April 23, 2003

Mr. Jack Gray, Chairman
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SUBJECT: REQUEST FOR ADDITIONAL INFORMATION ON BOILING WATER REACTOR OWNERS GROUP (BWROG) TOPICAL REPORT NEDC-33046, "TECHNICAL JUSTIFICATION TO SUPPORT RISK-INFORMED PRIMARY CONTAINMENT ISOLATION VALVE AOT EXTENSIONS FOR BWR PLANTS" (TAC NO. MB1054)

Dear Mr. Gray:

On January 5, 2001, the BWROG submitted Topical Report (TR) NEDC-33046, "Technical Justification to Support Risk-Informed Primary Containment Isolation Valve AOT Extensions for BWR Plants," for staff review. The staff has determined that additional information is needed to complete our review. Enclosed is our request for additional information (RAI) regarding TR NEDC-33046. As discussed with your staff, it was agreed that you would respond within 30 days of receipt of the RAI.

If you have any questions, please contact me at (301) 415-1445.

Sincerely,

/RA/

Alan B. Wang, Project Manager, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Project No. 691

Enclosure: Request for Additional Information

cc w/encl: See next page

REQUEST FOR ADDITIONAL INFORMATION REGARDING

BWROG TOPICAL REPORT (TR) NEDC-33046

"TECHNICAL JUSTIFICATION TO SUPPORT RISK-INFORMED

PRIMARY CONTAINMENT ISOLATION VALVE AOT EXTENSIONS FOR BWR PLANTS"

PROJECT NO. 691

1. What effect will this TR have on vacuum breakers that function as primary containment isolation valves (PCIV)? How is the data referenced in Section 6.3.2.1.i applicable to these valves?

2. Why were penetrations connected to a closed loop system inside and outside containment not addressed as part of the Class A penetrations?

3. With regard to Cases A-1, A-2, A-3, B-1, B-2, C-2, E-1, and E-2, shouldn't the probability of failing to isolate the containment penetration by crediting the unaffected PCIV (P_{CIV}) be the probability of failing to operate on demand plus the probability that the valve spuriously transfers to open? Based on Section 6.3.2.1.i, P_{CIV} would be 2.00E-03 plus 2.35E-03 or 4.35E-3. Please provide a reference, standard or other suitable basis, for modeling the probability of failure as just to close on demand.

4. Equation 6b appears to consider relief valve failure. Does this include the probability of inadvertent opening of the relief valve? If not, what impact would adding this have?

5. It appears that Case D can be easily assessed quantitatively by multiplying the base case core damage frequency (CDF) by the probability of the line to fail. Why hasn't this been quantitatively assessed? What are the acceptable limits discussed in the first paragraph on page 6-34 of the TR? How can a conclusion be made concerning these acceptable limits unless it is quantitatively assessed?

6. Case E-2 states, "Securing a PCIV associated with the Containment Spray line in the closed position will impact the potential core damage and large early release." This impact was quantitatively assessed for previously approved similar TRs by looking at the loss of one system train on CDF and large early release frequency (LERF). The qualitative argument provided in Section 6.3.2.6 does not appear to provide a sufficient argument for approval of the TR. This comment also applies to Case E-3.

7. Figure 6.3-11 shows the PCIVs are normally closed. Based on this shouldn't P_{MOV} be the likelihood to remain closed or 1.29E-04 from Section 6.3.2.1.i?

8. Section 6.6, "Tier 2 considerations," states that no Tier conditions were noted that were not prohibited by technical specification (TS) 3.6.1.1 (that is, two PCIVs inoperable in the same line, loss of function, etc.). Case E-3 appears to be a special case of this. Address Case E-3 relative to Section 6.6.

9. Page 6-42 states, "With the motor operated PCIV secured in the open position, a pathway for the release of radioactive motor following core damage may be established ..." Shouldn't this be "radioactive material?"

10. The Abstract states that plant improvements can be achieved by extending the allowed outage time (AOT) for PCIVs from the current 4, 24, or 72 hours to 7 days in order to perform on-line maintenance, repair, or testing. The first paragraph of the executive summary on pages xiii/xiv, states that the proposed AOT extension is sought to provide flexibility in the performance of surveillance tests and preventive and corrective maintenance of containment isolation/pressure boundary valves during power operation. However, the second paragraph states that incurred plant risk will be strongly dependent on how the AOT is implemented and further states that it is expected that the primary usage of the proposed extended AOT will involve low risk or risk insignificant maintenance activities associated with preventive maintenance of the subject PCIV. Additionally, Section 5.2.1 states that in light of the current 4, 24, 72 hour AOTs, on-line scheduled preventive maintenance of PCIVs is rare – a limited amount of surveillance testing is performed. Reconcile these differences and confirm the assumption of a single AOT of 168 hours per year for scheduled maintenance is adequate for the risk analysis considering the actual maintenance to be performed.

