



10 CFR 50.54(f)

RS-16-173  
TMI-16-083

October 28, 2016

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

Three Mile Island Nuclear Station, Unit 1  
Renewed Facility Operating License No. DPR-50  
NRC Docket No. 50-289

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 (Partial Submittal - High Frequency work scope)

References:

1. NEI 12-06, Revision 2, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, December 2015 (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, January 22, 2016 (ML15357A163)
3. Exelon Generation Company, LLC Letter to USNRC, 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 Review of Insights from the Fukushima Dai-ichi Accident – 1.5 Year Response for CEUS Sites, dated September 12, 2013 (ML13256A070)
4. Exelon Generation Company, LLC Letter to USNRC, Three Mile Island, Unit 1 - Seismic Hazard and Screening Report (Central and Eastern United States (CEUS) Sites), Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated March 31, 2014 (ML14090A271)
5. NRC Letter to Exelon Generation Company, LLC, Three Mile Island Nuclear 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 (TAC No. MF3905), dated August 14, 2015 (ML15223A215)

6. Exelon Generation Company, LLC Letter to USNRC, 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), dated June 29, 2016 (RS-16-087) (ML16183A025)

The purpose of this letter is to provide the results of the partial assessment (high frequency work scope) for Three Mile Island Nuclear Station, Unit 1 to demonstrate that the FLEX Mitigating Strategies, developed, implemented and maintained in accordance with NRC Order EA-12-049, can be implemented considering the impacts of the reevaluated seismic hazard for the high frequency evaluation scope for Path 4 (Reference 1). The assessment was performed in accordance with the guidance provided in Appendix H of NEI 12-06, Revision 2 (Reference 1) which was endorsed by the NRC (Reference 2). The Three Mile Island Nuclear Station, Unit 1 FLEX Mitigating Strategies are described in Reference 6.

The Mitigating Strategies Seismic Hazard Information (MSSHI) is the licensee's reevaluated seismic hazard information at Three Mile Island Nuclear Station, Unit 1, 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. Three Mile Island Nuclear Station, Unit 1 submitted the 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 GMRS that was submitted adequately characterizes the reevaluated seismic hazard for the site (Reference 5).

Three Mile Island Nuclear Station, Unit 1 qualifies as a Path 4 site having exceedances of the GMRS to the SSE both below and above 10 Hz and a GMRS  $<2 \times \text{SSE}$ . This submittal is limited to the high frequency portion of the Path 4 scope. The Path 4 scope is described in Section H.4.4 of Reference 1 and includes the requirement for a high frequency evaluation to be performed in accordance with Section H.4.2 (Path 2) of Reference 1. Therefore, an evaluation was performed for equipment required to implement the Mitigation Strategies that may be sensitive to high frequency ground motions.

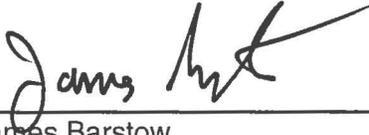
Based upon the Mitigating Strategies Assessment provided in the enclosure to this letter, the Mitigating Strategies for Three Mile Island Nuclear Station, Unit 1 can be implemented as designed when considering the impacts of the reevaluated seismic hazard for the high frequency scope for Path 4. The remaining scope of evaluations required for Path 4 for Three Mile Island Nuclear Station, Unit 1 will determine the adequacy of the complete design of the Mitigating Strategies to the reevaluated seismic hazard and will be submitted in accordance with the NRC agreed schedule for Path 4 plants.

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

If you have any questions regarding this submittal, please contact Ron Gaston at (630) 657-3359.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 28<sup>th</sup> day of October 2016.

Respectfully submitted,



---

James Barstow  
Director - Licensing & Regulatory Affairs  
Exelon Generation Company, LLC

Enclosure: Seismic Mitigating Strategies Assessment for Three Mile Island Nuclear Station,  
Unit 1

cc: NRC Regional Administrator - Region I  
NRC Project Manager, NRR – Three Mile Island Nuclear Station  
NRC Senior Resident Inspector – Three Mile Island Nuclear Station  
Mr. Brett A. Titus, NRR/JLD/JCBB, NRC  
Mr. Stephen M. Wyman, NRR/JLD/JHMB, NRC  
Mr. Frankie G. Vega, NRR/JLD/JHMB, NRC  
Mr. John D. Hughey, NRR/JLD/JOMB, NRC  
Director, Bureau of Radiation Protection - Pennsylvania Department of Environmental  
Resources  
Chairman, Board of County Commissioners of Dauphin County, PA  
Chairman, Board of Supervisors of Londonderry Township, PA  
R. R. Janati, Chief, Division of Nuclear Safety, Pennsylvania Department of Environmental  
Protection, Bureau of Radiation Protection

