Exelon Generation.

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

James A. FitzPatrick Nuclear Power Plant
Renewed Facility Operating License No. DPR-59
NRC Docket No. 50-333

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

References:

1. NEI 12-06, Revision 4, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, December 2016 (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 (ML17005A188)

The purpose of this letter is to provide the results of the assessment for James A. FitzPatrick Nuclear Power Plant (JAF) 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 reevaluated seismic hazard. The assessment 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].

Based upon the mitigating strategies assessment results provided in the Enclosure, the mitigating strategies for JAF, as described in Reference 14 of the enclosed report, are acceptable considering the impacts of the reevaluated 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 15th day of December 2017.

Respectfully submitted,

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Enclosure: Seismic Mitigating Strategies Assessment for James A. FitzPatrick Nuclear Power Plant

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JAFP-17-0104
ENCLOSURE

Seismic Mitigating Strategies Assessment for James A. FitzPatrick Nuclear Power Plant

(11 Pages)

1. BACKGROUND

James A. FitzPatrick Nuclear Power Plant (JAF) has completed the mitigating strategies assessment (MSA) for the impacts of the reevaluated 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 reevaluated 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 reevaluated seismic hazard information at JAF 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 JAF control point elevation. JAF submitted the reevaluated seismic hazard information including the UHRS, GMRS and the hazard curves to the NRC on March 31, 2014 and responded to a request for additional information on August 21, 2014 [References 3 and 25]. The NRC staff concluded that the GMRS that was submitted adequately characterizes the reevaluated seismic hazard for the JAF site [Reference 4]. Section 6.1.1 of Reference 2 identifies the method described in Section H.4.4 of Reference 1 as applicable to JAF.

2. ASSESSMENT TO MSSHI

Consistent with Section H.4.4 (Path 4) of Reference 1, the JAF 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) [Enclosure 1 to Reference 14], the plant equipment relied on for FLEX strategies have previously been evaluated as seismically robust to the SSE levels. The basic elements within the MSA of Path 4 Structures, Systems, and Components (SSCs) are described in Reference 1. Implementation of each of these basic Path 4 elements for the JAF site is summarized below.

2.1 Step 1 – Scope of MSA Plant Equipment

The scope of SSCs considered for the Path 4 MSA 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. These SSCs are part of the scope of MSA plant equipment as they are required FLEX components but do not need to be evaluated for the MSSHI.

2.2 Step 2 – ESEP Review

Equipment used in support of the FLEX strategies has been evaluated to demonstrate seismic adequacy following the guidance in Section 5 of NEI 12-06. 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 [Reference 10 and 26] for the FLEX strategies which were performed in accordance with EPRI 3002000704 [Reference 9]. 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 report.

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.

2.4 Step 4 – Evaluations Using Criteria in 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

An Expedited Seismic Equipment List (ESEL) was developed for JAF in accordance with the guidance in the ESEP [Reference 9]. A review of the ESEL concluded that all SSCs in this list are acceptable for at least the design basis seismic loads and spectra (SSE). Comparing the spectral ordinates of SSE and the GMRS in the 1 to 10 HZ range from Reference 3, the maximum exceedance ratio (GMRS/SSE) [Reference 26, Section 5.1] is 1.55 and occurs at 10 HZ. Considering Section H.5 of Reference 1 for a realistic lower bound case (i.e., with low generic Beta values) the ratio of $C_{10\%}$ to $C_{1\%}$ is 1.36. Since JAF's exceedance ratio is greater than 1.36, it was necessary to evaluate the items using a more detailed approach.

The following sections describe the various components relied upon to implement FLEX and provides a basis for why their $C_{10\%}$ capacity is at least equal to the GMRS as specified by Appendix H of NEI 12-06.

