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U.S. Nuclear Regulatory Commission
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Byron Station, Units 1 and 2
Renewed Facility Operating License Nos. NPF-37 and NPF-66
NRC Docket Nos. STN 50-454 and STN 50-455

Subject: Mitigating Strategies Assessment (MSA) Report for the Reevaluated Seismic Hazard Information – NEI 12-06, Appendix H, Revision 2, H.4.4 Path 4: GMRS < 2xSSE

References:

1. NEI 12-06, Revision 4, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, December 2016, ADAMS Accession Number ML16354B421
2. JLD-ISG-2012-01, Revision 2, Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, February 2017, ADAMS Accession Number ML17005A188
3. EPRI, "Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic", Report Number 3002000704, Palo Alto, CA, April, 2013.

The purpose of this letter is to provide the results of the Mitigating Strategies Assessment (MSA) and Expedited Seismic Evaluation Process (ESEP) reports for Byron Station, Units 1 and 2 (Byron Station), to demonstrate that the FLEX strategies developed, implemented, and maintained in accordance with NRC Order EA-12-049 can be implemented considering the impacts of the re-evaluated seismic hazard. The MSA was performed in accordance with the guidance provided in Appendix H Section H.4.4 of NEI 12-06 Revision 4 [Reference 1] which was endorsed by the NRC [Reference 2]. The ESEP is implemented using the methodologies in the NRC endorsed guidance in EPRI 3002000704 [Reference 3].

Based upon the MSA and ESEP results provided in Enclosures 1 and 2, respectively, the mitigating strategies for Byron Station, Units 1 and 2, as described in Reference 14 of Enclosure 1, are acceptable considering the impacts of the re-evaluated seismic hazard.

This letter contains no new regulatory commitments and no revision to existing regulatory commitments.

Should you have any questions regarding this submittal, please contact David J. Distel at (610)-765-5517.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 22nd day of August 2017.

Respectfully Submitted,

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Manager - Licensing
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Enclosures:

1. Seismic Mitigating Strategies Assessment for Byron Station, Units 1 and 2
2. Byron Station, Units 1 and 2, Expedited Seismic Evaluation Process (ESEP) Report

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ENCLOSURE 1

Seismic Mitigating Strategies Assessment for Byron Station, Units 1 and 2

NEI 12-06 Appendix H – Seismic "Path 4"

(7 Pages)

1. BACKGROUND

Byron Station, Units 1 and 2 (Byron Station or BYR) has completed a mitigating strategies assessment (MSA) [Reference 10] for the impacts of the re-evaluated seismic hazard to determine if the mitigating (FLEX) strategies developed, implemented and maintained in accordance with NRC Order EA-12-049 remain acceptable at the re-evaluated seismic hazard levels. The MSA was performed in accordance with the guidance provided in Appendix H of NEI 12-06 Revision 4 [Reference 1] which was endorsed by the NRC [Reference 2].

The Mitigating Strategies Seismic Hazard Information (MSSHI) is the re-evaluated seismic hazard information at Byron Station, developed using the Probabilistic Seismic Hazard Analysis (PSHA). The MSSHI includes a performance-based Ground Motion Response Spectrum (GMRS), Uniform Hazard Response Spectra (UHRS) at various annual probabilities of exceedance, and a family of seismic hazard curves at various frequencies and fractiles developed at the Byron Station control point elevation. Byron Station submitted the re-evaluated seismic hazard information including the UHRS, GMRS and the hazard curves to the NRC on March 31, 2014 [Reference 3]. The NRC staff concluded that the GMRS that was submitted adequately characterizes the re-evaluated seismic hazard for the Byron Station site [References 4 and 17]. Section 6.1.1 of Reference 2 identifies the method described in Section H.4.4 of Reference 1 as applicable to Byron Station.

2. ASSESSMENT TO MSSHI

Consistent with Section H.4.4 (Path 4) of Reference 1, the Byron Station GMRS has spectral accelerations greater than the safe shutdown earthquake (SSE) but no more than 2 times the Safe Shutdown Earthquake (SSE) anywhere in the 1 to 10 Hz frequency range. As described in the Final Implementation Plan (FIP) [Reference 14], the plant equipment relied on for FLEX strategies have previously been evaluated as seismically robust to the SSE levels. This plant equipment is evaluated for the MSSHI by the Expedited Seismic Evaluation Process (ESEP) and/or the MSA report following the guidance of Reference 1. The basic elements within the MSA of Path 4 systems, structures, and components (SSCs) are described in Reference 1. Implementation of each of these basic Path 4 elements for the Byron Station site is summarized in Sections 2.1 through 2.4.

Equipment needed to implement the FLEX strategies that was evaluated by the MSA report includes manual valves, power distribution panels, flow elements, safety injection accumulators, DC bus components, motor control centers, and FLEX neutral connection cabinets. Utilizing walkdowns and reviewing existing calculations for seismic margin, the components were shown to have sufficient $C_{10\%}$ capacity for the GMRS in accordance with Section H.5 of Reference 1. In-structure response spectra are scaled for the GMRS by multiplying the existing SSE response spectrum by the ratio between GMRS and SSE ground motion curves at the dominant frequency of the building for which the new GMRS spectrum is desired.

2.1 Step 1 – Scope of MSA Plant Equipment

The scope of SSCs considered for the Path 4 MSA [Reference 10] was determined following the guidance used for the expedited seismic evaluation process (ESEP) defined in EPRI 3002000704 [Reference 9]. FLEX SSCs excluded from consideration in the ESEP were added to the MSA equipment scope. In addition, SSC failure modes not addressed in the ESEP that could potentially affect the FLEX strategies were added and evaluated.

SSCs associated with the FLEX strategy that are inherently rugged or sufficiently rugged are discussed in Section 2.3 below and identified in Section H.4.4 (Path 4) of Reference 1.

2.2 Step 2 – ESEP Review

As stated in Appendix H of NEI 12-06, previous seismic evaluations should be credited to the extent that they apply for the assessment of the MSSHI. This includes the Expedited Seismic Evaluation Process (ESEP) evaluations for the FLEX strategies which were performed in accordance with EPRI 3002000704 [Reference 9]. The ESEP evaluates the plant equipment that is used for the FLEX strategies. The list of equipment is called the Expedited Seismic Equipment List (ESEL). Equipment on the ESEL has been evaluated to demonstrate seismic adequacy following the guidance in Section 5 of NEI 12-06. The ESEP evaluations remain applicable for this MSA since these evaluations directly addressed the most critical 1 Hz to 10 Hz part of the new seismic hazard using seismic responses from the scaling of the design basis analyses. In addition, separate evaluations are performed to address high frequency exceedances under the high frequency (HF) sensitive equipment assessment process, as required, and are documented in Section 4 of this enclosure. The ESEP report is included in Enclosure 2.

2.3 Step 3 – Inherently/Sufficiently Rugged Equipment

The qualitative assessment of certain SSCs not included in the ESEP was accomplished using (1) a qualitative screening of "inherently rugged" SSCs and (2) evaluation of SSCs to determine if they are "sufficiently rugged." Reference 1 documents the process and the justification for this ruggedness assessment. SSCs that are either inherently rugged or sufficiently rugged are described in Reference 1 and no further evaluations for these rugged SSCs are required under the MSA [Reference 10]

2.4 Step 4 – Evaluations Using Section H.5 of Reference 1

Step four for Path 4 plants includes the evaluations of:

1. FLEX equipment storage buildings and Non-Seismic Category 1 Structures that could impact FLEX implementation
2. Operator Pathways
3. Tie down of FLEX portable equipment
4. Seismic Interactions not included in ESEP that could affect FLEX strategies
5. Haul Paths

The results of the reviews of each of these areas are described in the sections below, per Reference 10.

2.4.1a FLEX Equipment Storage Buildings

The Robust FLEX Equipment Storage Building consists of 1'-9" thick reinforced concrete walls on a 3'-0" thick nominal reinforced concrete foundation mat. The 1'-9" thick roof slab is supported by W14 beams and girders. The FLEX Building is designed for a horizontal seismic acceleration (Cs) of 0.26g which is calculated using the peak SSE horizontal ground motion acceleration (0.6g). Because the peak GMRS horizontal ground motion acceleration (0.583g) is less than the SSE peak acceleration, the FLEX Building is adequate for the GMRS.

2.4.1b Non-Seismic Category 1 Structures

Areas of the Turbine Building are utilized for operator haul paths. The Turbine Building is classified as Category II but is designed for SSE loading using Category I allowables. Based on the EPRI NP-6041-SL [Reference 12] Table 2-3 screening criteria, the Turbine Building will have sufficient seismic capacity and will be adequate for the GMRS.

2.4.2 Operator Pathways

Operator paths described in the Final Implementation Plan [Reference 14] pass through the Auxiliary Building (AB), Turbine Building, Main Steam Tunnels, Fuel Handling Building, and Essential Service Cooling Tower which are designed for the SSE and are therefore adequate for the GMRS. These operator pathways are required to route hoses and cables and also allow operators to reach equipment required to be locally operated. Byron Station has reviewed the operator pathways and verified that the operator pathways are not impacted by the MSSHI. Considerations for this review included:

- Pathway includes only seismic Category 1 structures (and SSE qualified Turbine Building) with previous reviews for seismic ruggedness.
- Debris removal capabilities for moderate to smaller seismic interactions including cabinets and other items that may tip over and collapse of block walls. Block walls within the Auxiliary Building have adequate capacity to withstand a GMRS seismic event. There is adequate room to work around fallen block walls within the Turbine Building. In addition, there are multiple pathways within the Turbine Building.
- Time for operator actions is available. The only actions with time restraints less than 2 hours are DC bus load shedding (AB 451') and aligning the Service Water system with the Auxiliary Feed Pumps (AB 330'). Operators have clear pathways to perform these actions and, due to location, can easily be completed within the required time frame.
- Operator pathways were reviewed during a walkdown to assess seismic interactions associated with a GMRS-level seismic event.

2.4.3 Tie Down of Towable FLEX Equipment

Types of large portable equipment used for the Byron Station FLEX strategies include diesel generators, Ford F-750 truck to clear debris, satellite trailer, hose trailers, and towable pumps as described in Attachment 2 of Reference 14. These components are tied down in the Robust FLEX Storage Building.

Stored equipment was evaluated (for stability and restraint as required/necessary) and protected from seismic interactions to the SSE level as part of the FLEX design process to ensure that unsecured and/or non-seismic components do not damage the FLEX equipment. In addition, large FLEX equipment such as pumps and power supplies were secured as necessary to protect them during a SSE seismic event. These large components in the Robust FLEX Storage Building are tied down with ratchet straps that are secured to the building slab. Because of the low aspect ratios, low GMRS accelerations, and the restraints, the towable FLEX equipment was determined to be seismically adequate.

Smaller equipment is stored within storage lockers, boxes, and shelves inside the plant and inside the Robust FLEX Storage Building. These storage components were shown to have adequate capacity as to not tip over during a GMRS seismic event.

Byron Station has reviewed the storage requirements (including any tie-down or restraint devices) in effect for FLEX portable equipment and verified that the equipment has no adverse interactions or significant damage that could impair the ability of the equipment to perform its mitigating strategy function during or following the GMRS-level seismic event.

2.4.4 Additional Seismic Interactions

Seismic interactions that could potentially affect the FLEX strategies and were not previously reviewed as part of the ESEP program (e.g., flooding from non-seismically robust tanks, interactions to distributed systems associated with the ESEP equipment list, etc.) were reviewed for Byron Station. Walkdowns of the areas containing components used for the FLEX strategies were conducted and did not identify any additional seismic interactions. The areas that were not walked down are High Radiation areas or hard-to-access areas. These areas are not anticipated to be used for storage. Also, these areas are Seismic Category I areas with all items designed to Seismic I or Seismic II/I requirements.

No underground tanks are relied upon for the FLEX strategies, and therefore, soil failure affecting piping attached to buried tanks is not a concern.

The suspended ceiling in the Work Execution Center (WEC) was identified as a potential seismic interaction during the walkdown. It was determined that the ceiling will not inhibit the execution of the FLEX strategies following a seismic event because of the high tensile capacity of the wire hangers and the lightweight ceiling tiles that can be moved or worked around.

Byron Station has reviewed the additional seismic interactions and verified that the Mitigation Strategy is not adversely impacted by the GMRS.

2.4.5 Haul Paths

Byron Station has reviewed the haul paths and verified that the haul paths are not adversely impacted by the MSSHI.

The FLEX equipment haul paths are used to transport portable FLEX equipment from the Robust FLEX Storage Building to the deployment zones at the Essential Service Cooling Towers, the area near the Refueling Water Storage Tanks (RWSTs), and the Unit 1 and Unit 2 trackway doors. There are no slope stability concerns along the equipment haul paths. Liquefaction was shown not to be a concern for any haul paths except for the north entrance from German Church Road [Reference 13]. In this case, the south entrance can be utilized.

Walkdowns were performed to verify the adequacy of the equipment haul paths for the GMRS. It is concluded that debris in the form of metal siding, light posts, and power lines can be removed using the Ford F-750 truck [Reference 10].

3. SPENT FUEL POOL COOLING REVIEW

The evaluation of spent fuel pool cooling for Byron Station was performed based on the initial conditions established in NEI 12-06 [Reference 1] for spent fuel cooling coping in the event of an extended loss of AC power (ELAP) / loss of normal access to the ultimate heat sink (LUHS). The evaluation also used the results of pool heat-up analyses from the (ELAP) evaluation as input.

The FLEX strategy for spent fuel pool (SFP) cooling utilizes SFP level monitoring and make-up capability as described in the Byron Station Final Integrated Plan (FIP) [Reference 14]. SFP make-up capability is provided using the portable medium head FLEX pump taking suction through a portable flexible hose and discharging through a flexible hose to portable Fuel Pool monitor guns that spray water directly into the pool. The source of make-up water is either the RWST or Deep Well No. 1. Both sources are adequate for the GMRS due to being inherently rugged or being designed to the SSE.

