COMPILATION OF ACRS SUBCOMMITTE MEETING DISCUSSION COMMENTS ON 12/15/2016 AND THE CURRENT STATUS OF THEIR RESOLUTIONS

	Commenter	Comment	Response	Resolution
1	Powers	Where is the release path? Is it into auxiliary building?	The release path considered for scenarios involving creep rupture failure of SG tubes goes directly to the environment via open SG relief valves (RVs). This is a conservative assumption since all releases through secondary piping (for example - due to main steam isolation valve failure to close) may go through the condenser before leaving to the environment. These release paths may have some level of decontamination credit (DF>1), which is not credited in this study.	Some clarification is made in the NUREG that the release path is conservatively assumed through open SG RVs directly to the environment [see for example Sections 2.5.1.2, and 7.1.6]
2	Rempe	What would be the condition of stainless steel prior to failure of Inconel materials considering that the melting temperature of stainless steel could be about 100^{o} F below Inconel?	The temperature of concern for the creep rupture failures of hot leg and SG tubes for high/dry/low accident scenarios is generally below 1273^{o} K. The melting temperature for Inconel is between 1643 to 1698^{o} K. Both the stainless steel (ss) components and the Inconel tubes experience temperatures above 0.5 times the melting temperature during the transients considered in this work. However, the creep rate and the creep rupture of these components will depend upon temperature, applied stress and geometry, among other factors. One such example is provided by the analysis of Westinghouse design (see Chapter 4). In this case, the stainless steel hot-leg experiences higher temperatures as well a counter current flow, which influences the stresses, and could fail prior to Inconel tubes. The hot leg in the Combustion Engineering design is mostly made of carbon steel with thin layers of SS cladding. Its creep behavior is different and this issue does not directly apply.	No proposed changes in the NUREG
3	Shack	Boyd's conference paper cannot be located. Include the two figures of reference temperature and put it in the report.	The title was corrected and the ML# was added in the references section of the report. The report now includes a Figure 3-36, which presents the distribution of the normalized temperature across the SG tubes sheet inlet for the CE Plant. This figure is referenced as a part of the definition and for the clarification of TSGA−g−peak variable.	Changes made in reference Section 3.9 (ref. 6). Figure 3-36 was added and referenced.

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4	Several members including March-Leuba and Rempe	Why was MELCOR used and not RELAP or TRACE? The comparison of RELAP and MELCOR does not use the same stress multipliers; e.g., MP of 1 was used in RELAP and 2 for MELCOR	Whether to use MELCOR or RELAP was a major decision at the start of the project. The project participants held meetings on whether to use the SCDAP/RELAP5 code that was used for NUREG/CR-6995 or to switch to the MELCOR code. The participants weighed not only thermal hydraulic behavior of the codes, but also the capability of the codes to calculate fission product release, consistency with prior Westinghouse CSGTR calculations, consistency with other severe-accident calculations, the impact of changing codes, and plans for the direction of future code usage for these purposes at the NRC. After weighing all these considerations, the participants concluded that MELCOR was the proper code to use for this project. TRACE was not considered because the severe accident scenario involves heat generated during core degradation, and other processes including fission product transport that are not modeled in the TRACE thermal-hydraulic code.	No proposed changes in the NUREG
5	Powers and March-Leuba	There are studies out there that conclude that the loop seal may clear in DBAs in 1000 seconds, long before core damage. Do the TH results for any of the scenarios indicate that?	Our TH results do not indicate that loop seal could be cleared either early or late. There is a sufficient opening between the upper core and the bypass area that eliminates potential pressure differential necessary for seal clearing.	No proposed changes in the NUREG
6	Shack	Sandia's report on MELCOR analyses for Calvert Cliffs should be publicly available.	The report was generated several years ago and the project was closed. Making the report publicly available at this time will require Sandia's concurrence and thus a new project needs to be awarded. The NRC staff decided not to pursue this path due to its cost and time constraints: instead, the issue has been resolved by making changes to the NUREG.	Reference 3 was eliminated from reference Section 3.9. It is now footnoted within the test. NUREG guidance allows non-publicly available documents in footnotes.

