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August 9, 2017
L-17-243

10 CFR 50.54(f)

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852

SUBJECT:
Davis-Besse Nuclear Power Station
Docket No. 50-346, License No. NPF-3
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 (CAC No. MF3728)

The purpose of this letter is to provide the results of the MSA for Davis-Besse Nuclear Power Station (DBNPS) to demonstrate that the FLEX mitigating strategies developed, implemented, and maintained in accordance with Nuclear Regulatory Commission (NRC) Order EA-12-049 can be implemented considering the impact of the reevaluated seismic hazard. The assessment was performed in accordance with the guidance provided in Appendix H of Nuclear Energy Institute (NEI) 12-06, Revision 2 (Reference 1), which was endorsed by the NRC (Reference 2).

The mitigating strategies seismic hazard information (MSSHI) is the licensee's reevaluated seismic hazard information, developed using a 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 site control point elevation. FirstEnergy Nuclear Operating Company submitted the DBNPS reevaluated seismic hazard information including the UHRS, GMRS, and the hazard curves to the NRC in References 3 and 4. The NRC staff concluded that the MSSHI that was submitted adequately characterizes the reevaluated seismic hazard for the site (Reference 5).

Based upon the MSA provided in the enclosure to this letter, the mitigating strategies for DBNPS considering the impacts of the reevaluated seismic hazard can be implemented as designed with identified grating clips to be installed in one plant area.

There are no new regulatory commitments contained in this letter. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager – Fleet Licensing, at 330-315-6810.

I declare under penalty of perjury that the foregoing is true and correct. Executed on August 9, 2017.

Respectfully,

Mark B. Bezilla

Enclosure
Seismic Mitigating Strategies Assessment Davis-Besse Nuclear Power Station

References:

1. NEI 12-06, *Diverse and Flexible Coping Strategies (FLEX) Implementation Guide*, Revision 2, December 2015, Agencywide Documents Access and Management System (ADAMS) Accession Number ML16005A625.
2. JLD-ISG-2012-01, Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, Revision 1, dated January 22, 2016, ADAMS Accession Number ML15357A163.
3. FENOC Letter, FirstEnergy Nuclear Operating Company (FENOC) Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding the Seismic Aspects of Recommendation 2.1 of the Near-Term Task Force (NTTF) Review of Insights from the Fukushima Dai-ichi Accident – 1.5 Year Response for CEUS Sites, dated September 11, 2013, ADAMS Accession Number ML13254A312.
4. FENOC Letter, FirstEnergy Nuclear Operating Company (FENOC) Seismic Hazard and Screening 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 (NTTF) Review of Insights from the Fukushima Dai-ichi Accident, dated March 31, 2014, ADAMS Accession Number ML14092A203.
5. NRC Letter, Davis-Besse Nuclear Power Station, Unit 1 – 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, dated August 25, 2015, ADAMS Accession Numbers ML15230A289.

cc: Director, Office of Nuclear Reactor Regulation (NRR)
NRC Region III Administrator
NRC Resident Inspector
NRR Project Manager
Utility Radiological Safety Board

FIRST ENERGY NUCLEAR OPERATING COMPANY

Seismic Mitigating Strategies Assessment

Davis-Besse Nuclear Power Station

APPROVALS

Report Name: Seismic Mitigating Strategies Assessment
Davis-Besse Nuclear Power Station

Date: June 12, 2017

Revision No.: Revision 0

Reviewed by:

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2734296-R-017
Revision 0

Seismic Mitigating Strategies Assessment Davis-Besse Nuclear Power Station

June 12, 2017

Prepared for:
FirstEnergy Nuclear Operating Company

ABSG Consulting Inc. • 300 Commerce Drive, Suite 200 • Irvine, California 92602

SEISMIC MITIGATING STRATEGIES ASSESSMENT
DAVIS-BESSE NUCLEAR POWER STATION

ABSG CONSULTING INC. REPORT NO. 2734296-R-017
REVISION 0
RIZZO REPORT NO. R13 12-4737
JUNE 12, 2017

ABSG CONSULTING INC.
RIZZO ASSOCIATES

ABS Consulting
RIZZO

APPROVALS

Report Name: Seismic Mitigating Strategies Assessment
Davis-Besse Nuclear Power Station

Date: June 12, 2017

Revision No.: 0

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CHANGE MANAGEMENT RECORD

REVISION No.	DATE	DESCRIPTIONS OF CHANGES/AFFECTED PAGES
0	June 12, 2017	Initial Submittal

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LIST OF ACRONYMS

ABS	ABSG CONSULTING INC.
AC	ALTERNATING CURRENT
ACI	AMERICAN CONCRETE INSTITUTE
ALT	ALTERNATE
ASCE	AMERICAN SOCIETY OF CIVIL ENGINEERS
AUX	AUXILIARY BUILDING
AUX6	AUXILIARY BUILDING – AREA 6
AUX7	AUXILIARY BUILDING – AREA 7
AUX8	AUXILIARY BUILDING – AREA 8
AVV	ATMOSPHERIC VENT VALVE
BDB	BEYOND DESIGN BASIS
BDBEE	BEYOND-DESIGN-BASIS EXTERNAL EVENT
BWST	BORATED WATER STORAGE TANK
CR	CONDITION REPORT
CTMT	CONTAINMENT BUILDING
CWRT	CLEAN WASTE RECEIVER TANK
DBNPS	DAVIS-BESSE NUCLEAR POWER STATION
DC	DIRECT CURRENT
EFW	EMERGENCY FEEDWATER
EFWF	EMERGENCY FEEDWATER FACILITY
EFWP	EMERGENCY FEEDWATER PUMP
EFWST	EMERGENCY FEEDWATER STORAGE TANK
EL	ELEVATION
ELAP	EXTENDED LOSS OF AC POWER
EPRI	ELECTRIC POWER RESEARCH INSTITUTE
ESEL	EXPEDITED SEISMIC EQUIPMENT LIST
ESEP	EXPEDITED SEISMIC EVALUATION PROCESS
FENOC	FIRSTENERGY NUCLEAR OPERATING COMPANY

LIST OF ACRONYMS (CONTINUED)

FIP	FINAL INTEGRATED PLAN
FIRS	FOUNDATION INPUT RESPONSE SPECTRA
FLEX	DIVERSE AND FLEXIBLE COPING STRATEGIES
FSG	FLEX SUPPORT GUIDELINE
ft	FEET
g	ACCELERATION OF GRAVITY
GMRS	GROUND MOTION RESPONSE SPECTRA
HELB	HIGH ENERGY LINE BREAK
HF	HIGH FREQUENCY
Hz	HERTZ
ISRS	IN-STRUCTURE RESPONSE SPECTRA
LOCA	LOSS-OF-COOLANT ACCIDENT
LP	LOW PRESSURE
LUHS	LOSS OF NORMAL ACCESS TO THE ULTIMATE HEAT SINK
MCC	MOTOR CONTROL CENTER
MSA	MITIGATING STRATEGIES ASSESSMENT
MSSHI	MITIGATING STRATEGIES SEISMIC HAZARD INFORMATION
NEI	NUCLEAR ENERGY INSTITUTE
NRC	UNITED STATES NUCLEAR REGULATORY COMMISSION
NSGSF	NEW STEAM GENERATOR STORAGE FACILITY
NTTF	NEAR-TERM TASK FORCE
OBC	OHIO BUILDING CODE
OTSG	ONCE-THROUGH STEAM GENERATORS
PA	PROTECTED AREA
PAF	PERSONNEL ACCESS FACILITY
PGA	PEAK GROUND ACCELERATION
PORV	POWER OPERATED RELIEF VALVE
PSHA	PROBABILISTIC SEISMIC HAZARD ANALYSIS

LIST OF ACRONYMS (CONTINUED)

PSV	PRESSURIZER CODE SAFETY VALVE
RCP	REACTOR COOLANT PUMP
RFO	REFUELING OUTAGE
RIZZO	RIZZO ASSOCIATES
RLE	REVIEW LEVEL EARTHQUAKE
RP	RADIATION PROTECTION
SB7	SERVICE BUILDING 7
SFP	SPENT FUEL POOL
SG	STEAM GENERATOR
SFRCS	STEAM AND FEEDWATER RUPTURE CONTROL SYSTEM
SILO	SEAL-IN OR LOCK-OUT
SPRA	SEISMIC PROBABILISTIC RISK ASSESSMENT
SSCs	STRUCTURES, SYSTEMS, AND COMPONENTS
SSE	SAFE SHUTDOWN EARTHQUAKE
TURB	TURBINE BUILDING
UBC	UNIFORM BUILDING CODE
UHRS	UNIFORM HAZARD RESPONSE SPECTRA
USAR	UPDATED SAFETY ANALYSIS REPORT
V	VOLTS
VAC	VOLTS ALTERNATING CURRENT

MITIGATING STRATEGIES ASSESSMENT
DAVIS-BESSE NUCLEAR POWER STATION

1.0 BACKGROUND

Davis-Besse Nuclear Power Station (DBNPS) has completed a 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 Nuclear Regulatory Commission (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 Nuclear Energy Institute (NEI) 12-06 Revision 2 (Reference 1) which was endorsed by the NRC (Reference 2).

