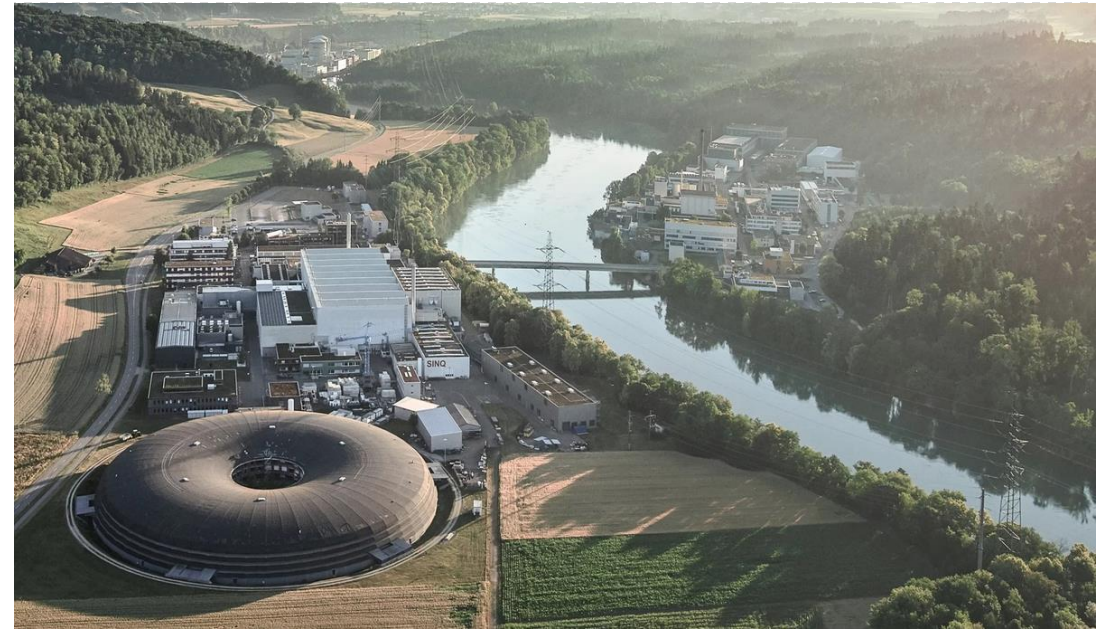


PSI Center for Nuclear Engineering
and Sciences



Opening remarks – SG16 on *“Computational Spent Nuclear Fuel decay heat: the PWR 0E2 case”*

D. Rochman

WPNCs SG16 Meeting, September 25th, 2024,

OECD-NEA, Boulogne Billancourt, France

- Feedback from SG12
- Recall of the general goal, activities, motivation, preliminary results
- Today's meeting

- SG12
 - On assessing our current knowledge regarding decay heat for current SNF
 - From January 2022 to December 2023
- Main outcomes:
 - Gather actors from different horizons and exchange of knowledge
 - Find a consensus, presented in
 - Publication at the ICNC 2023 conference
 - Accepted review paper in EPJ/N
- Related activities:
 - IAEA CRP, national projects, EU projects, blind decay heat benchmark, ongoing EPRI/SKB report
 - Recent discussion on knowledge associated to the “burnup quantity”
- Follow-up activity: this SG16, on “Computational Spent Nuclear Fuel decay heat: the PWR 0E2 case”

- 1st meeting: today

- Goals:
 - Defining a decay heat benchmark (done)
 - Perform required calculations (to be submitted before end 2024)
 - Analyze results (2025)
 - Report/publish results and discussions (2025)
 - Possibly extend the benchmark with new measurements & analysis (2025)

SG16 decay heat benchmark



- Specifications: sent by email on August 29



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31 July 2024

NUCLEAR ENERGY AGENCY
NUCLEAR SCIENCE COMMITTEE

Working Party on Nuclear Criticality Safety (WPNCSS)

Decay heat computational comparison exercise: definition for a PWR UO₂ assembly and pincell

Specifications for the exercise of WPNCSS SG16

Revision of June 25th, 2024: in table 4, He gap density was corrected to 1.3e-3 g/cm³ (in lieu of 1.3e-4 g/cm³)

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PAUL SCHERRER INSTITUT



**Decay heat computational benchmark:
definition for a PWR UO₂ assembly and pincell**

WPNCSS SG16

D. Rochman

Reactor Physics and Thermal hydraulic Laboratory, PSI, Switzerland

SG16 decay heat benchmark



- Specifications: sent by email on August 29
- Benchmark description in the document
 - Pincell
 - Assembly
 - 6 measurements

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3 Decay heat measurements for assembly 0E2

A total of 6 measurements was performed for assembly 0E2. The first one is mentioned in Ref. [1], and the 5 later ones in Ref. [2]. They are listed in Table 4, with the cooling time relative to the shutdown date for cycle C5: July 7, 1988.

Table 5: Decay heat measurements for assembly 0E2.

Cooling time (days)	Measurement date	Gamma escape (W)	Total decay heat (W)	Uncertainty (in W, 1 σ)	Reference
5823	16/06/2004	15.5	587.9	7.0	[1], pages 19,34/253, [2], Table A.2
6389	03/01/2006		566.0	6.9	[2], Table A.2
6390	04/01/2006		567.7	6.9	[2], Table A.2
7826	10/12/2009		522.4	6.6	[2], Table A.2
7837	21/12/2009		525.6	6.6	[2], Table A.2
7970	03/05/2010		520.1	6.6	[2], Table A.2



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- Required output: fill an Excel table about
 - Calculated decay heat at the measured times
 - Decay heat contributors
 - Neutron and gamma emission at the measured times
 - Number densities (during irradiation and at measured times)
 - k_{∞}
 - Fission rates
- Only the decay heat is measured
- All other quantities are only calculated
- Excel document distributed and available on the SG16 webpage

- As of today:
 - Results received from 4 institutes
 - Some institutes provided different scenarios (nuclear data, codes, options)
 - In total:
 - 12 calculations for the pincell and
 - 6 calculations for the assembly
- Some preliminary results at EOL ($\Delta = 1$ standard deviation)
 - Δk_{∞} : ≈ 2000 pcm
 - $\Delta^{235}\text{U}$: ≈ 2 %
 - $\Delta^{239}\text{Pu}$: ≈ 2 %
 - Δ neutron emission: ≈ 2 %
 - Δ gamma emission: ≈ 40 %
- Average pincell C/E decay heat: 1.034 ± 0.012
- Average assembly C/E decay heat: 0.995 ± 0.007

Today's meeting



- Presentations from different participants
- Discuss the plan (timeline, data to be analyzed, how to present)
- Possible extensions (new measurements, or including other existing measurements)

Many thanks

- Questions ?

