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U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT:
Perry Nuclear Power Plant
Docket Number 50-440, License Number NPF-58
Response to Request For Additional Information Regarding License Amendment to Adopt Technical Specification Task Force Traveler-425 (TAC No. MF3720)

By correspondence dated March 25, 2014 (Accession No. ML14084A165), as supplemented by letter dated October 7, 2014 (Accession No. ML14281A125), FirstEnergy Nuclear Operating Company (FENOC) submitted a license amendment request for the Perry Nuclear Power Plant (PNPP). The proposed amendment would modify the PNPP Technical Specifications by relocating specific surveillance frequencies to a licensee controlled program with the implementation of Nuclear Energy Institute (NEI) 04-10, "Risk-Informed Technical Specifications Initiative 5b, Risk-Informed Method for Control of Surveillance Frequencies." The proposed amendment is consistent with Nuclear Regulatory Commission (NRC)-approved Technical Specification Task Force (TSTF) Traveler TSTF-425, Revision 3, "Relocate Surveillance Frequencies to Licensee Control – Risk Informed Technical Specification Task Force (RITSTF) Initiative 5b," with certain proposed deviations.

On June 26, 2015 via electronic correspondence (Accession No. ML15179A007), the NRC requested additional information to complete the staff's review. FENOC's response to this request is attached.

There are no regulatory commitments established in this submittal. If there are any questions or additional information is required, please contact Mr. Thomas A. Lentz, Manager – Fleet Licensing, at (330) 315-6810.

I declare under penalty of perjury that the foregoing is true and correct. Executed on August 27, 2015.

Sincerely,

Ernest J. Harkness

Attachment: Response to June 26, 2015 Request for Additional Information

cc: NRC Region III Administrator
NRC Resident Inspector
NRC Project Manager
Executive Director, Ohio Emergency Management Agency,
State of Ohio (NRC Liaison)
Utility Radiological Safety Board

By correspondence dated March 25, 2014, FirstEnergy Nuclear Operating Company (FENOC) submitted a license amendment request for the Perry Nuclear Power Plant (PNPP). The proposed amendment was supplemented by letter dated October 7, 2014, The proposed amendment would modify the PNPP Technical Specifications by relocating specific surveillance frequencies to a licensee controlled program with the implementation of Nuclear Energy Institute (NEI) 04-10, "Risk-Informed Technical Specifications Initiative 5b, Risk-Informed Method for Control of Surveillance Frequencies."

On June 26, 2015 via electronic correspondence, the Nuclear Regulatory Commission (NRC) staff requested additional information to complete their review. The request for additional information (RAI) is presented in bold type, followed by the FENOC response. The letter dated October 7, 2014 provided the response to RAI 1.

RAI 2

Capability Category II of the endorsed American Society of Mechanical Engineers (ASME)/American Nuclear Society (ANS) PRA standard (i.e., ASME/ANS RA-Sa-2009) is the target capability level for supporting requirements for the internal events probabilistic risk assessment (PRA) for this application. In the response to RAI 1, dated October 7, 2014, FirstEnergy Nuclear Operating Company (FENOC or the licensee) provided the list of Facts and Observations (F&Os) findings and suggestions from the 2008 Gap Analysis and the 2011 and 2012 focused-scope peer reviews for large early release frequency (LERF) analysis and internal flooding analysis, respectively. The licensee also stated: "The 1997 PSA [Probabilistic Safety Assessment] Peer Review Certification F&Os were not included as the follow-on reviews were a complete reevaluation to the PRA standard in effect and supersede this information. Therefore, the 1997 PSA Peer Review Certification F&Os are not considered relevant to the application." In the application dated March 25, 2014, the licensee provided a summary of the PNPP PRA history. This summary stated that a model update and Computer Aided Fault Tree Analysis System (CAFTA) model conversion were performed in 2011. (The PNPP PRA originally used the WinNUPRA code, as explained in the letter dated October 7, 2014.) The NRC staff notes that many PRA model conversions also result in "PRA upgrades."

Based on Section 1-5, "PRA Configuration Control," of ASME/ANS RA-Sa-2009, and RG 1.200, Revision 2, Regulatory Position 1.4, "PRA Development, Maintenance, and Upgrade," a PRA upgrade must be peer reviewed. The NRC staff reviewed the response to RAI 1, in the letter dated October 7, 2014, and notes that a number of revisions were made to the PNPP PRA in response to the 2008 Gap Analysis. The licensee appears to treat all model revisions as PRA updates (i.e., PRA maintenance) and not PRA upgrades, and therefore, the PRA model does not need a subsequent peer review. The ASME/ANS PRA Standard defines upgrades as, "incorporation into a PRA model of a new methodology or significant changes in scope or capability that impact the significant accident sequences or the significant accident progression sequences." Based on this definition, please address the following:

a) **For F&O IE-A4a, the Status/Gap suggested using EPRI [Electric Power Research Institute Technical Report] TR-1013490 as guidance for support system initiator fault trees. (The NRC staff notes that EPRI TR-1013490, "Support System Initiating Events: Identification and Quantification Guideline," published in 2006, appears to have been superseded by its Technical Update, EPRI TR-1016741, published in December 2008. EPRI TR-1016741 was also sponsored by the NRC Office of Nuclear Regulatory Research, and focuses on the treatment of common cause failures (CCFs) when modeling support system initiating events.) Although the disposition of the F&O states that the initiating event fault trees were updated to include CCF events for applicable components, it is unclear if the disposition resulted in a change in the capability of the PNPP PRA that impacted the significant accident sequences (similar to Example 5 in Nonmandatory Appendix 1-A of ASME/ANS RA-Sa-2009) and could constitute a PRA upgrade. Please expand on the discussion of how this gap was resolved (i.e., discuss the methodology used and describe the changes to the model) and why it is not considered an upgrade.**

b) **For F&O DA-D5, the Status/Gap states: "The Alpha Factor method is used to conduct the CCF analysis...." The Perry Resolution then states: "In the PRA model update, the Multiple Greek Letter method was used to perform the Common Cause analysis for the model...." The Multiple Greek Letter and Alpha Factor Method are similar, but given the other changes to CCF modeling, this could constitute a PRA upgrade. Please explain why this model change is not considered an upgrade.**

c) **For F&O HR-G7 the Status/Gap states: "Although some dependencies are identified during the identification and definition process, all possible HFE [human factors engineering] combinations and dependencies are not addressed." The Perry Resolution then states: "HRA [human reliability analysis] ... for post-initiators, including HEP [human error probability] dependencies, has been completely redone...." It is unclear if a different**

HRA approach to human error analysis and dependency analysis than what has previously been used has been applied. A new approach could also constitute a PRA upgrade. Please expand on the discussion for the resolution of this gap and why it is not considered an upgrade.

Response:

The 2008 Gap Assessment, performed to the ASME PRA Standard Addendum "b", endorsed by Regulatory Guide 1.200 (RG 1.200) Rev. 1, was considered by FENOC to be equivalent to an industry Peer Review. The reason for not formally declaring it a Peer Review at the time was due to the fact there were no utility peers on the review team. This gap assessment brought in a team of highly qualified outside contractors with the direction to lead and perform the review, document the results per the industry peer review guidance of NEI 05-04, "Process for Performing Internal Events PRA Peer Reviews Using the ASME/ANS PRA Standard" and to identify where the PRA model did not fully address the Supporting Requirements (SRs) in the ASME/ANS PRA Standard. This gap assessment also reevaluated the identified Findings and Observations (F&Os) from the previous 1997 peer review, as it was felt based on preliminary review that they had not been adequately addressed, and then expand upon those insights additional findings and observations as needed based on the current state of knowledge and methods. Furthermore, this assessment also determined the amount of effort that would be required to close the identified F&O's (gaps), achieve Capability Category (CC) II for SRs in the standard, and develop a gap closure project plan, schedule, and cost estimate. During the review it was determined that some areas were deficient such that it would be more cost-effective to completely re-perform the analysis. High level requirements and supporting requirements for Section 2-2.8, "LERF Analysis (LE)" and Section 3-2, "Internal Flood Analysis (IF)" of the ASME/ANS PRA Standard therefore were not reviewed in the 2008 gap assessment. Following close-out of the identified gaps in the Level 1 internal events portions of the model, new analysis then commenced for LE and IF. Some members of the gap assessment team were retained following the assessment to support FENOC staff in addressing the F&O's and review the changes to ensure the responses were adequate. FENOC did not consider the F&O's from the gap assessment closed at this point, since the reviewer was directly involved in the solution and therefore no longer independent. The new modeling and methodologies applied in LE and IF did constitute an upgrade and were the subject of focused scope peer reviews.

