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PROPOSALS ON R E N D A - A WORLD-WIDE COMPILATION OF REQUESTS FOR NEUTRON DATA MEASUREMENTS FOR REACTORS

Usachev L.N., Bobkov Yu.G.

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Proposals on REWDA

1. To change the title, i.e. add the word EVALUATIONS, so that the full title to be:

A World-Wide Compilation of Requests for Neutron Data Measurements and Evaluations for Reactors.

Addition of the word "evaluations" corresponds to the precise sense itself of demands by reactor people, because the errors which they would like to have and write about in their requests are not those indicated by a single experimentator, but those of a whole set of experiments. It is known that the above errors do often considerably differ because of not taking into account, in a particular experimental procedure, of an unknown systematic error. Therefore, the data of individual experimentators often differ from one another by considerably greater values than the errors indicated by experimentators. Reactor people cannot be satisfied with the values of errors indicated by individual experimentators. But it means that they are in need of evaluated data with evaluated errors. Therefore, in the list of requests the question, from the logical point of view, is about the evaluated data.

But it is not proposed to discard the word "Measurements" bearing in mind that the combination of the two words "Measurements and Evaluations" reflects, most exactly, that conception of the evaluation process on which there was achieved agreement in the discussion at the Helsinki Conference. Namely, evaluation is the analysis of the causes of discrepancies in the experimental results, and carrying out of new experiments should help in elucidation of these discrepancies, i.e., to serve EVALUATION. This conception is fixed in the title itself of the subcommittee "On Discrepancies in the Most Important Data and EVALUATION".

2. To define fully and strictly what is understood under the required accuracy of each of the requested values.

The fact is that the list of requests is mainly a list of requests for accuracies, since all the values requested are known but with a poorer accuracy. That is why it is necessary to give completely exact definitions.

A. First of all, it is necessary to answer the question whether the requested value of the error corresponds to one standard deviation with the confidence level of 0.68, or to two - with the confidence level of 0.95, or to two and a half - with the confidence level of 0.99? The fact is that reactor people want to have a calculated parameter within the error predicted by them with the confidence level at least of 0.95. Otherwise, physicists under the term "error" usually mean one standard deviation. Is there established in RENDA any correspondence between reactor people's desires and physicists' customs? A discrepancy by a factor of 2 or even 2.5 should be eliminated by an exact indication of what the matter is.

B. Secondly, there should be given a quite clear definition for the nature of an error which, in compliance with a request, should make up a definite value, i.e., whether this is an error of an experimental point including a statistical, a systematic and a standard error, or whether it relates to the whole energy range indicated, or to some group interval. What are the correlation properties of this error? There is some information in the present RENDA, but it is quite insufficient.

The fact is that as it has been shown in our paper presented in August 1971 at the Seminar on Evaluation in Vienna, the error comprises components with different correlation properties whose influence upon the acouracy of reactor parameter predictions is greatly different. So, it is quite logical to assume the component resulting from a systematic error to be correlated over the whole region of measurement. Therefore, it is precisely this component that will make the greatest contribution into the inaccuracy of a reactor parameter calculation, and requirements placed upon this component will be especially stringent.

C. It should be noted that correlation properties of errors may be revealed in the process of evaluation. But microscopic cross sections are evaluated not by a reactor specialist. Hence it follows that a reactor specialist cannot correctly specify requirements for accuracies of specific microscopic cross sections, the more so, as there are many isotopes in the reactor, and accuracies may be redistributed between isotopes at one and the same given accuracy of a reactor parameter. And that again is no concern of a reactor specialist. At the same time, nobody except a reactor specialist knows what accuracies are needed for reactor parameter calculations.

Therefore, in order that all the work on elaboration of requirements to be carried out by specialists in their field, it is necessary at least to single out of it a stage of elaborating a requirement in the accuracy of the reactor parameter calculation. It is made by reactor people on the basis of technical and economical considerations. These considerations should be "sifted" at reactor committees. They provide, e.g., the following data: the value of the effective multiplication factor of the BN-600 reactor should be within 1% from the calculated one with the confidence level of 0.95, with the spread in values determined only by inaccuracies in nuclear data. In the same manner requirements for the accuracy of the breeding ratio, nonuniformity factor, etc., are specified. Besides, reactor people should provide the tables of sensitivity factors for all the above parameters relative to the variation of nuclear constants for all reactor materials. It would be useful to publish the above information in the introduction to RENDA.

Further work on elaboration of requirements should be conducted with the use of optimum planning of experiments. An example of such an approach for a set of only microscopic experiments has been presented in the above mentioned paper at the Seminar on Evaluation in August 1971. Undoubtedly it is necessary to develop also methods of planning for a set of microscopic and integral experiments. The fact is that an integral experiment at a suitable critical assembly, correctly

carried out analyzed, may substantially reduce requirements for the accuracy of microscopic experiments. For some limited purposes, e.g., for the prediction of K_{eff} for an enriched uranium fast reactor at the initial instant using the results of measurements at critical assemblies, the existing accuracies of microscopic nuclear data are quite sufficient. But there arises a demand for their refinement if we pass to calculated extrapolation onto some other compositions and onto values which are not measured directly on critical assemblies to a high accuracy, e.g., the breeding ratio.

A topical discussion at the next meeting of INDC might be devoted to the consideration of the whole range of problems on planning of experiments, i.e., on the elaboration of nuclear data requirements.