The spent fuel pool integrity evaluations demonstrated inherent margins of the Category I spent fuel pool structure above the SSE to a peak spectral acceleration of 0.8g [Reference 16]. The portable FLEX equipment availability, including its storage and deployment pathways, has subsequently been evaluated considering the GMRS-consistent loading conditions.

The spent fuel pool level indication components remotely display the water level in the spent fuel pool. The MSA report shows that these components have sufficient capacity for the GMRS. No seismic interactions were identified during the walkdowns that would adversely affect the function of the level indication components.

4. HIGH FREQUENCY REVIEW

The high frequency review was submitted under separate cover to the NRC [Reference 5]. As discussed in Reference 5, Byron Station has completed the evaluation of potentially sensitive contact devices in accordance with NEI 12-06 [Reference 1], Appendix H Section H.4.2 and EPRI 3002004396 [Reference 7]. The results from the evaluation confirm that the FLEX strategies for Byron Station can be implemented as designed and no further seismic evaluations are necessary.

5. CONCLUSION

Therefore, the FLEX strategies for Byron Station as described in the FIP [Reference 14] are acceptable as specified and no further seismic evaluations or modifications are necessary.

6. REFERENCES

1. NEI 12-06, Revision 4, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, December 2016, ADAMS Accession Number ML16354B421
2. JLD-ISG-2012-01, Revision 2, Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, February 2017, ADAMS Accession Number ML17005A188
3. Exelon Letter to NRC, Byron Station, Units 1 and 2, Exelon Generation Co., 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, [March 31, 2014], ML14091A010
4. NRC Letter, Byron Station, Units 1 and 2 - Staff Assessment Of Information Provided Pursuant To Title 10 Of The Code Of Federal Regulations Part 50, Section 50.54(F), Seismic Hazard Reevaluations For Recommendation 2.1 Of The Near-Term Task Force Review Of Insights From The Fukushima Dai-ichi Accident (Cac Nos. MF3884 And MF3885), [February 17, 2016] , ML16027A045
5. Exelon Letter to NRC, Byron Station, Units 1 and 2, Exelon Generation Co., LLC - Mitigating Strategies Assessment (MSA) Report for the Reevaluated Seismic Hazard Information - NEI 12-06, Appendix H, Revision 2, H.4.4 Path 4: GMRS < 2xSSE (Partial Submittal - High Frequency work scope), [November 3, 2016], ML16308A267
6. NRC Letter, Byron Station, Units 1 And 2 - Staff Review of High Frequency Confirmation Associated with Reevaluated Seismic Hazard Implementing Near-Term Task Force Recommendation 2.1, [January 30, 2017], ML17023A137
7. EPRI 3002004396, Final Report, July 2015, High Frequency Program Application Guidance for Functional Confirmation and Fragility Evaluation, ADAMS Accession Number ML15223A102
8. NRC Letter, Endorsement of Electric Power Research Institute Final Draft Report 3002004396, "High Frequency Program: Application Guidance for Functional Confirmation and Fragility", dated September 17, 2015, ADAMS Accession Number ML15218A569
9. EPRI, "Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic", Report Number 3002000704, Palo Alto, CA, April, 2013.
10. EXBY039-RPT-001, Rev. 0, "Byron MSA Seismic Path 4 Evaluation"
11. EPRI, "Seismic Evaluation Guidance: Screening, Prioritization and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic", Report Number 1025287, Palo Alto, CA, November, 2012.

12. EPRI, "EPRI NP-6041-SL Revision 1: A Methodology for Assessment of Nuclear Plant Seismic Margin, Revision 1", Palo Alto, CA, August, 1991.
13. Byron Station EC 399165, Rev. 0, "FLEX Haul Path Liquefaction Evaluation"
14. Exelon Letter to NRC, Byron, Unit 2, Exelon Generation Co., LLC -Report of Full Compliance with March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), [July 15, 2016], ML16197A390, [Contains Final Integration Plan for Units 1 and 2]
15. NRC Letter, Byron Station, Units 1 And 2 - Safety Evaluation Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Pool Instrumentation Related to Orders EA-12-049 and EA-12-051 (CAC NOS. MF0893, MF0894, MF0872, and MF0873), [December 19, 2016] ML16334A504
16. Exelon Letter to NRC, Byron Station, Units 1 and 2, Exelon Generation Co., LLC - Spent Fuel Pool Evaluation Supplemental Report, 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, [August 31, 2016], ML16244A800
17. NRC Letter, Byron Station, Units 1 and 2-Supplement to Staff Assessment Of Information Provided Pursuant To Title 10 Of The Code Of Federal Regulations Part 50, Section 50.54(F), Seismic Hazard Reevaluations For Recommendation 2.1 Of The Near-Term Task Force Review Of Insights From The Fukushima Dai-ichi Accident (Cac Nos. MF3884 And MF3885), [March 15, 2016] , ML16070A116

ENCLOSURE 2

Byron Station, Units 1 and 2

Expedited Seismic Evaluation Process (ESEP) Report

(68 Pages)

EXPEDITED SEISMIC EVALUATION PROCESS (ESEP) REPORT

IN RESPONSE TO THE 50.54(f) INFORMATION REQUEST REGARDING FUKUSHIMA NEAR-TERM TASK FORCE RECOMMENDATION 2.1: SEISMIC

for the

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Facility Operating License No. NPF-37 AND NPF-66
NRC Docket No. STN 50-454 and STN 50-455

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Figure 4-2 Byron GMRS versus SSE

Figure 5-2 Plot of RLGM

1.0 Purpose and Objective

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 and to determine if the agency should make additional improvements to its regulatory system. The NTTF developed a set of recommendations intended to clarify and strengthen the regulatory framework for protection against natural phenomena. Subsequently, the NRC issued a 50.54(f) letter on March 12, 2012 [1], requesting information to assure that these recommendations are addressed by all U.S. nuclear power plants. The 50.54(f) letter requests that licensees and holders of construction permits under 10 CFR Part 50 reevaluate the seismic hazards at their sites against present-day NRC requirements and guidance. Depending on the comparison between the reevaluated seismic hazard and the current design basis, further risk assessment may be required. Assessment approaches acceptable to the staff include a seismic probabilistic risk assessment (SPRA), or a seismic margin assessment (SMA). Based upon the assessment results, the NRC staff will determine whether additional regulatory actions are necessary.

This report describes the Expedited Seismic Evaluation Process (ESEP) undertaken for Byron Generating Station. The intent of the ESEP is to perform an interim action in response to the NRC's 50.54(f) letter [1] 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 is implemented using the methodologies in the NRC endorsed guidance in EPRI 3002000704, Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic [2].

The objective of this report is to provide summary information describing the ESEP evaluations and results for Byron Generating Station. The level of detail provided in the report is intended to enable NRC to understand the inputs used, the evaluations performed, and the decisions made as a result of the interim evaluations.

2.0 Brief Summary of the FLEX Seismic Implementation Strategies

The BYR FLEX strategies for Reactor Core Cooling and Heat Removal, Reactor Inventory Control/Long-term Sub-criticality and Containment Function are summarized below. This strategy is described in the Overall Integrated Plan (OIP) in Response to the March 12, 2012, Commission Order EA-12-049, including 6 month updates through August 2014 [3].

FLEX Phase 1, strategy relies on installed plant equipment. Reactor core cooling and heat removal is achieved via manual/local operation of the steam generator (SG) power operated relief valves (PORV). The safety injection (SI) accumulator will provide the initial boration for reactivity control and the Diesel Driven Auxiliary Feedwater (DDAF) pump will provide inventory to the SG via the condensate storage tank (CST) or Ultimate Heat Sink (UHS). Reactor coolant system (RCS) inventory and control is achieved by maintaining RCS temperature by controlling SG pressure with the PORVs. This ensures maximum SI accumulator injection. Containment temperature and pressure limits are not expected to challenged, but will be monitored. Instrumentation will be maintained available by performing DC and AC bus load shedding. Batteries are expected to last 8 hours after load shedding.

FLEX Phase 2, strategy relies on installed plant equipment and portable on-site equipment. Inventory to the SGs will continue to be provided by the DDAF pump or the medium head FLEX pump with inventory from the Essential Service Water Cooling (SXCT) which is maintained by well water backup. The FLEX diesel generator (DG) will provide power to the diesel oil (DO) transfer pumps to maintain oil inventory for the DDAF pump. The FLEX DG will also reenergize the DDAF pump battery chargers and the Div 2 instrumentation bus battery chargers. The high head FLEX pump will provide borated water from the RWST to the reactor through the FLEX connections to CV and/or SI.

FLEX Phase 3, strategy relies on installed plant equipment and portable on-site and off-site equipment. The portable equipment and connections used in phase 2 will continue to be used as the primary strategy with National SAFER Response Center (NSRC) equipment as spares.

3.0 Equipment Selection Process and ESEL and Alternate Path Justification

The selection of equipment for the ESEL followed the guidelines of EPRI 3002000704 [2]. The ESEL was validated in Report 14Q4240-RPT-003 [21.1]. The ESELs for Unit 1 and Unit 2 are presented in Attachments A and B, respectively. Items associated with both units (common) are identified on the Unit 1 ESEL in Attachment A.

3.1 Equipment Selection Process and ESEL

The selection of equipment to be included on the ESEL was based on installed plant equipment credited in the FLEX strategies during Phase 1, 2 and 3 mitigation of a Beyond Design Basis External Event (BDBEE), as outlined in the Byron Overall Integrated Plan (OIP) in Response to the March 12, 2012, Commission Order EA-12-049 [3]. The OIP provides the Byron FLEX mitigation strategy and serves as the basis for equipment selected for the ESEP.

The scope of "installed plant equipment" includes equipment relied upon for the FLEX strategies to sustain the critical functions of core cooling and containment integrity consistent with the Byron OIP [3]. FLEX recovery actions are excluded from the ESEP scope per EPRI 3002000704 [2]. The overall list of planned FLEX modifications and the scope for consideration herein is limited to those required to support core cooling, reactor coolant inventory and sub-criticality, and containment integrity functions. Portable and pre-staged FLEX equipment (not permanently installed) are excluded from the ESEL per EPRI 3002000704 [2].

The ESEL component selection followed the EPRI guidance outlined in Section 3.2 of EPRI 3002000704 [2].

1. The scope of components is limited to that required to accomplish the core cooling and containment safety functions identified in Table 3-2 of EPRI 3002000704. The instrumentation monitoring requirements for core cooling/containment safety functions are limited to those outlined in the EPRI 3002000704 guidance, and are a subset of those outlined in the Byron OIP [3].
2. The scope of components is limited to installed plant equipment, and FLEX connections necessary to implement the Byron OIP [3] as described in Section 2.
3. The scope of components assumes the credited FLEX connection modifications are implemented, and are limited to those required to support a single FLEX success path (i.e., either "Primary" or "Back-up/Alternate").
4. The "Primary" FLEX success path is to be specified. Selection of the "Back-up/Alternate" FLEX success path must be justified.
5. Phase 3 coping strategies are included in the ESEP scope, whereas recovery strategies are excluded.
6. Structures, systems, and components excluded per the EPRI 3002000704 [2] guidance are:
    - Structures (e.g. containment, reactor building, control building, auxiliary building, etc.)
    - Piping, cabling, conduit, HVAC, and their supports.
    - Manual valves and rupture disks.

- Power-operated valves not required to change state as part of the FLEX mitigation strategies.
- Nuclear steam supply system components (e.g. reactor pressure vessel and internals, reactor coolant pumps and seals, etc.)

7. For cases in which neither train was specified as a primary or back-up strategy, then only one train component (generally 'A' train) is included in the ESEL.

3.1.1 ESEL Development

The ESEL was developed by reviewing the Byron OIP [3] to determine the major equipment involved in the FLEX strategies. Further reviews of plant drawings (e.g., Process and Instrumentation Diagrams (P&IDs) and Electrical One Line Diagrams) were performed to identify the boundaries of the flow paths to be used in the FLEX strategies and to identify specific components in the flow paths needed to support implementation of the FLEX strategies.

Boundaries were established at an electrical or mechanical isolation device (e.g., isolation amplifier, valve, etc.) in branch circuits / branch lines off the defined strategy electrical or fluid flow path. P&IDs were the primary reference documents used to identify mechanical components and instrumentation. The flow paths used for FLEX strategies were selected and specific components were identified using detailed equipment and instrument drawings, piping isometrics, electrical schematics and one-line drawings, system descriptions, design basis documents, etc., as necessary.

The flow paths credited for ESEP for Byron are discussed in the table below.

