Exelon Generation®

10 CFR 50.54(f)

RS-15-185

July 22, 2015

U.S. Nuclear Regulatory Commission
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Dresden Nuclear Power Station, Units 2 and 3
Renewed Facility Operating License Nos. DPR-19 and DPR-25
NRC Docket Nos. 50-237 and 50-249

LaSalle County Station, Units 1 and 2
Facility Operating License Nos. NPF-11 and NPF-18
NRC Docket Nos. 50-373 and 50-374

Subject: Supplemental Information Regarding Seismic Hazard Risk Evaluation and Seismic Hazard Prioritization Results - Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident

References:

1. Exelon Generation Company, LLC, Seismic Hazard and Screening Report (Central and Eastern United States (CEUS) Sites), Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated March 31, 2014 (RS-14-067) [Dresden]
2. Exelon Generation Company, LLC, Seismic Hazard and Screening Report (Central and Eastern United States (CEUS) Sites), Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated March 31, 2014 (RS-14-068) [LaSalle]
3. NRC Letter, Screening and Prioritization Results Regarding Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Seismic Hazard Re-Evaluations for Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated May 9, 2014
4. Exelon Generation Company, LLC Expedited Seismic Evaluation Process Report (CEUS Sites), Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated December 26, 2014 (RS-14-297) [Dresden]
5. Exelon Generation Company, LLC Expedited Seismic Evaluation Process Report (CEUS Sites), Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated December 19, 2014 (RS-14-298) [LaSalle]

In References 1 and 2, Exelon Generation Company, LLC (EGC) provided the Seismic Hazard and Screening Reports for Dresden Nuclear Power Station, Units 2 and 3, and LaSalle County Station, Units 1 and 2, respectively. In References 4 and 5, EGC provided the Expedited Seismic Evaluation Process (ESEP) Reports for Dresden Nuclear Power Station, Units 2 and 3, and LaSalle County Station, Units 1 and 2, respectively.

In Reference 3, the NRC issued the industry screening and prioritization results based on review of the March 31, 2014 seismic hazard re-evaluation reports. The NRC review of the Dresden, and LaSalle plant sites determined these plants "screened-in" for the purposes of prioritizing and conducting additional seismic risk evaluations. Additionally, the NRC prioritized the Seismic Risk Evaluation for Dresden and LaSalle as Group 2 sites.

The purpose of this letter is to provide supplemental information to address the NRC staff prioritization and seismic risk evaluation of the Dresden and LaSalle sites. This information provides additional detailed basis and justification supporting the determination that these sites are low risk sites for seismic hazards and; therefore, do not require additional seismic probabilistic risk analyses. This determination is based on additional seismic risk and seismic capacity insights for each site as described in the enclosures to this letter.

This letter contains no new regulatory commitments. If you have any questions regarding this submittal, please contact Ron Gaston at (630) 657-3359.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 22nd day of July 2015.

Respectfully submitted,

Glen T. Kaegi
Director - Licensing & Regulatory Affairs
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Enclosures:

1. DR-MISC-56, Revision 1, Dresden Nuclear Power Station, Units 2 and 3, Supplemental Information in Response to NRC Seismic Hazard Risk Evaluation and Seismic Hazard Prioritization Results (24 pages)
2. LS-MISC-30, Revision 1, LaSalle County Station, Units 1 and 2, Supplemental Information in Response to NRC Seismic Hazard Risk Evaluation and Seismic Hazard Prioritization Results (19 pages)

cc: Director, Office of Nuclear Reactor Regulation
Regional Administrator - NRC Region III
NRC Senior Resident Inspector – Dresden Nuclear Power Station
NRC Senior Resident Inspector – LaSalle County Station
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Enclosure 1

DR-MISC-56, Rev.1

Dresden Nuclear Power Station, Units 2 and 3

Supplemental Information in Response to NRC Seismic Hazard Risk Evaluation and Seismic Hazard Prioritization Results

(24 pages)

RM DOCUMENTATION NO. DR-MISC-56	REV: 1	PAGE NO. 1

STATION: Dresden

UNIT(S) AFFECTED: Units 2 and 3

TITLE: Supplemental Information in Response to NRC Seismic Hazard Risk Evaluation and Seismic Hazard Prioritization Results

SUMMARY (Include Updating Requirement Evaluations (UREs) incorporated): The purpose of this document is to provide additional information regarding risk insights and the seismic capability of the Dresden Nuclear Power Station (DNPS) to the NRC to support the staff decision-making process for providing SPRA relief to a limited number of priority Group 2 and 3 plants, including DNPS, Units 2 and 3.

Documentation conforms to PRA Documentation "Category 1" per T&RM ER-AA-600-1012, because it will be provided to the NRC staff as a docketed submittal for NRC review/concurrence. Per the requirements of T&RM ER-AA-600-1012, this evaluation requires both independent review and approval.

[ ] Review required after periodic Update

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

Electronic Calculation Data Files:
(Program Name, Version, File Name extension/size/date/hour/min)

Calculation files stored on ERIN network in:

\\en1msfs01\en1nw501_vol3\DATA\PRA\ZPSADOC\PSA Support Applications\Dresden applications post May 1, 2008\DR-MISC-56.zip

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

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

Prepared by:	Bret E. Tegeler[1] / Structural Analysis	/ [signature] Sign	/ 7/20/15 Date
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Approved by:	GREGORY REINICK ~~Eugene Kelly~~ / ~~Sr. Manager, RM.~~ DIRECTOR - RISK MGT	/ [signature] Sign	/ 7/21/2015 Date

[1] Not qualified per Risk Management Certification Guides. Preparation and review of structural evaluations, and the technical qualifications for these subject matter experts, is out of scope for typical Risk Management Certification Guides.

DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3
Supplemental Information in Response to NRC Seismic Hazard Risk Evaluation and Seismic Hazard Prioritization Results

1.0 BACKGROUND / SCOPE

Following the accident at the Fukushima Dai-ichi nuclear power plant resulting from the March 11, 2011 Great Tohoku Earthquake and subsequent tsunami, the Nuclear Regulatory Commission (NRC) established a Near Term Task Force (NTTF) to conduct a systematic review of NRC processes and regulations. The NTTF developed a set of recommendations ranging from ensuring protection from external events, enhancing mitigation, and strengthening emergency preparedness. On March 12, 2012, the NRC issued a 50.54(f) letter requesting information to assure that the NTTF recommendations were addressed by all U.S. nuclear power plants [1]. The letter requested that licensees reevaluate the seismic hazards at their sites utilizing present day NRC requirements and guidance. Licensees were required to submit their reevaluated hazards by March 31, 2014.

In a May 9, 2014 letter [2], the NRC provided the results of their review of industry submittals and prioritized the Central and Eastern United States (CEUS) plants into three groups. Group 1 plants are generally those plants that have the highest reevaluated hazard relative to their original licensing basis in the 1 to 10 Hz frequency range. Group 2 plants have higher reevaluated hazard relative to their original licensing basis. Group 3 plants have the lowest re-evaluated hazard relative to their original licensing basis. NRC categorized Dresden Nuclear Power Station (hereafter referred to as "Dresden") as a Group 2 plant needing to perform a Seismic Risk Assessment, an Expedited Approach Evaluation as an interim action, and limited scope evaluations for high frequency and spent fuel pools.

In a May 21, 2015 public meeting related to NTTF 2.1 Seismic Issues [3], the NRC briefed that they are currently evaluating 50.54(f) responses and available information to support a determination that a Seismic Probabilistic Risk Assessment (SPRA) is not required for some Group 3 and a limited number of Group 2 plants. The NRC also briefed that available information supporting limited SPRA relief for these Group 2/3 plants will be drawn from (1) Reevaluated hazard and interim actions, (2) Walkdown reviews and inspections, (3) GI-199, CEUS seismic hazard insights, (4) Individual Plant Examinations of External Events (IPEEE) seismic plant capacity insights, and (5) Expedited Approach Evaluations.

The purpose of this document is to provide additional information regarding risk insights associated with the seismic capability of Dresden to the NRC to support the staff decision-making process for providing SPRA relief for Dresden, Units 2 and 3.

2.0 SUMMARY CONCLUSION

Detailed seismic margin evaluations, recent seismic walkdown confirmations, and risk insights, provide reasonable assurance that Dresden Units 2 and 3 have seismic capacity to withstand the beyond design basis seismic demands documented in the Dresden Seismic Hazard and Screening Report submitted on March 31, 2014 [7]. Plant-specific evaluations, described herein, provide confidence that the installed plant equipment has sufficient seismic capacity, such that, when coupled with onsite FLEX equipment and off-site capability, the risk from beyond-design-basis seismic events remains significantly below the Commission's Safety Goal Policy Statement subsidiary objectives of 1E-4/yr for Core Damage Frequency and 1E-5/yr for Large Early Release Frequency (LERF), as identified in Regulatory Guide (RG) 1.174 [15].

Although the Dresden site-specific Ground Motion Response Spectra (GMRS) exceeds the Safe Shutdown Earthquake (SSE) by a maximum factor of 1.78 in the 1 to10 Hz range, there is confidence that the Seismic Category I structures will remain functional for GMRS demands. In addition, simplified seismic risk calculations, based on the updated EPRI 2013 seismic hazard, indicate an approximate seismic core damage frequency (SCDF) to be in the low E-05/yr range (i.e., between 1E-05/yr and 3E-05/yr) [38], which is below the Commission's Safety Goal Policy Statement subsidiary objective of 1E-4/yr, as identified in RG 1.174 [15].

The Dresden Expedited Seismic Evaluation Process (ESEP) seismic margin evaluation reflects that the design of the key installed FLEX components is sufficiently robust so as to withstand the effects of ground motion commensurate with the Dresden Review Level Ground Motion (RLGM) per NRC endorsed EPRI ESEP guidance [5]. No plant modifications resulted from the ESEP efforts as all equipment evaluated had capacity at or above the RLGM demand level [10]. If the Dresden plant High Confidence of a Low Probability of Failure (HCLPF) is assumed to be greater than 0.356g, based on the limiting component ESEP HCLPF evaluated in the ESEP [10], the approximate SCDF estimate decreases by roughly a factor of 3 from the low E-05/yr range down to the mid E-06/yr range (i.e., between 4E-06/yr and 6E-06/yr) [38].

Portable equipment and components required for Dresden FLEX mitigation strategies will be stored on site in reinforced concrete structures designed to resist seismic, high-winds, and tornado events. The consideration of tornado wind, tornado-borne missiles, as well as consideration of ASCE 7-10 provisions [12], contributes to the robustness of the Dresden FLEX buildings. Section 3.2.6.2 of this report describes that haul paths have high safety margins for soil liquefaction based on FLEX evaluations [35]. The Dresden ESEP results, combined with the robust FLEX storage buildings and haul paths, collectively demonstrate the expected meaningful plant risk improvements resulting from FLEX. In addition, planned installations for a Hardened Containment Venting System (HCVS) for containment venting and Severe Accident Water Addition (SAWA) strategies for an alternate water pathway between the Ultimate Heat Sink

(UHS) and containment will both further reduce risk by these enhanced capabilities for maintaining containment integrity.

