Exelon Generation

4300 Winfield Road
Warrenville, IL 60555
630 657 2000 Office

RS-16-075

10 CFR 50.90

March 31, 2016

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Clinton Power Station, Unit 1
Facility Operating License No. NPF-62
NRC Docket Nos. 50-461

Subject: Supplemental Information Regarding License Amendment Request to Revise Technical Specification Section 5.5.13, "Primary Containment Leakage Rate Testing Program," for Permanent Extension of Type A and Type C Leak Rate Test Frequencies

References:

1. Letter from Patrick R. Simpson (Exelon Generation Company, LLC) to U. S. NRC, "License Amendment Request to Revise Technical Specification Section 5.5.13, "Primary Containment Leakage Rate Testing Program," for Permanent Extension of Type A and Type C Leak Rate Test Frequencies," dated January 25, 2016 (RS-16-015)

2. Letter from U. S. NRC to Bryan Hanson (Exelon Generation Company, LLC), "Clinton Power Station, Unit No. 1 - Supplemental Information Needed For Acceptance Of Requested Licensing Action Concerning Extension Of Leak Rate Testing (CAC No. MF7290)(RS-16-015)," dated March 17, 2016

In Reference 1, Exelon Generation Company, LLC (EGC) requested an amendment to Facility Operating License No. NPF-62 for Clinton Power Station (CPS), Unit 1. The proposed change is a request to revise TS 5.5.13, "Primary Containment Leakage Rate Testing Program" to allow for the permanent extension of the Type A Integrated Leak Rate Testing (ILRT) and Type C Leak Rate Testing frequencies.

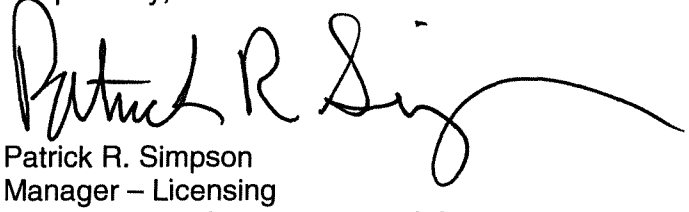
In Reference 2, the NRC provided the results of the acceptance review of the license amendment request. The NRC concluded that additional information is needed to enable the NRC to make an independent assessment regarding the acceptability of the proposed amendment in terms of regulatory requirements and the protection of public health and safety and the environment. As documented in Reference 2, the NRC requested that EGC supplement the application to address the information requested by April 4, 2016. In response to this request, EGC is providing the attached information.

EGC has reviewed the information supporting a finding of no significant hazards consideration, and the environmental consideration, that were previously provided to the NRC in Attachment 1 of Reference 1. The additional information provided in this submittal does not affect the bases for concluding that the proposed license amendment does not involve a significant hazards consideration. In addition, the additional information provided in this submittal does not affect the bases for concluding that neither an environmental impact statement nor an environmental assessment needs to be prepared in connection with the proposed amendment.

There are no regulatory commitments contained in this letter. Should you have any questions concerning this letter, please contact Mr. Timothy A. Byam at (630) 657-2818.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 31st day of March 2016.

Respectfully,



Patrick R. Simpson
Manager – Licensing
Exelon Generation Company, LLC

Attachment: Response to Request for Supplemental Information

cc: NRC Regional Administrator, Region III
NRC Senior Resident Inspector – Clinton Power Station
Illinois Emergency Management Agency – Division of Nuclear Safety

ATTACHMENT

Response to Request for Supplemental Information

RM DOCUMENTATION NO: CL-LAR-07 **REV: 1** **PAGE NO. 1**

STATION: Clinton Power Station (CPS)

UNIT(S) AFFECTED: 1

TITLE: Supplemental Information for Risk Assessment for CPS Regarding the ILRT (Type A) and DWBT Permanent Extension Request

SUMMARY: CPS is pursuing a License Amendment Request (LAR) to permanently extend the Integrated Leak Rate Test (ILRT) and Drywell Bypass Test (DWBT) to 15 years.

The purpose of this document is to provide supplemental information to the NRC regarding the F&Os from the 2009 Clinton Peer Review. This document supplements CL-LAR-07 Rev. 0, which remains in effect.

This is a Category 1 Risk Management Document in accordance with ER-AA-600-1012, which requires independent review and approval.

[ ] Review required after periodic Update

[X] Internal RM Documentation **[ ] External RM Documentation**

Electronic Calculation Data Files:

Method of Review: [X] Detailed [ ] Alternate [ ] Review of External Document

This RM documentation supersedes: N/A in its entirety.

	Name	Signature	Date
Prepared by:	Garrett Snedeker	Garrett Snedeker	3-30-16
Reviewed by:	Anthony Hable	Anthony Hable	03-30-16
Reviewed by:	John Steinmetz	John E Steinmetz	3-30-16
Independently Reviewed by:	Don Vanover	D E Vanover	3-30-16
Approved by:	Gene Kelly	Gene Kelly	3-30-16

Purpose

This document provides supplementary information related to the Clinton Full Power Internal Events (FPIE) PRA Model Quality review documented in Appendix A of CL-LAR-07 Rev. 0. Specifically, resolution for those peer review findings related to the 2009 ASME/ANS PRA Standard Requirements (SRs) not meeting Category I requirements is provided.