The Mitigating Strategies Seismic Hazard Information (MSSHI) is the reevaluated seismic hazard information at DBNPS 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 DBNPS control point elevation. DBNPS submitted the reevaluated 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 reevaluated seismic hazard for the DBNPS 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 DBNPS.

Subsequent to the March 31, 2014 submittal (Reference 3), the seismic hazard was updated considering site specific damping in rock. The updated seismic hazard is the basis for the recent station Seismic Probabilistic Risk Assessment (SPRA) and also for the Expedited Seismic Evaluation Process (ESEP) Reports submitted by FirstEnergy Nuclear Operating Company (FENOC) on December 19, 2014 (Reference 10).

Figure 1-1 presents the comparison of the Safe Shutdown Earthquake (SSE), ESEP GMRS (Reference 10) and the GMRS reported in the DBNPS March 2014 submittal (Reference 3). The difference in the GMRS results is attributed to the material damping used for the rock material over the upper 500 feet (ft). While the GMRS reported in the March 2014 submittal is based on the low strain damping of approximately 3.2 percent over a depth of 500 ft below the Containment Building (CTMT) foundation, the GMRS used in the ESEP limits this damping value to the upper 100 ft where the rock is considered as weathered or fractured. Below this depth, a low strain damping of 1.0 percent is used based on the unweathered shale dynamic properties from Stokoe et al. (Reference 17).

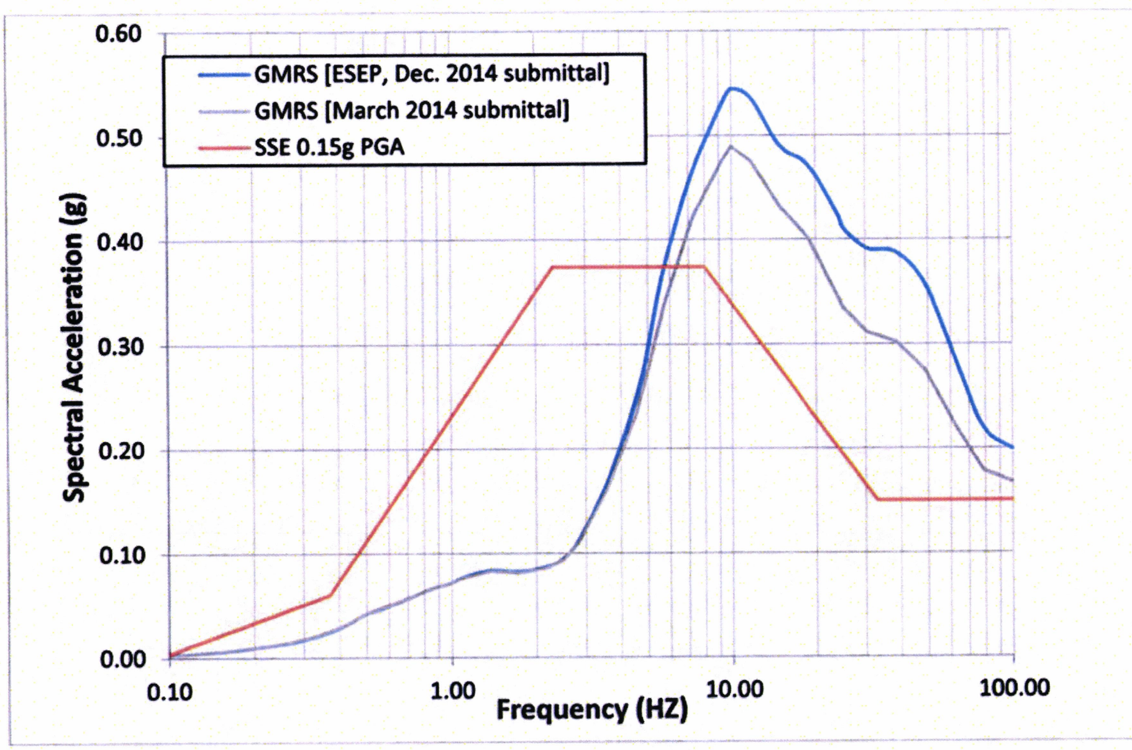

FIGURE 1-1
COMPARISON OF GMRS AND SSE AT THE DBNPS CONTROL POINT ELEVATION

In a letter dated October 19, 2015 (Reference 13), the NRC staff conveyed its acceptance of the DBNPS ESEP. Therefore, the ESEP GMRS, characterized by a peak ground acceleration (PGA) of 0.20g, is the review level earthquake (RLE) considered for the MSA.

2.0 ASSESSMENT TO MSSHI

Consistent with Section H.4.4 (Path 4) of Reference 1, the DBNPS GMRS has spectral accelerations greater than the SSE but no more than two times the SSE anywhere in the 1 Hertz (Hz) to 10 Hz frequency range. As described in the FLEX Strategy Design and Equipment Bases Detail (Reference 18), 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 DBNPS 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 ESEP defined in Electric Power Research Institute (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 were not explicitly added to the scope of MSA plant equipment.

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 ESEP evaluations (Reference 10) 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. Since all equipment in the Expedited Seismic Equipment List (ESEL) satisfies the ESEP requirements, they also meet the requirements for this MSA.

Therefore, any component on the ESEL requires no further evaluation to show the $C_{10\%}$ capacity is acceptable. Separate evaluations are performed to address high-frequency (HF) exceedances under the HF sensitive equipment assessment process, as required, and are documented in ***Section 4.0*** 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 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 five areas are described in the sections below.

In addition to the FLEX portable equipment, various anchored mechanical and electrical equipment (diesel-driven Emergency Feedwater (EFW) Pump, motor-driven Reactor Coolant System (RCS) FLEX Charging and Booster Pumps, Motor Control Center (MCC), fuel oil storage tank, battery charger, panels, etc.) were installed in the Emergency Feedwater Facility (EFWF) and the Auxiliary Building (AUX) in support of the FLEX strategy. This equipment was also evaluated under the GMRS level demand and found to all have $C_{10\%}$ capacities in excess of the RLE PGA.

For evaluations performed in accordance with Section H.5 of Reference 1, seismic demand developed in support of the recent SPRA for DBNPS is used as input. As part of the SPRA seismic demand development, detailed building model analyses were performed for all Seismic Category I structures. Using SPRA foundation input response spectra (FIRS) consistent with the GMRS as input, in-structure response spectra (ISRS) were obtained from these analyses. The SPRA ISRS was also used to complete the ESEP analysis (Reference 10).

2.4.1 FLEX Equipment Storage Buildings

The EFWF and Service Building 7 (SB7) are used for FLEX equipment storage. The EFWF is designated for "N" FLEX equipment storage and the SB7 for "N+1" equipment storage. Other FLEX equipment is located inside the AUX Building Area 6, Area 7, and Area 8, herein referred to as AUX6, AUX7, and AUX8, respectively, or generally as AUX, typically near locations where the equipment will be used. The EFWF and the AUX locations provide protection from all hazards – including seismic events. The remainder of FLEX equipment is stored in the DBNPS Yard area.

