

## **ENCLOSURE 2**

### **MFN 07-445 Supplement 2**

Response to USNRC Follow-up Question on RAI 33 RE: GEH Topical Report NEDE-32906P, Supplement 3, Migration to TRACG04/PANAC11 from TRACG02/PANAC10 for TRACG AOO and ATWS Overpressure Transients, (TAC No. MD2569)

Non-Proprietary Version

#### **IMPORTANT NOTICE**

This is a non-proprietary version of Enclosure 1 to MFN 07-445 Supplement 2, from which the proprietary information has been removed. Portions of the enclosure that have been removed are indicated by open and closed double square brackets as shown here [[ ]].

### **RAI 33 - Supplement**

#### **Request**

*The NRC staff cannot conclude based on the response that the black and white (B&W) control rod pattern conservatism in the analysis is sufficient to bound the limiting power shapes for BOC to MOC UB exposure. Particularly, the NRC staff is concerned that under MELLLA+ conditions at the low flow / 100% CLTP MELLLA+ corner that the TVAPS effect may be magnified by the axial power shape at reduced flow conditions and will not be compensated by high SCRAM reactivity because of spectrum hardening at the reduced flow condition.*

*Please provide the results of analyses for a large, representative EPU/MELLLA+ BWR/4 to demonstrate the effect of BOC to MOC UB at the MELLLA+ corner on (1) axial power shape, (2) TVAPS effect, and (3) DCPR/ICPR. Compare these results to BOC to MOC HBB results. Evaluate the conservatism of the B&W rod pattern for MELLLA+ conditions. Provide a detailed description of those aspects of the analysis assumptions and important phenomena that ensure the most limiting power shapes are bounded by the cycle-specific analyses.*

#### **GEH Response**

As this response is a demonstration of the application, and the process is independent of the TRACG version, a TRACG02 analysis was performed for a representative EPU/MELLLA+ BWR/4 plant to demonstrate the conservatism in the standard process of analyzing pressurization events at the MOC HBB exposure with a black-white rod pattern. The representative BWR/4 plant has 560 bundles and a rated thermal power of 2923 MWt (120% OLTP). The BWR/4 plant is loaded with only GE14 fuel.

The turbine trip no bypass (TTNB) and feedwater controller failure (FWCF) events were analyzed at MOC using both the UB and HBB burn strategies. For the MOC UB, both the nominal rod pattern and a black-white rod pattern were considered. As previously discussed, the black-white rod pattern is used to minimize the scram reactivity. However, the black-white rod pattern produces an excessively bottom peaked power profile for the MOC UB, which results in a significant scram contribution early in the event. Therefore, the nominal rod pattern was also analyzed for the MOC UB. To facilitate a comparison, the TTNB and FWCF were also analyzed at the MOC HBB exposure using the standard process of applying a conservative black-white rod pattern. All events were initiated from 100% CLTP (2923 MWt) and the MELLLA+ corner (85% rated core flow).

The DCPR/ICPR results are provided in the table below. As shown, [[

]] the HBB with the black-white rod pattern is very conservative for the BOC to MOC exposure range. For the MOC UB, the DCPR/ICPR results are mild because the extremely bottom peaked power profile (see Figure 1) results in the events being mitigated by the large scram reactivity during the early portion of the scram. One of the most important aspects for pressurization events is the power shape and associated scram reactivity. At EOC the UB power shape may be top peaked enough such that scram reactivity does not dominate and the effect of TVAPS is such that the UB can be close to a HBB result. At earlier exposures, the power shapes

are more bottom peaked and the scram is the more dominant factor. Although the impact of TVAPS is greater for bottom peaked power profiles, the scram reactivity at the MOC UB exposure more than compensates for any increased TVAPS effect. This is demonstrated in Table 1 below. Note the difference between the FWCF MOC HBB and the UB results is much smaller. This is because the event is dominated by the overcooling portion of the event and the pressurization portion is mild due to the availability of the turbine bypass system. The axial power shape is not as important for the FWCF transient.

**Table 1. DCPR/ICPR Results**

Event	MOC UB (nominal rod pattern)		MOC UB (black-white rod pattern)		MOC HBB (black-white rod pattern)	
TTNB	[[	]]	[[	]]	[[	]]
FWCF	[[	]]	[[	]]	[[	]]

**Figure 1. Initial Axial Power Profiles**

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