Enclosure 3

Errata Pages for WCAP-17642-NP-A

(Non-Proprietary)

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(3 pages including this cover page)

Westinghouse Electric Company
1000 Westinghouse Drive
Cranberry Township, PA 16066

FRAPCON code does not have the capability to model the radial power profile for ZrB_2 coating. PAD5 predicts a minor impact of this coating on the radial power profile (as expected). FRAPCON also does not have the capability to model the radial power for Erbia fuel. Based on the response to RAI-26 that the approved PARAGON code is used to calculate radial power profiles, the NRC staff finds the profiles for Erbia fuel acceptable.

The NRC staff concludes that the PAD5 code using lookup tables from PARAGON or input directly from PARAGON for calculating of radial power is acceptable for UO_2, UO_2- Gd_2O_3, UO_2 with ZrB_2 coating, and UO_2 doped with Erbia.

3.1.1.3 Fast Neutron Flux

The fast (E> 1.0 MeV) neutron flux and fast neutron fluence are necessary parameters for some of the cladding models. The TR stated that the fast flux is input for each time step. The staff asked Westinghouse in RAI-28 to describe how this is done and to describe how it is ensured that the input flux history is consistent with the input power history. Westinghouse responded that PAD5 has two options.

Westinghouse responded that the fast neutron flux and the fast fluence are calculated using NRC-approved core physics code, Westinghouse Advanced Nodal Code (ANC) (Reference 19) or any other NRC-approved code for determining the neutron flux and the fast fluence.

The first option is that **[**

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The second option is that given Westinghouse's experience, **[**

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Westinghouse provided data to show that either of these approaches gives reasonable fast fluence values.

The NRC staff reviewed the methodology for the determination of fast flux and fast fluence as a function of burnup and determined that either of the options above is acceptable.

3.1.2 Fuel Thermal Conductivity

SRP Section 4.2 specifies that for phenomenological models thermal conductivity of the fuel, cladding, cladding crud, and oxidation layers must be accurately modeled. This section will describe the details and confirmations of the results for Urania fuel thermal conductivity and Urania-Gadolinia and Urania-Erbia Fuel Pellet Thermal Conductivity.

The NRC staff concludes that the database used to assess the steady-state and power ramp FGR predictions is acceptable up to a rod-average burnup of 62 GWd/MTU and that the upper and LB FGR model parameters given in Table 1 are acceptable for use in a 95/95 uncertainty analysis based on comparisons of the UB and LB models to the rods in FGR database.

3.2.3 Helium Solubility and Release Model

The helium solubility model in PAD5 is a function of the fuel density initial gas pressure and fuel burnup. This model is developed based on multiple linear regressions on hot cell data over a range of densities, initial fill pressures, and fuel burnups. The NRC staff asked in RAI-5 to [ ] in solubility at high density, to provide low burnup puncture data (if available) to support the model and to address [ ] Westinghouse stated that [ ] Westinghouse also stated that [ ] and that temperature measurements were not available from the hot cell data, [ ] there is no significant concern.

During irradiation, PAD5 assumes that helium is produced at a rate of 0.3 atoms per 100 fission. The release model in PAD5 assumes that all the helium above the current solubility level is released to the void volume. These are both reasonable assumptions.

The UB and the LB of the helium solubility model are the same as those in PAD4 (Reference 20). The UB model increases the solubility by [ ] Because the helium release is the amount of gas currently in the pellet and that produced that is above the solubility level, the use of the LB solubility model will result in an UB release prediction and vice versa. These UB and LB models are very large, given the uncertainty in the hot cell data and based on engineering judgment, and the fact that they contribute very little to any output, it can be assumed that they represent a 95/95 or better UB and LB uncertainty.

The NRC staff concludes that the helium solubility model, helium production model, and helium release model are all acceptable, particularly given the low values of helium solubility predicted by the model. The UB and LB models for solubility are also acceptable for use in a 95/95 uncertainty analysis.

3.2.4 Helium Release from IFBA

A significant quantity of helium is produced in the ZrB_2 coating applied to the pellets in IFBA rods. PAD5 has a ZrB_2 production model that is based on the B^{10} depletion. The depletion model is a function of burnup and B^{10} enrichment. PAD5 also contains a model that is a function of burnup that predicts the quantity of He produced in the ZrB_2 coating as a function of burnup. In FRAPCON, it is assumed that because the ZrB_2 layer is so thin, that 100 percent of the He produced in the layer will be released to the void.