UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO

AMENDMENT NO. 225 TO RENEWED FACILITY OPERATING LICENSE NO. NPF-11

AND

AMENDMENT NO. 211 TO RENEWED FACILITY OPERATING LICENSE NO. NPF-18

EXELON GENERATION COMPANY, LLC

LASALLE COUNTY STATION, UNITS 1 AND 2

DOCKET NOS. 50-373 AND 50-374

1.0 INTRODUCTION

By application dated October 27, 2016 (Agencywide Documents Access and Management System (ADAMS) Package Accession No. ML16305A291), as supplemented by letters dated July 28, 2017, August 30, 2017, and October 19, 2017 (ADAMS Package Accession Nos. ML17213A139, ML17243A119, and ML17293A169, respectively), Exelon Generation Company, LLC (EGC or the licensee), requested changes to the licensing bases for the LaSalle County Station (LSCS), Units 1 and 2.

The proposed amendments revise the suppression pool swell design analysis. The new analysis utilizes a different computer code and incorporates different analysis assumptions than the current analysis. The changes are necessary because the current design analysis determining the suppression pool swell response to a loss-of-coolant accident (LOCA) was determined to be nonconservative.

The supplements dated July 28, 2017, August 30, 2017, and October 19, 2017, provided additional information that clarified the application but did not expand the scope of the application, and did not change the no significant hazards determination published in the *Federal Register* (82 FR 13022, March 8, 2017).

The licensee proposed a revised suppression pool swell analysis which is based on a different computer code and different assumptions from the Analysis of Record (AOR). The licensee stated that the amendment is necessary because the AOR was determined to be nonconservative. The revised analysis does not require any changes to the LSCS, Units 1 and 2, technical specifications. The licensee will revise the updated final safety analysis report (UFSAR) in accordance with the Title 10 of the *Code of Federal Regulations* (10 CFR) 50.71(e) following the U.S. Nuclear Regulatory Commission (NRC or Commission) approval of the proposed changes.

Enclosure 4

2.0 REGULATORY EVALUATION

The regulatory requirements and the guidance upon which the NRC staff based its review of the effects on pool swell analyses due to the proposed change in methodology are based on the following:

- 10 CFR 50, Appendix A, General Design Criteria (GDC):
    - GDC 4 as it relates to structures, systems, and components shall be appropriately protected against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the nuclear power unit
    - GDC 50 as it relates to the reactor containment structure, including access openings, penetrations, and the containment heat removal system shall be designed so that the containment structure and its internal compartments can accommodate, without exceeding the design leakage rate and with sufficient margin, the calculated pressure and temperature conditions resulting from any LOCA.
- NUREG-0487, "Mark II Containment Lead Plant Program Load Evaluation and Acceptance Criteria," published October 1978 (Reference 10)
- NUREG-0487, Supplement 1, "Mark II Containment Lead Plant Program Load Evaluation and Acceptance Criteria," published February 1981 (Reference 14)
- NUREG-0808, "Mark II Containment Program Load Evaluation and Acceptance Criteria," Appendix A, published August 1981 (Reference 15)
- NUREG-0800, Standard Review Plan (SRP) 6.2.1.1.C, "Pressure-Suppression Type BWR [boiling-water reactor] Containments," states, the acceptability of LOCA-related pool dynamic loads for plants with Mark II containments is based on conformance with the generic loads previously reviewed and found acceptable by the NRC and acceptance criteria. The LOCA-related pool dynamic loads and criteria are as discussed in NUREG-0808, and Appendix B to SRP 6.2.1.1.C.

3.0 TECHNICAL EVALUATION

3.1 Description of Primary Containment

LSCS, Units 1 and 2, are BWR plants of the BWR/5 design with Mark-II type pressure suppression containments. As described in UFSAR, Section 3.8.1.1.1.1, the primary containment consists of a steel dome head and post-tensioned concrete wall standing on a basemat of reinforced concrete. The inner surface of the containment is lined with steel plate which acts as a leak tight membrane. The drywell is topped by an elliptical steel dome called the drywell head. The drywell which houses the reactor and the associated primary system, in the form of a frustum of a cone, is located directly above the suppression chamber also called the wetwell. The suppression chamber is cylindrical and separated from the drywell by a reinforced concrete slab. The drywell atmosphere is vented into the suppression chamber through a series of downcomer pipes penetrating and supported by the drywell floor. Four vacuum relief valves are provided between the drywell and the suppression chamber to prevent exceeding the drywell floor negative design differential pressure and back flooding of the suppression pool water into the drywell. These valves are evenly distributed around the suppression chamber air volume to prevent any possibility of localized pressure gradients from occurring due to geometry. They are mounted in special piping and located outside the primary containment which form an extension of the primary containment boundary.

3.2 Description of Suppression Pool Swell Phenomena

The UFSAR, Section 3.9.1.1.2.2, provides an explanation of the pool swell phenomenon. During the first few seconds of the blowdown phase of a design basis (DB) LOCA due to a double-ended guillotine (DEG) reactor recirculation suction line break (RSLB), the pressurization of the drywell causes a mixture of noncondensable gas and steam to flow into the suppression pool through the downcomer vent lines. This mixture at the exit of each downcomer vent line would combine into a single large bubble blanket extending across the suppression pool. The differential pressure between the drywell and wetwell continues to feed the bubble with non-condensable gas and steam. As the size of the bubble blanket increases, it causes a slug of water located above it to accelerate and rise upwards causing compression of the wetwell airspace and impose drag and impact loads on the structures and components located in the suppression pool swell zone. As the wetwell pressure increases, the water slug decelerates, breaks-up, and then freely falls into the suppression pool. Since the containment is inerted with nitrogen gas, the initial discharge through the downcomer vent lines is nitrogen gas followed by an increasing concentration of steam. This phenomenon is known as suppression pool swell and is controlled by the Mass and Energy (M&E) release rate to the drywell during the first few seconds of the blowdown phase of a DB LOCA.

3.3 Description of Pool Swell Analysis

The licensee stated that the RSLB DB LOCA is the limiting event with respect to the initial M&E released into the drywell, and is also limiting for the drywell pressure and the associated pool swell response. Pool swell loads occur following a postulated DB LOCA during which the discharge of water initially present in the downcomer vents and subsequent transfer of steam and non-condensable mass from the drywell through these vents produces drag and impact loads on initially submerged structures and suppression pool boundaries as well as on structures above the initial suppression pool surface. The pool swell response is driven by the drywell pressure response during the first few seconds of LOCA which is controlled by the blowdown M&E release rate to the drywell during this period. This analysis provides a calculation of the RSLB DB LOCA drywell pressure response and the associated pool swell response during the first few seconds of the blowdown phase.