11. Section 6.3.2 states that it is assumed that an assessment that the remaining PCIV is operable (common cause failure modes are absent) is performed. What assessment is to be performed to eliminate the common cause consideration and confirm the remaining valves are operable?

12. The TR determined a probability of a pipe break during the proposed AOT of 6.14E-4 based on NUREG/CR-4407. The staff notes that for TR NEDO-32977-A, "Excess Flow Check Valve Testing Relaxation," dated June 2000, the BWROG referenced EPRI Technical Report No. 100380, "Pipe Failures in U.S. Commercial Nuclear Power Plants," dated July 1992. Discuss the impact on the TR results if data from the EPRI report were utilized. Confirm that the probability of a pipe failure during the proposed AOT (6.14E-4) is bounding for all pipe sizes considered in the TR.

13. Case B-1, assumption b, page 6-20, states that for the calculation performed for this configuration, it is assumed that the valves are initially closed. Assumption b also states that the probability of the PCIV failing to remain closed during the proposed AOT is more conservative than the probability of the PCIV failing to close. Valves appear to be normally open in Figure 6.3-4 and as such shouldn't both failure on demand and spurious operation be considered? See question 3.

14. Case C-1, assumption c, page 6-27, calculates the frequency of breaching closed loop system piping based on an inadvertent opening of a relief valve and a random frequency of pipe failure. Figure 6.3-6 does not indicate nor does Case C-1 discuss a relief valve installation.

15. Assumption L, page 6-9, states that due to the bounding nature of the calculations, the increase in PCIV unavailability due to testing or maintenance as a result of the AOT extension to 7 days and its potential impact on the average CDF for the plant is neglected. Provide a discussion on the applicability of this assumption to average CDF

and LERF (dual purpose valves for example or valve maintenance that may compromise piping integrity to perform maintenance).

16. Assumption N, page 6.9, states that maintenance on a PCIV is assumed not to break the pressure boundary for more than the currently allowed AOT. Does this indicate that if the pressure boundary is broken then the previous AOT is in effect and the current AOT request is not bounding for this condition? How will this be controlled by the maintenance rule (a)(4)?

17.a In Section 5.1, under "Class C," the following is stated:

> This type of containment piping flowpath is connected to a closed loop system inside the containment. These closed loop systems are designed to withstand a higher pressure than the containment design pressure. As a result, failure of the closed loop piping is deemed insignificant.

Clarify the last sentence. It seems that it may have meant to say that the probability, or risk, of failure of the closed loop piping is deemed insignificant.

17.b In the section quoted above, the only design criterion mentioned for a closed loop system inside the containment is the ability to withstand a higher pressure than the containment design pressure. However, if the intention is to take credit (in the PRA analysis) for the closed loop as a barrier that precludes leakage or flow of containment atmosphere out of the containment during an accident, then the design should meet standard design criteria, which are more extensive. Regulatory Guide 1.141, "Containment Isolation Provisions for Fluid Systems," dated April 1978, endorses American National Standard N271-1976/ANS-56.2, "Containment Isolation Provisions for Fluid Systems," dated June 28, 1976. Section 3.5, "Criteria for Closed Systems Inside Containment," of this standard, states a number of additional design criteria, such as Safety Class 2. Discuss this seeming discrepancy and any effect it may have on the risk assessments made in the TR.

18. Section 6.1 states:

> It is currently recommended that the 7 day AOT would apply to all PCIVs included within Condition A, C and E of the current Technical Specifications.

However, the Executive Summary states:

> The scope of the analysis included all PCIVs except the Main Steam Isolation Valves (MSIVs) and the ones in the Feedwater system. Based on the results of the analysis, the acceptance criteria for AOT extension were not met for the Low Pressure Core spray (LPCS) PCIVs for BWR 5/6 plants and the Shutdown Cooling Suction PCIVs for all BWRs.

Also, Section 6.3.2.1.a. states:

> The PCIV AOT is assumed to increase from its current duration of 4, 24, or 72 hours to a proposed duration of 168 hours for all PCIVs with the exception of Main Steam and Feedwater.

Clarify the seeming discrepancies among these sections.