The original WinNUPRA model was a linked fault tree model at the time of the review, and the conversion of a WinNUPRA linked fault tree to a CAFTA linked fault tree is not considered an upgrade as both models employ the same general methodology (Example 11 of Appendix 1-A of the ASME/ANS PRA Standard). Before proceeding with F&O resolution, sensitivity studies were performed at the time of conversion and no significant changes in results were identified, as documented in analysis/assessment PRA-PY1-09-003. Following conversion,

cosmetic and structural improvements were made to address F&O's as directed in the recommendations. In many cases, to accomplish this it was found to be easier to re-create the fault trees in CAFTA rather than re-use the original WinNUPRA fault trees. For example, the WinNUPRA model often considered a single train to be running with the alternate in standby. The revised CAFTA fault trees included the probability that a given train was in standby vs. run. The new CAFTA fault trees and resulting cutsets and importance measures were then compared to the original fault trees and results to ensure no systems, structures, and components (SSCs) were omitted and that no logic errors were introduced. This was considered to be PRA maintenance as no fault tree logic was altered such that it significantly impacted the model results, except by the correction of noted errors. There were significant editorial changes made to the model as well, such as consistent use of basic event names via type code and type set capability in CAFTA, the use of the common cause module in CAFTA, and other cosmetic changes such as consistent modeling philosophy applied (for example, not collapsing OR Gates) so a PRA analyst could transition from one fault tree to the next and see the same general structure used. Therefore, it is FENOC's interpretation that none of these changes constituted a "new methodology or significant changes in scope or capability."

Similar to the fault trees, the event trees were also reviewed and restructured to ensure consistency in modeling philosophy, making it easier to understand and review. Some unique independent event trees were removed from the model and logically relocated or subsumed in the event trees following industry best practices, such as loss of feedwater and station blackout (SBO). The loss of feedwater initiator was re-mapped to use the general transient event tree, which has an identical operator response with the exception of the availability of feedwater, which was captured in the underlying fault trees. Station blackout is not an initiating event, but rather a possible condition following a loss of offsite power (LOOP). Thus it is now captured in the LOOP event tree, which includes in the underlying logic the potential that either or both divisional diesels would fail. This change removed the need for additional mutually exclusive logic to prevent failures to both diesels from appearing in the LOOP tree. The operator response is otherwise the same for both SBO and LOOP, with the exception of what systems may be available to mitigate the event, which is again captured in the underlying fault tree logic. Additionally, the anticipated transient without scram (ATWS) event trees were combined into a single event tree. After changes were made, sensitivity studies between the two models were performed to ensure the resultant insights and importance were understood. It was found that a Data Update, including updated initiating event frequencies (for example, Finding and Observation (F&O) DA-D1), had a more pronounced effect on the results than any other changes made. Therefore, it is FENOC's determination that none of these changes constituted a "new methodology or significant changes in scope or capability."

The PRA model documentation was comprehensively revised and updated following the 2008 gap assessment to address F&O's. The original documentation was found to be inconsistent in format and content and not sufficient to meet the PRA standard requirements. The implementation of new fleet processes for PRA model maintenance, update, and configuration control to address other F&O's caused the PRA documentation to be reclassified in the form of PRA notebooks, with new records retention requirements, naming conventions, and new notebook format requirements. The original WinNUPRA model documentation was reviewed to ensure no significant information was omitted in the new model notebooks. The changes were reviewed by a gap assessment team member to ensure the F&O's were addressed appropriately. Therefore, none of these changes constituted a "new methodology or significant changes in scope or capability."

Following receipt of the request for additional information (RAI) discussed here, a review of model changes made following the 2008 Gap Assessment has been performed and is provided as Table 1, with a disposition as to whether each identified change was regarded as a "PRA update" or a "PRA upgrade." One item was determined to be a PRA model upgrade: offsite power recovery modeling. This was judged to be a PRA Upgrade based on Example 13 of Appendix 1-A of the ASME/ANS PRA Standard due to a change in methodology from a point value estimation to the convolution method. This was considered to be adequately covered under the Section 2-2.8, "LERF Analysis" (LE) focused scope peer review. As a contributor to LOOP and SBO sequences, impacts from offsite power recovery would be important to the Level 2 model results and thus concerns or discrepancies in the application of the method would be identified during the peer review, via SRs LE-C8, which refers back to Section 2-2.2, "Accident Sequence Analysis (AS)," and through the results review under SRs LE-E4 and LE-F. However, upon further review of the LE peer review documentation, a review of offsite power recovery is not explicitly documented. Furthermore, some aspects of the offsite power recovery may not have been thoroughly reviewed during the LE peer review. Therefore, FENOC conducted a focused scope peer review of the SRs pertinent to offsite power recovery. These SRs include DA-A1, DA-C1, DA-C16, AS-B7, QU-A1, QU-A2, QU-A5, and QU-F2. This peer review was performed July 24 – July 31, 2015, and found that the methodology was traceable and applied in a consistent manner, yielding reasonable results. No findings on the application of the methodology were identified. Some suggestions/observations to improve model documentation were provided. The F&O's from the peer review are included in the RAI 2 response Attachment. The suggested documentation enhancements will be incorporated into the model documentation during the next model update, currently scheduled for 2018, as the enhancements have no impact on model quantification or implementation.

The methodology employed for the Internal Events analysis was also consistently applied for the Level 2, and Internal Flooding, PRA models, which were re-assessed under focused scope peer reviews. The Level 2 and Internal Flooding models are

linked to the underlying Level 1 model and are not stand-alone. Any issues in the underlying model would propagate into the Level 2 and Internal Flooding (IF) models and thus be identified during the focus scope peer reviews. Additionally, various SRs in the Section 2-2.8, "LERF Analysis (LE)" and Section 3-2, "Internal Flood Analysis (IF)" requirements point back to other SRs in the internal events portion of the ASME/ANS PRA Standard, including Section 2-2.2, "Accident Sequence Analysis (AS)," Section 2-2.6, "Data Analysis (DA)," Section 2-2.4, "Systems Analysis (SY)," and Section 2-2.7, "Quantification (QU)." If there were challenges in the underlying logic model they would have been identified through these SRs, therefore it is concluded that the above methodology changes were appropriately assessed during the focused scope peer reviews. To demonstrate this, examples in Table 2 identify those SRs from LE and IF that reference back to other SRs.

In conclusion, while a number of changes were made to the model during this update process, only one item was determined to be a PRA model upgrade: offsite power recovery modeling, and a focused scope peer review was pursued for this item. Other than the offsite power recovery modeling, these changes did not appreciably impact the model results (Section B, page 33 of the ASME/ANS PRA Standard) and therefore, it was not necessary to perform an additional peer review on these items per Appendix 1-A of the ASME/ANS PRA Standard.

In response to the specific items raised:

In general the Support System Initiating Event (SSIE) fault trees (FTs) should mirror the post-initiator fault trees, with the notable exception of the exposure time. However, the previous model SSIE FTs did not capture all failure modes, and only included common cause failures (CCF) in a limited way. The SSIE fault trees were revised to include all the failure modes modeled in the post-initiator fault trees, including comprehensive common cause failure modeling. Although F&O IE-A4a states that the "the initiating event fault trees do not contain common cause failure events," in reality, CCF terms were included in the fault trees in a limited manner, for example, the basic event IACMCC modeled the CCF of the four instrument and service air compressors. Also, as stated in F&O SY-B4, "Many CCF events are modeled as single events and not expanded to capture multiple failure combinations." This comment was applicable to both the support system fault trees and support system initiating event fault trees. Therefore, as part of the disposition of both the IE-A4a and SY-B4 F&Os, the system modeling was reviewed from a common cause perspective and CCF terms were added or removed per EPRI 1016741 and the superseded EPRI EPRI TR-1013490, "Support System Initiating Events: Identification and Quantification Guideline," as directed in the F&O recommendation. Example 25 of Appendix 1-A of the ASME/ANS PRA Standard states that adding additional CCF terms using existing methodology is considered PRA maintenance. Therefore it is FENOC's determination that this was simply a correction to ensure the methodology was applied consistently within the existing initiating event fault trees, and is therefore

not deemed an upgrade. Sensitivity studies were performed to demonstrate there were no appreciable changes and that data update rather than structural changes had the largest impacts to the results.

a) As noted in RAI 2b, the Alpha Factor method and Multiple Greek Letter method are viewed to be similar and this was considered part of the data update and thus PRA maintenance. The two parameter estimations for deriving common cause factors are similar enough that this would not constitute a PRA upgrade, based on the fact that the Alpha Factor and Multiple Greek Letter methods are directly related through simple mathematical equations as described in Appendix A of NUREG/CR-5485, "Guidelines on Modeling Common-Cause Failures in Probabilistic Risk Assessment," (Equation A-25 and Table A-2). The methodology used to apply either parameter estimation in a PRA model is the same. Other changes in CCF were implemented due to other modeling requirements as discussed previously. Common Cause modeling improvements were done to enhance the model flexibility and match current industry practices but did not change the results appreciably. Therefore this did not constitute a "new methodology or significant changes in scope or capability that impacted significant accident sequences or accident progression sequences." Sensitivity studies were performed to demonstrate there were no appreciable changes and that data updates rather than structural changes had the largest impacts to the results.

b) Human Reliability Analysis (HRA) was fully updated (completely redone) using the same methodology as previously utilized (EPRI HRA Calculator) and modeled in the PRA. The purpose of updating the HRA analysis was to ensure consistency between Human Error Probabilities (HEPs) and to subsequently enhance the documentation. Therefore, the update to the HRA analysis is considered a data update. New HEPs were added as necessary to add further resolution and detail to the model (PRA maintenance per Example 20 of Appendix 1-A of the ASME/ANS PRA Standard). However, the process and methodology of identifying and assessing HEPs using the HRA Calculator software did not change. Improvements were also made to the individual HEPs to better track timing for the purposes of dependency analysis, this was to ensure the software would correctly identify the sequence of HEPs during the dependency analysis.