Based on the above description of the phenomena and its effects, the analysis consists of the following three steps: (a) M&E release analysis for the blowdown phase of a DB LOCA, (b) drywell pressure response analysis for which the M&E release calculated is applied as an input, and (c) suppression pool swell response analysis for which the drywell pressure response results are used as an input.

3.4 Pool Swell Analysis of Record

The licensee stated that the original M&E release analysis for a DB LOCA from a DEG RSLB was performed in 1975. The results of this analysis were used as an input to the analysis that determined the suppression pool swell loads. The licensee subsequently determined that the original containment pressure response which is an input to the pool swell analysis used a nonconservative value of the reactor water temperature and the blowdown flow area from the break. The main reason of non-conservatism was the analysis was based on the assumption of saturated reactor water released from the break instead of realistically assuming subcooled water present in the annulus area of the reactor vessel released from the break. The subcooled water released would have a higher density and, therefore, would result in a higher mass released into the drywell, thereby, resulting in an increased drywell pressure response and consequently greater pool swell loads acting upon structures and components located in the swell zone.

To address the inadequacies in the 1975 analysis, the licensee, in 1983, updated the suppression pool swell analysis to make it more realistic. However, it was found that 1975 analysis results enveloped the results of the 1983 analysis and, therefore, the previously calculated suppression pool swell loads were acceptable and no further evaluation was required for the affected components in the wetwell.

In 2012, the licensee discovered that the 1983 updated suppression pool swell analysis did not correctly address the issue of saturated versus subcooled reactor water condition at the break. Therefore, a revision of the suppression pool swell analysis and subsequent evaluation of the affected components was performed which include downcomers and their supports, safety relief valve (SRV) discharge lines, emergency core cooling system (ECCS) and reactor core isolation cooling (RCIC) piping and supports, and pool temperature monitoring instruments. The licensee included this issue for a corrective action with an operability evaluation that the condition of nonconservatism is nonconforming; however, the LSCS, Units 1 and 2, are operable. The licensee has implemented administrative controls until the nonconforming condition is resolved.

3.5 Proposed Analysis

The licensee's proposed analysis is applicable to the current licensed thermal power (CLTP) with thermal power optimization (TPO) of 3,546 megawatt thermal (MWt) or less. The maximum power used in the analysis is 3,559 MWt which is 100.36 percent of the TPO CLTP of 3,546 MWt. This analysis covers the entire power/flow map including the effect of reduced feedwater temperature (RFWT) operation.

3.5.1 M&E Release Analysis

The current LOCA M&E release analysis uses the M3CPT computer code (References 4 and 5), and the proposed analysis uses the General Electric-Hitachi (GEH) TRACG computer code (References 6 and 7). The licensee justified this change by stating that during the time of interest (i.e., 0 seconds to 2 seconds) following the DB LOCA, the results show a small difference. The NRC has approved the application of TRACG for LOCA evaluations (NEDE-33005P-A (Reference 12)), with direct applicability of the blowdown model. The NRC has also approved application of TRACG for the Grand Gulf extended power uprate containment subcompartment M&E analysis, and economic simplified boiling-water reactor containment design basis analysis. Incorporated into these NRC reviews are applicable portions of the TRACG Model Description (NEDE-32176P (Reference 6)), and TRACG Model Qualification Report (NEDE-32177P (Reference 7)). The licensee stated that use of TRACG computer code is a change in methodology and does not represent change in conservatism. In the NRC staff request for additional information (RAI) dated June 14, 2017, SRXB-RAI 1, the NRC staff requested that the licensee provide reasons why the conservatism is not changed in using TRACG's best-estimate methodology compared to using the current conservative M3CPT (References 4 and 5) methodology for M&E release analysis. In response, the licensee stated:

> The M3CPT methodology with respect to the containment response calculation is consistent with the model in NEDM-10320 (Reference 1-1 [Reference 4]) as accepted in NUREG-0487 (Reference 1-2 [Reference 10]). The LAMB code is also acceptable to use for the mass and energy release in the M3CPT methodology rather than the built-in vessel model in the M3CPT code (please see the response to SRXB-RAI 11).
>
> The LAMB and M3CPT vessel models are simpler than the TRACG model. Due to the limitations in computing power, the M3CPT and LAMB models were made in the past with a number of assumptions for the purpose of simplifying the model, not for the purpose of adding more margin. The TRACG model represents the conditions in the vessel more accurately, calculates the break flow more accurately, and has an extensive benchmarking to a number of test and plant data for both the separate effects and the integral tests.
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> Although the TRACG vessel and vessel blowdown models are different than the methodology described in NEDM-10320 (Reference 1-1 [Reference 4]) as accepted in NUREG-0487, the conservatism in the results with TRACG is not significantly affected, relative to the results which would be obtained with the methodology of NEDM-10320. **[[**
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> **]]**

The NRC staff finds the response acceptable because the selected drywell pressure response input bounds the drywell pressure response based on the codes used in the AOR. The TRACG code is acceptable for the M&E analysis because, as stated above, it has an extensive benchmarking to test and plant data.

The analysis for M&E release covered the entire power/flow map including the effect of operation with feedwater temperature reduction (FWTR) (see Table 4-1 in Reference 2). The most limiting case for the M&E analysis was determined to be at **[[ ]],** reactor dome pressure of 1040 pounds per square inch absolute (psia), and with FWTR of 100 °F (degree Fahrenheit) from the normal feedwater temperature of 428.5 °F. The NRC staff requested the licensee (SRXB-RAI 4, Reference 3), to explain the basis for selecting 100 °F as FWTR and justify why it is conservative. In response, the licensee stated that FWTR takes place when equipment is removed from service or a transient that results in equipment out of service (OOS). In case the equipment is intentionally removed from service, the FWTR is controlled by plant operating procedures. For the transients that result in equipment not in service, the licensee evaluated potential off-normal scenarios resulting from equipment failures, including isolation of extraction steam flows, heater trips, isolation of heater drains, and heater bypass. The off-normal scenarios here refer to equipment alignments of non-safety systems resulting from failures of components and/or instruments in the condensate, feedwater, and/or heater drains systems. In this evaluation the licensee determined that the most limiting event results in the final FWTR of approximately 63 °F and, therefore, the assumption of 100 °F is conservative.

The NRC staff accepts the final FWTR by 100 °F is conservative. A higher FWTR is conservative because the higher density fluid due to a colder feedwater temperature would result in a higher mass release from the break.
The licensee referred to GEH report NEDC-33485P, Revision 0 (Reference 11), and stated that performance improvement and OOS features currently licensed and acceptable at the TPO rated thermal power (RTP) identified in Section 1.3.2 of this report have no effect on the RSLB M&E release analysis and, therefore, the current analysis continues to support these features. In SRXB-RAI 5, the licensee was requested to explain how it is determined that these features do not affect the M&E release analysis. The NRC staff reviewed the response to SRXB-RAI 5 in Reference 3. The NRC staff finds the licensee's rationale that the M&E release analysis is bounded by the proposed M&E analysis for the pool swell acceptable for each of the performance improvement flexibility options and the equipment OOS features listed in NEDC-33485P, Revision 0 (Reference 11).

