Needs of Nuclear Data for Advanced Light Water Reactor

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Hitachi has been developing medium sized ABWRs as a power source that features flexibility to meet various market needs, such as minimizing capital risks, providing a timely return on capital investments, etc. Basic design concepts of the medium sized ABWRs are 1) using the current ABWR design which has accumulated favorable construction and operation histories as a starting point; 2) utilizing standard BWR fuels which have been fabricated by proven technology; 3) achieving a rationalized design by suitably utilizing key components developed for large sized reactors. Development of the medium sized ABWRs has proceeded in a systematic, stepwise manner. The first step was to design an output scale for the 600MWe class reactor (ABWR-600), and the next step was to develop an uprating concept to extend this output scale to the 900MWe class reactor (ABWR-900) based on the rationalized technology of the ABWR-600 for further cost savings [1]. In addition, Hitachi and MHI developed an ultra small reactor, “Package-Reactor” [2].

About the nuclear data, for the purpose of verification of the nuclear analysis method of BWR for mixed oxide (MOX) cores, UO_2 and MOX fuel critical experiments EPICURE and MISTRAL were analyzed using nuclear design codes HINES and CERES with ENDF/B nuclear data file. The critical keffs of the absorber worth experiments, the water hole worth experiments and the 2D void worth experiments agreed with those of the reference experiments within about 0.1%Δk. The root mean square differences of radial power distributions between calculation and measurement were almost less than 2.0%. The calculated reactivity worth values of the absorbers, the water hole and the 2D void agreed with the measured values within nearly experimental uncertainties. These results indicate that the nuclear analysis method of BWR in the present paper [3] give the same accuracy for the UO_2 cores and the MOX cores.

[1] Development of Medium Sized ABWRs (ABWR-600, ABWR-900),
Proceedings of GLOBAL 2005Tsukuba, Japan, Oct 9-13, 2005, Paper No. 417
[2] Development of the Package-Reactor, Trans. At. Energy Soc.Japan, *Vol.5, No. 4, pp. 257-267, 2006 (in Japanese)*
[3] Analysis of Mixed Oxide Fuel Critical Experiments EPICURE and MISTRAL with Nuclear Analysis Code for BWR, Trans. At. Energy Soc.Japan, *Vol.5, No. 1, pp. 34-44, 2006 (in Japanese)*