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7	Rempe	MELCOR models used in SOARCA analysis resulted in significant changes in timing of major events and peak core temperature in severe accidents. Do these changes in SOARCA affect the conclusion of this study?	MELCOR 1.86 and MELCOR 2.1 show good agreement up until tube rupture as documented in Table A1 of the SOARCA Uncertainty Analysis for the Surry short term station blackout (ML15224A001). Models modified in MELCOR 2.2 for the Sequoyah analysis in SOARCA mainly affect the code predictions in the region where the Lipinski dryout model is applied. As such improvements were also made to the quenching model. The dryout and quenching models impact behavior during reflood. Since the scenario modeled in MELCOR 1.86 for the CSGTR work considers behavior prior to re-flood, these models implemented in MELCOR 2.2 would not be expected to affect scenario behavior.	No proposed changes in the NUREG
8	ACRS Member	You presented some uncertainty results from a non-publicly available report. Could you provide some discussion and verification of those results?	This CSGTR project included an effort to characterize the uncertainty in failure timing. The CSGTR calculator accounted for variability in crack and material properties. Along with the initial input deck generation, Sandia National Laboratories performed an uncertainty analysis using the short term station blackout model in MELCOR to characterize the influence variability in TH-related parameters on absolute failure timing, and the relative failure timing of SG tubes to other RCS components. As part of the process of determining the parameters to vary in their uncertainty analysis, Sandia reviewed the TH uncertainty analysis parameters chosen in NUREG/CR-6285 and NUREG/CR-6995. The SNL chose the following parameters to vary for this uncertainty analysis: • PORV and SRV Valve discharge coefficients • Zirconium oxidation sensitivity coefficients • CFD mixing parameter: coefficient of discharge • CFD mixing parameter: recirculation ratio • Steam generator tube outer wall heat transfer coefficient multiplier • Hot leg wall emissivity • RCS-to-Containment heat transfer coefficient multiplier	No proposed changes in the NUREG

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			One hundred simulations were run by randomly sampling from these parameters using the MELCOR Uncertainty Engine. Distributions of failure timing and relative failure timing were generated from the 100 MELCOR simulations. The inspection of the cumulative distributions showed a standard deviation in relative SG-to-RCS component failure timing of about 420 seconds (7 min) and absolute component failure timing of about 600 seconds (10 min) for both the hot leg and steam generator tubes.	
9	Several members including Krichner, Stetkar	What is the effect of high temperature from severe accidents on other RCS components in RCP seals?	The integrity of RCP seals for temperatures greater than 650^{o}C is currently uncertain. Upon catastrophic failure of RCP seals at temperatures that creep rupture of SG tubes is imminent, the loop seal is expected to be cleared. This is predicted to result in the failures of a large number of SG tubes. Although RCP seal failure would also result in subsequent depressurization of the RCS the induced SG tube failures would likely challenge the SG relief valves. This condition could delay the failure of hot leg or other RCS equipment. On the contrary, if the RCP seals fail early when RCS temperature is significantly below the creep rupture failure of SG tubes, it will depressurize the RCS and eliminate the concern regarding the CSGTR. Addressing the RCP seal failure at high temperature for both CE and Westinghouse plants was beyond the scope of this research effort; the relative impact of its potential effect may not justify the considerable resources required for resolution. Therefore, the assumptions regarding RCP seal failure remain a source of uncertainty in the PRA and should be handled using appropriate methods (e.g., NUREG-1855).	No proposed changes in the NUREG
10	March-Leuba	Does MELCOR simulate failures of hot leg and SG tubes or is it done outside MELCOR?	MELCOR could simulate failure times, but for this project, the MELCOR runs were done with the failure routines suppressed. The MELCOR output then was used in the CSGTR Calculator software for estimating probabilistic failure times of SG tubes and hot leg.	No proposed changes in the NUREG

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11	Rempe	Guidance should be provided for SG design characteristics to distinguish between plants with high/Low probability of CGSTR. The risk guidance should be then provided accordingly for each type of design.	A user guide will be prepared after the final NUREG. It will include guidance to determine SG design characteristics for a specific case in question. Then the risk guidance will be matched to the SG design characteristics. At this time, it is envisioned that such a user guide may be in the form of a Risk Assessment Standardization Project (RASP) RASP Handbook chapter.	No proposed changes in the NUREG
12	Several members including Shack, Rempe, and others	Why is the C-SGTR probability higher for ltsbo compare to stsbo? Is the same true if the core damage is delayed for several days? Ltsbo= long term station blackout Stsbo = short term station black out	The equation for creep rupture depends on time- temperature and stress profile (i.e. the pressure). After the onset of core damage, TH results show that the temperature ramp is slower in ltsbo than in stsbo (lower decay heat and additional cooling). The creep rupture failure of both SG tubes and HL will take a bit longer. However, the time between the two failures becomes slightly longer, with SG tubes failing first. The C-SGTR probability is therefore slightly increased. However, these differences have a minimal impact on plant risk since a delayed release past 12 hours generally is not a contributor to LERF.	NUREG was modified to include this discussion in Section 7.2.4.
13	Corridini	Why is 6 centimeter-square considered as threshold for C-SGTR?	This is the area of equivalent to a double-ended break of a single SG tube in the Westinghouse plant studied. This break size is taken as the area of leakage that if exceeded, will pressurize the SG secondary and demand SG relief valves to open (release path). Smaller leakages cannot pressurize the SG when considering normal leakages in the secondary system (0.5 square-inches per SG).	No proposed changes in the NUREG
14	Rempe and other ACRS members	Will the guidance document be developed and what would it look like?	NRC staff will keep ACRS abreast of the progress in this area if requested.	No proposed changes in the NUREG