2nd Workshop of Spanish Users on Nuclear Data "the Accident Tolerant Fuels for LWRs" (Tele-conference)

May 20, 2020
Universidad Politécnica de Madrid
Instituto de Fusion Nuclear "Guillermo Velarde"
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SUMMARY RECORD

O. Cabellos (UPM/SP) opened the meeting and welcomed all participants (a list of participants is in Annex 1, agenda is in Annex 2).

1. Welcome and introduction to the meeting

The chair, **J. Dies** (CSN/SP) opened the meeting and introduced participants in different ATFs issues important for nuclear energy applications: safety, reliability, flexibility, economics, etc … He highlighted the importance of this meeting to identify user needs (nuclear data, neutronics, simulation…) to achieve these objectives.

2. Technical Presentations

- "*The JEFF nuclear data file and the need for your development goals*", A. Plompen (JRC/BE)
  A. Plompen presented the current status of the JEFF-3.3 evaluation (Nov. 2017) and the roadmap for JEFF-4 development (2020-2024). He pointed out the importance of this meeting to identify nuclear data needs for future reactor applications. So that JEFF libraries can take them on board in the future.

- "*Nuclear Data for ATF: A UK perspective*", A. Simpson (NNL/UK)
  A. Simpson presented an overview of NNL activities and Advanced Fuel Cycle Programme. He pointed out the need of better nuclear data for the assessment of advanced fuels and advanced reactors, including wastes of these systems. For ATFs, he explicitly mentioned the uranium nitride as a good candidate with potential use in fast reactors. A review of current nuclear data shows that ^{14}N(n.p) and ^{14}N(n,gamma) should be re-evaluated because current nuclear data would not be suitable for fuel qualification. Finally, he pointed out that there are no criticality benchmarks for nitride fuels which allow validation of these nuclear data.

- "*PSI developments on ATF*", C. Cozzo (PSI/CH)
  C. Cozzo presented PSI activities on ATFs. The Swiss simulation platform is shown including the capability to perform uncertainty quantifications. He also mentioned the irradiation campaigns of fuels with UO_2 doped with Cr_2O_3 in KKL(BWR) and UO_2 doped with Cr_2O_3 + Cr-coated/Zr cladding in KKG(PWR). He also mentioned irradiation campaigns in Goesgen with SiC claddings. In addition, data for screening SiC/UO2 and SiC/U_3Si_2 performance are presented. Finally, a numerical comparison of UO2 and U3Si2 composition irradiated in the framework of the burnup credit Phase-IB benchmark is presented.

- "*Current neutronics activities on LWR ATF at GRS*", R. Kilger (GRS/DE)
  R. Kilger presented a comparison of neutronics behaviour of six generic ATF model systems. SCALE-6.2.3 (T-NEWT code with ENDF/B-VII.1-56g, ENDF/B-VII.0-238g and ENDF/B-VII.1-252g) and SERPENT (CE-ENDF/B-VII.0) codes are used in this comparison. In addition, a selection of LCTs benchmarks is used for benchmarking calculation with Energy of Average Lethargy of Fission (EALF) values in the range of the six generic cases. Finally, he presented a first pin/assembly burn-up and activation studies, showing differences in the plutonium buildup, rim-effect and clad activation in a UO_2/FeCrAl cladding configuration.

- "*INGENIA/NUCLEAR: UPM-CDIO project in Nuclear Engineering Education*", V.J. Casas (UPM/SP)
  V.J. Casas presented the UPM/CDIO project on "Design and simulation of PWRs". This is the "INGENIA/NUCLEAR" course. This year, the work with students is focused on Accident Tolerant Fuels (ATFs) and 3D/simulation (SEANAP system) in a typical PWR Westinghouse, 157 fuel assemblies. In this PWR, Cycle-5 is used for comparison. Reference calculation is a loading pattern of 48 UO2-3.6wo/Zr-4 fresh fuel assemblies. Students were working to find 48 ATF/FAs with an equivalent cycle length. Six different types of ATFs are analysed.