Table 3-1 Flow Paths Credited for ESEP

Flow Path	**P&IDs**	
	Unit 1	**Unit 2**
RCS Heat Removal: Discharge of Main Steam from the Steam Generators to the Atmosphere via Main Steam Power Operated Relief Valves	M-35 sh. 1 M-35 sh. 2 M-35 sh. 8	M-120 sh. 1 M-120 sh. 2A M-120 sh. 2B M-120 sh. 9
RCS Heat Removal: Feedwater from the Essential Service Water Cooling Tower Basin to the Steam Generators via the Diesel Driven Auxiliary Feedwater Pump	M-36 sh. 1A M-36 sh. 1B M-36 sh. 1C M-36 sh. 1D M-37 M-42 sh. 3	M-121 sh. 1A M-121 sh. 1B M-121 Sh. 1C M-121 sh. 1D M-122 M-126 sh. 1 M-42 sh. 2A

Flow Path	P&IDs	
	Unit 1	Unit 2
RCS Inventory Control: Passive injection from the Safety Injection Accumulators; and active injection from the RWST to the RCS at the CV/SI Pump discharge piping, via a FLEX pump and FLEX connections.	M-61 sh. 5 M-61 sh. 6 M-61 sh. 1A M-61 sh. 3 M-61 sh. 1B M-60 sh. 2 M-60 sh. 3 M-60 sh. 4 M-62	M-135 sh. 1B M-135 sh. 2 M-135 sh. 3 M-135 sh. 4 M-136 sh. 5 M-136 sh. 6 M-136 sh. 4 M-136 sh. 1 M-137
Fuel Oil Supply: From the Diesel Fuel Oil Storage Tank to the FLEX Connection Point (for fueling FLEX Equipment) and the Diesel Driven Auxiliary Feedwater Pump	M-50 sh. 1A M-50 sh. 1B M-50 sh. 1D M-50 sh. 3	M-130 sh. 1A M-130 sh. 1B M-130 sheet 2
RCS Heat Removal and Equipment Cooling: Essential Service Water make-up from the Deep Well to the Essential Service Water Cooling Tower Basin and cooling for the Diesel Driven Auxiliary Feedwater Pump	M-42 sh. 1A M-42 sh. 2A M-42 sh. 2B M-42 sh. 6 M-42 sh. 7 M-83	M-42 sh. 1A M-42 sh. 2A M-42 sh. 2B M-42 sh. 6 M-42 sh. 7 M-83
RCS Pressure Control: Discharge of reactor coolant from the Pressurizer via Power Operated Relief Valves	M-60 sh. 5 M-60 sh. 8	M-135 sh. 5 M-135 sh. 8
Equipment Cooling and Ventilation: Battery Room HVAC for environment and hydrogen control	M-115 sh.	M-116 sh. 1

3.1.2 Power Operated Valves

Page 3-3 of EPRI 3002000704 [2] notes that power operated valves not required to change state are excluded from the ESEL. Page 3-2 also notes that "functional failure modes of electrical and mechanical portions of the installed Phase 1 equipment should be considered (e.g. RCIC/AFW trips)." To address this concern, the following guidance is applied in the Byron ESEL for functional failure modes associated with power operated valves:

- Power operated valves that remain energized during the Extended Loss of all AC Power (ELAP) events (such as DC powered valves), were included on the ESEL.

- Power operated valves not required to change state as part of the FLEX mitigation strategies were not included on the ESEL. The seismic event also causes the ELAP event; therefore, the valves are incapable of spurious operation as they would be de-energized.
- Power operated valves not required to change state as part of the FLEX mitigation strategies during Phase 1, and are re-energized and operated during subsequent Phase 2 and 3 strategies, were not evaluated for spurious valve operation as the seismic event that caused the ELAP has passed before the valves are re-powered.

3.1.3 Pull Boxes

Pull boxes were deemed unnecessary to add to the ESELs as these components provide completely passive locations for pulling or installing cables. No breaks or connections in the cabling are included in pull boxes. Pull boxes were considered part of conduit and cabling, which are excluded in accordance with EPRI 3002000704 [2].

3.1.4 Termination Cabinets

Termination cabinets, including cabinets necessary for FLEX Phase 2 and Phase 3 connections, provide consolidated locations for permanently connecting multiple cables. The termination cabinets and the internal connections provide a completely passive function; however, the cabinets are included in the ESEL to ensure industry knowledge on panel/anchorage failure vulnerabilities is addressed.

3.1.5 Critical Instrumentation Indicators

Critical indicators and recorders are typically physically located on panels/cabinets and are included as separate components; however, seismic evaluation of the instrument indication may be included in the panel/cabinet seismic evaluation (rule-of-the-box).

3.1.6 Phase 2 and Phase 3 Piping Connections

Item 2 in Section 3.1 above notes that the scope of equipment in the ESEL includes "… FLEX connections necessary to implement the Byron OIP [3] as described in Section 2." Item 3 in Section 3.1 also notes that "The scope of components assumes the credited FLEX connection modifications are implemented, and are limited to those required to support a single FLEX success path (i.e., either "Primary" or "Back-up/Alternate")."

Item 6 in Section 3.1 above goes on to explain that "Piping, cabling, conduit, HVAC, and their supports" are excluded from the ESEL scope in accordance with EPRI 3002000704 [2].

Therefore, piping and pipe supports associated with FLEX Phase 2 and Phase 3 connections are excluded from the scope of the ESEP evaluation. However, any active valves in FLEX Phase 2 and Phase 3 connection flow path are included in the ESEL.

3.2 Justification for use of Equipment that is not the primary means for FLEX implementation

No equipment that is not the primary means for FLEX implementation is specified on the Byron ESEL.

4.0 Ground Motion Response Spectrum (GMRS)

4.1 Plot of GMRS submitted by the Licensee

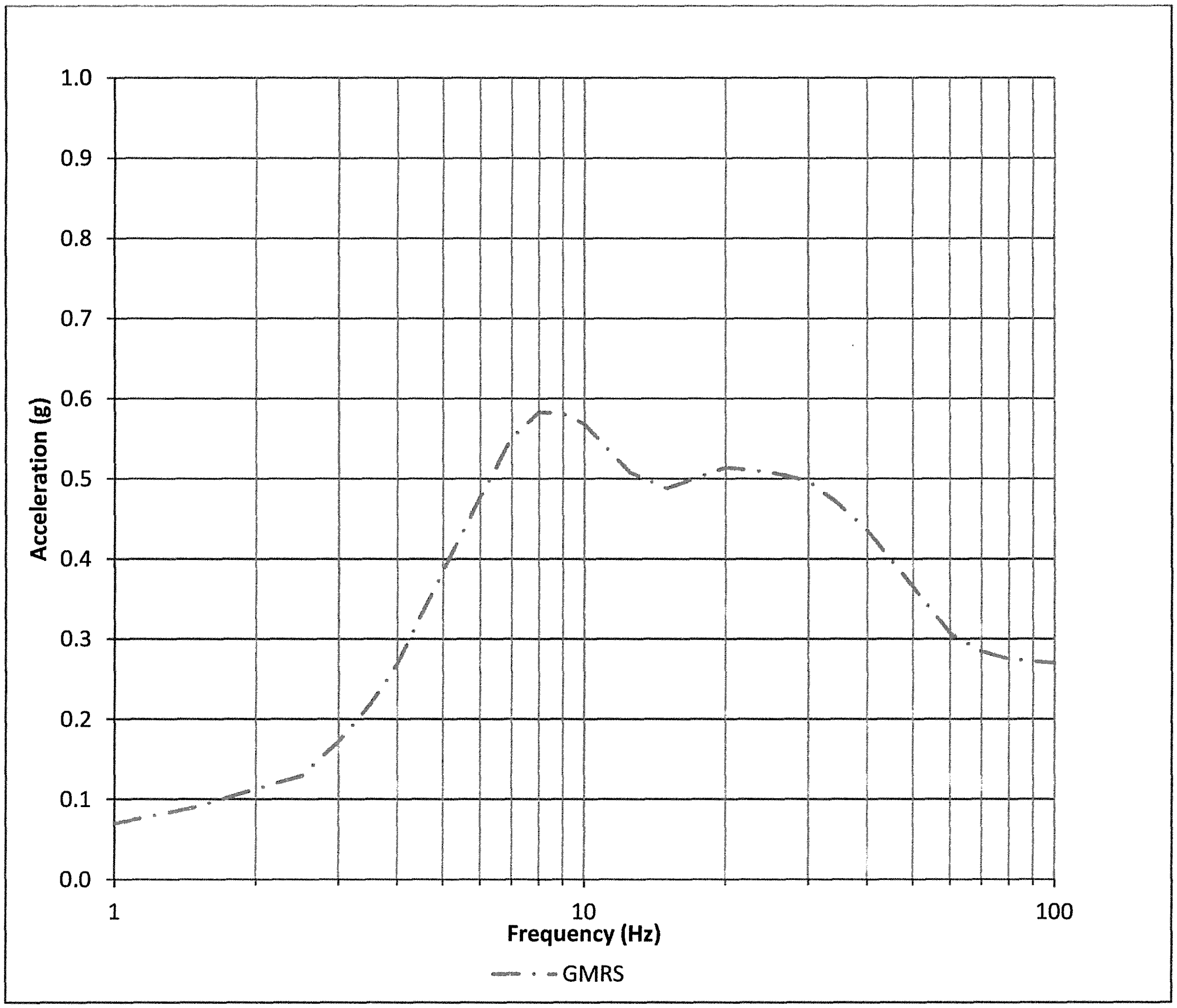
In accordance with Section 2.4.2 of the SPID [15], the licensing design basis definition of the SSE control point for Byron Station is used for comparison to the GMRS. Section 2.5.2.6 and 3.7.1.1 of the Byron UFSAR [18], states that the 0.20g Reg. Guide 1.60 site response spectra is defined at the bedrock-soil interface elevation of 869 feet mean sea level.

The GMRS per the March submittal report [4] is tabulated and graphed below:

TABLE 4-1 BYRON GMRS (5% Damping)

Freq. (Hz)	GMRS (unscaled, g)
1	0.070
1.25	0.081
1.5	0.090
2	0.113
2.5	0.129
3	0.172
3.5	0.218
4	0.269
5	0.385
6	0.477
7	0.551
8	0.583
9	0.581
10	0.568
12.5	0.508
15	0.488
20	0.514
25	0.508
30	0.497
35	0.467
40	0.435
50	0.365
60	0.307
70	0.284
80	0.275
90	0.272
100	0.270

FIGURE 4-1 BYRON GMRS PLOT



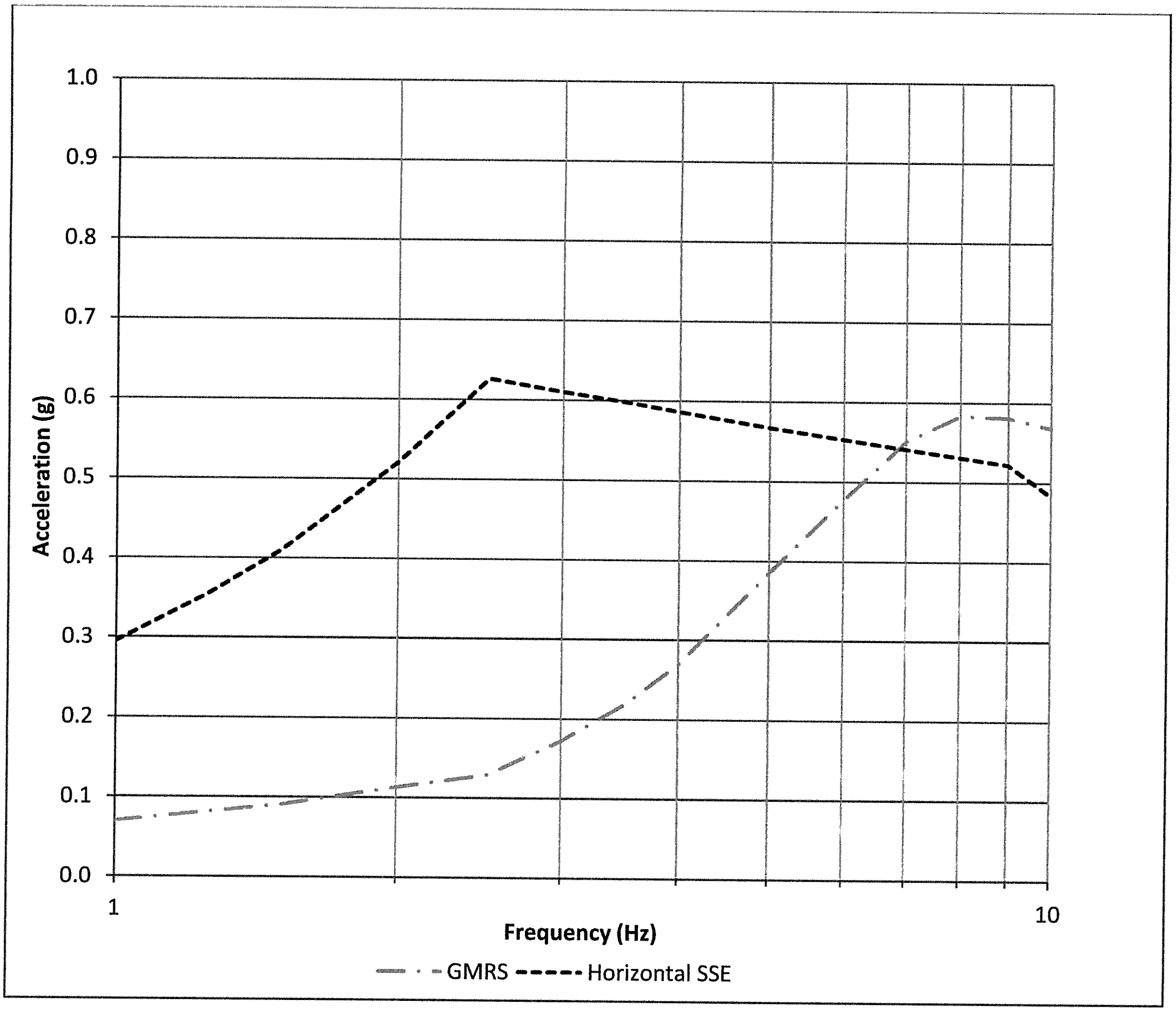
4.2 Comparison to SSE

As identified in the Byron March submittal report [4], the GMRS exceeds the SSE in the 1-10 hz range as shown in Table 4-2 and Figure 4.2.

TABLE 4-2 BYRON GMRS vs. SSE

Freq. (Hz)	GMRS (unscaled, g)	Horizontal SSE (g)
1	0.070	0.295
1.25	0.081	0.354
1.5	0.090	0.410
2	0.113	0.521
2.5	0.129	0.626
3	0.172	0.610
3.5	0.218	0.598
4	0.269	0.586
5	0.385	0.567
6	0.477	0.553
7	0.551	0.541
8	0.583	0.531
9	0.581	0.522
10	0.568	0.483

FIGURE 4-2 BYRON GMRS vs. SSE PLOT



5.0 Review Level Ground Motion (RLGM)

5.1 Description of RLGM selected

The RLGM for Byron was determined in accordance with Section 4 of EPRI 3002000704 [2] as being derived by linearly scaling the Byron SSE by the maximum ratio of the GMRS/SSE between the 1 and 10 hertz range. This calculation is shown in Table 5-1.

