Attachment 2

Topical Report DOM-NAF-1

Qualification of the Studsvik Core Management System Reactor Physics Methods for Application to North Anna and Surry Power Stations

Response To NRC Request for Additional Information

Virginia Electric and Power Company
(Dominion)

4) Please provide a worked example showing how the tolerance limit was calculated for the parametric case. For example, show how the tolerance limit of [ ] was obtained.

The W-prime sample sizes provided in the supplemented Table 4 (Attachment 1 to Dominion's letter to the NRC dated November 25, 2002, Serial No. 02-334A) were in error. Since W-prime is the normalized ratio of assembly power to flux thimble instrument reaction rate, there are only two W-prime comparison values for each two-by-two assembly case. Therefore, the sample size a) for each base W-prime sample (for example, Surry rodded) is 6, b) for each combined sample for a station is 12, and c) for the combined sample for both stations is 24. This revised information is provided in the updated Table 4 attached.

For the Surry rodded case, the standard deviation was [ ] for a sample size of 6. From Ref. 25, the one-sided tolerance multiplier for a normal distribution for 95/95 is 3.71. Therefore, the tolerance limit is:

[   ]

In calculating the W-prime tolerance limits, the mean was ignored. The treatment of the mean is academic for the W-prime data considering:

- the W-prime tolerance limit was based on that of the combined station case, which has a near zero mean,

- the mean for any core-wide normalized value should by definition be zero (consistent with the very low values for the Table 4 combined data means), and

- the W-prime tolerance limit is not used in the derivation of NRFs.

5) Please provide a worked example showing how the tolerance limit was calculated for the non-parametric case. For example, show how the tolerance limit of [ ] was obtained.

The tolerance limit for a non-normal distribution was determined based on the non-parametric ranking method of Somerville (Ref. 26) and referenced in USNRC Regulatory Guide 1.126 (Ref. 29). For the Surry rodded case (including gamma smearing), the sample size was 186. The Somerville method indicates the 5th most

negative value to be the 95/95 limiting tolerance value for a non-normal distribution of this size. The most negative value is used since this is the conservative direction. The first five ranked values for the Surry rodded case (including gamma smearing) are:

[   ]
[   ]
[   ]
[   ]
[   ]

Hence, the value of the 5th most negative ranked comparison is [   ].

6) *Why is the tolerance limit for the first block (w-prime) higher than the mean, whereas it is lower for the second and third blocks?*

This is due to an oversight in consistency. By one convention, the tolerance limit for power peaking might always be reported as positive since that is the direction in which it is applied to a prediction. For example, see the expanded version of Table 23 (Attachment 1 to the initial response to NRC questions, Serial No. 02-334A) where, for consistency, the sign of the reaction rate tolerance limits was changed from negative to positive. The presentation of negative tolerance limit values for the pin-to-box data in Table 4 serves to emphasize the fact that this is the conservative direction in the ranking of the comparison data from which the tolerance limit was derived.

Table 4

CASMO-4 W-prime and Pin-to-box Ratio Comparisons

Fuel Type / Parameter	Assembly	Sample Size	Mean (%)	Std. Dev. (%)	Normal	Tolerance Limit
Surry 15x15 W-prime	Rodded	6	[ ]	[ ]	Yes	[ ]
	Unrodded	6	[ ]	[ ]	Yes	[ ]
	Combined	12	[ ]	[ ]	Yes	[ ]
North Anna 17x17 W-prime	Rodded	6	[ ]	[ ]	Yes	[ ]
	Unrodded	6	[ ]	[ ]	Yes	[ ]
	Combined	12	[ ]	[ ]	Yes	[ ]
Combined data W-prime	Combined	24	[ ]	[ ]	Yes	[ ]
Pin-to-box Ratio Statistics (Including Gamma Smearing)						
Surry 15x15 Pin-to-box ratio	Rodded	186	[ ]	[ ]	No	[ ]
	Unrodded	186	[ ]	[ ]	No	[ ]
	Combined	372	[ ]	[ ]	No	[ ]
North Anna 17x17 Pin-to-box ratio	Rodded	234	[ ]	[ ]	No	[ ]
	Unrodded	234	[ ]	[ ]	No	[ ]
	Combined	468	[ ]	[ ]	No	[ ]
Pin-to-box Ratio Statistics (Excluding Gamma Smearing)						
Surry 15x15 Pin-to-box ratio	Rodded	186	[ ]	[ ]	No	[ ]
	Unrodded	186	[ ]	[ ]	No	[ ]
	Combined	372	[ ]	[ ]	No	[ ]
North Anna 17x17 Pin-to-box ratio	Rodded	234	[ ]	[ ]	No	[ ]
	Unrodded	234	[ ]	[ ]	No	[ ]
	Combined	468	[ ]	[ ]	No	[ ]

Note: Difference is ((SIMULATE – MCNP) / SIMULATE) x 100%
* Eliminating the MCNP W-prime uncertainty component (conservatively set at [   ]) by root sum square results in a W-prime tolerance interval of [   ].