The HRA dependency analysis was updated in an effort to capture as many dependencies as possible. This involved taking advantage of new software capabilities in the HRA Calculator to more robustly apply the existing dependency methodology. This was in direct response to F&O HR-G7 indicating that while some treatment of dependency analysis was performed, a more thorough and detailed approach was necessary. Therefore this update was performed in direct response to an F&O. The methodology

employed for the HRA analysis, including the dependency analysis, was also consistently applied for the Level 2 and Internal Flooding models. While this was a PRA update, it had the potential to have a more significant impact on the model results and was subsequently reviewed. For example, during the Level 2 peer review, a Finding was received (LE-C7-01) for not fully considering the dependencies between Level 1 and Level 2 events. However, no methodology issues were noted. As another example, the peer review team stated for IFQU-A5: "the dependency analyses for both Level 1 and LERF analyses are performed using the same methodologies as in the internal events models." Table 2 gives further examples and identifies those SRs from LE and IF that require the reviewer to go back to previous sections of the ASME/ANS Standard, including the SRs from HR. No issues with the human reliability analysis were noted in the Internal Flooding Peer Review, including the additional HEPs added to address failures to isolate flood sources and the methodology itself was found to be acceptable. Therefore the enhancements that were made to the dependency analysis were reviewed under the two focused scope peer reviews in sufficient detail to verify that it was performed correctly.

Table 1: Disposition of Model Changes				
SR	**Item**	**Description of Change**	**Update or Upgrade?**	**Justification**
AS-A3	Crediting Injection System	Some Event Trees were revised to take credit for an alternate means of high pressure injection: Standby Liquid Control (SLC) and Control Rod Drive (CRD) injection. This revision was prompted by Operator Interviews which revealed that in the event Feedwater (FDW), Reactor Core Isolation Cooling (RCIC), and High Pressure Core Spray (HPCS) were unavailable, operations would attempt to maintain level with CRD and SLC injection before depressurizing the vessel and utilizing low pressure injection sources.	Update	The overall process, including event tree modeling, fault tree modeling, and success criteria analysis, remains unchanged, and no new methodologies were introduced. Example 10 of Appendix 1-A of the ASME/ANS PRA Standard identifies such a change as an update. This change was prompted when addressing F&O HR-E3 and to meet SRs SC-A6 and HR-E3 to interview operations and training personnel to confirm the success criteria modeled is consistent with plant operations and operating philosophy.
AS-10	Event Trees	The Station Blackout Event Tree was subsumed into the Loss of Offsite Power Event Tree. The Loss of Feedwater and Inadvertent Stuck Open Relief Valve were subsumed with the General Transient Event Tree. The Anticipated Transient Without Scram (ATWS) Event Trees were combined into a single Event Tree.	Update	The methodology for developing the Event Trees was unchanged. Event Trees were combined to avoid unnecessary duplication of logic. Example 13 of Appendix 1-A describes a scenario in which the Station Blackout modeling is revised and the Loss of Offsite Power Event Tree is incorporated into the Transient Event Tree, and considers this change to be an upgrade. However, incorporating the Station Blackout Event Tree into the Loss of Offsite Power Event Tree is straightforward as they share similar operator response, mitigating systems, and success criteria. Station Blackout is a subset of the Loss of Offsite Power Condition. Operators would be working from the same flowcharts and procedures for a Loss of

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				Offsite Power or Station Blackout, but would be in a different set of flow charts and procedures in a general transient. Incorporating the Station Blackout and Loss of Offsite Power Event Trees into the Transient Event Tree would involve much more complex changes to the model logic. Incorporating the Station Blackout Event Tree into the Loss of Offsite Power Event Tree is a minor change and thus constitutes a PRA update rather than a PRA upgrade.
AS-B7	Offsite power recovery	WinNUPRA used Fault Trees with point estimate basic events to model the recovery of offsite power. Due to issues importing this tree and the corresponding House Events into CAFTA model, Offsite power recovery was changed to the Convolution Method implemented by Recovery Rules.	Upgrade	This was judged to be a PRA Upgrade based on Example 13 of Appendix 1-A of the ASME/ANS PRA Standard due to change in methodology from point value estimation to the convolution method. This item is discussed in detail in the response to RAI 2.
DA-D5	Common Cause	Revision from Alpha Factor method to Multiple Greek Letter (MGL) method.	Update	The two parameter estimations for deriving common cause factors are directly related through simple mathematical equations as described in NUREG/CR-5485 Appendix A (Equation A-25 and Table A-2). Therefore, this revision would not constitute a PRA upgrade. The process methodology used to apply either numerical data set in a PRA model is the same under industry consensus common cause modeling practices.

Table 1: Disposition of Model Changes				
SR	**Item**	**Description of Change**	**Update or Upgrade?**	**Justification**
HR-D5, HR-G7, QU-C2	HRA Dependency	Re-performed HRA dependency analysis with an effort to capture the possible HEP combinations	Update, but significant enough to impact results. Methodology reviewed as part of LE and IF peer reviews.	Some dependency analysis was present in the WinNUPRA model. The Gap Assessment produced an F&O to extend the scope of HRA Dependency Analysis to capture the possible combinations. This update was in response to the F&O and followed the recommendation exactly. However, the dependency analysis can have a significant impact to the model results. As such, it was reviewed during the LE and IF focused scope peer reviews. It is FENOC's interpretation that these peer reviews reviewed the update in sufficient detail to verify it was performed correctly.
IE-A1, IE-C1, IE-C8	Addition of new IEs	During the model update process new initiating events were identified and added to the model. For many of these initiating events, new fault tree logic was developed to calculate the IE frequency. New initiating events included a loss of nuclear closed cooling (NCC) and a loss of numerous alternating current (AC) or direct current (DC) buses.	Update	The methodology used for both developing IE point estimates and developing support system initiating event fault trees was previously used in the model. No new methodologies were introduced by this update. This was also performed to make the model more in-line with industry best practices. New initiating events were identified through the resolution of F&Os such as IE-A1 directing the performance of a failure modes and effects analysis, and IE-B1 and IE-C6 to re-consider improperly grouped events such as a loss of NCC or a loss of bus events. Example 1 of Appendix A-1 supports the view that this is an update.

Table 1: Disposition of Model Changes				
SR	**Item**	**Description of Change**	**Update or Upgrade?**	**Justification**
IE-C1, IE-C8	Developed Fault Trees for Support System Initiating Events	The loss of feedwater support system initiating event was modeled using a developed fault tree for the WinNUPRA model. This was changed to a point estimate for the CAFTA model, based on a recommendation from industry peers that a developed fault tree for a loss of feedwater tends to over-estimate the actual frequency.	Update	Numerous other initiating events utilized the point estimate method, and thus no new methodology was introduced by the change. This change was also identified during benchmarking and comparison with other plant IE frequencies and results, as required by the ASME/ANS PRA Standard. It was desirable to be more in line with current industry practices.
QU-B8	Mutually Exclusive Logic	WinNUPRA quantified specific fault trees (DAM) to obtain cutset files containing the mutually exclusive logic. CAFTA utilizes NOT logic to apply the mutually exclusive logic contained in the DAM fault trees.	Update	Overall process of developing fault trees to model the mutually exclusive logic remained the same.

Table 2: SRs from the Focused Scope Peer Review that Refer Back to Other SRs in Detail				
SR	**Referenced SRs**	**Description of Referenced SR(s)**	**Focus Scope Peer Review Results**	**PY notes**
LE-C6	2-2.4	SRs in SY	Met CC I/II/III with Suggestion (LE-C6-01) System models affecting the accident progression (such as hydrogen igniters and containment sprays) are developed in the system notebooks consistent with the applicable requirements of the ASME Standard section 2-2.4.	The methodology for modeling systems only credited in Level 2, such as Hydrogen Igniters and Containment Isolation, is identical to that for the Level 1 system modeling. Systems significant in Level 2 modeling, such as Residual Heat Removal (RHR), in the Containment Spray mode, were reviewed as part of the focused scope peer review. The F&O's were addressed as recommended.
LE-C7	2-2.5	SRs in HR	Not Met with Finding (LE-C7-01) The LE analysis credits operator actions that are contained with the procedural guidance, including the Emergency Procedure Guidelines (EPGs). The actions developed for the Perry Level 2 were evaluated using the HRA calculator, with the information presented in Appendix E of the L2 notebook. The analyses included an appropriate level of detail in terms of examining procedural guidance, training and time windows. However, the HEP dependency analysis only considered dependencies between the Level 2 HEPs and not between level 1 and Level 2 events. The justification for this is not documented in the analysis, but the PRA staff	The methodology for developing Level 1-specific HEPs was identical to that used for developing the Level 2-specific HEPs. Furthermore, the methodology for performing the Dependency Analysis was also the same. However, a Finding was received as the Level 2 dependency did not account for Level 1 to Level 2 dependencies. The F&O's

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			indicated that since the Level 2 actions are initiated by EPGs by emergency response personnel, there should not be a cognitive dependency. If true, then there is still the potential for dependency between the events if they would occur in a similar time window as the Level 1 HEP(s), if there are not adequate resources, or if there is a common manipulation error. The combinations of significant Level 1 and Level 2 HEPs should be examined for such dependency.	were addressed as recommended.

