on-site and ~5 remote participants + “observers”.

- PMO representative presented regarding periodic reporting, meetings and EURAD procedures.

- IAEA was represented, key-note presentation about IAEA activities relevant to spent fuel management.

- Group work, per task: Synchronize time plans and expected “cross-talk” between tasks and out from the WP.

- Next WP meeting to be held in December, then once per year.

Conclusion/Expected impacts

- Regarding RWM implementation needs:
  - Reduced uncertainty on estimates of decay heat.

- Regarding safety:
  - Reduced uncertainties on safety related parameters
  - To contribute to operational safety of both interim storage and fuel packaging facilities.
  - Enhance assessment of consequences of design changes of pre-disposal activities

- Regarding increasing scientific and technical Knowledge in RWM:
  - New insight on degrading mechanisms that are still not explained.
  - Increased knowledge for the European case (higher BU, MOX, temperature profiles and histories)
  - Additional understanding of the rods behavior during storage

- Regarding radioactive waste management routes:
  - Impact from performance assessment and regulatory requirements point of view (licensing process)

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Wir schaffen Wissen – heute für morgen