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PROJECT NUMBER 691

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SUBJECT: **BWROG RESPONSES TO NRC REQUEST FOR ADDITIONAL INFORMATION (RAI) ON NEDC 33046, "TECHNICAL JUSTIFICATION TO SUPPORT RISK-INFORMED PRIMARY CONTAINMENT ISOLATION VALVE AOT EXTENSIONS FOR BWR PLANTS" (TAC NO. MB 1054)**

REFERENCE: Letter from Alan B. Wang, Office of Nuclear Reactor Regulation to Jack Gray, Chairman, BWR Owners Group, same subject, dated April 23, 2003.

The BWR Owners' Group (BWROG) has reviewed the NRC Staff's RAI given in the Reference. These BWROG responses are attached.

While preparing responses to the RAI, additional changes were identified to correct minor errors in the report NEDC-33046. These changes are given at the end of the RAI responses. These changes are minor in nature and do not affect the technical basis or conclusions. In addition, the TSTF for this AOT extension will be submitted to NRC under separate cover within the next few weeks.

If you or the NRC have any questions regarding these responses, please contact Don McCamy (TVA), BWROG Risk Informed Specification Committee Chairman at (256) 729-2474 or Rick Hill (GE) Project Manager at (408) 925-5388.

Regards,

K. S. Putnam, Chairman
BWR Owners' Group

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Attachment: BWROG RAI Responses

cc: J. Conen, BWROG Vice Chairman
BWROG Primary Representatives
BWROG RITS Committee
B. Bradley, NEI
T. G. Hurst, GE
R. A. Hill, GE
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A. Wang, NRC

BWROG Response to NRC

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?

BWROG Response:

Vacuum breakers are covered by other Technical Specification sections (Sections 3.6.1.7 and 3.6.1.8 for BWR 4 STS and Section 3.6.5.6 for BWR 6 STS) and are therefore not included in this analysis scope

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

BWROG Response:

Class A penetrations connect the containment atmosphere to the environment, or connect to non-seismically qualified piping that interface with the containment atmosphere. Penetrations connected to closed loop system inside and outside containment are addressed as part of Class C containment 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.

BWROG Response:

For PCIVs that are normally closed, we evaluate the probability that the normally closed valve can open spuriously during the AOT period. The failure probability is obtained by multiplying the hourly valve failure rate by the duration of AOT.

For PCIVs that are normally open, the valve has to close on a core damage event. The relevant failure probability is the valve failure to close on demand. One could add the failure to stay closed probability to this. The failure to stay closed would be based on typical PRA mission period of 24 hours, (and not based on the proposed AOT period), and this represents a negligible addition to

the valve probability used. It would not be appropriate to add the 2.35 E-3 valve failure to stay closed probability to 2.00E-3 for valve failure to close probability.

For almost all cases, a bounding failure rate value is used to account for different valve types and modes of failure, i.e., the highest value for the two different modes of failure for different valve types listed in the Section 6.3.2.1 Table is used. The only exceptions are for Cases B2, E1, and E2. For these cases, the failure rate or failure probability (either failure to close on demand or failure to remain closed) for a motor-operated valve is used. This approach is considered a reasonable approach.

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?

BWROG Response:

Equation 6b does include the probability of inadvertent opening of the relief valve.

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?

BWROG Response:

The term acceptable limit is used in the following paragraph:

"An inoperable PCIV for Class D penetration that is secured in the open position has no impact on CDF because instrument lines are sized and orificed to limit the rate and extent of any coolant loss to a small amount relative to the reactor coolant makeup capability. A rupture in the containment or reactor pressure detector line outside the containment may establish a pathway to the environment. However, the risk of a significant release of radioactive material or coolant via the affected penetration is insignificant since the line is not capable of passing enough flow to exceed the acceptable limits."