3.5.2 Drywell Pressure Response for Input to the Pool Swell Response Analysis

The drywell pressure response input to the suppression pool swell AOR performed in 1975 was based on the NEDM-10320 (Reference 4) model. The proposed drywell pressure response is analyzed using the GEH M3CPT computer code (References 4 and 5). The blowdown M&E release generated by TRACG is applied as an input for the proposed drywell pressure response. The licensee used inputs and assumptions for conservatively calculating (maximizing) the drywell pressure response, such as maximum initial drywell pressure, suppression pool high water level during normal operation, drywell airspace relative humidity at its minimum value of 20 percent to maximize the noncondensable which is conservative, and zero heat loss from the drywell fluids to the heat sinks. The significant changes in the AOR introduced in the proposed analysis along with their justification and the results of the drywell pressure response are given below:

<u>100 Percent Air versus Air/Steam Mixture Flow through the Downcomer Vent</u>

During a DB LOCA, as an initial condition, the lower portion of downcomer vent has a water column and the remaining is filled with 100 percent air. Subsequent to the discharge of the water column, the AOR conservatively assumed 100 percent air flow through the downcomer vent during the transient. The proposed analysis (subsequent to the discharge of the water column) is based on an initial 100 percent air flow through the downcomer vent which subsequently transitions to a realistic flow of an air/steam mixture with a constant 0.39 fraction of steam and 0.61 fraction of air. This mixture ratio assumed in the analysis is conservative because it has conservatively higher fraction of air than the air fraction stated in the following statement in Section 11.A.3 of NUREG-0487, Supplement 1 (page 11-9), regarding the asymmetric LOCA pool boundary loads:

> *Using values for drywell volume and blowdown rate for a typical Mark II facility, the steam/air mixture was calculated by the staff to be 65% steam (or water) and 35% air.*

In addition, the licensee justified this change based on the full scale test results from testing performed by the Japan Atomic Energy Research Institute (JAERI). The results show that the loads based on the swell model of 100 percent air are significantly greater than those found during full scale JAERI testing. The conclusion drawn from analysis and testing is that the 'loads based on 100-percent air' (A) are greater than the 'loads based on air/steam mixture' (B) which are greater than the 'loads from JAERI testing' (C) (i.e., A > B > C). Even though the proposed assumption reduces the conservatism in the AOR, the NRC staff finds it acceptable because the JAERI test results are bounded by the loads obtained based on this assumption.

<u>Downcomer Vent Back Pressure</u>

The AOR for the LOCA drywell pressure response which was used as an input to the suppression pool swell analysis, accounted for the effect of the downcomer vent back pressure on the vent flow. The proposed analysis for the drywell pressure does not include the effect of the downcomer vent back pressure. The licensee provided the following rationale:

> *NUREG-0487 (Reference 11 [Reference 10]) accepted the use of the predicted drywell pressure based on the GEH containment models for input to the suppression pool swell model without accounting for LOCA bubble formation backpressure effects on vent flow. As described in NUREG-0487, this acceptance was based on a greater calculated pool swell response with the drywell pressure prediction from the GEH containment model relative to the calculated pool swell response obtained with measured test drywell pressure.*

Even though the proposed change reduces the conservatism in the AOR, the NRC staff finds it acceptable. In NUREG-0487, Section III.8.3.a.6, the analysis using the NEDM-10320 (Reference 4) methodology, which does not account for the vent back pressure, is acceptable based on the comparison and test data.

<u>Differences in the AOR and Proposed Analysis</u>

The licensee used TRACG (References 6 and 7) computer code for the M&E analysis and M3CPT (References 4 and 5) code for drywell pressure response analysis. In SRXB-RAI 11, the NRC staff requested the licensee to provide the following information:

(a) Computer codes used in the AOR for calculation of Pa, calculated peak containment internal pressure related to design basis accident, as defined in 10 CFR, Part 50, Appendix J.

(b) Differences in the inputs and assumptions for M&E and drywell pressure response between the AOR and the proposed analysis with justification of the inputs and assumptions for which the conservatism in the proposed analysis is reduced.

(c) In case the peak drywell pressure calculated using the assumptions and inputs in the proposed analysis results in a greater value than its current Pa, please explain and justify why Pa is not being revised.

In response to SRXB-RAI 11(a) (Reference 3), the licensee stated that for calculating Pa in the AOR, ISCOR computer code (General Electric (GE) NEDE-24011P, Revision 0) was used for the initial thermal-hydraulic conditions in the reactor (e.g., steady state pressure differences), LAMB computer code (Reference 9) was used for the break flow M&E, and M3CPT (References 4 and 5) computer code was used for containment analysis. Regarding the ISCOR computer code, in supplement (Reference 17), the licensee stated:

> The ISCOR code is not approved by name. However, the safety evaluation (SE) supporting approval of NEDE-24011P, Revision 0, by the letter from D. G. Eisenhut (U.S. Nuclear Regulatory Commission) to R. Gridley (GE) dated May 12, 1978, finds the models and methods acceptable and mentions the use of a digital computer code. The referenced digital computer code is ISCOR. The use of ISCOR to provide core thermal-hydraulic information in reactor internal pressure differences, transient, ATWS [anticipated transient without scram], stability, reactor core and fuel performance, and LOCA applications is consistent with the approved models and methods.

In response to SRXB-RAI 11(b) (Reference 3), the licensee stated that the following key inputs for the reactor and containment are the same in current M&E analysis using LAMB and proposed TRACG analysis: (i) initial reactor operating conditions, (ii) MSIV (main steam isolation valve) closing time, (iii) feedwater trip assumption, and (iv) SRVs) setpoints have no effect because the SRVs do not lift in AOR and the proposed analysis. The licensee stated the following differences in the inputs between the M&E analysis for Pa calculation using LAMB code (Reference 9), and the TRACG M&E analysis for drywell pressure calculation for the pool swell analysis. The licensee's response included both the proprietary information and non-proprietary information.

The licensee's proprietary response stated that:

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In the non-proprietary portion of the response, the licensee stated that:

i) TRACG model represents the reactor vessel more accurately compared to the simplified LAMB model, and (ii) the M3CPT vent back pressure model is used in the analysis for Pa, but not in the drywell pressure response for the pool swell analysis. Section III.B.3.a.6 of NUREG-0487 (Reference 10), states that the method used for the drywell pressure history in NEDM-10320 (Reference 4) which does not account for the vent back pressure is acceptable for the purpose of calculating the pool swell based on the comparisons to the test data. In supplement (Reference 17), the licensee provided the following information regarding the M3CPT code:

> The Vent Back Pressure Model uses M3CPT code and has a user input switch to include or exclude the vent back pressure produced by the LOCA bubble in calculating the drywell pressure. The vent back pressure is included in the P-sub-A analysis [Pa]. But the vent back pressure is excluded in the pool swell analysis as stated in the RAI response [for SRXB-RAI-11(b)], and in Attachment 2 [Reference 2] of the License Amendment Request [LAR].

