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10 CFR 50.54(f)

JAFP-17-0085
August 30, 2017

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

James A FitzPatrick Nuclear Power Plant
Renewed Facility Operating License No. DPR-059
NRC Docket No. 50-333

Subject: High Frequency Confirmation Report for March 12, 2012, Information Request Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1, Seismic

References:

1. NRC letter, Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, ML12053A340, dated March 12, 2012
2. NEI letter to NRC, Proposed Path Forward for NTTF Recommendation 2.1: Seismic Reevaluations, ML13101A345, dated April 9, 2013
3. Entergy letter, Entergy's 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, JAFP-13-0056, dated April 29, 2013
4. Entergy letter, Follow-up to 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, JAFP-14-0128, dated December 5, 2014
5. NRC letter, 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 Recommendations 2.1 "Seismic" of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, ML15194A015, dated October 27, 2015

Dear Sir or Madam:

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued a Request for Information per 10 CFR 50.54(f) [Reference 1] in regard to Recommendation 2.1: Seismic of the Near-Term Task Force review of insights from the Fukushima Dai-ichi Accident. Reference 2 is the Nuclear Energy Institute (NEI) Proposed Path Forward for Recommendation 2.1: Seismic, which James A. FitzPatrick Nuclear Power Plant (JAF) committed to in Reference 3.

On October 27, 2015 [Reference 5], the NRC provided a determination for acceptable methods that JAF may respond to the remaining 50.54(f) information requests. This letter is being submitted pursuant to option 2 of Table 1b in Reference 5, the completion of the 50.54(f) Enclosure Recommendation 2.1: Seismic requested information item (4) in Reference 1, and the portion of the Proposed Path Forward risk evaluations, to perform a High Frequency Confirmation evaluation in Reference 2.

The Enclosure to this letter contains the High Frequency Confirmation Report.

In addition, based on the decision to follow option 2 of Table 1b in Reference 5, JAF does not need to perform a Relay Chatter Review. The Attachment to this letter summarizes the cancellation of the regulatory commitment made in Reference 4 to perform a Relay Chatter Review.

Should you have any questions regarding this submittal, please contact Mr. William C. Drews, Regulatory Assurance Manager at (315) 349-6562.

I declare under penalty of perjury that the foregoing is true and correct. Executed on 30th day of August, 2017.

Sincerely,

for Pacher Acting

Joseph E. Pacher
Site Vice President
Exelon Generation Company, LLC

JEP/WCD/mh

Attachment: Regulatory Commitments
Enclosure: High Frequency Confirmation Report

cc: Director, Office of Nuclear Reactor Regulation
NRC Region I Administrator
NRC Resident Inspector
NRC Project Manager
NYSPSC
President NYSERDA

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Attachment

Regulatory Commitments

(1 Page)

Regulatory Commitments

This table identifies actions discussed in this letter that Exelon commits to perform. Any other actions discussed in this submittal are described for the NRC's information and are **not** commitments.

Number	**Text**	**SCHEDULED COMPLETION DATE**	
		Original	**Revised**
Source: JAFP-14-0128 dated December 5, 2014			
18482	Perform a Relay Chatter Review to support IPEEE focused scope margin assessment per SPID in accordance with NEI letter, "Relay Chatter Reviews for Seismic Hazard Screening", dated October 3, 2013	On the schedule specified in the April 9, 2013, NEI letter	Canceled

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Enclosure

High Frequency Confirmation Report

(53 Pages)

Executive Summary

The purpose of this report is to provide information as requested by the NRC in its March 12, 2012 50.54(f) letter issued to all power reactor licensees and holders of construction permits in active or deferred status [1]. In particular, this report provides requested information to address the High Frequency Confirmation requirements of Item (4), Enclosure 1, Recommendation 2.1: Seismic, of the March 12, 2012 letter [1].

Following the accident at the Fukushima Dai-ichi nuclear power plant resulting from the March 11, 2011, Great Tohoku Earthquake and subsequent tsunami, the Nuclear Regulatory Commission (NRC) established a Near Term Task Force (NTTF) to conduct a systematic review of NRC processes and regulations and to determine if the agency should make additional improvements to its regulatory system. The NTTF developed a set of recommendations intended to clarify and strengthen the regulatory framework for protection against natural phenomena. Subsequently, the NRC issued a 50.54(f) letter on March 12, 2012 [1], requesting information to assure that these recommendations are addressed by all U.S. nuclear power plants. The 50.54(f) letter requests that licensees and holders of construction permits under 10 CFR Part 50 reevaluate the seismic hazards at their sites against present-day NRC requirements and guidance. Included in the 50.54(f) letter was a request that licensees perform a "confirmation, if necessary, that SSCs, which may be affected by high-frequency ground motion, will maintain their functions important to safety."

EPRI 1025287, "Seismic Evaluation Guidance: Screening, Prioritization and Implementation Details (SPID) for the resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic" [2] provided screening, prioritization, and implementation details to the U.S. nuclear utility industry for responding to the NRC 50.54(f) letter. This report was developed with NRC participation and is endorsed by the NRC. The SPID included guidance for determining which plants should perform a High Frequency Confirmation and identified the types of components that should be evaluated in the evaluation.

Subsequent guidance for performing a High Frequency Confirmation was provided in EPRI 3002004396, "High Frequency Program, Application Guidance for Functional Confirmation and Fragility Evaluation," [3] and was endorsed by the NRC in a letter dated September 17, 2015 [4]. Final screening identifying plants needing to perform a High Frequency Confirmation was provided by NRC in a letter dated October 27, 2015 [5].

This report describes the High Frequency Confirmation evaluation undertaken for James A. FitzPatrick (JAF) using the methodologies in EPRI 3002004396 [3], "High Frequency Program, Application Guidance for Functional Confirmation and Fragility Evaluation," as endorsed by the NRC in a letter dated September 17, 2015 [4]. The objective of this report is to provide summary information describing the High Frequency Confirmation evaluations and results. The level of detail provided in the report is intended to enable NRC to understand the inputs used, the evaluations performed, and the decisions made as a result of the evaluations.

EPRI 3002004396 [3] is used for the JAF engineering evaluations described in this report. In accordance with Reference [3], the following topics are addressed in the subsequent sections of this report:

- Selection of components and a list of specific components for high-frequency confirmation
- JAF SSE and GMRS Information

- 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 Introduction

1.1 Purpose

The purpose of this report is to provide information as requested by the NRC in its March 12, 2012 50.54(f) letter issued to all power reactor licensees and holders of construction permits in active or deferred status [1]. In particular, this report provides requested information to address the High Frequency Confirmation requirements of Item (4), Enclosure 1, Recommendation 2.1: Seismic, of the March 12, 2012 letter [1].

1.2 Background

Following the accident at the Fukushima Dai-ichi nuclear power plant resulting from the March 11, 2011, Great Tohoku Earthquake and subsequent tsunami, the Nuclear Regulatory Commission (NRC) established a Near Term Task Force (NTTF) to conduct a systematic review of NRC processes and regulations and to determine if the agency should make additional improvements to its regulatory system. The NTTF developed a set of recommendations intended to clarify and strengthen the regulatory framework for protection against natural phenomena. Subsequently, the NRC issued a 50.54(f) letter on March 12, 2012 [1], requesting information to assure that these recommendations are addressed by all U.S. nuclear power plants. The 50.54(f) letter requests that licensees and holders of construction permits under 10 CFR Part 50 reevaluate the seismic hazards at their sites against present-day NRC requirements and guidance. Included in the 50.54(f) letter was a request that licensees perform a "confirmation, if necessary, that SSCs, which may be affected by high-frequency ground motion, will maintain their functions important to safety."

EPRI 1025287, "Seismic Evaluation Guidance: Screening, Prioritization and Implementation Details (SPID) for the resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic" [2] provided screening, prioritization, and implementation details to the U.S. nuclear utility industry for responding to the NRC 50.54(f) letter. This report was developed with NRC participation and is endorsed by the NRC. The SPID included guidance for determining which plants should perform a High Frequency Confirmation and identified the types of components that should be evaluated in the evaluation.

Subsequent guidance for performing a High Frequency Confirmation was provided in EPRI 3002004396, "High Frequency Program, Application Guidance for Functional Confirmation and Fragility Evaluation," [3] and was endorsed by the NRC in a letter dated September 17, 2015 [4]. Final screening identifying plants needing to perform a High Frequency Confirmation was provided by NRC in a letter dated October 27, 2015 [5].

On March 31, 2014, James A. FitzPatrick Nuclear Power Plant (JAF) submitted a reevaluated seismic hazard to the NRC as a part of the Seismic Hazard and Screening Report [6]. By letter dated October 27, 2015 [5], the NRC transmitted the results of the screening and prioritization review of the seismic hazards reevaluation.

This report describes the High Frequency Confirmation evaluation undertaken for JAF using the methodologies in EPRI 3002004396 [3], "High Frequency Program, Application Guidance for

Functional Confirmation and Fragility Evaluation," as endorsed by the NRC in a letter dated September 17, 2015 [4].