Background

NRC Reg. Guide 1.200 An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessments Results for Risk-Informed Applications, Revision 2, March 2009 provides guidance for documentation to support a regulatory submittal. Section 4 of the Reg. Guide recommends "A discussion of the resolution of the peer review (or self-assessment, for peer reviews performed using the criteria in NEI 00-02) findings and observations that are applicable to the parts of the PRA required for the application."

In a letter from the U. S. NRC to Bryan Hanson (Exelon Generation Company, LLC), "Clinton Power Station, Unit No. 1 – Supplemental Information Needed for Acceptance of Requested Licensing Action Concerning Extension of Leak ate Testing (CAC No. MF7290)(RS-16-015)," dated March 17, 2016, the results of the NRC acceptance review of the Exelon Generation Company, LLC (EGC) amendment request to revise the Clinton Power Station (CPS) technical specifications to reflect a permanent extension of the Type A Integrated Leak Rate Testing and Type C Leak Rate Testing were documented. The NRC indicated they had completed their review of the EGC application and in order for the application to be complete, the NRC requested that EGC supplement the application as follows:

NRC Request:
EGC is using a risk-informed approach to support the test frequency extension consistent with Regulatory Guide (RG) 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," Revision 2 (ADAMS Accession No. ML090410014). Therefore, consistent with the Section 3.2.4.1 of RG 1.200 and in Regulatory Issue Summary 2007-06, "Regulatory Guide 1.200 Implementation" (ADAMS Accession No ML070650428), EGC is requested to provide a list of all the facts and observations (F&Os) from the 2009 peer-review for which the probabilistic risk assessment (PRA) did not meet the 2009 American Society of Mechanical Engineers/American Nuclear Society PRA Standard Capability Category (CC) I supporting requirements. For each F&O, include details of its disposition, and if open, an explanation of why not meeting the corresponding CC I requirement has no impact on the request.

Methodology

As part of the PRA Quality review, all 2009 Peer Review 'findings' associated with SRs not meeting Capability Category I are identified as having the potential to impact the ILRT LAR risk assessment. Resolution documented in the Clinton PRA 'URE' database is reviewed and where necessary, the PRA model and documentation changes are also reviewed to verify 'findings' have been appropriately addressed.

If an F&O associated with a 'not met' SR has not been addressed, an explanation of why not meeting the corresponding CC I requirement has no impact on the request is provided.

Results/Conclusions

Peer Review findings, applicable SRs and resolution are found in Table 1 below.

All findings related to SRs 'not met' have been appropriately closed. This document supplements the PRA Quality Section of the Clinton ILRT Risk Assessment CL-LAR-07 Rev. 0. No changes to the PRA related quantitative results, other insights or conclusions are necessary.

TABLE 1

RESOLUTION OF PEER REVIEW F&Os

F&O	SR Not Met	F&O Description	Resolution
F&O 1-2	IE-A5	The SR requires that an evaluation of the potential for each system [to assess the possibility of an initiating event caused by the system] be performed. While some systems have been evaluated, as documented in Section 2, there is no evidence that each system at CPS has been evaluated.	A tabular system by system discussion of potential initiators is included in the IE Notebook. The additional system by system review did not result in new initiators.
F&O 1-3	IE-A5	The basis for excluding loss of electrical area ventilation is not supported with room heat-up calculations. Evaluate the room heat-up profile for each electrical room and compare the temperature profile with the capability of equipment in the room to withstand conditions expected to result from a loss of ventilation. An explicit evaluation of room heat-up could result in new initiating events.	Engineering Changes (ECs) 402194 and 402193 provide details of room cooling calculations for the switchgear rooms. The calculations show that without Switchgear Heat Removal System (VX) cooling the switchgear rooms will not exceed the 122 degree F equipment limits if operators open the doors as directed per procedures. Even without operator action the time to heatup to 122F is nearly 24 hours and it is not considered a credible initiating event.
F&O 1-4	IE-A6	No systematic evaluation of multiple equipment failures, including common cause and routine system alignments, was evident in the documentation. (This F&O originated from SR IE-A6) Perform an evaluation of multiple equipment failures and routine system alignments. Consideration of common cause events and routine alignments is required by the SR and RG 1.200. Such an evaluation could result in additional initiating events being identified.	A tabular system by system discussion of potential initiators is included in the IE Notebook. Common Cause Failure (CCF) is considered within the System IE fault trees. Routine alignments based on plant operating history are modeled in each of the System IE fault trees. Multiple equipment failures are considered and modeled in the System IE fault trees.

F&O	SR Not Met	F&O Description	Resolution
F&O 1-13	IE-D3 AS-C3 SC-C3 SY-C3 HR-I13 DA-E3 IFPP-B3 IFSO-B3 IFSN-B3 IFEV-B3 IFQU-B3 QU-E1 QU-F4 LE-E1 LE-F3 LE-G4	The Summary Notebook includes information that attempts to identify the key sources of uncertainty in the various analyses. However, with the changes to eliminate 'key' from the SR definition, this SR cannot be considered met. Appendix B of the CPS-PSA-013 notebook discusses the industry 'key sources of uncertainty' per EPRI TR-1009652. However, the current analysis does not fully meet the requirement of RG 1.200, which requires a discussion of sources of model uncertainty and related assumptions. Also, there may be some plant-specific assumptions made that may not be fully captured by the generic list of potential sources of uncertainty.	The Quantification Notebook includes the most recent CPS PSA modeling uncertainty discussions including many quantitative sensitivity studies. It should be noted that the ILRT risk assessment included the incorporation of several sensitivity studies and factored in the potential impacts from external events in a bounding fashion. None of the sensitivity studies or bounding analysis indicated any source of uncertainty or modeling assumption that would have resulted in exceeding the acceptance guidelines. Since the accepted process utilizes a bounding analysis approach which is mostly driven by that CDF contribution which does not already lead to LERF, there are no identified key assumptions or sources of uncertainty for this application (i.e. those which would change the conclusions from the risk assessment results).