High-frequency exceedances (>10 Hz) are less damaging to structures due to their correspondingly small displacements and will be addressed via limited scope high-frequency confirmations. These confirmations will be performed in accordance with EPRI 3002004396," High Frequency Program: Application Guidance for Functional Confirmation and Fragility Evaluation" (pending NRC endorsement).

This report provides risk insights which indicate that a relatively low SCDF would result in consideration of the reevaluated Dresden seismic hazard, enhancements made in response to IPEEE equipment insights, robust ESEP SSC's, containment integrity results from the IPEEE, and low Dual Unit Loss of Off-Site Power (DLOOP) risk estimates performed in a manner consistent with the IN 2010-18 methodology [16]. The SCDF estimates indicate significant margin below the Commission's Safety Goal Policy Statement subsidiary objectives of 1E-4/yr for Core Damage Frequency [15]. Additionally, the robust plant design is evident by the back-up AC power capabilities; three Emergency Diesel Generators (EDGs) and two Station Blackout (SBO) EDGs) which are not completely seismically correlated, and able to be cross tied between units, as well as the AC independent (High Pressure Coolant Injection) HPCI and Isolation-Condenser systems.

Based on the above considerations, Exelon concludes that performance of an SPRA for Dresden would not provide significant additional seismic risk insights and proposes Dresden be granted relief from the requirement to perform a seismic risk assessment. Additional information supporting this conclusion is provided below.

3.0 SUMMARY OF TECHNICAL BASIS

3.1 Seismic Hazard Information and Screening

An assessment of the significance of the increased seismic hazard level on the Dresden plant site has been performed. The assessment includes discussion of the inherent margin in the nuclear power plant design process, which is afforded by conservative design assumptions. In addition, Exelon has performed simplified seismic risk calculations, based on the updated EPRI 2013 seismic hazard for Dresden [18] and consistent with the IN 2010-18 Methodology [16], which indicate that the Dresden seismic design continues to provide margin to withstand potential earthquakes exceeding the seismic design basis. This modest SSE exceedance for the new seismic hazard combined with the seismic risk estimation indicates that a relatively low seismic risk is expected for Dresden Units 2 and 3. The details supporting this conclusion are provided in the sub-sections below.

3.1.1 Significance of Design Exceedances

In February 2013, EPRI published seismic evaluation guidance EPRI 1025287 "Seismic Evaluation Guidance, Screening, Prioritization, and Implementation Details (SPID)" [6], which provided a screening process for evaluating updated site-specific seismic hazard and GMRS estimates against the plant Safe Shutdown Earthquake (SSE) or alternatively the IPEEE HCLPF Spectra (IHS) curve. On March 31, 2014, Exelon submitted the results of its screening assessment to the NRC [7]. The Dresden horizontal GMRS is described in Section 2.4 of Reference 7.

Although the Dresden GMRS exceeds the Safe Shutdown Earthquake (SSE) by a maximum factor of 1.78 in the 1 to10 Hz range, there is confidence that the Seismic Category I structures will remain functional. Inherent conservatism in the design process and insights from past risk evaluations, such as those described in EPRI NP-6041 [9] provide confidence that risk-significant structures, systems, and components (SSCs) will remain functional for the reevaluated seismic hazard (GMRS) demands.

The Dresden GMRS has a peak ground acceleration (PGA) of 0.246g and a peak spectral acceleration of 0.587g at approximately 15 Hz per Section 2.4 of Reference 7. The Dresden horizontal SSE, described in Section 3.1 of Reference 7, is a broad-banded spectrum with a peak ground acceleration of 0.200 g and a peak spectral acceleration of 0.330g at approximately 5 Hz. Figure 3-1, below, provides the comparison of the Dresden SSE, GMRS, and RLGM response spectra. The Dresden RLGM is discussed in Section 3.2.2, below.

The reevaluated GMRS exceeds the Dresden SSE above 5 Hz. The ratio of the exceedance of GMRS to SSE is 1.78 at 10 Hz, which is the upper bound of the critical frequency range for screening considerations. In the high frequency range (>10 Hz), the ratio of GMRS to SSE is greater than 1.78, however, structural displacements in this frequency range are small and are considered non-damaging. For high-frequency sensitive components, such as electrical relays, a limited-scope high frequency evaluation will be performed in accordance with EPRI 3002004396 (pending NRC endorsement), to ensure adequate seismic margin exists for those components.

The Dresden Seismic Category I structures are judged to remain functional at the GMRS level based on the results of past industry SPRAs and conservatisms in the nuclear power plant design process. EPRI Report NP-6041-SL, Revision 1, A Methodology for Assessment of Nuclear Power Plant Seismic Margin [9], describes that for U.S. plants in lower seismic zones, for which SSE levels are commonly set at 0.12g and 0.25g peak ground acceleration (Note: Dresden SSE is 0.20g), past SPRAs have indicated that the dominant risk comes from earthquake ground motion that is 2 to 5 times larger than the

design SSE level. An additional source of conservatism is the design process itself. Examples include:

- Safety factors applied in design calculations
- Damping values used in the dynamic analysis of SSCs
- Bounding synthetic time histories for in-structure response spectra calculations
- Broadening criteria for in-structure response spectra
- Response spectra enveloping criteria typically used in SSC analysis and testing applications
- Response spectra based frequency domain analysis rather than explicit time history based time domain analysis
- Bounding requirements in codes and standards
- Use of minimum strength requirements of structural components (concrete and steel)
- Bounding testing requirements, and
- Ductile behavior of the primary materials (that is, not crediting the additional capacity of materials such as steel and reinforced concrete beyond the essentially elastic range, etc.)

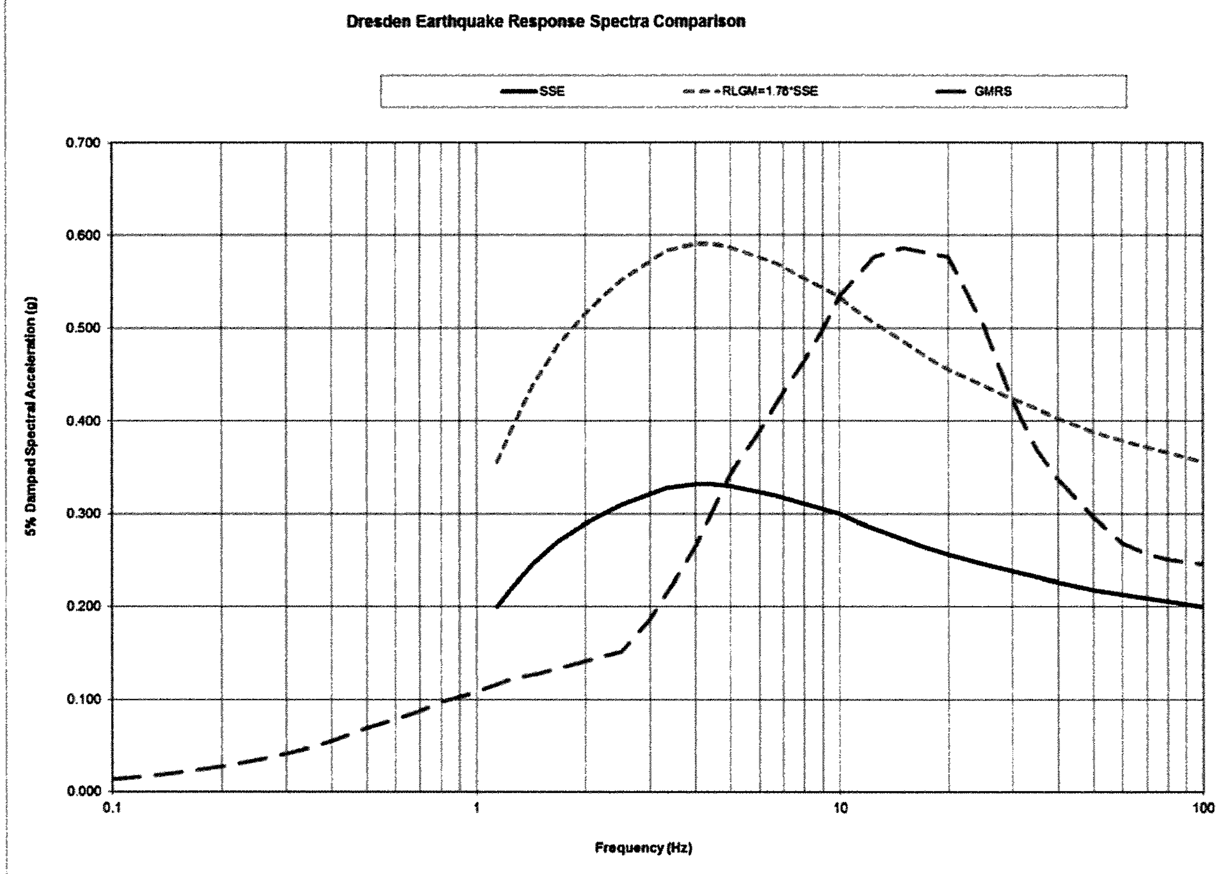

Figure 3-1: Comparison of Dresden SSE, GMRS, and RLGM response spectra

3.1.2 GI-199 CEUS Seismic Hazard Insights

Simplified seismic risk calculations, based on the updated EPRI 2013 seismic hazard, indicate that the Dresden seismic design continues to provide margin to withstand potential earthquakes exceeding the seismic design basis, as was also concluded in Information Notice (IN) 2010-18 USNRC 2010 Safety / Risk Assessment for GI-199 [16].

The United States Nuclear Regulatory Commission (USNRC) performed seismic risk calculations in IN 2010-18 for GI-199 [16]. The simplified calculations involved estimating the plant seismic fragility (i.e., conditional probability of plant damage at a given seismic hazard input level) from the results of the earlier IPEEE submittals, and convolving that plant fragility estimate with various seismic hazard curves to obtain SCDF estimates. EPRI also conducted a similar assessment of SCDFs for the fleet of CEUS plants using the same IPEEE-derived plant level fragilities combined with the new site-specific seismic hazard curves [17]. Table 3-1 provides the results for the simplified seismic risk calculations for Dresden from IN 2010-18. Table 3-1 also provides results for a surrogate seismic risk calculation for Dresden performed by Exelon [38] to

approximately reproduce the Dresden SCDF results in a manner consistent with those included with the fleet SCDF results in EPRI letter RSM-031114-077 [17].

