Enclosure 1

INTRODUCTION

At the September 28, 2007 public meeting (Accession No. ML071930260) to discuss the preliminary PWROG responses to the NRC's Requests for Additional Information (RAIs), the PWROG took an action to provide finalized RAI responses (including an additional RAI that was received after the meeting), provide an updated Table A-2 to WCAP-16308-NP, and to clarify the expectation for the scope of the NRC's review and safety evaluation of the PWROG Topical Report (TR) WCAP-16308-NP.

The RAI responses are provided in this document. The revised Table 2 to WCAP-16308-NP is provided in a separate document attached to the cover letter transmitting this document.

The PWROG expectation for the NRC review of WCAP-16308-NP is to obtain a clear safety evaluation which would allow licensees to take credit for the process used to categorize passive components in accordance with 10 CFR 50.69. This is consistent with the meeting summary from the February 6, 2007 public meeting (Ascension No. ML070440490). The PWROG believes that this includes the passive categorization process described in Section 4 of the TR and includes the IDP process used to finalize both the passive and the active categorization described in Section 3.7 or the TR. In addition, based on RAIs 10 and 11 below, the PWROG believes that the NRC's safety evaluation should also address the process used to satisfy 50.69 (d)(2) and (e) as discussed in the Section 7 and 8 of the TR as revised by the responses to RAIs 10 and 11. The active categorization described in Section 3 of the TR follows NEI 00-04 which has been endorsed by NRC in Regulatory Guide 1.200 and there is no need for further NRC review of this section, except Section 3.7 as discussed above.

NRC RAIs on WCAP-16308-NP, "Pressurized Water Reactor Owners Group 10 CFR 50.69 Pilot Program – Categorization Process – Wolf Creek Generating Station", Letter from Tanya Mensah (NRC) to Biff Bradley (NEI) dated August 28, 2007 (ML072220129)

1. Section I-3.0 of the ASME Code Case N-660, Rev. 0, refers to shutdown, fires, flooding and seismic (hereafter referred to as "external events") as providing information relevant to classification. Although external events are often not modeled in a probabilistic risk assessment (PRA), Tables I-1 to I-4 in ASME Code Case N-660, Rev. 0, may be used to classify structures, systems, and components (SSCs) needed to respond to these external events.

   The proposed methodology[1] retains the original discussion and again mentions external events in a new section (Section I-3.1.2), but provides no additional

[1] Table A-2 of TR WCAP-16308-NP identifies a number of differences between the process described in ASME Code Case N-660 and that applied by Wolf Creek Generating Station (WCGS) and other differences have been identified that are not included in Table A-2. The body of TR WCAP-16308-NP also provides some limited guidance as illustrated here. The process applied by WCGS (including any revision that may be made during the NRC staff review of TR WCAP-16308-NP) is referred to as the proposed methodology.

guidance. The pilot plant did not have an external event PRA and did not use Tables I-1 to I-4.

TR WCAP-16308-NP provides some discussion about external initiating events in the last paragraph on page 4-3 which states:

> "Also, only qualitative risk assessments exist for fire, seismic, external events and shutdown at WCGS. Therefore, to capture the risk importance of piping segments from the fire, seismic, external events and shutdown qualitative risk assessments, any piping segment supporting a high risk significant safe shutdown pathway would be a candidate medium safety significant pipe segment. This is equivalent to the active component classification process where active SSCs that support safe shutdown pathways are not automatically classified as high safety significant, but rather are left to the IDP for a final classification."

The NRC staff believes that the last sentence above is incorrect. As stated at the bottom of page 5, and in the third bullet on the top of page 6, in NEI 00-04, "10 CFR 50.69 SSC Categorization Guideline," an SSC identified as high safety significant (HSS) by a non-PRA method must remain HSS and may not be reclassified by the Integrated Decision-Making Panel (IDP). The paragraph in TR WCAP-16308-NP places these SSCs into a medium safety significant classification which does allow the IDP to reclassify the SSC as a low safety significant (LSS) SSC.

Please provide a description of how piping segments supporting a safe shutdown pathway that is obtained from a non-PRA analysis of external events should be identified and classified. If the proposed method differs from the method described in NEI 00-04 for active SSCs, please justify this difference.

RESPONSE:

The methodology used at Wolf Creek for the passive classification of pressure boundary components using a non-PRA method was consistent with the NEI 00-04 guidance. Components that support safe shutdown pathways at Wolf Creek were ranked as HSS during the preliminary classification and the Integrated Decisionmaking Panel (IDP) could not re-classify them into a lower risk category. Further, as discussed in Section 3.7 of WCAP-16308-NP[2], the IDP is provided with documentation from the passive categorization and is trained in the roles and responsibilities of the IDP, including passive categorization considerations.

The last sentence in the last paragraph on page 4-3 of WCAP-16308-NP is incorrect. The last sentence of the last paragraph on page 4-3 of WCAP-16308-NP will be revised to read:

> "Also, only qualitative risk assessments exist for fire, seismic, external events and shutdown at WCGS. Therefore, to capture the risk importance of piping segments from the fire, seismic, external events and shutdown qualitative risk assessments, any piping segment supporting a safe shutdown pathway would be classified as a high safety significant pipe segment. This is consistent with the active component classification process where active SSCs that support safe

[2] The IDP described in Section 3.7 of WCAP-16308-NP was used to meet the Code Case N-660 requirement in paragraph 1320 for diverse engineering disciplines in the passive categorization process. This clarification was added to Supplemental Table A-2b.

shutdown pathways are automatically classified as high safety significant and therefore not eligible to be ranked lower by the IDP."

Supplemental Table A-2[3] will be revised to reflect that no change was made to this section from Revision 0 of Code Case N-660 by deleting the line referring to N-660 Section I-3.1.2 from the table.

It is also noted that the consequence assessment from ASME Code Case N-578, "Risk Informed Requirements for Class 1, 2, and 3 Piping, Method B, Section XI, Division 1", is the basis for the consequence assessment used for the passive categorization in Code Case N-660, Revision 0. The consequence assessment categorizes piping from an internal events perspective as well as from an external and shutdown events perspective and ranks the piping accordingly. Therefore, the use of Code Case N-660, Revision 0 addresses external events through the consequence assessment.

2. On July 11, 2007, a Category 2 public meeting was held between the NRC staff and industry representatives at NRC headquarters. During the meeting, industry representatives provided a supplemental Table A-2 (that added a large number of entries) to discuss its draft comments in response to the NRC staff's comments on the 50.69 pilot documentation guidance (ADAMS Accession No. ML071930260). As described under the entry for I-3.1.1(a) in the supplemental Table A-2 (but not included in Table A-2 of TR WCAP-16308-NP), the proposed methodology modifies the Section I-3.1.1(a) of ASME Code Case N-660, Rev. 0, to expand the available alternatives to analyzing less that a large pressure boundary failure. The new alternative permitting the analysis of a smaller pressure boundary failure is:

   (4) when design insights do not support a large break based on pressure/temperature/ flow in the pipe segment.

   This guidance provides no predictability about which segments will be assigned a small leakage and which segments would not. Please provide additional guidance that clearly defines the "design insights" and identify criteria that would be used to conclude that the insight does not support a large break. Justify how these insights and criteria provide confidence that a large break in not a credible failure mode.

   RESPONSE:

   Any discussion of break size must start with the identification of the pipe failure mechanisms. The most recent study of pipe breaks is contained in NUREG-1829 "Estimating Loss of Coolant Accident (LOCA)" which was developed through an expert elicitation process to determine the frequency of loss of coolant accidents to support the rulemaking for 10 CFR 50.46a. While the information in that report concentrates on reactor coolant pressure boundary components, a number of insights can be drawn from the information contained in the report, including pipe break morphology, operational experience and probabilistic fracture mechanics assessments.

[3] Supplemental Table A-2 was provided to the NRC during a Category 2 public meeting on July 11, 2007 and archived under ADAMS Accession No. ML071930260.

The consideration of the appropriate break size to be used for considering the consequences of pipe breaks must start with the contributors to potential pipe breaks. As discussed in NUREG-1829, there are five key contributors to pipe breaks: geometry, materials and fabrication, loading history, degradation mechanisms, and mitigation / maintenance. It is noted that there are key interactions between certain considerations for each of the contributors that greatly influence the overall potential for and characteristics of a pipe failure. For example, flow accelerated corrosion (degradation mechanisms) is predominant in carbon steel piping (materials and fabrication), occurs predominantly at elbows and tees in the piping systems (geometry) and is monitored through mitigation measures (mitigation / maintenance) to ensure replacement before pipe failures occur. A detailed discussion of the considerations for each key contributor is provided in NUREG-1829.