F&O	SR Not Met	F&O Description	Resolution
F&O 1-14	IFSN-A6	Spray-induced and submergence induced failures appear to have been addressed in the analyses. No documentation of a systematic assessment of the effects of jet impingement, pipe whip, humidity, temperature, etc., on SSCs could be identified and Section 2.2.5 states that these effects are beyond the scope of the analysis. No evaluation of the specific equipment evaluated in the PRA compared to equipment considered in the design analyses, e.g., EQ lists, was documented Since the PRA can credit non-safety-related equipment, relying on design basis evaluations to dismiss these dynamic effects may credit equipment that cannot withstand the effects considered in the design analysis. In addition, failure in a system containing high temperature fluid can actuate fire systems and impact additional equipment. Also, the PRA models may evaluate breaks beyond those of the design basis.	The CPS PSA Internal Flooding analysis addresses spray/jet impacts on equipment (refer to Appendix B.5 of the CPS PSA Internal Flooding Notebook, Vol. 1). Humidity, temperature and pipe whip are also considered (refer to Section 2.2.5 of the CPS Internal Flooding Notebook). The internal flooding analysis covers low pressure low temperature fluids. High Energy Line Break (HELB) related issues are considered in the Interfacing System Loss of Coolant Accident (ISLOCA) and Break Outside Containment (BOC) analysis.
F&O 1-17	IE-C3	Recovery events are included in the WS and TBCCW initiating event fault trees. For example, the WS fault tree includes failure of actions to perform a manual backwash of service water strainers and TBCCW include actions to 'recover initial failure.' However, no basis for these actions was documented. Document the basis for recovery actions included as recovery events.	The Service Water (WS) and Turbine Building Closed Cooling Water (TBCCW) recovery events were added to Table 5.1-3 of the HRA notebook with a reference to the respective system notebooks. The basis for crediting recoveries using conservative probabilities is described in the system notebooks.

F&O	SR Not Met	F&O Description	Resolution
F&O 1-21	AS-B3	Nearly all event trees model [probabilistic] success of ECCS pump operation following a loss of suppression pool cooling if containment venting is successful. No evaluation of the ability of ECCS pumps to operate at post-containment-venting temperatures was provided. If ECCS pump operation for such conditions cannot be supported, then additional core damage sequences could result.	The bases for Emergency Core Cooling System (ECCS) pump failure/success following successful containment venting is documented in section titled 'Successful RPV Injection and Successful Vent' in the ET Notebook and the failure probabilities of the associated ECCS failure modes (e.g., basic event 1SY--STEAMBOUND-, "Vent Causes Steam Binding in ECCS Suction") are further discussed in AppendixG.13 of the Component Data Notebook.

F&O	SR Not Met	F&O Description	Resolution
F&O 1-22	AS-B3	An evaluation of the effects of conditions created by a break outside containment on equipment operation is not documented. For example, a break in the RCIC steam line could cause harsh conditions in plant buildings where equipment needed to support accident mitigation is located, thereby precluding use of that equipment in preventing core damage. If no equipment needed to mitigate the accident sequence is located in the areas where a break could occur, then such evaluations need to be made in the PRA for each accident sequence (or initiating event) in order to meet the SR. Some documentation of considering such potential effects needs to be presented, even if the conclusion is that there are no environmental effects by any initiating event. Breaks outside containment and ISLOCA events that require long-term injection (function XT-CRD) to be successful after an initial period of operation by HPCS or LPCS. However, the CRD model credits operation of condensate transfer as a suction source for CRD and condensate transfer could be failed by the conditions created by the BOC or ISLOCA initiators.	ISLOCA and break outside containment (BOC) accidents play a role in determining impact on risk. The operation of ECCS and credited non-safety related system during these conditions is documented in the Event Tree and Component Data notebooks. Additional information related to the example provided in the F&O: A Reactor Core Isolation Cooling (RCIC) steam line break would occur in containment (which contains little equipment modeled in the PRA) or in the Auxiliary Building. The High Pressure Core Spray (HPCS) pump is in a separate building, the Fuel Building. The Make-up Condensate (MC) and Cycled Condensate (CY) pumps are also in a separate building (the Turbine Building basement). A Control Rod Drive (CRD) pump is normally running, and it too is located in the Turbine Building. Credited systems are protected from the conditions created by the BOC and ISLOCA initiators by separation as noted above.

