



8. Activity of the Delayed Neutron Working Group of JNDC and the International Evaluation Cooperation - WPEC/SG6

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The Delayed Neutron Working Group was established in April 1997 within the Nuclear Data Subcommittee of JNDC. It has two principal missions. One is to coordinate the Japanese activities toward the WPEC/Subgroup-6 efforts, and the other is to recommend the delayed neutron data for JENDL-3.3. The final report of Subgroup-6, which is one of the subgroups of the NEA International Evaluation Cooperation(WPEC) and is in charge of the delayed neutron data, is to be completed in 1999. Here in Japan, JENDL-3.3 is planned to be released in early 2000. Delayed Neutron Working Group is, then, going to finalize its activity by the end of the fiscal year 1999 after recommending appropriate sets of data as coherently as possible with the of Subgroup-6 efforts.

1. Introduction

The delayed neutron (DN) plays a crucial role in nuclear reactor in all senses. The DN data are, therefore, essential in various areas of the nuclear technology from a conceptual design of future reactors to daily operation of the power reactors. Here in Japan, various recommended sets of the DN data and the spectra of foreign-origin[1 ~ 5] had long been used rather occasionally in each company or laboratory. In generating JENDL-3 (Japanese Evaluated Nuclear Data Library version 3), the average numbers of DNs emitted per fission, ν_a , were critically reviewed among the evaluations to be included in it[6]. The six-group structure and the related constants, however, were simply taken from Tomlinson's work[4], and the energy spectra from Saphier's work[5].

2. WPEC Effort

In 1989 an international working group was set up as a co-effort of the NEA Committee of Reactor Physics and the NEA Nuclear Data Committee in order to activate the world cooperation of nuclear data evaluation. Two years later, in 1992, the working group was reorganized into WPEC, the Working Party on International Evaluation Co-operation, under the NEA Nuclear Science Committee. Subgroup 6 of WPEC, coordinated by G. Rudstam and monitored by R. D. McKnight, was given a mission to improve the DN data to meet the

required accuracy standard in predicting the reactivity scales of the fast and the thermal reactors. Subgroup 6, or SG6, classified their activities into the following three levels[7]. Key words in the parentheses may help in grasping the idea.

Level 1: the individual precursor, or microscopic, level (Pn-values, fission yields, summation calculations)

Level 2: the aggregate precursor, or macroscopic, level (fissile-wise DN data, group constants)

Level 3: the integral or reactor level (criticality experiments, reactor kinetics, validation of β_{eff})

After several years of low-key activity, SG6 was reactivated in accordance with the progress of the FCA-MASURCA joint experiments of β_{eff} in Level 3 [8]. They organized a Colloquy on Delayed Neutron Data at Obninsk, Russia, in April 1996 under the new coordinatorship of A. D'Angelo. In this Obninsk meeting they concluded that they had better concentrate on the activities of Level 2 and 3 in order to propose a new set of improved DN data within several years. Spriggs proposed to extend the group structure of DN representation from the current 6-groups to 8-groups[9] on the basis of the extensive survey[10] of the existing experimental data categorized to Level 2. In ref.[10], 238 sets of DN parameters for 20 different fissionable isotopes are listed and reviewed, but no Japan-origin data is given. This reflects the historical weakness of the Japanese domestic activity in the research field of Level 2. Figure 1 is a brief mapping of the WPEC/SG6-related, current activities in the world after D'Angelo's survey[7].