A number of key insights can be taken from NUREG-1829:

- Large pipe breaks are highly unlikely without a severe transient load; cracks in piping systems will only leak until they are detected, and then the leak can be repaired.
- Based on operational experience, small pipes are more susceptible to large breaks than large pipes. A given flaw size represents a larger fractional pipe diameter for smaller diameter pipes. Smaller piping is also often subject to fabrication flaws which exacerbates this decreased failure margin. Additionally, smaller diameter lines are often fabricated from socket welded piping which has a history of mechanical fatigue damage from plant vibrations and is also susceptible to external failure mechanisms arising from human error (e.g., damage from equipment). Finally, small piping is typically more difficult to inspect and in-service inspection is not routinely performed on these lines.
- Through-wall flaws that result in leakage make up the majority of the operating history. While this substantiates the leak-before-break philosophy, it also shows the extreme conservatism in the large break assumption. This is apparent for all pipe sizes, from the small vent and drain lines to reactor coolant loop piping.
- Mechanical fatigue was noted to be one of the foremost causes of through-wall flaws, followed by fabrication defect and repair. Those failure mechanisms presently identified through condition monitoring programs (e.g., stress corrosion cracking [SCC] and flow accelerated corrosion [FAC]), are generally not dominant failure mechanisms.

Studies such as that reported in ASME Whitepaper 2002-02B-01, “Alternative Pressure Boundary Treatment Practices for Class 2 and 3 Service Water Systems“, have compared the service history of piping designed to different ASME requirements. This study focused on the reliability of raw water systems for plants that have used B31.1 (and AWWA) versus ASME Section III. If the entire operating history is used, plants designed to B31.1 (and AWWA) have a slightly higher piping failure rate than Section III plants. If the operating years prior to 1983, during which many degradation mechanisms were identified, are not considered, then the existing B31.1 (and AWWA) plant piping systems are actually operating more reliably than Section III plants. Others studies referenced in the ASME White Paper have also shown that there is little difference in failure probability for design loading conditions between the various design codes (e.g. B31.1, ASME Section III), in particular for low temperature systems.

Separate considerations need to be evaluated for seismic loadings on piping segments in determining an applicable break size. Seismic loadings have the potential to cause catastrophic piping failures if the pipe loadings exceed their design basis. There are three important aspects to be considered in seismic evaluations:

- 50.69(d)(2) requires that reasonable confidence be maintained that RISC-3 SSCs can perform their design basis functions under their design basis accident conditions, including seismic and environmental conditions and effects throughout their service life. As discussed in the response to RAI#11, the seismic requirements for repair and replacement of low risk significant components will consider the appropriate seismic conditons to provide that reasonable confidence.

- The resolution of Generic Letter 87-02, "Verification of Seismic Adequacy of Mechanical and Electrical Equipment in Operating Reactors, Unresolved Safety Issue (USI) A-46" included performing seismic verifications of certain classes of mechanical and electrical equipment. The resolution methodology proposed by the industry Seismic Qualification Users Group (SQUG) in their "Generic Implementation Procedure (GIP) for Seismic Verification of Nuclear Plant Equipment" was based on generic equipment earthquake experience data supplemented by generic equipment test data. With respect to pressure boundary components, the SQUG conclusion reflected in the GIP-2 report was that there is adequate seismic capacity for properly anchored equipment in older operating plants. The staff generic Safety Evaluation of the GIP-2 methodology concluded that the GIP-2 approach provides an adequate level of safety and that it was not cost-justifiable for the safety benefit gained to demonstrate the seismic qualification of equipment in these older operating plants by using rigorous current qualification requirements.

- It is also noted in the NUREG-1829 study that small piping using socket welds are susceptible to external failure mechanisms such as seismic loads.

In conclusion, it is proposed that break sizes other than large breaks can be used in the passive categorization subject to the conditions described below:

- A review needs to be conducted to assure the system/segment is not susceptible to any large break mechanisms (as described below) or that plant controls are in place (e.g. condition monitoring) to minimize the potential for occurrence of large break mechanisms. This includes a review of plant and industry operating experience to characterize the potential for piping pressure boundary failure, including unacceptable flaw growth, leaks, failures and degradation processes. Plant specific service history is a key element in identifying degradation mechanism susceptibility because of the uniqueness of particular plant configurations and service conditions to small or large leak applicability.

  A large break mechanism is defined as one that includes significant loadings above the normal loading on the system and specifically includes water hammer for which no mitigation is provided and internal deflagrations, but excludes seismic based on considerations stated above.

- The pipe segment is not part of a high energy system. A high energy system is defined as a system that, for the major operational period, is either in operation or maintained pressurized under conditions where either, or both, of the following are met: a) maximum operating temperature exceeds 200 degrees F, and b) maximum operating pressure exceeds 275 psi.

- The pipe is greater than 4 inches in diameter. This was chosen to coincide with the ASME definition of small bore piping. It also approximates the leak rate for Category 3 for PWRs in NUREG-1829. There is a significant decrease in the likelihood of piping failures between Category 2 and Category 3 for PWRs. This represents a break probability over two orders of magnitude less than the most likely pipe break. This also eliminates concerns about socket weld and support failures of small piping during seismic events.

- The considerations that permit the use of a small break in the passive categorization need to be clearly noted as a basis for the passive categorization to ensure that:

  - Appropriate design and operation measures are maintained to assure that reasonable confidence is maintained so that the plant can perform its design basis function under design basis conditions, considering seismic and environmental conditions, and

  - Post-implementation monitoring and possible corrective actions are based on the appropriate categorization basis.

The appropriate small break size for consideration in passive categorization is the calculated leak rate at normal operating conditions for a through-wall flaw with a length 6 times its depth. This is consistent with the NUREG/CR-4550 definition for a PRA small break LOCA and with the NUREG-1829 results that show this is the most likely leak rate to occur in both PWR and BWR plants. This is also consistent with the operating experience that pipe failures are dominated by mechanical fatigue and fabrication defects, both of which exhibit leak before break characteristics. A flaw aspect ratio of 6 is also commonly used for structural evaluations.

Supplemental Table A-2a will be revised at the entry for I-3.1.1(a) to reflect that smaller break sizes can be considered when certain design and operational considerations can be satisfied by inserting a new item (4) that reads:

> "(4) a small break with a calculated leak rate at design basis conditions for a through-wall flaw with a length six times its depth can be used when certain design and operational considerations are satisfied:
>
> - the pipe segment is not susceptible to any large break mechanisms or plant controls are in place to minimize the potential for occurrence of large break mechanisms,
>
>   + a large break mechanism is one that produces significant loadings above the normal loading on the system and specifically includes water hammer for which no mitigation is provided and internal deflagrations, but excludes seismic,
>
> - the pipe segment is not part of a high energy system,

- the pipe segment is greater than 4 inches in diameter."

3. As described under the entry for Section I-3.1.2(b) in Table A-2 of TR WCAP-16308-NP, the NEI proposed new text to be used instead of the text in ASME Code Case N-660, Rev. 0. The single sentence in Section I-3.1.2(a) of ASME Code Case N-660, Rev. 0, is to be expanded into four bullets. It is not clear that the proposed text does not change the original process.

   a. Please identify the Risk-Informed Inservice Inspection (RI-ISI) program criteria (i.e., document and page number) referred to in the explanatory note in this entry in Table A-2.

   b. Please describe each of the proposed changes and provide examples illustrating the differences and similarities between the endorsed ASME Code Case N-660, Rev. 0, text and the proposed text of Section I-3.1.2(b).

   RESPONSE:

   The proposed modification to Section I-3.1.2(b) of Code Case N-660 was not intended to change the process or methodology. The text for Section I-3.1.2(b) in Revision 0 of Code Case N-660 was used for the Wolf Creek categorization.

   Supplemental Table A-2 will be revised to reflect that no change was made to Section I-3.1.2(b) from Revision 0 of Code Case N-660 by deleting the line referring to Section I-3.1.2(b) from the table.

   A proposed modification to Section I-3.1.2(d) of Code Case N-660 was made to be consistent with the proposed modification to Section I-3.1.2(b) of Code Case N-660. The categorization process for Wolf Creek also used the text for Section I-3.1.2(d) of Revision 0 of Code Case N-660.

   Supplemental Table A-2 will be revised to also reflect that no change was made to Section I-3.1.2(d) from Revision 0 Code Case N-660 by deleting the line referring to Section I-3.1.2(c) from the table.

4. During the May 17, 2007, audit of the WCGS IDP documentation, the NRC staff noted that the piping attached to the reactor sump screens was classified as LSS while the screens themselves had been categorized HSS during the active SSC classification phase. After several discussions with industry representatives, it appears that the reactor coolant recirculation function of these screens was not included in the passive classification process because the passive categorization only included the containment spray system functions. At WCGS, failure of the containment spray system does not affect core damage or large early release. Page 27 of NEI 00-04 states, "there may be circumstances where the categorization of a candidate low safety-significant SSC within the scope of the system being considered cannot be completed because it also supports an interfacing system." This caution is not included in the proposed passive categorization methodology.

   a) Please provide additional guidance that provides confidence that piping segments that support two or more systems' functions will be classified based on the highest safety significance function being supported.

b) The proposed method does not appear to require identification and resolution of differences between the safety significance classification between an active SSC and the piping attached to the SSC. Under what conditions is it reasonable for the safety significance of the pressure boundary function of a piping segment to be classified lower than the SSCs to which it is attached?