Emergency Feedwater Facility

DBNPS constructed a new EFWF to support the site's FLEX mitigation strategy. The EFWF is located inside the Protected Area (PA) to the west of the CTMT. The EFWF consists of two parts – (1) an Emergency Feedwater Storage Tank (EFWST) designed to hold approximately 290,000 gallons of condensate quality water and (2) a facility used to house the Emergency Feedwater (EFW) system and FLEX equipment. The EFWST is at grade level, while the facility consists of three floors. The basement of the facility, which is located approximately 20 ft below grade, will store the diesel-driven EFW pump as well as a chemical injection skid. The first floor of the facility, situated at elevation (EL) 586 ft, houses the FLEX 'N' turbine generator, FLEX pumps (i.e., Alternate Low Pressure Emergency Feedwater 'N' Pump, EFWST Replenishment 'N' Pump, Spent Fuel Spray 'N' Pump, etc.), and also provides the means of egress to the EFWF. The second floor of the facility at EL 603 ft stores the diesel fuel oil tank, batteries, 480VAC Main Control Center, and other equipment.

The roof of the building is at approximate EL 620 ft. The EFWF is rectangular with a total footprint of 72 ft x 54 ft.

The EFWF is a reinforced concrete structure. The 54 ft x 34 ft EFWF basement mat foundation bears on bedrock and the EFWST 54 ft x 36 ft mat foundation is supported by drilled piers socketed into bedrock. The first and second floors of the structure are supported by composite beams. The roof consists of reinforced concrete slabs spanning between the reinforced concrete walls. The roll-up door on the north side of the EFWF is shielded with a Kevlar outer door that swings open.

The EFWF is a non-safety-related structure, and is not required for safe shutdown of the plant; however, to satisfy NEI 12-06 (Reference 1) requirements, it is designed to withstand the loads of a Seismic Category I structure. Seismic Category 1 structures at DBNPS are designed for seismic loads due to the site SSE characterized by a 0.15g PGA and considering applicable load combinations. The loads are compared to the strengths determined in accordance with American Concrete Institute (ACI) 318.

The failure modes of the structure are evaluated considering the mats, floor slabs, roof slabs, shear walls, and foundation systems. With the exception of foundation systems, the aforementioned failure modes were evaluated under the RLE to develop a $C_{10\%}$ capacity in accordance with Section H.5 of Reference 1. The roof system represents the governing failure mode of the EFWF with a calculated $C_{10\%}$ capacity well in excess of the RLE PGA. This result is consistent with the Reference 1 Section H.4.4 guidance for sufficiently rugged structures. Liquefaction and bearing capacity failures of the soil under the EFWF are not required to be considered since the structure is founded on rock, directly or via piers, as previously described. Therefore it is concluded that the DBNPS EFWF has adequate seismic capacity to withstand the RLE and meets the requirements to satisfy Reference 1, Appendix H.

Auxiliary Building

The AUX Buildings are Seismic Category 1 structures which house equipment serving safety-related functions and have also been purposed for FLEX equipment storage. The AUX is an L-shaped structure that partially surrounds the CTMT. The AUX is divided in three separate areas which are isolated from each other and supported on independent foundation systems. The Seismic Category I AUX buildings are designed for loads due to the DBNPS site SSE characterized by a 0.15g PGA.

AUX6, the northeast portion of the AUX, is 150 ft x 85 ft in plan. It is a four-story reinforced concrete structure. Slabs are located at ELs 585 ft, 603 ft, 623 ft, and 643 ft. The lateral resistance of the building structure is derived primarily by the shear walls. The walls transfer vertical and shear forces as well as bending moments to the reinforced concrete foundation mat, which largely bears on rock. AUX6 is isolated from the adjacent CTMT, Turbine Building (TURB), and AUX7, through expansion joints that allow them to behave as independent structures under gravity and seismic loads. The building is supported on drilled piers embedded into compacted structural backfill. The total height of the building, including piers, is approximately 85 ft. The foundation piers extend through the structural fill to the bedrock, and are socketed into rock, at EL 558 ft. The length of these piers is about 27 ft.

AUX7, the southeast portion of the AUX, is 130 ft x 140 ft in plan. It is a five-story reinforced concrete structure with two levels below grade, for a total of seven floor levels. Floors are located at ELs 545 ft, 565 ft, 585 ft, 603 ft, 623 ft, 643 ft, and 654/660 ft. It is observed that the lateral resistance of the building structure is derived primarily by the shear resistance of the walls. The walls transfer vertical and shear forces, as well as bending moments, to the reinforced concrete foundation mat construction, largely supported on an independent mat foundation bearing on rock. AUX7 is isolated from the adjacent CTMT, TURB, AUX6, and AUX8, through expansion joints that allow them to behave as independent structures under gravity and seismic loads. Most of the AUX7 is founded on rock at EL 542 ft, approximately 40 ft below grade. A small portion at the north of AUX7 is founded on drilled piers embedded into compacted backfill and socketed into rock at EL 558 ft. The length of these piers is about 25 ft. The total height of the building is approximately 120 ft.

AUX8, the southwest portion of the AUX, is 140 ft x 140 ft in plan. It is a five-story reinforced concrete structure with two levels below grade, for a total of seven floor levels. Floors are located at ELs 545 ft, 565 ft, 585 ft, 603 ft, 623 ft, 643 ft, and 654/660 ft. The lateral resistance of the building structure is derived primarily from the shear resistance of the walls. The walls transfer vertical and shear forces as well as bending moments to the reinforced concrete foundation mat, which largely bears on rock. AUX8 is isolated from the adjacent CTMT, TURB, and AUX7, through expansion joints that allow them to behave as independent structures under gravity and seismic loads. Most of this building is founded on rock at approximately EL 560 ft.

Based on the structural systems comprising the Seismic Category 1 AUX buildings, the guidance of Reference 1 Section H.4.4 indicates the buildings have sufficient seismic capacity to withstand the RLE based on the EPRI NP-6041 screening criteria and do not require additional evaluations to demonstrate robustness. Liquefaction and bearing capacity failures of the soil under the AUX are not required to be considered since the structures are founded on rock, directly or via piers, as previously described. Therefore it is concluded that the DBNPS AUX has adequate seismic capacity to withstand the RLE and meets the requirements to satisfy Reference 1, Appendix H.

Non-Seismic Category 1 Structures

Two non-Seismic Category 1 structures, the TURB and Service Building 7 (SB7), were identified to serve functions related to the DBNPS FLEX strategies. The following provides descriptions of the structures' construction, design criteria, and FLEX functions served.

Turbine Building

Several normal operator travel paths to perform FLEX Support Guideline (FSG) actions are through the non-Seismic Category 1 TURB per Reference 19. The TURB consists of a concrete shear wall structure and steel superstructure. The concrete structure is from EL 565 ft to EL 623 ft and the steel structure is from EL 623 ft to EL 692 ft.

Per the DBNPS Updated Safety Analysis Report (USAR) (Reference 21) this building was designed to the requirements of Uniform Building Code (UBC) Code Zone 1. While this building was designed for seismic loading, the wind loading typically governs the design of steel frames when compared with a Zone 1 seismic coefficient.

The concrete shear walls and diaphragms of the TURB are sufficiently rugged per Reference 1 Section H.4.4 guidance. For the steel frame superstructure, considering the severe wind loading and the fact that steel frame buildings exhibit large inelastic absorption capacity, it is expected that the C10% seismic capacity is in excess of the RLE PGA. Therefore it is reasonable to conclude that, under the RLGM, the TURB may sustain limited inelastic displacements to allow a safe pathway.

In the event the normal operator travel paths through the TURB are not available after the RLE, multiple backup travel paths are available through the Seismic Category 1 AUX. Thus, the integrity of the TURB and its operator pathways is not essential to implementing the FLEX strategies. Further discussion of operator pathways is provided in ***Section 2.4.2***.

Service Building 7

In accordance with the FLEX diversity requirements, the FLEX Storage Building SB7 houses the "N+1" FLEX portable equipment such as a turbine generator, transcube fuel tank, debris removal truck, and Godwin pumps among other portable items. During the walkdowns it was noted that none of the portable equipment was securely tied to the floor.