In response to SRXB-RAI 11(c) (Reference 3), the licensee stated that the peak drywell pressure Pa (equal to 42.6 pounds per square inch gauge (psig)) occurs after 10 seconds into the transient. This value proposed in a previous LAR was based on a revised analysis which used a lower initial drywell air temperature of 98 °F instead of 135 °F and the change resulted in a higher Pa. The LAR was approved by the NRC in safety evaluation report enclosed in letter dated January 29, 2015 (ADAMS Accession No. ML14353A083). The codes used for the calculation of Pa were LAMB for M&E release and analysis and M3CPT for containment response. For the proposed pool swell analysis, the drywell pressure is based on the first 2 seconds of the transient and the codes used are TRACG and M3CPT. **[[**

]] The drywell pressure transient for pool swell analysis and for Pa calculation are both based on 98 °F as the initial drywell temperature. Therefore, the AOR peak drywell pressure Pa of 42.6 psig is not being revised because it is based on vent back pressure assumption, whereas, the drywell pressure response for the pool swell analysis is not based on the same assumption.

In SRXB-RAI 12, referring to Figures 5-1, 6-3, and 6-3A in Reference 2, the NRC staff requested that the licensee describe the analysis which results in the graphs labelled "LSCS Design Calc 3C7-1075-001", "LAMB CLTP 100P 100F," and "LSCS Design Calc 3C7-1075-001 R6." In response to SRXB-RAI 12 (Reference 3), the licensee stated:

> [1] Analysis 3C7-1075-001 is titled "Loads Due to Loss-of-Coolant Accidents in LaSalle Containment." The purpose of this calculation is to determine the best assessment loads due to a LOCA in the suppression pool. The analytical models are used to compute the elevation, velocity and acceleration of the suppression pool surface, as well as the pressures of both the air bubble and the free air spaces as functions of time during the pool swell phenomenon.
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> [2] The plot labeled "LAMB CLTP 100P 100F" is provided as a sensitivity study. The plot demonstrates the effect of using the AOR methodology (GEH's LAMB code) with the proposed new methodology where downcomer vent back pressure upon vent flow is not taken into account. Similarly, the plots for TRACG cases A through E ignore the downcomer vent back pressure upon vent flow.

The graph labelled “LSCS Design Calc 3C7-1075-001 R6” in Figure 5-1 showed the results from the analysis described in [1] above.

In SRXB-RAI 13, referring to Figure 5-1 in Reference 2, the NRC staff requested that the licensee provide reasons for the discontinuity (drastic reversal of slope) in the graph labelled "LSCS Design Calc 3C7-1075-001," and why does it differ from other graphs shown in this figure, with respect to its reversal of slope after vent clearing.

In response to SRXB-RAI 13 (Reference 3), the licensee stated:

> The plot "LSCS Design Calc 3C7-1075-001" is LSCS's AOR drywell pressure response for a DBA LOCA, utilizing GEH's LAMB-based prediction. In this AOR response, downcomer vent back pressure upon vent flow is taken into account. The slope reversal shown on Figure 5-1 at approximately t = 0.7 seconds occurs

at the completion of the vent clearing. Following vent clearing, there is a very short period when drywell pressure decreases that coincides with the beginning of the suppression chamber pressurization. While the decrease in drywell pressure is not extensively explained, it is mentioned in Section III.B.3.a.1 of NUREG-0487, "Mark II Containment Lead Plant Program Load Evaluation and Acceptance Criteria," October 1978.

NUREG-0487 accepted the use of the predicted drywell pressure based on the GEH containment models (Reference NEDM-10320) for input to the pool swell model (Reference NEDE-21544-P), without accounting for LOCA bubble formation backpressure effects on vent flow. This was based upon pool swell model-to-test data comparisons which are discussed in NUREG-0487.

The other plots (TRACG cases A through E and the LAMB case) shown on Figure 5-1 all ignore the effects of vent back pressure from the vent flow. The TRACG cases were run to ensure that subsequent calculations were based upon the most limiting combination of operating and equipment out of service conditions permitted by the power to flow map.

The NRC staff finds the drywell pressure response input for the pool swell analysis acceptable because it uses conservative assumptions and is consistent with NUREG-0487 with respect to not considering the downcomer vent back pressure effect on the vent flow. The licensee clearly explained the analysis which results in Figures 5-1, 6-3, and 6-3A, graphs. The licensee's explanation of the discontinuity in the Reference 2, Figure 5-1, graph labelled "LSCS Design Calc 3C7-1075-001," is acceptable because it is consistent with Section III.B.3.a.1 of NUREG-0487 (Reference 10).

3.5.3 Pool Swell Analysis

The suppression pool swell height, velocity, and acceleration responses are subsequently generated with the GEH PICSM (Reference 8), method. The PICSM models are described in NEDE-21544-P and have been accepted by the NRC for use in predicting the Mark II suppression pool swell in NUREG-0487 (Reference 10), NUREG-0487 Supplement 1 (Reference 14), and NUREG-0808 (Reference 15). The drywell pressure response determined by the M3CPT code is applied as an input to the PICSM code for the pool swell response. The NRC staff has approved the use of drywell pressure response analyzed from the M3CPT code as an input to the PICSM code (Reference 8), in NUREG-0487, Supplement 1 (Reference 14), and NUREG-0808 (Reference 15).

The licensee used the following inputs and assumptions associated with the suppression pool swell analysis using the PICSM models (Reference 8):

1. Air is assumed to behave as an ideal gas.

2. Following the clearing of the submerged portion of the downcomer, (i) the AOR assumes air only flows into the suppression pool as approved by NRC in NUREG-0487, Supplement 1, (ii) The proposed analysis assumes air flow only until a specified amount of air (established by the air mass contained within the non-submerged portion of the downcomer vent) has been purged followed by a flow of an steam/air mixture for the remainder of the transient. Assuming complete condensation of the vapor in the flow so that the driving force produced

by the noncondensables to the bubble is reduced. For the remaining portion of the transient, the vent flow is kept constant at a value established by the air/steam ratio in drywell at the time all initial air in the downcomer is purged. The assumption of a constant steam/air mixture is conservative relative to a transient steam/air ratio because the amount of air in the mixture gets progressively smaller with time into the transient. The licensee selected the mixture ratio to represent the air fraction in the drywell when the downcomer vents have been purged (vent clearing occurs at approximately 0.7 seconds, vent purging occurs at approximately 0.9 seconds). A constant air fraction of 0.61 is conservative because the air fraction in the drywell (100 percent) air is not constant. It decreases from a value of near 1.00 (near 100 percent air) when the DBA LOCA occurs and decreases to 0.40 (40 percent air, 60 percent steam) at 2 seconds, when the suppression pool swell phenomena is over. The constant value of the mixture ratio (air/steam = 0.61/0.39) is acceptable for the following reasons:

- A comparison of the predicted swell velocities with a 1.1 multiplier with the best estimate predictions of the Mark 4T test results, including the assumptions of air/steam mixture in the vent flow, instead of air only, shows that the predicted swell velocities are conservative.