RESPONSE:

If a piping segment supports more than one function, the piping segment should be classified to the highest safety significance of the functions that it supports. In fact, Section I-3.1.3(a)(3) of the N-660 Code Case, as modified in the response to RAI #5, directs that an assessment of the impact of the failure of a piping system on other systems be undertaken. The intent of this criterion is to ensure that a pipe segment is classified to the highest safety significance of all of the functions that it supports. Using this criterion, the passive categorization of the sump screen should consider both the containment spray recirculation function and the core cooling recirculation function. Since the core cooling recirculation function was not categorized when the containment spray system categorization was undertaken, the containment sump screen classification should not have been completed and its original classification (e.g., high safety significance) should have been retained.

The safety significance of the pressure boundary function of a piping segment should normally be consistent with the safety significance of the active function of a component attached to the subject piping segment, except in certain circumstances. All such circumstances would need to be justified on a case by case basis. Examples of some circumstances are:

- Piping segments are defined based on similarities in consequences. Many times valves are at a boundary between two piping segments and are therefore associated with each piping segment. For example, a containment isolation valve can act a boundary between two piping segments. In this case, the active and passive function ranking of the valve itself would likely be high based on providing a safety significant containment isolation function. However, the associated piping in the piping segments on either side of the isolation valve could be low if they do not serve a fission product release mitigation function. In this case, the active and passive categorization of the isolation valve would be high while the piping segments associated with the valve could be low.
- The failure of a pipe segment may be high because it can result in the draining of a tank that would fail a high safety significant function while an active failure of the pumps taking suction from the tank might be low based on the number of trains in the system or diverse means of performing the high safety significant function. For example, a failure of the piping segment on the suction side of a high head safety injection pump might be high based on draining the suction source for safety injection while the active ranking for that train of safety injection might be low based on multiple trains or diverse means of safety injection such as safety grade charging pumps. This would result in a high passive ranking for the pipe segment but a low ranking for the active function that the pipe segment supports.

To ensure that it is clear that the passive categorization of pipe segment is based on the highest safety significance of all of the functions that it supports, additional guidance will be included in Section 4.5 of WCAP-16308-NP. A new paragraph will be inserted at the top of page 4-5 to read:

> "Piping segments shall be ranked based on the highest safety significance of all of the functions that it supports. If the importance of all functions that it supports has not been completed, the piping segment must retain its original classification until the importance of all supporting systems has also been evaluated."

To clarify that the passive categorization ranking of a piping segment should generally be consistent with the active categorization for the function that it supports, additional guidance will be included in Section 4.5 of WCAP-16308-NP. Directly following the proposed additional paragraph directly above, another paragraph will be inserted that reads:

> "The safety significance of the pressure boundary function of a piping segment should be consistent with the safety significance of the active function of a piping segment, except in certain circumstances. All such circumstances would need to be justified on a case by case basis."

The guidance in Section 4.5 of WCAP-16308-NP is used during the preliminary engineering passive classification of the pipe segments. As described in Section 3.7 of WCAP-16308-NP, this guidance will also used by the IDP to finalize the pipe segment passive classifications.

5. As described in the entry under Section I-3.1.3(a)(3) in Table A-2 of TR WCAP-16308-NP, the NEI proposed to use new text instead of the text in the endorsed version of N-660. ASME Code Case N-660, Rev. 0 states,

> "Even when considering operator actions used to mitigate an accident, failure of the piping segment will fail a high-safety-significant function."

This text has been moved to Section I-3.2.2(b)(1) and modified to now state,

> "Even when taking credit for plant features and operator actions, failure of the piping segment will not[4] directly fail another high-safety-significant function."

The introduction of the word "another" in the proposed version significantly alters when the response to this question would be "True" and "False" in a manner which requires further explanation. The original text ensures that a piping segment that would disable any single HSS function would be classified HSS. In the proposed revision, a second (i.e., "another") HSS function would have to be failed in addition to whatever function that the piping segment being classified would directly degrade or fail. Is the intent of this proposed text to require that a second HSS function be consequently failed? If so, please justify not assigning a HSS classification to an SSC whose failure could consequently fail an HSS function.

RESPONSE:

The proposed modification was not intended to change the process or methodology in Revision 0 of Code Case N-660. Since no change of process or methodology was

[4] The negative in the proposed methodology is a natural consequence of changing the way "true" and "false" responses are used in the IDP classification as discussed further in .

implemented by Wolf Creek, this section will be returned to the text in Revision 0 of Code Case N-660.

Supplemental Table A-2 will be revised to reflect that no change was made to this criterion by using the wording:

> "Even when taking credit for plant features and operator actions, failure of the piping segment will not directly fail a high safety significant function."

In addition, Consideration 1 on page 4-4 of Section 4.5 of WCAP-16308-NP will be revised to read:

> "Even when taking credit for plant features and operator actions, failure of the piping segment will not directly fail a high safety significant function."

The discussion under Consideration 1 of Section 4.5 of WCAP-16308-NP does not require any change because the process and methodology used by Wolf Creek is consistent with the text in Revision 0 of Code Case N-660.

Also, as noted in footnote 4 on the previous page, the considerations in Section I-3.1.3(a) of Revision 0 of Code Case N-660 were changed in the way that "true" and "false" are used by reversing the responses for a given condition. Human performance fundamentals suggest that the wording of equivalent considerations between the active and passive categorization guidance should be as similar as possible. Therefore, the passive categorization perspective for these considerations was changed to be consistent with the NEI 00-04 considerations. By making this change, the IDP, that makes the final passive and active classification determinations as described in Section 3.7 of WCAP-16308-NP, will be making consistent responses. For an equivalent consideration using the Code Case N-660, Revision 0 guidance, to come to a low safety significance finding the IDP would respond in the positive (e.g., true) for the active ranking and in the negative (e.g., false) for the passive ranking. Therefore, all of the considerations in Section I-3.1.3(a) were revised to have a "true" response for a low safety significance finding from both active and passive categorization. To ensure that this change is highlighted in WCAP-16308-NP, a new bullet will be added in Section 4-5 on page 4-4 to read:

- "All of the considerations in Section I-3.1.3 of Code Case N-660 were changed so that the response (i.e., true or false) for the passive categorization would match the response for the equivalent consideration from the active categorization process in NEI 00-04."

6. As described in the entry under Section I-3.1.3(b)(2) in Table A-2 of TR WCAP-16308-NP, you have proposed to use new text instead of the text in ASME Code Case N-660, Rev. 0. The endorsed version of ASME Code Case N-660 states,

   > "The piping segment supports a significant mitigating or diagnosis function addressed in the Emergency Operating Procedures or the Severe Accident Management Guidelines."

   This text has been moved to Section I-3.2.2(b)(4) and modified to now state,

> "The piping segment does not[5] individually support a significant mitigating or diagnosis function addressed in the Emergency Operating Procedures or the Severe Accident Management Guidelines, with no redundancy or alternate means of support."

The introduction of the phrase "with no redundancy or alternative means of support" in the proposed version significantly alters when the response to this question would be "True" and "False" in a manner which requires further explanation. The original question addressed two issues, a particularly important aspect of defense-in-depth and the complexity of modeling human errors. One of the defense-in-depth considerations is to avoid over-reliance on programmatic activities to compensate for weakness in plant design. In this case, relying on the operators to overcome failures which reduce diagnosis information relied upon to mitigate accidents. Quantitative evaluation of the impact of these failures may provide additional information about the impact of these failures on risk and how that impact compares to the acceptance guidelines, but such calculations are very resource intensive and of limited accuracy.

The NRC staff has not yet concluded whether the original statement was too limiting, as argued in TR WCAP-16308-NP, but considers that the introduction of the "individually supports" may provide reasonable flexibility commensurate with the safety significance of the piping. However, because of the pervasive inclusion of instrumentation throughout the plant that normally includes measurements of many related parameters, it would appear that there would never be a piping segment failure for which the response to the proposed question would be "False."

a) Please explain the difference between "individually support" and "no redundancy."

b) Please define "alternative means of support" and justify that full loss of a diagnosis function would not be expected to be safety significant unless these alternative means are also lost. For example, upon loss of the reference leg for level measurement in a refueling water storage tank, would low pressure in the high-pressure safety injection pump inlet (or some other indication) provide an acceptable alternative means for determining when to switch over from injection to recirculation?

RESPONSE:

The Emergency Operating Procedure (EOP) considerations in the passive categorization process used at Wolf Creek were consistent with those used in the active categorization as defined in Section 9.2.2 of NEI 00-04.

In NEI 00-04, Consideration 4 states:

> "The active function/SSC is not called out or relied upon in the plant Emergency / Abnormal Operating Procedures or similar guidance as the sole means for the successful performance of operator actions required to mitigate an accident or transient. This also applies to instrumentation and other equipment associated with the required actions."