The SCDF estimates in Table 3-1 are based on assuming a plant level fragility for Dresden corresponding to a high confidence of low probability of failure (HCLPF) value of 0.2g peak ground acceleration (PGA) per the IN 2010-18 GI-199 calculation [16]. When using the IN 2010-18 GI-199 methodology [16] to convolve the plant level HCLPF value of 0.2g PGA with the EPRI 2013 hazard curve for Dresden [18], the simplified SCDF is estimated to be in the low E-05/yr range (i.e., between 1E-05/yr and 3E-05/yr), which is below the Commission's Safety Goal Policy Statement subsidiary objective of 1E-4/year, as identified in RG 1.174 [15].

The simplified SCDF values in Table 3-1 are believed to overestimate the seismic risk because there are reasons why the plant level HCLPF is expected to be higher than 0.2g. For example, the Dresden IPEEE [19] identified that the Condensate Storage Tanks (CSTs) had a HCLPF of 0.2g PGA. However, the Seismic Category 1 suppression pool, which has a HCLPF of 0.28 g [19], remains as a backup water source given seismic failure of the CST. Therefore, using a HCLPF of 0.2g based on the CST seismic capacity underestimates the plant response seismic capacity.

The Dresden ESEP evaluation [10] provides recent information to support this conclusion. The ESEP evaluated HCLPF values for a selected set of SSCs for a single success path. The single success path study HCLPF is actually a conservative surrogate for a higher plant HCLPF value that would be expected in an SPRA. Components evaluated in that study support single success path HCLPF values >0.356g. As shown in Table 3-1, when assuming an increase in the plant HCLPF value from 0.2g to 0.356g based on the limiting HCLPF value in the ESEP, the simplified SCDF estimate performed by Exelon [38] decreased by roughly a factor of 3 from the low E-05/yr range down to the mid E-06/yr range (i.e., between 4E-06/yr and 6E-06/yr). Refer to Section 3.2.1 for additional information on Dresden component HCLPF values.

In addition, information from the Dresden ESEP report [10] and the NTTF 2.3 walkdown report [11] related to the availability of FLEX equipment and strategies, and plant and procedural improvements, support a conclusion that the minimum plant level HCLPF for Dresden is likely higher than 0.2g. This supports an expectation that the simplified SCDF estimate is conservatively high and that there is further margin below the subsidiary SCDF safety goal objective [15].

This information supports the conclusion that the current Dresden seismic design continues to provide a safety margin to withstand potential earthquakes exceeding the seismic licensing basis, as was concluded in IN 2010-18 [16] and reiterated in EPRI letter RSM-031114-077 [17].

Table 3-1
SIMPLIFIED SCDF CALCULATIONS FOR DRESDEN USING METHODOLOGY OF IN 2010-18 for GI-199 [16]

PGA Fragility Data			Simplified Seismic CDF Estimate (/yr) Seismic Hazard Curve Input (PGA)			
Plant HCLPF	Median Capacity (C_{50})	$Beta_C$	2008 USGS(2)	1989 EPRI(3)	1994 LLNL(4)	2013 EPRI
0.2g(1)	0.51g(1)	0.4(1)	1.9E-05	2.3E-06	8.4E-06	Low E-05(5)
0.26g(6)	0.66g(6)	0.4(1)	(10)	(10)	(10)	High E-06(7)
0.356g(8)	0.90g(8)	0.4(1)	(10)	(10)	(10)	Mid E-06(9)

Notes to Table 3-1:

(1) Plant level PGA fragility data provided for Dresden in Table C-2 of IN 2010-18 [16].
(2) Simplified SCDF result provided in Table D-1 of [16] based on convolving plant level fragility data with 2008 USGS hazard curve (PGA).
(3) Simplified SCDF result provided in Table D-2 of [16] based on convolving plant level fragility data with 1989 EPRI hazard curve (PGA).
(4) Simplified SCDF result provided in Table D-3 of [16] based on convolving plant level fragility data with 1994 LLNL hazard curve (PGA).
(5) Exelon calculation for simplified SCDF result based on convolving plant level fragility data [16] with 2013 EPRI hazard curve (PGA) [18]. The "Low E-05" range is identified as between 1E-05/yr and 3E-05/yr.
(6) An assumed plant HCLPF of 0.26g (PGA) is based on an evaluation of the IPEEE identified plant improvements discussed in Section 3.2.1. A plant HCLPF of 0.26g is calculated to result in a median capacity of 0.66g per equation (C-3) of IN 2010-18 [16].
(7) Exelon calculation for simplified SCDF result based on convolving assumed plant level HCLPF of 0.26g (PGA) with 2013 EPRI hazard curve (PGA) [18]. The "High E-06" range is identified as between 7E-06/yr and 9E-06/yr.
(8) An assumed plant HCLPF of 0.356g (PGA) is based on the limiting component HCLPF in the ESEP evaluation discussed in Section 3.1.2. A plant HCLPF of 0.356g is calculated to result in a median capacity of 0.90g per equation (C-3) of IN 2010-18 [16]
(9) Exelon calculation for simplified SCDF result based on convolving assumed plant level HCLPF of 0.356g with 2013 EPRI hazard curve (PGA) [18]. The "Mid E-06" range is identified as between 4E-06/yr and 6E-06/yr
(10) Additional Exelon calculations not performed using the 2008 USGS, 1989 EPRI, and 1994 LLNL seismic hazard curves.

3.2 Robust Plant Seismic Capability

Dresden maintains a robust plant seismic capability, as evidenced by completion of NTTF 2.3 Seismic Walkdowns, completion of the ESEP, use of redundant and diverse key safety functions (defense-in-depth), completion of a Seismic Margins Assessment (SMA) based IPEEE, evaluation of containment risk insights, and use of robustly designed SSCs for the new FLEX implementation strategies per NEI 12-06 [34], including on-site FLEX storage buildings. The details supporting this conclusion are discussed in the sub-sections below.

3.2.1 NTTF 2.3 Seismic Walkdowns

Exelon performed seismic walkdowns of Dresden Units 2 and 3 in accordance with NRC endorsed guidance (EPRI 1025286) [21] and the submitted reports concluded [11] that no adverse anchorage conditions, no adverse seismic spatial interactions, and no adverse seismic conditions existed for the examined equipment. Further, these walkdowns confirmed the implementation of the IPEEE vulnerabilities, effectively increasing the limiting HCLPF over that identified from the IPEEE (based on plant improvements).

In response to the NTTF Recommendation 2.3, Dresden performed seismic walkdowns [11] to verify that the current plant configuration is consistent with the design basis, verify the adequacy of current strategies, monitoring, and maintenance programs, and identify degraded, nonconforming, or unanalyzed conditions. The walkdowns were performed in accordance with NRC endorsed guidance (EPRI 1025286) [21] and determined that no adverse anchorage conditions, no adverse seismic spatial interactions, and no adverse seismic conditions existed for the examined equipment. Any potentially degraded, non-conforming, or unanalyzed conditions identified during the seismic walkdown program were assessed in accordance with the plant corrective action program, and were identified as being minor issues. All of these items have now been resolved.

Plant improvements and "outliers" or "vulnerabilities" identified in the Dresden seismic Individual Plant Examination of External Events (IPEEE) were reviewed as part of the NTTF 2.3 Seismic Walkdowns. Plant improvements were implemented to improve seismic capacity. In the case of a few electrical buses, identified as having limiting HCLPF's, seismic bracing was added to the cabinets to improve lateral resistance. The HCLPF for these selected components increased from 0.20g PGA to greater than 0.30g PGA [4] such that the electrical buses are no longer limiting.

Based on the IPEEE identified plant improvements, the lowest component HCLPF has been evaluated to increase from 0.2g to 0.26g to correspond to the limiting HCLPF of an EDG fuel oil day tank [19]. As discussed in Section 3.1.2, failure of the CSTs alone would not lead to core damage, supporting that the HCLPF of 0.2g for the CSTs should not be used as a surrogate for the plant HCLPF. Therefore, a sensitivity case to calculate the simplified Dresden SCDF can be based on assuming a plant HCLPF of 0.26g. As shown in Table 3-1, when convolving an assumed plant level HCLPF value of 0.26g PGA with the EPRI 2013 hazard curve for Dresden [18], the simplified SCDF performed by Exelon [38] is estimated to be in the high E-06/yr range (i.e., between 7E-06/yr and 9E-06/yr), which is significantly below the Commission's Safety Goal Policy Statement subsidiary objective of 1E-4/yr [15].

This simplified SCDF estimate, using the EPRI 2013 hazard curve and a plant limiting HCLPF of 0.26g, is similar to the simplified SCDF of 8.4E-06/yr in Table 3-1 for the 1994 Lawrence Livermore National Laboratory (LLNL) hazard curve based on the GI-199

calculations [16]. This sensitivity case indicates that when accounting for both the changes for the EPRI 2013 hazard curve and the IPEEE identified plant improvements, the seismic risk for Dresden has not significantly changed when compared to the GI-199 calculations with the LLNL hazard curve.

3.2.2 Expedited Seismic Evaluation Process (ESEP)

Exelon performed the ESEP to demonstrate seismic margin through a review of a subset of the plant equipment that can be relied upon to protect the reactor core following beyond design basis seismic events. The ESEP for Dresden provided an important demonstration of seismic margin through evaluations of plant equipment that can be relied upon to protect the reactor core following beyond design basis seismic events.

In developing FLEX strategies for Dresden, Exelon considered a three phase approach: (1) Initially coping by reliance on installed plant equipment, (2) Transition from installed plant equipment to on-site equipment, and (3) Obtain additional capability and redundancy from off-site equipment until power, water, and coolant injection systems are restored or commissioned. These strategies are described in the December 26, 2014 summary report [10] and are briefly described below.

From Dresden FLEX 6 month update of Aug. 2014 [20]:

- At the initiation of the event with an Extended Loss of AC Power (ELAP), Dresden Phase 1 will rely on (High Pressure Coolant Injection) HPCI for Reactor water level and pressure control. Approximately 2.5 hours of HPCI operation is available in Phase 1.
- Within the initiation timeframe, a proposed pre-staged FLEX Makeup Pump would be lined up to take suction off of an Emergency Core Cooling System (ECCS) Ring Header and discharge into each Unit's Isolation Condenser, Reactor Pressure Vessel (RPV), and Spent Fuel Pool (SFP) via temporary connections. The proposed FLEX Makeup Pumps will be powered by a proposed portable FLEX Diesel Generator via temporary connections. This provides continuous makeup to both Units for approximately 14 hours.
- During the 14 hours of available makeup from an ECCS Ring Header, a portable submersible pump is deployed to take suction from the UHS and discharge to a Unit's Suppression Pool for long-term makeup to a FLEX Makeup Pump. Long term makeup water source will be available before the water contained in the Suppression Pools for both Units is exhausted.

