2. Nuclear Data for LWR and Nuclear Fuel Cycle
2.2 Requests from Nuclear Fuel Cycle and Critical Safety Design

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The quality and reliability of criticality safety design of nuclear fuel cycle facilities such as fuel fabrication, spent fuel reprocessing, storage of various forms of fissile materials or transportation casks have been largely dependent on the quality of criticality safety analyses using qualified calculation code systems and reliable nuclear data sets.

Particularly in today's global market of fuel casks, where fierce competition is taking place, it is vitally important to avoid any luxurious design margin. It is also deemed true in the design of spent fuel storage foreseen in years to come.

The criteria for criticality safety design are often expressed as the limit of neutron multiplication factor (*keff* or *kinf*), which shall depend on the reliability of the code systems and nuclear data used in the criticality safety design analyses.

Most commonly used limit for those designs is

$$keff \leq 0.95,$$

where *keff* is the effective neutron multiplication factor calculated with some well-qualified code system and data. The 0.95 criterion is rather heaven-sent and has been used since very old days. The regulator in our country suggests that it can be relaxed, if its validity can be shown by quantitative data. In this validation, the quality of nuclear data is of large importance. The integral validation by some series of criticality experiments simulating the systems of interest is directly useful for this purpose.

On the other hand, the front of nuclear criticality safety designs has been seeking for the application of “Burnup Credit”. In this field, it is regarded to be prudent to take the credit of the limited absorbing nuclides seen in spent fuels. They must be long-lived, chemically stable and have well-established neutron absorption cross sections. The direct simulation of spent fuels in the criticality experiments has its limitation by nature. So, the microscopic validation case would be of more importance.

These days, the discussion on the direct disposal of spent fuels is going on mainly from the economic points of view. In those cases, the above discussion on the Burnup Credit would be truer, since the characteristics of spent fuels during tremendously long years would be more uncertain and more difficult to simulate in the integral experiments.