F&O	SR Not Met	F&O Description	Resolution
F&O 1-24	SY-A18	From a review of system notebooks, it appears that no concerted attempt was made to identify and model accident conditions that could cause system failures. For example, in the RCIC notebook, Assumption 6 states the water leg pump is only needed if AC power is available. Assumption 17 says that the water leg pump is not needed and the fault tree gate UGATE06 included water leg pump failure as a failure of the RCIC system. Also, the high steam flow isolation is not addressed in the RCIC notebook nor is isolation based on area temperature sensors. The RCIC gland seal compressor is included as a failure mode for RCIC, but it is not clear from the documentation why that failure mode is included. Another example is the circulating water system. No mention is made of the circulating water pump trip in high level in the turbine building. Because of the inconsistent documentation and above mentioned omissions from the documentation, and further because no evidence of a review for such conditions was identified in the documentation, it appears that this condition is not an isolated error but a complete omission from the analysis. Because of these issues this SR is assessed as not met.	The resolution of this F&O found the issue to be documentation issue only. The RCIC documentation was corrected to be consistent on the water leg pump requirement. The high steam flow and high temperature isolation have been added to the documentation. The gland seal compressor discussion was enhanced for clarity. The Circulating Water (CW) pump trip on high level was added to the CW system notebook. Other system notebook corrections and enhancements have also been made since the Peer Review to better document the model.

F&O	SR Not Met	F&O Description	Resolution
F&O 1-26	SY-A22	No calculations supporting room cooling requirements are documented. No evaluation of control room HVAC was identified. Better documentation of analysis to demonstrate that rated or design capabilities are not exceeded is needed within the system notebooks. Document the calculations used to exclude room cooling for each system.	Calculations are now documented in the Dependency Matrix Notebook. A reference to room cooling discussion in Dependency Matrix Notebook has been added to all of the System Notebooks in Section 2.5. Room cooling calculations for the Switchgear Rooms support the mission time for electrical equipment. (See F&O 1-3 resolution above). A calculation was performed for the 2011 PRA update (Axioma Report -55-2009-0048) that confirms the success of opening the RHR B room doors for SX failures. This calculation is used as the basis of allowing credit for operators opening room doors as a success of room cooling. A Human Error Probability (HEP) is included in the model for operator action to open the room doors. (See F&O 6-8 below). The heat load in the MCR compared with its relatively large size and the ability to open doors, should the need arise, are judged as making it no more limiting than some of the areas where heatup effects have been evaluated and discounted.

F&O	SR Not Met	F&O Description	Resolution
F&O 1-27	SY-A24 DA-C15 LE-E1	The CPS PRA models one instance where credit is given for repair of hardware failures, repair of RHR. Per the requirements of RG 1.200, plant-specific data to quantify the probability of repair should be collected and analyzed to support any credit given. The analysis for CPS uses generic industry data. Therefore, this SR is assessed as not met. Collect plant-specific repair data for RHR system failures and include the data in the repair probability calculations.	The RHR recovery terms represent the only recoveries applicable to this F&O. They are based on applicable industry experience as allowed by SR DA-C15. Fifteen pages of documentation describing industry data, an EPRI study, alternatives to modeling and conclusions are presented in Appendix G.14 of the Component Data Notebook. The recovery values are based on an exponential repair model and the average MTTR is judged reasonable given the long time for RHR recovery to avoid containment failure.

F&O	SR Not Met	F&O Description	Resolution
F&O 1-30	SY-A13	Flow diversion criterion or discussion otherwise is provided in the "Assumption" sections of the individual system notebooks. All flow diversion pathways that divert less than ten-percent of system flow are categorically excluded without consideration of the flow actually required.	The Clinton flow diversion modeling was compared with the MSO expert panel flow diversion analysis and conclusions. The current 2014 Clinton flow diversion modeling agrees with the Expert Panel discussion. The current site MSO resolutions are now supported by Engineering Change (EC) Documentation. The EC documentation provides additional detail. It appears that the present model is conservative for those scenarios where the valves have been placed in the closed position and the circuit breaker placed on the off position (Ref. MSO 2i for RHR/LPCI flow diversion). Note that the PRA model does not rely solely on MSO resolutions. For example, a LPCS test return valve F012 spurious opening is OK in MSO space, as LPCS is not a credited system and water is returned to the suppression pool. However, the PRA model fails LPCS if the F012 valve spuriously opens.

F&O	SR Not Met	F&O Description	Resolution
F&O 1-31	HR-G6	Table 5.1-4 summarizes the post-initiator HEPs in tabular form and compares the results to results from previous versions of the CPS PRA models. No evidence of a check for consistency between operator actions was identified. Compare the final HEP values against each other to check their reasonableness and document the comparison.	A new appendix was added to the Clinton 2011 HRA notebook to document the reasonableness of the HEPs. The validation of the HEPs is performed primarily through the following mechanisms: • Independent review of the detailed HEP quantifications and results by both PRA and operations personnel • Consistent use of HRA procedures that are designed to meet the requirements of the ASME/ANS PRA Standard. This consistently is facilitated by using the EPRI HRA Calculator. In addition to the above, the appendix documents an additional HEP consistency review based on comparison of the final HEPs and associated characteristics. The length of time available to perform an action and the level of stress are the classic influential performance shaping factors (PSFs).