19. In the cover letter it is stated that "—acceptance criteria for AOT extension were not met for the LPCS PCIVs for BWR 5/6 plants—" Explain how the criteria for low pressure coolant injection (LPCI) PCIV for all boiling water reactors (BWRs) and core spray (CS) PCIVs were met for BWR 3/4/5 plants.

20. Section 6.2, ECCS Isolation Valves, states that "—while inoperability of a single SI isolation valve to open may render the system technically INOPERABLE. The system remains fully capable of meeting the intent of LOCA event mitigation (that is, the systems remains functional)."

    All emergency core cooling systems (ECCS) are assumed in the loss-of-coolant accident (LOCA) analyses. If a CS system pump is out for maintenance and the safety injection (SI) valve of the remaining CS is assumed to be inoperable, complete spray system is lost. Explain how the ECCS will mitigate the LOCA event in this scenario, including post-accident long term core cooling.

21. In Section 6.3.2.1, General Assumptions/Input, in the exception category, low pressure core spray/high pressure core spray (LPCS/HPCS) and shutdown cooling (SDC) valves are not included. Explain why these valves need not be included.

22. In Section 6.3.2.6.1.1, Impact on ISLOCA for Securing a PCIV in Locked Open Position, the staff has the following questions:

    a. <u>P 6-39, last sentence</u>, it is stated that "Some systems in this class have three valves available to isolate the high pressure fluid system from the low pressure piping, 2 of those valves being PCIVs." Identify the systems which have three valves.

    b. <u>P 6-40</u>, under penetrations with three high pressure valves, the following low pressure injection systems are listed:

       LPCI injection
       CS Injection
       LPCS
       SDC Suction

       These systems are low pressure systems. Explain the location of the high pressure isolation valves in these systems.

23. Submit the marked-up TS changes where the AOTs are changed.

24. Attachments 1 and 2 to NEDC-33046, "Technical Justification to Support Risk-Informed Primary Containment Isolation Valve AOT Extensions for BWR Plants," are unmarked copies of Improved Standard Technical Specification (ISTS) 3.6.1.3, "Primary Containment Isolation Valves (PCIVs)," from NUREG-1433, "Standard Technical Specification - General Electric Plants-- BWR/4," and NUREG-1434, "Standard Technical Specification - General Electric Plants - BWR/6," respectively. While the title and specification itself for attachment 2 seems to reflect the BWR/6 specification, the

header at the bottom of some of the pages indicates that it is the BWR/4 specifications. Correct this discrepancy.

25. A statement is made in the Executive Summary and in Section 2.2 of NEDC-33046 which states that, "The scope of the analysis included all PCIVs except the Main Steam Isolation Valves (MSIVs) and the ones in the Feedwater system. Based on the results of the analysis, the acceptance criteria for AOT extension were not met for the Low Pressure Core Spray (LPCS) PCIVs for BWR 5/6 plants and the Shutdown Cooling Suction PCIVs for BWR 5/6 plants and the Shutdown Cooling Suction PCIVs for all BWRs." The staff does not agree that the phrase "all PCIVs" is the correct terminology to use for this report. (See question 26). The staff does not believe that the BWROG has looked at every PCIV penetration at all the BWR plants and verified that they meet the specific criteria in the TR. It is assumed that a licensee submitting a plant TS amendment to revise the PCIV TS to take advantage of the extended AOT would verify that the TR is applicable to the containment penetrations at the plant. This plant-specific verification may result in some penetrations/PCIVs for which the TR does not apply or the licensee's own evaluation results in an unacceptable risk, thus the AOT extension would not be allowed for those penetrations. The TR does not address this aspect nor show how it would be addressed in the STS. Revise these TR sentences and provide a draft sample marked-up STS to address this concern.

26. A statement is made in the Executive Summary and in Section 2.2 of NEDC-33046 which states that, "The scope of the analysis included all PCIVs except...". The staff believes that "all PCIVs" were not evaluated in this TR. The TR states in Sections 1.0, "Purpose"; 2.0, "Scope of Proposed Change to Technical Specifications"; and 4.0, "Summary of Applicable Technical Specifications" that the AOT extension applies to penetrations addressed by STS 3.6.1.3, Condition C. STS 3.6.1.3, Condition C applies to two types of penetrations with a single PCIV – penetrations with a closed system and penetrations without a closed system (opened). The TR addresses various types of penetrations with a single PCIV and a closed system, but does not seem to address penetrations with a single PCIV and an open system. Provide a discussion to show that the TR is applicable to penetrations with a single PCIV and an open system or revise the report to exclude these penetrations from the AOT extension. (See question 25).