Per the DBNPS Final Integrated Plan (FIP) (Reference 14), SB7 is a non-Seismic Category 1 commercial grade building that was used prior to and during 18RFO to store the new Once-Through Steam Generators (OTSGs). The structure, previously designated as the New Steam Generator Storage Facility (NSGSF), is designed in accordance with the 2011 Ohio Building Code (OBC). The 2011 OBC uses American Society of Civil Engineers (ASCE) 7-05 as the basis for design loads. The superstructure is constructed of premanufactured frames with roof and wall purlins to support the metal siding and roofing. The substructure consists of a slab-on-grade, a perimeter grade wall with strip footing extending below the frost line and spread footings at the building frames. The finish floor elevation of SB7 is 584 ft-7 1/4 inches. The lateral resistance for SB7 is provided by steel moment frames in the transverse direction and steel tension rods in the longitudinal direction. The SB7 is separated in distance from the EFWF.

Per Reference 1, Section H.4, equipment required to support an alternative means to accomplish a function is not required to be included in the MSA and therefore no further review is required for the SB7 and the FLEX equipment stored within it.

2.4.2 Operator Pathways

DBNPS has reviewed the operator pathways and verified that the operator pathways are not impacted by the MSSHI. Considerations for this review included:

- Multiple available pathways or multiple FLEX components
- Pathway includes only Seismic Category 1 structures with previous reviews for seismic ruggedness – an exception is the TURB which is a non-Seismic Category 1 building with available travel paths which is discussed below
- 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

A review of the operator pathways to perform the FSGs' actions (Reference 19) indicates normal travel paths often are through the TURB which is non-Seismic Category 1 structure. However, multiple backup travel paths are available through the Seismic Category 1 AUX to the locations of the FSG actions. In the event the normal travel paths through the TURB are unavailable, the paths through the AUX result in changes in response times ranging from potential time savings to an addition of approximately three minutes (Reference 19).

Operator pathways from the Control Room to the EFWF and equipment haul paths related to FLEX implementation were walked down. Many of the preferred operator pathways at DBNPS transit through the TURB or through areas of the AUX Building where housekeeping is a potential concern, such as Radiation Protection (RP) storage areas with unrestrained file cabinets and storage lockers. Nevertheless, the walkdown team identified a pathway located entirely within Category I structures and free of potential seismic interactions. The operator can exit the back door of the Control Room, walk west through Room 500 and down the stairs to EL 585 to the roll-up door in the Fuel Handling Area and finally be outside next to the EFWF.

Potential impairments to required access are: (1) doors and gates, and (2) site debris blocking personnel or equipment access. The coping strategy to maintain site accessibility through doors and gates is applicable to all phases of the FLEX coping strategies, but is immediately required as part of the immediate activities required during Phase 1.

Doors and gates serve a variety of barrier functions on the site. One primary function is security and is discussed below. However, other barrier functions include fire, flood, radiation, pressure boundary, tornado, and high energy line break (HELB). As barriers, these doors and gates are typically administratively controlled to maintain their function as barriers during normal operations. Following a Beyond-Design-Basis External Event (BDBEE) and subsequent Extended Loss of AC Power (ELAP) event, FLEX coping strategies require the routing of hoses and cables to be run through various barriers in order to connect beyond-design-basis (BDB) equipment to station fluid and electric systems. For this reason, certain barriers (gates and doors) will be opened in response to the events and remain open. This violation of normal administrative controls is acknowledged and is acceptable during the implementation of FLEX coping strategies.

The ability to open doors for ingress and egress, ventilation, or temporary cables/hoses routing is necessary to implement the FLEX coping strategies. Operators responsible for implementing FLEX strategies have keys in their possession that provide access to all required areas. Keys will be turned over between individuals as part of the Shift Relief and Turnover Process.

Access into the PA through the normal entrance (PA sally port) is protected by a security barrier. This barrier can be manually operated during a loss of all AC power. The ability to open the barrier during a loss of AC power event is achieved through Security Shift Supervisor training and the requirement of maintaining a minimum number of individuals qualified as Security Shift Supervisors.

Two Heavy Duty Pickup Trucks will be used as debris removal and towing vehicles. They are equipped with snow plows to remove snow from travel paths as necessary. One truck is stored in SB7 and the second is parked inside the PA on the north side of the plant such that prevailing tornado path and width should not impact both debris removal trucks (diverse locations). The truck parked in the PA is not located near any structures which could fall on it and render it unavailable. Ice augers and chain saws are staged in the trucks to create openings in the ice to access water during cold weather events if necessary.

Given the number and variety of potential paths, verification that multiple backup paths are in Seismic Category 1 structures, debris removal capability, available time for operator actions, and walkdown observations, it is probable operators will be able to gain access to the locations of the FSG actions after the RLE.

2.4.3 Tie-Down of FLEX Portable Equipment

All portable equipment staged for use in the FLEX strategy is stored in either EFWF or AUX. The two structures are described in ***Section 2.4.1*** The following portable equipment are staged in one of the two structures and are included in the FLEX strategy:

- FLEX ALT LP EFW 'N' Pump
- FLEX Replenishment 'N' Pump
- FLEX Spray 'N' Pump
- FLEX 'N' 480 Volt Turbine Generator

Descriptions for where each of these fits into the FLEX strategy can be found in the FIP (Reference 14).

In addition, several other minor items are stored in these buildings. These items include:

- Ice Auger
- Fans
- Portable Generators (120 volt AC)
- Portable Generator Fuel Caddies
- Lighting
- Hand tools (saws, screwdrivers, wrenches, etc.)

Stored equipment were 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.

For the purposes of satisfying this MSA, all essential equipment is reevaluated to the RLE in accordance with Section H.5 of Reference 1. The 4160 breaker connection carts are light weight and restrained to straps and consequently are judged to have $C_{10\%}$ capacities well in excess of the RLE PGA. The Trailer Caddy (not specifically FLEX equipment but used to support maintenance and stored in the EFWF) has a low weight and a low center of gravity and also has a $C_{10\%}$ capacity in excess of the RLE PGA. For the rest of the essential portable equipment, it is conservatively assumed in the evaluation that no tie downs are installed and that all equipment relies solely on self-resistance. The evaluation demonstrates that, even with the very conservative assumption, all essential portable equipment staged in the EFWF and AUX structures has a $C_{10\%}$ capacity greater than the RLE.

DBNPS 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 RLE using the methods described in Section H.5 of Reference 1.

Having satisfied all requirements, there are no plans to modify any tie downs or plant procedures regarding the staging of the portable equipment in the EFWF and AUX structures.

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 DBNPS.

A detailed walkdown was performed for this MSA to identify any potential interactions that were not previously captured by the ESEP program. This walkdown included the EFWF structure, all new equipment staged/installed within the EFWF structure, AUX and Yard, and operator and haul pathways. A sampling walkdown of FLEX piping connections and isolation valves supporting the FLEX strategy was considered adequate due to the rugged nature and absence of potential interactions of the sample of connections walked down. Potential interactions found during the walkdown are discussed in detail below.

EL 586 ft in the EFWF is mostly used as storage for FLEX 'N' turbine generator, Godwin pumps, panel enclosures, piping connections, and miscellaneous items such as hoses, carts, and ladders. Larger items such as the turbine generator and Godwin pumps are tied down with ratchet straps connected to concrete expansion anchors. On the other hand, miscellaneous items are unrestrained and there is no plan for the plant to restrain them. These unrestrained items are at least 8 ft from the nearest trailer-mounted FLEX equipment. It is judged that any potential interaction would not impact the operability of the equipment. A CartCaddy and a portable fan were observed to be in close proximity and it is judged that the interaction, if probable, would be non-damaging.

EL 603 ft of the EFWF houses critical electrical FLEX equipment such as MCCs, transformers, panels, switchgears, and battery racks. This level also houses an exhaust fan and fuel oil storage tank. During the walkdowns, it was observed that the grating at EL 603 ft is not restrained with clips. This grating could potentially uplift and fall onto the FLEX pumps below. This concern was communicated to plant personnel during the walkdowns and it was recommended to add grating clips as identified on design drawings. In response, DBNPS has generated an Order to install restraints for the grating (CR 2016-14033).