The objective of this report is to provide summary information describing the High Frequency Confirmation evaluations and results. The level of detail provided in the report is intended to enable NRC to understand the inputs used, the evaluations performed, and the decisions made as a result of the evaluations.

1.3 APPROACH

EPRI 3002004396 [3] is used for the JAF engineering evaluations described in this report. Section 4.1 of Reference [3] provided general steps to follow for the high frequency confirmation component evaluation. Accordingly, the following topics are addressed in the subsequent sections of this report:

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

1.4 PLANT SCREENING

JAF submitted reevaluated seismic hazard information including GMRS and seismic hazard information to the NRC on March 31, 2014 [6]. In a letter dated February 18, 2016, the NRC staff concluded that the submitted GMRS adequately characterizes the reevaluated seismic hazard for the JAF site [7].

The NRC final screening determination letter [5] concluded that the JAF GMRS to SSE comparison resulted in a need to perform a High Frequency Confirmation in accordance with the screening criteria in the SPID [2].

2 Selection of Components for High-Frequency Screening

The fundamental objective of the high frequency confirmation review is to determine whether the occurrence of a seismic event could cause credited equipment to fail to perform as necessary. An optimized evaluation process is applied that focuses on achieving a safe and stable plant state following a seismic event. As described in EPRI 3002004396 [3], this state is achieved by confirming that key plant safety functions critical to immediate plant safety are preserved (reactor trip, reactor vessel inventory and pressure control, and core cooling) and that the plant operators have the necessary power available to achieve and maintain this state immediately following the seismic event (AD/DC power support systems).

Within the applicable functions, the components that would need a high frequency confirmation are contact control devices subject to intermittent states in seal-in or lockout circuits. Accordingly, the objective of the review as stated in Section 4.2.1 of Reference [3] is to determine if seismic induced high frequency relay chatter would prevent the completion of the following key functions.

2.1 Reactor Trip/SCRAM

The reactor trip/SCRAM function is identified as a key function in Reference [3] to be considered in the High Frequency Confirmation. The same report also states 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."

2.2 Reactor Vessel Inventory Control

The reactor coolant system/reactor vessel inventory control systems were reviewed for contact control devices in seal-in and lockout (SILO) circuits that would create a Loss of Coolant Accident (LOCA). The focus of the review was contact control devices that could lead to a significant leak path. Check valves in series with active valves would prevent significant leaks due to misoperation of the active valve; therefore, SILO circuit reviews were not required for those active valves.

The process/criteria for assessing potential reactor coolant leak path valves is to review all P&IDs of systems interfacing with the reactor coolant pressure boundary. Success for the inventory control function was taken as the ability to isolate the connections to the reactor coolant pressure boundary with the pressure boundary isolation valve closest to the reactor vessel and a second isolation valve if applicable. To accomplish isolation, normally closed valves need to stay closed and normally open valves need to close or have the ability to close. This includes active isolation valves that are closed during normal operation or are required close upon an initiating event (Loss of Coolant Accident "LOCA" or Seismic). The control schemes of these valves (and their associated pilot valves, if applicable) were reviewed for SILO circuits that could open a normally closed valve or prevent closure of a normally open valve. If such a SILO circuit is found, the associated contact device is selected for high frequency confirmation.

As such, the closing circuit of a normally closed valve is not assessed since the valve is in the desired position. Likewise, the opening circuit of a normally open valve is not assessed since it is in its normal position unchanged by chatter.

Manual valves are not part of this assessment since contact chatter would not affect their positions.

Instrumentation lines are typically fitted with orifices and excess flow check valves that are designed to mitigate leakage, and which are immune to chatter. Therefore, instrumentation lines are not considered further.

Table B-2 contains a list of valves that were considered important for the inventory control function. Valves are marked if their control circuitry contains a SILO device. If the SILO device can produce an undesired valve position under chatter then the device is listed for high frequency confirmation (HFC). If the SILO device is not selected a justification is provided in Table 2-2 in Reference [17]. Based on Table B-2 and the analysis detailed below, there are two SILO devices selected for HFC based on the criteria established above.

<u>High Pressure Coolant Injection (HPCI)</u>

Injection Side

34FWS-28B Reactor Feedwater Inboard Isolation Check Valve

The HPCI injection line is connected to the "B" feedwater line. Therefore, this check valve provides isolation to the HPCI injection line. The check valve has no operator and is not affected by contact chatter.

Steam Side

23MOV-15 Turbine Steam Supply Inboard Containment Isolation Valve
23MOV-16 Turbine Steam Supply Outboard Containment Isolation Valve
23MOV-60 Turbine Steam Supply Outboard Containment Isolation Bypass Valve

HPCI is not required to be isolated upon a LOCA. The inboard isolation valve 23MOV-15 and the outboard 1-inch bypass valve 23MOV-60 are normally open to admit some steam to the steam supply piping in order to keep it warm in anticipation of an actuation of HPCI. The outboard isolation valve 23MOV-16 opens upon HPCI actuation. Both 23MOV-15 and 23MOV-16 have to be open during HPCI operation to supply steam to the HPCI turbine. However, HPCI is not being credited for core cooling in this analysis.

There are SILO devices in the control circuits of these valves that can result in valve closure. Since Reactor Core Isolation Cooling (RCIC), not HPCI, is credited for core cooling, the SILO devices causing valve closure do not meet a selection criterion. There is no SILO device that could prevent the closure of these valves if closure is needed.

<u>Reactor Core Isolation Cooling (RCIC)</u>

Injection Side

34FWS-28A Reactor Feedwater Inboard Isolation Check Valve

The RCIC injection line is connected to the "A" feedwater line. Therefore, this check valve provides isolation to the RCIC injection line. The check valve has no operator and is not affected by contact chatter.

Steam Side

13MOV-15 RCIC Steam Supply Inboard Containment Isolation Valve
13MOV-16 RCIC Steam Supply Outboard Containment Isolation Valve

RCIC is not required to be isolated upon a LOCA. These MOVs are normally open to admit steam to the steam supply piping in order to keep it warm in anticipation of an actuation of RCIC. Also, 13MOV-15 and 13MOV-16 have to be open during RCIC operation to supply steam to the RCIC turbine.

The closure circuit for 13MOV-15 contains SILO devices:

- Relay 13A-K33 can seal-in itself or cause seal-in of contactor 42/C
- Contactor 42/C can seal-in itself

The closure circuit for 13MOV-16 contains SILO devices:

- Relay 13A-K15 can seal-in itself or cause seal-in of contactor 42/2C
- Contactor 42/2C can seal-in itself

Chatter can result in valve closure. The impact on the core cooling function of inadvertent closure of these valves will be assessed in Section 2.4. From the perspective of inventory control, RCIC is not required to be isolated for a LOCA; however, there is no SILO device that could prevent the closure of these valves if closure is needed.

Core Spray (CS)

14SOV-13A/B Reactor Isolation Testable Check Valves
14AOV-13A/B Reactor Isolation Testable Check Valves

The check valves passively open to allow Core Spray pump discharge flow into the reactor vessel. There are two trains of Core Spray. These solenoid- and air-operated valves form an assembly that allows the check valve disc to be opened for testing to ensure it has free movement and will allow flow into the reactor vessel when core spray is actuated. Otherwise, these valves are passively held closed by reactor vessel pressure and disc weight. Actuation of the valves for testing is controlled only by rugged pushbutton switches. Therefore, these valves are not susceptible to chatter.

Residual Heat Removal (RHR)

Injection Side

10SOV-68A/B RHR Testable LPCI Check Valves
10AOV-68A/B RHR Testable LPCI Check Valves

The check valves passively open to allow RHR pump discharge flow into the reactor vessel. There are two trains of RHR. These solenoid- and air-operated valves form an assembly that allows the check valve disc to be opened to ensure it has free movement and will allow flow into the reactor vessel when RHR is used for shutdown cooling or for Low Pressure Coolant Injection (LPCI). Otherwise, these valves are passively held closed by reactor vessel pressure and disc weight. Actuation of the valves for testing is controlled only by rugged pushbutton switches. Therefore, these valves are not susceptible to chatter.

Suction Side

10MOV-18 RHR Shutdown Cooling Inboard Isolation Valve
10MOV-17 RHR Shutdown Cooling Outboard Isolation Valve

These valves are normally closed and need to remain closed for inventory control. They are opened to allow the RHR pumps to take a common suction on the reactor vessel through a recirculation loop during shutdown cooling. However, RHR is not credited for core cooling in this analysis. Power to the valve motor for 10MOV-18 is disconnected by rugged switches during normal operation preventing any spurious opening. Therefore, chatter cannot result in an open pathway and is acceptable.

Standby Liquid Control (SLC)

11SLC-17 Standby Liquid Control Inboard Isolation Check Valve

This check valve opens to allow SLC pump discharge flow into the reactor vessel. The check valve has no operator and is not affected by contact chatter.

