Exelon Generation.

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

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

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

The purpose of this letter is to provide the results of the assessment for Dresden Nuclear Power Station, Units 2 and 3 (Dresden) 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 Dresden Station, Units 2 and 3, as described in References 14 and 15 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 31st day of August 2017.

Respectfully Submitted,

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Enclosure: Seismic Mitigating Strategies Assessment for Dresden Nuclear Power Station, Units 2 and 3

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ENCLOSURE

Seismic Mitigating Strategies Assessment for Dresden Nuclear Power Station, Units 2 and 3

NEI 12-06 Appendix H – Seismic “Path 4”

(9 Pages)

1. BACKGROUND

Dresden Nuclear Power Station (Dresden) has completed a Mitigating Strategies Assessment (MSA) [Reference 18] 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 Dresden, 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 Dresden control point elevation. Dresden submitted the reevaluated seismic hazard information including the UHRS, GMRS and the hazard curves to the NRC on March 31, 2014 and July 22, 2015 [References 3 and 17]. The NRC staff concluded that the GMRS that was submitted adequately characterizes the reevaluated seismic hazard for the Dresden 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 Dresden.

Dresden submitted the Expedited Seismic Evaluation Process (ESEP) report on December 26, 2014 [Reference 10]. Using the guidance of EPRI 3002000704 [Reference 9], the ESEP evaluated plant equipment that is used for the FLEX strategies. The NRC staff review for the Dresden ESEP was documented in Reference 13.

2. ASSESSMENT TO MSSHI

Consistent with Section H.4.4 (Path 4) of Reference 1, the Dresden GMRS has spectral accelerations greater than the Safe Shutdown Earthquake (SSE) but no more than 2 times the SSE anywhere in the 1 to 10 Hz frequency range [Reference 3]. 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 ESEP and/or the MSA report following the guidance of Reference 1. The basic elements within the MSA of Path 4 SSCs are described in Reference 1. Implementation of each of these basic Path 4 elements for the Dresden site is summarized below.

Equipment needed to implement the FLEX strategies that was evaluated by the MSA report includes manual valves, FLEX neutral connection cabinets, and FLEX pumps. Utilizing walkdowns and existing calculations to determine seismic margin in the design, 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 spectra by the ratio between GMRS and SSE ground motion curves at the dominant frequency of the building for which the new GMRS spectrum are needed.

The Dresden GMRS has spectral accelerations greater than the SSE above 10 Hz. Therefore, Dresden has, also, conducted a high frequency review. See Section 4 below.

2.1 Step 1 – Scope of MSA Plant Equipment

As stated in Appendix H of NEI 12-06, the scope of SSCs considered for the Path 4 MSA [Reference 18] was determined following the guidance used for the 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 ESEP evaluations [Reference 10] 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 evaluated in the ESEP 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 portion 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.

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 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 18.

2.4.1a FLEX Equipment Storage Buildings

There are two Robust FLEX Equipment Storage Buildings that store the large portable FLEX equipment (pumps, trailers, generators, etc). These buildings are identified as FLEX Building A (31' X 40') and FLEX Building B (50' X 75'). FLEX Building A 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 a W40 girder. FLEX Building B 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 W36 girders. The FLEX Buildings are designed for a horizontal seismic acceleration (Cs) of 0.26g. Cs is typically calculated using equations from AISC/SEI 7-10 and the peak horizontal ground motion acceleration. The Cs values calculated using the peak SSE horizontal ground motion acceleration (0.332g) are 0.10g and 0.09g for FLEX Building A and FLEX Building B, respectively. Therefore, margins of 2.6 and 2.9 are present for the FLEX Buildings with respect to the motions associated with the SSE. These margins are greater than the increase in the peak spectral acceleration from the SSE to the GMRS (1.77).