The BWROG suggests the following changes to this paragraph:

"An inoperable PCIV for Class D penetration that is secured in the open position has no significant impact on CDF because instrument lines are sized and orificed to limit the rate and extent of any coolant loss to a small amount relative to the reactor coolant makeup capability. A rupture in the containment or reactor pressure detector line outside the containment may establish a pathway to the environment and cause a plant shutdown. However, the risk of a significant release of radioactive material or coolant via the affected penetration is insignificant since the line is not capable of passing enough flow to exceed the 10 CFR 100 limits or CFR 50.67 limits as applicable. The BWROG report for extending testing intervals for Excess Flow Check Valves (EFCVs) (NEDO-32977-A, June 2001) shows that instrument lines cannot pass large releases.

Based on this penetration configuration, the incremental change in core damage and large early release is negligible and well below the acceptance probability criteria values."

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.

BWROG Response:

Securing a PCIV in a closed position ensures containment isolation. However, the operability of the associated coolant injection loop or train will be affected. The ECCS Technical Specification Section 3.5.1 provides a 7 day AOT for an inoperable coolant injection loop. The basis for this AOT is the reliability study referenced in the Technical Specification Basis (Section B 3.5.1). Therefore, the effect of failure of a valve in a closed position during a 7 day AOT is already considered in quantitative reliability analysis to support existing Technical Specifications.

The above response provides a reference with basis the coolant injection loop. For the containment spray line, the BWR 6 STS Section 3.6.1.7 (Condition A) provides a 7 day AOT for a single containment spray subsystem. The basis for this AOT is provided in Section B.3.6.1.7. For the RHR Suppression Pool Spray line, the BWR 4 STS Section 3.6.2.4 (Condition A) provides a 7 day AOT for a single Suppression Pool Spray subsystem. The basis for this AOT is provided in Section B.3.6.2.4.

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?

BWROG Response:

In the most likely scenario, modeling the MOV to remain closed with a failure probability of 1.29 E-4 would be appropriate. However, there is a chance that the MOV may be open for the containment spray function, in which case it would be appropriate to model failure of the MOV to close on demand. Failure to close probability of the MOV on demand is one order magnitude higher than failure probability to remain closed. Therefore, use of the higher failure probability provides a conservative approach.

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.

BWROG Response:

The Case E-3 configurations include penetrations with a single PCIV and closed

piping outside containment. The penetration lines terminate under water in the Suppression Pool and the water seal provides a passive barrier for the containment atmosphere. The closed piping system outside containment provides a means of isolating the containment when the PCIV is secured open during a AOT. Therefore, the containment isolation function is not lost when the single PCIV is taken out of service.

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?"

BWROG Response:

Yes, the editorial correction will be made in the report

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.

BWROG Response:

As stated in Section 3.0, Background, the BWROG analysis for extending the PCIV AOT to 168 hours is in accordance with NRC Regulatory Guide 1.177, which provides the guidance for making a risk informed Technical Specification change. Each utility will assess the risk associated with plant maintenance as part of plant program(s) to meet paragraph (a)(4) of the Maintenance Rule. In addition, based on the low risk identified in Table 6.3-3 of the BWROG PCIV AOT report, entry into a reasonable number of multiple cases is not expected to result in an incremental change in the probabilities for core damage or large early release in excess of acceptance criteria. For this reason, the proposed AOT of 168 hours is judged to be adequate for on-line maintenance.

The following clarification will be added to the end of Section 5.2.1, Preventive Maintenance: "The proposed AOT of 168 hours is judged to be adequate for on-line maintenance. This report assumes an single AOT of 168 hours per year in calculating the risks associated with the proposed AOT."

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?

BWROG Response

The risk of common cause failure (CCF) was considered in establishing the current surveillance interval. This implies that the potential of having a CCF where both valves fail to isolate is acceptably low during the current surveillance interval. If one valve is found failed and taken out of service to repair for the proposed 7 day AOT, the risk that a second valve in the same flow path is also failed is acceptably low based on the current surveillance interval. The proposed change to AOT does not change the risk of CCF associated with the current surveillance interval.