The ratio between the GMRS and SSE at 5% damping is tabulated.

TABLE 5-1 RATIO BETWEEN GMRS AND SSE

Freq. (Hz)	GMRS (unscaled, g)	Horizontal SSE (g)	SF = GMRS/SSE
1	0.070	0.295	0.24
1.25	0.081	0.354	0.23
1.5	0.090	0.410	0.22
2	0.113	0.521	0.22
2.5	0.129	0.626	0.21
3	0.172	0.610	0.28
3.5	0.218	0.598	0.36
4	0.269	0.586	0.46
5	0.385	0.567	0.68
6	0.477	0.553	0.86
7	0.551	0.541	1.02
8	0.583	0.531	1.10
9	0.581	0.522	1.11
10	0.568	0.483	1.18

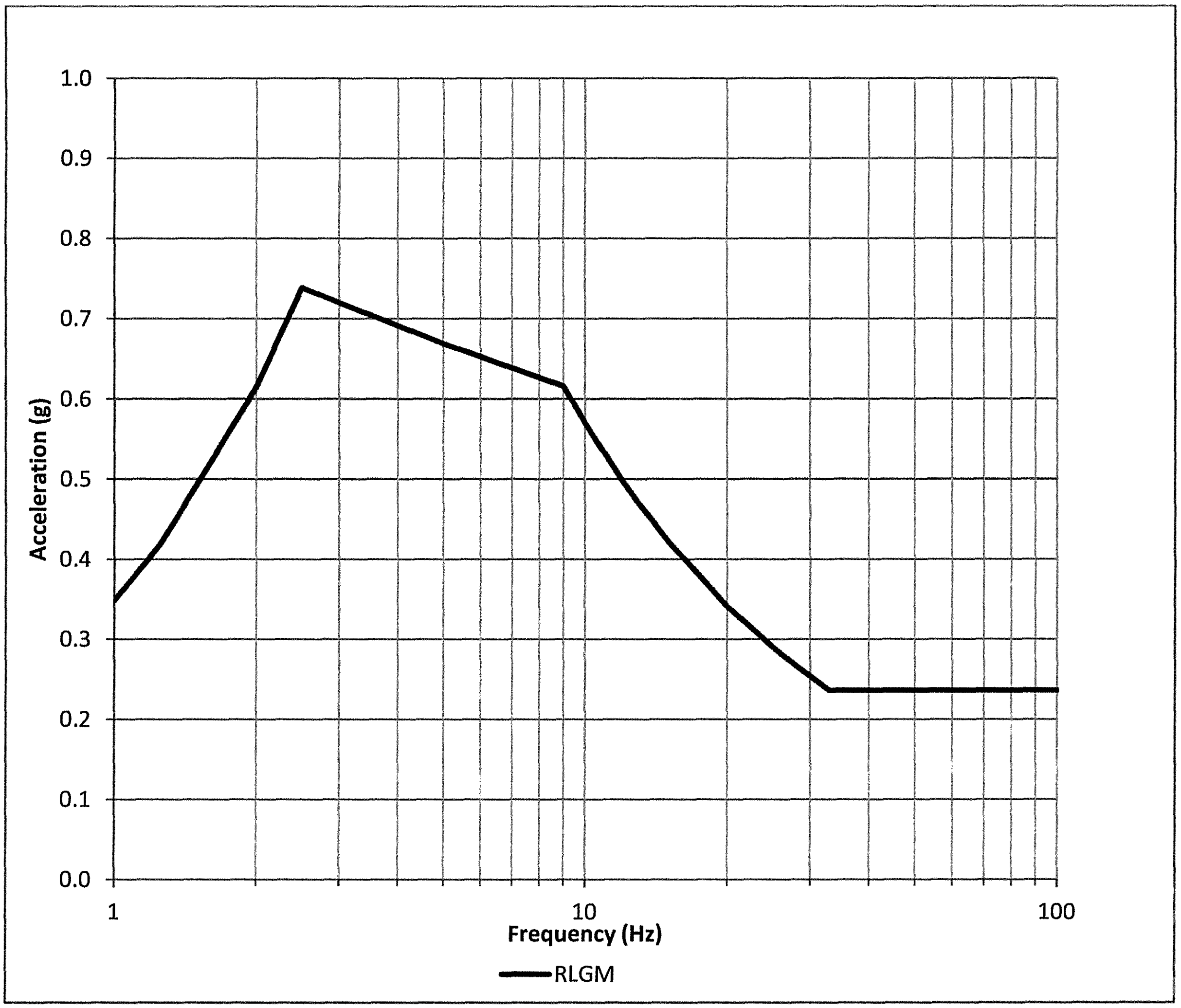
As shown above, the maximum ratio between the 5% damping GMRS and horizontal SSE occurs at 10 Hz and equals 1.18.

The resulting 5% damped RLGM, based on increasing the horizontal SSE by the maximum GMRS/SSE ratio of 1.18 is shown in Table 5-2 and Figure 5-2, the Byron Horizontal SSE is obtained from reference [4] Table 3.1-1. Note the RLGM PGA is 0.24.

TABLE 5-2 Byron RLGM (5% Damping)

Freq. (Hz)	Horizontal SSE (g)	RLGM (g)
0.35	0.124	0.146
0.5	0.167	0.197
1	0.295	0.348
1.25	0.354	0.418
2	0.521	0.615
2.5	0.626	0.739
3	0.610	0.720
4	0.586	0.691
5	0.567	0.669
6	0.553	0.653
7	0.541	0.638
8	0.531	0.627
9	0.522	0.616
10	0.483	0.570
12	0.422	0.498
12.5	0.410	0.484
13	0.398	0.470
15	0.358	0.422
20	0.289	0.341
25	0.246	0.290
28	0.226	0.267
30	0.215	0.254
33	0.200	0.236
40	0.200	0.236
50	0.200	0.236
100	0.200	0.236

FIGURE 5-2 PLOT OF RLGM



5.2 Method to estimate ISRS

The method used to derive the ESEP in-structure response spectra (ISRS) was to uniformly scale the existing SSE-based ISRS obtained from DC-ST-04-BB, Revision 2, "Development of Seismic Subsystem (or Equipment) Design Criteria (Horizontal and Vertical Earthquake) and Response Spectra" [22] by the maximum ratio of 1.18. The scaled ISRS was determined for all buildings and elevations where ESEL items are located at Byron and are documented in 14Q4240-CAL-001 [10.5].

6.0 Seismic Margin Evaluation Approach

It is necessary to demonstrate that ESEL items have sufficient seismic capacity to meet or exceed the demand characterized by the RLGM. The seismic capacity is characterized as the peak ground acceleration (PGA) for which there is a high confidence of a low probability of failure (HCLPF). The PGA is associated with a specific spectral shape, in this case the 5%-damped RLGM spectral shape. The calculated HCLPF capacity must be equal to or greater than the RLGM PGA (0.24g from Table 5-2). The criteria for seismic capacity determination are given in Section 5 of EPRI 3002000704 [2].

There are two basic approaches for developing HCLPF capacities:

1. Deterministic approach using the conservative deterministic failure margin (CDFM) methodology of EPRI NP-6041, A Methodology for Assessment of Nuclear Power Plant Seismic Margin (Revision 1) [7].
2. Probabilistic approach using the fragility analysis methodology of EPRI TR-103959, Methodology for Developing Seismic Fragilities [8].

For Byron, the deterministic approach using the CDFM methodology of EPRI NP-6041 [7] was used to determine HCLPFs.

6.1 Summary of methodologies used

Byron performed a seismic margin assessment (SMA) in 1998 in accordance with Nuclear Regulatory Commission, NUREG-1407, Procedural and Submittal Guidance for the Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities, June 1991 [5] and Nuclear Regulatory Commission, Generic Letter No. 88-20 Supplement 4, Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities - 10CFR 50.54(f), June 1991 [6]. Byron submitted the results of this SMA to the NRC per ComEd (now Exelon) Letter BY: 96-0323, "Transmittal of Byron Station Individual Plant Examination of External Events Submittal Report", December 23, 1996 [9]. The SMA was based on the IPEEE RLE, which was anchored to 0.3g peak ground acceleration. The SMA consisted of screening walkdowns and HCLPF calculations in accordance with EPRI NP-6041 [7]. HCLPF calculations were based on the CDFM methodology of EPRI NP-6041 [7].

For ESEP, Byron conservatively applied the methodology of EPRI NP-6041 [7] to all items on the ESEL. The screening walkdowns used the screening tables from Chapter 2 of EPRI NP-6041 [7]. The walkdowns were conducted by engineers who as a minimum attended the SQUG Walkdown Screening and Seismic Evaluation Training Course. The walkdowns were documented on Screening Evaluation Work Sheets from EPRI NP-6041 [7] which are included in Report 14Q4240-RPT-005 [21.2]. Anchorage capacity calculations used the CDFM criteria from EPRI NP-6041 [7] with Byron specific allowables and material strengths used as applicable. The input seismic demand was the RLGM provided in Table 5-2 and Figure 5-2.

6.2 HCLPF screening process

From Table 5-2 the spectral peak of the RLGM (amplified PGA) for Byron equals 0.739. The screening tables in EPRI NP-6041 [7] are based on ground peak spectral accelerations of 0.8g and 1.2g. These both exceed the RLGM peak spectral acceleration. The Byron ESEL components were screened against the 0.8g column of Table 2-4 of NP-6041 [7]. Note that the 0.8g corresponds to a PGA of 0.3g.

Per Report 14Q4240-RPT-003 [21.1], the Unit 1 and Unit 2 ESEL contain 111 and 104 items respectively. Of these, 16 are valves in Unit 0 and Unit 1 and 15 in Unit 2, both power-operated and relief. In accordance with Table 2-4 of EPRI NP-6041 [7], active valves may be assigned a functional capacity of 0.8g peak spectral acceleration without any review other than looking for valves with large extended operators on small diameter piping, and anchorage is not a failure mode. Therefore, valves on the ESEL may be screened out from ESEP seismic capacity determination, subject to the caveat regarding large extended operators on small diameter piping. The non-valve components in the ESEL were evaluated to the EPRI NP-6041 [7] caveats.

6.3 Seismic walkdown approach

6.3.1 Walkdown approach

Walkdowns for Byron were performed in accordance with the criteria provided in Section 5 of EPRI 3002000704 [2], which refers to EPRI NP-6041 [7] for the Seismic Margin Assessment process. Pages 2-26 through 2-30 of EPRI NP-6041 [7] describe the seismic walkdown criteria, including the following key criteria.

> *"The SRT [Seismic Review Team] should "walk by" 100% of all components which are reasonably accessible and in non-radioactive or low radioactive environments. Seismic capability assessment of components which are inaccessible, in high-radioactive environments, or possibly within contaminated containment, will have to rely more on alternate means such as photographic inspection, more reliance on seismic reanalysis, and possibly, smaller inspection teams and more hurried inspections. A 100% "walk by" does not mean complete inspection of each component, nor does it mean requiring an electrician or other technician to de-energize and open cabinets or panels for detailed inspection of all components. This walkdown is not intended to be a QA or QC review or a review of the adequacy of the component at the SSE level.*
>
> *If the SRT has a reasonable basis for assuming that the group of components are similar and are similarly anchored, then it is only necessary to inspect one component out of this group. The "similarity-basis" should be developed before the walkdown during the seismic capability preparatory work (Step 3) by reference to drawings, calculations or specifications. The one component or each type which is selected should be thoroughly*

inspected which probably does mean de-energizing and opening cabinets or panels for this very limited sample. Generally, a spare representative component can be found so as to enable the inspection to be performed while the plant is in operation. At least for the one component of each type which is selected, anchorage should be thoroughly inspected.

The walkdown procedure should be performed in an ad hoc manner. For each class of components the SRT should look closely at the first items and compare the field configurations with the construction drawings and/or specifications. If a one-to-one correspondence is found, then subsequent items do not have to be inspected in as great a detail. Ultimately the walkdown becomes a "walk by" of the component class as the SRT becomes confident that the construction pattern is typical. This procedure for inspection should be repeated for each component class; although, during the actual walkdown the SRT may be inspecting several classes of components in parallel. If serious exceptions to the drawings or questionable construction practices are found then the system or component class must be inspected in closer detail until the systematic deficiency is defined.

The 100% "walk by" is to look for outliers, lack of similarity, anchorage which is different from that shown on drawings or prescribed in criteria for that component, potential SI [Seismic Interaction] problems, situations that are at odds with the team members' past experience, and any other areas of serious seismic concern. If any such concerns surface, then the limited sample size of one component of each type for thorough inspection will have to be increased. The increase in sample size which should be inspected will depend upon the number of outliers and different anchorages, etc., which are observed. It is up to the SRT to ultimately select the sample size since they are the ones who are responsible for the seismic adequacy of all elements which they screen from the margin review. Appendix D gives guidance for sampling selection.

The Byron walkdowns included as a minimum a 100% walk-by of the existing items on the ESEL except as noted in Section 7.0. Any previous walkdown information that was relied upon for SRT judgment is documented in Section 6.3.2.

6.3.2 Application of Previous Walkdown Information

The seismic walkdowns for Byron included as a minimum a walk-by of all the components on the ESEL with the exception of 0WW01PA (deep well pump) which is discussed in Section 7.0. All non-energized cabinets were opened when specialized tools were not needed to operate the cabinet doors. For the switchgear (1/2AP12E), the photos taken during the NTTF R2.3 walkdowns [17] were utilized for SRT judgment.

6.3.3 Significant Walkdown Findings

Consistent with the guidance from NP-6041 [7], no significant outliers or anchorage concerns were identified during the Byron seismic walkdowns. The following findings were noted during the walkdowns.

- Several block walls were identified in the proximity of ESEL equipment. These block walls were assessed for their structural adequacy to withstand the seismic loads resulting from the RLGM. For these cases, the block wall is noted on the ESEL HCLPF tables in Attachments C and D.