F&O	SR Not Met	F&O Description	Resolution
F&O 1-32	HR-G7 HR-H3 QU-A5 QU-C1 QU-C2 LE-E1	CPS-PSA-004 Section 5.2 discusses the use of screening values used for HEPs in order to identify cutsets with dependent HEPs. However, only twelve of the over 100 basic events modeling post-initiator operator actions are listed in Table 5.2-1 as using screening values to identify dependency. Of these, six use a value of 1.0E-02 and one uses a value of 1.0E-03. The remaining five use a value of 0.1. It appears that all other HEPs are quantified with their nominal values. Use of such low probability values is likely to result in combinations of dependent HEPs being omitted by truncation values. Use of a sufficiently high value for HEPs is required by SR QU-C1 and not using a sufficiently high value would result in an inadequate assessment of dependent HEPs.	For the HRA dependency analysis performed as part of the 2011 PRA update, the post-initiator HEPs are set to 0.1 or higher (i.e., if the HEP is already >0.1 it is left at that higher value) and the model re-quantified during the PRA update development process to support identification of important operator action combinations in cutsets. Those combinations are then explicitly discussed, dependent events created, and then included in the quantification. The HEPs are then left at the value of 0.1 or higher for the base model run. The recovery file identifies the dependent groups and also resets the independent HEPs to their actual probabilities. The HRA Notebook has been updated to document this process.

F&O	SR Not Met	F&O Description	Resolution
F&O 1-33	HR-G7 HR-H3 QU-A5 QU-C1 QU-C2 LE-E1	Several operator actions, which are evaluated with their values set to nominal probability, are evaluated. For example refer to Sections 3.4, 3.5, and 3.6 which evaluate actions related to makeup condensate. The failure probability of these actions is so low that the associated basic events would not appear in cutsets for dependency analyses. Similarly, several events are developed for actions to start the standby condensate booster pumps or the associated lube oil pumps. No discussion of the dependence of these actions on the need to restart a feedwater pump was found. Particularly, would failure to start a condensate booster pump result in a low suction pressure trip of the feedwater pump.	For the HRA dependency analysis performed as part of the 2011 PRA update, the HRA, post-initiator HEPs are set to 0.1 or higher (i.e., if the HEP is already >0.1 it is left at that higher value) and the model re-quantified during the PRA update development process to support identification of important operator action combinations in cutsets. Those combinations are then explicitly discussed, dependent events created, and then included in the quantification. The HEPs are then left at the value of 0.1 or higher for the base model run. The recovery file identifies the dependent groups and also resets the independent HEPs to their actual probabilities. The HRA Notebook has been updated to document this process. This process ensures cutsets will not be inappropriately truncated out and eliminate the concern of modeling too fine a level of detail.
F&O 1-34	HR-G7 HR-H3 QU-A5 QU-C1 QU-C2 LE-E1	Solving the PRA models with some HEPs at nominal can result in cutsets with multiple operator actions being truncated out or with the combined probability of all operator actions much below the 1E-6 or 5E-7 floor that the HRA notebook says is used. The peer review team quantified the PRA model with post-initiator HEPs set to 0.1 and identified a significant number of cutsets containing combinations of basic events representing operator action failure. These combinations were reviewed and a large number of combinations identified in this review were not included in the CPS HRA dependency evaluation	This F&O overlaps with F&Os 1-32 and 1-33 and therefore the resolutions to those F&Os also resolves this F&O.

F&O	SR Not Met	F&O Description	Resolution
F&O 1-42	LE-E1	Common cause factors used only non-staggered CCF values (CPS-PSA-002 Volume 2 section 4.2). This assumption could impact results in a non-conservative basis and may not be true for outage tested systems. The use of staggered testing could provide non-conservative results and is not supported with plant experience. Identify, document and correct basis for use selected applied CCF factors.	CPS testing practices are staggered (at least for on-line work), testing is performed in the context of divisional work weeks; as such, the use of staggered CCF approach is appropriate and is used in the model. Key PRA components are typically tested online. Section 4.2 of Vol. 2 of the Component Data Notebook states "The Clinton Data Analysis utilizes the staggered component testing scheme".

F&O	SR Not Met	F&O Description	Resolution
F&O 1-43	QU-D1	The top ten cutsets are reviewed in Section 6.3.1 of CPS-PSA-014. The frequency of these cutsets total to 7.7E-07 per year or 1.4% of the 5.57E-06 CDF. The top ten accident sequences are reviewed in Section 6.3.2 of CPS-PSA-014. These sequences total 1.7% of CDF. A "significant cutset" is defined in the ASME/ANS standard. One of the criteria is a cutset that contributes to the summed percentage of 95% of CDF with other additional criteria specified. Other criteria than specified in the standard for "significant" can be used if justified, however, no other criteria are specified in the documentation reviewed. Although some cutsets were reviewed, the review did not constitute a review of "significant cutsets" as defined in the standard. A "significant accident sequence" is defined in the ASME/ANS standard. One of the criteria is an accident sequence that contributes to the summed percentage of 95% of CDF with other additional criteria specified. Other criteria than specified in the standard for "significant" can be used if justified, however, no other criteria are specified in the documentation reviewed. Although some cutsets were reviewed, the review did not constitute a review of "significant accident sequences" as defined in the standard. Perform and document a review of "significant" cutsets and accident sequences.	In the latest CPS FPIE PRA model the top 10 cutsets total to 20% of CDF. The top 10 accident sequences total 81% of CDF. Review of the top 10 cutsets and accident sequences is documented. A listing of the top 200 cutsets for both CDF and LERF are provided in the Quantification notebook. A sampling of cutsets and sequences are reviewed during the PRA Model review prior to model approval. This is considered sufficient. Refer to PRA Standard Inquiry 06-609 which states "the lists in [SY, QU, etc.] are provided as examples of documentation forms or types that may be used to meet the documentation requirements of the PRA Element. They should not be interpreted as specific requirements for the documentation."