Table 2: SRs from the Focused Scope Peer Review that Refer Back to Other SRs in Detail				
SR	**Referenced SRs**	**Description of Referenced SR(s)**	**Focus Scope Peer Review Results**	**PY notes**
LE-C8	2-2.2	SRs in AS	Met CC I/II/III with Suggestion (LE-C8-01) Inter-system dependencies are captured throughout the accident sequence because of the linked Level 1/Level 2 approach developed in the CAFTA model. Functional dependencies, such as failure to depressurize after core damage, given early success or failure are generally accounted for by use of the same basic events pre and post core damage. However, the approach of having a small number of Plant Damage States (PDSs) and questioning system logic in the Containment Event Trees (CETs) has the potential to lose some functional information about the core damage sequence and must be performed carefully. For example, the Level 2 CET event that questions injection uses gate LATEINJ that is low pressure Emergency Core Cooling System (ECCS) (level 1 logic) and Level 2 HEP CPHISAG1-INJLATE. For Level 1 sequences with successful injection, this should not be considered a failure. It is acceptable to have the conservative modeling if it is documented and noted to be insignificant, but this was not noted in the L2 notebook.	The methodology for modeling accident sequence dependencies is identical from the Level 1 model to the Level 2 model and the F&O's were addressed as recommended.
LE-E1	2-2.5	SRs in HR	Met CC I/II/III Equipment survivability is addressed in Appendix F. HRA probabilities are calculated consistent with that for Level 1 with consideration for conditions present. The fault tree models developed for the Level 2 analysis utilize the same data and HRA methods as are used in the Level 1 system models, in accordance with the DA and HR assessments.	Methodologies used to determine parameter estimates for equipment and operator actions was identical for the Level 1 and Level 2 models.
	2-2.6	SRs in DA		

Table 2: SRs from the Focused Scope Peer Review that Refer Back to Other SRs in Detail				
SR	**Referenced SRs**	**Description of Referenced SR(s)**	**Focus Scope Peer Review Results**	**PY notes**
LE-E4	2-2.7-2(a)	QU-A	Met CC I/II/III with 1 Finding (LE-C7-01) and 1 Suggestion (LE-E4-01) The LERF quantification process uses the same process as the CDF quantification process, meeting the QU requirements. The only requirement from Tables 2-2.7-4(a), (b) and (c) that is not met is QU-C2 (assessing the degree of dependency between HFEs) for the Level 1/Level 2 HEP combinations. The HFE dependency issue refers back to F&O LE-C7-01. In addition, the documentation for QU-B3 (establishing acceptable truncation limits) should be clarified. Otherwise, this SR is met.	Between LE-E4 and LE-F3, QU SRs except F (Documentation) are covered. The methodology to quantify the model, including determining importance rankings, performing truncation analysis, and uncertainty analysis, is the same for the Level 1 and Level 2 models. The F&O's were addressed as recommended.
	2-2.7-2(b)	Should be 2-2.7.3(b) - QU-B		
	2-2.7-2(c)	Should be 2-2.7.4(c) - QU-C		
LE-F3	2-2.7-2(d)	Should be 2-2.7.5(d) - QU-D	Met CC I/II/III with Suggestion (LE-F3-01) Of the items listed in Table 2-2.7-2(d) and (e) of the Standard, the following are noted for LE: Reviews of the results were performed in Sections 3.3.1 and 3.3.2. A comparison of the results to Clinton was presented in Section 3.6.4. Significant contributors to LERF are identified in Section 3.3.3. Sources of modeling uncertainty and generic modeling uncertainty are considered in Table H-49, although the disposition of the treatment of ex-vessel cooling and	Between LE-E4 and LE-F3, QU SRs except F (Documentation) are covered. The methodology to quantify the model, including determining importance rankings, performing truncation analysis, and uncertainty analysis, is the same for the

Table 2: SRs from the Focused Scope Peer Review that Refer Back to Other SRs in Detail				
SR	**Referenced SRs**	**Description of Referenced SR(s)**	**Focus Scope Peer Review Results**	**PY notes**
	2-2.7-2(e)	Should be 2-2.7.6(e) - QU-E	hydrogen combustion are not clear as to why they are not a source of uncertainty at Perry. Table H-50 presents a list of plant-specific assumptions that could affect LERF. Section 4.3 compiles the list of modeling uncertainties that could have a noticeable impact on LERF. QU-E4 calls for identifying how the PRA model is affected which has been qualitatively addressed (see also HLR-QU-E which states the potential impact of the modeling uncertainties and assumptions can have on the LERF results is to be understood. This SR is considered to be met because the bulk of the uncertainty characterization has been performed, but a suggestion F&O is presented to further evaluate the impact of these on the LERF results quantitatively. The following are also noted: In Table H-49, #20 is missing information. #21 discusses MCCI but not debris contact with containment.	Level 1 and Level 2 models. The F&O's were addressed as recommended.
IFEV-A3	2-2.1	SRs in IE; grouping and subsuming of IEs	Met CC I/II with Finding (1-7) Basis: Based on a review of the information presented in Appendices E and G, it does not appear that any initiating event scenarios have been improperly grouped with existing internal event groups. Therefore, this SR is considered met.	The methodology for grouping and subsuming Internal Flooding events was similar to that for Internal Events. The F&O's were addressed as recommended.

Table 2: SRs from the Focused Scope Peer Review that Refer Back to Other SRs in Detail				
SR	**Referenced SRs**	**Description of Referenced SR(s)**	**Focus Scope Peer Review Results**	**PY notes**
IFQU-A1	2-2.2	SRs in AS	Met CC I/II/III with Suggestion 2-5 Basis: In most cases, internal flooding accident sequences were modeled using the general transient event tree. Flooding events involving service water pipe breaks were modeled using the loss of service water initiating event. This treatment was determined to be the most conservative treatment of internal flooding accident sequences. While the association of accident sequence appears to be appropriate, the basis for the association is documented sparsely in Section 8.1.4.	Internal Flooding utilized a few of the Internal Events Event Trees, namely General Transient (T3A), Loss of Condenser (T2), Loss of Instrument Air (TIA), and Loss of Service Water or NCC (TSW). As the Internal Flooding analysis including consequential events such as ATWS and LOOP, those Event Trees were also utilized for the Internal Flooding analysis. The methodology used to develop these Event Trees was the same as that for the remaining Event Trees (primarily LOCAs) from the Internal Events analysis. The F&O's were addressed as recommended.

Table 2: SRs from the Focused Scope Peer Review that Refer Back to Other SRs in Detail				
SR	**Referenced SRs**	**Description of Referenced SR(s)**	**Focus Scope Peer Review Results**	**PY notes**
IFQU-A5	2-2.5	SRs in HR	Met CC I/II/III Basis: The probability value for each new human failure event (HFE) defined for the internal flooding scenarios is calculated using the same methodology as in the internal events PRA. The values and analyses reviewed appear reasonable based on the documentation in Appendix K. Similarly, the dependency analyses for both level 1 and LERF analyses are performed using the same methodologies as in the internal events models. Therefore, this SR is considered met.	The methodology to develop the new HEPs is the same as that used for the Internal Events. Similarly, the methodology to perform the dependency analysis was the same as that used for the Internal Events.

RAI 3

In the application dated March 25, 2014, as supplemented by letter dated October 7, 2014, FENOC indicated that portions of the PNPP internal events PRA model have been assessed against ASME RA-Sb-2005, "Addenda to ASME RA-S-2002 Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications," with the clarifications and qualifications in Regulatory Guide (RG) 1.200, Revision 1 (ADAMS Accession No. ML070240001). According to NRC Regulatory Issue Summary 2007-06, "Regulatory Guide 1.200 Implementation" (ADAMS Accession No. ML070650428), the NRC staff expects licensees to fully address all scope elements with Revision 2 of RG 1.200 (ADAMS Accession No. ML090410014) by the end of its implementation period (i.e., one year after the issuance of Revision 2). Regulatory Guide 1.200, Revision 2, endorses, with clarifications and qualifications, the use of the combined ASME/ANS PRA Standard, ASME/ANS RA-Sa-2009, "Addenda to ASME/ANS RA-S-2008 Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications."

Identify and address any gaps between the PNPP PRA model and ASME/ANS RA-Sa-2009, including the clarifications and qualifications in RG 1.200, Revision 2, that are relevant to this application, or explain why addressing the gaps would have no impact on this application. (Portions of the PRA model that have been peer reviewed to ASME/ANS RA-Sa-2009 and RG 1.200, Revision 2, would not require a gap assessment.)