- As discussed in NUREG-0808 (Reference 15), the JAERI conducted full scale testing of a 20-degree sector of Mark II containment. Section 2.1.2.3 of NUREG-0808 (Reference 15) compares the actual pool velocities against the calculated values based on all air flow through the vent. The comparison between the measured maximum center-pool velocities shows the calculated values are 10 percent to 40 percent larger and have an even greater margin to the average pool-surface velocities.

- The mixture used is conservative. Section 11.A.3 of NUREG-0487, Supplement 1 (page 11-9), regarding Asymmetric LOCA Pool Boundary Loads states:

  Using values for drywell volume and blowdown rate for a typical Mark II facility, the steam/air mixture was calculated by the staff to be 65% steam (or water) and 35% air.

3. The mass flow rate of noncondensables into the bubble is calculated assuming adiabatic flow through a duct with friction.

4. The air in the DW [drywell] is isentropically compressed and heat transfer to the walls is conservatively neglected. For this compression process it is assumed that no mixing occurs, but mix and purge is allowed for in the vent mass flow model.

5. A variable bubble temperature equal to the current DW temperature throughout the transient.

6. Following vent clearing, the water above the exit of the vent (equal to the initial vent submergence plus the pool displacement due to vent clearing) accelerates as a slug of constant thickness.

7. Frictional losses between the water and the confining walls are negligible.

8. Viscous forces are negligible compared to the inertial and pressure forces.

9. The suppression pool air space is isentropically compressed by the upward moving water slug. Heat transfer to the walls is neglected. (Note that for this proposed calculation a polytropic coefficient of 1.2 accepted by NRC in NUREG-0487,

   Supplement 1, is used for wetwell airspace compression when establishing peak pool swell height, velocity and acceleration).

10. The air velocity in the DW is sufficiently small so that static and stagnation conditions are equivalent.

11. The entire pool surface rises as a uniform ligament of constant thickness.

With regard to assumption No. 2 above, in SRXB-RAI 6, the NRC staff requested that the licensee describe the analysis that resulted in the graph shown in Figure 7-1 in Reference 2. In response to SRXB-RAI 6 (Reference 3), the licensee provided the following description:

> The mass and energy release is obtained from the TRACG analysis for the Case A reduced feedwater temperature (RFWT) conditions in Table 4-1 of Attachment 2 [Reference 2].
>
> The mass and energy release rate from the TRACG output is input into the M3CPT code to calculate the transient drywell and wetwell parameters such as pressure, temperature, steam, and air mass in the air space. The blue curve labeled "Drywell Air Fraction RFWT Case A" is the ratio of the air mass in the drywell to the total steam and air mass in the drywell, as obtained from the M3CPT results.
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> **[[**
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> **]]**

The NRC staff finds the RAI response acceptable because the licensee clearly described the analysis that resulted in the graph shown in Figure 7-1 in Reference 2.

With regard to assumption number 3 above, in SRXB-RAI 7, the NRC staff requested that the licensee: (a) clarify which duct is meant to be feeding the noncondensables into the bubble, (b) provide the assumed value of frictional loss coefficient and how is it determined, and (c) justify the assumption of adiabatic flow with friction is conservative. In response to SRXB-RAI 7 (Reference 3), the licensee provided the following information: (a) duct refers to the downcomers, (b) the vent loss coefficient assumed is 5.2 based on the loss coefficient correlations for the LSCS, Units 1 and 2, downcomer geometry, and (c) a higher bubble temperature results in a higher bubble pressure, and, therefore, higher pool swell velocity.

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The NRC staff finds the response for item (a) acceptable because the licensee clarified the duct to be the downcomer feeding the non-condensibles into the bubble. The NRC staff finds the response for item (b) acceptable because the value of the loss coefficient of 5.2 is conservative for the LSCS, Units 1 and 2 containment downcomer vent having 23.5 inch diameter and 49.3 feet length with the air/steam mixture flow. The NRC staff finds the licensee response for item (c) acceptable because the adiabatic flow with friction will have zero heat transfer resulting in a higher bubble temperature and pressure and therefore would result in higher pool swell velocity.

With regard to assumption No. 6 above, in SRXB-RAI 8, the NRC staff requested that the licensee describe the geometric shape of the assumed slug and how its dimensions are determined from the dimensions of the initial water column in the vent, and the basis for assuming a constant thickness of the slug. In response to SRXB-RAI 8 (Reference 3), the licensee provided the following description:

> The diameter of the water column is the same as the inner diameter of the downcomers. **[[**
>
> **]]** An adder equal to 1.125 times the downcomer diameter is used to account for the virtual mass in the suppression pool based on the Bodega Bay test data as described in Assumption (2) of Section 4.1 [typographical error, it should be 4.2 (Reference 17)] of NEDM-10320 (Reference 8-1[Reference 4]).

The NRC staff finds the RAI response acceptable because the licensee assumed the same geometric shape of the water slug discharged into the pool. The water slug assumed has the same diameter as the downcomer vent with a conservatively greater length than the submerged portion of the vent.

With regard to assumption No. 7 above, in SRXB-RAI 9, the NRC staff requested that the licensee describe which confining walls are referred to in this assumption. In response to SRXB-RAI 9 (Reference 3), the licensee stated that the statement refers to the friction effects of the structures in the suppression pool and the suppression pool walls which would confine the flow. The licensee also stated that the frictional effects in the downcomers are also neglected in calculating the acceleration of the liquid initially contained in the downcomers and not neglected after vent clearing.

The NRC staff finds the RAI response acceptable because the licensee clarified the confining walls to be the walls of the suppression pool.

In SRXB-RAI 10, referring to assumption 10 above, the NRC staff requested that the licensee specify with justification, at what time during the transient, the air velocity in the drywell is assumed sufficiently small so that its velocity head is negligible. In response to SRXB-RAI 10 (Reference 3), the licensee stated:

This assumption applies at all times following a LOCA, which is inherent in the lumped parameter analysis used for the drywell. Even if the jet issuing from a break is directed toward a few of the downcomer entrances, there are baffle plates (top hats) at the entrance of the downcomers to prevent any dynamic head from affecting the flow in the vent. Therefore, the velocity of the jet from a break does not affect the calculations.