Reactor Water Clean Up (RWCU)

Injection Side

34FWS-28A Reactor Feedwater Inboard Isolation Check Valve

The RWCU injection line is connected to the RCIC injection line which is connected to the "A" feedwater line. Therefore, this check valve provides isolation to the RWCU injection line. The check valve has no operator and is not affected by contact chatter.

Suction Side

12MOV-15 Suction Inboard Containment Isolation Valve
12MOV-18 Suction Outboard Containment Isolation Valve

These MOVs are normally open and need to be able to close for inventory control. They are normally open to allow the RWCU pumps to take suction on a recirculation loop to process the reactor water to maintain it at BWR quality.

The closure circuit for 12MOV-15 contains SILO devices:

- Relay 16A-K26 can cause seal-in of contactor 42/C
- Contactor 42/C can seal-in itself

The closure circuit for 12MOV-18 contains SILO devices:

- Relay 16A-K27 can cause seal-in of contactor 42/2C
- Contactor 42/2C can seal-in itself

Chatter can result in valve closure and does not inhibit closure. This behavior is desirable for inventory control and chatter is acceptable.

Safety Relief Valves (SRV)

Electric Lift of the SRVs

02SOV-71A1/B1/C1/D1/E1/F1/G1/H1/J1/K1/L1 SOVs for Automatic Opening of associated SRVs
02RV-71A/B/C/D/E/F/G/H/J/K/L Safety Relief Valves

All eleven of the normally closed SRVs are equipped with the electric lift feature. Electric lift assists the mechanical lift of the SRVs for pressure relief of the reactor vessel. The assistance is provided to mitigate any disc seat sticking that might be occurring in the SRV. It is an automatic system that employs the SOV to open the SRV at a pressure slightly lower than or at the actual SRV setpoint pressure.

The control circuitry for these SOVs features 2-out-of-2 logic that must be satisfied. The relays implementing this logic are not SILO devices and are not controlled by SILO devices. As a result, this logic enhances the chatter resistance of the control circuitry. Chatter of interposing relays 2E-K114 through 2E-K124 could momentarily energize their associated SOVs. However, the relays do not seal-in to keep the SOVs energized and the SRVs open. Therefore, chatter in the Electric Lift circuitry of the SRVs will not result in a LOCA.

Automatic Depressurization System (ADS)

02SOV-71A1/B1/C1/D1/E1/G1/H1 SOVs for Automatic Opening of associated SRVs
02RV-71A/B/C/D/E/G/H Safety Relief Valves

The ADS uses 7 of the 11 normally closed SRVs to perform its function of backing up HPCI to depressurize the reactor vessel in order to allow injection by Core Spray and RHR if HPCI injection is not sufficient. The ADS opens its associated SRVs by energizing the SOVs listed above. The SOV must remain energized to keep the SRV open. As such, ADS control circuitry is reviewed for SILO devices that could keep an SRV open causing a LOCA.

The control circuitry for these SOVs features 2-out-of-2 logic that must be satisfied. The relays implementing this logic are not SILO devices and are not controlled by SILO devices. As a result, this logic enhances the chatter resistance of the control circuitry. There is a time delay relay controlling some of the logic relays that can seal-in once the delay period has passed. However, time delay relays are not chatter sensitive in the coil circuit because of the time delay feature and, therefore, not considered SILO devices. Furthermore, ADS actuation has a permissive that requires an RHR or Core Spray pump to be running. The time delay relay will not seal-in unless this permissive is satisfied. Chatter of interposing relays 2E-K14A/B/C/D/E/G/H could momentarily energize their associated SOVs. However, the relays do not seal-in to keep the SOVs energized and the SRVs open. Therefore, chatter in the ADS circuitry of the SRVs will not result in a LOCA.

Manual Depressurization

02SOV-71A2/B2/C2/D2/E2/F2/G2/H2/J2/K2/L2 SOVs for Manual Opening of associated SRVs
02RV-71A/B/C/D/E/F/G/H/J/K/L Safety Relief Valves

All eleven of the normally closed SRVs have the option for manual opening that utilizes a second SOV installed in the SRV. The SOV is controlled by rugged pushbuttons which are not chatter sensitive.

Reactor Feedwater

34FWS-28A Reactor Feedwater Inboard Isolation Check Valve
34FWS-28B Reactor Feedwater Inboard Isolation Check Valve

These normally open check valves allow feedwater into the reactor vessel to make up for the generated steam. The "A" valve also allows RWCU effluent into the reactor during power operation and RCIC injection flow when needed. The "B" valve also allows HPCI injection flow when needed. The check valves have no operator and are not affected by contact chatter.

Main Steam

29SOV-80A1/B1/C1/D1 MSIV Test SOV
29SOV-80A2/B2/C2/D2 MSIV AC Closure SOV
29SOV-80A3/B3/C3/D3 MSIV DC Closure SOV
29AOV-80A/B/C/D Main Steamline Isolation Valves (MSIV)

The normally open MSIVs allow steam flow to be supplied to the main turbine. The MSIV is a quick acting valve controlled by an AC SOV and a DC SOV. The SOVs are normally energized, normally open to keep the MSIV open. Both SOVs must be de-energized to close the MSIV. The control circuitry utilizes normally energized relays in a "fail closed" scheme to close the MSIVs. Therefore, the trip relays are normally sealed-in to maintain power to their own coils during at-power operation. If the seal-in contact is broken, the trip coil will de-energize; it does not re-energize automatically which causes a de-energized "seal-in." Hence, the closure circuits contain SILO devices:

- Trip relays 16A-K7A/B/C/D can de-energize and "seal-in" the de-energized state

Therefore, chatter can result in valve closure. This behavior is desirable for inventory control and chatter is acceptable.

The Test SOVs are controlled by rugged pushbuttons which are not vulnerable to chatter

29MOV-74 Main Steamline Drain Valve (Inboard)
29MOV-77 Main Steamline Drain Valve (Outboard)

These MOVs are normally closed and need to remain closed for inventory control. These two valves are in series and are used to pass condensate from the main steam lines to be collected and re-used. The contactors in the opening circuit have a seal-in contact that can open the valve if it chatters.

Therefore, 29MOV-74 contains a SILO device:

- Contactor 42/O can seal-in itself

Also, 29MOV-77 contains a SILO device:

- Contactor 42/2O can seal-in itself

Chatter can result in valve opening and the contactors are selected for HFC based on the criteria promulgated in this section. Note that there is no leak path unless both MOVs open.

Nuclear Boiler

02SOV-17 Reactor Vent Valve
02AOV-17 Reactor Vent Valve (Inboard)
02SOV-18 Reactor Vent Valve
02AOV-18 Reactor Vent Valve (Outboard)

These AOVs are normally closed and need to remain closed for inventory control; these two AOVs are in series. Each AOV is controlled by a normally de-energized, normally closed SOV. The AOV is opened to allow venting of the reactor vessel head. Actuation is controlled only by a rugged hand switch. Therefore, these valves are not susceptible to chatter.

Reactor Water Recirculation (RWR)

Recirculation Pump Seal Purge

02-2RWR-13A/B Mini-Purge Check Valves

These check valves have no operator and are not affected by contact chatter.

Recirculation Pump Sampling

02-2SOV-39 Recirculation Pump Sampling Line Inboard Containment Isolation Valve
02-2AOV-39 Recirculation Pump Sampling Line Inboard Containment Isolation Valve
02-2SOV-40 Recirculation Pump Sampling Line Outboard Containment Isolation Valve
02-2AOV-40 Recirculation Pump Sampling Line Outboard Containment Isolation Valve

These normally open AOVs are used to isolate flow from the recirculation pump discharge to the Process Sampling System. Each AOV is controlled by an SOV that is normally energized to keep the AOV open. The control circuitry utilizes normally energized relays in a "fail closed" scheme to close the AOV. Chatter of relays in the Primary Containment Isolation (PCI) circuit can close the AOV. This behavior is desirable for inventory control and chatter is acceptable.

Control Rod Drive (CRD)

03SOV-120 Control Rod Withdrawal Valve
03SOV-122 Control Rod Withdrawal Valve
03SOV-121 Control Rod Insertion Valve
03SOV-123 Control Rod Insertion Valve
03SOV-117 Control Rod Scram Valve
03SOV-118 Control Rod Scram Valve
03AOV-126 Control Rod Scram Valve
03AOV-127 Control Rod Scram Valve
03HCU-138 CRDM Cooling Water Check Valve

The CRD system consists of Hydraulic Control Units (HCU) directing the flow from the Drive Water Pumps to the Control Rod Drive Mechanisms (CRDM). An HCU contains SOVs used for normal rod insertion and withdrawal and the scram function. The SOVs used for normal rod positioning are controlled from the control room and do not have seal-in circuits since such an arrangement could result in unintended rod movement. These SOVs are not considered further. The scram SOVs are used to insert the rods by opening the scram AOVs. The scram SOVs are controlled by the fail-safe Reactor Protection System and are not considered further. An HCU also directs cooling water into each CRDM which is deposited in the reactor vessel after cooling the CRDM. The check valve installed in this flow path prevents backflow from the CRDM and, by extension, the reactor vessel. In conclusion, the CRD system does not contain any devices for HFC.