Response:

The following table (Table 3), presents the Gap Assessment between the ASME/ANS RA-Sa-2009, "Addenda to ASME/ANS RA-S-2008 Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," from the previous assessment performed to the ASME/ANS RA-Sb-2005, "Addenda to ASME RA-S-2002 Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications." The table provides a comparison between the portions of ASME/ANS RA-Sb-2005 that Perry is assessed against to the related portion in ASME/ANS RA-Sa-2009. The comparison between ASME/ANS RA-Sb-2005 and ASME/ANS RA-Sa-2009 resulted in only minor changes made to the internal events portion of the standard. No gaps were identified between ASME/ANS RA-Sb-2005 and ASME/ANS RA-Sa-2009. The Focused Scope Peer Reviews on Internal Flood (IF) and Large Early Release Frequency (LE) were peer reviewed to ASME/ANS RA-Sa-2009; therefore a comparison is not provided in Table 3.

Table 3 Keywords	
Keyword in "Change From 05 to 09" Column	**Description of Keyword**
Exact	No change, not even to wording
Same	Same intent with slightly different wording (for example. Writing out acronyms, rearranging a sentence, and others)
Change	Small change
Different	Big change
N/A	SR deleted
New	New to standard

Table 3 : Gap Assessment from ASME/ANS RA-Sb-2005 to ASME/ANS RA-Sa-2009				
ASME/ANS RA-Sb-2005 (Reg Guide 1.200 Rev 1)	**ASME/ANS RA-Sa-2009 (Reg Guide 1.200 Rev 2)**	**Change from 05 to 09**	**Description of Change**	**PY Comments**
Section 2 (internal events)				
HLR-IE-A	HLR-IE-A	exact		
HLR-IE-B	HLR-IE-B	exact		
HLR-IE-C	HLR-IE-C	exact		
HLR-IE-D	HLR-IE-D	same	wording	Change in the order of the wording, no change to intent
IE-A1	IE-A1	exact		
IE-A2	IE-A2	change	removes internal flooding initiators	Meet CC I/II/III Internal Flooding assessed in IF
IE-A3	IE-A3	exact		

Table 3 : Gap Assessment from ASME/ANS RA-Sb-2005 to ASME/ANS RA-Sa-2009				
ASME/ANS RA-Sb-2005 (Reg Guide 1.200 Rev 1)	**ASME/ANS RA-Sa-2009 (Reg Guide 1.200 Rev 2)**	**Change from 05 to 09**	**Description of Change**	**PY Comments**
IE-A3a	IE-A4	exact		
IE-A4	IE-A5	exact		
IE-A4a	IE-A6	exact		
IE-A5	IE-A7	exact		
IE-A6	IE-A8	exact		
IE-A7	IE-A9	exact		
IE-A8-deleted	n/a	n/a		SR deleted in ASME/ANS RA-Sb-2005
IE-A9-deleted	n/a	n/a		SR deleted in ASME/ANS RA-Sb-2005
IE-A10	IE-A10	exact		
IE-B1	IE-B1	same	changed reference from Paragraph 4.5.2 to 2-2.2 and from 4.5.8 to 2-2.7	text of the referenced Sections is essentially the same
IE-B2	IE-B2	exact		
IE-B3	IE-B3	same	Capability Category 2 wording change from "AVOID subsuming event into a group unless ..." to "DO NOT SUBSUME scenarios into a group unless..."	Intent of CC II unchanged. Initiating events are not subsumed unless the impacts are comparable or less than those of the remaining events in that group
IE-B4	IE-B4	exact		

Table 3 : Gap Assessment from ASME/ANS RA-Sb-2005 to ASME/ANS RA-Sa-2009				
ASME/ANS RA-Sb-2005 (Reg Guide 1.200 Rev 1)	**ASME/ANS RA-Sa-2009 (Reg Guide 1.200 Rev 2)**	**Change from 05 to 09**	**Description of Change**	**PY Comments**
IE-B5	IE-B5	exact		
IE-C1	IE-C1	exact		
IE-C1a	IE-C2	exact		
IE-C1b	IE-C3	same	reference to other supporting requirements changed in numbers	text of the referenced SRs is essentially the same
IE-C2	IE-C4	same	Note 2 changed to Reference 2-2	No change to intent of SR, prior distribution data obtained from NRC 2010 Parameter Estimation Update
IE-C3	IE-C5	exact		
IE-C4	IE-C6	same	reference to Paragraphs 4.5.6 changed to Section 2-2.7, reference to Paragraph 4.5.8 changed to Section 2-2.7	text of the referenced Sections is essentially the same
IE-C5	IE-C7	same	added an acceptable method (NUREG/CR-6928)	no change to intent of SR

Table 3 : Gap Assessment from ASME/ANS RA-Sb-2005 to ASME/ANS RA-Sa-2009				
ASME/ANS RA-Sb-2005 (Reg Guide 1.200 Rev 1)	**ASME/ANS RA-Sa-2009 (Reg Guide 1.200 Rev 2)**	**Change from 05 to 09**	**Description of Change**	**PY Comments**
IE-C6	IE-C8	same	changed reference from Paragraph 4.5.4 to Section 2-2.4, and Paragraph 4.5.6 to Section 2-2.6	text of the referenced Sections is essentially the same
IE-C7	IE-C9	same	changed reference from Paragraph 4.5.4 to Section 2-2.4	text of the referenced Sections is essentially the same
IE-C8	IE-C10	exact		
IE-C9	IE-C11	same	changed reference from Paragraph 4.5.5 to Section 2-2.5	text of the referenced Sections is essentially the same
IE-C10	IE-C12	exact		

Table 3 : Gap Assessment from ASME/ANS RA-Sb-2005 to ASME/ANS RA-Sa-2009				
ASME/ANS RA-Sb-2005 (Reg Guide 1.200 Rev 1)	**ASME/ANS RA-Sa-2009 (Reg Guide 1.200 Rev 2)**	**Change from 05 to 09**	**Description of Change**	**PY Comments**
IE-C11	IE-C13	same	changed "Use generic data and INCLUDE plant-specific functions" to "Use generic data and INCLUDE plant-specific features to decide which generic data are most applicable"	IE frequencies, including LOCA frequencies, based on generic-BWR numbers from NRC Parameter Estimate 2010. Interfacing Systems LOCA and Break Outside Containment LOCAs were calculated based on plant-specific information. IE frequencies were compared with other BWR/6's to verify reasonableness.
IE-C12	IE-C14	exact		
IE-C13	IE-C15	exact		
IE-D1	IE-D1	exact		
IE-D2	IE-D2	exact		
IE-D3	IE-D3	same	added reference to QU-E1 & QU-E2	Added reference to SRs on uncertainty and assumptions, no change to intent
HLR-AS-A	HLR-AS-A	exact		
HLR-AS-B	HLR-AS-B	exact		
HLR-AS-C	HLR-AS-C	same	wording	Change in the order of the wording, no change to intent
AS-A1	AS-A1	exact		
AS-A2	AS-A2	exact		

Table 3 : Gap Assessment from ASME/ANS RA-Sb-2005 to ASME/ANS RA-Sa-2009				
ASME/ANS RA-Sb-2005 (Reg Guide 1.200 Rev 1)	**ASME/ANS RA-Sa-2009 (Reg Guide 1.200 Rev 2)**	**Change from 05 to 09**	**Description of Change**	**PY Comments**
AS-A3	AS-A3	same	reference to another SR changed from SC-A4 to SC-A3 (this is the same SR)	text of the referenced SR is essentially the same
AS-A4	AS-A4	same	reference to another SR changed from SC-A4 to SC-A3 (this is the same SR)	text of the referenced SR is essentially the same
AS-A5	AS-A5	exact		
AS-A6	AS-A6	exact		
AS-A7	AS-A7	exact		
AS-A8	AS-A8	exact		
AS-A9	AS-A9	exact		
AS-A10	AS-A10	exact		
AS-A11	AS-A11	exact		
AS-B1	AS-B1	exact		
AS-B2	AS-B2	exact		
AS-B3	AS-B3	exact		
AS-B4	AS-B4	exact		
AS-B5	AS-B5	exact		
AS-B5a	AS-B6	exact		
AS-B6	AS-B7	exact		

Table 3 : Gap Assessment from ASME/ANS RA-Sb-2005 to ASME/ANS RA-Sa-2009				
ASME/ANS RA-Sb-2005 (Reg Guide 1.200 Rev 1)	**ASME/ANS RA-Sa-2009 (Reg Guide 1.200 Rev 2)**	**Change from 05 to 09**	**Description of Change**	**PY Comments**
AS-C1	AS-C1	exact		
AS-C2	AS-C2	exact		
AS-C3	AS-C3	same	added reference to QU-E1 & QU-E2	Added reference to SRs on uncertainty and assumptions, no change to intent
HLR-SC-A	HLR-SC-A	exact		
HLR-SC-B	HLR-SC-B	exact		
HLR-SC-C	HLR-SC-C	same	wording	Change in the order of the wording, no change to intent
SC-A1	SC-A1	exact		
SC-A2	SC-A2	exact		
SC-A3-deleted				SR deleted in ASME/ANS RA-Sb-2005
SC-A4	SC-A3	exact		
SC-A4a	SC-A4	exact		
SC-A5	SC-A5	exact		
SC-A6	SC-A6	exact		
SC-B1	SC-B1	exact		
SC-B2	SC-B2	exact		
SC-B3	SC-B3	exact		
SC-B4	SC-B4	exact		
SC-B5	SC-B5	exact		
SC-C1	SC-C1	exact		
SC-C2	SC-C2	exact		