1. The majority of FLEX credited items were evaluated through the ESEP or IPEEE Report JAF-RPT-MULT-02438 [References 26 and 27]. The ESEP evaluated components to ensure that they had a High Confidence Low Probability of Failure (HCLPF) capacity of at least 2 times the SSE. The IPEEE Seismic Report developed a Structural Margins Earthquake (SME) which greatly exceeds the new GMRS at JAF (See Section 5.4.1 of Reference 20). All items covered by these two documents have a $C_{10\%}$ capacity greater than the new GMRS and are acceptable.
2. The components not directly screened by ESEP or IPEEE consist of common components contained in the SQUG equipment classifications. These are valves (manual and motor operated), indicators, fans and dampers. Based on experience data, these items will function as required provided that the SQUG bounding spectrum is not exceeded and that the anchorage is adequate. The Generic Implementation Procedure's (GIP's) bounding spectrum exceeds the new GMRS making these components acceptable for the FLEX strategy. Furthermore, there is more than a 20% margin between anchor bolt allowable loads specified in the SQUG GIP and those specified in EPRI NP-6041 [Reference 12] to be used to calculate a HCLPF. Therefore, these components are also adequate for the GMRS.
3. The 1.36 $C_{10\%}/C_{1\%}$ ratio provided in Table H.1 of NEI 12-06 is considered a realistic lower bound ratio for items with brittle failure modes. These items would include relays, block walls and concrete walls or columns.
    a. The relays credited for FLEX are evaluated in Report JAF-RPT-17-00048 [Reference 6] and have been found to be designed for accelerations more than 1.55 times the SSE and are acceptable.
    b. The concrete structures utilized for FLEX have been evaluated in the IPEEE Seismic Report as meeting the screening criteria based on EPRI NP-6041 [Reference 12] and requiring no further evaluations to demonstrate robustness.
    c. All block walls in the vicinity of FLEX components were evaluated by the ESEP. The only exception to this is the N FLEX Equipment Storage Building (FESB) and the East Diesel Driven Fire Pump Room. The N FESB was designed to the new GMRS and the East Diesel Driven Fire Pump Room is only required for an alternate FLEX strategy. Therefore, the block walls are also considered acceptable for the new GMRS.

JAF performed dynamic analyses for the SSE to develop In-Structure Response Spectra (ISRS) at various elevations. ESEP ISRS were developed by scaling the SSE-based ISRS by the maximum MSSHI GMRS/SSE spectral ratio (1.55) and then used to perform the necessary HCLPF capacity evaluations for the ESEL items, as outlined in Section 6.0 of Reference 26. Section 6.2 and Attachment B of Reference 26 demonstrates that all FLEX equipment included in the ESEL are acceptable for the MSSHI.

The results of the reviews of each of these five areas for items not included in the ESELs are described in the sections below.

2.4.1 FLEX Equipment Storage Buildings

JAF has two FESBs that are used to store onsite FLEX equipment.

N FESB

- The N FESB is a reinforced masonry block building located inside the Protected Area.
- The seismic design criteria for the N FESB was established using the JAF peak SSE input at 5% damping (0.24g) multiplied by 1.55 for a final horizontal design acceleration of 0.37g. The vertical acceleration was taken as 2/3 of the horizontal or 0.25g. These seismic loads were then evaluated using the ASCE 7-10 methodology. The N FLEX Equipment Storage Building is considered a Risk Category II structure.
- Calculation JAF-CALC-17-00071 [Reference 16] demonstrates that the N FESB is acceptable for the new GMRS by following the seismic design methodology presented in ASCE 7-10. Since the SSE was factored up by 1.55 for the analysis and the interaction ratios presented in the calculation are less than 1, it is reasonable to conclude that the N FESB has adequate $C_{10\%}$ capacities corresponding to the GMRS.

N+1 FESB

- The N+1 FESB is a pre-engineered metal building located outside of the Protected Area.
- The seismic design criteria for the N+1 FESB used ASCE 7-10 methodology using the James A. FitzPatrick Nuclear Power Plant peak SSE input at 2% damping of 0.35g multiplied by 1.55 for a horizontal design acceleration of 0.54g. In accordance with Table 12.2-1 of ASCE 7-10, a Response Modification Coefficient or R value of 3 was selected for a Type H Seismic Force Resisting System. The revised base shear acceleration was then 0.18g (0.54g/3) using a Seismic Design Category of A. This Seismic Design Category was determined by using the United States Geological Survey website for JAF. For conservatism, the Seismic Design Category was considered Type C and the R value was reduced from 3 to 2. This resulted in a final horizontal design acceleration of 0.36g (0.18g * 2). The vertical acceleration was taken as 2/3 of the horizontal or 0.24g. The N+1 FLEX Equipment Storage Building is considered a Risk Category II structure.

- Calculations JAF-CALC-17-00076 and JAF-CALC-17-00077 [References 17 and 18] demonstrate that the N+1 FESB is acceptable for the new GMRS by following the seismic design methodology presented in ASCE 7-10. Since the SSE was factored up by 1.55 for the analysis and the interaction ratios presented in the calculation are less than 1, it is reasonable to conclude that the N+1 FESB has adequate $C_{10\%}$ capacities corresponding to the GMRS.