**Enclosure**

Seismic Mitigating Strategies Assessment for Three Mile Island Nuclear Station, Unit 1

(16 pages)

**SEISMIC MITIGATING STRATEGIES  
ASSESSMENT REPORT**  
IN RESPONSE TO REGULATORY GUIDE JLD-ISG-2012-01

for the

**THREE MILE ISLAND NUCLEAR STATION, UNIT 1  
Middletown, PA 17057  
Facility Operating License No. DPR-50  
NRC Docket No. 50-289  
Correspondence No.: RS-16-173, TMI-16-083**



Exelon Generation Company, LLC (Exelon)  
PO Box 805398  
Chicago, IL 60680-5398

Prepared by:  
Stevenson & Associates  
1661 Feehanville Drive, Suite 150  
Mount Prospect, IL 60056

Report Number: 15C4343-RPT-003, Rev. 0

	<u>Printed Name</u>	<u>Signature</u>	<u>Date</u>
Preparer:	F. Ganatra	<i>F. Ganatra</i>	9/29/2016
Reviewer:	M. Delaney	<i>M. Delaney</i>	9/30/2016
Approver:	M. Delaney	<i>M. Delaney</i>	9/30/2016
Lead Responsible Engineer:	<i>PAT MULLEN</i>	<i>Pat Mullen</i>	10-3-16
Branch Manager:	<i>P. Bennett</i>	<i>P. Bennett</i>	10/5/16
Senior Manager Design Engineering:	<i>JOHN J. PIAZZA</i>	<i>John J. Piazza</i>	10/6/2016
Corporate Acceptance:	<i>Jeffrey S. Clark</i>	<i>Jeffrey S. Clark</i>	10/6/2016

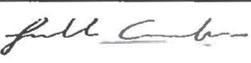
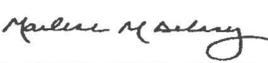
Document ID: 15C4343-RPT-003  
 Title: High Frequency Confirmation Report for Three Mile Island Nuclear Station, Unit 1  
 in Response to Regulatory Guide JLD-ISG-2012-01

Document Type:

Criteria  Interface  Report  Specification  Other  Drawing

Project Name: Three Mile Island, Unit 1 High Frequency Confirmation	
Job No.: 15C4343	
Client:	

This document has been prepared under the guidance of the S&A Quality Assurance Program Manual, Revision 18 and project requirements:

Initial Issue (Rev. 0) (for the Attachment Section of the Confirmation Report)		
Originated by: F. Ganatra		Date: 9/29/2016
Checked by: M. Delaney		Date: 9/30/2016
Approved by: M. Delaney		Date: 9/30/2016

Revision Record:				
Revision No.	Originated by/ Date	Checked by/ Date	Approved by/ Date	Description of Revision
		DOCUMENT APPROVAL SHEET Figure 2.8		PROJECT NO. 15C4343

**ATTACHMENT**

Exelon Generation Company, LLC (Exelon)

Three Mile Island Nuclear Station, Unit 1

NRC Docket No. 50-289

Facility Operating License No. DPR-50

Seismic Mitigating Strategies Assessment for TMI-1

## **1 INTRODUCTION**

### **1.1 BACKGROUND**

Three Mile Island Nuclear Station, Units 1 (TMI-1) has completed a partial Mitigating Strategies Assessment (MSA) of 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 can be implemented. The MSA was performed in accordance with the guidance provided in Appendix H of NEI 12-06 Revision 2 [1] which was endorsed by the NRC [2]. The TMI-1 FLEX Mitigating Strategies are described in Reference [3] and Reference [4].

