Tuesday, June 5, 2007

Preliminary Review Discussion: Passive Categorization

Items arising during an NRC audit of the WCGS 50.69 pilot application documentation at NEI on May 17, 2007, related to the ongoing NRC staff review of the passive categorization in WCAP-16308-NO, Revision 0. Attachment 1.

Table A-2 (cont.)	**Impact of Changes in ASME Code Case N-660 on the WCGS Categorization**		
N-660 Section	**Endorsed Revision 0**	**WCGS IDP Version**	**Basis for Change**
I-1.0	N/A	Added figure 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.
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 paragraph 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
Reg Guide 1.147 says, "The Code Case must be applied only to ASME Code Classes 2 and 3, and non-Code Class pressure retaining components and their associated supports. Is the Topical requesting approval of the process excluding all Class 1, or with the above proposed text?			

I-3.0, Title	"Consequence Assessment"	"Evaluation of Risk-Informed Safety Classification"	For clarification to meet Figure I-1.
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.
The text in the endorsed Rev 0 of N-660 refers here to shutdown, fires, flooding and seismic as providing information relevant to classification. This appears to contradict the latter assertion that the approved version of N-660 did not require external events to be included (see comments on I-3.1.2 below). How did WCGS interpret the above text to if not to included external events in the categorization?			
I-3.1.1(a)	N/A	(4) when design insights do not support a large break based on pressure/temperature/flow in the pipe segment	Consideration given to the moderate energy conditions (temperature below 200 F and pressure less than 275 psig) of the systems being evaluated. It is anticipated to use this provision for other moderate energy systems at Wolf Creek.
This guidance provides no predictability about which segments will be assigned a small leakage. Introduction of this "guideline" during the ASME code development process was one of the primary reasons for the staff vote "No" on the proposed code case. The staff position has not changed and this guidance would then not be endorsed in the RG. If guidance on reducing pipe failure size is pursued, alternative guidance needs to be developed that is acceptable to the staff (e.g., acceptable in other similar contexts) and predictable. Note that it may be easier to rely on other qualitative consideration instead of a reduced break size to properly identify LSS segments. During the audit of the pilot the staff noted that application of this guideline will result in long times to damage due to the minimal water release rate. This long time frame will, in turn, permit consideration of long term operator actions while addressing the qualitative considerations. For example, Segment CS04A "There is indication of a leak and this can be isolated prior to taking another system [?]. If a system is taken out, there are other trains of equipment available." These types of interactions between the guidelines should be identified so that the overall process can be effectively evaluated.			

I-3.1.2	N/A	"In assessing the appropriate consequence category, risk information for all initiating events, including fire and seismic, should be considered.'	This statement was originally added to help clarify Section I-3.0 when considering other relevant information. However, it was determined prior to performing the WCGS categorization that this step was not necessary. Therefore, the WCGS process in section I-3.1.2 followed the endorsed Revision 0 where it was not required to consider all initiating events, including fire and seismic, when determining the appropriate consequence category.

The approved Code Case N-660 does include a discussion on external events etc. (see the I-3.0 in the original N-660 or the entry for I-3.0 above). External initiating events would be treated like all others, most likely in I-3.1.2(b) System Impact Group assessment because the pipe rupture would not "cause" an external event (or fire). If the licensee had no PRA for external events, Table I-2 in N-660 provides a method for determining safety-significance. NEI 00-04 provides different guidance on determining safety-significance for SSCs needed to respond to external events not included in the PRA. For example, as discussed on the top of page 44 in NEI 00-04, the safe shutdown paths for an initiating event not modeled in the PRA are determined, and all SSCs in that path are HSS and the IDP may not reduce these (requires a PRA analysis). Topical WCAP-16308-NP itself appears inconsistent with NEI 00-04. The last sentences on paragraph on 4-3 in the Topical state: "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."		
I-3.1.2(b)	"System Impact Group Assessment. 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:"	"System Impact Group Assessment. 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,	For consistency with RI-ISI program criteria for system impact group assessment.