6.4 HCLPF calculation process

ESEL items were evaluated using the criteria in EPRI NP-6041 [7]. Those evaluations included the following steps:

- Performing seismic capability walkdowns for equipment to evaluate the equipment installed plant conditions
- Performing screening evaluations using the screening tables in EPRI NP-6041[7] as described in Section 6.2 and
- Performing HCLPF calculations considering various failure modes that include both structural failure modes (e.g. anchorage, load path etc.) and functional failure modes.

All HCLPF calculations were performed using the CDFM methodology and are documented in Byron calculations [10].

Anchorage for non-valve components was evaluated either by SRT judgment, large margins in existing design basis calculations, or CDFM HCLPF calculations [10]. This is documented in Attachments C and D.

A number of components were located above 40 feet from grade. For components located 40 feet above grade, screening based on ground peak spectral acceleration is not applicable and additional consideration is required. In accordance with Appendix B of EPRI 1019200 [19], spectral acceleration of the ground can be converted to 5% damper spectral acceleration at the base of the component. Therefore, components that are above 40 feet from grade and have corresponding ISRS at the base of component not in exceedance of 1.8g (1.5 times 1.2g) in the component frequency range of interest may be screened using the caveats of the 2nd screening column. Per Calculation 14Q4240-CAL-001 [10.5], the acceleration values at elevations above 40 feet are significantly larger than 1.8g. In order to determine the equipment capacity of these components, existing Byron design basis seismic test qualification reports were utilized by increasing the Required Response Spectra by the ratio of GMRS/SSE to determine their acceptability and the HCLPFs for these components.

In addition, potential seismic interactions such as block walls were identified during the walkdowns and the CDFM HCLPFs were determined for these interactions as noted in Attachment C and D.

As described in Section 6.0, for HCLPF calculations the conservative, deterministic failure margin (CDFM) analysis criteria established in Section 6 of EPRI NP-6041 [7] are used for a detailed analysis of components. The relevant CDFM criteria from EPRI NP-6041 [7] are summarized in Table 6-1.

Table 6-1: HCLPF Calculation Summary

Load combination:	Normal + Ec
Ground response spectrum:	Conservatively specified (84% non-exceedance probability)
Damping:	Conservative estimate of median damping.
Structural model:	Best estimate (median) + uncertainty variation in frequency.
Soil-structure interaction	Best estimate (median) + parameter variation
Material strength:	Code specified minimum strength or 95% exceedance of actual strength if test data is available.
Static capacity equations:	Code ultimate strength (ACI), maximum strength (AISC), Service Level D (ASME) or functional limits. If test data is available to demonstrate excessive conservatism of code equations then use 84% exceedance of test data for capacity equations.
Inelastic energy absorption:	For non-brittle failure modes and linear analysis, use 80% of computed seismic stress in capacity evaluation to account for ductility benefits or perform nonlinear analysis and use 95% exceedance ductility levels.
In-structure (floor) spectra generation:	Use frequency shifting rather than peak broadening to account for uncertainty and use median damping.

The HCLPF capacity is equal to the PGA at which the strength limit is reached. The HCLPF earthquake load is calculated as follows:

U = Normal + Ec

Where:

- U = Ultimate strength per Section 6 of EPRI NP-6041 [7]
- Ec = HCLPF earthquake load
- Normal = Normal operating loads (dead and live load expected to be present, etc.)

For this calculation, the HCLPF earthquake load is related to a fixed reference earthquake:

Ec = SFc*Eref

Where:

- Eref = reference earthquake from the relevant in-structure response spectrum (ISRS)
- SFc = component-specific scale factor that satisfies U = Normal +Ec

The HCLPF will be defined as the PGA produced by Ec. Because the Byron RLGM PGA is 0.24g:

HCLPF = 0.24g *SFc

6.5 Functional evaluation of relays

Per Report 14Q4240-RPT-003 [21.1], twenty-six relays in the ESEL associated with the FLEX Phase 1 response required functional evaluations. Each relay was evaluated using the SMA relay evaluation criteria of Section 3 of NP-6041 [7].

Twelve relays were evaluated using Generic Equipment Ruggedness Spectra in accordance with NP-6041 [7].

Specific seismic qualification test-based capacities were available for the remaining relays in Byron documentation. In-cabinet capacity to demand evaluations were performed using the Byron relay seismic capacities and the ESEP ISRS scaled with the NP-6041 in-cabinet amplification factors.

The ESEP relay functional evaluations are documented in a Byron calculation 14Q4240-CAL-005 [10.4].

6.6 Tabulated ESEL HCLPF values (including Key failure modes)

Tabulated ESEL HCLPF values including the key failure modes are included in Attachment C for Unit 1 and common items and in Attachment D for Unit 2 items.

- For items screened out using NP 6041 [7] screening tables, the screening level can be provided as >RLGM (0.24g) and the failure mode can be listed as "Screened", (unless the controlling HCLPF value is governed by anchorage).
- For items where anchorage controls the HCLPF value, the HCLPF value is listed in the table and the failure mode is noted as "anchorage."
- For items where equipment capacity based upon the screening lane values of Table 2-4 of EPRI NP-6041 [7] controls the HCLPF value (e.g. anchorage HCLPF capacity exceeds the equipment capacity derived from screening lanes), the HCLPF value is listed in the table and the failure mode is noted as "equipment capacity."

7.0 Inaccessible Items

7.1 Identification of ESEL Items inaccessible for walkdowns

There are no inaccessible items for the Byron ESEP with the exception of the deep well pump 0WW01PA and low suction pressure switch 1/2PSL-AF055. This pump is incased in a concrete vault and is not accessible. However, this pump undergoes frequent surveillance for functionality per Byron procedure BVP 800-27 [20]. The pump is not anchored to any concrete elements but is grouted in place therefore no anchorage calculation is required. Similarly, seismic interactions with components such as block walls are not a feasible concern. The pressure switch is located in panel 1/2PA34J which was walked down. The switch is located within a Westinghouse unit and cannot be visually inspected.

Twelve components in the Unit 2 containment were not walked down. Based on the results of the Unit 1 ESEP walkdowns, these components would be qualified by comparison to their counterpart in the other unit. Based on the location of the items and with regard to seismic interactions, there would be no block walls or attached piping.

2PL60JB
2PL60JD
2PL61JA
2PL61JC
2PL69J
2PL75J
2RY32MB
2RY456
2SI8808A
2SI8808B
2SI8808C
2SI8808D

1/2PIS-0403 in the Auxiliary Building were not walked down, due to radiation and safety concerns. 1/2PIS-0403 are located in a high radiation area of the plant a few feet from 1/2PT-0403. 1/2PT-0403 were walked down the week of April 28th, 2014, and systems interactions were not noted in that area of the plant. 1/2PIS-0403 are acceptable by engineering judgement for seismic interactions due to their proximity to 1/2PT-0403 and the walkdown performed the week of April 28th, 2014.

7.2 Planned Walkdown / Evaluation Schedule / Close Out

No additional walkdowns are required.

8.0 ESEP Conclusions and Results

8.1 Supporting Information

Byron Generating Station has performed the ESEP as an interim action in response to the NRC's 50.54(f) letter [1]. It was performed using the methodologies in the NRC endorsed guidance in EPRI 3002000704 [2].

The ESEP provides an important demonstration of seismic margin and expedites plant safety enhancements through evaluations and potential near-term modifications of plant equipment that can be relied upon to protect the reactor core following beyond design basis seismic events.

The ESEP is part of the overall Byron response to the NRC's 50.54(f) letter [1]. On March 12, 2014, NEI submitted to the NRC results of a study [12] of seismic core damage risk estimates based on updated seismic hazard information as it applies to operating nuclear reactors in the Central and Eastern United States (CEUS). The study concluded that "site-specific seismic hazards show that there has not been an overall increase in seismic risk for the fleet of U.S. plants" based on the re-evaluated seismic hazards. As such, the "current seismic design of operating reactors continues to provide a safety margin to withstand potential earthquakes exceeding the seismic design basis."

The NRC's May 9, 2014 NTTF 2.1 Screening and Prioritization letter [14] concluded that the "fleetwide seismic risk estimates are consistent with the approach and results used in the GI-199 safety/risk assessment." The letter also stated that "As a result, the staff has confirmed that the conclusions reached in GI-199 safety/risk assessment remain valid and that the plants can continue to operate while additional evaluations are conducted."

An assessment of the change in seismic risk for Byron was included in the fleet risk evaluation submitted in the March 12, 2014 NEI letter [12] therefore, the conclusions in the NRC's May 9 letter [14] also apply to Byron.

In addition, the March 12, 2014 NEI letter [12] provided an attached "Perspectives on the Seismic Capacity of Operating Plants," which (1) assessed a number of qualitative reasons why the design of SSCs inherently contain margin beyond their design level, (2) discussed industrial seismic experience databases of performance of industry facility components similar to nuclear SSCs, and (3) discussed earthquake experience at operating plants.

The fleet of currently operating nuclear power plants was designed using conservative practices, such that the plants have significant margin to withstand large ground motions safely. This has been borne out for those plants that have actually experienced significant earthquakes. The seismic design process has inherent (and intentional) conservatisms which result in significant seismic margins within structures, systems and components (SSCs). These conservatisms are reflected in several key aspects of the seismic design process, including:

- Safety factors applied in design calculations
- Damping values used in 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.).

These design practices combine to result in margins such that the SSCs will continue to fulfill their functions at ground motions well above the SSE.

The intent of the ESEP is to perform an interim action in response to the NRC's 50.54(f) letter [1] 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. In order to complete the ESEP in an expedited amount of time, the RLGM used for the ESEP evaluation is a scaled version of the plant's SSE rather than the actual GMRS. To more fully characterize the risk impacts of the seismic ground motion represented by the GMRS on a plant specific basis, a more detailed seismic risk assessment (SPRA or risk-based SMA) is to be performed in accordance with EPRI 1025287 [15]. Per the NRC May 9, 2014 letter [14], it is not necessary for Byron to perform a risk evaluation. The completion of the ESEP satisfies the regulatory commitment.

8.2 Summary of ESEP Identified and Identification of Planned Modifications

The results of the Byron ESEP performed as an interim action in response to the NRC's 50.54(f) letter [1] using the methodologies in the NRC endorsed guidance in EPRI 3002000704 [2] show that all equipment evaluated are adequate in resisting the seismic loads expected to result from the site RLGM. Therefore, no plant modifications are required as a result of the Byron ESEP.

8.3 Modification Implementation Schedule

No modification implementation schedule is required since no modifications are required.

8.4 Summary of Regulatory Commitments

No regulatory commitments are required.

9.0 References

1) NRC (E Leeds and M Johnson) Letter to All Power Reactor Licensees et al., "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," March 12, 2012.

2) Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1 – Seismic. EPRI, Palo Alto, CA: May 2013. 3002000704.

3) Order Number EA-12-049 responses:

3.1) NRC Letter RS-13-018 from Byron (ML13060A364), "Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)", February 28, 2013

3.2) NRC Letter RS-13-115 from Byron (ML13241A279), "First Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)", August 28, 2013

3.3) NRC Letter RS-14-008 from Byron (ML14059A425), "Second Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)", February 28, 2014

3.4) NRC Letter RS-14-206 from Byron (ML14248A229), "Third Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)", August 28, 2014

4) Seismic Hazard and Screening Report in Response to the 50.54(f) Information Request Regarding Fukushima Near-Term Task Force Recommendation 2.1: Seismic for Byron Generating Station dated 3/17/14, Correspondence No. RS-14-065 (S&L Report SL-012185, Revision 0).

5) Nuclear Regulatory Commission, NUREG-1407, Procedural and Submittal Guidance for the Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities, June 1991

6) Nuclear Regulatory Commission, Generic Letter No. 88-20 Supplement 4, Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities - 10CFR 50.54(f), June 1991

7) A Methodology for Assessment of Nuclear Power Plant Seismic Margin, Rev. 1, August 1991, Electric Power Research Institute, Palo Alto, CA. EPRI NP 6041

8) Methodology for Developing Seismic Fragilities, August 1991, EPRI, Palo Alto, CA. 1994, TR-103959

9) ComEd, K. L. Graesuar, Letter By: 96-0323 to the USNRC, "Transmittal of Byron Station Individual Plant Examination of External Events Submittal Report", December 23, 1996

10) Byron HCLPF Calculations for the ESEP project

  10.1) 14Q4240-CAL-002, Revision 1, HCLPF Evaluations of Equipment and Anchorage for Byron ESEP

  10.2) 14Q4240-CAL-003, Revision 1, HCLPF Evaluations of Masonry Block Walls for Byron ESEP

  10.3) 14Q4240-CAL-004, Revision 1, HCLPF Evaluation of the Diesel Oil Storage Tanks for Byron ESEP

  10.4) 14Q4240-CAL-005, Revision 1, HCLPF Evaluations of Relays for Byron ESEP

  10.5) 14Q4240-CAL-001, Revision 1, Generation of In-Structure Response Spectra for Byron ESEP

11) Nuclear Regulatory Commission, NUREG/CR-0098, Development of Criteria for Seismic Review of Selected Nuclear Power Plants, published May 1978

12) Nuclear Energy Institute (NEI), A. Pietrangelo, Letter to D. Skeen of the USNRC, "Seismic Core Damage Risk Estimates Using the Updated Seismic Hazards for the Operating Nuclear Plants in the Central and Eastern United States", March 12, 2014

13) Nuclear Energy Institute (NEI), A. Pietrangelo, Letter to D. Skeen of the USNRC, "Proposed Path Forward for NTTF Recommendation 2.1: Seismic Reevaluations", April 9, 2013

14) NRC (E Leeds) Letter to All Power Reactor Licensees et al., "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," May 9, 2014.