A portable FLEX DG will also be pre-staged in a robust structure near the Reactor Building. Prestaging in this manner allows timely implementation of the FLEX strategies by not requiring transport of the generator prior to use. The generator is a portable

(trailer mounted) unit that will be connected through the use of temporary cabling. The robust structure that will house the FLEX DG will accommodate running of the DG within the building.

For the purpose of demonstrating that the Expedited Seismic Equipment List (ESEL) items have sufficient seismic capacity to meet or exceed the demand characterized by the RLGM, a seismic margins assessment was performed for the Dresden ESEL SSCs. Consistent with NRC endorsed guidance [5], the deterministic approach using the conservative deterministic failure margin (CDFM) methodology of EPRI NP-6041 [9] was utilized to develop HCLPF capacities. The seismic margin calculations included: (1) performing seismic capability walkdowns for equipment to evaluate the equipment installed plant conditions, (2) performing screening evaluations using the screening tables in EPRI NP-6041, and (3) performing HCLPF calculations considering various failure modes that include both structural (e.g., anchorage, load path, etc.) and functional failure modes.

The RLGM for Dresden was determined in accordance with Section 4 of EPRI 3002000704 by linearly scaling the Dresden SSE (5% damping) by the maximum GMRS/SSE ratio between 1 and 10 Hz. This resulted in a maximum GMRS/SSE ratio of 1.78 at 10 Hz. The Dresden RLGM has a peak ground acceleration of 0.356g and a peak spectral acceleration of 0.591g at approximately 4 Hz [10, Table 5-2].

The ESEP was implemented using NRC endorsed guidance [5]. All equipment evaluated for the ESEP was found to have adequate capacity for the Dresden RLGM and no equipment modifications were required. The conservative design practices, previously discussed, and seismic margin insights combine to increase confidence that safety significant SSC's will continue to fulfill their functions at RLGM ground motion levels.

3.2.3 Emergency / Back-up AC Power and LOOP Mitigation Capability

Seismic events often induce a Loss of Offsite Power (LOOP). Dresden relies, in part, on a defense-in-depth approach to help prevent and mitigate seismic accidents that may result in the offsite release of radionuclides. This approach includes the use of redundant and diverse key safety functions. Dresden has the following plant features to support defense-in-depth to mitigate LOOP and station blackout (SBO) events:

- There are three Emergency Diesel Generators (EDGs), one dedicated EDG for each unit (EDG 2 for Unit 2 and EDG 3 for Unit 3) and a swing EDG (EDG 2/3) that can be aligned to supply power to either unit [28]. Given a LOOP event, procedural guidance allows various cross-tie alignments to provide AC power from individual station EDGs to either unit [29, 30].

- Each unit is equipped with a Station Blackout EDG (SBO DG2 for Unit 2 and SBO DG3 for Unit 3) for responding to SBO conditions [31]. Given a LOOP

event, each SBO DG can be procedurally cross-tied to provide power to either unit [30]. In addition, each SBO DG has sufficient capacity to support safe shutdown of both units [32].

- Each unit has an AC independent High Pressure Coolant Injection (HPCI) system that can be used to support RPV pressure control and RPV inventory control

- Each unit has an AC independent Isolation Condenser (IC) system that can be used to support RPV pressure control and RPV inventory control

In addition, the following plant features provide additional defense-in-depth with respect to reducing seismic risk:

- EDG 2 is located in the Unit 2 Turbine Building (El. 517'), EDG 3 is located in the Unit 3 Turbine Building (El. 517')[1], and swing EDG 2/3 is located in the Seismic Category 1 Unit 2/3 Reactor Building (El. 517').

- SBO DG2 and SBO DG3 are located in the Seismic Category 1 SBO Building [36].

- Given that SBO DG2 and SBO DG3 are located in a separate Seismic Category 1 building and are of a significantly different design [36] than the three (3) station EDGs, the seismic response of SBO DG2 and SBO DG3 can be considered, from a risk perspective, to be different than that of EDG 2, EDG 3, and EDG 2/3, i.e., in an SPRA, the seismic failure probabilities of SBO DG2 and SBO DG3 can be modeled as not completely correlated with the three (3) station EDGs. Thus, there is redundancy in the onsite emergency AC power capability from a seismic fragility perspective.

3.2.4 IPEEE Related Plant Changes / Insights

In June, 1991, NRC issued a Generic Letter requesting that all licensees perform an IPEEE to identify plant-specific vulnerabilities to severe accidents. In December 1997, Dresden submitted its response to the NRC [19]. Dresden is categorized as a 0.3g focused-scope plant in accordance with NUREG-1407 [27]. For the seismic evaluation, Dresden used the EPRI seismic margins assessment as described in EPRI NP-6041[9] and NUREG-1407.

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[1] Per Section 3.8.5 of the Dresden UFSAR [26], the diesel generators and other standby electrical equipment represent seismic Class I structures, systems, and components (SSCs) that are located in Class II structures. The Class II structures supporting Class I SSCs were designed to Class II requirements, but have been investigated to assure that the integrity of the Class I items is not compromised.

The Dresden Station IPEEE Seismic Margins Assessment (SMA) did not identify any overall seismic concerns [19]. The IPEEE submittal report [19] concluded that Dresden has reasonable margin with respect to its licensing basis earthquake based on experience with actual industrial facilities in moderate to severe earthquakes. Subsequent design changes, to address IPEEE insights, have been implemented to improve seismic margin of risk-significant SSC's. Changes included improving anchorages of motor control centers, adding lateral bracing to electrical equipment cabinets, addressing seismic interaction issues, and connecting electrical panels together to preclude 'slamming' effects. A summary of Dresden IPEEE results and modifications incorporated to resolve identified issues is provided below. Particular focus is made on modifications that are judged to have a beneficial risk impact.

The beyond-design-basis SMA was performed assuming a review level earthquake (RLE) spectrum anchored to 0.3g PGA. The majority of components on the IPEEE Success Path Equipment List (SPEL) had capacities greater than or equal to the RLE, which demonstrates seismic capacity beyond the design basis. However, there were some items with HCLPFs less than the RLE. The limiting HCLPF capacity was reported to be 0.20g PGA, controlled by a few electrical buses and two CSTs. Therefore, the IPEEE HCLPF spectrum (IHS) was defined as a NUREG/CR-0098 rock spectrum anchored to 0.2 PGA.

Dresden has implemented design changes to improve the seismic margin of risk-significant SSC's. Changes included improving anchorage of motor control centers, adding lateral bracing to electrical equipment cabinets, addressing seismic interaction issues, and connecting electrical panels together to preclude 'slamming' effects. The implementation of these changes was confirmed as part of the NTTF 2.3 Seismic Walkdowns discussed in Section 3.2.1 of this report.

Containment Integrity

Dresden also performed a specific IPEEE walkdown for containment integrity [19]. The purpose of the containment integrity walkdown was to identify vulnerabilities associated with early containment failure due to a postulated seismic event. The scope of the walkdown included the integrity of the containment itself, isolation systems such as valves, mechanical and electrical penetrations, bypass systems, and plant-unique containment systems such as igniters and active seals [19].

Section 3.5 of the Dresden IPEEE submittal [19] states:

Virtually all power-actuated valves were reviewed either as part of the USI A-46 or IPEEE program efforts. In addition, all other isolation valves along with their associated solenoid valves were at least walked by and no concerns were found. Typical configurations were assessed from both inside and outside the drywell. No piping supports were observed to provide a 'hard point' so all systems have sufficient flexibility to withstand differential displacement between the reactor building and drywell containment.

The personnel and equipment hatches were walked down. The personnel air lock and equipment access hatch were judged to be rugged with no credible seismic vulnerabilities. No 'active' isolation systems are utilized.

The main steam and other mechanical penetrations are welded to the steel containment. Some can accommodate thermal movement and there are also those which experience relatively little thermal stress. No concerns were noted.

Electrical penetration areas are also welded assemblies that are leak tight and exhibit no credible seismic vulnerabilities. Instrument line penetrations also are welded configurations with numerous small diameter lines welded to header plates on the penetrations. As with previous penetrations, no plausible seismic vulnerabilities leading to early containment failure could be reasonably postulated.

In summary, the IPEEE report stated that, with respect to seismic hazard, no early containment failure features could be identified by virtue of the drywell (containment) walkdown.

3.2.5 Containment Risk Insights

Risk insights on containment performance were evaluated in the 1996 Dresden Individual Plant Examination (IPE) for internal events [14]. Containment performance can be characterized by Large Early Release Frequency (LERF). The LERF from the Dresden Rev. 1 IPE [14] was 1.6E-7/yr, which is significantly below the surrogate quantitative health objective of 1E-5/yr for LERF [15].

Additional confidence in the adequacy of containment seismic response, and on seismic large early release frequency (SLERF), can be gained by considering containment structure response relative to the new GMRS and insights from the Dresden internal events PRA model [13].

The seismic robustness of containment is also supported by IPEEE seismic margins calculations [19], which estimated the containment drywell and suppression pool (torus) to have HCLPFs of 0.5g PGA and 0.28g PGA, respectively. The drywell steel pressure

boundary has increased seismic capacity because it is keyed to the basemat to prevent slippage under lateral earthquake loads. The IPEEE submittal states that the torus HCLPF value is conservative and that seismic demands are not usually a controlling load case in torus evaluations.

The 1999 Dresden Level 1 and Level 2 LERF Full Power Internal Events (FPIE) PRA model was peer reviewed in January 2001 [25] against the NEI PRA Peer Review Process Guidance [22]. All significant facts and observations (i.e., Level A and B) from the 2001 peer review were resolved and dispositioned as part of the Exelon Risk Management PRA update and maintenance process in accordance with Exelon procedures. The Dresden Level 1 and Level 2 PRA models were also periodically updated in 2005, 2009, and 2013. Although the Dresden PRA models and documentation have not been peer reviewed against the ASME/ANS PRA Standard [24], following the periodic PRA updates in 2005, 2009, and 2013, Exelon performed a self-assessment of the updated Dresden PRA model and documentation against the available versions of the ASME/ANS PRA Standard (e.g., Reference [24]) addressing the NRC qualifications noted in Regulatory Guide (RG) 1.200 [23]. The purpose of the self-assessment was to confirm that the Dresden PRA model and documentation have been reviewed considering any potential "gaps" between the technical requirements in the version of the ASME PRA Standard in effect when the 2001 peer review was conducted and that endorsed in [23] to support maintaining a high level of PRA technical capability. The latest self-assessment performed in 2013 did not identify any significant technical issues associated with the Dresden PRA model or documentation [37].