F&O	SR Not Met	F&O Description	Resolution
F&O 1-46	QU-D5	No review of nonsignificant cutsets or accident sequences was identified. Perform and document a review of nonsignificant cutsets and accident sequences.	Exelon Risk management ER-AA-600-1015 FPIE PRA Model Update guidance was followed which requires the following, "Review a sampling of the dominant and non-dominant cutsets from the integrated results, based on the changes that have been made to the model." This review is performed and documented during PRA model updates.
F&O 1-48	LE-G6	No definition of significant accident progression sequence was found. This F&O originated from SR LE-G6. A definition is required per this SR. Document that the definition from the PRA standard was used.	The definition of significant accident sequence progression is defined in Appendix B (refer to pp. B-95 and B-122) of document CPS-PSA-000; the definition in Section 2 of the PRA Standard is adopted.
F&O 1-49	QU-B3	As described in the PRA standard, convergence can be considered sufficient when successive reductions in truncation value of one decade result in decreasing changes in CDF or LERF, and the final change is less than 5%. The truncation study in Section 3.1.2 of CPS-PSA-013 clearly demonstrates that this convergence has not occurred. For example, in Table 3.1-4 of CPS-PSA-013, there is a 20.5% difference in CDF between 1E-11 and 1E-12 truncation limits. Similarly, convergence of LERF was not demonstrated with a 29% increase from a truncation of 1.E-11 to 1E-12. Complete and document a convergence study to the criteria specified in the PRA standard.	The truncation study has been revised for the 2014 PRA update for both CDF and LERF. The truncation limit was lowered for CDF from 1E-11 to 5E-13 to demonstrate convergence. Lowering the truncation to 5E-14 will produce a <5% increase in CDF. The truncation for LERF was lowered to 5E-14 from 5E-13. Lowering the truncation further was not possible due to computer memory limitations. The truncation level is 6 orders of magnitude lower than the LERF result and is considered appropriate.

F&O	SR Not Met	F&O Description	Resolution
F&O 2-3	QU-B2	The truncation study shown in Section 3.1 of CPS-PSA-013 shows a 20% change in CDF from a truncation value of 1.0E-11 (used for the CPS PRA) to 1.0E-012. The requirement of this SR is to use a truncation value that will not eliminate dependencies of significant cutsets or accident sequences. Since the definition of "significant" given in the PRA standard is the top 95% of cutsets (or accident sequences), the "significant" cutsets will change by increasing CDF by 20%. No basis for why the truncation value of 1.0E-11 maintains the dependencies of significant cutsets was identified in the documentation. Therefore, this SR is considered not met. (This F&O originated from SR QU-B2)	This F&O overlaps with F&O 1-49 and the same resolution applies.
F&O 2-7	IE-C14 LE-D4	The ISLOCA initiating event frequency values appear to be much lower than others in the industry and are developed based on old data. Furthermore, the frequency calculations do not appear to consider correlated data which is recommended in recent industry documents such as NUREG/CR-5744 and NUREG/CR-5124. Also, recovery check valve failures for the valves that have failed to cause the initiating event is credited in the analysis. No basis for the credit is provided.	The Clinton ISLOCA evaluation was performed in accordance with NSAC-154 and is representative of the latest technology. The 2011 PRA updated the ISLOCA analysis to remove credit for isolation of the MOVs at ISLOCA pressures. The increase in frequency produced a <1% change in both CDF and LERF. Currently the Clinton total ISLOCA falls between the ISLOCA values for Quad Cities and Dresden as documented in Table 4-3 in the Initiating Event Notebook.
F&O 2-14	HR-A3 LE-E1	The pre-initiator HRA in the CPS [PRA Notebook] did not review plant procedures or work practices specific to the plant. This F&O originated from SR HR-A3. Identification of work practices that involve a mechanism that simultaneously affects equipment in either different trains of a redundant system or diverse systems is required by the SR.	The 2011 PRA project updated the pre-initiator identification and quantification process. The PRA update included pre-initiators that defeat multiple systems or trains. The CPS HRA uses the system analysis identification process which involves reviewing In Service Testing (IST) procedures and general post-maintenance test procedures.

F&O	SR Not Met	F&O Description	Resolution
F&O 2-16	HR-B2 LE-E1	Review of HRA notebook did not reveal rule that discusses not screening out activities that could impact multiple trains of a redundant SSC or diverse SSCs. Furthermore, no evidence could be found that that the process established by Exelon RM Best Practice BP-005 was followed.	The CPS 2011 PRA update included pre-initiators that defeat multiple systems or trains. As part of the pre-IE HEP development IST procedures were reviewed to find any restoration errors that could affect multiple systems or trains. The HRA documentation has been updated to better discuss these details.
F&O 3-13	HR-A1 HR-A2 LE-E1	Per Section 2.3.2.1.1 of CPS-PSA-004, the pre-initiators were identified by '... it was judged that the best use of resources is to identify the leading candidates for risk significant pre initiators and not to expend substantial effort to quantify other preinitiator HEPs for which no data are available and for which the contribution can be expected to be small.' The section states a methodology 'when resources become available', the identification should be performed in a way that would meet the SR.	The 2011 PRA project updated the pre-initiator identification and quantification process. The CPS HRA uses the system analysis identification process which involves reviewing IST procedures and general post-maintenance test procedures.
F&O 3-22	LE-G5	Limitations in the LERF analysis that would impact applications were not identified.	In subsequent PRA updates documentation was enhanced to explicitly indicate that there are no limitations in the LERF analysis unique to Clinton that would affect applications. Uncertainties with regard to severe accident phenomena and plant response (e.g., equipment survivability and crew actions) are addressed in the uncertainty evaluation performed for the 2014 Clinton model in Appendix B of the Summary Notebook.