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

16) NRC (E Leeds) Letter to NEI (J Pollock), "Electric Power Research Institute Final Draft Report XXXXXX, "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 Reevaluations," May 7, 2013 ADAMS Accession No. ML13106A331

17) NTTF 2.3 Seismic Walkdown Submittals

17.1) Correspondence RS-12-161, Report 12Q0108.20-R-001, Revision 1, Unit 1

17.2) Correspondence RS-12-161, Report 12Q0108.20-R-002, Revision 1, Unit 2

17.3) Correspondence RS-13-218, Updated Transmittal #1 (Annex A), Unit 1

17.4) Correspondence RS-13-218, Updated Transmittal #1 (Annex A), Unit 2

18) Byron/Braidwood Nuclear Stations Updated Final Safety Analysis Report (UFSAR), Revision 13

19) EPRI Technical Report (TR) 1019200, "Seismic Fragility Applications Guide Update," December 2009.

20) BVP 800-27, Revision 4, "Seismic Requirements for Deep Well Pumps"

21) Byron ESEP Reports

21.1) 14Q4240-RPT-003, Revision 3, Validation of Expedited Seismic Equipment List

21.2) 14Q4240-RPT-005, Revision 1, Byron ESEP SEWS

22) DC-ST-04-BB, Revision 2, "Development of Seismic Subsystem (Or Equipment) Design Criteria (Horizontal and Vertical Earthquake) and Response Spectra"

Attachment A

Byron Unit 1 ESEL

Item #	Equipment ID	Description	Equipment Normal State	Equipment Desired State	Notes
1	1SX04P	1B AF PP ENG DRV CLG WTR PP	In Service	In Service	
2	1SX01K	1B AF PP ENG CLSD CYCLE HX	In Service	In Service	Passive Component
3	1SX02K	1B AF PP RHT ANGLE GEAR LUBE OIL CLR	In Service	In Service	Passive Component
4	1AF01AB	1B DSL DRV AF PP OIL CLR	In Service	In Service	Passive Component
5	1AF02A	1B DSL DRV AF PP GEAR OIL CLR	In Service	In Service	Passive Component
6	1VA08S	1B DSL DRV AF PP CUB CLR	In Service	In Service	Passive Component
13	1AF017B	MOV 1B AF PP SX SUCT UPST ISOL VLV	Closed	Open	
14	1AF006B	MOV 1B AF PP SX SUCT DWST ISOL VLV	Closed	Open	
15	0CC01A	Unit 0 CC Heat Exchanger	In Service	In Service	Passive Component (Common to Both Units)
16	1CC01A	Unit 1 CC Heat Exchanger	In Service	In Service	Passive Component
18	1AF01PB	1B AF DSL Pump Assembly	Stand By	In Service	Diesel Engine and Pump on a single skid
19	1AF01J	1B DSL DRV AF PP STARTUP CONT PNL	In Service	In Service	
20	1AF03J	1B DSL DRV AF PP EMERGENCY STARTUP CONT PNL	Normal	Normal	Control Panel
21	1AF005E	AOV 1B AF PP DSCH TO 1A S/G FCV	Open	Throttled	AOV Manual operation only Control via Hand wheel after Air fails
22	1AF005F	AOV 1B AF PP DSCH TO 1B S/G FCV	Open	Throttled	AOV Manual operation only Control via Hand wheel after Air fails
23	1AF005G	AOV 1B AF PP DSCH TO 1C S/G FCV	Open	Throttled	AOV Manual operation only Control via Hand wheel after Air fails
24	1AF005H	AOV 1B AF PP DSCH TO 1D S/G FCV	Open	Throttled	AOV Manual operation only Control via Hand wheel after Air fails
25	1PL84JB	Local Instrument Panel	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters

Item #	Equipment ID	Description	Equipment Normal State	Equipment Desired State	Notes
27	1PM06J	PANEL CONT MAIN BOARD ENG SAFETY 0-3378 MCR	In Service	In Service	Control Panel
41	1PL85JB	Local Instrument Panel	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
43	1PL79JB	1A SAFETY VLV RM LOC INST PNL	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
44	1PL77JC	1B SAFETY VLV RM LOC INST PNL	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
49	1PL69J	RX1 CNMT LOC INST PNL	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
50	1PL75J	RX1 CNMT LOC INST PNL	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
51	1PM04J	PANEL CONT MAIN BOARD FEEDWATER 0-3378 MCR	In Service	In Service	Control Panel
52	1MS018A	1A SG PORV	Closed	Throttled	Valve
53	1MS018A-HFK	1A S/G MS PORV HANDPUMP	Stand By	In Service	Hand pump
54	1MS018B	1B SG PORV	Closed	Throttled	Valve
55	1MS018B-HFK	1B S/G MS PORV HANDPUMP	Stand By	In Service	Hand pump
56	1MS018C	1C SG PORV	Closed	Throttled	Valve Includes manual hand pump and controls
57	1MS018C-HFK	1C S/G MS PORV HANDPUMP	Stand By	In Service	Hand Pump and indications

Item #	Equipment ID	Description	Equipment Normal State	Equipment Desired State	Notes
58	1MS018JCE-BAT	1C MS PORV Controller Battery Bank	Energized	Energized	Valve
59	1MS018JCE	1C PORV CONTROLLER UPS	In Service	In Service	UPS
60	1MS018JC	1C MS PORV Control Panel	In Service	In Service	Control Panel
61	1MS018D	1D SG PORV	Closed	Throttled	Valve Includes manual hand pump and controls
62	1MS018D-HFK	1D S/G MS PORV HANDPUMP	Stand By	In Service	Hand Pump and indications
63	1MS018JD	1D MS PORV Control Panel	In Service	In Service	Control Panel
64	1MS018JDE-BAT	1D MS PORV Controller Battery Bank	Energized	Energized	Battery is not recharged during the FLEX Response
65	1MS018JDE	1D PORV CONTROLLER UPS	In Service	In Service	UPS
66	1RY456	U1 PZR PORV	Closed	Closed	Valve
67	1RY32MB	1B PZR PORV Accumulator	In Service	In Service	Passive Component
68	1DC11J	125V DC ESF 12 Fuse Panel	Energized	Energized	Panel
86	0WW01PA	PUMP DEEP WELL M-83 M-3 GL	In Service	In Service	Pump common to both units, circuit breaker controlled manually per 0BFSG-5
87	0WW019A	AOV 0B DEEP WELL PP 0WW01PB TO 0A SXCT LCV	Throttled	Throttled	Air Operated Valve (common to both units) will be manually operated per procedure 0BFSG-5
88	1AP99E	Bus 131Z	Energized	Energized	480VAC Bus
89	1LT-0933	REF WTR STG TK LVL D/P XMTTR	In Service	In Service	Instrument
91	1SI01T	U-1 RWST	In Service	In Service	Passive Component
93	1DO01TB	1B DO STO TK, 25,000 GAL	In Service	In Service	Passive Component
94	1DO01TD	1D DO STO TK, 25,000 GAL	In Service	In Service	Passive Component
95	1DO01PB	1B DG 1B FO XFER PP	In Service	In Service	Pump
96	1PL08J	ASSY - 1B DG 1DG01KB CONT PNL	In Service	In Service	Control Panel

Item #	Equipment ID	Description	Equipment Normal State	Equipment Desired State	Notes
97	1DO10T	1B AF DO DAY TK, 500 GAL	In Service	In Service	Passive Component
98	1LI-DO032	1B AF DO Day Tank Level Site Glass	In Service	In Service	Passive Component
99	1AP27E	MCC 132X2	Energized	Energized	MCC
106	1SI8808A	A SI Accum Isolation Valve	Open	Closed	Valve
108	1SI8808B	B SI Accum Isolation Valve	Open	Closed	Valve
109	1AP27E-A	MCC 132X2A	Energized	Energized	MCC
110	1SI8808C	C SI Accum Isolation Valve	Open	Closed	Valve
111	1SI8808D	D SI Accum Isolation Valve	Open	Closed	Valve
112	1PL61JA	RX1 CNMT LOC INST PNL	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
113	1PL60JB	RX1 CNMT LOC INST PNL	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
114	1PL61JC	RX1 CNMT LOC INST PNL	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
115	1PL60JD	RX1 CNMT LOC INST PNL	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
116	1PA06J	U-1 PROC I&C RACK CONT GRP 2 CAB 6	In Service	In Service	Instrument Rack containing separately powered and separately listed instrumentation transmitters
117	1PA08J	U-1 PROC I&C RACK	In Service	In Service	Instrument Rack containing separately powered and separately listed instrumentation transmitters

Item #	Equipment ID	Description	Equipment Normal State	Equipment Desired State	Notes
130	1PIS-403	W-RNG LP 1A HOT LEG ISOLATOR	In Service	In Service	Instrument
131	1PA04J	U-1 PROC I&C RACK PROTECT CH 4	In Service	In Service	Instrument Rack containing separately powered and separately listed instrumentation transmitters
132	1PM05J	PANEL CONT MAIN BOARD RX/CV 0-3378 MCR	In Service	In Service	Control Panel
133	1PA02J	U-1 PROC I&C RACK PROTECT CH 2	In Service	In Service	Instrument Rack containing separately powered and separately listed instrumentation transmitters
134	1PA52J	CAB HJTC RX VESSEL LEVEL CH B 0-3371B	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
135	1PI-PC005	CNMT PRESSURE CHANNEL B PRESSURE INDICATOR	In Service	In Service	Instrument
136	1PT-PC005	CNMT PRESSURE CHANNEL B PRESSURE TRANSMITTER	In Service	In Service	Instrument
137	1PA34J	CAB CONT SYSTEM ESF 12 0-3371B	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
146	1NR13EB	Wide Range Amp	In Service	In Service	Instrument
147	1NR13EC	Signal Processor	In Service	In Service	Instrument
148	1NR13ED	Optical Signal Isolator	In Service	In Service	Instrument
149	0PM02J	MCR at Center Desk	In Service	In Service	Control Panel (Common to Both Units) containing separately powered and separately listed instrument indicators

Item #	Equipment ID	Description	Equipment Normal State	Equipment Desired State	Notes
150	1PM07J	U1 NI panels	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
156	1AP12E	Bus 132X	Energized	Energized	480VAC Bus
157	1DC02E	125V DC Battery 112	Energized	Energized	Battery
158	1DC04E	125V DC BATT CHGR 112	Energized	Energized	Battery Charger
159	1IP06E	112 Inverter	Energized	Energized	Inverter
160	1IP08E	114 Inverter	Energized	Energized	Inverter
161	1IP02J	Instrument Bus 112	Energized	Energized	120VAC Bus
162	1IP04J	Instrument Bus 114	Energized	Energized	120VAC Bus
170	1AF01EA-A	1B DSL DRV AF PP BANK A BATT A	Energized	Energized	Battery
171	1AF01EA-B	1B DSL DRV AF PP BANK A BATT B	Energized	Energized	Battery
172	1AF01EB-1	1B DSL DRV AF PP 1B BATT CHGR	Energized	Energized	Battery Charger
173	1AF01EA-1	1B DSL DRV AF PP 1A BATT CHGR	Energized	Energized	Battery Charger
174	1AP24E	MCC 132X3	Energized	Energized	MCC
175	1AP23E	MCC132X1	Energized	Energized	MCC
182	1VE02C	BATT RM-112 EXH FAN	In Service	In Service	Fan
184	1AP28E	MCC 132X4	Energized	Energized	MCC
186	1AP32E	MCC 132X5	Energized	Energized	MCC
190	1RH02AA-1A	RHR HX 1A	Available	Available	Passive Component
191	1RH02AB-1B	RHR HX 1B	Available	Available	Passive Component
192	1SX01FB-2	SX Strainer	Available	Available	Passive Component
193	0VA413Y	Fire Damper	In Service	In Service	Damper
194	K7 @ 1AF01J	OVERCRANK RELAY	In Service	In Service	Relay
195	K4 @ 1AF01J	OVERCRANK TIMER RELAY	In Service	In Service	Relay

Item #	Equipment ID	Description	Equipment Normal State	Equipment Desired State	Notes
196	S1 @ 1AF01J	Speed Switch 1SS-AF8002	In Service	In Service	Relay
197	K9 @ 1AF01J	OVERSPEED RELAY	In Service	In Service	Relay
198	1PSL-AF143	LUBE OIL PRESSURE	In Service	In Service	Pressure Switch
199	K10 @ 1AF01J	LOW LUBE Oil PRESSURE RELAY	In Service	In Service	Relay
200	K8 @ 1AF01J	HIGH WATER TEMPERATURE RELAY	In Service	In Service	Relay
201	1PSL-AF055	LOW SUCTION PRESSURE	In Service	In Service	Relay
202	K12 @ 1AF01J	ENGINE FAILURE LOCKOUT RELAY	In Service	In Service	Relay
203	1DC04E-K1-1	OVERVOLTAGE RELAY	In Service	In Service	Relay
204	1DC04E-K1-2	OVERVOLTAGE RELAY	In Service	In Service	Relay
205	1PM01J	PANEL CONT MAIN BOARD MCR	In Service	In Service	Panel with bus voltage indicators
206	1VE01J	CONTROL PANEL	In Service	In Service	Control Panel