Further, Consideration 5 from Section 9.2.2 of NEI 00-04 states:

[5] The negative in the proposed methodology is a natural consequence of changing the way "true" and "false" responses are used in the IDP classification.

> "The active function/SSC is not called out or relied upon in the plant Emergency / Abnormal Operating Procedures or similar guidance as the sole means of achieving actions for assuring long term containment integrity, monitoring of post-accident conditions, or offsite emergency planning activities. This also applies to instrumentation and other equipment associated with the required actions."

As discussed in the response to RAI #5, human performance fundamentals suggest that the wording of equivalent considerations between the active and passive categorization guidance should be as similar as possible. By making this change, the IDP, that makes the final passive and active classification determinations as described in Section 3.7 of WCAP-16308-NP, will be making consistent responses.

Therefore, the entry in the third column of Supplemental Table A-2 for I-3.1.3(b)(2) will be revised to read:

> "The piping segment is not relied upon to support an active function in the plant Emergency / Abnormal Operating Procedures or similar guidance as the sole means for the successful performance of operator actions required to mitigate an accident or transient, or for achieving actions for assuring long term containment integrity, monitoring of post-accident conditions, or offsite emergency planning activities. This also applies to instrumentation and other equipment associated with the required actions."

In addition, Consideration 4 on page 4-5 of Section 4.5 of WCAP-16308-NP will be revised to read:

> "The piping segment is not relied upon to support an active function in the plant Emergency / Abnormal Operating Procedures or similar guidance as the sole means for the successful performance of operator actions required to mitigate an accident or transient, or for achieving actions for assuring long term containment integrity, monitoring of post-accident conditions, or offsite emergency planning activities. This also applies to instrumentation and other equipment associated with the required actions."

The discussion under Consideration 4 in Section 4.5 of WCAP-16308-NP does not require any change because the process and methodology used by Wolf Creek is consistent with the text in Revision 0 of Code Case N-660.

7. The proposed methodology proposes to address the safety significant implication of known active degradation mechanisms using a new question described in the entry under Section I-3.2.2(b)(5) in the Supplemental Table A-2 (ADAMS Accession No. ML071930260). The proposed question states that "the plant condition monitoring program would identify any known active degradation mechanism in the pipe segment prior to its failure in test or actual demand event." The second sentence in Section I-3.2.2(b) in Code Case N-660, stated, "Any piping segment initially determined to be a Medium consequence category and that is subject to a known active degradation mechanism shall be classified HSS." Evidently, the proposed method replaced the guidance in ASME Code Case N-660, Rev. 0, with the guidance under the new Section I-.2.2(b)(5). This change to ASME Code Case N-660, Rev. 0, will almost certainly result in a number of segments that would have been classified HSS, according to the Code Case, to be classified LSS according to the proposed method.

As written in the proposed methodology, the simple existence of a degradation monitoring program at a plant would seem to result in a “True” designation for every location in the plant that may be susceptible to that degradation mechanism, regardless of whether there are any inspections in the segment being classified. This interpretation is supported by the observation during the NRC staff audit of the WCGS IDP documentation, that the WCGS IDP used the phrase, “[a] plant conditioning monitoring program exists” in a number of places. No other discussions about degradation mechanisms were identified during the audit.

The generic disposition of all known, active degradation mechanisms is contradictory to ASME Code Case N-660, Rev. 0. Please provide additional description about how active degradation mechanisms should be incorporated into the safety-significance classification for a segment. The discussion should describe the relationship between the plant’s degradation monitoring programs, the inspection locations within the programs, and the inspection locations within the segment being classified. Please describe the differences between the results that would be obtained using the endorsed code case and the results that will be obtained using the proposed method, and explain why these differences are acceptable.

RESPONSE:

The second sentence in Section I-3.2.2(b) in Revision 0 of Code Case N-660 states:

> “Any piping segment initially determined to be a ‘Medium’ consequence category and that is subject to a known active degradation mechanism shall be classified HSS.”

During the preliminary Wolf Creek passive categorization, it was identified that a significant number of piping systems (and therefore pipe segments) are potentially subject to known active degradation mechanisms, such as flow accelerated corrosion (FAC), microbiologically influenced corrosion (MIC), thermal fatigue, stress corrosion cracking (SCC), etc. Wolf Creek has condition monitoring programs to: a) identify active degradation mechanisms applicable to Wolf Creek, b) identify the piping systems and locations subject to the active degradation mechanisms, c) periodically assess the extent of degradation, and d) initiate corrective actions when necessary to prevent pipe failures due to these degradation mechanisms. Therefore, it is unduly conservative to classify any pipe segment that is subject to active degradation mechanisms as high safety significant without consideration of the assurance provided by the condition monitoring programs.

10 CFR 50.69(d)(2) requires that a licensee implementing 50.69 shall ensure, with reasonable confidence, that RISC–3 SSCs remain capable of performing their safety related functions under design basis conditions, including seismic conditions and environmental conditions and effects throughout their service life. In addition, 50.69(d)(2) requires that the treatment of RISC–3 SSCs must be consistent with the categorization process and that inspection and testing, and corrective action shall be provided for RISC–3 SSCs. Finally, 50.69(d)(2) and (e) requires that the performance of RISC-3 SSCs be monitored and corrective actions be taken.

The Wolf Creek condition monitoring programs provide reasonable confidence that the piping systems can perform their design basis functions by a multi-step process. First, industry experience and plant experience are periodically reviewed to identify active degradation mechanisms that are applicable to Wolf Creek piping systems.

Second, the condition monitoring programs identify the candidate piping systems and locations that may be subject to the various active degradation mechanisms and an acceptance criterion is developed to provide confidence that a pipe rupture would not be expected. Third, the candidate degradation locations are periodically assessed to determine the extent of degradation that is occurring. The assessment can include periodic monitoring of the degradation through non-destructive processes (e.g., for flow accelerated corrosion), through evaluations (e.g., thermal degradation) or a combination of the two (e.g. stress corrosion cracking). The final step involves the potential for corrective action based on the periodic assessment and monitoring. The corrective action can involve trending assessments, extent of condition assessments, apparent cause assessments, etc. When warranted, the corrective action can include repair and replacement activities.

The Wolf Creek condition monitoring programs are applied to both safety related and non-safety related systems to provide assurance that safety is maintained and that the plant is a highly reliable source of electricity production. Re-classifying piping segments from high safety significance to low safety significance should have no impact on the condition monitoring that is done for those piping systems.

Also it is noted that the passive categorization methodology in Code Case N-660 assumes that a break occurs in a pipe segment with a probability of 1.0. This consideration is applied regardless of whether a potentially active degradation mechanism is present. That is, the impact of the postulated break (e.g. initiating event, number of unaffected systems, and impact on containment) is the same and the resultant consequence rank is the same regardless of the potential for active degradation mechanisms.

Based on the considerations outlined above, the last column of the row identified as I-3.2.2(b) in Supplemental Table A-2a will be changed to read:

> "Continued condition monitoring for known active degradation mechanisms would be a consideration in meeting 50.69 (d)(2) and (e) and therefore classification of HSS is unduly conservative."

No change is required for the row identified as I-3.3.3(b)(5) in Supplemental Table A-2a.

8. Table A-2 provided in TR WCAP-16308-NP is incomplete. Page A-5 states that, "[n]ot all modifications to the code case are reported. Only those differences that could impact the categorization process used a WCGS are shown in Table A-2." The Table did not include a number of differences that have a major impact on the process. During a July 11, 2007, NRC public meeting, Westinghouse representatives provided a supplemental Table A-2 that added a large number of entries. The supplemental Table still does not identify all of the differences between the proposed method and ASME Code Case N-660, Rev. 0.

   For example, the new question listed under Section I-3.2.2(b)(5) in RAI question #7 was not included in Table A-2 in Revision 0 of TR WCAP-16308-NP. The question was included in the supplemental Table A-2. However, in this supplemental table, the entry under "Endorsed Revision 0" was N/A while, in practice, this question replaced the guidance on the same subject that was in Section I-3.2.2(b) of Code Case N-660. There was an entry under I-3.2.2(b) in Table A-2 of TR WCAP-16308-NP but the entry only refers to the first sentence in Section 3.2.2(b) in the Code Case and stated that “new considerations have been provided.”

Not included in either table, nor the TR WCAP-16308-NP, is the deletion of the Code Case’s guidance on how degradation mechanisms are to be incorporated into the categorization process. Please submit a table that includes all differences between the endorsed ASME Code Case N-660, Rev. 0, and the proposed method for which approval is being requested. Based on the problems associated with only identifying important differences in the previous tables, please include all differences in the table.

RESPONSE:

Supplemental Table A-2 has been be revised to be consistent with the methodology used by Wolf Creek. Additionally, changes identified in the response to these RAIs have also been incorporated into Supplemental Table A-2. This updated Supplemental Table A-2 is included as a separate attachment to the letter transmitting these RAIs and will replace the current Table A-2 in WCAP-16308-NP.