2.3 Reactor Vessel Pressure Control

The reactor vessel pressure control function is identified as a key function in Reference [3] to be considered in the High Frequency Confirmation. The same report also states that "required post event pressure control is typically provided by passive devices" and that "no specific high frequency component chatter review is required for this function."

2.4 Core Cooling

James A. FitzPatrick credits their Reactor Core Isolation Cooling (RCIC) system to provide a single train of non-AC powered decay heat removal. RCIC consists of a high pressure pump powered with a steam turbine.

RCIC was reviewed for SILO devices that could prevent system operation and deprive the plant of its core cooling function. A general description of the RCIC system is provided in Section 4.7 of the UFSAR [8] and in reference [9].

Analysis of RCIC revealed several seal-in circuits that could place valves in undesired positions. However, the RCIC actuation signal will automatically align the system valves into their desired positions and RCIC will successfully actuate unless chatter has produced one of the following vulnerabilities:

- false RCIC auto-isolation signal
- false RCIC turbine trip
- premature RCIC turbine start

These are described in further detail below. All of the SILO devices selected for HFC are listed in Table B-1.

Steam Supply Isolation

RCIC is vulnerable to isolation of the steam supply line to the RCIC turbine Isolation of this line will result in the loss of the credited core cooling function. Therefore, any relays that could cause this isolation must be selected for HFC.

The vulnerability centers on the RCIC Steam Supply Containment Isolation Valves and their control relays:

- 13A-K15 (controls 13MOV-16 Outboard Containment Isolation Valve)
- 13A-K33 (controls 13MOV-15 Inboard Containment Isolation Valve)

The valves are in series and, as such, the closure of only one of them will isolate steam flow. These relays can be sealed in by upstream relays, can seal-in themselves, and will disable the opening circuit once sealed in. They also require a manual reset once sealed in. They will drive their respective isolation valves closed and the valves will not re-open upon a RCIC actuation signal until these relays are reset.

Upstream relays of 13A-K15 and -K33 are also selected for HFC since they could cause a seal-in of 13A-K15 or -K33. Most of the SILO devices listed for RCIC in Table B-1 are listed there for this reason.

RCIC Turbine Trip

Any energization of the turbine trip solenoid is assumed to trip the turbine which requires operator intervention to reset the trip valves.

The RCIC turbine trip solenoid is energized by the following signal chain:

- Logic relay 13A-K8 > logic relay 13A-K49 > trip solenoid 13TS-1

Relay 13A-K8 is the signal "funnel" receiving input from 13A-K6, -K7, -K15 or -K33. These relays provide signals to trip the turbine on auto-isolation, low RCIC pump suction pressure, or high turbine exhaust pressure. These relays, along with their upstream contact devices, are selected for HFC. The applicable pressure switches and logic relays are listed for HFC in Table B-1.

Premature Steam Admission to RCIC Turbine

13MOV-131 is a normally closed valve used to block steam from the turbine stop and throttle valves while allowing reactor steam to keep the steam supply line. Opening of this valve before a RCIC actuation signal could damage RCIC functionality because the rest of the system is not necessarily aligned for operation. Namely, the RCIC pump has no discharge path, potentially leading to pump damage, and there is no cooling flow to the turbine lube oil cooler or the barometric condenser. The SILO device that can lead to this situation is:

- Contactor 42/O in motor control center 71BMCC-3-OB1(MC)

This device is selected for HFC.

2.5 AC/DC Power Support Systems

The AC and DC power support systems were reviewed for contact control devices in seal-in and lockout circuits that prevent the availability of DC and AC power sources. The following AC and DC power support systems were reviewed:

- Emergency Diesel Generators,
- Battery Chargers,
- Emergency 120V AC (Inverters / Uninterruptable Power Supplies),
- EDG Ancillary Systems, and
- Switchgear, Load Centers, and MCCs.

Electrical power, especially DC, is necessary to support achieving and maintaining a stable plant condition following a seismic event. DC power relies on the availability of AC power to recharge the batteries. The availability of AC power is dependent upon the Emergency Diesel Generators and their ancillary support systems. EPRI 3002004396 [3] requires confirmation that the supply of emergency power is not challenged by a SILO device. The tripping of lockout devices or circuit breakers is expected to require some level of diagnosis to determine if the trip was spurious due to contact chatter or in response to an actual system fault. The actions taken to diagnose the fault condition could substantially delay the restoration of emergency power.

In order to ensure contact chatter cannot compromise the emergency power system, control circuits were analyzed for the Emergency Diesel Generators (EDG), Battery Chargers, Emergency 120V AC (Inverters/uninterruptible power), and Switchgear/Load Centers/MCCs as necessary to distribute power from the EDGs to the Battery Chargers and EDG Ancillary Systems. General information on the arrangement of safety-related AC and DC systems, as well as operation of the EDGs, was obtained from JA Fitzpatrick's UFSAR. Fitzpatrick has two divisions of Class 1E loads with two EDGs per division. The two EDGs supplying each 4KV emergency bus operate in parallel. The 4KV buses provide power to the redundant 600V AC emergency buses, which in turn are a power source for 125V DC and emergency 120V AC. A general description of the class 1E AC distribution scheme is described in UFSAR sections 8.5 and 8.6, and shown on 4KV one-line drawings and 600V AC one-line drawings. The Class 1E DC distribution scheme is described in UFSAR section 8.7 and shown on one-line drawings. The 120V AC is described in UFSAR section 8.9 and shown on one-line drawings.

The analysis necessary to identify contact devices in this category relies on conservative worst case initial conditions and presumptions regarding event progression. The analysis considers the reactor is operating at power with no equipment failures or LOCA prior to the seismic event. The Emergency Diesel Generators are not operating but are available. The seismic event is presumed to cause a Loss of Offsite Power (LOOP) and a normal reactor SCRAM. In response to bus undervoltage relaying detecting the LOOP, the Class 1E control systems must automatically shed loads, start the EDGs, and sequentially load the diesel generators as designed. Ancillary systems required for EDG operation as well as Class 1E battery chargers and emergency AC must function as necessary. The goal of this analysis is to identify any vulnerable contact devices that could chatter during the seismic event, seal-in or lock-out, and prevent these systems from performing their intended safety-related function of supplying electrical power during the LOOP.

The following sections contain a description of the analysis for each element of the AC/DC support systems. Contact devices are identified by description in this narrative and apply to all four EDGs. The selected contact devices for both divisions appear in Table B-1.

Emergency Diesel Generators

The analysis of the four EDGs (EDG A and C on 4KV bus 10500, and EDG B and D on 4KV bus 10600) is broken down into the generator protective relaying and diesel engine control. General descriptions of these systems and controls appear in the UFSAR Section 8.6. The contact devices are identified by description in this narrative and apply to all four EDGs. Full relay identification for the relays selected for HFC is in Table B-1.

Generator Protective Relaying

The control circuits for the EDG output breakers (e.g., 4KV breaker 10502 for EDG A) include several relays whose chatter could trip and/or lockout the EDG output breaker. These include the phased high speed differential relays (87-A, 87-B, 87-C), the phased time-overcurrent relays (27/51-A, 21/57-B, 21/57-C) and the generator fault relay (86X1). There are relays in the static exciter and voltage regulator circuit that can also trip the output breaker. These include the exciter-regulator voltage shutdown relay (K1VR), and the engine failure and generator field shorted relay (K10). Also in this circuit are the diesel generator exciter-regulator sensing relay (K3VR) and the diesel generator exciter-regulator reset relay (K4VR), which can interrupt automatic field flashing if they chatter.

Chatter in the anti-motoring circuit could actuate the EDG shutdown relay (SDR) and trip the output breaker. This includes the high circulating current power relay (32), the high circulating current seal in relay (32/SI), and the high circulating current shutdown relay (32X1). Also, chatter of the contacts on the high circulating current interlock time delay relay (62-1EDG_12) could enable the anti-motoring circuit prematurely, which could possibly result in trip of the circuit.

Diesel Engine Control

Chatter analysis for the diesel engine control was performed on the start and shutdown circuits of each EDG. The start circuit is blocked by seal-in of the shutdown relay (SDR), which signifies engine trouble. Chatter of the seal-in contact of this relay, its auxiliary relay arranged in parallel (SDRX), or of the contacts of relays within the coil circuits of SDR or SDRX may prevent EDG start.