Table 3 : Gap Assessment from ASME/ANS RA-Sb-2005 to ASME/ANS RA-Sa-2009				
ASME/ANS RA-Sb-2005 (Reg Guide 1.200 Rev 1)	**ASME/ANS RA-Sa-2009 (Reg Guide 1.200 Rev 2)**	**Change from 05 to 09**	**Description of Change**	**PY Comments**
SC-C3	SC-C3	same	added reference to QU-E1 & QU-E2	Added reference to SRs on uncertainty and assumptions, no change to intent
HLR-SY-A	HLR-SY-A	exact		
HLR-SY-B	HLR-SY-B	exact		
HLR-SY-C	HLR-SY-C	same	wording	Change in the order of the wording, no change to intent
SY-A1	SY-A1	exact		
SY-A2	SY-A2	exact		
SY-A3	SY-A3	exact		
SY-A4	SY-A4	same	added knowledgeable (before plant personnel)	This SR requires interviews with knowledgeable plant personnel. Interviews were performed with the responsible System Engineer for each system.
SY-A5	SY-A5	exact		
SY-A6	SY-A6	exact		
SY-A7	SY-A7	exact		
SY-A8	SY-A8	exact		
SY-A9-deleted				SR deleted in ASME/ANS RA-Sb-2005
SY-A10	SY-A9	exact		
SY-A11	SY-A10	exact		
SY-A12	SY-A11	same	reference to another supporting requirement	text of the referenced SR is the same

Table 3 : Gap Assessment from ASME/ANS RA-Sb-2005 to ASME/ANS RA-Sa-2009				
ASME/ANS RA-Sb-2005 (Reg Guide 1.200 Rev 1)	**ASME/ANS RA-Sa-2009 (Reg Guide 1.200 Rev 2)**	**Change from 05 to 09**	**Description of Change**	**PY Comments**
			changed SY-A14 changed to SY-A15	
SY-A12a	SY-A12	exact		
SY-A12b	SY-A13	exact		
SY-A13	SY-A14	same	reference to another supporting requirement changed SY-A12 changed to SY-A11	text of the referenced SR is the same
SY-A14	SY-A15	same	Made supporting requirement applicable to all three categories	No change from previously incorporated corrections.
SY-A15	SY-A16	same	references paragraph 4.5.5 changed to 2-2.5	references overall HR Section
SY-A16	SY-A17	same	references paragraph 4.5.2 changed to 2-2.2	references overall HR Section
SY-A17	SY-A18	same	SY-A20 changed to SY-A22	text of the referenced SR is the same
SY-A18	SY-A19	same	wording	no affect

Table 3 : Gap Assessment from ASME/ANS RA-Sb-2005 to ASME/ANS RA-Sa-2009				
ASME/ANS RA-Sb-2005 (Reg Guide 1.200 Rev 1)	**ASME/ANS RA-Sa-2009 (Reg Guide 1.200 Rev 2)**	**Change from 05 to 09**	**Description of Change**	**PY Comments**
SY-A18a	SY-A20	same	DA-C13 changed to DA-C14	text of the referenced SR is the same
SY-A19	SY-A21	exact		
SY-A20	SY-A22	exact		
SY-A21	SY-A23	exact		
SY-A22	SY-A24	same	DA-C14 changed to DA-C15	text of the referenced SR is the same
SY-B1	SY-B1	same	note (1) changed to reference [2-4]	Referenced NUREG is the same
SY-B2	SY-B2	exact		
SY-B3	SY-B3	exact		
SY-B4	SY-B4	exact		
SY-B5	SY-B5	exact		
SY-B6	SY-B6	exact		
SY-B7	SY-B7	exact		
SY-B8	SY-B8	exact		
SY-B9-deleted				SR deleted in ASME/ANS RA-Sb-2005
SY-B10	SY-B9	exact		
SY-B11	SY-B10	exact		
SY-B12	SY-B11	exact		
SY-B13	SY-B12	exact		
SY-B14	SY-B13	exact		
SY-B15	SY-B14	exact		
SY-B16	SY-B15	exact		

Table 3 : Gap Assessment from ASME/ANS RA-Sb-2005 to ASME/ANS RA-Sa-2009				
ASME/ANS RA-Sb-2005 (Reg Guide 1.200 Rev 1)	**ASME/ANS RA-Sa-2009 (Reg Guide 1.200 Rev 2)**	**Change from 05 to 09**	**Description of Change**	**PY Comments**
SY-C1	SY-C1	exact		
SY-C2	SY-C2	exact		
SY-C3	SY-C3	same	wording, added reference to QU-E1 and QU-E2	Added reference to SRs on uncertainty and assumptions, no change to intent
HLR-HR-A	HLR-HR-A	exact		
HLR-HR-B	HLR-HR-B	exact		
HLR-HR-C	HLR-HR-C	exact		
HLR-HR-D	HLR-HR-D	exact		
HLR-HR-E	HLR-HR-E	exact		
HLR-HR-F	HLR-HR-F	exact		
HLR-HR-G	HLR-HR-G	exact		
HLR-HR-H	HLR-HR-H	exact		
HLR-HR-I	HLR-HR-I	same	wording	Change in the order of the wording, no change to intent
HR-A1	HR-A1	exact		
HR-A2	HR-A2	exact		
HR-A3	HR-A3	exact		
HR-B1	HR-B1	exact		
HR-B2	HR-B2	exact		
HR-C1	HR-C1	exact		
HR-C2	HR-C2	exact		
HR-C3	HR-C3	exact		

Table 3 : Gap Assessment from ASME/ANS RA-Sb-2005 to ASME/ANS RA-Sa-2009				
ASME/ANS RA-Sb-2005 (Reg Guide 1.200 Rev 1)	**ASME/ANS RA-Sa-2009 (Reg Guide 1.200 Rev 2)**	**Change from 05 to 09**	**Description of Change**	**PY Comments**
HR-D1	HR-D1	same	note 1 and note 2 changed to references 2-5 and 2-6	Referenced NUREGs are the same
HR-D2	HR-D2	exact		
HR-D3	HR-D3	exact		
HR-D4	HR-D4	exact		
HR-D5	HR-D5	exact		
HR-D6	HR-D6	exact		
HR-D7	HR-D7	exact		
HR-E1	HR-E1	exact		
HR-E2	HR-E2	exact		
HR-E3	HR-E3	exact		
HR-E4	HR-E4	exact		
HR-F1	HR-F1	exact		
HR-F2	HR-F2	exact		
HR-G1	HR-G1	exact		
HR-G2	HR-G2	exact		
HR-G3	HR-G3	exact		
HR-G4	HR-G4	exact		
HR-G5	HR-G5	exact		
HR-G6	HR-G6	exact		
HR-G7	HR-G7	exact		
HR-G8-deleted				SR deleted in from ASME/ANS RA-Sb-2005

Table 3 : Gap Assessment from ASME/ANS RA-Sb-2005 to ASME/ANS RA-Sa-2009				
ASME/ANS RA-Sb-2005 (Reg Guide 1.200 Rev 1)	**ASME/ANS RA-Sa-2009 (Reg Guide 1.200 Rev 2)**	**Change from 05 to 09**	**Description of Change**	**PY Comments**
HR-G9	HR-G8	exact		
HR-H1	HR-H1	exact		
HR-H2	HR-H2	same	wording, added "if the following occur"	The intent and the criteria in this SR is the same
HR-H3	HR-H3	exact		
HR-I1	HR-I1	exact		
HR-I2	HR-I2	exact		
HR-I3	HR-I3	same	wording, added reference to QU-E1 and QU-E2	Added reference to SRs on uncertainty and assumptions, no change to intent
HLR-DA-A	HLR-DA-A	exact		
HLR-DA-B	HLR-DA-B	exact		
HLR-DA-C	HLR-DA-C	same	wording	Change in the order of the wording, no change to intent
HLR-DA-D	HLR-DA-D	exact		
HLR-DA-E	HLR-DA-E	same	wording	Change in the order of the wording, no change to intent
DA-A1	DA-A1	exact		
DA-A1a	DA-A2	same	wording, changed references to other SRs	text of the referenced SRs is essentially the same
DA-A2	DA-A3	exact		
DA-A3	DA-A4	exact		
DA-B1	DA-B1	exact		

Table 3 : Gap Assessment from ASME/ANS RA-Sb-2005 to ASME/ANS RA-Sa-2009				
ASME/ANS RA-Sb-2005 (Reg Guide 1.200 Rev 1)	**ASME/ANS RA-Sa-2009 (Reg Guide 1.200 Rev 2)**	**Change from 05 to 09**	**Description of Change**	**PY Comments**
DA-B2	DA-B2	exact		
DA-C1	DA-C1	same	DA-A3 is now DA-A4, moved references from Notes to References list, added NUREG-1715 and NUREG/CR-6928 to part (a), added line to say "see NUREG/CR-6823 [2-1] for a listing of additional data sources"	text of the referenced SRs is essentially the same, NUREG/CR-6928 is the primary source for generic probability failures in the PY PRA
DA-C2	DA-C2	same	DA-A2 and DA-A3 change to DA-A3 and DA-A4	text of the referenced SRs is essentially the same
DA-C3	DA-C3	exact		
DA-C4	DA-C4	exact		
DA-C5	DA-C5	exact		
DA-C6	DA-C6	exact		
DA-C7	DA-C7	exact		
DA-C8	DA-C8	exact		
DA-C9	DA-C9	exact		
DA-C10	DA-C10	exact		
DA-C11	DA-C11	exact		