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.

BWROG Response:

The largest probability of a BWR pipe break given in EPRI Technical Report No. 102266, dated April 1993 is 2.3E-9 per section hour. This report is an update to EPRI TR 100380, dated July 1992. Using the method cited in Section 6.3.2.1, paragraph j (assumes 100 sections in a run of piping), the probability of a random pipe failure during the proposed 7 day AOT is 3.86E-5. This probability is less than the bounding value of 6.14E-4 used in BWROG report.

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.

BWROG Response:

The PCIVs for Case B-1 are normally closed during power operation and are cycled open on a daily basis to obtain the necessary samples from the RCS. The PCIVs are designed to close automatically on a containment isolation signal. The PCIVs for Case B-1 in Figure 6.3-4 should be shown in a normally closed position. Since during power operation the PCIVs are normally closed, the failure to remain closed probability during the AOT applies. If a PCIV is cycled open to obtain a RCS sample the applicable failure mode is failure to close. However, for purposes of this analysis, the bounding probability for failure to remain closed during the AOT was used. Refer to the response for RAI 3 for further discussion of the demand and spurious operation failure modes.

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.

BWROG Response:

The figure does not show a relief valve. However, a relief valve has been assumed conservatively for calculation purposes.

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).

BWROG Response:

The contribution of PCIV unavailability due to test and maintenance is a small contributor to the overall core damage frequency. For most cases, the AOT extension does not impact the CDF. For those cases where there is a potential CDF impact, the analysis provides an assessment of the incremental change in CDF due to the AOT extension. A similar assessment is provided for the incremental change in LERF due to the AOT extension.

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)?

BWROG Response:

Assumption n on page 6-9 will be deleted in the revised topical report.

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.

BWROG Response:

We agree with the comment. We will revise the sentence as follows:

*"These closed loop systems are designed to withstand a higher pressure than the containment design pressure. As a result, the **probability of** failure of the closed loop piping is deemed negligible."*

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.

BWROG Response:

The calculations consider the probability of a break in a closed system. The calculations also assume that the closed loop acts as a barrier that precludes leakage or flow of containment atmosphere out of the containment during an accident. However, it is based on the fact that the typical containment design pressures are about 45 psig while the closed pipes can withstand much higher pressure. All this means is that if the containment pressure is high, the potential for leakage into the piping is negligible. Meeting the stated RGs is not a necessary condition for this position.

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.

BWROG Response:

As stated in the Executive Summary, the scope of the analysis included all PCIVs except the Main Steam Isolation Valves (MSIVs) and the Feedwater isolation valves. 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.

It is agreed that the last sentence in Section 6.1 could be misinterpreted and will be revised as follows:

"The objective of this analysis is to revise the current 4, 24, and 72 hours AOT to a 7 day AOT for all PCIVs included within Condition A, C and E of the current Technical Specification that can be supported by analysis. The AOTs for the Main Steam Isolation Valves (MSIVs) and Feedwater isolation valves are specially excluded from this analysis. Vacuum breakers are covered by other Technical Specification sections and are therefore not included in this analysis scope.. "

In addition, Section 6.3.2.1a will be revised as follows:

"For purposes of this analysis, the PCIV AOT is assumed to increase from its current duration of 4, 24, or 72 hours to a proposed duration 168 hours for all PCIVs with the exception of Main Steam Isolation Valves and Feedwater isolation valves. "

The following additional revisions will be made to other sections:

ABSTRACT

"The analyses conclude that plant safety and operational improvements can be achieved by extending the AOT for selected primary containment valves supported by analysis from the current 4, 24, or 72 hours to 7 days in order to perform on-line maintenance, repair, or testing. Main Steam Isolation Valves (MSIVs) and Feedwater isolation valves were specifically excluded from the scope of these analyses. Vacuum breakers are covered by other Technical Specification sections and are therefore not included in this analysis scope."