Also on the EL 603 ft level of the EFWF, a long ladder is loosely tied off to the handrail, but the other end of the ladder is free to move and can potentially impact a nearby MCC. Although DBNPS housekeeping requirements only require the ladder to be tied off at one point, the walkdown team recommended to tie it at several points to avoid rattling and contact between MCC and ladder. Upon further review, the potential interaction between the ladder and MCC is indeed judged to be credible but not significant. The interaction is not significant on the bases that (1) the ladder lies on its side and a potential interaction would be with the sheet metal rear of MCC which would not be damaging and (2) there are no chatter sensitive devices of concern within MCC. In general, FLEX items at this level possess good anchorage design and are free of seismic vulnerabilities.

DBNPS has reviewed the additional seismic interactions and verified that the mitigation strategy is not adversely impacted by the RLE.

2.4.5 Haul Path

DBNPS FLEX storage is designed to minimize the deployment routes to the operations areas (designed areas where FLEX equipment is operated). In addition, the DBNPS FLEX strategies are intended to minimize the impact of debris by installing equipment in robust locations such as inside the AUX or the EFWF that minimize the number of activities the operators must perform outside.

Pre-determined, preferred haul paths have been identified and documented in the FSGs DB-OP-02705, Initial Assessment, and FLEX Equipment Staging (Reference 20). The preferred haul path uses the normal vehicle entrance into the PA located adjacent to the Personnel Access Facility (PAF) at the southwest corner of the PA. An alternate haul path into the PA uses "Gate 10" which is the former main entry point in the Protected Area located at the northeast corner of the PA. The current configuration of Gate 10 includes security features and barriers that can be manually opened. The size of the pathway through each barrier is adequate for the FLEX equipment deployment. Removal of the security features and barrier would be performed with security notification and is within the capability of debris removal equipment.

Once in the PA, the preferred haul path to FLEX staging Area 1 and Area 2 turns north-northeast and continues along the PA west boundary. FLEX staging Area 1 is located adjacent the EFWF. From there, the haul path continues to the north to FLEX staging Area 2 located near the station transformers. From the PA Primary Access, the preferred haul path to FLEX staging Area 3 and Area 4 continues to the east. FLEX staging Area 3 is outside the CAF. From there, the haul path continues east and then to the northeast and eventually terminating at FLEX staging Area 4 near the Intake Structure.

Additionally, the preferred haul paths attempt to avoid areas with trees, power lines, narrow passages, etc. when practical. If debris interferes with planned haul paths, two Heavy Duty Pickup Trucks will be used as debris removal vehicles. One truck is stored on the north side of the plant inside the PA and the other in SB7 where prevailing tornado path and width should not impact both debris removal trucks.

By procedure, all haul paths are kept clear during all operation modes. That is, no laydown areas for refueling outages are permitted in areas that would impede implementation of the FLEX strategy.

Haul paths were walked down for the RLE. Equipment haul paths are generally within the PA, and are free of potential seismic vulnerabilities. Two of the alternate haul paths cross small bridges over the cooling tower basin discharge channel. One of the bridges is located just north of the TURB and carries heavy industrial traffic, as a tanker truck was observed driving over it during the walkdown. These bridges are judged to be sufficiently rugged and do not present a seismic concern. It is judged that the bridges will remain functional after an earthquake.

As described in the FIP (Reference 14), it is concluded that the subsurface soils and man-made fill deposits encountered below the anticipated haul paths are not considered to be susceptible to liquefaction during seismic events.

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

3.0 SPENT FUEL POOL COOLING REVIEW

3.1 SPENT FUEL POOL COOLING EVALUATION

The evaluation of spent fuel pool (SFP) cooling for DBNPS was performed based on the initial conditions established in NEI 12-06 (Reference 1) for spent fuel cooling coping in the event of an 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 SFP cooling utilizes SFP level monitoring and make-up capability as described in the DBNPS FIP (Reference 14). SFP make-up capability is provided using the Diesel-Driven Emergency Feedwater Pump (EFWP) taking suction though a portable flexible hose. The hose connection for the permanent, seismically designed primary emergency SFP make-up connection is located on an inside wall of the Fuel Handling Area. This new make-up header for the FLEX SFP Cooling allows for connection of flexible hoses from the EFW system to the new SFP make-up piping installed in the SFP area and finally to the SFP. This is accomplished by routing hoses from FLEX connection EF48, EFW TO SFP Make-Up Throttle Valve (located in Mechanical Penetration Room 3), to Primary SFP Make-up Header (SFP Train Bay southeast corner 585 ft level). Once connected, throttle valve EF48 is opened, as necessary to maintain SFP level. The source of make-up water for the EFW system is the EFWST.

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 SFP integrity evaluations demonstrated inherent margins of the SFP structure and interfacings plant equipment above the SSE to a peak spectral acceleration of 0.8g (Reference 16).

If needed, the Alternate Low Pressure Emergency Feedwater 'N' Pump, the EFWST Replenishment 'N' Pump, or the Spent Fuel Spray 'N' Pump, all located in the EFWF, may be used as alternate SFP make sources. 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 under the RLE.

4.0 HIGH-FREQUENCY REVIEW

A HF review consistent with Reference 1, Sections H.4.2 and H.4.4, was performed. The scope of the HF review consists of devices with the potential to affect the following functions: Reactor Trip / SCRAM, RCS Inventory, RCS Pressure, Phase 1 FLEX, and Phase 2 FLEX.

Reactor Trip / SCRAM, RCS Pressure, and RCS inventory are overlapping scope items between the NTTF 2.1 HF confirmation performed in accordance with EPRI 3002004396 (Reference 7) and the NEI 12-06 (Reference 1) Appendix H MSA Path 4 HF evaluation; however, review is not necessary for the former two system functions. HF sensitive devices with the potential to affect RCS inventory have already been evaluated as part of the NTTF 2.1 HF confirmations and these evaluations can serve as the capacity bases for these devices for MSA Path 4 HF review. HF sensitive devices supporting Phase 1 FLEX and Phase 2 FLEX are scope items unique to the MSA. A review of the equipment which encompasses the FLEX Phase 1 strategy indicates the NTTF 2.1 HF confirmation has evaluated all potentially high-frequency sensitive devices of concern. FLEX Phase 2 equipment is installed such that they will not automatically start and connect to the plant and consequently there are no potentially HF sensitive devices of concern.

The DBNPS NTTF 2.1 HF confirmation (Reference 5) results show that the $C_{10\%}$ capacities of all devices evaluated exceed the GMRS PGA of 0.20g. The HF review concludes that potentially HF sensitive devices will not adversely impact the success of the FLEX strategy via relay chatter for the RLE.

See ***Enclosure 1*** for details of the High-Frequency Review.

5.0 CONCLUSION

The FLEX strategies for DBNPS as described in the FIP (Reference 14) are acceptable as specified with the grating clips to be installed per CR 2016-14033 as discussed above.

6.0 REFERENCES

1. NEI 12-06, Revision 2, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, December 2015, ADAMS Accession Number ML16005A625.

2. JLD-ISG-2012-01, Revision 1, Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, ADAMS Accession Number ML15357A163.

3. FirstEnergy Nuclear Operating Company (FENOC) Seismic Hazard and Screening 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 (NTTF) Review of Insights from the Fukushima Dai-ichi Accident, dated March 31, 2014, ADAMS Accession Number ML14092A203.

4. NRC Letter, Davis-Besse Nuclear Power Station, Unit 1 – 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, dated August 25, 2015, ADAMS Accession Number ML15230A289.

5. Davis-Besse Nuclear Power Station High Frequency Supplement to Seismic Hazard Screening 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.

6. Not used.

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. FirstEnergy Nuclear Operating Company (FENOC) Expedited Seismic Evaluation Process (ESEP) Reports, Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force (NTTF) Review of Insights from the Fukushima Dai-ichi Accident: Enclosure C-Expedited Seismic Evaluation Process (ESEP) Report for Davis-Besse Nuclear Power Station dated December 19, 2014, ADAMS Accession Number ML14353A059.