Table 3 : Gap Assessment from ASME/ANS RA-Sb-2005 to ASME/ANS RA-Sa-2009				
ASME/ANS RA-Sb-2005 (Reg Guide 1.200 Rev 1)	**ASME/ANS RA-Sa-2009 (Reg Guide 1.200 Rev 2)**	**Change from 05 to 09**	**Description of Change**	**PY Comments**
DA-C11a	DA-C12	exact		
DA-C12	DA-C13	same	added knowledgeable (before plant personnel)	This SR states that interviews should be conducted in the case that "reliable estimates or the start and finish times are not available." For PY reliable start and finish times for the significant maintenance activities are available through the history of the Online Risk Monitor and the Plant Narrative Logs. Therefore no specific interviews have been conducted.
DA-C13	DA-C14	same	wording, added phrase "that is a result of a planned, repetitive activity", added example of intersystem unavailability	intent of SR unchanged
DA-C14	DA-C15	exact		
DA-C15	DA-C16	exact		
DA-D1	DA-D1	exact		

Table 3 : Gap Assessment from ASME/ANS RA-Sb-2005 to ASME/ANS RA-Sa-2009				
ASME/ANS RA-Sb-2005 (Reg Guide 1.200 Rev 1)	**ASME/ANS RA-Sa-2009 (Reg Guide 1.200 Rev 2)**	**Change from 05 to 09**	**Description of Change**	**PY Comments**
DA-D2	DA-D2	exact		
DA-D3	DA-D3	exact		
DA-D4	DA-D4	exact		
DA-D5	DA-D5	exact		
DA-D6	DA-D6	same	wording, for CC II added the phrase "in a manner" prior to "consistent with the component boundaries"	intent of SR unchanged
DA-D6a	DA-D7	exact		
DA-D7	DA-D8	exact		
DA-E1	DA-E1	exact		
DA-E2	DA-E2	exact		
DA-E3	DA-E3	same	added reference to QU-E1 and QU-E2	Added reference to SRs on uncertainty and assumptions, no change to intent
HLR-QU-A	HLR-QU-A	exact		
HLR-QU-B	HLR-QU-B	exact		
HLR-QU-C	HLR-QU-C	exact		
HLR-QU-D	HLR-QU-D	change	added LERF	LERF added to the model following 2008 Self-Assessment and assessed via focused scope peer review

Table 3 : Gap Assessment from ASME/ANS RA-Sb-2005 to ASME/ANS RA-Sa-2009				
ASME/ANS RA-Sb-2005 (Reg Guide 1.200 Rev 1)	**ASME/ANS RA-Sa-2009 (Reg Guide 1.200 Rev 2)**	**Change from 05 to 09**	**Description of Change**	**PY Comments**
HLR-QU-E	HLR-QU-E	exact		
HLR-QU-F	HLR-QU-F	same	wording	Change in the order of the wording, no change to intent
QU-A1	QU-A1	exact		
QU-A2a	QU-A2	exact		
QU-A2b	QU-A3	exact		
QU-A3	QU-A4	exact		
QU-A4	QU-A5	exact		
QU-B1	QU-B1	exact		
QU-B2	QU-B2	exact		
QU-B3	QU-B3	exact		
QU-B4	QU-B4	exact		
QU-B5	QU-B5	change	AVOID changed to DO NOT; reference changed from Note to References	Circular logic broken using the guidance from NUREG/CR-2728, with care to ensure no unnecessary conservatisms or nonconservatisms were introduced into the model logic
QU-B6	QU-B6	exact		
QU-B7a	QU-B7	exact		
QU-B7b	QU-B8	exact		
QU-B8	QU-B9	exact		
QU-B9	QU-B10	exact		

Table 3 : Gap Assessment from ASME/ANS RA-Sb-2005 to ASME/ANS RA-Sa-2009				
ASME/ANS RA-Sb-2005 (Reg Guide 1.200 Rev 1)	**ASME/ANS RA-Sa-2009 (Reg Guide 1.200 Rev 2)**	**Change from 05 to 09**	**Description of Change**	**PY Comments**
QU-C1	QU-C1	exact		
QU-C2	QU-C2	exact		
QU-C3	QU-C3	exact		
QU-D1a	QU-D1	exact		
QU-D1b	QU-D2	exact		
QU-D1c	QU-D3	exact		
QU-D2-deleted				SR deleted in from ASME/ANS RA-Sb-2005
QU-D3	QU-D4	exact		
QU-D4	QU-D5	exact		
QU-D5a	QU-D6	exact		
QU-D5b	QU-D7	exact		
QU-E1	QU-E1	same	removed "key" from key sources	Efforts made to capture the sources of uncertainty, and not just key sources, utilizing NUREG 1855 and EPRI 1016737.
QU-E2	QU-E2	same	removed "key" from key sources	The assumptions are documented in the respective notebooks
QU-E3	QU-E3	same	HR-G9 is now HR-G8, IE-C13 is now IE-C15	text of the referenced SRs is essentially the same

Table 3 : Gap Assessment from ASME/ANS RA-Sb-2005 to ASME/ANS RA-Sa-2009				
ASME/ANS RA-Sb-2005 (Reg Guide 1.200 Rev 1)	**ASME/ANS RA-Sa-2009 (Reg Guide 1.200 Rev 2)**	**Change from 05 to 09**	**Description of Change**	**PY Comments**
QU-E4	QU-E4	different	changed from 3 distinct capability categories to a single CC I/II/III	The PY Quantification Notebook identifies assumptions and sources of uncertainty and assesses how they impact the overall model and results
QU-F1	QU-F1	exact		
QU-F2	QU-F2	exact		
QU-F3	QU-F3	exact		
QU-F4	QU-F4	same	wording (took out the examples "such as..)	The intent to document the model assumptions and sources of uncertainty is unchanged. The PY documentation includes discussions on these items.
QU-F5	QU-F5	exact		
QU-F6	QU-F6	exact		

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Offsite power recovery Focused Scope Peer Review Findings and Observations

The offsite power recovery focused scope peer review did not result in any findings, but did identify a number of suggestions. Those suggestions were items to correct or enhance the documentation, and are not expected to have any impact on the results of the offsite power recovery analysis and implementation. For the sake of completeness, they are listed below along with the proposed edits to the documentation. These edits will be incorporated into the next model update, to the extent practical as other revisions to the model may make some items obsolete. These resolutions were reviewed by the peer review team and found to be acceptable and fully address the suggestions.

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Suggestion F&Os

F&O Number	F&O Details
1 Associated SR(s) QU-F2	In the equation used to calculate the non-recovery factors, Delay is defined as "Sum of delay times," this term should be "Max of delay times." Basis for Significance *The "max of delay times" was used in the analysis, as appropriate.* Possible Resolution Correct the documentation to use the correct implementation of the delay times Perry Response *The draft documentation for the next model update has been corrected to identify the Delay as the "Max of delay times." Note that this is strictly a documentation error as the calculations were performed using the maximum of the delay times, which the Peer Review team agreed was correct and appropriate.*
2 Associated SR(s) QU-F2	The term "mts" (mission time start) is defined in the equation for offsite power non-recovery but is not explained how it is defined and will be used in the equations. Basis for Significance *This is a suggestion to enhance the documentation.* Possible Resolution *Add further discussion to the documentation as indicated.* Perry Response *The "mts" (mission time start) is used to identify basic events that are associated with failures to run for over at least 1 hour, as it is common practice to collect diesel failure data assuming failures within the first hour are demand failures. The Perry PRA model identifies three failure modes for diesels and standby pumps: failure to start, failure to load/run less than 1 hour, and failure to run for greater than 1 hour. The convolution calculation accounts for this by using a mission time start (mts) of 1.0 for the diesel failures, and a mission start time of 0 for other failures.* *The draft documentation for the next model update has been updated to include this discussion.*

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Suggestion F&Os (continued)

F&O Number	F&O Details
3 Associated SR(s) QU-F2	It is unclear for the reviewers the percentage of cutsets that contains LOSP events are recovered. Basis for Significance *This does not impact the results of the analysis but can provide another means to review the results.* Possible Resolution Add the identified information to the documentation as indicated. Perry Response *The draft documentation for the next model update will be updated to include a review of pertinent cutsets and provide the percentage of cutsets that includes loss of station power (LOSP) events and are recovered. In the current effective model, 23 percent of LOOP cutsets include a recovery term; however, this number is expected to change slightly as other updates are incorporated during the normal model updated process.*
4 Associated SR(s) QU-F2	The non-recovery curve parameters values were taken directly from NUREG/CR-6928 . It does not seem to be correct. It could be NUREG/CR-6890 because NUREG/CR-6928 does not seem to have the non-recovery curve parameters listed. Basis for Significance *This does not impact the results of the analysis but the appropriate reference is necessary for the repeatability of the work performed.* Possible Resolution *Correct the reference in the documentation.* Perry Response *The actual reference is an NRC 2004 online database: http://nrcoe.inel.gov/resultsdb/publicdocs/LOSP/loop-summary-update-2004.pdf* *The draft documentation for the next model update has been revised to include the correct reference.*