The licensee analyzed four cases shown in Table 1 below, for the pool swell response using the PICSM code (Reference 8):

Table 1: Pool Swell Cases Analyzed

Case Number	Downcomer Vent Flow	Coefficient for Wewtell Airspace Compression	For Calculation of Vent Flow Rate
1	Air	Polytropic (k = 1.2)	Isentropic (k = 1.4)
2	Air	Isentropic (k = 1.4)	Isentropic (k = 1.4)
3	Air/Steam mixture	Polytropic (k = 1.2)	Isentropic (k = 1.4)
4	Air/Steam mixture	Isentropic (k = 1.4)	Isentropic (k = 1.4)

For the downcomer vent flow, for all four cases, the licensee assumed isentropic flow (coefficient for air = 1.4) which is more conservative than the coefficient for steam (k = 1.3) from the standpoint of calculation of vent flow rate.

For the wetwell airspace compression, the assumption of the isentropic coefficient k = 1.4 (Cases Nos. 2 and 4) would result in a higher compression effect than the polytropic coefficient k = 1.2 (Case Nos. 1 and 3). Therefore, k = 1.4 would be less conservative than k = 1.2 from the standpoint of maximizing the pool swell height, velocity, and acceleration.

The assumption of air (Case Nos. 1 and 2) versus air/steam mixture (Case Nos. 3 and 4) would result in higher pool swell height, velocity, and acceleration because of absence of steam which would otherwise condense in the pool as in Cases Nos. 3 and 4.

The conservative methodology using the Case No. 1 assumption of air flow through the vent and polytropic coefficient k = 1.2 was approved by NRC is NUREG-0487, Supplement 1 (Reference 14), and NUREG-0808 (Reference 15). This case maximizes the pool swell height, velocity, and acceleration. The AOR for the pool swell response is based on the Case No. 1 assumptions.

The realistic methodology using Case No. 3 assumptions is less conservative than the methodology based on Case No. 1 assumptions because in Case No. 3, the vent flow is realistically assumed to be mixture of air and steam. This polytropic coefficient of 1.2 used for the analysis of the wetwell airspace pressurization loads due to pool swell induced wetwell airspace compression is consistent with the Appendix C of NUREG-0808 (Reference 15), which specifies that the wetwell air compression should be calculated consistent with the analyses for determination of the peak pool swell elevation. The proposed best estimate analysis for the suppression pool swell response is based on Case No. 3 assumptions.

The licensee performed Case Nos. 2 and 4 analysis using k = 1.4 to show the sensitivity of the results to the compression coefficient.

Pool Swell Height

Applying the drywell pressure response as an input, the licensee calculated the suppression pool swell height as a function of time using the PICSM code (Reference 8). The Mark II Owners' Group criteria given in NUREG-0487, Supplement 1 (Reference 14), Section II.A.2, which is acceptable to NRC (NUREG-0487, Supplement 1, Table IV-1) for the maximum pool swell height is greater of the following options (a) or (b):

(a) 1.5 times the vent submergence;
(b) The elevation corresponding to the drywell floor uplift differential pressure used for design assessment. The pool surface elevation corresponding to the maximum wetwell airspace compression will be calculated assuming a polytropic process with an exponent of 1.2.

The maximum pool swell height in option (a), based on the initial downcomer vent submergence of 12.33 ft is 18.5 ft (1.5 x 12.33), which is greater than option (b). The analyzed maximum pool swell height is 16.44 ft (Reference 1, Attachment 1, Table 5, Item 3, Case No. 3, based on steam/air mixture flow through the vent and polytropic coefficient of 1.2, and also Table 6-3 in Attachment 2) which is more conservative than already conservative full scale JAERI test results. The pool swell height 16.44 ft includes a multiplier of 1.1 and a 0.7 ft adder to the PICSM prediction to account for the difference between the initial pre-LOCA elevation and initial PICSM elevation which corresponds to the elevation after vent clearing. In SRXB-RAI 3, the licensee was requested to explain how the 0.7 ft adder to the PICSM predicted pool swell height which accounts for the difference between the initial pre-LOCA elevation and initial PICSM elevation corresponding to the elevation after vent clearing was determined. The licensee was also requested to explain if the 0.7 ft adder is included in the data for pool swell elevation above initial elevation in Tables 6-1 through 6-4 in Reference 2. In response to SRXB-RAI 3 (Reference 3), the licensee provided the following explanation:

> The PICSM code calculates the pool swell height as the increase from the Suppression Pool (SP) level at the end of the vent clearing period. The increase in the pool height during the vent clearing period prior to the start of the PICSM calculation is
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> **[[**
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> **]]**
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> The above ratio is approximately 0.7 ft and is added to all PICSM results.

The licensee also stated that approximately 0.7 ft is added to the PICSM results in the fourth columns of Tables 6-1 through 6-4 in Reference 2.

For further conservatism and to ensure acceptability to NRC, the licensee used option (a) value of 18.5 ft instead of the analyzed value of 16.44 ft.

Pool Swell Velocity and Acceleration

The pool-swell velocity and acceleration as a function of time is calculated using the PICSM (Reference 8) computer code. For conservatism, the licensee multiplied the calculated velocity and acceleration by a factor of 1.1. The licensee also provided pool swell velocity and acceleration versus height graphs up to a maximum height of 18.5 ft. The velocities and elevation values used to generate acceleration graphs include a multiplier of 1.1.

3.5.4 Dynamic Loads

Asymmetric Bubble Load

NUREG-0808 (Reference 15), Appendix A, Section A.4, specifies the following NRC acceptance criteria for the asymmetric bubble load on the submerged boundary of the wetwell during vent-clearing:

> A load equal to 20% of the maximum LOCA vent-clearing bubble pressure is to be applied to ½ of the submerged boundary. This load is to be applied statically together with normal hydrostatic pressure to the submerged portion of the containment.

The licensee used value for the differential overpressure of 24 psid [pounds per square-inch differential] applied to the basemat and the wetwell wall below the vent exit with a linear attenuation up to the pool surface considering the Mark II containment test data. As per NUREG-0487, Supplement 1 (Reference 14), Section II.A.1 (page II-2), the NRC has accepted this load proposed by the Mark II Owners' Group. In addition to the hydrostatic pressure on the submerged portion of the wetwell, an asymmetric load of 22 psid was applied to a 180° sector of the wetwell wall.