Attachment B

Byron Unit 2 ESEL

Item #	Equipment ID	Description	Equipment Normal State	Equipment Desired State	Notes
7	2SX04P	2B AF PP ENG DRV CLG WTR PP	In Service	In Service	
8	2SX01K	2B AF PP ENG CLSD CYCLE HX	In Service	In Service	Passive Component
9	2SX02K	2B AF PP RHT ANGLE GEAR LUBE OIL CLR	In Service	In Service	Passive Component
10	2AF01AB	2B DSL DRV AF PP OIL CLR	In Service	In Service	Passive Component
11	2AF02A	2B DSL DRV AF PP GEAR OIL CLR	In Service	In Service	Passive Component
12	2VA08S	2B DSL DRV AF PP CUB CLR	In Service	In Service	Passive Component
17	2CC01A	Unit 2 CC Heat Exchanger	In Service	In Service	Passive Component
28	2AF017B	MOV 2B AF PP SX SUCT UPST ISOL VLV	Closed	Open	MOV
29	2AF006B	MOV 2B AF PP SX SUCT DWST ISOL VLV	Closed	Open	MOV
30	2AF01PB	2B AF DSL Pump Assembly	Stand By	In Service	Diesel Engine and Pump on a single skid
31	2AF01J	2B DSL DRV AF PP STARTUP CONT PNL	In Service	In Service	
32	2AF03J	AF PUMP 2B EMERGENCY CONT PNL	Normal	Normal	Control Panel
33	2AF005E	AOV 2B AF PP DSCH TO 2A S/G FCV	Open	Throttled	AOV Manual operation only Control via Hand wheel after Air fails
34	2AF005F	AOV 2B AF PP DSCH TO 2B S/G FCV	Open	Throttled	AOV Manual operation only Control via Hand wheel after Air fails
35	2AF005G	AOV 2B AF PP DSCH TO 2C S/G FCV	Open	Throttled	AOV Manual operation only Control via Hand wheel after Air fails
36	2AF005H	AOV 2B AF PP DSCH TO 2D S/G FCV	Open	Throttled	AOV Manual operation only Control via Hand wheel after Air fails
37	2PL84JB	Local Instrument Panel	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters

Item #	Equipment ID	Description	Equipment Normal State	Equipment Desired State	Notes
39	2PM06J	PANEL CONT MAIN BOARD ENG SAFETY 0-3378 MCR	In Service	In Service	Control Panel
40	2PL85JB	Local Instrument Panel	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
42	2PL69J	RX2 CNMT LOC INST PNL	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
45	2PL79JB	2A SAFETY VLV RM LOC INST PNL	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
46	2PL77JC	2B SAFETY VLV RM LOC INST PNL	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
47	2PL75J	RX2 CNMT LOC INST PNL	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
48	2PM04J	PANEL CONT MAIN BOARD FEEDWATER 0-3378 MCR	In Service	In Service	Control Panel
69	2MS018A	2A SG PORV	Closed	Throttled	Valve Includes manual hand pump and controls
70	2MS018A-HFK	2A S/G MS PORV HANDPUMP	Stand By	In Service	Hand Pump and indications
71	2MS018B	2B SG PORV	Closed	Throttled	Valve Includes manual hand pump and controls
72	2MS018B-HFK	2B S/G MS PORV HANDPUMP	Stand By	In Service	Hand Pump and indications
73	2MS018C	2C SG PORV	Closed	Throttled	Valve Includes manual hand pump and controls

Item #	Equipment ID	Description	Equipment Normal State	Equipment Desired State	Notes
74	2MS018C-HFK	2C S/G MS PORV HANDPUMP	Stand By	In Service	Hand Pump and indications
75	2MS018JC	2C MS PORV Control Panel	In Service	In Service	Control Panel
76	2MS018JCE	2C PORV CONTROLLER UPS	Energized	Energized	UPS
77	2MS018JCE-BAT	2C PORV CONTROLLER BATTERY BANK	Energized	Energized	Battery
78	2MS018D	2D SG PORV	Closed	Throttled	Valve Includes manual hand pump and controls
79	2MS018D-HFK	2D S/G MS PORV HANDPUMP	Stand By	In Service	Hand Pump and indications
80	2MS018JD	2D MS PORV Control Panel	In Service	In Service	Control Panel
81	2MS018JDE	2D PORV CONTROLLER UPS	Energized	Energized	UPS
82	2MS018JDE-BAT	2D PORV CONTROLLER BATTERY BANK	Energized	Energized	Battery is not recharged during the FLEX Response
83	2RY456	U2 PZR PORV	Closed	Closed	Valve
84	2RY32MB	2B PZR PORV Accumulator	In Service	In Service	Passive Component
85	2DC11J	125V DC FUSE PNL ESF 22	Energized	Energized	Panel
90	2LT-0933	REF WTR STG TK LVL D/P XMTTR	In Service	In Service	Instrument
92	2SI01T	U-2 RWST	In Service	In Service	Passive Component
100	2DO01TB	2B DO STO TK, 50,000 GAL	In Service	In Service	Passive Component
101	2DO01PB	2B DG 2B FO XFER PP	In Service	In Service	Pump
102	2PL08J	2B DG control panel	In Service	In Service	Control Panel
103	2DO10T	U-2 B AF DO Day Tank	In Service	In Service	Passive Component
104	2LI-DO032	2B AF DO Day Tank Level Site Glass	In Service	In Service	Passive Component
105	2AP27E	MCC 232X2	Energized	Energized	MCC
118	2SI8808A	A SI Accum Isolation Valve	Open	Closed	Valve
120	2SI8808B	B SI Accum Isolation Valve	Open	Closed	Valve
121	2AP27E-A	MCC232X2A	Energized	Energized	MCC

Item #	Equipment ID	Description	Equipment Normal State	Equipment Desired State	Notes
122	2SI8808C	C SI Accum Isolation Valve	Open	Closed	Valve
123	2SI8808D	D SI Accum Isolation Valve	Open	Closed	Valve
124	2PL61JA	RX2 CNMT LOC INST PNL	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
125	2PL60JB	RX2 CNMT LOC INST PNL	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
126	2PL61JC	RX2 CNMT LOC INST PNL	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
127	2PL60JD	RX2 CNMT LOC INST PNL	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
128	2PA06J	U-2 PROC I&C RACK CONT GRP 2	In Service	In Service	Instrument Rack containing separately powered and separately listed instrumentation transmitters
129	2PA08J	U-2 PROC I&C RACK	In Service	In Service	Instrument Rack containing separately powered and separately listed instrumentation transmitters
138	2PIS-403	W-RNG LP 2A HOT LEG ISOLATOR	In Service	In Service	Instrument
139	2PA04J	U-2 PROC I&C RACK PROTECT CH 4	In Service	In Service	Instrument Rack containing separately powered and separately listed instrumentation transmitters
140	2PM05J	PANEL CONT MAIN BOARD RX/CV 0-3378 MCR	In Service	In Service	Control Panel

Item #	Equipment ID	Description	Equipment Normal State	Equipment Desired State	Notes
141	2PA02J	U-2 PROC I&C RACK PROTECT CH 2	In Service	In Service	Instrument Rack containing separately powered and separately listed instrumentation transmitters
142	2PA52J	CAB HJTC RX VESSEL LEVEL CH B 0-3371B	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
143	2PI-PC005	CNMT PRESSURE CHANNEL B PRESSURE INDICATOR	In Service	In Service	Instrument
144	2PA34J	CAB CONT SYSTEM ESF 12 0-3371B	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
145	2PT-PC005	CNMT PRESSURE CHANNEL B PRESSURE TRANSMITTER	In Service	In Service	Instrument
151	2NR13EB	JUNCT BOX NTRN DET 90 AMP 2NR257	In Service	In Service	Instrument
152	2NR13EC	JUNCT BOX NTRN DET 90 PROC 2NR248	In Service	In Service	Instrument
154	2PM07J	U2 NI panels	In Service	In Service	Panel containing separately powered and separately listed instrumentation transmitters
155	2NR13ED	NEUTRON MONITOR OPTICAL ISOLATOR, CHANNEL 2	In Service	In Service	Instrument
163	2AP12E	Bus 232X	Energized	Energized	480VAC Bus
164	2DC02E	125V DC Battery 212	Energized	Energized	Battery
165	2DC04E	125V DC BATT CHGR 212	Energized	Energized	Battery Charger
166	2IP06E	212 Inverter	Energized	Energized	Inverter
167	2IP08E	214 Inverter	Energized	Energized	Inverter

Item #	Equipment ID	Description	Equipment Normal State	Equipment Desired State	Notes
168	2IP02J	Instrument Bus 212	Energized	Energized	120VAC Bus
169	2IP04J	Instrument Bus 214	Energized	Energized	120VAC Bus
176	2AF01EA-A	2B DSL DRV AF PP BANK A BATT A	In Service	In Service	Battery
177	2AF01EA-B	2B DSL DRV AF PP BANK A BATT B	In Service	In Service	Battery
178	2AF01EB-1	2B DSL DRV AF PP 1B BATT CHGR	In Service	In Service	Battery Charger
179	2AF01EA-1	2B DSL DRV AF PP 1A BATT CHGR	In Service	In Service	Battery Charger
180	2AP24E	MCC 232X3	Energized	Energized	MCC
181	2AP23E	MCC 232X1	Energized	Energized	MCC
183	2VE02C	BATT RM-212 EXH FAN	In Service	In Service	Fan
185	2AP28E	MCC 232X4	Energized	Energized	MCC
187	2AP32E	MCC 232X5	Energized	Energized	MCC
207	2RH02AA-2A	RHR HX 2A	N/A	N/A	Passive Component
208	2RH02AB-2B	RHR HX 2B	N/A	N/A	Passive Component
209	2SX01FB-2	SX Strainer	N/A	N/A	Passive Component
210	K7 @ 2AF01J	OVERCRANK RELAY	In Service	In Service	Relay
211	K4 @ 2AF01J	OVERCRANK TIMER RELAY	In Service	In Service	Relay
212	S1 @ 2AF01J	Speed Switch 1SS-AF8002	In Service	In Service	Relay
213	K9 @ 2AF01J	OVERSPEED RELAY	In Service	In Service	Relay
214	2PSL-AF143	LUBE OIL PRESSURE	In Service	In Service	Pressure Switch
215	K10 @ 2AF01J	LOW LUBE OIE PRESSURE RELAY	In Service	In Service	Relay
216	K8 @ 2AF01J	HIGH WATER TEMPERATURE RELAY	In Service	In Service	Relay
217	2PSL-AF055	LOW SUCTION PRESSURE	In Service	In Service	Relay
218	K12 @ 2AF01J	ENGINE FAILURE LOCKOUT RELAY	In Service	In Service	Relay
219	2DC04E-K1-1	OVERVOLTAGE RELAY	In Service	In Service	Relay
220	2DC04E-K1-2	OVERVOLTAGE	In Service	In Service	Relay

Item #	Equipment ID	Description	Equipment Normal State	Equipment Desired State	Notes
221	2PM01J	PANEL CONT MAIN BOARD MCR	In Service	In Service	Panel with bus voltage indicators
222	2VE01J	CONTROL PANEL	In Service	In Service	Control Panel

Attachment C

ESEP HCLPF Values and Failure Modes Tabulation, Unit 1

ESEL Number	Equipment ID	Failure Mode	HCLPF	Additional Discussion
15	0CC01A	Equipment Capacity	0.33g	Component evaluated in Calculation 14Q4240-CAL-002
149	0PM02J	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Control room ceiling seismic interaction HCLPF determined > 0.24g in Calculation 14Q4240-CAL-002
193	0VA413Y	Screened	> 0.24g	Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g
87	0WW019A	Screened	> 0.24g	
86	0WW01PA	Equipment capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
21	1AF005E	Screened	> 0.24g	Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g
22	1AF005F	Screened	> 0.24g	Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g
23	1AF005G	Screened	> 0.24g	Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
24	1AF005H	Screened	> 0.24g	Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g
14	1AF006B	Screened	> 0.24g	Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g
13	1AF017B	Screened	> 0.24g	Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g
4	1AF01AB	Screened	> 0.24g	Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g

ESEL Number	Equipment ID	Failure Mode	HCLPF	Additional Discussion
173	1AF01EA-1	Screened	> 0.24g	Anchorage Screened by large available margin in existing design basis calculation. Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
170	1AF01EA-A	Screened	> 0.24g	Anchorage Screened by large available margin in existing design basis calculation. Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
171	1AF01EA-B	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
172	1AF01EB-1	Screened	> 0.24g	Anchorage Screened by large available margin in existing design basis calculation. Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
19	1AF01J	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
199	K10 @ 1AF01J	Functional	0.38g	Component evaluated in Calculation 14Q4240-CAL-005 Host component is 1AF01J with HCLPF = 0.24g
202	K12 @ 1AF01J	Functional	0.38g	Component evaluated in Calculation 14Q4240-CAL-005 Host component is 1AF01J with HCLPF = 0.24g
195	K4 @ 1AF01J	Functional	0.54g	Component evaluated in Calculation 14Q4240-CAL-005 Host component is 1AF01J with HCLPF = 0.24g
194	K7 @ 1AF01J	Functional	0.38g	Component evaluated in Calculation 14Q4240-CAL-005 Host component is 1AF01J with HCLPF = 0.24g
200	K8 @ 1AF01J	Functional	0.38g	Component evaluated in Calculation 14Q4240-CAL-005 Host component is 1AF01J with HCLPF = 0.24g
197	K9 @ 1AF01J	Functional	0.38g	Component evaluated in Calculation 14Q4240-CAL-005 Host component is 1AF01J with HCLPF = 0.24g

ESEL Number	Equipment ID	Failure Mode	HCLPF	Additional Discussion
196	S1 @ 1AF01J (1SS-AF8002)	Functional	0.25g	Component evaluated in Calculation 14Q4240-CAL-005 Host component is 1AF01J with HCLPF = 0.24g
18	1AF01PB	Screened	> 0.24g	Anchorage Screened by large available margin in existing design basis calculation. Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
5	1AF02A	Screened	> 0.24g	Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
20	1AF03J	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
156	1AP12E	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
175	1AP23E	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
174	1AP24E	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
99	1AP27E	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
109	1AP27E-A	Anchorage	0.24g	See 1AP27E
184	1AP28E	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
186	1AP32E	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.

ESEL Number	Equipment ID	Failure Mode	HCLPF	Additional Discussion
88	1AP99E	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
16	1CC01A	Equipment Capacity	0.33g	Component evaluated in Calculation 14Q4240-CAL-002
157	1DC02E	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
158	1DC04E	Anchorage / Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
203	K1-1 @ 1DC04E	Functional	0.31g	Component evaluated in Calculation 14Q4240-CAL-005 Host component is 1DC04E with HCLPF = 0.24g
204	K1-2 @ 1DC04E	Functional	0.31g	Component evaluated in Calculation 14Q4240-CAL-005 Host component is 1DC04E with HCLPF = 0.24g
68	1DC11J	Anchorage / Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
95	1DO01PB	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
93	1DO01TB	Anchorage / Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-004
94	1DO01TD	Anchorage / Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-004
97	1DO10T	Equipment Capacity	0.31g	Component evaluated in Calculation 14Q4240-CAL-002
161	1IP02J	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.