TMI-1 submitted a reevaluated seismic hazard to the NRC [5]. By letter dated October 27, 2015 [6], the NRC transmitted the results of the screening and prioritization review of the seismic hazards reevaluation. Per the results of Reference [5] and Reference [6], TMI-1 qualifies as a Path 4 site having exceedance of the GMRS to the SSE both below and above 10Hz and a GRMS < 2\*SSE. Therefore, the site falls under the guidance of Reference [1], Appendix H, Section H.4.4 (i.e., Path 4). This requires that high frequency sensitive plant equipment associated with the TMI-1 mitigating strategies; namely, electrical contact devices, be evaluated for effects of the Mitigation Strategies Seismic Hazard Information (MSSHI) in accordance with the guidance of Reference [1], Appendix H, Section H.4.2.

This report describes the partial Mitigation Strategies Assessment undertaken for TMI-1, implemented using the methodologies in NEI12-06 [1], Appendix H, which in turn specifies the methodologies from EPRI 3002004396, "High Frequency Program, Application Guidance for Functional Confirmation and Fragility Evaluation." [7]

The objective of this report is to provide summary information describing the partial assessment for TMI-1 to demonstrate that the FLEX strategies developed, implemented and maintained in accordance with NRC Order EA-12-049 [8] can be implemented considering the impacts of the reevaluated seismic hazard for the high frequency evaluation scope for Path 4. As described in the Final Integrated Plan (FIP) [3,4], the plant equipment relied on for FLEX strategies have previously been evaluated as seismically robust to the SSE levels. The level of detail provided in the report is intended to enable NRC to understand the inputs used, the basis for the scope selection, the evaluations performed, and the conclusions made as a result of the partial MSA.

## 1.2 APPROACH

NEI 12-06 [1], Appendix H Section H.4.2 refers to EPRI 3002004396 [7] for the high-frequency contact device analysis approach. Reference [7] is the primary guidance document used for the TMI-1 evaluations described in this report. Acceptance criteria for the evaluations are found in Reference [1], Appendix H, Section H.5. In accordance with References [7] and [1], the following topics are addressed in the subsequent sections of this report:

- TMI-1 SSE and GMRS/MMSHI Information
- Selection of components and a list of specific components for high-frequency confirmation
- Estimation of seismic demand for subject components
- Estimation of seismic capacity for subject components
- Summary of subject components' high-frequency evaluations
- Summary of Results

## 1.3 PLANT SCREENING

The Mitigating Strategies Seismic Hazard Information (MSSHI) is the licensee's reevaluated seismic hazard information at TMI-1, developed using 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 TMI-1 control point elevation. TMI-1 submitted the reevaluated seismic hazard information including the UHRS, GMRS and the hazard curves to the NRC on March 31, 2014. [5]. The TMI-1 Seismic Hazard and Screening NRC Staff Assessment Report confirmed Three Mile Island, Unit 1 Seismic Hazard Reevaluation on August 14, 2015 [9]. The NRC summarized their screening evaluations in 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 [6].

## 1.4 REPORT DOCUMENTATION

Section 2 describes the selection of devices. The identified devices are evaluated in Reference [17] for the seismic demand specified in Section 3 using the evaluation criteria discussed in Section 4. The overall conclusion is discussed in Section 5.

Table A-1 lists the devices identified in Section 2 and provides the results of the evaluations performed in accordance with Section 3 and Section 4.

## **2 SELECTION OF COMPONENTS**

The fundamental objective of the MSA evaluation is to determine whether the FLEX/mitigating strategies developed, implemented and maintained in accordance with NRC Order EA-12-049 [8] can be implemented considering the impacts of the reevaluated seismic hazard. Within the applicable functions identified in Section H.4.2 (Path 4) [1], the components that require a high frequency evaluation are contact control devices subject to intermittent states in seal-in or lockout (SILO) circuits. Plants in Path 4 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 their functions perform as necessary for the FLEX/mitigating strategies. The equipment selection process for each of those categories is described below.

### **2.1 REACTOR TRIP/SCRAM**

Section H.4.2 of NEI 12-06 Appendix H [1] identifies the Reactor Trip/SCRAM function as a function to be considered in the high frequency evaluation. The EPRI guidance for High Frequency Confirmation [7] notes that "the design requirements preclude the application of seal-in or lockout 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 CONTROL**

The equipment in the Reactor Vessel Inventory Control function are the same between NEI 12-06 Appendix H [1] and EPRI 3002004396 [7]. The concern for both these 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. Control circuits for the Electromatic Relief Valves (ERV) as well as other Reactor Coolant System (RCS) valves listed in Attachment 9.2 of Reference [16] were analyzed. In this case, the "undesirable state" criterion for selection of devices was any device that could lead to a listed valve opening and remaining open after the period of strong shaking. Loss of AC power is a basic premise of NEI 12-06, thus control devices for AC-powered valves are not included in the NEI 12-06 Appendix H selection. No devices in this category met all criteria for selection.