Impact Loads on Small Structures

NUREG-0487 (Reference 10), Section III.B.3.c.1 and NUREG-0808 (Reference 15), Appendix A, Section A.5, provides the NRC acceptance criteria for the impact load on small structures. The equations to be used are also provided in SRP 6.3.1.1.c, Footnote 2, in Table B-1. In this criteria, the hydrodynamic mass factor (hydrodynamic mass per unit area) should be according to the appropriate correlation for cylindrical and flat surfaces in Figure 6-8 of NEDE-13426P (Reference 13). In the analysis, the licensee used American Society of Mechanical Engineers (ASME Code) publication, 65-WA/UNT-2, dated September 1, 1966, "Tables of Hydrodynamic Mass Factors for Translational Motion" (Reference 16), for determining the hydrodynamic mass factors and stated that the ASME Code publication provides the equivalent hydrodynamic mass factor as in NEDE-13426P (Reference 13), Figure 6-8. The equations for determining the impulse on pipes and flat surfaces, and the temporal maximum of pressure acting on the projected area of the structure (P_{max}) are equivalent to those identified in NUREG-0808 (Reference 15). The equations used for pulse duration are the same as given in NUREG-0808 (Reference 15).

The NRC staff finds the impact load analysis for small structures in the wetwell acceptable because the licensee used the same or equivalent equations for calculating impact loads as specified in the SRP 6.3.1.1.c and NUREG-0808 (Reference 15), acceptance criteria.

3.5.5 Structural Changes

Pursuant to Section 4.4 of Attachment 1 to the LAR (Reference 1), the licensee stated that it did not analyze all affected components and structures, but assessed a representative sample of the low margin SSCs consisting of piping subsystems and penetrations, pipe supports, temperature monitor supports, and vent line downcomers and bracing.

In SRXB-RAI 2, the NRC staff requested that the licensee provide the following information:

(a) Further explanation on the basis of selection of the SSCs (i.e., low margin of which parameter) for analyzing structural impacts,

(b) Specify the systems to which the piping, associated supports and penetrations that are analyzed belong to, and any special reasons for selecting these systems.

(c) What is the total number of SSCs that are affected and how many were selected for structural re-analysis,

(d) Maximum and minimum value of percentage in stress margins in the SSCs selected for structural analysis,

(e) Revised (new) maximum and minimum percentage in the stress margin in the SSCs structurally analyzed,

(f) Justification as to why the SSCs not structurally analyzed will have adequate stress margin.

In response to SRXB-RAI 2(a) and (b) (Reference 3), the licensee stated that the piping subsystems inside the suppression pool along with their pipe supports and associated containment penetrations were divided into four groups based on type and elevation inside the suppression pool. The groups based on elevation are: (i) below the initial pool surface, (ii) two groups between the initial pool surface and the height at which maximum velocity occurs, and (iii) above the maximum velocity height. These groups are at the elevations where the largest velocity increases relative to the original profile occur. Two groups are formed between the initial pool surface and the maximum velocity height to ensure the largest velocity difference is captured. Between approximately 5 ft and 18.5 ft from the bottom of the suppression pool, only the main steam system piping exists which is excluded from the screening because the piping is vertically oriented and has a minimal projected area exposed to the pool swell velocity and, therefore, the impact force to the piping is not a concern. The licensee selected one subsystem from each of the four groups, including pipe penetrations and pipe supports, based on the lowest available stress margin for piping resulting from application of Equation 9 of the ASME Code, Section III for Service Condition C. In each case, the selected subsystem had a currently available stress interaction coefficient (IC) greater than 90 degrees (e.g., 10 percent margin based on a maximum allowable stress of 27,000 psi). The stress IC is the ratio of the component’s maximum stress to allowable stress. The ASME Code equation considers primary stress limits for components from both internal pressure plus bending in determination of the stress IC for service condition limits A-D. The subsystems selected by the licensee included the high pressure core spray (HP04), reactor drains and vents (RE04), residual heat removal (RH34), and reactor core isolation cooling (RI67). The SSCs evaluated are valid for both units because the swell profile and loadings are the same for both units.

The NRC staff finds the selection of the SSCs for analyzing structural impacts acceptable because the licensee screened affected ones based on the lowest available stress margin. The exclusion of reanalyzing of the main steam piping is also acceptable because the projected area to the pool swell velocity is minimal and therefore the change in impact force would not be of concern.

In response to SRXB-RAI 2(c) (Reference 3), the licensee stated that the SSCs directly affected by the pool swell are: 58 piping subsystems; associated supports and 98 downcomer vent lines; 35 primary containment penetrations; portions of the primary containment associated with the suppression chamber including suppression pool walls and floor, reactor pedestal, support columns, lower downcomer bracing, suppression pool temperature monitoring instruments, and structural steel. Those selected for reanalysis are stated in response to SRXB-RAI 2(a) above.

In response to SRXB-RAI 2(d) (Reference 3), the licensee provided the AOR highest stress ratio IC for the piping subsystems described in response to SRXB-RAI 2(a) and (b) (see Table 1 below). The licensee also provided the highest AOR IC for the reanalyzed pipe supports (see Table 2 below).

In response to SRXB-RAI 2(e) (Reference 3), the licensee provided the new highest IC for the piping subsystems and the pipe supports reanalyzed. Tables 1 and 2 below show a comparison of the AOR and the new maximum IC for the Unit 1 reanalyzed piping subsystems and the pipe supports.

Table 1: Comparison of AOR and New Maximum IC for Selected Piping Subsystems

Piping Subsystem	Maximum IC (AOR)	Maximum IC (New)
1HP04	0.943	0.993
1RE04	0.935	0.278
1RH34	0.914	0.978
1RI67 & 1RI77	0.906	0.681

Table 2: Comparison of AOR and New Maximum IC for Pipe Supports

Piping Subsystem	Pipe Support	Maximum Stress IC (AOR)	Maximum Stress IC (New)
1HP04	HP08-1003G-Penetration No. M-82	0.778	0.986
1RE04	M09-RF19-1512G-Penetration No. M-98	< 1	< 1
1RE04	M09-RF19-1513X	< 1	< 1
1RE04	M09-RF19-1514X	< 1	< 1
1RE04	M09-RF19-1515X	< 1	< 1
1RH34	M09-RH13-1143G-Penetration No. M-79	0.946	< 1
1RH34	M09-RH13-1146X	< 1	< 1
1RH34	M09-RH13-1147X	< 1	< 1
1RI67	M09-RI40-1505G-Penetration No. M-92	0.615	0.617

For the Piping Subsystem RE04, the licensee stated that the stress due to pool swell loads is decreased because it is affected only when the swell is at its maximum elevation where the revised pool swell profile is locally bounded by the AOR swell profile. For the 1RI67 and 1RI77 subsystems, the maximum impact loads are increased while the pool swell drag and fallback loads are decreased.

The licensee reanalyzed penetrations M-79, M-82, M-92, and M-98 and stated their stress IC. The maximum stress IC is 0.70 for penetration M-79. For M-82, M-92, and M-98, the value of IC is less than 0.70.