Non-Seismic Category 1 Structures

The superstructure of the of the Screenwell House is classified as Seismic Category 2. Per Section 12.4.6.3 of the FSAR [Reference 19], the superstructure is designed to the Operating Basis Earthquake (OBE) which governed the Design Basis Earthquake (DBE). Therefore, this portion of the Screenwell house is considered acceptable for FLEX as the seismic design meets the same demands as the Category 1 structures.

No other non-seismic Category 1 structures were used for the FLEX strategy.

2.4.2 Operator Pathways

The FIP [Enclosure 1 to Reference 14] and Attachment 7.1 of Reference 20 provide the different FLEX operator pathways as well as FLEX hose and cable routes for JAF. JAF has reviewed the operator pathways and verified that the operator pathways are not impacted by the MSSHI [Reference 20]. Considerations for this review included:

- FLEX pathways (e.g., width of the pathways and FLEX equipment deployment areas)
- Pathway includes only seismic Category 1 structures with previous reviews for seismic ruggedness
- Proximity, type, size, general condition and anchorage of other plant SSCs with respect to FLEX SSCs, including overhead items such as lighting, piping, cable trays, conduits, etc.
- Debris removal capabilities for moderate to smaller seismic interactions
- Available time for operator actions
- Operator pathways were reviewed during a walkdown to assess seismic interactions associated with a GMRS-level seismic event

Per MSA walkdown observations [Reference 20], operator pathways within the buildings are interconnected by stairs and hallways that have enough space for operators to walk through. Equipment within these pathways is adequately supported such that FLEX equipment will not be adversely impacted during a MSSHI event. Even if an equipment or equipment support failure occurs during such an event, any given pathway would not be completely blocked such that successful implementation of the Strategy would be prevented.

Therefore, the JAF FLEX Strategy Operator pathways are assessed to be successful for a MSSHI event.

2.4.3 Tie Down of FLEX Portable Equipment

The portable equipment required for the implementation of the FLEX strategy is described in the FIP [Enclosure 1 to Reference 14]. JAF 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.

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. The SSE was factored by 1.55 to account for the GMRS/SSE ratio for JAF. Calculation JAF-CALC-16-00019 [Reference 24] determined that all FLEX portable equipment stored within the N and N+1 FESBs are stable for overturning and do not require any tie-downs or restraints. Sliding was also reviewed and it was determined that the spacing provided between equipment is sufficient to prevent any interaction due to sliding.

JAF 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 using the methods described in Section H.5 of NEI 12-06.

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 were reviewed for JAF and it was determined that there are no adverse seismic interactions. The review is documented in Report No. JAF-RPT-17-00047 [Reference 20] and included the following considerations:

1. Seismically induced spatial interaction between FLEX equipment and other plant equipment
    a. Plant equipment included piping, cable trays, conduits, gas cylinders, fire extinguishers, overhead lighting, block walls excluded from the ESEP, and others.
    b. Observations of interest included the clear distance between the FLEX equipment in question and adjacent equipment, and anchorage of the equipment. Also, attention was given to the potential of having a piece of equipment turn over or slide in a way that could block the entrance to a room needed for FLEX implementation, which could not be removed by debris removal equipment.

2. Flooding due to failure of non-seismically robust tanks
    a. Tank 76TK-4 was evaluated in Report No. JAF-RPT-17-00047 [Reference 20] for the new GMRS seismic loads. The existing supports were found to be acceptable; therefore, there is no risk of seismic induced flooding.
3. Equipment that could completely block a pathway, haul path, or FLEX cable/hose route, which could not be removed by debris removal equipment. It was determined that there is no such equipment at JAF.
4. Buried tanks and associated piping
    a. Tanks 93TK-6A, 93TK-6B, 93TK-6C and 93TK-6D are underground fuel oil tanks used for FLEX. The tanks are qualified for the DBE and are therefore considered adequate for the new GMRS. The associated piping was evaluated and qualified for the MSSHI in Reference 20.

JAF has reviewed the additional seismic interactions and verified that the Mitigation Strategy is not adversely impacted by the MSSHI.

In addition, as described in Section 2 of Report No. JAF-RPT-17-00047 [Reference 20], a number of SSCs not required at the time the ESEP was developed were identified during the MSA review as requiring further evaluation to ensure acceptability for the MSSHI. The complete list of SSCs is described, evaluated, and qualified for the MSSHI in Reference 20.