The SDR/SDRX coils can be energized by chatter of the contacts of the diesel fail to start relay (TD5). This is a time-delay relay that shuts down the engine if it fails to start within 10 seconds. Other contact devices whose chatter can trip SDR/SDRX include the jacket water high temperature shutdown switch (TS-3A) and the engine start bypass interlock relay (TD6). TD6 is a time delay relay that is used as a permissive for the low lube oil pressure trip. Its contacts close after engine speed reaches 200 RPM; if it chatters before lube oil pressure is up, then the SDR will trip.

The SDR/SDRX coils can also be actuated by chatter of the generator field failure relay (40X1). The coil circuit of 40X1 has an open contact from a time-delay relay (TD10, loss of field relay), whose chatter can seal-in the circuit if the diesel engine reaches a speed of 400 RPM before the strong shaking stops. Circuits on the coil side of TD10 are immune from chatter because of the buffering effect of the time delay.

The EDG is started by the auto start relay (K1), which is a latching relay. Chatter of the operate coil contacts is acceptable because it will cause the relay to latch to the EDG start position. However, the EDG must start in ten seconds, and the seismic shaking is assumed to last 30 seconds. Therefore, this relay is included for HFC to ensure that strong shaking will not cause the reset coil to unlatch the circuit.

There is an electronic speed switch (ESS), which has three sets of contacts (SPSW40, SPSW200, and SPSW400) to signal increasing engine speeds of 40 RPM, 200 RPM, and 400 RPM, respectively. These correspond to engine speed sensing relays ESR40, ESR200 and ESR400, which each have a seal in and a different control function. ESR40 and ESR200 are used in the air start logic, and chatter prior to the engine reaching the indicated speed can prevent the air start system from operating. ESR200 also signals the start of forced-paralleling for the two EDGs on the same 4KV bus (see below). For successful paralleling the two diesel engines must reach 200 RPM within 3 seconds of each other. Therefore, premature actuation of an ESR200 relay due to chatter could defeat the operation. ESR400 is used to initiate generator field flashing (as well as start of emergency service water flow through the water jackets). Two paralleled EDGs must reach 400 RPM within 3 seconds of each other. Therefore, chatter of the seal-in contact prior to 400 RPM can cause the generator field to flash early or may defeat paralleling.

Once the EDGs are started, the two EDGs that operate on each 4KV emergency bus are paralleled via a tie breaker (breaker 10504 for EDG A and C, breaker 10604 for EDG B and D). This is controlled by the force paralleling and tie breaker control circuits. There are relays in these circuits that can trip the tie breaker, including: the force parallel loss of 125vdc control voltage relay (74C), tie breaker open control relay (K9), force parallel logic relays (TD9X, TD9M, TD8M), and fail to synch relays (FTS1A, FTS2A). In addition, chatter of the tie breaker closing control relay (K8) can cause the tie breaker to close prematurely. The EDG output breakers (e.g., breaker 10502 for EDG A) also have interlock relays on the close circuit whose chatter may cause the output breaker to close prematurely. These include the output breaker voltage check close interlock relay (62-1EDG_01), output breakers (e.g., A and C) close interlock relay (62-1EDG_02), and tie (e.g., A and C) auxiliary time delay relay (62X-1EDG_02).

There are other contact devices in the above-described circuits that are excluded from HFC because they are inherently rugged (e.g., mechanical switches [3]), do not seal in because the contact is upstream of a time-delay coil, or are blocked by a normally-open switch contact. A complete accounting of these devices is contained in Reference [17].

Battery Chargers

The 125V DC power system consists of two redundant and independent trains. Each train includes a lead-calcium battery and a static battery charger operating in parallel. The output power from each battery/charger train is supplied to its own battery control board. The battery control board supplies power to 125V DC distribution panels, motor control centers, UPS Static Inverter, and emergency lighting panels.

There is protective relaying associated with the battery charger (71BC-1A and 1B). Each charger includes ground detect relays, AC power failure relays, charger failure relays, and low DC voltage sensing relay. These relays provide contact outputs for external annunciators only; they have no SILO function.

Emergency 120V AC (Inverters / Uninterruptable Power Supplies)

The emergency 120V AC power system consists of two redundant and independent divisions, which supply all of the safety-related loads associated with safeguard control and instrument power. The power to the 120V AC panels is from single phase distribution transformers supplied from the 600V AC emergency buses and backed by the EDGs. The only contact devices of interest in this distribution are the protective relays associated with the 4KV supply breakers that distribute power via stepdown transformers from the 4KV safeguards buses to their associated 600V load centers; these are covered in the section below on Switchgear, Load Centers and MCCs.

There are dedicated inverters (71INV-1A and 1B) that provide power for LPCI valves. One of these inverters also supplies a backup power source for one of the RCIC pump enclosure exhaust fans in case of EDG failure. Since LPCI is not a flow path that is credited for this analysis, and station blackout is not assumed, chatter in these circuits is not of interest.

There is an uninterruptible power system (UPS) that supplies power to vital non-safety related loads such as the control rod drives and process radiation monitoring. This non-safety related UPS system consists of two redundant motor-generator sets and a static inverter (71UPP). These are not required for the functions that are in the scope of this analysis, so chatter analysis is not necessary.

The RCIC system (credited for core cooling in Section 2.4) has a small inverter (13INV-152) that provides power to the instrumentation, specifically the RCIC pump discharge flow indication and control. Flow indication is used by the control room operator to evaluate pump performance and is also used by the RCIC turbine control system to automatically adjust turbine speed to match the flow demand. Investigation shows this to be a solid state inverter with no contact devices that require circuit analysis.

RCIC also has steam leak detection logic that is powered by inverters (B21B-K801A and K801B). However, circuit analysis of these inverters is unnecessary because loss of power is fail safe with respect to RCIC function (i.e., isolation logic is energize to trip).

EDG Ancillary Systems

In order to start and operate the Emergency Diesel Generators, a number of components and systems are required. For the purpose of identifying electrical contact devices, only systems and components which are electrically controlled are analyzed.

Starting Air

Based on Diesel Generator availability as an initial condition, the passive air reservoirs are presumed pressurized and the only active components in this system required to operate are the air start solenoids. The control circuit for the air start solenoids includes SILO devices consisting of the EDG auto start relay (K1), the EDG electronic speed switch (ESS), and the engine speed sensing relays (ESR-40, ESR-200), which are covered under the EDG engine control analysis discussed above.

Combustion Air Intake and Exhaust

The combustion air subsystem for the Diesel Generators is passive, which does not rely on electrical control.

Lube Oil

The Diesel Generators utilize engine-driven mechanical lubrication oil pumps, which do not rely on electrical control. (There are also pre-lube pumps that keep the EDGs lubricated during standby, which are not needed after the postulated event begins.)

Fuel Oil

The Diesel Generator Fuel Oil System is described in section 8.6 of the UFSAR and shown on flow diagrams. Each diesel generator unit is provided with an independent fuel oil system consisting of a main fuel storage tank, a day tank and pumps. Two full-capacity motor-driven transfer pumps are provided for filling the day tank from the storage tank. An engine-driven prime pump and a DC motor-driven prime pump are provided to pump fuel from the day tank to the fuel injectors and are arranged so as to provide two redundant engine fuel pumping systems. Chatter analysis of the control circuits for the electrically powered transfer and prime pumps concluded they do not include SILO devices.

Cooling Water

The EDG Jacket Cooling Water System is a closed-loop system, one for each EDG, consisting of a temperature control valve, engine-driven cooling water pump, jacket water heat exchanger, and coolant expansion tank. The only SILO device in this cooling loop is the jacket water high temperature shutdown switch (TS-3A), which is covered above in the section on diesel engine control.

The jacket water heat exchangers are cooled by the emergency service water (ESW) system. A general description of the ESW system is in section 9.7.1 of the UFSAR. As described above in the section on diesel engine control, the ESW pumps are started on a signal from the 400 RPM engine speed sensing relays (ESR400). Examination of the control circuits for the ESW pumps and associated valves indicates that there are no SILO devices that can prevent the system from operating.

Ventilation

The EDG Building ventilation during accidents is provided by one supply fan per diesel engine. These fans are started via the EDG Start Signal. Chatter analysis of the EDG start signal is included in the section above. Other than SILO devices identified for the EDG start signal, chatter analysis of the control circuits for these fans and their associated dampers concluded they do not include SILO devices that can impede system operation.

The ESW pump rooms have supply and exhaust fans that are required for ventilation. Other than the SILO devices identified for the EDG and ESW start signals describe above, chatter analysis of the control circuits for these fans and their associated dampers concluded they do not include SILO devices that can impede system operation.

The battery and battery charger rooms also have a ventilation system that consists of exhaust fans, recirculation/exhaust fans, and air handling units. Chatter analysis for control circuits for this equipment concluded that there are no SILO devices that can impede system operation.

The RCIC pump enclosure also has two exhaust fans 13FN-1A and 2A. Chatter analysis of the control circuits for these fans and their associated dampers concluded they do not include SILO devices that can impede system operation.