9. When used in support of the implementation of Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.69, a categorization process must include an evaluation that provides reasonable confidence that sufficient safety margins are maintained and that any potential increases in core damage frequency (CDF) and large early release frequency (LERF) are small. Please explain how a licensee applying this methodology to categorize the passive SSCs can satisfy 10 CFR 50.69(c)(1)(iv) and provide reasonable confidence that sufficient safety margins are maintained and that any potential increases in CDF and LERF are small.

RESPONSE:

The 50.69 (d)(2) requirement to provide reasonable confidence that RISC–3 SSCs remain capable of performing their safety related functions under design basis conditions, including seismic conditions and environmental conditions and effects throughout their service life would also apply to low safety significant pipe segments. Therefore, safety margins are not impacted because there are no proposed changes to the plant design basis. Additionally, the monitoring and corrective action required by 50.69(d)(2) assures that any changes in performance of the pressure boundary components would be identified, assessed and corrected as necessary to meet the requirements of the rule. As discussed in the response to RAI #7, this would include known active degradation mechanisms that could impact safety margins of the pressure boundary function.

In addition, the passive categorization process includes a consequence assessment and qualitative considerations to assure that potential changes in CDF and LERF are small. The consequence assessment is applied to all piping segments regardless of whether or not the pressure boundary function is explicitly modeled in the PRA. This provides a first level of confidence that the delta CDF and LERF remain small. The qualitative considerations that are important to risk are applied to the Medium and Low consequence category piping segments to further ensure that the delta CDF and LERF remain small. Finally, 50.69(d)(2) requires that the performance of low safety significant components be monitored and that changes to their performance be assessed in light of the assumptions made in the categorization process. Thus, any degradation in performance would be assessed to ensure that the delta CDF and LERF remain small.

10. Section 7.3, "Monitoring of RISC-3 SSCs," discusses the review of failures of low-risk safety-related (RISC-3) SSCs as part of the monitoring process under 10 CFR 50.69 of the NRC regulations. Discuss plans to monitor corrective action for degradation of RISC-3 SSCs.

    RESPONSE:

    Wolf Creek has not developed plant specific methods for monitoring of correction actions to address degradation of RISC-3 SSCs. Note that Wolf Creek uses the term RISC-3 SSC to encompass low safety significant safety related <u>active</u> components classified using the NEI 00-04 guidance as well as low safety significant pressure boundary components classified using the <u>passive</u> categorization process described in WCAP-16308-NP. Plant specific methods, when developed in detail, will follow the approach of NEI 00-04. Specifically, the Wolf Creek monitoring program will include:

    - Failures of RISC-3 SSCs will be identified and tracked in a corrective action program.
    - Failures of RISC-3 SSCs will be reviewed, as part of the corrective action program, to determine the extent of condition (i.e., whether this failure is indicative of a potential common cause failure).
    - Non-failures, such as known active degradation processes, will also be tracked as part of the corrective action program to determine the extent of condition (i.e., the degree of degradation versus the condition monitoring acceptance criterion) and need for corrective actions as discussed in the response to RAI #7.
    - Failures of RISC-3 SSCs will be assessed for groups of like component types (e.g., motor operated valves, air operated valves, motor-driven pumps, etc.) for the purposes of assessing data from the corrective action program.
    - A periodic review of all failures of RISC-3 SSCs, also considering previous component performance history, will be undertaken at least once every two fuel cycles (per the periodic review schedule recommended in Section 12.1 of NEI-00-04) to:
        - Ensure that the failure rate of RISC-3 SSCs in a given time period has not unacceptably increased due to the changes in treatment. The periodic review will validate that the rate of RISC-3 SSC equipment failures has not increased by a factor greater than that used in the integrated risk sensitivity study.
        - Detect the occurrence of potential inter-system common cause failures, and to allow timely corrective action if necessary.

      If the number of failures for a group of SSCs exceeds the expected number of failures by a factor of two or more, a potential adverse trend is identified requiring further assessment. As a result of the assessment, either:

        - The categorization will be revised to reflect the increased failure rates and the ranking of appropriate SSCs will be reviewed, or

- A corrective action plan will be developed to return the reliability of the SSCs to a level consistent with the categorization.

Section 7.3 of WCAP-16308-NP will be revised to include the response to RAI #10 above.

11. Section 8, "Application of RISC-3 Treatment Requirements," states that the Wolf Creek Nuclear Operating Corporation (WCNOC) will develop and implement documented processes to control the design, procurement, inspection, and maintenance to ensure, with reasonable confidence, that RISC-3 SSCs remain capable of performing their safety-related functions under design-basis conditions. Section 8 also states that the WCNOC approach to inspection, testing, and corrective actions is described in Section 7 of the TR. However, Section 7 discusses monitoring of failure rates. Discuss the plans for inspection, testing, and corrective actions for RISC-3 SSCs that satisfy 10 CFR 50.69(c)(1)(iv), (d)(2), and (e). For example, the South Texas Project nuclear power plant is implementing a specific plan for treatment of low-risk safety-related SSCs as part of an exemption received from special treatment requirements in 10 CFR Part 50.

RESPONSE:

Wolf Creek has not developed plant specific methods for inspection testing and corrective actions for RISC-3 SSCs to ensure, with reasonable confidence, that RISC-3 SSCs remain capable of performing their safety-related functions under design-basis conditions. Note that Wolf Creek uses the term RISC-3 SSC to encompass low safety significant safety related <u>active</u> components classified using the NEI 00-04 guidance as well as low safety significant pressure boundary components classified using the <u>passive</u> categorization process described WCAP-16308-NP.

10 CFR 50.69(d)(2) requires that two elements of safety be maintained:

- Reasonable confidence be maintained that RISC-3 SSCs can perform their design basis functions under their design basis accident conditions, including seismic and environmental conditions and effects throughout their service life, and
- The basis for the categorization of RISC-3 SSCs be validated through monitoring of the performance of RISC-3 SSCs and corrective actions be implemented when the categorization basis is not maintained.

10 CFR 50.69(e) requires that changes to the plant, operational practices, applicable plant and industry operational experience be periodically reviewed and, as appropriate, the PRA and SSC categorization and treatment processes be updated.

To comply with the requirements of 50.69(d)(2), and (e), WCNOC will:

- Procure RISC-3 SSCs in a manner consistent with current practices for commercial grade equipment that includes, as a minimum: a) development of procurement specifications that ensure that the component can perform its design basis function under the appropriate design basis conditions, including seismic and environmental conditions and effects throughout their service life, and b) inspect the equipment upon receipt at the plant to ensure that the proper component was received.

- Periodically maintain and test RISC-3 SSCs in a manner consistent with current practices for commercial grade equipment that includes, as a minimum, development of preventive maintenance requirements and schedules.
- Track and assess failures of RISC-3 SSCs through the corrective action program that includes those actions outlined in the response to RAI #10.

Section 8 of WCAP-16308-NP will be revised to include the response to this RAI and will refer back to Section 7.3 for the discussion of monitoring and corrective actions.

12. Section I-3.1.1(e) of CC N-660 provides for "[p]ossible automatic and operator actions to prevent loss of system function," to be included in the consequence evaluation. WCAP-16308[-NP] indicates that this section is unchanged in its proposed methodology. Please describe how these automatic and operator actions should be included in the consequence evaluation.

RESPONSE:

Section I-3.1.1 refers to the Failure Modes and Effects Analysis (FMEA) that identifies potential failure modes for each piping segment and their effects. The FMEA is then used as input to the Impact Group Assessment described in Section I-3.3.2. The consequence assessment described in Sections I-3.3.1 and I-3.3.2 of Code Case N-660 is taken from Code Case N-578, “Risk Informed Requirements for Class 1, 2, and 3 Piping, Method B, Section XI, Division 1”. Details of the consequence assessment for Code Case N-578 are documented in EPRI TR-112657, Rev B-A, “Risk-Informed Inservice Inspection Evaluation Procedure” [ADAMS Accession No. ML013470102].

A White Paper is prepared for each ASME Code Case that describes the background for the considerations in the Code Case. The White Paper for Code Case N-660, Revision 0 describes the use of operator actions in the consequence assessment, consistent with the Code Case N-578 process and TR-112657, Rev B-A. In Section 3.3.1, “Fundamental Principles” of TR-112657, Rev B-A, it is stated that:

> “The possibility of isolating a break is also identified and accounted for as part of the consequence analysis. A break could be isolated by a protective check valve, a closed isolation valve, or it could be automatically isolated by an isolation valve that closes on a given signal. If not automatically isolated, a break can be isolated by an operator action, given successful diagnosis. The likelihood of isolating a break depends on the availability of isolation equipment, a means of detecting the break, the amount of time available to prevent specific consequences (e.g., flooding of the room or draining of the tank), and human performance. If isolation is possible, the consequence assessment should be conducted for both cases: successful and unsuccessful isolation. Operator recovery actions are further discussed in Section 3.3.3.2 [of TR-112657, Rev B-A].”