PURPOSE

"This proposed modification applies to those selected PCIVs addressed by Condition A, C, and E of Section 3.6.1.3 of NUREG-1433, revision 2 (Attachment 1) and Section 3.6.1.3 of NUREG-1434, Revision 2 (Attachment 2) which are supported by analysis. Main Steam Isolation Valves (MSIVs) and Feedwater isolation valves were specifically excluded from the scope of these analyses. Vacuum breakers are covered by other Technical Specification sections and are therefore not included in this analysis scope.

2.1 DEFINITION OF PRIMARY CONTAINMENT ISOLATION VALVE (Last Paragraph)

"Main Steam Isolation Valves (MSIVs) and Feedwater isolation valves were specifically excluded from the scope of these analyses. Vacuum breakers are covered by other Technical Specification sections and are therefore not included in this analysis scope. In addition, this study does not include an evaluation of the AOTs associated with Secondary Containment Isolation Valves and containment valves covered by other Technical Specification sections."

4.1 IMPROVED STANDARD TECHNICAL SPECIFICATION GUIDANCE

"This report provides risk-informed justifications for selected AOT extensions supported by analysis corresponding to the actions in response to either Condition A, Condition C, or condition E as defined in NUREG-1433/4. Main Steam Isolation Valves (MSIVs) and Feedwater isolation valves were specifically excluded from the scope of these analyses. Vacuum breakers are covered by other Technical Specification sections and are therefore not included in this analysis scope.

6.3.2.4 RISK ASSESSMENT OF AOT EXTENSION FOR CLASS A CONTAINMENT PENETRATIONS

Second to last sentence of first paragraph, change to: "The proposed PCIV AOT extension considered in this report is not applicable to MSIVs and Feedwater isolation valves."

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.

BWROG Response:

Section 6.3.2.6.1.1 of the report shows how the acceptance criteria were met for the LPCI PCIV for all BWRs and LPCS PCIVs for all BWR 3/4 plants. The penetrations for these systems have three valves available to isolate the high-pressure fluid from the low-pressure piping. Two of these valves are CIVs and the third valve is a high pressure valve in the low pressure injection system. The piping upstream of the CIV to the third valve is also high pressure. A schematic of this three valve configuration is shown in the revised Figure 6.3-9 given in the response to RAI 22.

Systems with two high-pressure valves (LPCS for BWR 5/6 plants and Shutdown Cooling Suction for all BWRs) do not meet the core damage and large release acceptance criteria. Therefore, a Technical Specification change is NOT requested for systems in this class with two isolation valves.

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.*

BWROG Response:

The complete paragraph from which the NRC quote is taken is as follows:

"ECCS Isolation Valves"

"In the case of ECCS Safety Injection (SI) isolation valves (LPCI/HPCS(HPCI)/LPCS isolation valves), the unavailability of one SI flowpath will not compromise the ability of the ECCS to mitigate a LOCA. Thus, 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 system remains functional)."

What is meant here is that if a single SI flowpath or loop in LPCI/HPCS(HPCI)/LPCS is unavailable, the remaining SI loops in ECCS remain fully capable of meeting the intent of LOCA event mitigation (that is, the ECCS remains functional). For BWR 3/4 plants, there are two low pressure loops for core spray. For BWR 5/6 there is a single low pressure core spray loop (LPCS) and a high pressure core spray loop (HPCS).

The NRC described scenario of a CS system pump out for maintenance and the SI valve of the remaining CS inoperable is governed by the ECCS Technical Specification (TS), not the PCIV TS. The applicable ECCS TS for this condition requires immediate entry into LCO 3.0.3.

The following changes to the text will clarify this:

"Thus, while inoperability of a single SI isolation valve to open may render the **subsystem** technically INOPERABLE, the **ECCS** remains fully capable of meeting the intent of LOCA event mitigation (that is, the **ECCS** remains functional)."

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.