Switchgear, Load Centers, and MCCs

Power distribution from the EDGs to the necessary electrical loads (Battery Chargers, Emergency AC, Fuel Oil Pumps, and EDG Ventilation Fans) was traced to identify any SILO devices that could lead to a circuit breaker trip and interruption in power. This effort excluded the EDG circuit breakers, which are covered in the sections above, as well as component-specific contactors and their control devices, which are covered in the analysis of each component above.

The loads described in this section are supplied via motor control centers (MCC) in the 600V AC load centers. This includes the ESW pumps, fuel oil transfer pumps, battery chargers, and the ventilation fans for the diesel engines, ESW pump rooms, and battery rooms. The motive power for AC-powered components credited in the previous sections on RCS inventory control and core cooling is also supplied by 600V MCCs. This includes normally-open MOVs in the RCS pressure boundary that are credited with closing, and MOVs in RCIC that are credited to open.

The 600V MCCs are also the source of power for DC-powered components. The 125VDC loads are powered from the 600V AC MCCs via the battery chargers (see discussion in section on battery chargers). This includes the DC-powered MOVs in RCIC, the DC fuel prime pump, and the various component control circuits. Individual 125V DC circuits are protected by molded case circuit breakers, which are not vulnerable to chatter [3], or by fuses.

The 120V AC emergency loads are also powered from the 600V MCCs via transformers, as discussed in the section above on emergency 120V AC. Individual 120V AC circuits are protected by molded case circuit breakers, which are not vulnerable to chatter, or by fuses.

Each 600V MCC bus is protected from phase and ground faults by long time adjustable and short time adjustable solid state trip devices, which are installed on each 600V load center breaker supplying the MCC. Solid state trip devices are not vulnerable to chatter [3]. There are no contact devices in the protective circuitry for the power distribution that are vulnerable to chatter, except as noted below.

The only circuit breakers affected by protective relaying (not already covered) are those that distribute power via stepdown transformers from the 4KV safeguards buses to their associated 600V load centers. A chatter analysis of the control circuits for these circuit breakers (breakers 10560, 10660) indicates that chatter in the 50/51 Phase Overcurrent Relays or the 50GS Ground Overcurrent Relay in the trip circuits of these breakers could cause breaker tripping following the seismic event.

2.6 SUMMARY OF SELECTED COMPONENTS

The investigation of high-frequency contact devices as described above was performed in accordance with the EPRI guidance [3]. Reference [17] provides a more detailed accounting of the relay chatter analysis. A list of the contact devices requiring a high frequency confirmation is provided in Table B-1.

3 Seismic Evaluation

3.1 Horizontal Seismic Demand

Per Reference [3], Sect. 4.3, the basis for calculating high-frequency seismic demand on the subject components in the horizontal direction is the JAF horizontal ground motion response spectrum (GMRS), which was generated as part of the JAF Seismic Hazard and Screening Report [6] submitted to the NRC on March 31, 2014 and accepted by the NRC on February 18, 2016 [7].

It is noted in Reference [3] that a Foundation Input Response Spectrum (FIRS) may be necessary to evaluate buildings whose foundations are supported at elevations different than the Control Point elevation. Section 3.2 of Reference [6] notes that the control point elevation is defined at a depth of 12 ft, which is the top of the Oswego sandstone where all plant structures are founded. Combining this condition with the justification provided in section 3.3 of Reference [3] on when a FIRS would normally be defined, the GMRS is judged appropriate for use as the site review level ground motion for high frequency evaluations.

The horizontal GMRS values are provided in Table 3-2.

3.2 Vertical Seismic Demand

As described in Section 3.2 of Reference [3], the horizontal GMRS and site soil conditions are used to calculate the vertical GMRS (VGMRS), which is the basis for calculating high-frequency seismic demand on the subject components in the vertical direction.

The site's soil mean shear wave velocity vs. depth profile is provided in Reference [6], Table 2.3.2-1 (Profile 1) and partially reproduced below in Table 3-1 below.

Table 3-1: Soil Mean Shear Wave Velocity Vs. Depth Profile

Layer	Depth (ft)	Depth (m)	Thickness, d_i (ft)	Vs_i (ft/sec)	d_i / Vs_i	$\Sigma [d_i / Vs_i]$	Vs30 (ft/s)
1	6.00	1.83	6.0	7,500	0.0008	0.0008	7,500
2	12.00	3.66	6.0	7,500	0.0008	0.0016	
3	20.00	6.10	8.0	7,500	0.0011	0.0027	
4	30.90	9.42	10.9	7,500	0.0015	0.0042	
5	49.80	15.18	18.9	7,500	0.0025	0.0067	
6	68.70	20.94	18.9	7,500	0.0025	0.0092	
7	87.60	26.70	18.9	7,500	0.0025	0.0117	
8	98.43	30.00	10.8	7,500	0.0014	0.0131	
	106.50	32.46	8.1				

Using the shear wave velocity vs. depth profile, the velocity of a shear wave traveling from a depth of 30m (98.4ft) to the surface of the site (Vs30) is calculated per the methodology of Reference [3], Section 3.5.

- The time for a shear wave to travel through each soil layer is calculated by dividing the layer depth (d_i) by the shear wave velocity of the layer (Vs_i).
- The total time for a wave to travel from a depth of 30m to the surface is calculated by adding the travel time through each layer from depths of 0m to 30m ($\Sigma[d_i/Vs_i]$).
- The velocity of a shear wave traveling from a depth of 30m to the surface is therefore the total distance (30m) divided by the total time;
  i.e., $Vs30 = (30m)/\Sigma[d_i/Vs_i]$.

The site's soil class is determined by using the site's shear wave velocity (Vs30) and the peak ground acceleration (PGA) of the GMRS and comparing them to the values within Reference [3], Table 3-1. Based on the PGA of 0.12g and the shear wave velocity of 7,500ft/s, the site soil class is Class A-Hard.

Once a site soil class is determined, the mean vertical vs. horizontal GMRS ratios (V/H) at each frequency are determined by using the site soil class and its associated V/H values in Reference [3], Table 3-2.

The vertical GMRS is then calculated by multiplying the mean V/H ratio at each frequency by the horizontal GMRS acceleration at the corresponding frequency. It is noted that Reference [3], Table 3-2 values are constant between 0.1Hz and 20Hz for Class A-Hard sites.

The V/H ratios and VGMRS values are provided in Table 3-2 of this report.

Figure 3-1 below provides a plot of the horizontal GMRS, V/H ratios, and vertical GMRS for JAF.

Table 3-2: Horizontal and Vertical Ground Motions Response Spectra

Frequency (Hz)	HGMRS (g)	V/H Ratio	VGMRS (g)
0.10	0.008	0.67	0.005
0.13	0.009	0.67	0.006
0.15	0.011	0.67	0.008
0.20	0.015	0.67	0.010
0.25	0.019	0.67	0.013
0.30	0.023	0.67	0.015
0.35	0.026	0.67	0.018
0.40	0.030	0.67	0.020
0.50	0.038	0.67	0.025
0.60	0.045	0.67	0.030
0.70	0.051	0.67	0.034
0.80	0.057	0.67	0.038
0.90	0.061	0.67	0.041
1.00	0.064	0.67	0.043
1.25	0.071	0.67	0.048
1.50	0.075	0.67	0.050
2.00	0.085	0.67	0.057
2.50	0.094	0.67	0.063
3.00	0.114	0.67	0.076
3.50	0.127	0.67	0.085
4.00	0.144	0.67	0.096
5.00	0.170	0.67	0.114
6.00	0.188	0.67	0.126
7.00	0.204	0.67	0.137
8.00	0.215	0.67	0.144
9.00	0.226	0.67	0.151
10.00	0.233	0.67	0.156
12.50	0.239	0.67	0.160
15.00	0.241	0.67	0.161
20.00	0.231	0.67	0.155
25.00	0.216	0.69	0.149
30.00	0.209	0.74	0.155
35.00	0.199	0.79	0.157
40.00	0.187	0.84	0.157
50.00	0.155	0.88	0.136
60.00	0.133	0.90	0.120
70.00	0.125	0.89	0.111
80.00	0.122	0.85	0.104
90.00	0.120	0.81	0.097
100.00	0.120	0.78	0.094