For the temperature monitoring instrument supports which are attached to the containment wall, the licensee stated:

> The evaluation does not provide an aggregate stress IC value for each support, but rather it provides IC checks for various stress states of the structures. The application of the revised pool swell loads marginally increased the stresses on all of the supports, with new stress IC results ranging from 0.11 up to a maximum of 0.91.

The NRC staff finds the reanalysis results for piping and pipe penetrations given in Tables 1 and 2 acceptable because the new stress ICs are less than 1.0.

In response to SRXB-RAI 2(f) (Reference 3), the licensee provided the following justification for the SSCs not structurally analyzed but have adequate stress margin:

> The identified SSCs were initially screened using the methodology noted in SRXB-RAI 2(a). The SSCs located in the upper elevations of the pool swell (e.g., after the maximum swell velocity occurs) are judged to be minimally impacted by revised loads. Most of the SSCs that are located above the maximum velocity swell height are considered bounded locally (between 9 and 18.5 ft swell height) by the AOR swell profile as shown on Figure 1 [Reference 3]. Because these SSCs are bounded locally by the AOR swell profile, by inspection the swell velocities are lower and the resulting loads will be lower. The RE04 subsystem is one such group of SSCs in this case and it also has the least stress margin available. The evaluation demonstrated the loads and stresses were reduced. As such, most SSCs in this category (located above the maximum swell velocity height) are deemed by engineering judgement to have adequate stress margin.
>
> Other SSCs are located below the initial pool surface or between the initial pool surface and the maximum velocity swell height. In these cases the SSCs were screened to determine which have the lowest available stress margin while having the largest swell velocity increase between the AOR swell profile and the revised swell profile (see Figure 1 [Reference 3]) between 0 and 9 ft swell height). The results of these piping subsystem evaluations were found to be acceptable, and there is a high degree of confidence that other SSCs in this category with lower magnitude load changes would prove to have acceptable results as well.

The NRC staff finds the above evaluation acceptable because the licensee's screening for reanalyzing the SSCs is based on locations where the revised pool swell velocities are greater than the AOR pool swell velocities at the same locations.

4.0 CONCLUSION – TECHNICAL EVALUATION

The proposed LOCA pool swell analysis and the dynamic load evaluation for the suppression chamber and its internal SSCs is in accordance with SRP 6.2.1.1.C, NUREG-0808, NUREG-0487, and NUREG-0487, Supplement 1, with the exception that the revised analysis realistically assumes air/steam mixture as opposed to the conservative AOR assumption of all air flow through the downcomer vents after vent clearing.

GDC 4, as it relates to the SSCs being appropriately protected against the dynamic effect of discharging fluid into the suppression chamber, is met because the revised DB LOCA pool swell analysis and the dynamic loads evaluation on the suppression chamber and its internal SSCs meets the NRC acceptance criteria.

GDC 50, as it relates to the design of the reactor containment structure, including access openings, penetrations, and the containment heat removal system, is met because, based on the revised DB LOCA pool swell analysis and dynamic loads evaluation on the suppression chamber and its internal SSCs, the containment structure and its internal SSCs can accommodate without exceeding the design leakage rate and with sufficient margin, the calculated pressure and temperature conditions resulting from any LOCA.

5.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Illinois State official was notified of the proposed issuance of the amendment on September 8, 2017. The State official had no comments.

6.0 ENVIRONMENTAL CONSIDERATION

The amendments change requirements with respect to installation or use of a facility's components located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (82 FR 13022, March 8, 2017). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

7.0 CONCLUSION

The Commission has concluded based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) there is reasonable assurance that such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

8.0 REFERENCES

1. EGC [Exelon Generation Company LLC] Letter to NRC dated October 27, 2016, "License Amendment Request to Revise Suppression Pool Swell Design Analysis," (ADAMS Accession No. ML16305A295)

2. Attachments 2 and 4 to Reference 1, GE Hitachi Nuclear Energy Report 003N9278-RO-P, "Exelon Nuclear LaSalle County Generating Station Units 1 & 2 Pool Swell Response," October 2016 (ADAMS Accession Nos. ML16305A297 (Proprietary) and ML16305A296 (Non-Proprietary))

3. EGC letter to NRC dated July 28, 2017, "Response to Request for Additional Information Regarding LaSalle County Station License Amendment Request to Revise Suppression Pool Swell Design Analysis," (ADAMS Package No. ML17213A139)

4. General Electric Company, "The GE Pressure Suppression Containment Analytical Model," NEDM-10320, March 1971

5. GE Nuclear Energy, "The General Electric Mark III Pressure Suppression Containment System Analytical Model," NED0-20533, June 1974.

6. GE Hitachi Nuclear Energy, "TRACG Model Description," NEDE-32176P, Revision 4, January 2008

7. GE Hitachi Nuclear Energy, "TRACG Qualification," NEDE-32177P, Revision 3, August 2007

8. GE Nuclear Energy, "Mark II Pressure Suppression Containment Systems: An Analytical Model of the Pool Swell Phenomenon," NEDE-21544-P, December 1976.

9. General Electric Company, "General Electric Company Analytical Model for Loss-of-Coolant Analysis in Accordance with 10CFR50 Appendix K," NEDE-20566-P-A, September 1986 (ADAMS Accession No. ML092110816)

10. NUREG-0487 "Mark II Containment Lead Plant Program Load Evaluation and Acceptance Criteria," October 1978

11. GE Hitachi Nuclear Energy, "Safety Analysis Report for LaSalle County Station Units 1 and 2 Thermal Power Optimization," NEDC-33485P, Revision 0, January 2010 (ADAMS Accession No. ML100321327)

12. GE Hitachi Nuclear Energy, "TRACG Application for Emergency Core Cooling Systems / Loss-of-Coolant-Accident Analyses for BWR/2-6," NEDE-33005P-A, Revision 1, February 2017, (ADAMS Accession No. ML17055A389)

13. NEDE-13426P, "Mark III Confirmatory Test Program, One-Third Scale Pool Swell Impact Tests, Test Series 5805," dated August 1975, (Legacy Accession No. 8007030157)

14. NUREG-0487 Supplement 1, "Mark II Containment Lead Plant Program Load Evaluation and Acceptance Criteria," September 1980

15. NUREG-0808, "Mark II Containment Program Load Evaluation and Acceptance Criteria," August 1981

16. ASME Publication 65-WA/UNT-2, "Tables of Hydrodynamic Mass Factors for Translational Motions," Kirk T. Patten, dated September 1, 1966.

17. EGC Letter to NRC dated August 30, 2017, "Supplemental Information Regarding LaSalle County Station License Amendment Request to Revise Suppression Pool Swell Design Analysis," (ADAMS Accession No. ML17243A119)

Principal Contributors: S. Ahsan, NRR/SRXB
R. Pettis, NRR/ESEB

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