		or that will prevent or adversely affect the plant's capability to reach or maintain safe shutdown conditions, shall be based on the following:"	
What RI-ISI criteria are being referred to with the statement "for consistency with RI-ISI program criteria for system impact group assessment" and what context are the criteria being used in? Does this new list, screen-out evaluations that the approved text would require evaluation of? Does the new list add evaluations that the approved text does not require? If no evaluations are added and none are subtracted, what is the basis for, and the utility of, the change. Normally, no piping failures are modeled explicitly in any PRA but almost all are modeled implicitly insofar as the transient and failures caused by the pipe failure can be reflected in the PRA (the exception being when the failure only impacts design and operation considerations that do not impact CDF/LERF). The original paragraph introduces the N-660 section for evaluating the consequences of pipe failures that cause no initiating event but which can impact a system essential to prevent core damage. The original text provides for evaluating potentially HSS segment failures by evaluating the impact of their failure on essential systems (pretty much every system in the shutdown paths). The proposed text limits this evaluation to pipe failures that can degrade system functions already determined (from somewhere) to be HSS. This is less reflective of the safety significance of a segment failure because the spatial impacts of the segment failure, both on the function it directly supports and on other its functions, could make the segment failure more safety significant than the function it is supporting For example, a MSS function could become a HSS function when the spatial effects of the failed segment are added. The change seems to be a substantive change, not simply a consistency change. Please explain how this change impacts the population of piping segments that would be evaluated in I-3.1.2(b) as compared to the original text. Please provides some examples for WCGS of segment that met the criteria to be evaluated with I-3.1.2(b) and some that did not.			
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.	For inclusion of new wording under system impact group assessment considering reaching or maintaining safe shutdown conditions.
The utility of these changes is unclear. I-3.1.2(d) was only intended to provide the link between CDF and LERF without requiring a direct calculation of LERF. As discussed under I-3.1.2(b), the "plant's capability to reach or maintain safe shutdown" with respect to successful shutdown after an initiating event should be already included in the consequence analysis when pipe failures are accurately reflected in the PRA (or in an analysis which uses Table I-2) because the PRA analysis would normally include all impact that might hinder a plant to reach and maintain a safe-shutdown condition following an initiating event. The WCGS included the statement that, "The safe shutdown list from the IPEEE includes the sump screens and containment isolation valves. However, the expert panel could find no valid reason to consider these components necessary to reach or maintain safe shutdown." Is the "safe-shutdown" path from the IPEEE (fires and external events) the "capability" being discussed here or is it something else? What is the relationship between this and I-3.2.2(3)			

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.
The WCGS documentation included an evaluation of piping segments CS003A/B which were eventually placed in LSS. These pipe segments are attached to the two sump screens. The sump screens are in EN-04 which is HSS based on RAW (unclear if from CCF or directly). The IDP documentation included the statement that "the expert panel could find no valid reason to consider these components necessary to reach or maintain safe shutdown." Therefore, the questions in I-3.2.2(b)(3) is being used on these segments. Many other segments had similar discussions. As with the above example, it was not apparent from the audit of the documentation that a segment was passed through a PRA analysis (or the alternative Tables) to determine whether it was Medium, Low, or None before I-3.2.2(b) was used. Instead it seemed that I-3.2.2(b) was used directly for every segment. In most RI-ISI analyses, the CCDP of each segment is estimated and compared to Table I-5. Given the above discussion of the sump screens, it would seem that the categorization of the active SSC in segments such as CS003A/B could provide a starting point for a segment PRA evaluation because the CCDP is related to the RAW which is used to categorize the active component (rupture of the component or attached segment would most likely fail the component function in addition to causing additional SSC failures from spatial effects not included in the RAW). Please explain in detail how the Safety-significance of CS003A/B was passed through each of the steps in the proposed process.			
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.
Most of these questions when formulated in the negative are difficult to understand which could easily lead to misapplication. Unlike the NEI 00-04 questions on page 65, referred to in I-3.1.3, these questions are more complicated because of the “Even when taking credit for..” modifiers.			

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."	Not used	Piping segments are not modeled in the PRA.
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)."	Not used	All reactor coolant pressure boundary segments are ranked high safety significant per -1200(b).

Table A-2 (cont.)	**Impact of Changes in ASME Code Case N-660 on the WCGS Categorization**		
N-660 Section	**Endorsed Revision 0**	**WCGS IDP Version**	**Basis for Change**
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), "Event when taking credit for plant features and operator actions, failure of the piping segment will not directly fail another high safety-significant function."	Added plant features along with operator actions. Footnote provided for credible operator actions.
Please define "plant features" and explain why such features would not normally already be included in the results of the PRA analysis. If such features are already credit in placing the segment in MSS, for example, why would this not be double accounting to again credit an item already credited the PRA? The addition of the "directly fail <u>another</u>" appears to be a major change. In the original, failing one safety-significant function by being in the function flow path is sufficient, whereas here another function would also have to be "directly failed". For example, the active function of valve ENHV0006 is HSS based on PRA results and failure of the piping attached to the valve would cause at least as much disruption as the valve failing to open so, by definition, the piping segment failure could fail a HSS function which would result in HSS. In the proposed revision, even if it failed one function directly, it must now also fail "another" function. Please explain how this question was addressed for ENHV0006			
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 results in failure of another high safety-significant piping segment, e.g., through indirect effects."	Minor change.