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, Davis-Besse Nuclear Power Station, Unit 1 – Staff Review of Interim Evaluation Associated with Reevaluated Seismic Hazard Implementing Near-Term Task Force Recommendation 2.1, dated October 19, 2015, ADAMS Accession Number ML15273A237.

14. Davis-Besse Nuclear Power Station, "Davis-Besse FLEX Final Integrated Plan," NORM-LP-7203, Revision 0, 10/10/16.

15. Davis-Besse Nuclear Power Station, Unit 1 – Safety Evaluation Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Pool Instrumentation Related to Orders EA-12-051 and EA-12-049 (CAC Nos. MF0960 and MF0961), January 31, 2017, ADAMS Accession Number ML17017A340

16. FirstEnergy Nuclear Operating Company 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, Davis-Besse Nuclear Power Station, dated December 9, 2016, ADAMS Accession Number ML16344A010.

17. Stokoe, K. H., W. K. Choi, and F-Y Menq, 2003, "Summary Report: Dynamic Laboratory Tests: Unweathered and Weathered Shale Proposed Site of Building 9720-82 Y-12 National Security Complex, Oak Ridge, Tennessee", Department of Civil Engineering, The University of Texas at Austin, Austin, Texas, 2003.

18. Davis-Besse Nuclear Power Station, "Davis-Besse FLEX Strategy Design & Equipment Bases Detail," NORM-LP-7204, Revision 0, 8/5/16.

19. Davis-Besse Nuclear Power Station, "Davis-Besse FLEX Validation Process Report," NORM-LP-7201, Revision 0, 7/7/16.

20. Davis-Besse Nuclear Power Station, "FLEX Support Guideline, Initial Assessment and FLEX Equipment Staging," DB-OP-02705, Revision 0, 7/7/16.

21. Davis-Besse Nuclear Power Station Updated Safety Analysis Report (USAR), Revision 30.

ENCLOSURE 1

NEI 12-06 APPENDIX H PATH 2 HF REVIEW

ENCLOSURE 1 – NEI 12-06 APPENDIX H PATH 2 HF REVIEW

1.0 INTRODUCTION

A high-frequency (HF) review consistent with Reference 1 Sections H.4.2 and H.4.4 was performed. Nuclear Energy Institute (NEI) 12-06 (Reference 1), Appendix H Section H.4.2 refers to Electric Power Research Institute (EPRI) 3002004396 (Reference 7) for the high-frequency contact device analysis approach. Reference 7 is used for the Davis-Besse Nuclear Power Station (DBNPS) engineering evaluations described in this report. Acceptance criteria for the evaluations are found in Reference 1, Appendix H, Section H.5. Note that a previous High-Frequency Confirmation, based on EPRI 3002004396, was submitted to the Nuclear Regulatory Commission (NRC) (Reference 9). This Enclosure refers back to that submittal where possible.

2.0 SELECTION OF COMPONENTS

The fundamental objective of the MSA evaluation is to determine whether the FLEX strategies developed, implemented and maintained in accordance with NRC Order EA-12-049 (Reference 8) can be implemented considering the impacts of the reevaluated seismic hazard. Within the applicable functions identified in Section H.4.2 (Path 2) (Reference 1), the components that would need a high-frequency evaluation are contact control devices subject to intermittent states in seal-in or lock-out (SILO) circuits. Plants in Path 2 are required to evaluate SILO devices in the control systems of four specific categories: (1) Reactor Trip/Scram, (2) Reactor Vessel Coolant Inventory leakage pathways, (3) FLEX Phase 1 Components, and (4) Automatically Operated FLEX Phase 2 Components to ensure those functions perform as necessary in the FLEX strategies. The equipment selection process for each of those categories is described below. Note that categories (1) and (2) were addressed in the high-frequency evaluation (Reference 9). Additionally, category (3) components were addressed in the high-frequency evaluation, although not explicitly identified as FLEX Phase 1 components in that submittal.

2.1 Reactor Trip/SCRAM

Section H.4.2 of NEI 12-06 Appendix H (Reference 1) identifies the reactor trip/SCRAM function as a function to be considered in the high-frequency evaluation, and was included in Reference 9. The EPRI guidance for High-Frequency Confirmation (Reference 7) notes that "the design requirements preclude the application of seal-in or lock-out circuits that prevent reactor trip/SCRAM functions" and that no high-frequency review of the reactor trip/SCRAM systems is necessary. Therefore, no additional evaluations are necessary for the reactor trip/SCRAM function.

2.2 Reactor Vessel Inventory And Pressure Control

The equipment in the Reactor Vessel Inventory Control function are the same equipment evaluated in the DBNPS NTTF 2.1 High-Frequency Confirmation, and was included in Reference 9. The primary concern for both the NTTF 2.1 and MSA programs is the actuation of valves that have the potential to cause a loss-of-coolant accident (LOCA). A LOCA following a seismic event could provide a challenge to the mitigation strategies and lead to core damage. Per Reference 3, Reactor Coolant System (RCS) Pressure control is accomplished through the use of the pressurizer heaters to maintain saturation temperature and pressure within the pressurizer and pressure reduction can be accomplished through the use of the Power Operated Relief Valve (PORV) in venting steam to the pressurizer quench tank. RCS Overpressure protection is also afforded by means of the pressurizer code safety valves (PSVs) that vent to the Containment atmosphere.

Control circuits for the PORV as well as other RCS valves and pressurizer heater controls were analyzed as part of the DBNPS submittal to address NTTF 2.1 recommendations (Reference 9). The components covered in this category are the same as those covered in the RCS/Reactor Vessel Inventory Control category of EPRI 3002004396 DBNPS submittal (Reference 9).

HF sensitive devices with the potential to affect RCS inventory have already been evaluated as part of the NTTF 2.1 HF confirmations and these evaluations can serve as the capacity bases for these devices for MSA Path 4 HF review. A number of relays were identified in the HF review, which are identified in ***Table A-1***.

2.3 FLEX PHASE 1

Section H.4.2 of NEI 12-06 Appendix H (Reference 1) requires the analysis of relays and contactors that may lead to circuit SILO that could impede the Phase 1 FLEX capabilities, including vital buses fed by station batteries through inverters. Phase 1 of the FLEX Strategy is defined in NEI 12-06 (Reference 1) as the initial response period where a plant is relying solely on installed plant equipment. During this phase, the plant has no AC power and is relying on batteries, steam, and air accumulators to provide the motive force necessary to operate the critical pumps, valves, instrumentation, and control circuits.

As stated in Reference 3, during Plant Modes 1-4, *Reactor Core Cooling and Heat Removal* is maintained through natural circulation heat removal from the RCS via the Steam Generators (SG). Natural circulation is maintained by ensuring adequate RCS inventory and preventing voids at the top of the RCS hot legs. RCS inventory is maintained initially in Phase 1 by limiting leakage (isolating letdown and RCP Seal Return from the Control Room and crediting the actual demonstrated RCP seal performance during testing) to minimize RCS losses. Heat rejection through the SGs is maintained by manually starting (from the Main Control Room) the diesel-driven Emergency Feedwater Pump (EFWP) taking a suction on the Emergency Feedwater Storage Tank (EFWST) and providing inventory initially to SG1 and later with operator action to include SG2. Reactor Decay Heat (post trip) will be released via steam to the atmosphere through the Main Steam Safety Valves and later with manual operator action, via the Atmospheric Vent Valves (AVVs) using the installed remote hand wheels.

DC bus load shedding will ensure 2P battery life is extended to 14.6 hours as described in calculation C-EE-002.01-016, Station Battery Discharge Analysis for Beyond-Design-Basis Events. The FLEX 480V Generator will be used to repower installed station battery chargers prior to battery depletion. In addition, in the event the station DC or 120V AC Instrument Bus power distribution is damaged, FSG DB-OP-02707, Loss of DC Power, provides direction to use portable meters to obtain key parameter information during a loss of all AC and DC power. RCS makeup and boron addition from the Borated Water Storage Tank (BWST) or from the Clean Waste Receiver Tank (CWRT) will be initiated within 4.5 hours to ensure natural circulation, reactivity control, and boron mixing is maintained.