2.4.1b Non-Seismic Category I Structures

Areas in the Class II Turbine Building are used for operator pathways and also contain components needed for the FLEX strategies. Although the Turbine Building is a Class II structure, the Reactor Building and Turbine Building are evaluated as one integral Class I structure [Section 3.4.1 of Reference 5 & Section 3 of Reference 23]. The load combinations for this integral structure include SSE loading. Per Section 3.4.1 of Reference 5, the Turbine Building complex meets the requirements of Table 2-3 of NP-6041-SL [Reference 12] since the structure was evaluated for an SSE of 0.1 or greater and the 5 percent-damped peak GMRS spectral acceleration is less than 0.8g. The Reactor-Turbine Building was evaluated for an SSE horizontal ground motion of 0.2g, and the peak acceleration of the GMRS is 0.587g. Therefore, no further evaluation is required for the GMRS. There are no other non-seismic Category I structures that are relied on for implementation of the FLEX strategy.

2.4.2 Operator Pathways

Operator paths described in the Final Implementation Plan [Reference 14] pass through the Reactor Building and Turbine Building which are considered adequate for the GMRS as described in Section 2.4.1 of this report. These operator pathways are required to route hoses and cables and also allow operators to reach equipment required to be locally operated. Dresden 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. There is adequate room to work around fallen block walls, and there are multiple pathways within the Reactor Building and Turbine Building.
- Operator pathways were reviewed during a walkdown to assess seismic interactions associated with a GMRS level seismic event.

2.4.3 Tie Down of FLEX Portable Equipment

Types of large portable equipment used for the Dresden FLEX strategies include diesel generators, submersible pumps, temporary power distribution units, Ford F-750 truck, and mobile crane as described in Section 2.18.5 of Reference 14. These components are located in FLEX Buildings A and B.

Stored equipment was evaluated (for stability and restraint as 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 FLEX Storage Buildings 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 FLEX Storage Buildings. These storage components were shown to have adequate capacity as to not tip over during a GMRS seismic event.

Dresden 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 Dresden. Piping attached to buried tanks within the FLEX strategy was determined not to be a concern per the ESEP effort. 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 inaccessible areas. These areas are not anticipated to be used for storage. Also, these areas are Seismic Category I areas with all equipment in the area designed to, at least, seismic II/I requirements.

The suspended ceiling in the Main Control Room (MCR) was identified as a potential seismic interaction during the walkdown. The previous IPEEE Report [Reference 5] determined that the MCR ceiling was adequate for the in-structure response spectra developed under the IPEEE for the MCR. These spectra envelope the MCR in-structure spectra developed for the MSA using the GMRS as input. Therefore, the MCR ceiling is adequate for the MSA.

Block walls located near operator pathways and components required for implementation of the FLEX strategies were evaluated for the MSSHI. Block walls were shown to: 1) not completely block the operator pathways if collapsed, 2) have been evaluated by the ESEP,

3) have sufficient capacity by reviewing existing calculations, 4) have sufficient capacity by performing new calculations, or 5) have alternate pathways to be utilized in the event of collapse.

Dresden has reviewed the additional seismic interactions and verified that the Mitigation Strategy is not adversely impacted by potential interactions that may occur at the GMRS seismic level.

2.4.5 Haul Path

Dresden 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 FLEX Building B to the deployment zones near the Cribhouse and the Unit 2 interlock. There are no slope stability concerns along the equipment haul paths. Liquefaction was shown not to be a concern for any haul paths.

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

3. SPENT FUEL POOL COOLING REVIEW

The evaluation of Spent Fuel Pool cooling for Dresden was performed based on the initial conditions established in NEI 12-06 [Reference 1] for Spent Fuel Pool cooling coping in the event of an ELAP/LUHS. The evaluation also used the results of Spent Fuel 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 Dresden Final Integrated Plan (FIP) [Reference 14]. SFP make-up capability is provided using one of the pre-installed FLEX pumps, taking suction through a portable flexible hose and permanent steel piping. The pump discharges through portable flexible hoses and permanent steel piping to the FLEX Connection SFP isolation valves. The source of make-up water is the Torus. SFP make-up can also be achieved by spraying water directly into the spent fuel pools using spray monitors taking water, by means of flexible portable hoses and permanent hoses, from the Torus.