### **2.3 FLEX PHASE 1**

Section H.4.2 of NEI 12-06 Appendix H [1] requires the analysis of relays and contactors that may lead to circuit seal-in or lockout 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 [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.

FLEX Strategies specific to a seismic event response or common to all external event responses were examined to identify flow paths, electrical distribution and instrumentation relied upon to accomplish the reactor and containment safety functions identified in NEI 12-

06 [1], omitting response strategies only valid in an outage<sup>1</sup>. The selected equipment is a subset of equipment relied upon to establish the credited flow paths, electrical distribution, and instrumentation identified in the FLEX responses examined. Permanent plant equipment required for implementation of Phase 1 of the FLEX Strategy was identified by reviewing the FLEX Strategy, FLEX support documents, and associated flow path Piping and Instrumentation Diagrams (P&IDs), instrument elementary diagrams, and electrical distribution one-line diagrams.

The following key functions were reviewed.

- Piping Flow Paths
- Equipment/Room Cooling
- Key Parameter Instrumentation
- Diesel Fuel Oil Supply
- Instrument Air Distribution
- Electrical Power Distribution
- Control Systems

### **Piping Flow Paths**

Once the FLEX Strategy and FLEX support documents (flow diagrams) were reviewed, P&IDs were examined to identify the primary Phase 1 flow paths credited for seismic response and pressure boundaries necessary to establish those flow paths. In accordance with NEI 12-06, not all success paths need to be evaluated for all hazards; therefore, only a single success path needs to be reviewed for cooling or make-up functions. All components within these identified flow paths and pressure boundaries were screened utilizing the evaluation guidance [7] to exclude components having the following criteria:

- Non-power operated valves (manual valves, check valves, rupture disks) excluding pressure relief valves and manual valves with reach-rods
- Power operated valves, pressure relief valves, and manual valves with reach rods not required to change state to establish identified flow paths
- Sub-components mounted within equipment already included on the list
- In-line pipe-supported components
- Pumps and small heat exchangers within piping pressure boundaries but not in the flow path
- Instrumentation not relied upon for the FLEX response
- Components expected to operate during the initial reactor transient (as described in NEI 12-06, Section 3.2.1.4 [1])
- Containment isolation valves not required to change state following the initial containment isolation action (as described in NEI 12-06, Section 3.2.1.11 [1])

The remaining components not screened out are included in the equipment list. Of these components, pumps needed to operate, power-operated valves needed to change state to establish the identified flow paths and pressure boundaries, as well as instruments that are

---

<sup>1</sup> Based on NEI 12-06 boundary conditions [1, p. 6], at-power operation is the presumed initial plant condition prior to the precipitating beyond-design-basis seismic event.

essential to Phase 1 FLEX Strategy within these paths were singled out for identification of necessary motive and control sources.

For the Phase 1 FLEX response, TMI-1 credits the Turbine Driven Emergency Feedwater Pump to provide feedwater to the Steam Generators to maintain core decay-heat cooling. For this effort, the flow paths credited include: (1) Steam from the Steam Generators to the Emergency Feedwater Pump Turbine; (2) Feedwater from the Condensate Storage Tank to the Steam Generators; and (3) Steam from the Steam Generators vented to atmosphere via the Steam Generator PORVs.

#### **Equipment/Room Cooling**

Cooling for rooms is normally provided by AC power, and thus components associated with fans, dampers, compressors or other systems relied upon to provide ventilation or cooling to these rooms were not considered as these would not be Phase 1 systems.

#### **Key Parameter Instrumentation**

Instruments identified to monitor parameters critical to control of elements of the Phase 1 FLEX Strategy are included in the equipment list. For each of the included instruments, flow diagrams were reviewed as applicable to confirm the transmitter is within an established FLEX flow path. Elementary diagrams were reviewed to establish the signal path between the instrument transmitter and the credited indicator. The transmitter, indicator and any signal conditioning components, as well as power supplies used to power all the components necessary to the signal path were identified. For each of these items either the component itself or the instrumentation cabinet containing it (per rule-of-the-box (ROB)) was included in the equipment list.