F&O	SR Not Met	F&O Description	Resolution
F&O 4-2:	DA-C11 LE-E1	The PRA documentation uses Maintenance Rule data to quantify component unavailability data. No comparison of the Maintenance Rule function definitions to the PRA component boundaries or of the Maintenance Rule definition of available compared to the PRA was identified in the documentation. Therefore, it is not possible to determine if the unavailability values used in the PRA data analysis are correct.	The peer reviewer found documentation was lacking to substantiate the use of Maintenance Rule and MSPI data for PRA updates. Exelon document ER-AA-310-1004, Maintenance Rule - Performance Monitoring provides details on Maintenance Rule unavailability definitions. These rules are found to lead to unavailability tracking consistent with PRA unavailability criteria. Maintenance Rule unavailability is only used where Maintenance Rule functions are mapped appropriately to the PRA train or component. The PRA documentation has been updated to reflect this.
F&O 4-5:	SC-B5	The PSA Deterministic Calculations Notebook, CPS-PSA-007 does not have a comparison of results with those of the same analyses performed for similar plants.	The Success Criteria have been reviewed. Comparisons of the resulting success criteria were reviewed and compared with other similar plants using the MAAP computer code as a basis, with NUREG-1150 BWR/6 plant results, and with NEDO 24708A (GE report on core damage prevention success criteria). No anomalies are identified in the Clinton success criteria.

F&O	SR Not Met	F&O Description	Resolution
F&O 4-11	LE-E1	Basic events in Table C.2-1 appear to be grouped by Type Code, but not all Basic Events within some 'groups' have the same probability. As examples, the following are noted (System/Component/ Failure Mode): AP/CB/K, AP/CB/U, SP/AT/F, VY/FN/A	For the CPS 2011 PRA Update, the data groups were reevaluated based on component similarities in design, safety categorization, normal operating state, and water type. A new Table C.2-1 shows the results of this analysis. Table C.2-1 also identifies systems for which the type code applies. Groups were then updated with plant specific data (where available). All basic events with the same type code are assigned the same probability.
F&O 4-12	LE-E1	CPS-PSA-010, Rev. 2 has no discussion of how grouping was done to avoid including outliers in the definition of a group. Data grouping process is not clear regarding how generic data was updated by failure mode and grouped by mission type and by system. Including outliers, either by including exposure time or failures, could skew the data results. Identify outliers that are included in the data analysis and provide discussion of how grouping was done and include discussion of how outliers were excluded from the definition of a group.	For the CPS 2011 PRA Update, the data groupings were reevaluated based on component similarities in design, safety categorization, normal operating state, and water type. A new Table C.2-1 shows the results of this analysis. These groups were then updated with plant specific data. A review of the exposure time and failures was performed to ensure applicability. If an outlier was found (e.g., the data reflects more than a factor of three unavailability above the average), then a specific assessment of that system or component was required separate from the other similar systems or components.

F&O	SR Not Met	F&O Description	Resolution
F&O 4-18	DA-C14 LE-E1	CPS-PSA-010, Vol. 1, App. G.8 and Table G.8-1 identify how coincident corrective maintenance unavailability was included in the model. Assumption of 2 hours per 10 years for all combinations of coincident corrective maintenance of selected components appears to be conservative when compared to the unavailability of the individual components but no justification is provided for selection of this value. Coincident unavailability that results from planned, repetitive activities should be based on actual plant experience if available. Provide justification for selection of 2 hours in 10 years for assumed planned maintenance.	For the 2011 PRA update, the coincident maintenance was revised with plant specific data on coincident maintenance of multiple PRA related systems. Only planned and repetitive coincident maintenance events were considered consistent with the latest PRA Standard. The 2 hours in 10 years is no longer used.
F&O 4-23	QU-F6	The contributors and sequences considered is much less than what would be required in order to meet the defined limits as stated in the ASME standard. The use of the term "significant" in the CPS Quantification notebook must be defined in accordance with the ASME standard. The use of the term 'significant' is not defined in The CPS model.	The definition of significant accident sequence progression is defined in Appendix B (refer to pp. B-95 and B-122) of document CPS-PSA-000, the definition in Section 2 of the PRA Standard is adopted.
F&O 5-2:	DA-C6 DA-C10 LE-E1	Demand and run-time data is documented in Table C.2-3. The data sources used were provided in the table. A footnote in the table indicates that plant-specific data were not used. Some of the data is based on the MSPI basis document which should provide a basis for the period of the basis document. However, data was extrapolated beyond the period of time considered in the basis document. No consideration of surveillance tests, maintenance acts, etc., was documented. There was no accounting for the exclusion of post maintenance demands.	The 2011 CPS PRA update obtained plant specific data for the data collection period. This data is based on actual plant experience and includes demands based on surveillance tests and maintenance events. The PRA documentation has been revised and Appendix F of the Component Data Notebook contains all of the plant specific data obtained from the site.