At Section 3.3.3.2.2, “Number of Backup Systems and/or Trains Available” of TR-112657, Rev B-A, under the subheading of “Human Actions as Backup Trains”, additional details of the consideration of operator actions in the consequence analysis are provided:

> “Human actions, included in the PSA success criteria, are also credited as backup trains, based on human error probability (HEP). One example is shown in Figure 3-3, where the operator action to initiate feed and bleed is credited in the heat removal function. In addition to human actions modeled in the PSA, the actions to recover from pipe failures, and minimize consequences by isolating breaks, are also modeled in this approach and credited as backup trains. If isolation is possible, consequences should be analyzed for both cases: successful and unsuccessful isolation. In the case where isolation is successful, then the recovered trains or systems are credited. In the case where isolation failed, then, in addition to the isolation, only the remaining trains (if any) are credited. If an unisolated failure would disable all backup trains, the only protection available is isolation of the break.
>
> Operator recovery actions (isolation of the break) can only be credited if:
>
> - There is an alarm and/or clear indication, to which the operator will respond,
> - The response is directed by procedure,
> - The isolation equipment (e.g. valves) is not affected by the break,
> - There is enough time to perform isolation and reduce consequences.
>
> If all of the above factors are satisfied, and can be documented, it is recommended crediting the recovery action, and assuming one backup train “worth” (HEP of approximately 1E-2). The licensee shall not take credit for more than what the recoverable train or system is worth. Additional recovery may be credited on a plant specific basis and should be documented. As necessary, the performance of detailed HRA analysis can be required. Of course, it is left to the analyst to evaluate how reasonable the simplified assumption is and, if necessary, perform a full HEP analysis. It should be noted that, in the addition to the new recovery actions specifically introduced in this analysis, recovery actions already modeled in the PSA can be affected by the analyzed events and need to be reevaluated. If a failure of the system or train is a result of a pressure boundary failure, then the recoveries usually credited in PSA, for example a recovery of the pump, can not be credited.”

The following provides an example of the consideration of operator actions in the Wolf Creek categorization of the containment spray system (EN system). The FMEA identified that a number of pipe segments have the potential for the loss of RWST if a failure in an EN pipe segment is not isolated. It was determined that the failure of an EN pipe segment would not result in an initiating event (although it may result in a plant shutdown due to the Tech Specs requirements for a low RWST level). In the System Impact Group Assessment a medium safety significance was assigned to these segments based on the potential loss of RWST if a failure in the pipe segment is not isolated for an accident in which the containment spray system is actuated based on high containment pressure. The medium classification was based on Table I-2 of Code Case N-660 with:

- An “unexpected” frequency of challenge,
- A yearly exposure time, and
- With operator action to isolate the affected EN system train
  - One train of EN still operating for containment cooling; no credit was taken for the containment fan coolers.
- Without operator action to isolate the affected EN system train
  - Credit was taken for the two trains of containment fan coolers for containment cooling.

The potential for success of the operator action to diagnose and take actions to isolate the break was performed for EN pipe segment breaks consistent with the process described in the White Paper.

Consideration of the impact of a loss of the RWST inventory on the emergency core cooling function is assessed using the considerations in Section I-3.1.3 as modified for the Wolf Creek categorization to require use of Section I-3.1.3 for all pipe segments classifed as medium or low from the consequence assessment in Section I-3.1.2 of N-660, Revision 0. In this case, consideration of operator actions to isolate a break in an EN piping segment to preserve RWST inventory for emergency core cooling was applied consistent with the considerations outlined in the TR-112657, Rev B-A and Supplemental Table A-2 entries for new Section 3.2.2(b)(1) and the associated footnote.

Table A-2a	Methodology/Process Changes in ASME Code Case N-660 for WCGS Categorization		
N-660 Section	**Endorsed Revision 0**	**WCGS IDP Version**	**Basis for Change**
-1200(a)	"… failure potential is conservatively assumed to be 1.0 in determining a consequence category in Appendix I."	"…failure potential is conservatively assumed to be 1.0 in performing the initial consequence evaluation per I-3.1 in Appendix I."	To be clear that the failure potential is conservatively assumed to be 1.0 in I-3.1, Consequence Evaluation. This allows the expert panel to assume other than 1.0 for the failure potential when considering the other relevant information in I-3.2 for piping segments determined to be Medium, Low, or None consequence category in I-3.1.
-1200(b)	"Class 1 items that are part of the reactor coolant pressure boundary…"	"Items optionally classified to Class 1 and Class 1 items…"	Although this section was modified for the WCGS IDP Version there were no Class 1 items in the two systems evaluated at Wolf Creek. Therefore, this provision was not applied at Wolf Creek. Nonetheless, it was decided that for all future applications at Wolf Creek all Class 1 items will be classified as HSS per the NRC endorsement of N-660 in Reg Guide 1.147, Rev 14.
I-1.0	N/A	Added figure[1] illustrating the modified RISC methodology process, including scope identification, consequence evaluation, consequence categorization, classification considerations, and final classification definitions.	Figure added to provide high level overview of RISC methodology process. New process calls for all segments to be included in the consequence evaluation to determine high, medium, low or none consequence category. Then only the non-high category segments would be considered in the classification considerations of I-3.2.2(b) – previously I-3.1.3.

Table A-2a	**Methodology/Process Changes in ASME Code Case N-660 for WCGS Categorization**		
N-660 Section	**Endorsed Revision 0**	**WCGS IDP Version**	**Basis for Change**
I-2.0	N/A	"Items optionally classified to Class 1 and Class 1 items connected to the reactor coolant pressure boundary, as defined in paragraphs 10 CFR 50.55a (c)(2)(i) and (c)(2)(ii), are within the scope of the RISC evaluation process. All other Class 1 items shall be classified High Safety Significant (HSS) and the provisions of the RISC evaluation shall not apply."	Although this section was modified for the WCGS IDP Version there were no Class 1 items in the two systems evaluated at Wolf Creek. Therefore, this provision was not applied at Wolf Creek. Nonetheless, it was decided that for all future applications at Wolf Creek all Class 1 items will be classified as HSS per the NRC endorsement of N-660 in Reg Guide 1.147, Rev 14.
I-3.0, Title	"Consequence Assessment"	"Evaluation of Risk Informed Safety Classifications"	For clarification to meet Figure I-1.
I-3.0	"Piping segments can be grouped based on common conditional consequence…"	"All pressure retaining items, including supports for a piping system, shall be evaluated by defining piping segments that are grouped based on common conditional consequence…"	For clarification of the scope of components to be evaluated.
I-3.0	"Additionally, information shall be collected for each piping segment that is not modeled in the PRA, but considered relevant to the classification (e.g., information regarding design basis accidents, shutdown risk, containment isolation, flooding, fires, seismic conditions)."	"Additionally, information considered relevant to the classification shall be collected for each piping segment (e.g., information regarding design basis accidents, at-power risk, shutdown risk, containment isolation, flooding, fires, seismic conditions, etc.). This other relevant information is considered in conjunction with the Consequence Category to determine the Risk Informed Safety Classification."	Statement clarified for other relevant considerations besides internal events PRA.

Table A-2a Methodology/Process Changes in ASME Code Case N-660 for WCGS Categorization			
N-660 Section	**Endorsed Revision 0**	**WCGS IDP Version**	**Basis for Change**
I-3.1.1(a)	N/A	“(4) a small break with a calculated leak rate at design basis conditions for a through-wall flaw with a length six times its depth can be used when certain design and operational considerations are satisfied: - the pipe segment is not susceptible to any large break mechanisms or plant controls are in place to minimize the potential for occurrence of large break mechanisms, + a large break mechanism is one that produces significant loadings above the normal loading on the system and specifically includes water hammer for which no mitigation is provided and internal deflagrations, but excludes seismic, - the pipe segment is not part of a high energy system, - the pipe segment is greater than 4 inches in diameter.”	Consideration given to specific design and operational characteristics of the pressure retaining and support items that can affect the size of failure of the pipe segments.

Table A-2a	Methodology/Process Changes in ASME Code Case N-660 for WCGS Categorization		
N-660 Section	**Endorsed Revision 0**	**WCGS IDP Version**	**Basis for Change**
I-3.1.3, 3.1.4, & 3.1.5	All	Sections has been modified and moved into new section I-3.2.2(b). The process used at the WCGS IDP calls for all segments to be created and assigned a consequence category in Sections I-3.1.1 & 3.1.2. Then, for those segments with a consequence category of MEDIUM, LOW, or NONE, the user must evaluate a modified Sections I-3.1.3, 3.1.4, and 3.1.5 (now in I-3.2.2(b)) to assign final high or low safety significance.	Original intent of section was to provide additional considerations for segments not modeled in the PRA. However, the grouping of components into piping segments and the use of surrogate components in the PRA provide quantitative evaluations for each piping segment. The intent of this section now is to provide further considerations for piping segments with MEDIUM, LOW, or NONE consequence categories. See the following entries for specific changes to the original considerations of I-3.1.3, 3.1.4, and 3.1.5.
I-3.1.3	All	Questions changed such that all TRUE responses will support LSS and at least one FALSE response will support HSS.	For consistency with NEI 00-04 process.
I-3.1.3(a)(1)	"Failure of the piping segment will significantly increase the frequency of an initiating event, including those initiating events originally screened out in the PRA, such that the CDF or large early release frequency (LERF) would be estimated to increase by more than 10-6/yr or 10-7/yr, respectively."	Deleted	Redundant to the considerations in I-3.1.1 and I-3.1.2 when determining failure consequences and consequence category.
I-3.1.3(a)(2)	"Failure of the piping segment will compromise the integrity of the reactor coolant pressure boundary as defined in –1200(b)."	Deleted	All reactor coolant pressure boundary segments are ranked high safety significant per -1200(b).