BWROG Response:

Section 6.3.2.1 lists the exceptions prior to doing the risk evaluation. The outcome of the evaluation is that the LPCS (BWR 5/6) and SDC (all BWRs) valves do not meet the acceptability criteria (Section 6.3.2.6.1.1). It would therefore be inappropriate to include exceptions determined from the analysis in the General Assumptions/Input Section.

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. P 6-39, last sentence, 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. P 6-40, 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.

BWROG Response:

(a) The systems with three valves are listed on page 6-40 and copied below:

"The resulting ICCDP and ICLERP for penetrations in this class that have three high-pressure valves is well below the acceptance criteria of 5E-07 and 5E-08, respectively. Penetrations with three high-pressure valves are:

- Steam to HPCI, RCIC and RHR
- LPCI Injection
- HPCI Injection
- HPCS Injection
- RCIC Injection
- Core Spray Injection (BWR3/4)
- Head Spray

(b) The low-pressure systems listed on page 6-40 with **three high-pressure valves** are LPCI Injection for all BWR plants and Core Spray Injection for BWR 3/4 plants. The low-pressure systems with **two high-pressure valves** which do not meet the acceptance criteria are LPCS for BWR 5/6 plants and Shutdown Cooling Suction for all BWR plants.

In the BWR design, certain low-pressure systems, such as those listed above, are connected to the reactor or reactor coolant systems, which normally operate at high-pressure (approximately 1050 psi). The low-pressure systems operate only after the reactor is depressurized. When the reactor is at high-pressure, high-pressure valves ensure that the high-pressure piping stay isolated from the low-pressure piping. The interfacing systems LOCA calculations address the scenarios when the low-pressure piping gets accidentally over-pressurized.

A typical schematic of a LPCI line penetration is shown in Figure 6.3-9.for a Mark III containment design. This representation also applies to the Mark I and II containment designs. The figure shows that a typical LPCI line includes a motor-operated valve, which is located outside the containment, is normally closed and opens automatically. There is a testable check valve inside the containment that is used for pressure isolation. Not shown in this figure is a third valve (motor-operated) outside containment that is applicable for some low-pressure systems. The low-pressure systems with two and three high-pressure valves are listed on page 6-40 of Section 6.3.2.6.1.1.

The following revised Figure 6.3-9 shows the location of the third valve.

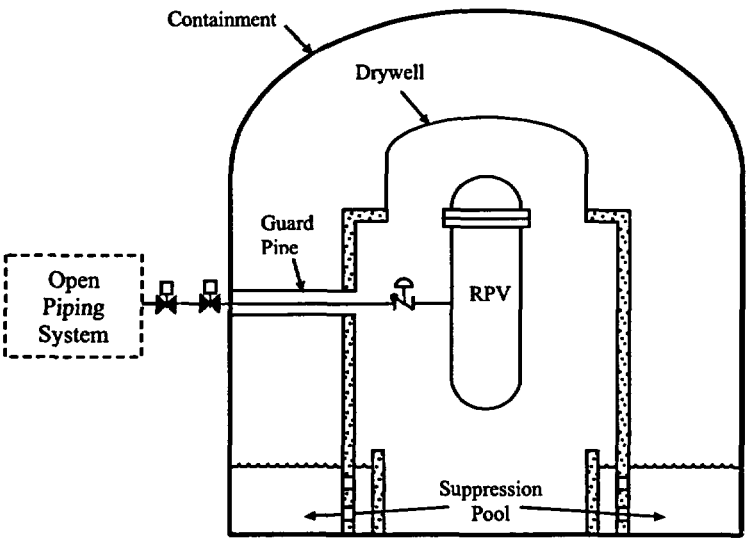

Figure 6.3-9
Case E-1: Schematic of Penetration Connected to LPCI Line

The LPCI line motor-operated PCIV is credited in the PSA model(s). The inoperability of a PCIV has the potential for impacting CDF and LERF, regardless of whether the affected valve is secured in the open or closed position...

