NRR-PMDAPEm Resource

From: Miller, Ed
Sent: Friday, March 10, 2017 8:58 AM
To: Miller, Ed
Subject: FW: CC RAI#6 - 3-9-17 draft to NRC
Attachments: CC RAI#6 - 3-9-17 draft to NRC.docx

This is the draft of RAI response #6 from SNC for discussion at the March 13, 2017, public meeting.

Hearing Identifier: NRR_PMDA
Email Number: 3392

Mail Envelope Properties (08a6608384f348d18674d014e7cd3049)

Subject: FW: CC RAI#6 - 3-9-17 draft to NRC
Sent Date: 3/10/2017 8:57:51 AM
Received Date: 3/10/2017 8:57:52 AM
From: Miller, Ed

Created By: Ed.Miller@nrc.gov

Recipients:
"Miller, Ed" <Ed.Miller@nrc.gov>
Tracking Status: None

Post Office: HQPWMSMRS02.nrc.gov

Files	Size	Date & Time
MESSAGE	102	3/10/2017 8:57:52 AM
CC RAI#6 - 3-9-17 draft to NRC.docx	39098	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

RAI #6 (revised 2-24-17):

According to Section A-1.3.2.1 of Appendix A of RG 1.177, when a component fails, the CCF probability for the remaining redundant components should be increased to represent the conditional failure probability due to CCF of these components, in order to account for the possibility that the first failure was caused by a CCF mechanism. When a component fails, the calculation of the plant risk, assuming that there is no increase in CCF potential in the redundant components before any extent of condition evaluation is completed, could lead to a non-conservative extended completion time calculation, as illustrated by inclusion of the guidance in Appendix A of RG 1.177. Much of the discussion in Appendix A describes how configuration specific risk calculations should be performed.

In Section 3.2 of the NRC safety evaluation for NEI 06-09, the NRC staff stated that compliance with the guidance of RG 1.174 and RG 1.177, "is achieved by evaluation using a comprehensive risk analysis, which assesses the configuration-specific risk by including contributions from human errors and common cause failures."

The limitations and conditions in Section 4.0 of the safety evaluation for NEI 06-09 state that:

> The [NRC] staff interprets TR NEI 06-09, Revision 0, as requiring consideration of [additional] RMAs [due to the potential for increased risks from common cause failure of similar equipment] whenever the redundant components are considered to remain operable, but the licensee has not completed the extent of condition evaluations [such that a CCF mechanism can be confirmed or excluded].

The requirement to consider additional RMAs prior to the determination that a CCF mechanism exists or does not exist was included by the NRC staff in the safety evaluation for NEI 06-09 as an additional measure to account for the potential that the first failure was caused by a CCF mechanism. However no exception to the RG 1.177 guidance was taken in the LAR for the calculation of the RICT with regards to the quantification of CCF before a CCF can be confirmed or excluded.

Please confirm and describe how that treatment of CCF, in the case of an emergent failure, either meets the guidance in RG 1.177 or meets the intent of this guidance when quantifying a RICT. Addressing CCF in this case could adjust the RICT calculation to numerically account for the increased possibility of CC. Alternatively, prior to exceeding the front stop, implement RMAs that are not credited in the RICT calculation sufficient to ensure that any safety function of the remaining train would not be lost if a CCF condition did exist and the remaining train failed to function upon demand.

Either option would need to remain in effect until the possibility of CCF was excluded at which point, a new RICT could be calculated or appropriate RMAs reconsidered.

SNC Response to RAI #6:

Southern Nuclear believes the intent of RG 1.177 guidance on treatment of common cause for Technical Specification Completion Time (CT) changes is to account for the increased risk to the plant from potential CC failures by adjusting the CC factors in the risk model when a TS component has failed. However, we believe the specific adjustment of the CC factors in the PRA model was intended for Tier 1 (license amendment) changes and the RICT calculation for 4b is more closely aligned with the RG and NEI guidance associated with Tier 3 (contemporaneous configuration risk management changes) which compensate for the CC potential through risk management actions rather than a specific adjustment of the CC factors in the PRA model. Regardless of whether the Risk Informed Completion Time (RICT) is a Tier 1 or Tier 3 change, the intent of RG 1.177 guidance for an emergent failure is to compensate for the increase in plant risk created by a potential common cause failure. As stated above, this common cause risk compensation is appropriate for the period of time before common cause can be confirmed or excluded as the failure mechanism.