F&O	SR Not Met	F&O Description	Resolution
F&O 5-3:	LE-E1	Actual plant experience, practices and plant maintenance plans were not used to base the number of surveillance tests and maintenance acts.	The 2011 CPS PRA update obtained plant specific data for the data collection period. This data is based on actual plant experience and includes demands based on surveillance tests and maintenance events. The PRA documentation has been revised and Appendix F of the Component Data Notebook contains all of the plant specific data obtained from the site.
F&O 5-4:	LE-E1	Plant-specific records were not used to determine the time that components were configured in their standby status.	Typically systems that have one or more components in standby while others are running will rotate the equipment for even wear on all the components according to the system managers. For systems with a preferred lineup (e.g., condensate), the standby probability is adjusted to reflect actual plant operation. Estimates are used for these probabilities. Plant specific records would have a negligible impact on results. SR DA-C8 allows the use of estimates for Capability Category I.
F&O 5-7:	HR-D6 LE-E1	Median values were used for HEPs - need to use mean values.	The EPRI HRA Calculator is now used to quantify the probabilities of the HEPs in the Clinton model. The HRA calculator uses the mean values from the THERP tables for quantification. The transition to using the EPRI HRA Calculator did not represent a methodology change, but the results produced by the HRA Calculator are considered to be industry acceptable for use in the PRA.

F&O	SR Not Met	F&O Description	Resolution
F&O 5-10	HR-D4 HR-D5 LE-E1	No evidence (other than the final HEP) of accounting for quality of procedures and quality of the human machine interface of HFE was found - values are provided but input for assessment is not provided. Documentation of process and a flow chart (section 4.3 of CPS-PSA-004) and final pre-initiator HEP values - would expect some justification (inputs) for final basis of the individual HEP.	The Clinton PRA HRA Analysis now uses the EPRI HRA Calculator to calculate both the pre- and post-initiator HEPs. The HRA Calculator takes into account the clarity and simplicity of the procedures and the required steps. The current HRA documentation shows the calculator inputs for all pre- and post-initiator HEPs.
F&O 5-12	IE-C14 LE-D4	Credit has been taken for the capability to close valves against ISLOCA dynamic loads. The evaluation of closure capability only evaluated normal loads and delta pressures.	In a subsequent PRA update, the credit for isolating the MOVs in ISLOCA was removed. The ISLOCA and Initiating Event notebook have been updated to reflect this change. The CDF and LERF results were not significantly affected by this minor change (i.e., delta CDF and LERF < 1%).
F&O 6-7:	SY-A20 DA-C14	System notebooks, specifically fault trees associated with the ECCS Systems (division 1 and division 2), do not contain divisional planned concurrent maintenance activities. For example RHR B and RHR C.	A review of plant specific coincident maintenance events was performed for the CPS 2011 update. Coincident maintenance events were updated based on plant specific planned and repetitive coincidence maintenance activities during the data period. Several coincident maintenance events were added to the model (including RHR B and RHR C).

F&O	SR Not Met	F&O Description	Resolution
F&O 6-8:	SY-B6	ECCS Room Cooling applications document the need for room cooling. Credit is provided for the opening of doors (LPCS pump room for example). No formal engineering analyses were identified that supports this application.	Each ECCS room has a design basis calculation supporting system operation with room coolers in service and doors shut. In addition a calculation was performed for the 2011 PRA update (Axioma Report -55-2009-0048) that confirms the success of opening the RHR B room doors for SX failures. This calculation is used as the basis of allowing credit for operators opening room doors as a success of room cooling. The analysis used a computational fluid dynamics (CFD) code (FLUENT), which models density driven airflows through open doorways, to demonstrate the viability of open doors as a room cooling method. Because of the similarity of ECCS rooms (e.g. similar large motor driven pumps, with similar doorways) the physical processes are believed to be similar and the door open cooling method was applied in the PRA model to the other ECCS rooms.

F&O	SR Not Met	F&O Description	Resolution
F&O 6-10	LE-F2	CPS-PSA-015 Section 7 and CPS-PSA-013 document the overall results of the Level 2 assessment. While it is assumed that results presentation involved the review for reasonableness, review of the associated documentation did not explicitly reveal a check for reasonableness. The model owner was asked about this comparison and replied that no such comparison was performed. No comparison was noted to have been made to similar plants.	In subsequent PRA updates the Level 2 results have been reviewed for reasonableness and documented in the Summary Notebook. The CPS Level 2 PRA results are plant specific and are strongly influenced by the plant specific contributors to the risk profile from Level 1 accident sequences. The available PRA Level 2 results are mostly limited to LERF analyses. The older NUREG-1150 analysis was distorted in its calculation of the Grand Gulf Generating Station (GGNS) by attributing 99% of the risk profile to Station Blackout. Therefore, the availability of one-to-one correspondence with other studies is not possible. Nevertheless, the CPS results have been compared qualitatively with PRA analyses performed by other Mark III plants and similar PRA analyses performed by the NRC to ensure that the latest techniques, data, and deterministic results are properly incorporated into the CPS Level 2.