

Status Report of the WPEC Subgroup 6 (SG6) activities

A. D'ANGELO - April 1999

BACKGROUND

Two years ago, a meeting was held at Obninsk to review progresses on the Delayed Neutron Data activities (Colloquy on Delayed neutron Data, IPPE Obninsk, 9-10 April 1997 / see Minutes annexed to the 1997 SG6 Status Report). At the end of the meeting it was stated to terminate the SG6 activities after having defined a new group-structure of the time-depending parameters and written a state-of-the-art giving recommendations on the best Delayed Neutron data for the main fissile isotopes.

STATUS REPORT

The largest part of the SG6 activities has been carried out. A DRAFT (third revised version) of the SG6 **Final Report** is attached to the present 1999 status report.

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The **Introduction** and the **section II** of the SG6 final report are practically terminated.

Section III: The validation of main-fissile-isotope total-delayed-neutron-yields (DNY) on more than 20 integral results (in-pile effective-beta measurements) has been terminated by Eric Fort and Veronique Zammit (CEA/Cadarache). Section III will contain the report of this important action or at least a synthesis of it. Eric Fort has quite terminated the report (a draft version will be diffused directly by Eric Fort during the present WPEC-WPMA meeting).

Section IV: The results of 245 measured DN group constants for 20 different fissionable isotopes have been summarized in the LA-UR-98-918 Los Alamos Report (a literature survey on the last 50 years!). Then, the group parameters of these 245 set of measured delayed neutron group constants have been expanded into a new 8-group model based on a consistent set of group half lives (Los Alamos Report LA-UR-98-1619).

This new 8-group model, defined by Gregory Spriggs, Joann Campbell (Los Alamos) and Vladimir Piksaikin (IPPE/Obninsk), uses the same set of λ values for all the isotopes and all the incident neutron energies. This characteristic allows an important improvement of the kinetics calculations for actual reactor systems.

Moreover, the λ values of the first three groups satisfy the asymptotic die-away time constants associated with the three longest lived precursors of significant yield: ^{87}Br , ^{137}I , ^{88}Br ($T_{1/2} = 55.6$, 24.5 and 16.3 s respectively). This characteristic improves the analysis of negative-period reactivity measurements and the coherence between in-pile reactivity calibrations obtained by different techniques (negative period and rod drop).

Both the mentioned Los Alamos reports are also on the following WEB site:
http://public.lanl.gov/jomc/DN_TOC.html

The following general selection criteria have been used to choose the best sets of time-depending DN parameters to be recommended:

- Sample transfer time
- Graphical versus Least-Squares-Fit
- Standard Deviation of Parameters (uncertainty on the area under the DN decay curve)
- Consistency of Mean Half Lives
- Agreement with Systematic Models

For each of the 20 fissionable isotopes, Thermal, Fast and High-energy sets have been recommended. The Section IV of the SG6 Final Report will contain the 8-group model definition and the proposal of the recommended data (Los Alamos Report LA-UR-98-1619).

Section V: Six group DN spectra that matches the decay constants of Keepin's delayed neutron measurements have been obtained at Los Alamos by Joann Campbell and Gregory Spriggs. Joann Campbell and Gregory Spriggs are now producing a full set of 6 group and 8 group delayed neutron spectra for each of the 245 sets of measured DN parameters. The Section V of the SG6 final report will contain the results of this (now still in-progress) work.

Appendix A: Vladimir Piksaikin wrote the progress report relevant to the experimental activities at the Institute of Physics and Power Engineering - Obninsk. The report contain also the preliminary results of a very important study on the correlation properties of delayed neutron data. This study is still in progress (the end is foreseen on June of this Year), but the preliminary results allowed the choice of the best sets of time-depending DN parameters that have been recommended in the SG6 Final Report.

Appendix B: Shigeaki Okajima and Takeshi Sakurai wrote a summary of the BERENICE and the XIX International Benchmarks on effective-beta measurement promoted by WPEC respectively at the MASURCA (CEA/France) and at the FCA (JAERI/Japan) fast facilities. This summary contains the in-pile experimental results and the corresponding reactor calculational models for both the benchmarks.

By the way, it must be mentioned that the XIX campaign results will be also the object of a special issue of the **Progress in Nuclear Energy Journal**.

POSSIBLE IMPROVEMENTS OF THE SG6 RESULTS

Activities on DN data of major isotopes are still in progress at Obninsk:

1) Very promising correlation studies on both the total DNY and on the DN time-depending parameters will finish by June of this year. The definitive results of these correlation studies will improve the choice of the best data to be recommended. Systematics on the incident neutron energy dependence of the DN average half-lives should be also obtained.

2) measurements of the energy dependence relevant to the time-depending parameters for U-235, U-238, and Pu-239 are in progress. The neutron energy range is 0.3-5 MeV and 15 MeV (for U-238 1.2-5 MeV). The end of these measurements is foreseen at the current year end.

At the end of these activities, major actinide time-depending data could be recommended as a function of the incident neutron energy (as already done in the case of Total DNY). This means also that the coherence between recommended time-depending and total DNY data by could be improved.

3) the time schedule of the extension of the major actinide DN emission measurements to total yields for U-238(0.3-5,15MeV), Pu-239(0.3-5,15 MeV) and U-235(0.3-1 MeV) will depend on possible financial supports.

4) rearrangement of set-up to get thermal data for relative abundancies and Ti for U-235, U-238, Pu-239 are also in progress at Obninsk.

An extension of the SG6 activities can be foreseen to further improve the SG6 Final Report by including next Obninsk results on major isotope DN time depending parameters.