A HF review of the Steam Driven Feedwater System and the newly installed Diesel-Driven Feedwater System were performed in the High-Frequency Confirmation (Reference 9), as part of the Section 2.4 Core Cooling evaluation. Because the Steam and Feedwater Rupture Control System (SFRCS) is de-energized to actuate, many of the valves in the Steam Driven Feedwater line that had a potential to reposition due to relay chatter would be placed in the desired position due to successful SFRCS actuation.

Instrumentation is dependent on the availability of Essential DC power. Distribution to the DC buses was also included in the HF review performed in Reference 9, as part of the Section 2.5 AC/DC Power Support Systems evaluation. Relays were identified that could prevent power distribution to the battery chargers from the 4160VAC Buses. Those relays are identified in ***Table A-1***. The FLEX strategy is to perform a load shed to keep essential loads prior to initializing the FLEX Phase 2 480V Generators. It should be noted that there were no devices subject to chatter that would prevent power distribution below 480VAC and no devices subject to chatter that would prevent power distribution from the 125VDC.

Finally, a comparison between the equipment identified in Reference 3 and Reference 9 was performed, to confirm that the HF component selection appropriately covered all the FLEX Phase 1 equipment. No additional equipment was identified during the review.

2.4 FLEX PHASE 2 AUTOMATIC OPERATION

The DBNPS Phase 2 strategy includes continuation of the Phase 1 strategy. If the SGs are available then no Containment Cooling is needed and Containment Isolation is confirmed as resources permit. If the SGs are not available, the RCS is vented to Containment and Containment is vented to the atmosphere through the Emergency Hatch. This will ensure Containment pressure and temperature remain acceptable with no further action.

NEI 12-06 Appendix H (Reference 1) requires the inclusion of SILO relays and contactors that could impede FLEX capabilities for mitigation of seismic events in permanently installed Phase 2 SSCs that have the capability to begin operation without operator manual actions.

With the loss of AC power, Phase 2 SSCs to be evaluated are limited to any permanently installed FLEX generator and, if allowed to automatically start, any electrical components powered by the FLEX generator and relied upon for Phase 2 of the FLEX Strategy. DBNPS does not have any permanently installed Phase 2 equipment that would automatically start. DBNPS credits a portable FLEX generator, FLEX RCS Charging Pumps, and other portable pumps as necessary for Phase 2 response, and the operator actions necessary to install and initiate the equipment. Since operator actions are necessary no devices subject to high frequency were identified.

2.5 SUMMARY OF SELECTED COMPONENTS

A list of the contact devices requiring evaluation as part of the NTTF 2.1 High Frequency Confirmation (Reference 9) is provided in ***Table A-1***. The HF Relay Groups which also required evaluation as part of the NEI 12-06 Appendix H Path 2 High Frequency Confirmation are identified in the table by a note. In total, two groups comprising six components were identified for NEI 12-06 Appendix H Path 2 High Frequency Confirmation.

3.0 SEISMIC EVALUATION

The generation of the high-frequency seismic demand on the subject components is documented in Section 3 of the high-frequency evaluation (Reference 9).

4.0 CONTACT DEVICES EVALUATIONS

The performance of the seismic evaluations is documented in Section 4 of the high-frequency evaluation (Reference 9). No additional components were identified in this assessment.

A summary of the high-frequency evaluation results is provided in ***Table A-1***.

5.0 CONCLUSIONS

The high-frequency capacity of each device was evaluated in Reference 9. These components and the results of the individual component evaluations are provided in ***Table A-1***, below. A total of six components are identified that required NEI 12-06 Appendix H Path 2 High-Frequency Confirmation evaluation. The six components are grouped into two main groups based on device type and capacity and enclosure dynamic characteristics and location.

The two HF Relay groups in the scope of the NEI 12-06 Appendix H Path 2 are identified by a note in ***Table A-1.***

As shown in ***Table A-1***, 11 components out of a total of 80 components requiring evaluation as part of the NTTF 2.1 High Frequency Confirmation have Capacity less than Demand when evaluated in accordance with Reference 9 guidance. These components were then reevaluated through mitigation strategies included in Appendix H of Reference 1 and shown to be adequate (i.e., $HCLPF_{C10\%} > PGA_{GMRS}$) and do not impact the credited path for mitigation strategies.

5.1 GENERAL CONCLUSIONS

DBNPS 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 of the evaluation confirm that the FLEX strategies for DBNPS can be implemented as designed and no further seismic evaluations are necessary.

5.2 IDENTIFICATION OF FOLLOW-UP ACTIONS

For DBNPS, all the identified components have adequate seismic capacity and no follow-up actions were identified.

6.0 REFERENCES

1. NEI 12-06, Revision 2, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, December 2015, ADAMS Accession Number ML16005A625.

2. JLD-ISG-2012-01, Revision 1, Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, February 2016, ADAMS Accession Number ML15357A163.

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Events (TAC No. MF0961), September 23, 2016, ADAMS Accession Number ML16267A471.

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6. NRC (W. Dean) Letter to the Power Reactor Licensees on the Enclosed List, "Final Determination of Licensee Seismic Probabilistic Risk Assessments Under the Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendation 2.1 "Seismic" of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident." October 27, 2015.

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Table A-1, below, contains the results of the NTTF 2.1 High Frequency Confirmation from Reference 9. All components were identified and assessed in Reference 9. No new components were identified from this NEI 12-06 Appendix H MSA Path 2 High Frequency Confirmation. The components which are in the scope of the MSA Path 2 High Frequency Confirmation review are identified by a note in ***Table A-1***. All of the components which are in the scope of the MSA Path 2 High Frequency Confirmation have a seismic capacity greater than the seismic demand.

TABLE A-1
COMPONENTS IDENTIFIED FOR HIGH FREQUENCY EVALUATION

No.	Unit	Component					Enclosure		Bldg.	Elev. (ft)	Component Evaluation			C1%[4] (g)	C10%[4] (g)
		ID	Type	System Function	Manufacturer	Relay/ Contactor/ Breaker Model No.	ID	Type			Basis for Capacity	C/D Ratio[3]	Evaluation Result		
1	1	AC103/86-1/C1 AC103/86-2/C1 AD103/86-1/D1 AD103/86-2/D2	Protective Relay	AC/DC Power Support System, Actuates Bus Lockout	G.E.	HFA53K91F	C1, D1	Switchgear	Aux. 6	585	IEEE/ANSI C37-98 test	1.61	Capacity > Demand	0.32	0.44
	1	AC103/51-1X AC103/51-1 AC103/51-2 AC103/51-3 AD103/51-1X AD103/51-1 AD103/51-2 AD103/51-3		AC/DC Power Support System, Over Current Protection											
2	1	AC110/51-4 AD110/51-4	Protective Relay	AC/DC Power Support System, Over Current Protection	Westinghouse	CO-2	C1, D1	Switchgear	Aux. 6	585	IEEE/ANSI C37-98 test	1.93	Capacity > Demand	0.39	0.53
3	1	AC110/51-5 AD110/51-5	Protective Relay	AC/DC Power Support System, Over Current Protection	Westinghouse	CO-5	C1, D1	Switchgear	Aux. 6	585	IEEE/ANSI C37-98 test	2.90	Capacity > Demand	0.58	0.79
4	1	AC110/51GS-3 AC1CE11-50/51 AC1CE12-50/51 AD110/51GS-3 AD1DF11-50/51 AD1DF12-50/51	Protective Relay	AC/DC Power Support System, Over Current Protection	Westinghouse	CO-11	C1, D1	Switchgear	Aux. 6	585	IEEE/ANSI C37-98 test	4.51	Capacity > Demand	0.90	1.23
5	1	AC107-50/51 AC108-50/51 AC109-50/51 AC113-50/51 AD107-50/51 AD108-50/51 AD109-50/51 AD113-50/51	Protective Relay	AC/DC Power Support System, Over Current Protection	ABB	COM-5	C1, D1	Switchgear	AUX. 6	585	IEEE/ANSI C37-98 test	2.90	Capacity > Demand	0.58	0.79