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

BWROG Response:

Marked-up TS changes will be given in the TSTF which will be submitted with NEDC report.

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.

BWROG Response:

The Standard Technical Specifications given in Attachments 1 and 2 will be deleted from the report. Marked-up TS changes will be given in the TSTF which will be submitted with NEDC report.

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.

BWROG Response:

As part of the topical report, BWROG has completed a detailed survey of all the plants PCIV configurations. Each plant had to respond to two sets of surveys: a) relating to plant CDF values and related information, and b) survey related to PCIV configuration.

The results of the first survey were used to come up with envelope values for PRA-related information.

In the second survey, each plant was given a set of PCIV configurations, which showed typical systems covered by each configuration, and the plant was required to verify if the ones in the survey covered their PCIV configurations. The plants responded to the survey and the responses are documented in the design record file and available for audit.

It is reasonable to require that each Licensee confirm that the following when they seek to extend their AOTs:

a). The PCIV configurations in the plant match the ones analyzed in the report

b). The PRA values for the plant are bounded by the ones used in the report.

For PCIVs where these two requirements are not met, the Licensee will have to make plant-specific justifications.

The above requirements will be added to the PCIV AOT report.

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).

BWROG Response:

We believe we have included all the configurations we have in BWRs. A statement will be added to the NEDC report that the proposed AOT changes do not apply to an open system with a single PCIV.

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.

BWROG Response:

The BWROG analysis supports extension of the AOT to 7 days for one or more penetration flow paths with **one** containment purge valve inoperable in a flow

path. The revised STS 3.6.1.3 Condition E would have to be written to allow a 7 days AOT for one containment purge valve inoperable in one or more penetration flow paths and 24 hours AOT when there are **more than one** inoperable purge valves in any penetration flow path. Some plants do not have the capability to determine which individual PCIV in a flow path is outside the allowable leakage limits. For these plants, the proposed AOT extension for Condition E for a single PCIV in a flow path would offer no benefit. The BWROG has concluded any benefits derived from this change are outweighed by the required complexity associated with implementing the change. Therefore, the BWROG has decided to withdraw the proposed 7 day AOT extension for STS 3.6.1.3 Condition E.

Condition D includes EFCV leakage rate not within limit. The specified AOT for EFCV leakage is 72 hours which is the same as the AOT for Condition C. The analysis for extending the 72 hour AOT for EFCVs (Condition C) supports the AOT extension for EFCV leakage in Condition D. Therefore, the TS markup will reflect this change to 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.

BWROG Response:

The Applicability for Technical Specification 3.6.1.3 for PCIVs includes Modes 1, 2, and 3 and when associated instrumentation is required to be OPERABLE per LCO 3.3.6.1, "Primary Containment Isolation Instrumentation." Although STS Condition G is theoretically possible, it is high unlikely and physically impractical for plants to move recently (within 7 days) irradiated fuel during Modes 1, 2, or 3 when a PCIV AOT would be in effect. The only instrumentation specified in LCO 3.3.6.1 that is applicable for Mode 5 when irradiated fuel assemblies are moved is Reactor Vessel Water Level 3 for Shutdown Cooling System Isolation. The valves associated with this instrumentation are normally closed during reactor operation and open during RHR shutdown cooling operation. The suction valves close on reactor water level 3 to prevent loss of reactor coolant. The shutdown cooling suction isolation valves were analyzed as part of Case E-1 in the report. The analysis concluded that these valves do not meet the acceptance criteria and therefore no change in AOT was proposed for these valves. Based on the above, the proposed AOT extension to 7 days will not be affected by TSTF-51 and no further STS changes are required.

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.

