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TITLE: PEAK REACTIVITY CHARACTERIZATION AND ISOTOPIC INVENTORY CALCULATIONS FOR BWR CRITICALITY APPLICATIONS.

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Abstract

For BWR criticality calculations supporting spent fuel storage racks design, the most reactive fuel assembly to be stored, at its maximum reactivity point (peak reactivity) must be used.

Determination of the most reactive fuel assembly should consider the distribution (as a function of burnup) of fissile content, burnable absorbers and fission product inventories in the fuel assembly.

BWR fuel designs are highly heterogeneous both radial and axially, with increasing (in current designs) number of different lattices with specific enrichment and gadolinium configurations. Moreover, the isotopic evolution (and hence the reactivity) of the BWR fuel shall also depend on the local core conditions, mainly void fraction and control rod insertion, during its life in the core that, in turn, change with burnup. All those characteristics make not an easy task, nor practical for production purposes, the BWR fuel characterization for criticality calculations.

This paper will present a simple conservative model for peak reactivity definition and isotopic inventory calculation for BWR criticality applications. The relevant parameters analyzed to define this model include:

- Core conditions (void fraction and control blades insertion)
- Gadolinium distribution
- Axial enrichment distribution
- Radial enrichment distribution
- Radial isotopic distribution
- Axial burnup and isotopic distribution

As a result of the performed sensitivity analysis, a practical (i.e. simple and conservative) method to define the fuel bundle material model to be used in criticality calculations is defined. Results of the sensitivity calculations shall be included in the paper, as well as different comparisons of the result produced by the model vs. those obtained with best-estimate approaches, that confirm the conservatism of the proposed model.

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