TABLE A-1
COMPONENTS IDENTIFIED FOR HIGH FREQUENCY EVALUATION
(CONTINUED)

No.	Unit	Component					Enclosure		Bldg.	Elev. (ft)	Component Evaluation			C1%[4] (g)	C10%[4] (g)
		ID	Type	System Function	Manufacturer	Relay/ Contactor/ Breaker Model No.	ID	Type			Basis for Capacity	C/D Ratio[3]	Evaluation Result		
6	1	AC107/50GS AC113/50GS AC1CE11/50GS AD107/50GS AD1DF12/50GS	Protective Relay	AC/DC Power Support System, Ground Sensing Relay	ABB	ITE Type 50D	C1, D1	Switchgear	Aux. 6	585	IEEE/ANSI C37-98 test	5.00	Capacity > Demand	1.00	1.36
7	1	AC103/51GS-1 AC103/51GS-2 AD103/51GS-1 AD103/51GS-2		AC/DC Power Support System, Over Current Protection											
8	1	AC110/51X AD110/51X	Protective Relay	AC/DC Power Support System, Over Current Protection	G.E	HGA17C61	C1, D1	Switchgear	Aux. 6	585	GERS	1.55	Capacity > Demand	0.31	0.42
9	1	AC101/51V2DG AD101/51V2DG	Protective Relay	AC/DC Power Support System; Back Up OC Trip of AC101	ABB	COV-9	C1, D1	Switchgear	Aux. 6	585	IEEE/ANSI C37-98 test	4.51	Capacity > Demand	0.90	1.23
10[5]	1	BF1285/42	Control Relay	RCS Inventory Control; Control of Valve RC200; Drain valve to RCS Quench Tank	Cutler Hammer	Electro-Mechanical Contactor A201K1C	F12A	MCC	Aux. 6	603	EPRI HF Test	3.12	Capacity > Demand	0.62	0.85
	1	BF1126/42	Control Relay	RCS Inventory Control; Control of Valve RC239A; RCS Sample Isolation Valve			F11A		Aux. 7	603		3.06	Capacity > Demand	0.61	0.83

TABLE A-1
COMPONENTS IDENTIFIED FOR HIGH FREQUENCY EVALUATION
(CONTINUED)

No.	Unit	Component: ID	Component: Type	Component: System Function	Component: Manufacturer	Component: Relay/ Contactor/ Breaker Model No.	Enclosure: ID	Enclosure: Type	Bldg.	Elev. (ft)	Component Evaluation: Basis for Capacity	Component Evaluation: C/D Ratio[1]	Component Evaluation: Evaluation Result	C1%[4] (g)	C10%[4] (g)
10[3]	1	BF1127/42	Control Relay	RCS Inventory Control; Control of Valve RC239B; RCS Sample Isolation Valve	Cutler Hammer	Electro-Mechanical Contactor A201K1C	F11A	MCC	Aux 7	603	EPRI HF Test	3.06	Capacity > Demand	0.61	0.83
	1	BF1128/42	Control Relay	RCS Inventory Control; Control of Valve RC240B; RCS Sample Isolation Valve											
	1	BE1181/42	Control Relay	RCS Inventory Control; Control of Valve RC240A; RCS Sample Isolation Valve			E11B		Aux. 8	585		5.27	Capacity > Demand	1.05	1.43
11	1	R7_1	Control Relay	EDG1 Shutdown Relay	Square D	8501KPD13V63	C3621	Relay Panel	Aux 6	585	IEEE/ANSI C37-98 test	3.06	Capacity > Demand	0.61	0.83
		R7_2		EDG2 Shutdown Relay			C3622								
		OTR_1		EMER DSL GEN 1-1 OVERSPEED TRIP RELAY			C3621								
		OTR_2		EMER DSL GEN 1-2 OVERSPEED TRIP RELAY			C3622								
		R2_1		EMER DSL GEN 1-1 FAIL TO START RELAY			C3621								
		R2_2		EMER DSL GEN 1-2 FAIL TO START RELAY			C3622								
		SDRX1_1		EMER DSL GEN 1-1 SHUTDOWN/LOCKOUT RELAY			C3621								

TABLE A-1
COMPONENTS IDENTIFIED FOR HIGH FREQUENCY EVALUATION
(CONTINUED)

No.	Unit	Component					Enclosure		Bldg.	Elev. (ft)	Component Evaluation			C1%[4] (g)	C10%[4] (g)
		ID	Type	System Function	Manufacturer	Relay/ Contactor/ Breaker Model No.	ID	Type			Basis for Capacity	C/D Ratio[1]	Evaluation Result		
11	1	SDRX1_2	Control Relay	EMER DSL GEN 1-2 SHUTDOWN/LOCKOUT RELAY	Square D	8501KPD13V63	C3622	Relay Panel	Aux 6	585	IEEE/ANSI C37-98 test	3.06	Capacity > Demand	0.61	0.83
		SDRX_1		EMER DSL GEN 1-1 SHUTDOWN/LOCKOUT RELAY			C3621								
		SDRX_2		EMER DSL GEN 1-2 SHUTDOWN/LOCKOUT RELAY			C3622								
		R3X1_1		EMER DSL GEN 1-1 AUTO/EMER START RELAY			C3617								
		R3X1_2		EMER DSL GEN 1-2 AUTO/EMER START RELAY			C3618								
		SS3_1		EMER DSL GEN 1-1 ENGINE SPEED RELAY 400R			C3621								
		SS3_2		EMER DSL GEN 1-2 ENGINE SPEED RELAY 400R			C3622								
		SS4_1		EMER DSL GEN 1-1 ENGINE SPEED RELAY 800R			C3621								
		SS4_2		EMER DSL GEN 1-2 ENGINE SPEED RELAY 800R			C3622								
12	1	TD1_1	Protective Relay	EDG 1 Start Failure	Agastat	E7012PC0004	C3621	Relay Panel	Aux 6	585	IEEE/ANSI C37-98 test	2.43	Capacity > Demand	0.49	0.66
		TD1_2		EDG 2 Start Failure			C3622								

TABLE A-1
COMPONENTS IDENTIFIED FOR HIGH FREQUENCY EVALUATION
(CONTINUED)

No.	Unit	Component					Enclosure		Bldg.	Elev. (ft)	Component Evaluation			C1%(4) (g)	C10%(4) (g)
		ID	Type	System Function	Manufacturer	Relay/ Contactor/ Breaker Model No.	ID	Type			Basis for Capacity	C/D Ratio(1)	Evaluation Result		
13	1	AC108/50GS AC109/50GS AC1CE12/50GS AD109/50GS AD113/50GS AD108/50GS AD1DF11/50GS	Protective Relay	AC/DC Power Support System, Ground Sensing Relay	Westinghouse	ITH	C1, D1	Switchgear	Aux 6	585	GERS	0.77	Capacity < Demand(2)	0.15	0.21
14	1	86-1/DG1 86-2/DG1 86-1/DG2 86-2/DG2	Protective Relay	EDG Lockout Relay	GE	HFA53K91H	C3615, C3616	Relay Panel	Aux 6	585	IEEE/ANSI C37-98 test	0.93	Capacity < Demand(2)	0.19	0.25
15	1	94-1/DG1 94-1/DG2	Protective Relay	EDG Lockout Relay	GE	HFA51A42H	C3615, C3616	Relay Panel	Aux 6	585	GERS	1.49	Capacity > Demand	0.30	0.41
16(3)	1	SV4632/4	Control Relay	RCS Inventory Control; Valve RC4632	Agastat	EGPD	RC4607	Relay Panel	Aux 7	603	EPRI HF Test	2.69	Capacity > Demand	0.54	0.73

Notes

[1] C/D Ratios are the minimum of horizontal or vertical C/D ratios

[2] While the Capacity-Demand Ratio is shown to be less than 1.0, this relay meets the intent of HF confirmation by showing its C10% capacity exceeds the PGA of 0.20 g consistent with NEI 12-06 guidance

[3] HF Relay Group requiring evaluation as part of the NEI 12-06 Appendix H Path 2 High Frequency Confirmation

[4] Reported values are representative of the 15 Hz to 40 Hz frequency range

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