Table A-2a	**Methodology/Process Changes in ASME Code Case N-660 for WCGS Categorization**		
N-660 Section	**Endorsed Revision 0**	**WCGS IDP Version**	**Basis for Change**
I-3.2.2(b)	All	Rather than referring to Sections I-3.1.3, I-3.1.4, and I-3.1.5, new considerations have been provided as listed above. Process still requires user to evaluate the additional considerations for any segment with consequence category Medium, Low, or None.	To improve the process, the additional considerations were moved into this section from I-3.1.3, I-3.1.4, and I-3.1.5. See above for basis of consideration changes.
I-3.2.2(b)	"Any piping segment initially determined to be a Medium consequence category and that is subject to a known active degradation mechanism shall be classified HSS."	Deleted	Continued condition monitoring for known active degradation mechanisms would be a consideration in meeting 50.69 (d)(2) and (e) and therefore classification of HSS is unduly conservative.
I-3.2.2(b)(5)	N/A	"The plant condition monitoring program would identify any known active degradation mechanisms in the pipe segment prior to its failure in test or an actual demand event (e.g., flow accelerated corrosion program)."	In response to previous change immediately above.

Table A-2a	Methodology/Process Changes in ASME Code Case N-660 for WCGS Categorization		
N-660 Section	**Endorsed Revision 0**	**WCGS IDP Version**	**Basis for Change**
I-3.2.2(b)	N/A	Following the new 11 considerations, there was a provision added to allow a pipe segment to be ranked as LSS even if one of the 11 considerations was answered FALSE. The provision states; "If any of the above eleven (11) conditions are not true, HSS should be assigned unless the following can be met: • A condition monitoring program would identify the degradation of the piping segment prior to its failure in test or an actual demand event, or • Historical data show that these failure modes are unlikely to occur and such failure modes can be detected in a timely fashion. Historical data should be restricted to items procured to a specification no more stringent than the minimum specification that could be imposed on a similar item determined to be LSS by this process.	This provision was not used at Wolf Creek and will not be used for future Wolf Creek applications. It was also suggested to ASME that this provision be removed from future revisions of N-660.

Table A-2b	Clarification Changes in ASME Code Case N-660 for WCGS Categorization		
N-660 Section	**Endorsed Revision 0**	**WCGS IDP Version**	**Basis for Change**
Applicability	"… through 2001 Edition"	"… through 2003 Edition"	Updated to be current at the time of the WCGS IDP.
-1200(b)	Entire paragraph	Reworded for clarity	Clarification of the scope of items to be evaluated.
-1320	Entire paragraph	"(a) An Integrated Decisionmaking Panel (IDP) shall use the information and insights compiled in the initial categorization process and combine that with other information from design bases, defense-in-depth, and safety margins to finalize the categorization of functions/SSCs. (b) The designated as members of the IDP shall have joint xpertise in the following fields: - Plant Operations (SRO qualified), - Design Engineering, - Safety analysis, - Systems Engineering, and Probabilistic Risk Assessment. (c) Requirements for ensuing adequate expertise levels and training of IDP members in the categorization process shall be established. (d) To the extent possible, the classification of pressure retaining and support items in a system should be performed by the same IDP members as the categorization of active SSCs in that system."	Clarification of the process used for the WCGS categorization of pressure retaining and support items. An initial categorization of pressure retaining and support items was performed by an engineering function. The IDP, composed of the members with expertise in the disciplines identified in the original paragraph -1320, then considered the initial categorization, along with other information from their respective disciplines, to finalize the categorization. The method used at WCGS results in a categorization processes for classifying pressure retaining and support items that is similar to that used for active SSCs. This helps to ensure consistent consideration of information used the two categorization processes.

Table A-2b Clarification Changes in ASME Code Case N-660 for WCGS Categorization			
N-660 Section	**Endorsed Revision 0**	**WCGS IDP Version**	**Basis for Change**
-9000, high-safety-significant function	N/A	Added to end of definition – “or from other relevant information (e.g., defense in depth considerations)”	Added to consider defense in depth in determining the safety significance of a function.
-9000, plant features	N/A	“Plant features – systems, structures, and components that can be used to prevent or mitigate an accident”	Plant features terminology added to Code Case relative to operator and possible automatic actions
-9000, PRA	“a qualitative and quantitative assessment…”	“an assessment…”	Changed to be consistent with the ASME PRA Standard.
-9000, spatial effects	“A failure consequence affecting other systems or components, such as failures due to pipe whip, jet impingement or flooding.”	“A failure consequence affecting other systems or components, such as failures due to pipe whip, jet impingement, jet spray, loss of inventory due to draining of a tank or flooding.”	Including other possible forms of spatial effects.
I-2.0	“The owner shall define the boundaries included in the scope of the RISC evaluation process.”	“The owner shall define the boundaries included in the scope of the RISC evaluation process. Items optionally classified to Class 1 and Class 1 items connected to the reactor coolant pressure boundary, as defined in paragraphs 10 CFR 50.55a (c)(2)(i) and (c)(2)(ii), are within the scope of the RISC evaluation process. All other Class 1 items shall be classified High Safety Significant (HSS) and the provisions of the RISC evaluation shall not apply.”	The third and fourth sentences added for clarification of the scope of items to be evaluated. As previously stated, there is no intention for Wolf Creek to rank Class 1 items anything other than high safety significant. The second sentence will not be suggested for future inclusion in N-660.
I-3.0, Title	“Consequence Assessment”	“Evaluation of Risk Informed Safety Classifications”	For clarification to meet Figure I-1.
I-3.0, 1st Paragraph	“Piping segments can be grouped based on common conditional consequence…”	“All pressure retaining items, including supports for a piping system, shall be evaluated by defining piping segments that are grouped based on common conditional consequence…”	For clarification of the scope of components to be evaluated.

Table A-2b Clarification Changes in ASME Code Case N-660 for WCGS Categorization			
N-660 Section	**Endorsed Revision 0**	**WCGS IDP Version**	**Basis for Change**
I-3.0, 1st Paragraph	"Additionally, information shall be collected for each piping segment that is not modeled in the PRA, but considered relevant to the classification…"	"Additionally, information considered relevant to the classification shall be collected for each piping segment…"	Clarifies requirement to collect relevant information for ALL piping segments, not just those modeled in the PRA.
I-3.1.1, 1st Sentence	"Potential failure modes for each piping segment shall be identified…"	"Potential failure modes for each system or piping segment shall be identified…"	Clarify that evaluation should consider system level failure modes as well as piping segment failure modes.
I-3.1.1(c), Indirect Effects	"These include spatial interactions such as pipe whip, jet spray, and loss of inventory effects (e.g., draining of a tank)."	"A failure consequence affecting other systems or components, such as spatial effects."	To be consistent with glossary term for spatial effect.
I-3.1.1(d), Initiating Events	"These are identified using a list of initiating events from any existing plant specific Probabilistic Risk Assessment (PRA) or Individual Plant Examination (IPE) and the Owner's Requirements."	"For systems or piping segments that are modeled either explicitly or implicitly in any existing plant-specific Probabilistic Risk Assessment (PRA), any applicable initiating event is identified using a list of initiating events from that PRA."	Clarify source of initiating events.
I-3.1.2, 3rd sentence	"… (high, medium, low)..."	"… (high, medium, low, or none)…"	"None" is one of the four consequence categories which can be assigned in I-3.1.
I-3.1.2(a)(1)	"The initiating event shall be placed in one of the categories in Table I-1."	"The initiating event shall be placed in one of the Design Basis Event Categories in Table I-1."	More clearly defined what "category" means relative to Table I-1.
I-3.1.2(a)(1)	"… updated final safety analysis report, PRA, or IPE shall be included"	"… updated final safety analysis report or PRA shall be included"	Removed IPE because it was felt that the IPE does not provide any additional information in this area.