#### **Diesel Fuel Oil Supply**

Diesel Fuel Oil is not necessary for Three Mile Island's Phase 1 response [4] and is thus not considered for the Phase 1.

#### **Instrument Air Distribution**

Instrument air P&IDs were reviewed along with TMI FIP [4] to determine if any tanks, accumulators, pressure regulating valves, or any power operated valves are required to provide Instrument Air (IA) to air-operated valves necessary to establish FLEX Phase 1 flow paths. In general, normal instrument air (IA) is non-safety related. Any valves credited to establish Three Mile Island's FLEX Phase 1 flow paths which use normal instrument air as a motive source either fail to their required state or will be manually overridden, thus no instrument air components are necessary on the Phase 1 equipment list.

#### **Electrical Power Distribution**

The Phase 1 response relies on station batteries for electrical power (motive force). One-line drawings were reviewed and the batteries, inverters, and electrical distribution between the batteries and the required DC Panels and vital instrumentation power supplies were included on the equipment list.

#### **Control Systems**

For every FLEX Phase 1 item on the equipment list requiring control, the associated control diagrams were reviewed and the control cabinets or panels critical to the item's control were included on the equipment list. Power sources for the required control circuits were traced

and any power distribution component necessary for the control circuits (and not already identified) was added as well. Relay control logic was analyzed and relays or switches that could cause seal-in or lockout and leave the circuit in a state other than what would be desired for FLEX response were identified and added to the equipment list. The criteria for determining if a component needed to be evaluated are provided below. A component must meet all three of the following criteria to be selected.

(Criterion 1)

The Phase 1 FLEX Strategy for Three Mile Island, as described in the Overall Integrated Plan [3] and its updates [3.1, 3.2, 3.3, 3.4, 3.5, 3.6], relies on permanent plant equipment in the Turbine Driven Emergency Feedwater and Steam Generator PORV systems. Control elementary diagrams, piping and instrumentation diagrams, and system technical manuals were reviewed as necessary to determine which relays and switches have an impact on the operation of these systems. Any impact to AC powered valves in these systems was ignored as loss of AC power is a requirement for entry into FLEX.

(Criterion 2)

Before entry into FLEX a site must first (for this evaluation) experience a beyond design-basis seismic event coupled with an Extended Loss of AC Power (ELAP) and Loss of normal access to the Ultimate Heat Sink (LUHS). In this event scenario, the site would need time to assess plant conditions before it would declare itself in an ELAP/LUHS condition. By the time this condition is declared it is expected the period of strong shaking would be over and thus any temporary effect of relay chatter would be cleared before entry into FLEX. In some control circuits, however, contacts are fed back into the control to electrically seal-in and cause a sustained change of state in the control circuit. This circuit seal-in may cause valves to change position, pumps to change state, or controls to lock-out operation of systems or components. Control elementary diagrams, piping and instrumentation diagrams, and system technical manuals were reviewed as necessary to determine the potential of chatter (in the relays and switches identified by Criterion 1) to cause a seal-in or lock-out. Only those relays and switches with the potential to cause seal-in or lock-out were screened-in for evaluation, relays and switches with only the potential to cause temporary conditions that clear on their own before entry into FLEX were screened out.

(Criterion 3)

In some cases, spurious chatter leads to a circuit seal-in or lock-out that either has no effect on the FLEX Response, or has a beneficial effect on the FLEX Response (for example the unintentional change of state in a valve that aids in aligning a credited flow path). Contact chatter having no system effect or beneficial system effects allow a relay or switch to be functionally screened out of consideration for this category. Control elementary diagrams, piping and instrumentation diagrams, and system technical manuals were reviewed as necessary to determine the potential impact of chatter (in the relays and switches identified by Criterion 2) on the operation of the Phase 1 systems. Only those relays and switches which could cause an undesirable effect on these systems were screened-in.

The selection of contact devices for the Turbine Driven Emergency Feedwater Pump was performed in TMI-1 ESEL. For more information on the ESEL selection process and the complete ESEL refer to Ref. [18]. The devices selected based on this discussion are listed in Table A-1.