The Level 2 LERF evaluation includes accounting for early release scenarios as identified in Table 2-2.8-9 of the ASME/ANS PRA Standard [24], such as Mark I shell failure, containment bypass scenarios, and containment venting. In addition, the radionuclide release magnitude and timing characterization is based on plant specific thermal-hydraulic calculations, Emergency Action Levels (EALs), and evacuation studies. The current 2013 Dresden Level 2 FPIE LERF value is 7.3E-7/yr [13].

The Dresden FPIE PRA model [13] also provides insights about the containment performance under beyond design basis seismic events from the plant systems perspective. The results from the FPIE dual unit Loss of Offsite Power (DLOOP) initiating event can be used to provide appropriate risk insights because beyond design basis seismic events can be generally modeled as DLOOP events. The conditional Large Early Release Probability (LERP) from the FPIE PRA model is based on the Large Early Release Frequency (LERF) due to a DLOOP event given the Core Damage Frequency (CDF) due to a DLOOP event. Based on the Dresden 2013 FPIE PRA update, the CDF due to DLOOP events is 1.6E-7/yr, and the LERF due to DLOOP events is 3.3E-8/yr [13]. Therefore, the conditional LERP due to a DLOOP event is (3.3E-8/yr)/(1.6E-7/yr), or approximately 0.2. Given that seismic events can be modeled as DLOOP events in the PRA, and given the conclusion above regarding the structural capability of the containment, the relatively low conditional LERP from FPIE DLOOP

events can be used as a surrogate risk insight to support that the Dresden containment analysis is robust and can provide defense-in-depth for seismic events from a plant systems perspective.

3.2.6 FLEX Storage Buildings, Haul Paths, and Overall FLEX Risk Insights

3.2.6.1 Storage Buildings

FLEX storage buildings will be utilized to store Phase 2 equipment relied upon for mitigation of beyond design basis events, including seismic. The inherent robustness of these Dresden FLEX building designs will enable them to remain functional for seismic demands consistent with ASCE 7-10 [12]. The supporting basis for this conclusion is provided below.

Phase 2 of FLEX relies on the use of portable equipment to maintain Reactor Core Cooling and Heat Removal, Reactor Inventory Control, Containment Function, and Spent Fuel Pool Cooling. Dresden has two robust FLEX storage buildings that function as protected storage facilities for FLEX equipment such as vehicles for towing and haul path debris removal, portable pumps and generators, hoses, tools, cabling, lights, and fans.

Both FLEX buildings are being constructed with reinforced concrete and are designed to resist tornado wind, tornado-borne missiles, severe wind, snow/ice, and seismic demands [8]. The design of the buildings is based on the provisions of ASCE 7-10 [12]. The design assumes importance factors consistent with Risk Category IV (Essential Facility). This risk category is the highest in ASCE 7-10 and typically includes structures, the failure of which would inhibit the availability of essential community services necessary to cope with an emergency situation (e.g., hospitals, police stations, fire stations, and emergency communication centers). The consideration of tornado wind, tornado-borne missiles, as well as consideration of ASCE 7-10 provisions, contributes to the robustness of the Dresden FLEX buildings.

3.2.6.2 Haul Paths

In addition to structural considerations, the potential for haul path liquefaction was also assessed. The haul paths, on which equipment will be transported, were assessed to have acceptable factors-of-safety against the effects of liquefaction. Regarding haul path soil liquefaction, the Dresden FLEX six month update from Aug. 2013 states [20]:

> "It is not expected that Dresden roads would be subject to damage caused by liquefaction in a seismic event.
>
> The Dresden UFSAR [33] describes the site geology as a thin (less than 10-foot) mantle of soil, mostly glacial drift, overlying bedrock at the site.

Per Section 2.1.3 of the Dresden West ISFSI 10 CFR 72.212 Evaluation Report [35], Dresden is located in seismic zone 1. Using an empirical technique outlined in the NAVFAC Design Manual (DM-7.3) to evaluate liquefaction potential of soils, for sites in seismic zone 1, a factor of safety in excess of 5 was calculated for the granular deposits encountered in the Dresden East ISFSI soil borings.

With a safety factor of 5 for soil liquefaction, the potential for liquefaction is low. Therefore, soil liquefaction will not be considered for assessment within the site boundary."

Per Section 5.2 of [34], all sites will consider the seismic hazard. Thus Dresden screens in for an assessment for seismic hazard except for liquefaction.

Regarding haul path debris removal, the Dresden FLEX six month update from Aug. 2013 [20] states:

"Transportation routes will be developed from the equipment storage area to the FLEX staging areas. An administrative program will be developed to ensure pathways remain clear or compensatory actions will be implemented to ensure all strategies can be deployed during all modes of operation. Identification of storage areas and creation of the administrative program are open items."

Dresden employs a F-750 Heavy Duty Truck with an installed reinforced plow to remove snow and ice and other debris.

3.2.6.3 Overall FLEX Contribution to Mitigating Risk

The Dresden incorporation of FLEX strategies to mitigate beyond-design-basis events per [34], including seismic, is a significant safety enhancement. A quantitative measure of the risk benefit for FLEX equipment is not available without performing more detailed evaluations (e.g., seismic capacity of the FLEX building, human reliability analysis of the FLEX procedures). However, credit for the FLEX equipment and associated mitigation strategies will help reduce seismic risk by providing additional defense-in-depth for responding to Extended Loss of AC Power (ELAP) events that are generally amongst the dominant contributors to SCDF. Successful implementation of the FLEX equipment in conjunction with the existing installed equipment will extend the Station Blackout coping time in order to support reaching a safe stable end state. By providing additional back-up power and water sources and pathways as described in the ESEP Section 3.2.2 above, FLEX supports mitigation of these critical risk contributors and improves overall plant seismic risk.

3.2.6.4 Hardened Containment Venting System (HCVS)

In addition to Dresden's FLEX mitigation strategy, Dresden plans to install a reliable Hardened Containment Venting System (HCVS) for each unit to meet the intent of the NRC order and industry guidance [39]. The HCVS system can be actuated from a remote operating station and allows venting of the containment through the wetwell. The

Dresden Unit 3 HCVS is planned for installation by the end of 2016 and Unit 2 is planned for installation by the end of 2017.

Dresden is also currently in the planning and preliminary design phase to incorporate Severe Accident Water Addition (SAWA) strategies as part of Phase 2 of the NRC order and industry guidance [39]. The plan will be to provide water from the UHS to the containment under severe accident conditions as described in reference 39.

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Enclosure 2

LS-MISC-30, Rev.1

LaSalle County Station, Units 1 and 2

Supplemental Information in Response to NRC Seismic Hazard Risk Evaluation and Seismic Hazard Prioritization Results
(19 pages)

RM DOCUMENTATION NO. LS-MISC-30 **REV: 1** **PAGE NO. 1**

STATION: LaSalle

UNIT(S) AFFECTED: Units 1 and 2

TITLE: Supplemental Information in Response to NRC Seismic Hazard Risk Evaluation and Seismic Hazard Prioritization Results

SUMMARY (Include Updating Requirement Evaluations (UREs) incorporated): The purpose of this document is to provide additional information regarding risk insights and the seismic capability of the LaSalle County Station to the NRC to support the staff decision-making process for providing SPRA relief to a limited number of priority Group 2 and 3 plants, including LaSalle, Units 1 and 2.

Documentation conforms to PRA Documentation "Category 1" per T&RM ER-AA-600-1012, because it will be provided to the NRC staff as a docketed submittal for NRC review/concurrence. Per the requirements of T&RM ER-AA-600-1012, this evaluation requires both independent review and approval.

[ ] Review required after periodic Update

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

Electronic Calculation Data Files:
(Program Name, Version, File Name extension/size/date/hour/min)

Calculation files stored on ERIN network in:

\\En1msfs01\en1nw501_vol3\DATA\PRA\ZPSADOC\PSA Support Applications\LaSalle Applications post May 1, 2008\LS-MISC-30.zip

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

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

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LASALLE COUNTY STATION, UNITS 1 AND 2
Supplemental Information in Response to NRC Seismic Hazard Risk Evaluation and Seismic Hazard Prioritization Results

1.0 BACKGROUND / SCOPE

Following the accident at the Fukushima Dai-ichi nuclear power plant resulting from the March 11, 2011 Great Tohoku Earthquake and subsequent tsunami, the Nuclear Regulatory Commission (NRC) established a Near Term Task Force (NTTF) to conduct a systematic review of NRC processes and regulations. The NTTF developed a set of recommendations ranging from ensuring protection from external events, enhancing mitigation, and strengthening emergency preparedness. On March 12, 2012, the NRC issued a 50.54(f) letter requesting information to assure that the NTTF recommendations were addressed by all U.S. nuclear power plants [1]. The letter requested that licensees reevaluate the seismic hazards at their sites utilizing present day NRC requirements and guidance. Licensees were required to submit their reevaluated hazards by March 31, 2014.

In a May 9, 2014 letter [2], the NRC provided the results of their review of industry submittals and prioritized the Central and Eastern United States (CEUS) plants into three groups. Group 1 plants are generally those plants that have the highest reevaluated hazards relative to their original licensing bases in the 1 to 10 Hz frequency range. Group 2 plants have higher reevaluated hazards relative to their original licensing bases. Group 3 plants have the lowest reevaluated hazards relative to their original licensing bases. NRC categorized LaSalle County Station (hereafter referred to as "LaSalle") as a Group 2 plant needing to perform a Seismic Risk Assessment, an Expedited Approach Evaluation as an interim action, and limited scope evaluations for high frequency and spent fuel pools.

In a May 21, 2015 public meeting related to NTTF 2.1 Seismic Issues [3], the NRC briefed that they are currently evaluating 50.54(f) responses and available information to support a determination that a Seismic Probabilistic Risk Assessment (SPRA) is not required for some Group 3 and a limited number of Group 2 plants. The NRC also briefed that available information supporting limited SPRA relief for these Group 2/3 plants will be drawn from (1) NTTF 2.1 Reevaluated hazard and interim actions, (2) NTTF 2.3 Seismic Walkdown reviews and inspections, (3) GI-199, CEUS seismic hazard insights, (4) Individual Plant Examinations of External Events (IPEEE) seismic plant capacity insights, and (5) Expedited Approach Evaluations.

The purpose of this document is to provide additional information regarding risk insights associated with the seismic capability of LaSalle to the NRC to support the staff decision-making process for providing SPRA relief for LaSalle, Units 1 and 2.