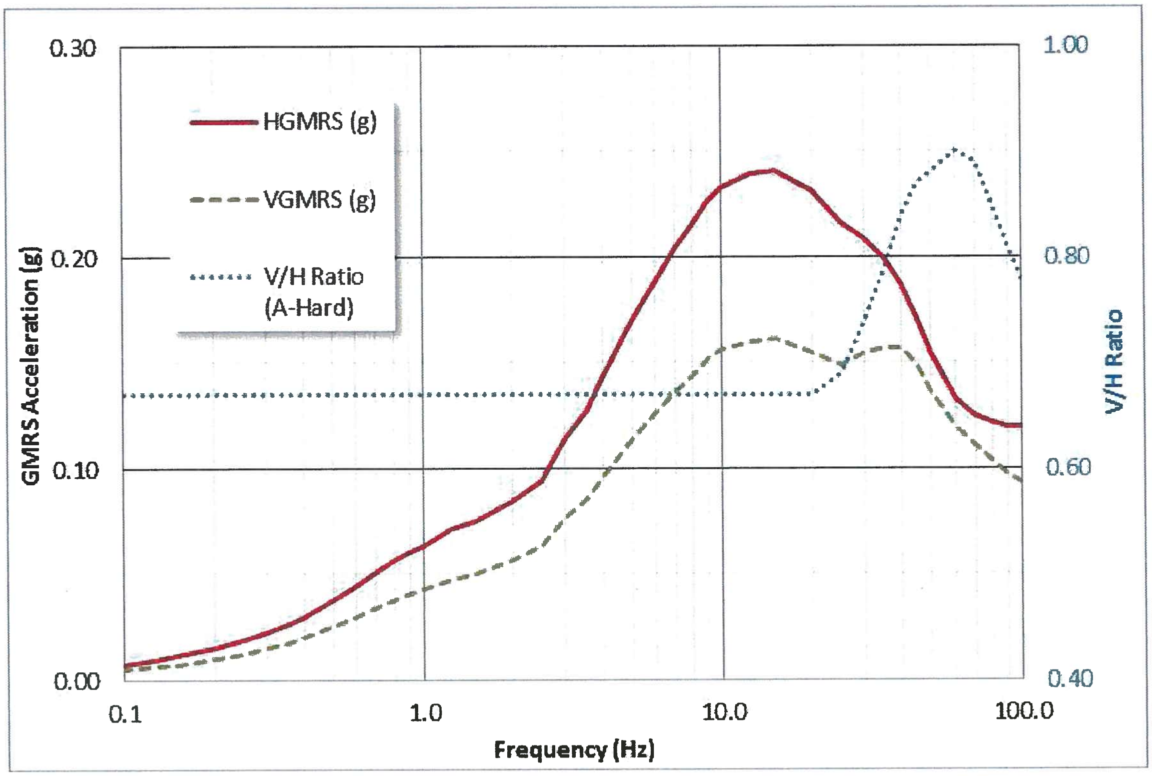

Figure 3-1 Plot of the Horizontal and Vertical Ground Motions Response Spectra and V/H Ratios

3.3 Component Horizontal Seismic Demand

Per Reference [3] the peak horizontal acceleration is amplified using the following two factors to determine the horizontal in-cabinet response spectrum:

- Horizontal in-structure amplification factor AF_{SH} to account for seismic amplification at floor elevations above the host building's foundation
- Horizontal in-cabinet amplification factor AF_{cH} to account for seismic amplification within the host equipment (cabinet, switchgear, motor control center, etc.)

The in-structure amplification factor AF_{SH} is derived from Figure 4-3 in Reference [3]. The in-cabinet amplification factor, AF_{cH} is associated with a given type of cabinet construction. The three general cabinet types are identified in Reference [3] and Appendix I of EPRI NP-7248 [14] assuming 5% in-cabinet response spectrum damping. EPRI NP-7148 [14] classified the cabinet types as high amplification structures such as switchgear panels and other similar large flexible panels, medium amplification structures such as control panels and control room benchboard panels and low amplification structures such as motor control centers.

All of the electrical cabinets containing the components subject to high frequency confirmation (see Table B-1 in Appendix B) can be categorized into one of the in-cabinet amplification categories in Reference [3] as follows:

- Motor Control Centers are identified during walkdowns and typically consist of a lineup of several interconnected sections. Each section is a relatively narrow cabinet structure with height-to-depth ratios of about 4.5 that allow the cabinet framing to be efficiently used in flexure for the dynamic response loading, primarily in the front-to-back direction. This results in higher frame stresses and hence more damping which lowers the cabinet response. In addition, the subject components are not located on large unstiffened panels that could exhibit high local amplifications. These cabinets qualify as low amplification cabinets and receive an in-cabinet amplification factor of 3.6.
- Switchgear cabinets are large cabinets consisting of a lineup of several interconnected sections typical of the high amplification cabinet category. Each section is a wide box-type structure with height-to-depth ratios of about 1.5 and may include wide stiffened panels. This results in lower stresses and hence less damping which increases the enclosure response. Components can be mounted on the wide panels, which results in the higher in-cabinet amplification factors and receive an in-cabinet amplification factor of 7.2. The switchgear amplification factor is used when uncertainty exists in the applicability of lower amplification cabinet categories.
- Control cabinets are in a lineup of several interconnected sections with moderate width. Each section consists of structures with height-to-depth ratios of about 3 which results in moderate frame stresses and damping. The response levels are mid-range between MCCs and switchgear and therefore these cabinets can be considered in the medium amplification category and receive an in-cabinet amplification factor of 4.5.

3.4 Component Vertical Seismic Demand

The component vertical demand is determined using the peak acceleration of the VGMRS between 15 Hz and 40 Hz and amplifying it using the following two factors:

- Vertical in-structure amplification factor AF_{SV} to account for seismic amplification at floor elevations above the host building's foundation
- Vertical in-cabinet amplification factor AF_{cV} to account for seismic amplification within the host equipment (cabinet, switchgear, motor control center, etc.)

The in-structure amplification factor AF_{SV} is derived from Figure 4-4 in Reference [3]. The in-cabinet amplification factor, AF_{cV} is derived in Reference [3] and is 4.7 for all cabinet types.

4 Contact Device Evaluations

Per Reference [3], seismic capacities (the highest seismic test level reached by the contact device without chatter or other malfunction) for 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 [10], then the component seismic capacity from this program is used.

(2) If a contact device was not tested as part of [10], then one or more of the following means to determine the component capacity were used:

  (a) Device-specific seismic test reports (either from JAF or from the SQURTS testing program).

  (b) Generic Equipment Ruggedness Spectra (GERS) capacities per [11], [12], [13], and [15].

  (c) Assembly (e.g. electrical cabinet) tests where the component functional performance was monitored.

The high-frequency capacity of each device was evaluated in Reference [18] with the component mounting point demand from Section 3 using the criteria in Section 4.5 of Reference [3].

A summary of the high-frequency evaluation conclusions is provided in Table B-1 in Appendix B.

5 Conclusions

5.1 General Conclusions

JAF has performed a High Frequency Confirmation evaluation in response to the NRC's 50.54(f) letter [1] using the methods in EPRI report 3002004396 [3].

The evaluation, References [17, 18], identified a total of 174 components that required seismic high frequency evaluation. As summarized in Table B-1 in Appendix B, 162 of the devices have adequate seismic capacity. The 12 devices that have seismic capacity less than seismic demand can be resolved by JAF operator actions.

5.2 Identification of Follow-up Actions

Twelve EDG high speed differential relays are installed with GE model CFD12B and have been determined to have capacity to demand ratio of 0.19 under HFE approach.

These relays have been determined to be in the 86 lockout relay circuits [16]. If a seismic event were to occur with a magnitude high enough to cause these relay contacts to chatter, the lockout relays would trip. If the EDG lockout relays were to trip the diesel generator will trip if running and would not start if the diesel generator was in standby. An operator action to reset the 86 lockout relays would be required prior to being able to re-start the diesel generator.

Procedural guidance for the above actions can be found in the following JAF procedures.

Procedure	Revision	Title
OP-22	61	Diesel Generator Emergency Power
ARP-93ECP-A-16	1	EDG A Prot Relay
ARP-93ECP-B-16	1	EDG B Prot Relay
ARP-93ECP-C-16	1	EDG C Prot Relay
ARP-93ECP-D-16	1	EDG D Prot Relay
ARP-93EGP-A-5	1	EDG A Prot Relay
ARP-93EGP-B-5	1	EDG B Prot Relay
ARP-93EGP-C-5	1	EDG C Prot Relay
ARP-93EGP-D-5	1	EDG D Prot Relay

No additional follow up actions are required.

6 References

1 NRC (E. Leeds and M. Johnson) Letter to All Power Reactor Licensees et al., "Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3 and 9.3 of the Near-Term Task Force Review of Insights from the Fukushima Dai-Ichi Accident," March 12, 2012, ADAMS Accession Number ML12053A340

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

3 EPRI 3002004396. "High Frequency Program: Application Guidance for Functional Confirmation and Fragility Evaluation." July 2015

4 NRC (J. Davis) Letter to Nuclear Energy Institute (A. Mauer). "Endorsement of Electric Power Research Institute Final Draft Report 3002004396, 'High Frequency Program: Application Guidance for Functional Confirmation and Fragility.'" September 17, 2015, ADAMS Accession Number ML15218A569

5 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, ADAMS Accession Number ML15194A015

6 Entergy Letter to U.S. NRC, letter number JAFP-14-0039, "Entergy's 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 Review of Insights from the Fukushima Dai-ichi Accident," March 31, 2014, NRC ADAMS Accession No. ML14090A243.