Considering the intent of RG 1.177, the guidance for risk compensation could be met by ensuring appropriate RMAs are in place to offset risk contributions from common cause failures. This is the method SNC proposes to use. It should be noted that adjusting CC factors in the RICT calculation or ensuring appropriate RMAs are in place do not actually reduce the probability of a common cause failure. However, both ~~due~~ do reduce risk.

Adjustment of CC factors has the effect of increasing the calculated instantaneous risk and reducing the overall Completion Time. Adjusting factors does not specifically reduce the probability of having an initiating event or mitigate the subsequent impact of common cause failure. However, this method meets the intent of RG 1.177 by increasing the quantified risk, which reduces the time the plant can operate without confirming the absence of a common cause failure mechanism.

Southern Nuclear proposes to meet the intent of RG 1.177 by implementing appropriate RMAs that decrease the actual instantaneous risk. The risk reduction impact of the RMAs would not be quantified and used directly in the RICT calculation (i.e., not credited) and would not involve a quantified risk increase from adjustment of CC factors or otherwise reduce the length of time the plant is in the RICT. Appropriate RMAs typically include actions to decrease the potential for risk significant initiating events, limit the potential for important SSCs becoming unavailable due to human error or damage from fire, and prepare operators to respond to risk significant events, recognizing the specific plant conditions in effect during the TS CT. The RMAs include actions that focus on the success of redundant and/or diverse SSCs that perform the function(s) of the failed SSC. Important initiating events will typically include initiating events where event mitigation requires operation of Structures, Systems, and Components (SSCs) susceptible to failure by common cause. Important SSCs will typically include SSCs providing redundancy to the failed SSC and diverse SSCs that provide the remaining redundancy for functions performed by the failed SSC. This ~~M~~method ~~2~~ also meets the RG 1.177 intent by limiting overall risk through implementation of RMAs during the time when investigations are confirming or excluding the presence of a common cause failure mechanism. It is expected that the RMAs collectively provide a greater risk reduction than the risk increase introduced by CC adjustment.

Southern Nuclear believes protected equipment actions, compensatory measures, and RMAs performed as part of a configuration risk management process provide a more risk-informed

process to mitigate the risk of a potential common cause risk than the adjustment of common cause factors in the PRA model. The following considerations support this conclusion:

1. Adjusting CC factors only addresses the components on the same system's other train. Risk Management Actions can extend beyond that system and consider/protect other functions that can mitigate the potential risk (e.g., offsite power and the switchyard when an emergency diesel generator is out of service).
2. Adjusting a CC factor probability conditionally only addresses one possible contribution to configuration risk. RMA's and protective actions affect a number of important risk impacts in a positive way (e.g. human error shaping factors, initiating event likelihood, equipment availability), pointing the risk arrow down.
3. Adjusting CC factors focuses on one specific parameter; RMA's and protection actions ask "what's the next worse thing that can happen?" They look ahead, and anticipate more restrictive risk implications.
4. Implementing protective actions and RMA's uses all the other tools available to an operator to manage online risk such as heightened personnel awareness, physical restrictions for important equipment and human actions, triggering-up online status for severe weather and grid conditions.

Southern Nuclear will revise RICT Program procedures to reinforce requirements for RMA development, adding rigor and specificity to the required RMAs in the event Plant Vogtle must enter an emergent RICT, including RMAs targeting success of redundant and diverse SSCs that perform the function(s) of the failed SSC.

Comparison of the RG 1.177 Methods – Southern Nuclear has prepared examples to illustrate the risk reduction from adjusting of CC factors in the PRA model (Method 1) and compare this to the implementing RMAs (Method 2). Figure 1 illustrates this comparison qualitatively. For the examples, SNC chose two TS Conditions. Listed below are developed RMAs for each TS Condition. The RMA information was generated in accordance with the draft implementing procedures. To the extent practical, SNC has quantified some of the RMAs to compare with quantification of CC factor adjustment. Quantifying the numeric impact of appropriate RMAs indicates RMAs are effective in addressing risk during an emergent RICT where the potential for CC failure of the remaining train(s) is not known. Therefore, the intent of RG 1.177 is met.