It is unclear that replacing "safety-significant" with "high-safety significant" is a minor change. If piping that directly causes a MSS transient (CCDP between 1E-4 and 1E-6) results in the failure of a second function that is also MSS, the two cascading failures could failures could well have a CCDP>1E-4 and be HSS. For non-quantifiable segments (i.e., don't contribute to CDF/LERF) it is less clear what a cascading failure over two MSS segments should be.			
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), Event 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.
Here also, plant features and operator actions are credited the PRA analysis (or using the Tables in lieu of the PRA). This section is intended to have the IDP place, for example, a Medium segment into the HSS or LSS category. Operator actions and plant features that were initially included in the PRA would be double accounted if they are once again credited here. What plant specific features and operators actions should be credited here and how should they be differentiated from those credited earlier in the PRA analysis?			
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."	Not used	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, there is redundancy with new subsection I-3.2.2(b)(11)
Rather than simple removed, perhaps a more focused question would be appropriate.			
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 does not 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 original statement was too limiting to any segment supporting functions addressed in the EOPs or SAMGs. The term significant was too vague. New statement clarifies the interpretation for the WCGS IDP and allows for reasonable consideration of plant features and operator actions.

Credit for the operator somehow fixing or otherwise overcoming this loss of instrumentation at the same time as they are responding to the original upset that requires them to rely on this instrumentation is really crediting multiple complex actions simultaneously. In PRA this would require extensive task and timing analysis and would often not be permitted with ASME standard on PRA and therefore RG 1.200. It also appears inconsistent with footnote (2) in the proposed code case which defines what operator actions may be credited. Please provide an explanation of the sequence of events being evaluated here and identify how crediting these actions are consistent with PRA practices and the definition in footnote (2).

The application of this question in the WCGS pilot documentation was not clear. For example, EN-07 – Provide system alarm and indication. This function includes all instrumentation for the EN system that provides system alarm and indication only (although system control, read to mean actual automatic control signals to the EN system functions, is in the other functions). EN-07 was simply placed in LSS automatically placing all instrumentation in that function into LSS. It is unclear how the IDP could correctly disposition this question based on the high level information provided. Please identify whether any of the EN system instrumentation supports a mitigating or diagnosis function in the EOP or SAMAs, how the significance of these functions was determined, what redundant functions are available, and the sequence of operator actions whose crediting would be permissible with PRA practices and footnote (2).

Table A-2 (cont.) **Impact of Changes in ASME Code Case N-660 on the WCGS Categorization**

N-660 Section	Endorsed Revision 0	WCGS IDP Version	Basis for Change
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-3.2.2(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 required 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)(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)."	Consideration added for existing plant programs that may impact the ability to prevent a pipe segment from failing given a known active degradation mechanism in the pipe segment.
WCGS pilot application included numerous statements that such a plant condition monitoring program exists. It would appear that this question always yields "True" if generally applied (i.e., not for specific locations in each segment). There are augmented programs for most active degradation programs (FAC, IGSCC, MIC) and so programs would always exist and this would be true. If an unknown degradation mechanism was exists this would still yield "True" because there is no known degradation mechanism. To be valid for providing assurance that a particular segment will not fail, it would appear that not only should the program exist, but all locations in that segment exposed to that degradation mechanism should be inspected under the program. If there is a known degradation active in the segment and there is a program but no actual inspections in the segment, what would the answer be to this question? If one or more, but not all, susceptible locations were inspected in this segment, what would the answer be? If all susceptible locations were inspected what would the answer be? Under what conditions, would the response to this question be "false"? The question could also be read that there only needs to be a program capable of identifying mechanisms in the segment before the segment fails, which states that the mere existence of a program capable of identify a degradation mechanism is sufficient. What is being credited, however, is the ability of the program to prevent the particular segment from failing. How was this implement in the pilot plants? Which augmented programs (other than the FAC example given) would be credited as being able to fulfill the requirement?			
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.

Table A-2 (cont.)	**Impact of Changes in ASME Code Case N-660 on the WCGS Categorization**		
N-660 Section	**Endorsed Revision 0**	**WCGS IDP Version**	**Basis for Change**

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.
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(b)	N/A	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
The staff will review the WCGS method.			
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.