## **2.4 FLEX PHASE 2 AUTOMATIC OPERATION**

NEI 12-06 Appendix H [6] 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, the Phase 2 SSCs would be 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. Three Mile Island has installed two permanent flex generators, FX-Y-1A and FX-Y-1B, that have been seismically tested as part of their qualification [19]. The generators are manually started and no externally-mounted relays could cause a false start or prevent starting when needed.

## **2.5 SUMMARY OF SELECTED COMPONENTS**

The investigation of high-frequency contact devices as described above was performed in Ref. [16]. A list of the contact devices requiring a high frequency evaluation is provided in Appendix A, Table A-1. The identified devices are evaluated in Ref. [17] per the methodology/description of Section 3 and 4. Results are presented in Section 5 and Table A-1.

### **3 SEISMIC EVALUATION**

#### **3.1 HORIZONTAL SEISMIC DEMAND**

TMI-1 performed a High Frequency Confirmation using the criteria in Reference [7], which is the same criteria specified for the MSA Path 2 evaluation which is part of the Path 4 evaluation requirements [1]. The horizontal ground motion applicable to the MSA Path 2 evaluation is the same horizontal ground motion identified in TMI-1 submittal [10].

#### **3.2 VERTICAL SEISMIC DEMAND**

TMI-1 performed a High Frequency Confirmation using the criteria in Reference [7], which is the same criteria specified for the MSA Path 2 evaluation which is part of the Path 4 evaluation requirements [1]. The vertical ground motion applicable to the MSA Path 2 evaluation is the same vertical ground motion identified in TMI-1 submittal [10].

#### **3.3 COMPONENT HORIZONTAL SEISMIC DEMAND**

The components identified in Section 2 are the same components previously evaluated in the TMI-1 High Frequency Confirmation [10]. Therefore, the component horizontal seismic demands for the MSA are the same as the demands applied in the High Frequency Confirmation.

#### **3.4 COMPONENT VERTICAL SEISMIC DEMAND**

The components identified in Section 2 are the same components previously evaluated in the TMI-1 High Frequency Confirmation [10]. Therefore, the component vertical seismic demands for the MSA are the same as the demands applied in the High Frequency Confirmation.

## 4 CONTACT DEVICES EVALUATION

Per Reference [7], seismic capacities (the highest seismic level reached by the contact device without chatter or other malfunction) of each subject contact device are determined by the following procedures:

- (1) If a contact device was tested as part of the EPRI High Frequency Testing program [11], then the component seismic capacity from this program is used.
- (2) If a contact device was not tested as part of Reference 10, then one or more of the following means to determine the component capacity were used:
  - (a) Device-specific seismic test reports (either from the station or from the SQRSTS testing program).
  - (b) Generic Equipment Ruggedness Spectra (GERS) capacities per References [12, 13, 14, 15].
  - (c) Assembly (e.g. electrical cabinet) tests where the component functional performance was monitored.
  - (d) Procedural guidance (Station A-46 program reports) are used for contact devices where operator action can resolve any inadvertent actuation of the essential components.

The high-frequency capacity of each device was evaluated with the component mounting point demand from Section 3 using the criteria in Section 4.5 of Reference [7] and the acceptance criteria in Section H.5 of [1].

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

## **5 Conclusions**

### **5.1 GENERAL CONCLUSIONS**

The evaluation of potentially sensitive contact devices for seismic high frequency has been completed for TMI-1 in accordance with NEI 12-06 [1], Appendix H Section H.4.2 and EPRI 3002004396 [7]. The results of the evaluation confirm that the FLEX strategies for TMI-1 can be implemented as designed and no further seismic evaluations are necessary.

### **5.2 IDENTIFICATION OF FOLLOW-UP ACTIONS**

No follow-up actions were identified.