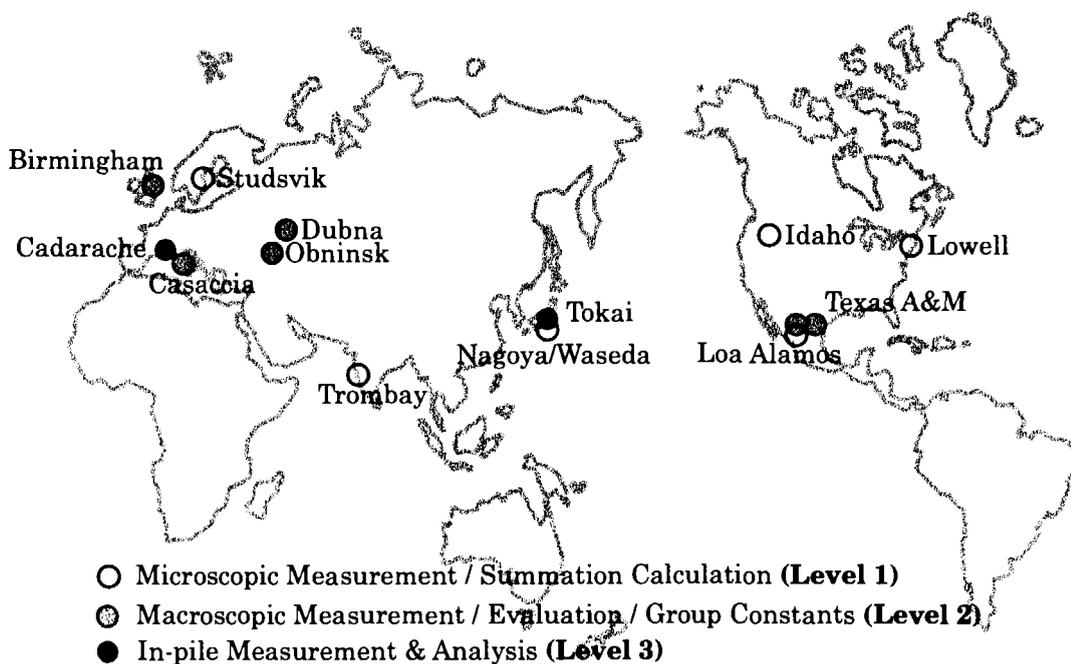


Fig. 1 WPEC/SG6-Related Activities in the World

At the Obninsk Colloquy, the SG6 members summarized the discussion as follows[11]: "The session devoted to a general discussion started with a presentation of the Japanese view[12] on the future programme of work for the subgroup. In summary, it was proposed that a state-of-the-art report, recommending the best delayed neutron data for the major actinides, should be written and published in 1998. The present subgroup should then be closed, and a new subgroup created for new interest areas, such as minor actinides". This recommendation met with general approval by the participants. Presently SG6 is working in accordance with this summary and the final report will be presented at the WPEC meeting to be held at Brookhaven National Laboratory on April 1999.

3. JNDC Effort

The Delayed Neutron Working Group was established in April 1997 with 9 members as a part of the Nuclear Data Subcommittee of the Japanese Nuclear Data Committee(JNDC). At the beginning, the mission of DNWG was to coordinate our domestic activities toward the WPEC/Subgroup-6 efforts and to avoid duplication in the work for SG6 and for JENDL-3.3. For this purpose DNWG made a proposal to SG6 at the Obninsk meeting[12] and it was approved by the participants there in principle as was described above. Soon after the Obninsk meeting, DNWG formally accepted the mission to recommend the DN data of major actinides, $^{235,238}\text{U}$ and ^{239}Pu , for inclusion in JENDL-3.3 upon a request from Heavy Nuclear Data Evaluation WG of JNDC.

The DNWG recommendation for JENDL-3.3 should be as coherent as possible with the coming SG6 recommendation. The latter, however, may possibly be given in a novel 8-group structure proposed by Spriggs[9]. G.D.Spriggs made a presentation on his 8-group structure at a DNWG meeting in Tokai in October 1997 [13], and the DNWG members studied his idea. Though it seemed to be a clear improvement from the conventional 6-group in a scientific sense, the DNWG members concluded that it is not appropriate to change the group structure from 6 to 8 in the coming JENDL-3.3 from the view point of the technological continuity. DNWG is, therefore, prepared to collapse the possible SG6 recommendation in 8-groups into a 6-group set for inclusion in JENDL-3.3 in case it becomes necessary. It may also help us to learn the effect of changing from 6 to 8. Anyway, we have to validate the DN data set on the basis of the integral, or Level 3, data from FCA and MASURCA [8], and from other two Japanese facilities; TCA and VHTRC. By the end of the year 1999 DNWG is to propose the best DN data sets for inclusion in JENDL-3.3.

4. Concluding Remarks

The three-year activity (1997-2000) of the Delayed Neutron Working Group is rather limited in its scope. It is, however, the first domestic working group concentrating on the delayed neutron in the 36-year history of JNDC, and we have to leave much to be experienced and studied in the future. In fact DNWG is to be closed in 2000, but a new working

group can be set up if we need the improved DN data for minor actinides, for example. In addition, the method-and-data for summation calculations, which is categorized to Level 1 in the SG6 classification, must be improved much further, not only for obtaining better DN data, but for all other technical goals concerning the aggregate behavior of the fission products; the decay heat, for example. After closing of DNWG, one of the working groups of JNDC will take over the works related to DN summation calculation putting it in an appropriate place in the wider range of the fission-product study, which is of common interest of both JNDC and WPEC.

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