- "*PWR 3D-Core Simulation using different ATF cladding materials*", G. Piedra (UPM/SP)
  G. Piedra presented results for four different cladding materials in the previous PWR system. Equivalent enrichments are found. For those cases A.O, peaking factor, reactivity coefficients, axial power distributions and bank worths were shown. In this presentation, JEFF-3.3 and ENDF/B-VIII.0 gave good agreement. No differences with nuclear data are expected.

- "*PWR 3D-Core Simulation using different ATF fuels*", M. Muñoz (UPM/SP)
  M. Muñoz presented results for four different ATF fuels in the previous PWR system. Updates in SEANAP system were explained: i) Reactivity-equivalent Physical Transformation (RPT) to be used in conjunction with WIMSD5 lattice code for TRISO/SiC modelization, ii) Teff fuel-temperature is updated based on thermo-mechanical data found in the bibliography. Equivalent enrichment are also found. For those cases A.O, peaking factor, reactivity coefficients, axial power distributions and bank worths were shown. In this presentation, JEFF-3.3 and ENDF/B-VIII.0 gave good agreement except for Doped-BeO with JEF-2.2

- "*Simulation of the Power Maneuvering of PWRs using new ATF*", J. Marín (UPM/SP)
  O. Cabellos presented an operational maneuver of return to power after a short (9 hours) shutdown in the previous PWR system. Calculations are performed at BOC and EOC for six different ATFs. Differences with Constant Axial Offset Control (CAOC) technique and optimized maneuver at Boron-constant are shown.

- "*Emerging activities on nuclear data for ATF at CIEMAT*", D. Cano (CIEMAT/SP)
  D. Cano presented CIEMAT activities on nuclear data and neutronics/burnup simulation for ATFs. Nuclear data needs for ATF concepts were identified. In addition, detailed calculations and S/U for high burnup scenarios were presented. He addressed issues such as reactor operation, cooling at pools, predisposal, re-processing and final disposal. A list of priority nuclear data is presented, including for example the following: ^{244,246}Cm, ^{143}Nd(n,gamma) and ^{155}Eu(n,gamma).

3. Summary: main actions for the JEFF nuclear data community

- Nuclear data needs (with uncertainties:
  - ATF cladding materials: Ti, Nb, Fe, Mo, Si, Cr.
  - ATF fuel materials: Be, ^{14}N(n,p), ^{14}N(n,gamma), ^{28}Si(n,gamma), ^{95}Mo(n,gamma)
  - High burnup : ^{143}Nd(n,gamma), ^{155}Eu(n,gamma), ^{244,246}Cm(n,gamma)
  - Neutron Thermal Scattering Laws: graphite, SiC
- More integral experiments (UN, U_3Si_2, …) for nuclear data validations of ATF concepts. Since experimental data in ICSBEP is scarce, also code-to-code comparisons may be included.
- Future needs in nuclear applications using higher enrichment: for current LWRs (5-10%), for advanced, SMRs and research reactors (20%)

APPENDIX 1. Agenda

Start - End	Presenter (Institution)	Title
9:00 - 9:10	O. Cabellos (UPM/SP)	Welcome
9:10 - 9:30	J. Dies (CSN/SP)	Introduction to the Workshop
9:30 - 9:50	A. Plompen (JRC/BE)	The JEFF nuclear data file and the need for your development goals
9:50 - 10:10	A. Simpson (NNL/UK)	Nuclear Data for ATF: A UK perspective
10:10 - 10:30	C. Cozzo (PSI/CH)	PSI developments on ATF
10:30 - 10:50	R. Kilger (GRS/DE)	Current neutronics activities on LWR ATF at GRS
10:50 - 11:00	V.J. Casas (UPM/SP)	INGENIA/NUCLEAR: UPM-CDIO project in Nuclear Engineering Education
11:00 - 11:10	G. Piedra (UPM/SP)	PWR 3D-Core Simulation using different ATF cladding materials
11:10 - 11:20	M. Muñoz (UPM/SP)	PWR 3D-Core Simulation using different ATF fuels
11:20 - 11:30	J. Marín (UPM/SP)	Simulation of the Power Maneuvering of PWRs using new ATF
11:30 - 11:50	D. Cano (CIEMAT/SP)	Emerging activities on nuclear data for ATF at CIEMAT
11:50 - 12:30	Discussion and closing remarks	

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