ESEL Number	Equipment ID	Failure Mode	HCLPF	Additional Discussion
162	1IP04J	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
159	1IP06E	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
160	1IP08E	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
98	1LI-DO032	Screened	> 0.24g	Anchorage Screened by SRT judgment. Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
89	1LT-0933	Screened	> 0.24g	Anchorage Screened by SRT judgment.
52	1MS018A	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
53	1MS018A-HFK	Screened	> 0.24g	Anchorage Screened by SRT judgment.
54	1MS018B	Equipment capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
55	1MS018B-HFK	Screened	> 0.24g	Anchorage Screened by SRT judgment.
56	1MS018C	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
57	1MS018C-HFK	Screened	> 0.24g	Anchorage Screened by SRT judgment.
61	1MS018D	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002

ESEL Number	Equipment ID	Failure Mode	HCLPF	Additional Discussion
62	1MS018D-HFK	Screened	> 0.24g	Anchorage Screened by SRT judgment.
60	1MS018JC	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
59	1MS018JCE	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
58	1MS018JCE-BAT	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Chain link fence seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
63	1MS018JD	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
65	1MS018JDE	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
64	1MS018JDE-BAT	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Chain link fence seismic interaction HCLPF determined > 0.24g.
146	1NR13EB	Screened	> 0.24g	Anchorage Screened by SRT judgment.
147	1NR13EC	Screened	> 0.24g	Anchorage Screened by SRT judgment.
148	1NR13ED	Screened	> 0.24g	Anchorage Screened by SRT judgment.
133	1PA02J	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002

ESEL Number	Equipment ID	Failure Mode	HCLPF	Additional Discussion
131	1PA04J	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
116	1PA06J	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
117	1PA08J	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
137	1PA34J	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
134	1PA52J	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
135	1PI-PC005	Screened	> 0.24g	Block wall and control ceiling seismic interaction HCLPF determined > 0.24g. Anchorage Screened by SRT judgment.
96	1PL08J	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
113	1PL60JB	Screened	> 0.24g	Anchorage Screened by large available margin in existing design basis calculation.
115	1PL60JD	Screened	> 0.24g	Anchorage Screened by large available margin in existing design basis calculation.
112	1PL61JA	Screened	> 0.24g	Anchorage Screened by large available margin in existing design basis calculation.
114	1PL61JC	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
49	1PL69J	Screened	> 0.24g	Anchorage Screened by large available margin in existing design basis calculation.

ESEL Number	Equipment ID	Failure Mode	HCLPF	Additional Discussion
50	1PL75J	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
44	1PL77JC	Screened	> 0.24g	Anchorage Screened by large available margin in existing design basis calculation.
43	1PL79JB	Screened	> 0.24g	Anchorage Screened by large available margin in existing design basis calculation.
25	1PL84JB	Screened	> 0.24g	Anchorage Screened by large available margin in existing design basis calculation. Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
41	1PL85JB	Screened	> 0.24g	Anchorage Screened by large available margin in existing design basis calculation. Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
205	1PM01J	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall and control room ceiling seismic interaction HCLPF determined > 0.24g.
51	1PM04J	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall and control room ceiling seismic interaction HCLPF determined > 0.24g.
132	1PM05J	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall and control room ceiling seismic interaction HCLPF determined > 0.24g.
27	1PM06J	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall and control room ceiling seismic interaction HCLPF determined > 0.24g.
150	1PM07J	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall and control room ceiling seismic interaction HCLPF determined > 0.24g.

ESEL Number	Equipment ID	Failure Mode	HCLPF	Additional Discussion
201	1PSL-AF055	Functional	1.47g	Component evaluated in Calculation 14Q4240-CAL-005 Host component is 1PA34J with HCLPF = 0.24g.
198	1PSL-AF143	Functional	0.32g	Component evaluated in Calculation 14Q4240-CAL-005 Host component is 1AF01PB with HCLPF = 0.24g.
136	1PT-PC005	Equipment capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
190	1RH02AA	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
191	1RH02AB	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
67	1RY32MB	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
66	1RY456	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
91	1SI01T	Screened	> 0.24g	Anchorage Screened by SRT judgment.
106	1SI8808A	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
108	1SI8808B	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
110	1SI8808C	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
111	1SI8808D	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002

ESEL Number	Equipment ID	Failure Mode	HCLPF	Additional Discussion
192	1SX01FB	Screened	> 0.24g	Anchorage Screened by large available margin in existing design basis calculation.
2	1SX01K	Screened	> 0.24g	Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
3	1SX02K	Screened	> 0.24g	Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
1	1SX04P	Screened	> 0.24g	Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
6	1VA08S	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
206	1VE01J	Anchorage / Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
182	1VE02C	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.

Attachment D

ESEP HCLPF Values and Failure Modes Tabulation, Unit 2

ESEL Number	Equipment ID	Failure Mode	HCLPF	Additional discussion
33	2AF005E	Screened	> 0.24g	
34	2AF005F	Screened	> 0.24g	
35	2AF005G	Screened	> 0.24g	
36	2AF005H	Screened	> 0.24g	
29	2AF006B	Screened	> 0.24g	Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
28	2AF017B	Screened	> 0.24g	Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
10	2AF01AB	Screened	> 0.24g	Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
179	2AF01EA-1	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
176	2AF01EA-A	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
177	2AF01EA-B	Screened	> 0.24g	Anchorage Screened by large available margin in existing design basis calculation. Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
178	2AF01EB-1	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.

ESEL Number	Equipment ID	Failure Mode	HCLPF	Additional discussion
31	2AF01J	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
215	K10 @ 2AF01J	Functional	0.51g	Component evaluated in Calculation 14Q4240-CAL-005 Host component is 2AF01J with HCLPF = 0.24g
218	K12 @ 2AF01J	Functional	0.51g	Component evaluated in Calculation 14Q4240-CAL-005 Host component is 2AF01J with HCLPF = 0.24g
211	K4 @ 2AF01J	Functional	0.54g	Component evaluated in Calculation 14Q4240-CAL-005 Host component is 2AF01J with HCLPF = 0.24g
210	K7 @ 2AF01J	Functional	0.51g	Component evaluated in Calculation 14Q4240-CAL-005 Host component is 2AF01J with HCLPF = 0.24g
216	K8 @ 2AF01J	Functional	0.51g	Component evaluated in Calculation 14Q4240-CAL-005 Host component is 2AF01J with HCLPF = 0.24g
213	K9 @ 2AF01J	Functional	0.51g	Component evaluated in Calculation 14Q4240-CAL-005 Host component is 2AF01J with HCLPF = 0.24g
212	S1 @ 2AF01J (2SS-AF8002)	Functional	0.27g	Component evaluated in Calculation 14Q4240-CAL-005 Host component is 2AF01J with HCLPF = 0.24g
30	2AF01PB	Screened	> 0.24g	Anchorage Screened by large available margin in existing design basis calculation. Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
11	2AF02A	Screened	> 0.24g	Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
32	2AF03J	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002

ESEL Number	Equipment ID	Failure Mode	HCLPF	Additional discussion
163	2AP12E	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
181	2AP23E	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
180	2AP24E	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
105	2AP27E	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
121	2AP27E-A	Anchorage	0.24g	See 2AP27E. Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
185	2AP28E	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
187	2AP32E	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
17	2CC01A	Equipment Capacity	0.33g	Component evaluated in Calculation 14Q4240-CAL-002
164	2DC02E	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
165	2DC04E	Anchorage / Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
219	K1-1 @ 2DC04E	Functional	0.31g	Component evaluated in Calculation 14Q4240-CAL-005 Host component is 2DC04E with HCLPF = 0.24g

ESEL Number	Equipment ID	Failure Mode	HCLPF	Additional discussion
220	K1-2 @ 2DC04E	Functional	0.31g	Component evaluated in Calculation 14Q4240-CAL-005 Host component is 2DC04E with HCLPF = 0.24g
85	2DC11J	Anchorage / Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
101	2DO01PB	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
100	2DO01TB	Anchorage / Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-004
103	2DO10T	Equipment Capacity	0.31g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
168	2IP02J	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
169	2IP04J	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
166	2IP06E	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
167	2IP08E	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
104	2LI-DO032	Screened	> 0.24g	Anchorage screened by SRT judgment.
90	2LT-0933	Screened	> 0.24g	Anchorage screened by SRT judgment.

ESEL Number	Equipment ID	Failure Mode	HCLPF	Additional discussion
69	2MS018A	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
70	2MS018A-HFK	Screened	> 0.24g	Anchorage screened by SRT judgment.
71	2MS018B	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
72	2MS018B-HFK	Screened	> 0.24g	Anchorage screened by SRT judgment.
73	2MS018C	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
74	2MS018C-HFK	Screened	> 0.24g	Anchorage screened by SRT judgment.
78	2MS018D	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
79	2MS018D-HFK	Screened	> 0.24g	Anchorage screened by SRT judgment.
75	2MS018JC	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
76	2MS018JCE	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
77	2MS018JCE-BAT	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Chain link fence seismic interaction HCLPF > 0.24g.
80	2MS018JD	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF > 0.24g.

ESEL Number	Equipment ID	Failure Mode	HCLPF	Additional discussion
81	2MS018JDE	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
82	2MS018JDE-BAT	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Chain link fence seismic interaction HCLPF determined > 0.24g.
151	2NR13EB	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
152	2NR13EC	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
155	2NR13ED	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
141	2PA02J	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
139	2PA04J	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
128	2PA06J	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
129	2PA08J	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
144	2PA34J	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
142	2PA52J	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
143	2PI-PC005	Screened	> 0.24g	Block wall and Control room ceiling seismic interaction HCLPF determined > 0.24g. Anchorage Screened by SRT judgment.
102	2PL08J	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002

ESEL Number	Equipment ID	Failure Mode	HCLPF	Additional discussion
125	2PL60JB	Screened	>0.24g	Component acceptable compared to 1PL60JB
127	2PL60JD	Screened	>0.24g	Component acceptable compared to 1PL60JD
124	2PL61JA	Screened	>0.24g	Component acceptable compared to 1PL61JA
126	2PL61JC	Equipment Capacity	0.24g	Component acceptable compared to 1PL61JC (1PL61JC evaluated in Calculation 14Q4240-CAL-002)
42	2PL69J	Screened	>0.24g	Component acceptable compared to 1PL69J
47	2PL75J	Equipment Capacity	0.24	Component acceptable compared to 1PL75J (1PL75J evaluated in Calculation 14Q4240-CAL-002)
46	2PL77JC	Screened	> 0.24g	Anchorage screened by large available margin in existing design basis calculations.
45	2PL79JB	Screened	> 0.24g	Anchorage screened by large available margin in existing design basis calculations.
37	2PL84JB	Screened	> 0.24g	Anchorage screened by large available margin in existing design basis calculations.
40	2PL85JB	Screened	> 0.24g	Anchorage screened by large available margin in existing design basis calculation. Block wall seismic interaction HCLPF > 0.24g.
221	2PM01J	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall and control room ceiling seismic interaction HCLPF determined > 0.24g.
48	2PM04J	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall and control room ceiling seismic interaction HCLPF determined > 0.24g.

ESEL Number	Equipment ID	Failure Mode	HCLPF	Additional discussion
140	2PM05J	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall and control room ceiling seismic interaction HCLPF determined > 0.24g.
39	2PM06J	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall and control room ceiling seismic interaction HCLPF determined > 0.24g.
154	2PM07J	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall and control room ceiling seismic interaction HCLPF determined > 0.24g.
217	2PSL-AF055	Functional	1.47g	Component evaluated in Calculation 14Q4240-CAL-005 Host component is 2PA34J with HCLPF = 0.24g
214	2PSL-AF143	Functional	0.32g	Component evaluated in Calculation 14Q4240-CAL-005 Host component is 2AF01PB with HCLPF = 0.24g
145	2PT-PC005	Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Anchorage screened by SRT judgment.
207	2RH02AA	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
208	2RH02AB	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
84	2RY32MB	Screened	0.24g	Component acceptable compared to 1RY32MB
83	2RY456	Equipment Capacity	0.24g	Component acceptable compared to 1RY456 (1RY456 evaluated in Calculation 14Q4240-CAL-002)
92	2SI01T	Screened	> 0.24g	Anchorage screened by SRT judgment.

ESEL Number	Equipment ID	Failure Mode	HCLPF	Additional discussion
118	2SI8808A	Equipment Capacity	0.24	Component acceptable compared to 1SI8808A (1SI9908A evaluated in Calculation 14Q4240-CAL-002)
120	2SI8808B	Equipment Capacity	0.24	Component acceptable compared to 1SI8808B (1SI9908B evaluated in Calculation 14Q4240-CAL-002)
122	2SI8808C	Equipment Capacity	0.24	Component acceptable compared to 1SI8808C (1SI9908C evaluated in Calculation 14Q4240-CAL-002)
123	2SI8808D	Equipment Capacity	0.24	Component acceptable compared to 1SI8808D (1SI9908D evaluated in Calculation 14Q4240-CAL-002)
209	2SX01FB	Screened	> 0.24g	Anchorage screened by large available margin in existing design basis calculation.
8	2SX01K	Screened	> 0.24g	Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
9	2SX02K	Screened	> 0.24g	Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
7	2SX04P	Screened	> 0.24g	Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
12	2VA08S	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.
222	2VE01J	Anchorage / Equipment Capacity	0.24g	Component evaluated in Calculation 14Q4240-CAL-002
183	2VE02C	Anchorage	0.24g	Component evaluated in Calculation 14Q4240-CAL-002 Block wall seismic interaction HCLPF determined in Calculation 14Q4240-CAL-002 to be > 0.24g.