27 The TR states in Sections 1.0, 2.0, and 4.0 that the proposed modification applies to PCIVs addressed by STS 3.6.1.3, Conditions A, C, and E. STS 3.6.1.3, Condition E specifies the remedial actions to be taken when purge valve leakage is not within limits for those designs in which the purge valve leakage rate can be measured separately for each purge valve. STS 3.6.1.3, Condition D also specifies the remedial actions to be taken when purge valve leakage is not within limits, but it applies to those designs in which the purge valve leakage rate cannot be measured separately for each purge value. In addition, STS 3.6.1.3, Condition D specifies the remedial actions to be taken and AOTs for various types of PCIV leakage not within limits. It is unclear from the discussions in the TR as to why the purge valve leakage AOT (Condition E) can be extended, since the leakage has more to do with containment integrity with regards to 10 CFR Part 50, Appendix J rather than valve inoperability. In addition, if it is acceptable to increase the AOT for purge valve leakage in Condition E, why isn't it also acceptable to increase the AOT for purge valve leakage in Condition D, as well as the other PCIV leakage AOTs, since the actions are similar per the Bases discussion for

Condition D? Restoration of leakage limit can be accomplished by isolating the penetration. Provide a discussion on why the AOT extension is applicable only to purge valve leakage AOT in Condition D as well as to the other PCIV leakage AOTs in Condition D.

28. STS 3.6.1.3, Condition G specifies the remedial actions to be taken when the required actions and associated completion times of Conditions A, B, C, D or E are not met during movement of recently irradiated fuel assemblies. Recently irradiated fuel assemblies is defined in the Bases and in Technical Specification Task Force (TSTF) - 51 as fuel that has occupied part of a critical reactor core within the previous [X] days, due to radioactive decay. The staff has reviewed a number of TSTF-51 amendment requests over the last few years, in which "recently" has been defined as low as 24 hours and as high as 28 days. Some recent BWR TSTF-51 requests have proposed 24 hours for "recently." The TR is mute on this area. Since Condition G is only entered if the completion times specified in Conditions A, B, C, D, or E are exceeded, the proposed AOT extension of 7 days could negate the changes made in and the analyses done for this specification by TSTF-51. Provide a discussion on how the proposed AOT extension will be affected by TSTF-51 in this specification and what STS changes may need to be made to accommodate both of these conditions.

29. Section 1.0 of NEDC-33046 states that the report has been prepared in the same format as the CEOG report for AOT extension of containment isolation values. Section 2.1, "Definition of Primary Containment Isolation Valve" states that the report does not include an evaluation of the AOTs associated with secondary containment isolation valves (SCIVs). While some pressurized water reactors (PWRs) do not have a secondary containment, there is no STS requirement for PWR-SCIVs. However, all BWRs do have secondary containments and do have STS requirements for SCIVs and drywell isolation vales for the BWR/6 plants. By not addressing the AOTs for SCIVs and drywell isolation valves, the TR creates a problem. Currently, STS 3.6.1.3 actions for most PCIVs are more restrictive than the STS actions for SCIVs and drywell isolation valves because they are the primary isolation boundary for design basis accidents (DBAs). By relaxing the AOTs for PCIVs and modifying the STS accordingly, it results in the actions for SCIVs and drywell isolation valves being the more restrictive STS by a very large margin (4 hours to 8 hours versus 7 days to 8 hours – PCIV AOT to SCIV/drywell AOT respectively). Licensees proposing to implement this TR into their plant TS, would probably object to the secondary boundary TS being substantially more restrictive than the primary boundary and thus the staff could be faced with a multitude of different SCIV/drywell isolation valve AOTs based on a variety of justifications. This would be unacceptable since the intent of the STS is consistency. The staff believes that if changes to one specification has an impact or effect on other specification actions, then the other specification actions should be evaluated with respect to the proposed change and modified accordingly. Since the PCIV AOT extension has an impact on the SCIV/drywell isolation valve AOT, the TR should be modified to evaluate and propose AOT extension for the SCIVs and drywell isolation valves on a risk-informed basis.

April 23, 2003

Mr. Jack Gray, Chairman
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Dear Mr. Gray:

On January 5, 2001, the BWROG submitted Topical Report (TR) NEDC-33046, "Technical Justification to Support Risk-Informed Primary Containment Isolation Valve AOT Extensions for BWR Plants," for staff review. The staff has determined that additional information is needed to complete our review. Enclosed is our request for additional information (RAI) regarding TR NEDC-33046. As discussed with your staff, it was agreed that you would respond within 30 days of receipt of the RAI.

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Project No. 691

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