

Recent Nuclear Data Needs from Innovative Reactor Design

M. Ishikawa (JAEA)

The Working Party on Evaluation Cooperation (WPEC) of the OECD Nuclear Energy Agency Nuclear Science Committee has established an International Subgroup (Subgroup 26) to perform an activity in order to develop a systematic approach to define data needs for Gen-IV and, in general, for advanced reactor systems. A comprehensive sensitivity and uncertainty study has been performed to evaluate the impact of neutron cross-section uncertainty on the most significant integral parameters related to the core and fuel cycle of a wide range of innovative systems, even beyond the Gen-IV range of systems. The analysis was performed in the past with an “home-made” ANL covariance matrix (“educated” guess of nuclear data uncertainties relying, as much as possible, on the nuclear data performance in the analysis of selected, clean integral experiments). In the present document, the integral parameter uncertainties previously calculated have been revised by the use of preliminary covariance data developed by joint efforts of several Labs within the WPEC Subgroup 26. As general features, the calculated integral parameters uncertainties, resulting from the presently assessed uncertainties on nuclear data are probably acceptable in the early phases of design feasibility studies. However, later conceptual and design optimization phases of selected reactor and fuel cycle concepts, will need improved data and methods, in order to reduce margins, both for economical and safety reasons. For this purpose, a target accuracy assessment has been also performed in order to give a preliminary quantitative evaluation of nuclear data improvement requirements (isotopes, nuclear reaction, energy range). The results of the assessment indicated that a careful analysis is needed in order to define the most appropriate and effective strategy for data uncertainty reduction. Priority issues are pointed out, and the role of integral experiments in order to meet requirements is underlined.

As for the future, it is proposed to WPEC to consider the setting-up of two new subgroups:

- A new specific Subgroup on “Methods and issues for the combined use of integral experiments and covariance data”. Participation of evaluators (to account for feedbacks to files) and a close link to related activities like the ones coordinated at the Uncertainty Analysis of Criticality Safety Assessment Expert Group (WPNCES) should be clearly established.
- A Subgroup that should organize the work needed to meet the requirements as they have been pointed out: share of work on different installations and different projects, evaluation etc.

The present draft has been compiled by G. Aliberti and sent out by Y. Rugama (available on the NEA website <http://www.nea.fr/html/science/wpec/meeting2007/SG26/>): It was agreed that the following items should be added to the present version:

- More details on covariance data (evaluation and processing: by P. Oblozinsky, based on his paper at ND-2007)
- Comment on improved approach in the resonance region (M.Dunn)
- Comments from LANL
- State of the art for current measurements and achievable accuracies (A.Plompen)
- Summary of findings by Ishikawa on self-shielding uncertainty effects on Doppler
- Comment by Rimpault on cross correlations (case of Na)
- Fission spectrum effects and comments on appropriate sensitivity coefficients (Aliberti will take care of different contributions)
- Comments by Ignatyuk on systematic errors in experiments and impact on e.g. Pu-239 fission uncertainty.
- Comment on availability of 3D sensitivity method based on MCNP (Hogenbirk).
- The presentation by G.Palmiotti can be used as Annex to present in general sensitivity methods.
- Annex to explain position on fuel cycle parameter uncertainty for future systems (see Mills presentation and paper, G. Rimpault, Y Rugama)

The next version of the Report will be assembled by January 30, 2008. This version will be finalized by March 2008 and submitted to WPEC.