2.4.5 Haul Path

There are two FLEX haul paths utilized at James A. FitzPatrick Nuclear Power Plant shown in Figure 6 of the FIP [Enclosure 1 of Reference 14]. The primary path (the most conservative path) begins at the N+1 FESB and travels on Lake Road where it ties into the East Access Road and heads into the Protected Area (PA). The path then travels around the east side of the Training Center, Warehouse and Interim Rad Waste Storage Building before turning west along the waterfront. The primary path concludes on the south side of the Diesel Generator Building. The alternate path also begins at the N+1 FESB; however, it uses the West Access Road and an existing parking lot to travel to the PA. Once inside the PA, this path travels on the west side of the Training Center, Warehouse and Interim Radwaste Storage Building before tying back into the Primary Path along the waterfront.

Both the Primary and Alternate haul paths were reviewed as part of the seismic MSA evaluation documented in Reference 20. Both paths have a low probability of being unavailable following a GMRS-level event for two main reasons. First, soil liquefaction-induced failures are not credible as documented in Geotechnical Report JAF-RPT-16-00020 [Reference 21]. Second, although some non-seismic SSCs in the vicinity of the haul path may collapse and cause debris, the debris will be localized and small enough such that operators can drive around or over it with the FLEX truck and trailers, or remove it as necessary with on-site capabilities for debris removal.

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

3. SPENT FUEL POOL COOLING REVIEW

Spent Fuel Pool Cooling Evaluation

The evaluation of spent fuel pool cooling for JAF 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 Alternating Current Power/Loss of Ultimate Heat Sink (ELAP/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 JAF FIP [Enclosure 1 of Reference 14]. SFP make-up capability is provided using permanently installed Diesel Driven Fire Pumps to supply make-up water through the existing fuel pool cooling assist mode piping and the valves of the Residual Heat Removal (RHR) system [Enclosure 1 of Reference 14, Section 2.4]. An alternate SFP make-up strategy runs flexible hoses from Diesel Driven Fire Pumps to the SFP. The source of make-up water for all of the SFP strategies is Lake Ontario.

The permanently installed plant equipment relied on for the implementation of the SFP Cooling FLEX strategy has been designed and installed, or evaluated to remain functional, in accordance with the plant design basis to the SSE loading conditions. The spent fuel pool integrity evaluations demonstrated inherent margins of the spent fuel pool structure and interfacing plant equipment above the required peak ground acceleration (PGA) [Reference 15]. The portable FLEX equipment availability, including its storage and deployment pathways, and the permanently installed plant equipment needed to accomplish SFP cooling have subsequently been evaluated considering the MSSHI loading conditions [Reference 20].

4. HIGH FREQUENCY REVIEW

The high frequency review is included in the MSA high frequency report [Reference 6]. JAF has conducted a high frequency (HF) evaluation consistent with NEI 12-06 [Reference 1] Path 4 guidance and EPRI 3002004396 [Reference 7]. This review identifies electrical contact devices (ECDs) in seal-in or lockout circuits that, if contacts were to chatter due to ground motion, could impact the ability to safely shut down the plant. ECDs are evaluated by either fragility screening or quantitative assessment. All ECDs were shown to demonstrate adequate capacity for the high frequency motion of the GMRS. Additional explanation is provided in Attachment 1.

