Responses to NRC Request for Additional Information on WCAP-15836-P, "Fuel Rod Design Methods for Boiling Water Reactors – Supplement 1"

TAC No. MB5740

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10. Define the range of applicability of STAV7.2 relative to rod average heat generation rate and justify this limit relative to the experience database.

Measured parameters which are of interest and which are directly proportional to LHGR are fuel centerline temperature (thermocouple data) and fission gas release. In addition, internal fuel rod pressure is proportional to LHGR. However, the combination of fuel temperature, fission gas release, and internal void volume provide a good measure of pressure in STAV7.2. STAV7.2 has been shown to provide excellent predictions of void volume in WCAP-15836-P. Considering the extent of phenomenological models in STAV7.2, a [

]^{a,c} The range of LHGR corresponding to the fission gas release and fuel centerline temperature databases, since these are directly or closely determined by the LHGR, can be used to define a range of LHGRs for which this confirmation has been made.

The nodal linear heat rate in the data base as a function of rod average burnup is shown in Figure 1 for the fission gas release data and in Figure 2 for the temperature data. Based on the data range, an upper bound LHGR limit for the applicability of the STAV7.2 code is suggested as [

]^{a,c}

The fuel rods in the data base which are within at least [

]^{a,c}

Like the fission gas release data, not all of the [

]^{a,c}

These combinations of the fission gas release and fuel temperature data comparisons support the conclusion that the STAV7.2 fuel temperature model predictions, and fission gas release model predictions, when considered independently and together, provide accurate or conservative predictions of fuel temperature and fission gas release for fuel rods operating up to the proposed LHGR.

Figure 1 – LHGR versus Burnup for Fission Gas Release Database

a,b,c

Figure 2 – LHGR versus Burnup for Fuel Temperature Database

a.b.c

Figure 3 – LHGR versus Burnup for Fission Gas Release Rod Data – Best Estimate Release Comparison

a,b,c

Figure 4 – LHGR versus Burnup for Fission Gas Release Rod Data – RMS Release Comparison

a,b,c

Figure 5 – LHGR versus Burnup for Fuel Temperature Data Rods

a,b,c