BWROG Response:

It is recognized that the scope of the BWROG AOT extension was limited to primary containment isolation valves. The primary reason for this focus was based on the potential benefits to be derived with implementation of the proposed AOT extension for PCIVs. Although it may be possible to provide a similar analysis and change basis for secondary containment vales (SCIVs), it was determined the benefits from implementation of similar AOT extension for SCIVs at the current time are not as cost beneficial as for the PCIV AOT extension. The primary reason for this is that for the majority of BWR plants, the SCIVs are more easily accessible for maintenance and repair and do not have the same hardships as PCIVs. The BWROG feels that the proposed AOT change for PCIVs with no change to the SCIV AOTs will have no adverse impact on plant operations.

Additional Changes Made to NEDC-33046, February 2002

1. Delete Attachment 1 and 2 and make necessary changes to text where these Attachments are referenced. These Attachments are not necessary since the information will be part of the marked-up Technical Specification.

2. Table 6.3-3, page 6-47, the risk ratios appearing in the last two columns are incorrect. The risk ratios in the last two columns are given in the Attached corrected Table 6.3-3.

3. Page 6-40, last paragraph, change "This configuration DOES NOT MEET either acceptance criteria" to "This configuration DOES NOT MEET the acceptance criteria for ICLERP".

4. Page 6-11, Figure 6.3-1 and page 6-20, Figure 6.3-4 show the normally open valves. These valves should be shown as normally closed valves. See Attached corrected Figures.

Corrected Table 6.3-3

Table 6.3-3
Summary of Plant Risk for Proposed PCIV AOT Extension

Class	Description	Seismic Effect on Piping Y	Seismic Effect on Piping N	Position of INOPERABLE PCIV	Proposed AOT (Days)	ICCDP	ICLERP	ICCDP Risk Ratio (Note 4)	ICLERP Risk Ratio (Note 5)
A	1. PCIVs in penetrations connected directly to containment atmosphere and outside environment	(Note 1)		OPEN	7	0	3.05E-9	0	6.10E-2
	2. PCIVs in penetration connected directly to containment atmosphere and closed loop system outside containment	√		OPEN	7	0	1.87E-12	0	3.74E-5
			√	OPEN	7	0	1.15E-9	0	2.30E-2
	3. PCIVs in penetrations connected to containment atmosphere and open loop system outside containment	√		OPEN	7	0	1.87E-12	0	3.74E-5
			√	OPEN	7	0	1.15E-9	0	2.30E-2
B	1. PCIVs in penetrations connected to Reactor Coolant sample lines	√		OPEN	7	1.58E-10	1.58E-10	3.16E-4	3.16E-3
			√	OPEN	7	1.27E-11	1.27E-11	2.54E-5	2.54E-4
	2. PCIVs in penetrations conneced to RWCU (Note 3)	√		OPEN	7	9.11E-9	9.11E-9	1.82E-2	1.82 E-1
			√	OPEN		5.18E-12	5.18E-12	1.04E-5	1.04E-4
C	1. PCIVs in penetrations connected containment cooling units (PCIVs outside and closed loop inside)	√		OPEN	7	8.79E-9	5.39E-12	1.76E-2	1.08E-4
			√	OPEN	7		2.47E-10		4.94E-3
	2. PCIVs in penetrations connected containment cooling units (PCIVs inside and outside)	√		OPEN	7	8.79E-9	1.54E-14	1.76E-2	3.08E-7
			√	OPEN	7		1.15E-9		2.30E-2
D	PCIVs in penetrations connected to containment atmosphere pressure detector	(Note 2)		OPEN	7	Neg	Neg	Neg	Neg
E	1. PCIVs in penetrations used to support Reactor Coolant Inventory Control Safety Function – coolant injection	(Note 2)		OPEN	7	1.66E-11	1.66E-11	3.32E-5	3.32 E-4
	2. PCIVs in penetrations used to support Containment Heat Removal safety function using containment sprays	(Note 2)		OPEN	7	0	1.77E-12	0	3.54E-5
	3. PCIVs in penetrations connected to the Suppression Pool	(Note 2)		OPEN	7	0	6.55E-10	0	1.31E-2