2.0 SUMMARY CONCLUSION

Detailed seismic margin evaluations, recent seismic walkdown confirmations, and risk insights, provide reasonable assurance that LaSalle Units 1 and 2 have seismic capacities to withstand the beyond design basis seismic demands documented in the LaSalle Seismic Hazard and Screening Report submitted on March 31, 2014 [7]. Plant specific evaluations, described herein, provide confidence that the installed plant equipment has sufficient seismic capacity, such that, when coupled with onsite FLEX equipment and off-site capability, the risk from beyond-design-basis seismic events remains below the Commission's Safety Goal Policy Statement subsidiary objectives of 1E-4/yr for Core Damage Frequency and 1E-5/yr for Large Early Release Frequency (LERF), as identified in Regulatory Guide (RG) 1.174 [15].

Although the LaSalle site-specific Ground Motion Response Spectra (GMRS) exceeds the Safe Shutdown Earthquake (SSE) by a maximum factor of 1.83 in the 1 to10 Hz range, there is confidence that the Seismic Category I structures will remain functional for GMRS demands. In addition, simplified seismic risk calculations [35], based on the updated EPRI 2013 seismic hazard, indicate an approximate seismic core damage frequency (SCDF) to be in the low E-06/yr range (i.e., between 1E-06/yr and 3E-06/yr), which is small relative to the Commission's Safety Goal Policy Statement subsidiary objective of 1E-4/yr, as identified in RG 1.174 [15].

The LaSalle Expedited Seismic Evaluation Process (ESEP) seismic margin evaluation reflects that the design of the key installed FLEX components is sufficiently robust so as to withstand the effects of ground motion commensurate with the LaSalle Review Level Ground Motion (RLGM) per the NRC endorsed EPRI ESEP guidance [5]. No plant modifications resulted from the ESEP efforts as all equipment evaluated had capacity at or above the RLGM seismic demand level [10]. Portable equipment and components required for LaSalle FLEX mitigation strategies will be stored on site in reinforced concrete structures designed to resist seismic, high-winds, and tornado events. The consideration of tornado wind, tornado-borne missiles, as well as consideration of ASCE 7-10 provisions [12], contributes to the robustness of the LaSalle FLEX buildings. Section 3.2.6.2 of this report describes that haul paths were evaluated for soil liquefaction based on FLEX evaluations [19]. The LaSalle ESEP results, combined with the robust FLEX storage buildings and haul paths, collectively demonstrate the expected meaningful plant risk improvements resulting from FLEX. In addition, planned installations for a Hardened Containment Venting System (HCVS) for containment venting and Severe Accident Water Addition (SAWA) strategies for an alternate water pathway between the Ultimate Heat Sink (UHS) and containment will both further reduce risk by these enhanced capabilities for maintaining containment integrity.

High-frequency exceedances (>10 Hz) are less damaging to structures due to their correspondingly small displacements and will be addressed via limited scope high-frequency confirmations. These confirmations will be performed in accordance with

EPRI 3002004396," High Frequency Program: Application Guidance for Functional Confirmation and Fragility Evaluation" (pending NRC endorsement).

This report provides risk insights which indicate that a relatively low SCDF would result in consideration of the reevaluated LaSalle seismic hazard, robust ESEP SSC's, containment integrity results from the IPEEE, and low Dual Unit Loss of Off-Site Power (DLOOP) risk estimates. The SCDF estimates, performed in a manner consistent with the IN 2010-18 methodology [16], indicate significant margin below the Commission's Safety Goal Policy Statement subsidiary objectives of 1E-4/yr for Core Damage Frequency [15]. Additionally, the robust plant design is evident by the back-up AC power capabilities (e.g., 5 Emergency Diesel Generators (EDGs)) which are not completely seismically correlated, and can be cross tied between units, as well as the AC independent Reactor Core Isolation Cooling (RCIC) system.

Based on the above considerations, Exelon concludes that performance of an SPRA for LaSalle would not provide significant additional seismic risk insights and proposes LaSalle be granted relief from the requirement to perform a seismic risk assessment. Additional information supporting this conclusion is provided below.

3.0 SUMMARY OF TECHNICAL BASIS

3.1 Seismic Hazard Information and Screening

An assessment of the significance of the increased seismic hazard level on the LaSalle plant site has been performed. The assessment includes discussion of the inherent margin in the nuclear power plant design process, which is afforded by conservative design assumptions. In addition, simplified seismic risk calculations, based on the updated EPRI 2013 seismic hazard for LaSalle [18] and consistent with the IN 2010-18 methodology [16], were performed and indicate that the LaSalle seismic design continues to provide margin to withstand potential earthquakes exceeding the seismic licensing basis. This modest SSE exceedance for the new seismic hazard (GMRS) combined with the seismic risk estimations indicate that a relatively low seismic risk is expected for LaSalle, Units 1 and 2. The details supporting this conclusion are provided in the sub-sections below.

3.1.1 *Significance of Design Exceedances*

In February 2013, EPRI published seismic evaluation guidance EPRI 1025287 "Seismic Evaluation Guidance, Screening, Prioritization, and Implementation Details (SPID)" [6], which provided a screening process for evaluating updated site-specific seismic hazard and GMRS estimates against the plant Safe Shutdown Earthquake (SSE) or alternately the IPEEE High Confidence of a Low Probability of Failure (HCLPF) Spectra (IHS)

curve. On March 31, 2014, Exelon submitted the results of its screening assessment to the NRC [7]. The LaSalle horizontal GMRS is described in Section 2.4 of Reference 7.

Although the LaSalle GMRS exceeds the Safe Shutdown Earthquake (SSE) by a maximum factor of 1.83 in the 1 to10 Hz range, there is confidence that the Seismic Category I structures will remain functional. Inherent conservatism in the design process and insights from past risk evaluations, such as those described in EPRI NP-6041 [9], provide confidence that risk-significant structures, systems, and components (SSCs) will remain functional for the reevaluated seismic hazard (GMRS) demands.

The LaSalle GMRS has a peak ground acceleration (PGA) of 0.317g and a peak spectral acceleration of 0.695g at approximately 10Hz. The LaSalle horizontal SSE, described in Section 3.1 of Reference 7, is a broad-banded spectrum with a peak ground acceleration of 0.20 g and a peak spectral acceleration of 0.54g in the 2-6.4 Hz range. Figure 3-1, below, provides the comparison of the LaSalle SSE, GMRS, and RLGM response spectra. The LaSalle RLGM is discussed in Section 3.2, below.

The reevaluated GMRS exceeds the LaSalle SSE above 5 Hz. The ratio of the exceedance of GMRS to SSE is 1.83 at 10 Hz [10, Table 5-1], which is the upper bound of the critical frequency range for screening considerations. In the high frequency range (>10 Hz), the ratio of GMRS to SSE is greater than 1.83 [10, Fig. 4-2], however, structural displacements in this frequency range are small and are considered non-damaging. For high-frequency sensitive components, such as electrical relays, a limited-scope high frequency evaluation will be performed in accordance with EPRI 3002004396 (pending NRC endorsement), to ensure adequate seismic margin exists for those components.

The LaSalle Seismic Category I structures are judged to remain functional at the GMRS level based on the results of past SPRAs and conservatisms in the nuclear power plant design process. EPRI Report NP-6041-SL, Revision 1, A Methodology for Assessment of Nuclear Power Plant Seismic Margin [9], describes that for U.S. plants in lower seismic zones, for which SSE levels are commonly set at 0.12g and 0.25g peak ground acceleration (Note: the LaSalle SSE is 0.20g), past SPRAs have indicated that the dominant risk comes from earthquake ground motions that are 2 to 5 times larger than the SSE level. An additional source of conservatism is the design process itself. Examples include:

- Safety factors applied in design calculations
- Damping values used in the dynamic analysis of SSCs
- Bounding synthetic time histories for in-structure response spectra calculations
- Broadening criteria for in-structure response spectra
- Response spectra enveloping criteria typically used in SSC analysis and testing applications

- Response spectra based frequency domain analysis rather than explicit time history based time domain analysis
- Bounding requirements in codes and standards
- Use of minimum strength requirements of structural components (concrete and steel)
- Bounding testing requirements, and
- Ductile behavior of the primary materials (that is, not crediting the additional capacity of materials such as steel and reinforced concrete beyond the essentially elastic range, etc.)

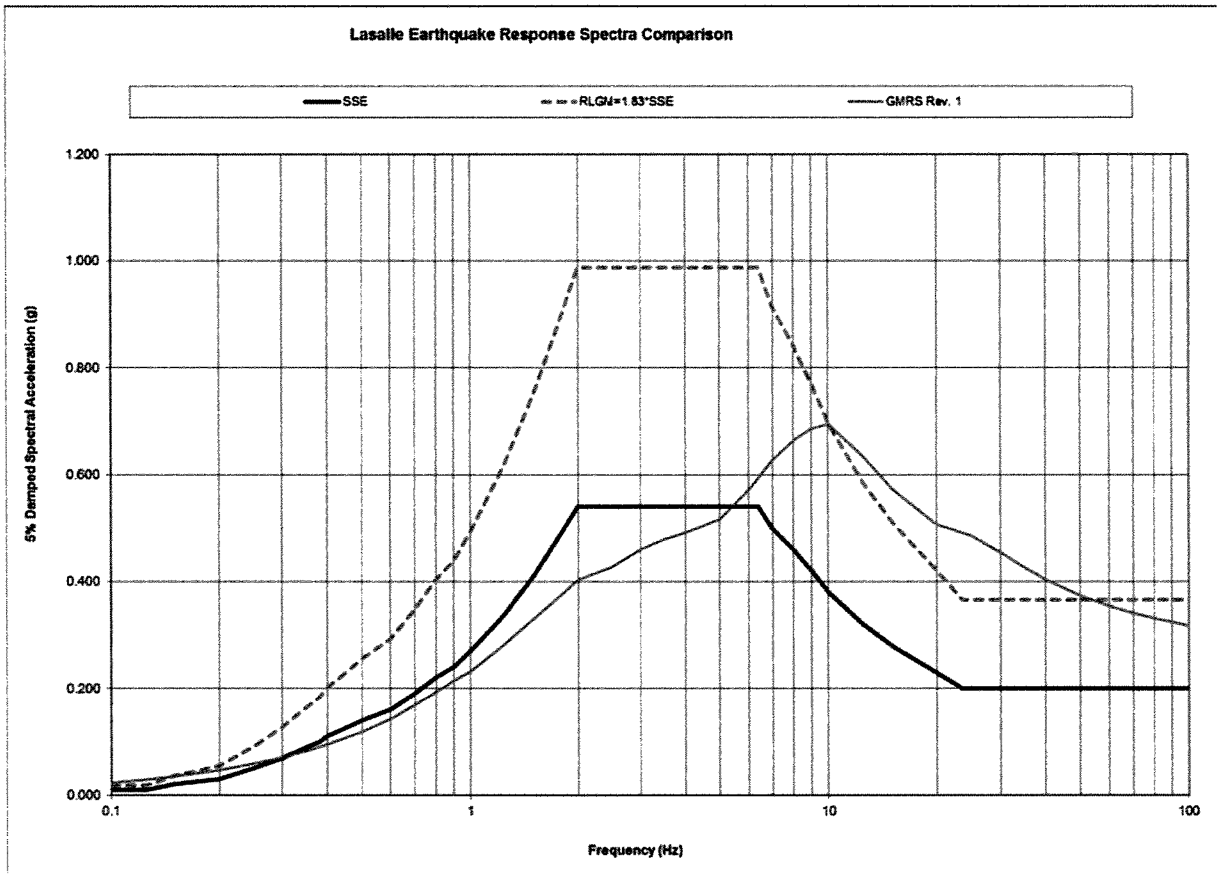

Figure 3-1: Comparison of LaSalle SSE, GMRS, and RLGM response spectra

3.1.2 *GI-199 CEUS Seismic Hazard Insights*

Simplified seismic risk calculations, based on the updated EPRI 2013 seismic hazard, indicate that LaSalle seismic design continues to provide margin to withstand

potential earthquakes exceeding the seismic licensing basis, as was also concluded in Information Notice (IN) 2010-18, USNRC 2010 Safety / Risk Assessment for GI-199 [16]. The details supporting this conclusion are provided below.