5. CONCLUSION

Therefore, the FLEX strategies for JAF as described in the FIP [Enclosure 1 of 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. Entergy Letter to NRC, Entergy Seismic Hazard and Screening Report (CEUS Sites), Response NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated March 31, 2014, ADAMS Accession Number ML14090A243
4. NRC Letter, James A. FitzPatrick Nuclear Power Plant – 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 NO MF3725), dated February 18, 2016, ADAMS Accession Number ML16043A411
5. Exelon Letter to NRC, JAFP-17-0085,High Frequency Confirmation Report for March 12, 2012, Information Request Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1, Seismic, dated August 30, 2017
6. JAF-RPT-17-00048, James A FitzPatrick High Frequency Contact Chatter Assessment, Rev. 0
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. JAFP-14-0143, Entergy's Expedited Seismic Evaluation Process Report (CEUS Sites), Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated December 30, 2014, ADAMS Accession Number ML1500A234
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. James A. FitzPatrick Nuclear Power Plant – Staff Review of Interim Evaluation Associated with Reevaluated Seismic Hazard Implementing Near-Term Task Force Recommendation 2.1 (TAC NO. MF5242), September 15, 2015, ADAMS Accession Number ML15238A810
14. JAFP-17-0083, James A. FitzPatrick Nuclear Power Plant, Report of Full Compliance with March 12, 2012 Commission Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated August 29, 2017
15. JAF-RPT-16-00004, Spent Fuel Pool Seismic Risk Evaluation, Rev. 0
16. JAF-CALC-17-00071, FLEX N Building Structural Calculation, Rev.0
17. JAF-CALC-17-00076, FLEX N+1 Building Structural Design Data, Rev. 0
18. JAF-CALC-17-00077, FLEX N+1 Building Structural Foundation Calculation, Rev. 0
19. JAF Final Safety Analysis Report (FSAR), Rev. 6
20. JAF-RPT-17-00047, Seismic MSA Path 4 Seismic Evaluation Report for James A. FitzPatrick, Rev. 0
21. JAF-RPT-16-00020, FLEX Equipment Storage Building Sites, Staging Area B, Helicopter Landing Zone and Travel Paths, Rev. 0
22. EPRI Report 3002002997, High Frequency Program – High Frequency Testing Summary [September 2014]
23. EPRI Report NP-7147-SL, Seismic Ruggedness of Relays [August 1991]
24. JAF-CALC-16-00019, Rocking and Sliding Evaluation of Equipment Inside FLEX Equipment Storage Buildings, Rev. 0
25. Entergy Letter to NRC, JAFP-14-0102, Response to Request for Additional Information (RAI) Associated with Near-Term Task Force (NTTF) Recommendation 2.1, Seismic Hazard and Screening Report, dated August 21, 2014, ADAMS Accession Number ML14237A097
26. Entergy Letter to NRC, JAFP-17-0029, Revision to Entergy's Expedited Seismic Evaluation Process Report (CEUS Sites) Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated April 27, 2017
27. JAF-RPT-MULT-02438, JAF IPEEE Seismic Evaluation, Rev. 0

Attachment 1

High Frequency Review

James A. FitzPatrick has performed a review of equipment required to implement the Mitigation Strategies that may be sensitive to high frequency ground motions. The MSA High Frequency Report [Reference 6] is consistent with EPRI 3002004396 [Reference 7] and focuses on contact control devices subject to intermittent states (e.g., relays and contactors that could chatter) in seal-in and lockout circuits that, if contacts were to chatter due to ground motion, could impact the ability to safely shut down the plant.

A systems-based approach to identify seismic chatter scenarios focused on those scenarios that cannot be reliably recovered by the operations crew in sufficient time and on additional special scenarios not explicitly represented by the internal events. This approach began by reviewing the ESEL to identify chatter-susceptible equipment; this list of chatter-susceptible equipment is further screened to include only equipment whose mal-operation can impact plant response in a manner substantially different from impacts that don't involve contact chatter. A second selection process was performed by reviewing post-fire Multiple Spurious Operation (MSO) scenarios to identify additional special seismic scenarios. This approach resulted in a list of component states identified for the Path 4 high frequency contact chatter assessment.

The identified component states received circuit evaluations by examining the electrical schematics for the components. The circuit evaluations identified all electrical contact devices in seal-in or lockout circuits that could fail the component state in question. A list of chatter sensitive Electrical Contact Devices (ECD) was created.

The chatter sensitive ECDs were evaluated for the high frequency ground motion. Horizontal high frequency seismic demand was determined by multiplying the peak spectral acceleration of the horizontal GMRS between 15 Hz and 40 Hz by a horizontal in-cabinet amplification factor and a horizontal in-structure amplification factor. Vertical high frequency seismic demand was determined by multiplying the peak spectral acceleration of the vertical GMRS between 15 Hz and 40 Hz by a horizontal in-cabinet amplification factor and a horizontal in-structure amplification factor. The vertical GMRS was created following the guidance of Section 3.2 of EPRI Report 3002004396 [Reference 7]. High frequency seismic capacity of the ECDs was determined using either the high frequency capacity for the high frequency program [Reference 22], the Generic Equipment Ruggedness Spectra (GERS) capacity from EPRI NP-7147-SL [Reference 23], or component specific test reports. High frequency seismic margin for the relays and pressure switches were calculated by multiplying 1.36 by the ratio of capacity to demand. The 1.36 factor accounts for the ratio of the 10% failure probability capacity to the 1% failure probability capacity. The seismic margin is calculated for both the horizontal and vertical directions.

Per the MSA High Frequency Report [Reference 6], all ECDs were shown to have adequate capacity for the high frequency motion of the GMRS.