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Suggestion F&Os (continued)

F&O Number	F&O Details
5 Associated SR(s) QU-F2	What's the minimum time required to restore onsite power after offsite power is restored? For some situations, operator actions to restore onsite power following the restoration of offsite power become very high priority actions for Operations. Basis for Significance *This is not expected to impact the results of the analysis, but a discussion of these aspects should be included in the documentation.* Possible Resolution *Add further discussion to the documentation as indicated.* Perry Response *The draft documentation for the next model update has been revised to include the following discussion:* *Following recovery of offsite power sources, it is necessary to then restore impacted systems so that they can fulfill their functions to prevent core damage or containment failure. Restoration of these systems becomes a high priority for operations.* *Following the Perry 2003 LOOP it took approximately 1 hour and 10 minutes for the blackstart source (Eastlake line) to be available, restoring offsite power to the site. It took an additional 1 hour and 15 minutes to restore the first emergency bus (EH11) from that offsite source. However, during this event the emergency diesel generators were running, as well as RCIC, so while offsite power recovery was a priority it was not an urgency. In an SBO with RCIC running, offsite power recovery to an emergency bus will either initially allow the dumping of the upper pool (immediate action in flowchart following power recovery) and prolong the use of RCIC (increasing heat capacity temperature limit via cooler water addition to the pool) or in the case of the diesel fire pump, allow actions to be taken to recover ECCS Systems. It is expected that on the order of 1 hour would be required to fill and vent an ECCS System, should such actions be necessary. Recovery of an initial system would then allow a cascading recovery of the other systems.* *Based on a review of NUREG/CR-6980, the generic data represents the probability of not recovering offsite power to a safety bus following the initiation of the LOOP. As such, the analysis then must consider the time required to restore systems once the electrical bus(es) have been re-energized. Note that if the system was not initially de-energized, restoration is not required (that is, offsite power was recovered prior to the diesel generator failing to continue to run). Therefore, the time of recovery actions is only important for recoveries involving a delay time following diesel failures.*

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Suggestion F&Os (continued)

F&O Number	F&O Details

5 (continued)	*A review of the time delay events credited in the offsite power recovery was performed, and is presented below. Note that this review will be re-performed on the updated model during the next model update, to verify that the justification given here is still true and to identify if any new patterns emerge in the cutsets.*
	
	• *CPHIONISPID7-DFPFO / CPHI-DFPFUELOIL, Operator failures to refill the diesel fire pump's fuel oil tank: Injection was being supplied by the diesel fire pump, until the pump's fuel oil tank was emptied. The diesel fire pump can run for 7.5 hours on a ½ tank of fuel. The offsite power recovery calculation only credited 4 hours for this delay event. Therefore there is sufficient margin for offsite power to be recovered and restoration actions on an ECCS system, including fill and vent, to be completed prior to loss of the diesel fire pump.*
	• *CRHIARI-LOSSOFHVAC, Loss of switchgear HVAC: Cutsets that appear with this term and credit offsite power recovery include additional 4 hour delay flags. Thus this delay term provides no further value in this analysis. This item will be considered for removal from the recovery rules and documentation.*
	• *DCBTDP-U1/ DCBTDP-U2, Battery Depletion Flags: These flags indicate station batteries were available until the batteries were depleted. A cutset review identified the following patterns:*
	  • *Failure to maintain the reactor pressure vessel (RPV) depressurized: injection is successfully supplied by a low pressure injection source (typically the diesel fire pump). However, a loss of DC due to battery depletion resulted in an inability to maintain the vessel depressurized, resulting in SRVs closing, the vessel re-pressurizing and a subsequent loss of the low pressure injection source. Recovery of offsite power prior to battery depletion would allow for the battery chargers to be placed in service and maintain the vessel depressurized before a loss of injection would occur. Should offsite power be recovered just as the batteries are depleted, it is judged that there is sufficient time to restore the battery chargers and re-open the SRVs before the vessel reaches a pressure at which injection would be lost.*
	  • *RCIC is supplying injection until a loss of DC occurs due to battery depletion. The loss of DC results in the RPV becoming overfilled, tripping RCIC on a Level 8 signal. Recovery of offsite power prior to battery depletion would allow for the battery chargers to be placed in service to maintain RCIC control or isolate/bypass RCIC trips as appropriate. Should offsite power be recovered just as the*

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Suggestion F&Os (continued)

F&O Number	F&O Details
5 (continued)	*batteries are depleted, it is judged that there is sufficient time to restore the battery chargers before level 8 is reached in the RPV, resulting in the undesired RCIC trip.* • *SPFG-2HR/ SPFG-4HR, Suppression Pool Heat Up Flags: These flags indicate that RCIC was successfully supplying injection until suppression pool temperatures required the vessel to be depressurized, resulting in a subsequent loss of RCIC injection. If the two hours was credited, restoration of power will immediately allow a dump of the upper containment pools into the suppression pool, extending RCIC availability for another two hours while ECCS systems are restored, including any fill and vent actions. A review of cutsets containing the four-hour flag (indicating the Upper Pool dump was performed prior to the loss of onsite power) was performed, and noted the vast majority of cutsets also included a CV0x term indicating a long term event (see CV01-CV05, below). A small percentage of cutsets did not contain a CV0x term and instead followed the following pattern:* • *DDFG-1HR/ DGFG-3HR. Loss of fuel oil transfer pumps: These basic events indicate that the diesel was running until the diesel fuel oil day tank emptied (1 hour for division 1 and 2, and three hours for division 3). Restoration of offsite power prior to emptying the day tank indicates that the safety-related bus(es) were never de-energized and additional restoration actions for ECCS systems is not required.* • *CV01 – CV05, Loss of Injection due to Containment Failure: These flags indicate that an injection source was available and supplying the RPV; however, no means of containment heat removal was available. Containment failure due to no heat removal is a long term event, yet only 4 hours was credited in this analysis. Following recovery of offsite power, containment venting can be aligned and initiated in approximately 35 minutes. Alternatively, RHR in the suppression pool cooling mode can be restored and initiated, although this action is expected to take longer as it will likely involve a fill and vent. There is sufficient time available for these recovery actions following restoration of offsite power, prior to containment over-pressurization and subsequent injection failure.*

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Suggestion F&Os (continued)

F&O Number	F&O Details
6 Associated SR(s) QU-F2	It is unclear for the reviewers if recovery of failed diesel generators (DGs) is credited in the analysis. Discussion with the utility indicated recovery of DGs was not credited in the analysis. The documentation should be updated to include such a statement. Basis for Significance *This does not impact the results of the analysis, but a statement should be included in the documentation to indicate the scope of the analysis.* Possible Resolution *Add the identified information to the documentation.* Perry Response *No recovery of failed DGs is credited in this analysis or in the overall PRA model. A statement to this effect has been added to the draft documentation for the next model update.*

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Suggestion F&Os (continued)

F&O Number	F&O Details
7 Associated SR(s) QU-F2	Some delay type events were identified as being used in the offsite power recovery rule file, but they are not listed as delay time events in the documentation. Examples are: CV01, CV02, CV03, CV04 and CV05. Also basic event "CRHIARI-LOSSOFHVAC" is missing from the table in Appendix D of the quantification notebook. Basis for Significance *This is does not impact the results of the analysis, but is a suggestion to enhance the documentation for consistency and completeness.* Possible Resolution *Add the identified information to the documentation.* Perry Response *The following discussion has been added to the draft documentation for the next model update. In addition, the CRHIARI-LOSSOFHVAC will either be added to the quantification notebook, or removed from the analysis based on the cutset review as indicated in F&O 5.* ***Time Delays*** *Basic Event — Description — Hours — Electrical Failure* *CV01 CORE VULNERABLE HPCS OPERATING — 4 — No* *CV02 CORE VULNERABLE LOW PRESS INJ OPER — 4 — No* *CV03 CORE VULNERABLE FEEDWATER OPERATING — 4 — No* *CV04 CORE VULNERABLE INJ OUTSIDE AB — 4 — No* *CV05 CORE VULNERABLE ANCHORAGE FAILURE — 4 — No* *The above basic events represent containment failures due to over-pressurization, resulting in damage to an injection line that was supplying the RPV. Appearance of one of these terms in the cutsets indicates that injection was successful but containment heat removal was not. There is a significant period of time until containment failure would occur; however, only 4 hours was credited in this analysis. Recovery of offsite power would allow operations to restore a mode of containment heat removal, most likely containment venting through the fuel pool cooling and cleanup path (there is a containment isolation valve inside containment, valve 1G41F0140, for which no credit is given in the PRA for manual action to open. Restoration of power would allow this valve to be remotely opened from the Control Room).*