The United States Nuclear Regulatory Commission (USNRC) performed seismic risk calculations in IN 2010-18 for GI-199 [16]. The simplified calculations involved estimating the plant seismic fragility (i.e., conditional probability of plant damage at a given seismic hazard input level) from the results of the earlier IPEEE submittals, and convolving that plant fragility estimate with various seismic hazard curves to obtain SCDF estimates. EPRI also conducted a similar assessment of SCDFs for the fleet of CEUS plants using the same IPEEE-derived plant level fragilities combined with the new site-specific seismic hazard curves [17]. Table 3-1 provides the results for the simplified seismic risk calculations for LaSalle from IN 2010-18 as well as providing the results for a surrogate seismic risk calculation for LaSalle performed by Exelon [35] to approximately reproduce the LaSalle SCDF results in a manner consistent with those included with the fleet SCDF results in EPRI letter RSM-031114-077 [17].

The SCDF estimates in Table 3-1 are based on assuming a plant level fragility for LaSalle corresponding to a median seismic capacity value of 1.32g peak ground acceleration (PGA) per the IN 2010-18 GI-199 calculation [16]. When convolving the plant level median capacity of 1.32g PGA and using a composite seismic uncertainty (i.e., $Beta_c$) value of 0.4 per the IN 2010-18 GI-199 calculation [16] with the EPRI 2013 hazard curve for LaSalle [18], the simplified SCDF performed by Exelon is estimated to be in the low E-06/yr range [35] (i.e., between 1E-06/yr and 3E-06/yr, which is small relative to the Commission's Safety Goal Policy Statement subsidiary objective of 1E-04/yr [15].

As identified above, the simplified SCDF estimate performed by Exelon with the EPRI 2013 hazard curve [35] is similar to the simplified SCDF of 2.8E-06/yr in Table 3-1 for the 1994 Lawrence Livermore National Laboratory (LLNL) hazard curve based on the GI-199 calculations [16]. This comparison indicates that when accounting for the changes for the EPRI 2013 hazard curve, the seismic risk for LaSalle has not significantly changed when compared to the GI-199 calculations with the LLNL hazard curve.

This information supports the conclusion that the current LaSalle seismic design continues to provide a safety margin to withstand potential earthquakes exceeding the seismic design basis, as was concluded in IN 2010-18 [16] and reiterated in EPRI letter RSM-031114-077 [17].

Table 3-1
SIMPLIFIED SCDF CALCULATIONS FOR LASALLE USING METHODOLOGY OF IN 2010-18 for GI-199 [16]

PGA Fragility(1)			Simplified Seismic CDF Estimate (/yr) Seismic Hazard Curve Input (PGA)			
Plant HCLPF(2)	Median Capacity (C_{50})	$Beta_C$	2008 USGS(3)	1989 EPRI(4)	1994 LLNL(5)	2013 EPRI(6)
0.52	1.32	0.4	2.3E-06	4.1E-07	2.8E-06	Low E-06

Notes to Table 3-1:

(1) Plant level PGA fragility data provided for LaSalle in Table C-2 of IN 2010-18 [16].
(2) The plant level HCLPF was not explicitly provided in Table C-2 of IN 2010-18. The plant level HCLPF was calculated based on using equation (C-3) IN 2010-18 [16].
(3) Simplified SCDF result provided in Table D-1 [16] based on convolving plant level fragility data with 2008 USGS hazard curve (SSE - PGA).
(4) Simplified SCDF result provided in Table D-2 [16] based on convolving plant level fragility data with 1989 EPRI hazard curve (SSE - PGA).
(5) Simplified SCDF result provided in Table D-3 [16] based on convolving plant level fragility data with 1994 LLNL hazard curve (SSE - PGA).
(6) Exelon calculation for simplified SCDF result based on convolving plant level fragility data [16] with 2013 EPRI hazard curve (PGA) [18]. The "Low E-06" range is identified as between 1E-06/yr and 3E-06/yr.

3.2 Robust Plant Seismic Capability

LaSalle maintains a robust plant seismic capability, as evidenced by completion of NTTF 2.3 Seismic Walkdowns, completion of the ESEP, use of redundant and diverse key safety functions (defense-in-depth), completion of an SPRA based IPEEE, evaluation of containment risk insights, and use of robustly designed SSCs for the new FLEX implementation strategies per NEI 12-06, including on-site FLEX storage buildings. The details supporting this conclusion are discussed in the sub-sections below.

3.2.1 NTTF 2.3 Seismic Walkdowns

Seismic walkdowns were conducted in accordance with EPRI 1025286 [21] for each unit on representative seismic equipment types to provide reasonable assurance that seismic equipment configuration control has been maintained, including consideration of seismic interaction concerns and equipment degradation (e.g. corrosion). The walkdown results were reported to the NRC on November 27, 2012 and in subsequent Annex Reports [11] and indicated that no adverse seismic conditions were found. Therefore, no significant seismic risks are expected in the area of configuration maintenance / control / processes and degradation of seismic equipment and their anchorages. All

potentially degraded, non-conforming, or unanalyzed conditions identified as a result of the seismic walkdowns were entered into the corrective action program and are now all resolved.

3.2.2 Expedited Seismic Evaluation Process (ESEP)

Exelon performed the ESEP to demonstrate seismic margin through a review of a subset of the plant equipment that can be relied upon to protect the reactor core following beyond design basis seismic events. The ESEP for LaSalle provided an important demonstration of seismic margin through evaluations of plant equipment that can be relied upon to protect the reactor core following beyond design basis seismic events.

In developing FLEX strategies for LaSalle, Exelon considered a three phase approach: (1) Initially coping by reliance on installed plant equipment, (2) Transition from installed plant equipment to on-site equipment, and (3) Obtain additional capability and redundancy from off-site equipment until power, water, and coolant injection systems are restored or commissioned. These strategies are described in the December 19, 2014 summary report and are briefly described below [10].

- At the initiation of the event with an ELAP, LaSalle Phase 1 will rely on RCIC for Reactor water level control and ADS SRV's for pressure control. Approximately 6 hours of operation is available in Phase 1 before Suppression Pool makeup is needed.

- Within the 6 hour initiation timeframe, a FLEX Makeup Pump will be deployed and lined up to take suction off of the UHS and discharge into each Unit's RPV, Suppression Pool, and SFP via permanent and temporary connections. The FLEX Makeup Pumps are self-powered via diesel engines. This provides indefinite continuous makeup to both Units from the UHS.

- Portable FLEX DG's will be stored in a robust structure on-site and ready for deployment within 8 hours. The generator is a portable (trailer mounted) unit that will be connected through the use of temporary cabling.

For the purpose of demonstrating that the Expedited Seismic Equipment List (ESEL) items have sufficient seismic capacity to meet or exceed the demand characterized by the RLGM, a seismic margins assessment was performed for the LaSalle ESEL SSCs. Consistent with NRC endorsed guidance [5], the deterministic approach using the conservative deterministic failure margin (CDFM) methodology of EPRI NP-6041 [9] was utilized to develop HCLPF capacities. The seismic margin calculations included: (1) performing seismic capability walkdowns for equipment to evaluate the equipment installed plant conditions, (2) performing screening evaluations using the screening tables in EPRI NP-6041, and (3) performing HCLPF calculations considering various failure modes that include both structural (e.g., anchorage, load path, etc.) and functional failure modes.

The RLGM for LaSalle was determined in accordance with Section 4 of EPRI 3002000704 [5] by linearly scaling the LaSalle SSE (5% damping) by the maximum GMRS/SSE ratio between 1 and 10 Hz. This resulted in a maximum GMRS/SSE ratio of 1.83 at 10 Hz. The LaSalle RLGM has a peak ground acceleration of 0.37g and a peak spectral acceleration of 0.99g in the 2-6.4Hz range.

LaSalle completed the ESEP and submitted a summary report [10] on December 19, 2014. The ESEP was implemented using NRC-endorsed guidance [5]. All equipment evaluated for the ESEP was found to have adequate capacity for the LaSalle RLGM and no equipment modifications were required.

These conservative design practices and seismic margin insights combine to increase confidence that safety significant SSC's will continue to fulfill their functions at the RLGM level.

3.2.3 Emergency / Back-up AC Power and LOOP Mitigation Capability

Seismic events often induce a Loss of Offsite Power (LOOP). The LaSalle County Station relies, in part, on a defense-in-depth approach to help prevent and mitigate seismic accidents that may result in the offsite release of radionuclides. This approach includes the use of redundant and diverse key safety functions. LaSalle has the following plant features to support defense-in-depth to mitigate LOOP and station blackout (SBO) events:

- Five (5) emergency diesel generators (EDGs) are available to support ECCS equipment at LaSalle Units 1 and 2 [29, 30].
    - EDG 0: Swing diesel, supplies Unit 1 or Unit 2, Division 1
    - EDG 1A: Supplies Unit 1, Division 2
    - EDG 1B: High Pressure Core Spray (HPCS) diesel, supplies Unit 1, Division 3
    - EDG 2A: Supplies Unit 2, Division 2
    - EDG 2B: High Pressure Core Spray (HPCS) diesel, supplies Unit 2, Division 3
- Given a LOOP event, procedural guidance allows various cross-tie alignments to provide AC power from EDG 0, 1A, and 2A to either unit. However, EDGs 1B and 2B are dedicated to supply the HPCS systems for the respective units [31,32].
- Each unit has an AC independent Reactor Core Isolation Cooling (RCIC) system that can be used to support RPV pressure control and RPV inventory control.

