Westinghouse Non-Proprietary Class 3

LTR-NRC-16-23 NP-Attachment

Westinghouse Comments Regarding Draft NRC Safety Evaluation (by NRR) for WCAP-17202-P/WCAP-17202-NP, Revision 0, "Supplement 4 to BISON Topical Report RPA 90-90-P-A" (Non-Proprietary)

June 2016

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Westinghouse Comments Regarding Draft NRC Safety Evaluation (by NRR) for WCAP-17202-P/WCAP-17202-NP, Revision 0, "Supplement 4 to BISON Topical Report RPA 90-90-P-A"

Comment 1

Section 1.0, page 1, lines 16, 19, 23-24; and
Section 2.0, page 6, line 33

"Supplement 4 to (for) WCAP-17202-P/WCAP-17202-NP" should be revised to read "WCAP-17202-P/ WCAP-17202-NP, 'Supplement 4 to BISON Topical Report RPA-90-90-P-A.'"

Comment 2

Section 3.3 page 12, lines 31-33 and 41-45;
Section 4.1, page 27, lines 36-40; and
Section 5.0, page 28, lines 41-51

Section 3.3 (page 12, lines 41-45) of the draft SE for WCAP-17202-P states: "Should WCAP-17203-P/ WCAP-17203-NP, receive approval, the NRR staff finds the Improved Method B applicable for turbine trip transients provided that the transient analysis and the associated uncertainty analysis are performed subject to any limitations and conditions established in the SE for WCAP-17203-P/WCAP-17203-NP."

The Westinghouse intention with the improvements to Method B is to qualify the Improved Method B as an acceptable alternative to Method C for performing licensing safety analysis of all transients.

Westinghouse seeks approval for the Improved Method B to be used as an alternative to Method C for analysis of all events including those limiting transients where Method C has been, until now, the only accepted Westinghouse methodology.

Westinghouse considers that both the Improved Method B and Method C, based on general collapsing principles, are acceptable cross-section collapsing methodologies which can be used in final licensing analyses of limiting transients. Condition #8 (page 27, lines 36-40), and in Section 5 (page 28, lines 41-51), which limits Improved Method B to only turbine trip transients, is considered by Westinghouse to be unnecessarily restrictive.

A comparison of results from the Improved Method B to the previously approved Method C as suggested in the draft SE (page 12, lines 31-32) was not included in WCAP-17202-P because Westinghouse did not consider it to be necessary, since the purpose of both methods is, for BISON, to replicate the nodal code predictions. Thus, comparisons between BISON and POLCA7 predictions were considered to be sufficient to demonstrate the applicability of the Improved Method B. The original qualification, Peach Bottom 2 turbine trip tests cases that were used to demonstrate the acceptability of Method C in

RPA-90-90-P-A, was also used to demonstrate the acceptability of Improved Method B for the analysis of limiting transients.

In response to discussions with the NRC Staff, Westinghouse is providing additional information to support the relaxation of Condition #8 and to allow the use of Improved Method B for all limiting and non-limiting transients. This information is provided as Comment 8.

Comment 3

Section 3.4, page 13, lines 32, 41 and 49

Typo: "Hamoaka" should be "Hamaoka."

Comment 4

Table 4-1, page 25, second row

Conditions and Limitations number (7) should be number (8), as Number (7) is already used on the previous page.

Also, as noted in Comment 2, Westinghouse is seeking approval of Improved Method B for all transient analyses, not limited to turbine trip.

Comment 5

Section 4.1, page 27, lines 34- 40

As discussed in Comment 2, Westinghouse is seeking approval of Improved Method B, pending approval of WCAP-17203-P/WCAP-17203-NP, as an acceptable alternative to Method C for all limiting transients.

Comment 6

Section 5, page 28, lines 41-51

As noted previously, Westinghouse is seeking approval for the Improved Method B for limiting transients in addition to non-limiting transients and sensitivity studies.

A turbine trip is not always the limiting transient for BWR/2-6 and, regarding the fuel physics response characterization (nuclear data such as cross sections and diffusion coefficients), there will be no difference if the pressurization transient starts due to a turbine trip or, for instance, main steam line isolation. The Improved Method B captures the existing nuclear characteristics of the core at the time of the initiation of the transient, without making any assumption as to its nature. To qualify Improved Method B for limiting transients, the same validation base as in RPA 90-90-P-A was used (see Comment 8 for additional information in support of the application of Improved Method B).

Comment 7

General

WCAP-17202-P Revision 0-1, submitted to the NRC via U7-C-NINA-NRC-140029, dated September 30, 2014, was prepared to incorporate changes to the topical report agreed to during the Request for Additional Information (RAI) process and in preparation for presenting this topical report to the Advisory Committee on Reactor Safeguards (ACRS). It is suggested that it would be more appropriate for the SE to reference Revision 0-1.

Comment 8

Additional information in support of relaxation of the Condition #8 restriction which would allow the use of Improved Method B for all limiting transients

A phone call between the U.S. NRC (Kate Lenning and Kevin Heller [NRR], Alex Burja and Jim Steckel [NRO]) and Westinghouse was held February 8, 2016 to discuss the Condition #8 restriction.