## 6 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
3. Three Mile Island (M. Jesse) Letter to NRC. "Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)." February 28, 2013, ADAMS Accession Number ML13059A299
  - 3.1. Three Mile Island (J. Barstow) Letter to NRC. "First Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)." August 28, 2013, ADAMS Accession Number ML13241A035
  - 3.2. Three Mile Island (D. Helker) Letter to NRC. "Second Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)." February 28, 2014, ADAMS Accession Number ML14063A221
  - 3.3. Three Mile Island (J. Barstow) Letter to NRC. "Third Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)." August 28, 2014, ADAMS Accession Number ML14241A251
  - 3.4. Three Mile Island (J. Barstow) Letter to NRC. "Fourth Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)." February 27, 2015, ADAMS Accession Number ML15058A264
  - 3.5. Three Mile Island (J. Barstow) Letter to NRC. "Fifth Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)." August 28, 2015, ADAMS Accession Number ML15243A088
  - 3.6. Three Mile Island (D. Helker) Letter to NRC. "Sixth Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)." February 26, 2016, ADAMS Accession Number ML16057A010
4. Three Mile Island (J. Barstow) Letter to NRC. "Report of Full Compliance with March 12, 2012 Commission Order Modifying Licensees with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)." June 29, 2016, ADAMS Accession Number ML16183A025

5. Seismic Hazard and Screening Report in Response to the 50.54(f) Information Request Regarding Fukushima Near-Term Task Force Recommendation 2.1: Seismic for TMI-1 dated March 26, 2014, ADAMS Accession Number ML14090A271
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
7. EPRI 3002004396. "High Frequency Program: Application Guidance for Functional Confirmation and Fragility Evaluation." July 2015
8. NRC (E. Leeds) Letter to All Power Reactor Licensees and Holders of Construction Permits in Active or Deferred Status. EA-12-049. "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events." March 12, 2012
9. NRC (F. Vega) Letter to Exelon Generation Company, LLC (B. Hanson). "Three Mile Island Nuclear 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 (TAC NO. MF3905)." August 14, 2015, ADAMS Accession Number ML15223A215
10. 15C4343-RPT-002, Rev. 0, "High Frequency Confirmation Report for Three Mile Island Nuclear Station, Unit 1 in Response to Near Term Task Force (NTTF) 2.1 Recommendation."
11. EPRI 3002002997. "High Frequency Program: High Frequency Testing Summary." September 2014.
12. EPRI NP-7147-SL. "Seismic Ruggedness of Relays." August 1991
13. EPRI NP-7147-SLV2, Addendum 1, "Seismic Ruggedness of Relays", September 1993
14. EPRI NP-7147-SLV2, Addendum 2, "Seismic Ruggedness of Relays", April 1995
15. EPRI NP-7147 SQUG Advisory 2004-02. "Relay GERS Corrections." September 10, 2004
16. Stevenson & Associates Report 15C4343-RPT-001, Rev. 1, "Selection of Relays and Switches for High Frequency Seismic Evaluation"
17. Stevenson & Associates Calculation 15C4343-CAL-001, Rev. 1, "High Frequency Functional Confirmation and Fragility Evaluation of Relays."
18. Three Mile Island Nuclear Station, Unit 1, "Expedited Seismic Evaluation Process (ESEP) Report" December 17, 2014, ADAMS Accession Number ML14353A194
19. Cummins Power Generation Certificate of Compliance VMA-49459-01C Rev. 0, "Seismic Design of Nonstructural Components and Systems."

## A Components Identified for High Frequency Evaluation

**Table A-1: Components Identified for High Frequency Evaluation**

No.	Unit	Component				Enclosure Type	Building	Component Evaluation Result
		ID	Type	System	Function			
1	1	MU-TS-1	Process Switch	FLEX Phase 1	Close MU-V-3 if temperature greater than 145° F	Control Cabinet	Auxiliary Building	Cap > Dem
2	1	MU-V-026\20X	Control Relay	FLEX Phase 1	Hold MU-V-26 solenoid in energized state to keep valve closed	Control Cabinet	Control Building	Cap > Dem
3	1	MS-V-004AB-AR23	Control Relay	FLEX Phase 1	Transfer control of MS-V-4A/B to BU Loaders	Control Cabinet	Control Building	Cap > Dem
4	1	MU-V-003\20X	Control Relay	FLEX Phase 1	Hold MU-V-3 solenoid in energized state to keep valve closed	Control Cabinet	Control Building	Cap > Dem
5	1	"Multiple"	Circuit Breaker	FLEX Phase 2	FLEX Generator SILO Devices	Flex Diesel Generator	Turbine Building	Cap > Dem
6	1	"Multiple"	Circuit Breaker	FLEX Phase 2	FLEX Generator SILO Devices	Flex Diesel Generator	Turbine Building	Cap > Dem