In addition, the following plant features provide additional defense-in-depth with respect to seismic risk:

- EDG 0, 1A, and 1B are located on El. 710' of the Seismic Category 1 Unit 1 Diesel Generator Building, which adjoins the south end of the common site Auxiliary Building [33, 34].

- EDG 2A and 2B are located on El. 710' of the Seismic Category 1 Unit 2 Diesel Generator Building, which adjoins the north end of the common site Auxiliary Building [33, 34].

- Given that the five EDGs are located in two separate Seismic Category 1 buildings, in an SPRA, the seismic failure probabilities of EDGs 0, 1A, and 1B can be modeled as not completely correlated with the seismic failure probabilities of EDGs 2A and 2B. Thus, a seismic event does not defeat the redundancy in the seismic on-site emergency AC power capability.

3.2.4 IPEEE Related Plant Changes / Insights

The LaSalle County Station is categorized as a 0.3g focused-scope plant in accordance with NUREG-1407 [4]. For the seismic evaluation, LaSalle relied exclusively on the information in NUREG/CR-4832, Analysis of the LaSalle Unit 2 Nuclear Power Plant: Risk Methods Integration and Evaluation Program (RMIEP) [22] and NUREG/CR-5305, Integrated Risk Assessment for the LaSalle Unit 2 Nuclear Power Plant, Phenomenology and Risk Uncertainty Evaluation Program (PRUEP) [23], which supported a full-scope Level 3 PRA (i.e., an integrated risk evaluation of core damage (Level 1), containment performance (Level 2), and offsite consequences (Level 3)). The seismic portion of the LaSalle RMIEP was performed by Lawrence Livermore National Laboratories (LLNL). Based on the RMIEP study, the total seismic core damage frequency was calculated to be 6E-7/yr as reported in the NRC SER of the LaSalle IPEEE submittal [20].

The LaSalle NTTF 2.3 Seismic Walkdowns confirmed that the LaSalle IPEEE did not identify any seismic vulnerabilities. Section 7 of the LaSalle NTTF 2.3 Seismic Walkdown report dated November 27, 2012 [11] identified the following:

> *"A review of the LaSalle County Nuclear Power Station Individual Plant Examination of External Events (IPEEE) Submittal along with the NRC Staff Evaluation Report of the IPEEE found that no vulnerabilities were identified and no plant improvements resulted from the IPEEE program."*

3.2.5 Containment Risk Insights

Risk insights on containment performance were evaluated in the 1994 LaSalle combined submittal for the Individual Plant Examination (IPE) for internal events and the Individual Plant Examination (External Events) [14]. Containment performance can be characterized by the Large Early Release Frequency (LERF) from the IPE, however, the LaSalle IPE/IPEEE identifies the following:

> *"The Level II portion of the PRA performed as part of the RMIEP study, and incorporated, therefore, into the LaSalle IPE/IPEEE, uses a fundamentally different approach than Level II analyses performed and submitted in other CECo IPE studies."*

The Risk Methods Integration and Evaluation Program (RMIEP) study in NUREG/CR-4832 [22] provided the primary basis for the analysis in the LaSalle IPE/IPEEE submittal. The LaSalle IPE/IPEEE did not provide quantitative LERF results in the submittal document [14]. Instead, the IPE/IPEEE discussed key results from NUREG/CR-5305 [23], which was a separate report to evaluate the Level 2 Containment Performance analysis and the Level 3 Offsite Consequence analysis. NUREG/CR-5305 did not provide readily available results that could be used as an appropriate surrogate for the FPIE LERF. In addition, the LaSalle IPE/IPEEE did not identify any specific vulnerabilities with respect to containment performance.

Additional confidence in the adequacy of containment seismic response, and on SLERF, can be gained by considering containment structure response relative to the new GMRS and insights from the LaSalle internal events PRA model.

The structural design of the LaSalle primary containment will not be significantly challenged by the increase in LaSalle GMRS. The primary containment is a steel-lined, post-tensioned concrete enclosure housing the reactor and the suppression pool [22]. The containment walls provide support to several levels of floor slabs and the top of each containment is capped by a steel dome head. Table 6.1 of [22] indicates that the containment has a fundamental lateral frequency of 2.2 Hz. As this frequency (2.2 Hz) is well below the frequency range of exceedance (<5 Hz), the containment design (for lateral loads) remains bounded by the LaSalle SSE.

A Peer Review of the 2006 LaSalle Unit 2 FPIE PRA model was performed using the NEI 05-04 process [24], the 2007 ASME PRA Standard [25], and Regulatory Guide 1.200 [26]. This Peer Review was documented in a report dated July 2008 [27]. The thirteen (13) Finding-level facts and observations identified from the 2008 peer review were resolved or appropriately dispositioned as part of the Exelon Risk Management

PRA update and maintenance process in accordance with Exelon procedures. The one (1) Finding associated with the Level 2 PRA was resolved as part of the LaSalle Level 1 and Level 2 PRA model periodic update in 2011 [13].

The 2011 Level 2 LERF evaluation accounts for early release scenarios as identified in Table 2-2.8-9 of the combined 2009 ASME/ANS PRA Standard [28], such as containment bypass scenarios and containment venting. In addition, the radionuclide release magnitude and timing characterization is based on plant specific thermal-hydraulic calculations, Emergency Action Levels (EALs), and evacuation studies. The current LaSalle FPIE model of record (MOR), LS211A, LERF value is 1.3E-7/yr [13].

3.2.6 The LaSalle FPIE PRA model [13] also provides insights about the containment performance under beyond design basis seismic events from a plant systems perspective. The results from the FPIE dual unit Loss of Offsite Power (DLOOP) initiating event can be used to provide appropriate risk insights because beyond design basis seismic events can be generally modeled as DLOOP events. The conditional Large Early Release Probability (LERP) from the FPIE PRA model is based on the Large Early Release Frequency (LERF) due to a DLOOP event given the Core Damage Frequency (CDF) due to a DLOOP event. Based on the LaSalle 2011 FPIE PRA update, the CDF due to DLOOP events is 3.1E-7/yr, and the LERF due to DLOOP events is 1.2E-9/yr. Therefore, the conditional LERP due to a DLOOP event based on the LaSalle 2011 FPIE PRA is (1.2E-9/yr)/(3.1E-7/yr), or approximately 4E-3. Given that seismic events can be modeled as DLOOP events in the PRA, and given the conclusion above regarding the structural capability of the containment, the relatively low conditional LERP from FPIE DLOOP events can be used as a surrogate risk insight to support that the LaSalle containment analysis is robust and can provide defense-in-depth for seismic events from a plant systems perspective. FLEX Storage Buildings, Haul Paths, and Overall FLEX Risk Insights

3.2.6.1 Storage Buildings

FLEX storage buildings will be utilized to store Phase 2 equipment relied upon for mitigation of beyond design basis events, including seismic. The inherent robustness of these LaSalle FLEX building designs will enable them to remain functional for seismic demands consistent with ASCE 7-10 [12]. The supporting basis for this conclusion is provided below.

Phase 2 of FLEX relies on the use of portable equipment to maintain Reactor Core Cooling and Heat Removal, Reactor Inventory Control, Containment Function, and Spent Fuel Pool Cooling. LaSalle has two robust FLEX storage buildings that function as protected storage facilities for FLEX equipment such as vehicles for towing and haul path debris removal, portable pumps and generators, hoses, tools, cabling, lights, and fans.

Both FLEX buildings are constructed with reinforced concrete and are designed to resist tornado winds, tornado generated missiles, severe wind, and seismic demands [8]. The design of the buildings is based on the provisions of ASCE 7-10 [12]. The design assumes importance factors consistent with Risk Category IV (Essential Facility). This risk category is the highest in ASCE 7-10 and typically includes structures, the failure of which would inhibit the availability of essential community services necessary to cope with an emergency situation (e.g., hospitals, police stations, fire stations, and emergency communication centers).

3.2.6.2 Haul Paths

In addition to structural considerations, the potential for haul path liquefaction was also assessed [19]. The haul paths, on which equipment will be transported, were assessed to have acceptable factors-of-safety against the effects of liquefaction [19].

3.2.6.3 Overall FLEX Risk Insights

The LaSalle incorporation of FLEX strategies to mitigate beyond-design basis events, including seismic, is a significant safety enhancement. A quantitative measure of the risk benefit for FLEX equipment is not available without performing more detailed evaluations (e.g., seismic capacity of the FLEX building, human reliability analysis of the FLEX procedures). However, credit for the FLEX equipment and associated mitigation strategies will help reduce seismic risk by providing additional defense-in-depth for responding to Extended Loss of AC Power (ELAP) events that are generally amongst the dominant contributors to SCDF. Successful implementation of the FLEX equipment in conjunction with the existing installed equipment will extend the Station Blackout coping time in support of reaching a safe stable end state. By providing additional back-up power and water sources and pathways, as described in the ESEP Section 3.2.2 above, FLEX supports mitigation of these critical risk contributors and improves overall plant seismic risk.

3.2.6.4 Hardened Containment Venting System (HCVS)

In addition to LaSalle's FLEX mitigation strategy, LaSalle plans to install a reliable Hardened Containment Venting System (HCVS) for each unit to meet the NRC order and industry guidance [36]. The HCVS system will allow venting of the containment which can be actuated from a remote operating station. The exhaust will vent through the wetwell and out of the Reactor Building into the atmosphere in the event that other mitigating actions are unsuccessful. The LaSalle Unit 1 HCVS is planned for installation by the end of 2018 and Unit 2 is planned for installation by the end of 2017.

LaSalle is also currently in the planning and preliminary design phase to incorporate Severe Accident Water Addition (SAWA) strategies as part of Phase 2 of the NRC order

and industry guidance [36]. The plan will be to provide water from the UHS to the containment under severe accident conditions as described in reference 36.

4.0 REFERENCES

1. NRC Letter, Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated March 12, 2012

2. NRC Letter, Screening and Prioritization Results Regarding Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Seismic Hazard Re-Evaluations for Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated May 9, 2014

3. NRC public meeting slides on "NTTF Recommendation 2.1 Seismic," dated May 21, 2015 (ML15140A628)

4. Procedural and Submittal Guidance for the Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities, (NUREG-1407), dated June 1991.

5. NRC Letter, EPRI Power Research Institute Report 3002000704, "Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic," as an Acceptable Alternative to the March 12, 2012, Information Request for Seismic Re-evaluations, dated May 7, 2013 (ML13106A331)

6. EPRI Report 1025287, Seismic Evaluation Guidance, Screening, Prioritization, and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic, dated February 2013

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32. LaSalle County Power Station Procedure LOA-AP-201 "Unit 2 AC Power System Abnormal", Revision 47

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