Notes for Table 6.3-3:

1. The associated piping located downstream of the PCIV outside Containment is open to the environment. The associated plant risk for this penetration is not impacted by a seismic event.
2. Associated piping outside the containment is seismically qualified.
3. ICLERP is bounded by penetration connected to an open loop cooling water system.
4. ICCDP risk ratio is defined as the ratio of the estimated ICCDP to RG 1.177 acceptance criteria of 5.0E-7.
5. ICLERP risk ratio is defined as the ratio of the estimated ICLERP to RG 1.177 acceptance criteria of 5.0E-8.

Corrected Figure 6.3-1

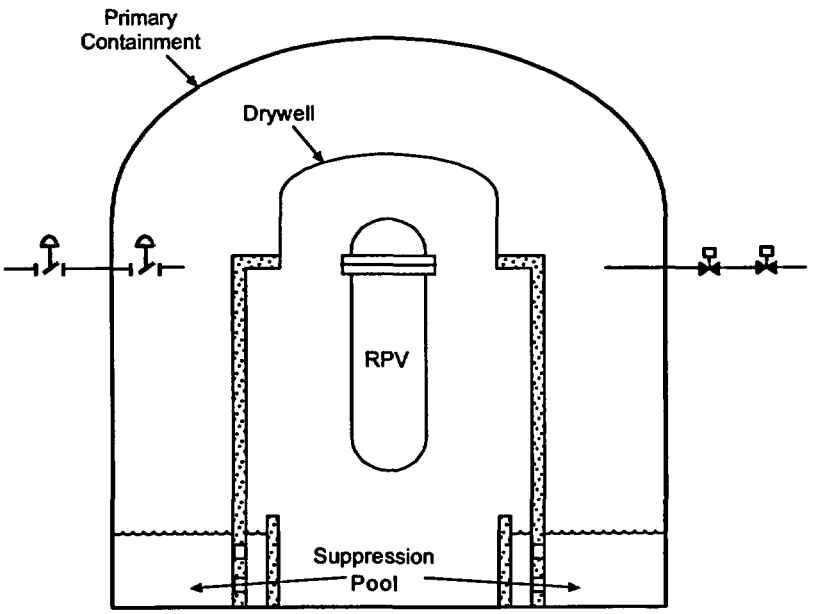

Figure 6.3-1
Case A-1: Schematic of Penetration Connected Directly to Containment Atmosphere and Outside Environment

Corrected Figure 6.3-4

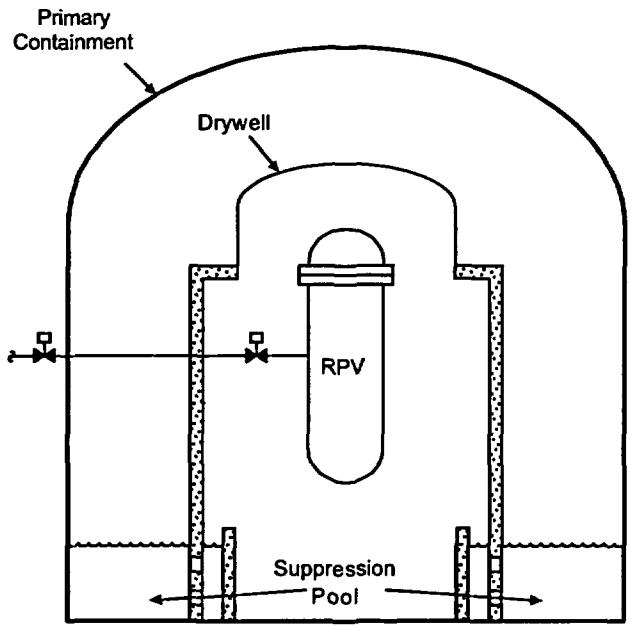

Figure 6.3-4
Case B-1: Schematic of Penetration Connected to Reactor Coolant Sample Line