The permanently installed plant equipment and portable FLEX equipment (including storage and deployment pathways) that are relied upon 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 MSA report [Reference 18] demonstrates that the permanently installed plant equipment and portable FLEX equipment (including storage and deployment pathways) that is relied upon for the implementation of the SFP cooling FLEX strategy is adequate for the GMRS loading conditions.

The Spent Fuel Pool Evaluation Supplemental Report [Reference 16] demonstrates inherent margins of the Spent Fuel Pool structure and interfacing plant equipment above the SSE to a peak spectral acceleration of 0.8g. Reference 16 demonstrates that the Spent Fuel Pool structure meets the caveats of EPRI 3002007148 [Reference 22] and is adequate for the GMRS loading conditions.

4. HIGH FREQUENCY REVIEW

The high frequency review is included in the MSA high frequency report [Reference 6]. Dresden 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 evaluation is provided in Attachment 1.

5. CONCLUSION

Therefore, the FLEX strategies for Dresden 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, Exelon Generation Company, LLC, Seismic Hazard and Screening Report (Central and Eastern United States (CEUS) Sites), Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, [March 31, 2014], ADAMS Accession Number ML14091A012
4. NRC Letter, Dresden Nuclear Power Station, Units 2 and 3 – Staff Review of Interim Evaluation Associated with Reevaluated Seismic Hazard Implementation Near-Term Task Force Recommendation 2.1 (TAC NOS. MF5239 and MF5240) [June 30, 2015], ML Accession Number ML15173A244
5. Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities Submittal Report, Dresden Nuclear Power Station Units 2 and 3, December 1997
6. EXLNDRE~00069, Rev. 0, Dresden High Frequency Contact Chatter Assessment
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. Exelon Letter to NRC, Exelon Generation Company, LLC, Expedited Seismic Evaluation Process Report (CEUS Sites), Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, [December 26, 2014], ADAMS Accession Number ML14360A123

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. NRC Letter, Dresden Nuclear Power Station, Units 2 and 3 – Staff Review of Interim Evaluation Associated with Reevaluated Seismic Hazard Implementation Near-Term Task Force Recommendation 2.1 (TAC Nos. MF5239 and MF5240), [June 30, 2015], ADAMS Accession Number ML15173A244

14. Exelon Letter to NRC, Exelon Generation Company, 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), [August 16, 2016], ADAMS Accession16 Number ML16230A487

15. NRC Letter, Dresden Nuclear Power Station, Units 2 and 3 – 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. MF1046, MF1047, MF1050, and MF1051), [February 16, 2017], ADAMS Accession Number ML17037C929

16. Exelon Letter to NRC, Exelon Generation Company, 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], ADAMS Accession Number ML16244A801

17. Exelon Letter to NRC, Exelon Generation Company, LLC, Supplemental Information Regarding Seismic Hazard Risk Evaluation and Seismic Prioritization Results -Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, [July 22, 2015], ADAMS Accession Number ML15204A088

18. EXDR027-RPT-001, Rev. 1, "MSA Seismic Path 4 Evaluation Dresden Station Unit 2 & 3"

19. EPRI Report 3002002997, High Frequency Program – High Frequency Testing Summary [September 2014]

20. EPRI Report NP-7147-SL, Seismic Ruggedness of Relays [August 1991]

21. SQUG General Implementation Procedure (GIP) for Seismic Verification of Nuclear Plant Equipment, Rev. 3A

22. EPRI Report 3002007148, Seismic Evaluation Guidance Spent Fuel Pool Integrity Evaluation, [February 2016]

23. Dresden Power Station, Updated Final Safety Analysis Report (UFSAR) Rev. 12

Attachment 1

High Frequency Review

Dresden has performed a review of equipment required to implement the Mitigation Strategies that may be sensitive to high frequency ground motions. This 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 19], the Generic Equipment Ruggedness Spectra (GERS) capacity from EPRI NP-7147-SL [Reference 20], 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.

The temperature switches were evaluated using Section 4.2.1 of the Seismic Qualification Utility Group (SQUG) General Implementation Procedure (GIP) [Reference 21].

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