Example # 1 – TS Condition 3.5.2, Condition A – One or more trains [of ECCS] inoperable with at least 100% of the ECCS flow equivalent to a single OPERABLE ECCS train available. The REQUIRED ACTION is to restore the train(s) to OPERABLE status within a Completion Time of 72 hours OR in accordance with the Risk Informed Completion Time Program. For this example, it is assumed RHR pump A is unavailable.

Upon inoperability of RHR pump A, immediate action is taken by operators to initiate protection (i.e. install barriers/signage) on RHR B in accordance with NMP-OS-010-003, Vogtle Protected Equipment Log. Specifically, the procedure requires protection of the B RHR pump room, the B train 4160V switchgear room, and the pump's control room handswitch. This is considered an RMA which reduces the likelihood of human error induced failures of the remaining RHR train.

RMAs are developed in accordance with draft RICT program procedures by using importance reports generated from quantification of the specific plant configuration.

RMA 1
A) Maintain availability of fire pumps. (This RMA increases the likelihood of adequate pressures in suppression system piping
B) For the listed fire zones, maintain availability of suppression, detection, and barriers, and avoid activities that increase fire risk (e.g. hot work, transient combustibles). (This RMA adds assurance that transient fires will not be initiated, increases the likelihood for suppression of a fire, and decreases the likelihood that a fire will spread between fire zones.)

Fire Zone	Description	RRW

RMA 2 – Perform a continuous fire watch at the Train B shutdown panel in Room A043. Keep the panel open to allow prompt identification of a fire. (This RMA increases the likelihood for suppression of a fire in the panel. The RRW for this panel fire is 1.5008.)

RMA 3
A) Challenge/preclude activities which could cause the listed initiating events. (This RMA reduces the likelihood of human induced initiating events.)
B) Do not perform switching (i.e. breaker operation) on 4160V bus 1AA02 and 1BA03, unless required for transient or event response. (This RMA reduces the likelihood for bus failure because a large percentage of bus failures occur during switching.)

Description	RRW

RMA 4
A. Maintain the listed SSCs available (preclude testing and maintenance activities which could impact the availability of the SSCs).
B. Perform non-intrusive inspection of the B RHR pump and support systems to identify any apparent operability concerns.
(This RMA reduces the likelihood for human induced events affecting availability of redundant SSCs, diverse SSCs which perform the functions of the failed SSC, and other important SSCs.)

Description	RRW

RMA 5
A) Brief operators on configuration risk profile, basis, and RMAs.
B) Perform beginning of shift briefings for control room operators focusing on actions to establish feed and bleed cooling in the event that main feedwater, condensate, and auxiliary feedwater are not available to supply steam generators. (This RMA increases the likelihood that operators will successfully implement a risk significant action.)

A sensitivity study was performed for Example #1 to quantitatively assess the risk reduction from implementation of RMAs. The majority of RMAs were not credited quantitatively in the sensitivity study. The RMAs credited are as follows:

- For RMA 2, performance of a continuous fire watch at the Train B shutdown panel in room A043, a 22.5% reduction is applied to the initiating event frequency for fire in the Train B shutdown panel based on the presence of the continuous fire watch.
- For RMA 3A, precluding activities that can cause an initiating event, including loss of offsite power and loss of 4160V bus 1BA03, which supplies power to the B train RHR system, a 10% reduction is applied to the frequency for loss of offsite power. By data review, a significant percentage of plant-centered and switchyard-centered LOSP events were caused by human interaction (i.e. maintenance, testing, etc.).
- RMA 3B, deferral of switching (i.e. breaker operation) on 4160V bus 1AA02 and 1BA03, a 10% reduction is applied to the frequency for both loss of 4160V bus 1BA03 and loss of 4160V bus 1AA02. The majority of bus failures occur during switching activities.

The table below provides a comparison of CC factor adjustment, base RICT evaluation with no adjustments to CC factors and no credit for RMAs, and a sensitivity case in which CC factors are adjusted and some quantitative RMA credit is applied as discussed above. Note CC factors and RMA benefit effectively cancel each other, returning to the Base RICT evaluation CDF, Delta CDF, and RICT.

Description	Base CDF (/year)	CDF (/year)	Delta CDF (/year)	RICT (days)
Increased CC factors impact evaluation (Method 1)	4.86E-05	4.58E-04	4.09E-04	8.5
Base RICT evaluation (Method 2)		4.16E-04	3.67E-04	9.4

Increased CC factors impact evaluation with some quantitative RMA impact		4.27E-04	3.78E-04	9.2

<insert Example #2 later>