In the draft SER, this restriction allowed the Improved Method B to be used only for the turbine trip transient. Two action items were defined that would provide a basis for use of the Improved Method B for all potentially limiting transients analyzed with BISON. A subsequent phone call was held between the U.S. NRC and Westinghouse on March 14, 2016, resulting in one additional action item. These action items, along with the Westinghouse responses, are provided below.

Action Item 1

Provide a discussion to demonstrate that the Peach Bottom cases provide a justification of the Improved Method B for all transients that result in a turbine trip, for example, the feedwater controller failure that leads to turbine trip. This discussion would also include generator load rejection, which has a similar response due to fast closure of the turbine control valves. The same kind of code models would be exercised by these transients. The intent of this addition information is to allow the SER to include wording allowing Improved Method B to be applied for all transients resulting in a turbine trip.

Westinghouse Response:

Results for three Peach Bottom turbine trip tests using the Improved Method B cross-section collapse for BISON are presented in Section 3.2 of WCAP-17202-P. Comparisons between test results and BISON predictions for core power (APRM) and integrated core power (integrated APRM) are provided to demonstrate that the BISON results are reasonably close to the Peach Bottom test results. Because of these comparisons the NRC accepted the use of the Improved Method B for a limiting turbine trip transient with an appropriate application of uncertainty (to be determined by WCAP-17203-P/ WCAP-17203-NP).

It should be noted that the cross-sections collapse method is independent of the type of transient to be analyzed and does not include any information on the transient itself.

In addition to a limiting turbine trip transient, Improved Method B should be extended to other fast transients that behave in a similar manner. Feedwater controller failure (FWCF) is one example. For this transient a failure in the feedwater controller system results in maximum feedwater flow to the reactor. The colder feedwater flow results in a slow power increase and eventual turbine trip on high reactor water level. Thus, there is a turbine trip superimposed on a slow power increase transient, but the fast transient response is that of a turbine trip.

A load rejection with fast closure of the turbine control valves is another example. The turbine control valves (TCVs) are in series with the turbine stop valves (TSVs) and fast-close at a comparable rate. Thus, on a load rejection (with a TCV fast closure scram signal), the TCVs close within a time comparable to the TSVs for a turbine trip. Because of the similar valve closure times the load rejection and turbine trip events have a similar impact on the reactor coolant system.

One remaining potentially limiting fast transient for BWR/3 and BWR/4 plants is the inadvertent high pressure coolant injection (IHPCI) with an additional failure in the feedwater system to control level. An analogous event for BWR/5 and BWR/6 plants is inadvertent actuation of high pressure core spray, or HPCS. If the high water level is reached, the response can be similar to FWCF, i.e., a turbine trip superimposed on a slow power increase (due to the cold HPCI or HPCS addition). Again, the fast transient response is that of a turbine trip.

The above discussion addresses limiting fast transients of interest for application of the Improved Method B. These all result in a turbine trip. Although turbine trip is not necessarily the initiating event, the fast transient response would be similar to, or that of, a turbine trip. The same kind of code models would be exercised by all these transients.

A slower transient case is discussed for the next action item.

Action Item 2

Provide a quantitative comparison between the accepted Method C and Improved Method B for potential limiting transients not leading to turbine trip. Main steam isolation valve (MSIV) closure would provide an acceptable example since the isolation valves close at a rate significantly slower than the turbine stop valves or fast closing turbine control valves. It would be acceptable to use an existing plant model even though the plant in question is not limited by the MSIV closure.

Westinghouse Response:

To extend the applicability of the Improved Method B to longer acting transients, a comparison of the accepted Method C and Improved Method B results was made for a MSIV closure transient for a BWR/3 plant. The MSIV closure (MSIVC) is assumed to occur in 3 seconds (between 1 second and 4 seconds transient time). Automatic scram on MSIV position is defeated (conservatively assumed to not occur) to allow for a slower transient. Instead, an indirect scram on high neutron flux (APRM) is modeled. Other limiting assumptions are characteristic of a MSIVC event analyzed for ASME over-pressure protection.

Both transient cases were run in an identical manner, with the only difference being the method of cross-section collapse.

As can be seen in the comparisons, the APRM predictions are very close (Figure 1). Furthermore, minor differences in the APRM response filter out so the integrated APRM results are nearly identical (Figure 2). Based on this comparison, it is demonstrated that the Improved Method B is acceptable to use for longer duration transients.

In summary, Westinghouse concludes that the Improved Method B for collapsing cross sections is acceptable for licensing analyses for limiting and non-limiting transients, as well as for sensitivity studies.

a,c

Figure 1. APRM Comparison for the MSIVC Transient

a,c

Figure 2. Integrated APRM Comparison for the MSIVC Transient

Action Item 3

Provide a discussion regarding how uncertainties are determined, i.e., are they determined from the full uncertainty distribution or within a constrained range.

Westinghouse Response:

Uncertainties analysis is applied using the methodology described in WCAP-17203-P/WCAP-17203-NP. In accordance with this methodology, the probability distribution of parameters is tested for normality. Sampling from [

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