Table A-2b	**Clarification Changes in ASME Code Case N-660 for WCGS Categorization**		
N-660 Section	**Endorsed Revision 0**	**WCGS IDP Version**	**Basis for Change**
I-3.1.2(b)	"The consequence category of a failure that does not cause an initiating event, but degrades or fails a system essential to prevention of core damage shall be based on the following:"	"The consequence category of a failure: • modeled in a PRA that degrades or fails a high-safety-significant function but does not cause an initiating event, or • not modeled explicitly or implicitly in a PRA, or • that results in failure of another high-safety-significant piping segment, e.g., through indirect effects, or • that will prevent or adversely affect the plant's capability to reach or maintain safe shutdown condition, shall be based on the following:"	Clarified to include the consideration of other consequences of a failure.
I-3.1.2(b)(1)	"Frequency of challenge that determines how often the mitigating function of the system is called upon. This corresponds to the frequency of initiating events that require the system operation."	"Frequency of challenge that determines how often the affected function of the system is called upon. This corresponds to the frequency of events that require the system operation."	Clarified to include functions other than simply mitigating functions and all events as opposed to only initiating events.
I-3.1.2(b)(3)	"Exposure time shall be obtained from Technical Specification limits."	Deleted	Deletion made because it was redundant to the 2nd sentence.
I-3.1.2(b)(3)	"In lieu of Table I-2, quantitative indices may be used to assign consequence categories in accordance with Table I-5."	Moved out from (b)(3) to directly under (b) and changed text to, "For failures modeled in a PRA, quantitative indices may be used to assign consequence categories in accordance with Table I-5 in lieu of Table I-2."	Clarification; this statement applies to all of (b) and not only (3) for Exposure Time.
I-3.1.2(c)	"In lieu of Table I-3, quantitative indices may be used to assign consequence categories in accordance with Table I-5."	"For failures modeled in a PRA, quantitative indices may be used to assign consequence categories in accordance with Table I-5 in lieu of Table I-3. The quantitative index for the combination impact group is the product of the change in conditional core damage frequency (CDF) and the exposure time."	Clarification of the use of Table I-5 and how the combination impact group quantitative index is calculated.

Table A-2b	Clarification Changes in ASME Code Case N-660 for WCGS Categorization		
N-660 Section	**Endorsed Revision 0**	**WCGS IDP Version**	**Basis for Change**
I-3.1.2(d)	“The above evaluations determine failure importance relative to core damage.”	“The above evaluations determine failure importance relative to core damage or the plant’s capability to reach or maintain safe shutdown conditions.”	Added consistent with the changes made to I-3.1.2(b).
I-3.1.3(a)(3)	“Even when considering operator actions used to mitigate an accident, failure of the piping segment will fail a high safety significant function.”	New Section I-3.2.2(b)(1), “Even when taking credit for plant features and operator actions, failure of the piping segment will not directly fail a high safety-significant function.”	Added plant features along with operator actions. Footnote provided for credible operator actions (see below).
I-3.1.3(a)(4)	“Failure of the piping segment will result in failure of other safety-significant piping segments, e.g., through indirect effects.”	New Section I-3.2.2(b)(2), “Failure of the piping segment will not result in failure of another high safety-significant piping segment, e.g., through indirect effects.”	Minor change.
I-3.1.3(a)(5)	“Failure of the piping segment will prevent or adversely affect the plant’s capability to reach or maintain safe shutdown conditions.”	New Section I-3.2.2(b)(3), Even when taking credit for plant features and operator actions, failure of the piping segment will not prevent or adversely affect the plant’s capability to reach or maintain safe shutdown conditions.	WCGS IDP was given ability to credit valid operator action when evaluating failure impact on shutdown conditions. Footnote provided for credible operator actions (see below).
I-3.1.3(b)(1)	“The piping segment is a part of a system that acts as a barrier to fission product release during severe accidents.”	Deleted	This statement was too conservative to force all segments to be ranked as HSS given that just one segment in the entire system meets this criterion. Also, the intent of this consideration is expressed in new subsections I-3.2.2(b)(6) and (11).

Table A-2b	Clarification Changes in ASME Code Case N-660 for WCGS Categorization		
N-660 Section	**Endorsed Revision 0**	**WCGS IDP Version**	**Basis for Change**
I-3.1.3(b)(2)	"The piping segment supports a significant mitigating or diagnosis function addressed in the Emergency Operating Procedures or the Severe Accident Management Guidelines."	New Section I-3.2.2(b)(4), "The piping segment is not relied upon to support an active function in the plant Emergency / Abnormal Operating Procedures or similar guidance as the sole means for the successful performance of operator actions required to mitigate an accident or transient of for achieving actions for assuring long term containment integrity, monitoring of post-accident conditions, or offsite emergency planning activities. This also applies to instrumentation and other equipment associated with the required actions."	The original statement was too limiting to any segment supporting functions addressed in the EOPs or SAMGs. The term significant was too vague. New statement is consistent with NEI 00-04 and clarifies the interpretation for the WCGS IDP. It allows for reasonable consideration of plant features and operator actions.
I-3.1.3(b)(3)	"Failure of the piping segment will result in unintentional releases of radioactive material in excess of plant offsite dose limits specified in 10 CFR Part 100."	New Section I-3.2.2(b)(6), "Even when taking credit for plant features and operator actions, failure of the piping segment will not result in releases of radioactive material that would result in the implementation of off-site emergency response and protective actions."	The off-site emergency response and protective actions limits are more conservative compared to those in Part 100.
I-3.1.4	All	No change to methodology but the appropriate items called out in Reg Guide 1.174 were placed in I-3.2.2(7) through (11) (see below).	For clarity and process improvement.
I-3.1.5	All	No change to methodology but section was moved to I-3.2.2(c). Format change also made to paragraph to more clearly identify questions for consideration.	For clarity and process improvement.
I-3.2	N/A	Added as first sentence, "Risk Informed Safety Classification is determined by considering the Consequence Category in conjunction with other relevant information."	Added to clarify intent of I-3.2.

Table A-2b	Clarification Changes in ASME Code Case N-660 for WCGS Categorization		
N-660 Section	**Endorsed Revision 0**	**WCGS IDP Version**	**Basis for Change**
I-3.2.2(b)	N/A	"The following conditions shall be evaluated and answered true or not true:"	Clarification provided to answering the additional considerations as true or not true. If any of the eleven considerations are not true then the segment shall be assigned HSS, otherwise it can be assigned LSS.
I-3.2.2(b), footnote	N/A	To credit operator actions, the following criteria must be met: • There must be an alarm or clear indication of the failure. • A procedure must direct the response to the alarm or indication. • Equipment activated to alleviate the condition must not be affected by the failure. • There must be sufficient time to perform the compensatory action.	Words paraphrased from Supplement 2, Rev 1 of WCAP-14572, Rev 1 – the Pressurized Water Reactor Owners Group Application of Risk-Informed Methods to Piping Inservice Inspection Topical Report Clarifications. The guidance is provided for expert panel members when relying on operator actions to make decisions regarding safety significance.
I-3.2.2(b)(7)	N/A	"A reasonable balance is preserved among prevention of core damage, prevention of containment failure, and consequence mitigation."	Taken from Reg Guide 1.174.
I-3.2.2(b)(8)	N/A	"Over-reliance on programmatic activities to compensate for weaknesses in plant design is avoided."	Taken from Reg Guide 1.174.
I-3.2.2(b)(9)	N/A	"System redundancy, independence, and diversity are preserved commensurate with the expected frequency, consequences of challenges to the system, and uncertainties (e.g., no risk outliers)."	Taken from Reg Guide 1.174.

Table A-2b Clarification Changes in ASME Code Case N-660 for WCGS Categorization			
N-660 Section	**Endorsed Revision 0**	**WCGS IDP Version**	**Basis for Change**
I-3.2.2(b)(10)	N/A	"Defenses against potential common cause failures are preserved, and the potential for the introduction of new common cause failure mechanisms is assessed."	Taken from Reg Guide 1.174.
I-3.2.2(b)(11)	N/A	"Independence of fission-product barriers is not degraded."	Taken from Reg Guide 1.174.
I-3.2.2(c)	All	The original text was combined in I-3.2.2(b). The new I-3.2.2(c) is a copy of the original I-3.1.5 section for safety margin assessment.	For simplification and process improvement.
I-3.2.2	A component support or snubber shall have the same classification as the highest-ranked piping segment within the piping analytical model in which the support is included. The Owner may further refine the classification ranking by more extensive application of the process defined in these requirements. These analyses shall be documented.	Moved into I-3.2.2(d) with no change to text.	For consistency.

Note 1 – Figure I-1, Risk-Informed Safety Classification Process

Scope Identification
Select system and define boundaries for evaluation

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Consequence Evaluation
Perform FMEA considering Direct & Indirect Effects
Identify Impact Groups: Initiating Event,
System/Train, Combination, Containment

↓

Consequence Categorization
Determine Consequence Ranking from Quantitative
Indices or Consequence Category Tables

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Classification Considerations
Consider other relevant information, including
defense-in-depth principles, for Medium/Low/None
consequence categories

↓

Final Classification Definitions
HSS – high-safety-significant
LSS – low-safety-significant

Figure I-1
Risk-Informed Safety Classification Process