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ASEA BROWN BOVERI

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Project No. 680

Mr. Dino Scaletti, Project Manager
Advanced Reactors Project Directorate
Division of Advanced Reactors
and Special Projects
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Subject: Comments on BNL PIUS Scram Reactivity Analysis Paper

Dear Mr. Scaletti:

This letter provides ABB Combustion Engineering and ABB Atom (collectively ABB) comments on the Brookhaven National Laboratory (BNL) draft conference paper entitled, "PIUS Scram Reactivity Analysis". Comments were solicted from ABB regarding technical accuracy with respect to the PIUS design and plant operation and the potential content of proprietary material. ABB's review has not shown any proprietary material content. Technical comments are contained in the enclosure.

If you have any questions, please do not hesitate to call me or Mr. Chuck Molnar at (203) 285-5205.

Very truly yours,

COMBUSTION ENGINEERING, INC.

C. B. Brinkman

C. B. Brinkman, Acting Director
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Enclosure: As stated

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Enclosure to LD-93-175

ABB Combustion Engineering & ABB Atom Comments

on

Brookhaven National Laboratory Conference Draft Paper

"PIUS Scram Reactivity Analysis"

Comments on BNL Draft Paper "PIUS Scram Reactivity Analysis"

1. This paper seems to discuss basics calculations to determine shutdown reactivity using a boron flow. We don't recognize typical PIUS behavior during boration.

2. We don't understand what phenomena in PIUS is associated with the assumption of linear-ramp injection and/or the square pulse. See comment 1.

3. From our simulations we have found that the maximum "boration speed" occurs under trip of the four coolant pumps. Initially the rate is about 130 ppm/s and subsequently decreases to about 75 ppm/s. This is at BOC condition, the rate will be higher at EOC. This does not relate to the values used by BNL.

4. To clarify the modelling, please state whether or not the main core flow is assumed to be constant when you use the ramp injection of boron to the core. Concerning the square pulse: include information on it's duration or state that it is a step in boron concentration with the short rise time of 1.2 seconds.

5. The approach used in the study to calculate the scram reactivity from assumed input flow distributions is interesting and it offers room for further development. The same method could be applied to non uniform mixing of boron pool flow and coolant flow by defining radial zones with different ramp injections.

6. The square wave pulse injection could, perhaps, be used to simulate events where the inlet boron flow from pool has an oscillatory increasing behavior as it can be found in the one coolant pump trip transient simulation. However, in general, this is not applicable to typical PIUS behavior.

7. The results for the boron coefficient given in your Table appear reasonable with respect to trends with the assumed type of pool flow and cycle burnup. However, there is one remark: the values we have calculated with our lattice code as given in the PIUS PSID (Chapter 4.3) are around -8 pcm/ppm as compared to the -15 pcm/ppm calculated by BNL.

8. The conclusion of Page 5, Line 13 (that the cooler 122°F pool inlet temperature results in a relatively small decrease in the scram reactivity) seems applicable only to the ramp boron injection. It seems that, as far as the temperature was concerned, BNL did not consider the 'worst' case, represented by the square pulse boron injection. It would be interesting to see how much the curve in Figure 5 would be affected by a reduction of the pool inlet water temperature from 250°F to 122°F.

   It is our opinion that taking into account the temperature effect would not change the study conclusions (that scram reactivity for linear ramp injection can be treated through point kinetic methods, while the one for square pulse requires spatial kinetic methods).