7 NRC letter to James A. FitzPatrick Nuclear Power Plant, "James A FitzPatrick Nuclear Power Plant – Staff Assessment of Information Provided Pursuant to Title 10 of the Code of Federal Regulations Part 50, Section 50.54(f), Seismic Hazard Reevaluations for Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident", February 18, 2016, ADAMS Accession Number ML16043A411

8 JAF Report, "Updated Final Safety Analysis Report (UFSAR)," Revision 6, April 2017

9 JAF Design Basis Document DBD-013, Revision 11, "Reactor Core Isolation Cooling System."

10 EPRI 3002002997. "High Frequency Program: High Frequency Testing Summary." September 2014

11 EPRI NP-5223-SLR1. "Generic Seismic Ruggedness of Power Plant Equipment." Revision 1, Final Report, August 1991

12 EPRI NP-7147-SL. “Seismic Ruggedness of Relays.” August 1991

13 EPRI NP-7147-SL-V2, Addendum 2. “Seismic Ruggedness of Relays.” Final Report, April 1995

14 EPRI NP-7148. “Procedure for Evaluating Nuclear Power Plant Relay Seismic Functionality.” December, 1990

15 EPRI TR-105988-V2, “GERS Formulated Using Data From the SQURTS Program.” Final Report, April 1999

16 Exelon Document JAF-RPT-17-00022, “JAF High Frequency Confirmation Evaluation (HFE) Relay Outlier Resolution”, April 21, 2017

17 AREVA Document 51-9267762-002, “James A. FitzPatrick High Frequency Chatter Assessment Supporting Documentation”

18 AREVA Document 32-9272552-000, “James A. FitzPatrick Nuclear Power Plant – High Frequency Relay HCLPF Evaluation”

19 Exelon Document Prepared by Engine Systems Inc., Report No. ESI-SR-09-196 Revision 0, October 3, 2009, “Seismic Qualification of Speed Switch ESI P/N ESI50213GG and 125 VDC / 24 VDC Converter Assy. ESI P/N ESI50211,” (Note: this reference is located in EC 9000017810 P2E attachments).

20 Exelon Document No. JAF-RPT-09-00012, “Seismic Qualification of Relay Assembly, K1 P/N: ESI50224,” Prepared by Engine Systems Inc. Report No. ESI-SR-09-171 Revision 0, September 12, 2009. EC-13685.

A Representative Sample Component Evaluations

A.1 Demand

The CDFM Mounting Point Demand values ($ICRS_{cH}$ and $ICRS_{cV}$) for 3 typical components (cabinet, switchgear, motor control center) at JAF for Elevations 242', 272', 284', and 300' are computed and summarized in Table A-1 below:

Table A-1: JAF High Frequency Acceleration Demand for Relays

				ISRS(GMRS)(g)		ISRS(@Elev.)(g)		AFcH				ICRScH (g)			ICRScV (g)
Component Elevation	HT. above Foundation	AFSH	AFSV	HGMRS	VGMRS	SAcH	SAcV	MCC	Switchgear	Control Cab.	AFcV	MCC	Switchgear	Control Cab.	All Cabinet
242'	0'	1.20	1.00	0.241	0.162	0.289	0.162	3.6	7.2	4.5	4.7	1.041	2.082	1.301	0.759
272' (Foundation)	0'	1.20	1.00	0.241	0.162	0.289	0.162	3.6	7.2	4.5	4.7	1.041	2.082	1.301	0.759
284'	12'	1.47	1.20	0.241	0.162	0.354	0.194	3.6	7.2	4.5	4.7	1.275	2.551	1.594	0.914
300'	28'	1.83	1.48	0.241	0.162	0.441	0.238	3.6	7.2	4.5	4.7	1.588	3.175	1.985	1.120

It should be noted, for the horizontal direction, the demand is dependent on the type of equipment in which the relay is mounted (i.e. MCC, switchgear, or control cabinet). There is one elevation below the main foundation elevation. This elevation is conservatively given the same in-structure amplification factor as the foundation since there would be no additional amplification below grade.

A.2 Square D KPD-13 Relay Evaluation

The Generic Equipment Ruggedness Spectrum (GERS) for the Square D KPD-13 series relays are presented in Table 3-1 of Reference [15]. For the KPD-13 relay, a high frequency capacity of 14.2g is used along with an F_K = 1.5 (the capacity knockdown factor, F_K, is determined based on the test source as provided in Table 4-2 of Reference [3]).

Table A-2 below contains the complete list of Square D KPD-13 relays along with their respective capacity to demand ratios. The minimum capacity to demand ratio is 4.55 for the horizontal and 12.47 for the vertical checks.

A.3 GE 12PJC11A4 – Code 11 Relay Evaluation

The Generic Equipment Ruggedness Spectrum (GERS) for the GE 12PJC series relays are presented starting on page B-87 of Reference [12]. EPRI's high frequency program tested a GE 12PJC11A (Table 5-10 of Reference [10]) and obtained a high frequency capacity of 6.5g prior to relay chatter for D/NO (De-Energized Normally Open). As the GERS grouped all PJC11 together, it is considered acceptable to use a high frequency capacity of 7.125g (=6.5g + 0.625g) with an F_K = 1.56 (the capacity knockdown factor, F_K, is determined based on the test source as provided in Table 4-2 of Reference [3]).

Table A-3 below contains the complete list of GE PJC series relays along with their respective capacity to demand ratios. The minimum capacity to demand ratio is 2.19 for the horizontal and 6.02 for the vertical checks.

Table A-2: Square D KPD Series Relay Margin

									High Frequency Horizontal							High Frequency Vertical						
SYSTEM	RELAY ID	Coil/ Contact	NOTES	MANUFACTURER	MODEL	CAB/RACK/ PANEL	ELEV	Box Type	$ICRS_c$ (g)	SA* (g)	SA_T (g)	F_k	F_{MS}	TRS SA_T*F_{MS}/F_k (g)	$TRS/ICRS_c$	$ICRS_c$ (g)	SA* (g)	SA_T (g)	F_k	F_{MS}	TRS SA_T*F_{MS}/F_k (g)	$TRS/ICRS_c$
EDG	93-32/SI-1EDGA12	ND/NO	EDGA HIGH CIRC CURRENT SEAL IN RELAY	SQUARE D	KPD-13	93EGP-A	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93-32/SI-1EDGB12	ND/NO	EDG B HIGH CIRC CURRENT SEAL IN RELAY	SQUARE D	KPD-13	93EGP-B	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93-32/SI-1EDGC12	ND/NO	EDGC HIGH CIRC CURRENT SEAL IN RELAY	SQUARE D	KPD-13	93EGP-C	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93-32/SI-1EDGD12	ND/NO	EDGD HIGH CIRC CURRENT SEAL IN RELAY	SQUARE D	KPD-13	93EGP-D	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93-32X1-1EDGA12	ND/NO	HIGH CIRCULATING CURRENT SHUTDOWN RELAY	SQUARE D	KPD-13	93ECP-A	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93-32X1-1EDGB12	ND/NO	EDG B HIGH CIRCULATING CURRENT ENG SHUTDOWN RELAY	SQUARE D	KPD-13	93ECP-B	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93-32X1-1EDGC12	ND/NO	EDG C HIGH CIRCULATING CURRENT ENG SHUTDOWN RELAY	SQUARE D	KPD-13	93ECP-C	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93-32X1-1EDGD12	ND/NO	EDG D HIGH CIRCULATING CURRENT ENG SHUTDOWN RELAY	SQUARE D	KPD-13	93ECP-D	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93-40X1-1EDGC12	ND/NO	EDG C FIELD FAILURE RELAY	SQUARE D	KPD-13	93ECP-C	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93-40X1-1EDGD12	ND/NO	EDG D FIELD FAILURE RELAY	SQUARE D	KPD-13	93ECP-D	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93-86X1-1EDGA12	ND/NO	GEN FAULT RELAY	SQUARE D	KPD-13	93ECP-A	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93-86X1-1EDGB12	ND/NO	EDG B GEN FAULT RELAY	SQUARE D	KPD-13	93ECP-B	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93-86X1-1EDGC12	ND/NO	EDG C GEN FAULT RELAY	SQUARE D	KPD-13	93ECP-C	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93-86X1-1EDGD12	ND/NO	EDG D GEN FAULT RELAY	SQUARE D	KPD-13	93ECP-D	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93-SDRX-1EDGA12	ND/NO	EDGA SHUTDOWN AUXILIARY RELAY	SQUARE D	KPD-13	93ECP-A	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93-SDRX-1EDGB12	ND/NO	EDGB SHUTDOWN AUXILIARY RELAY	SQUARE D	KPD-13	93ECP-B	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93-SDRX-1EDGC12	ND/NO	EDGC SHUTDOWN AUXILIARY RELAY	SQUARE D	KPD-13	93ECP-C	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93-SDRX-1EDGD12	ND/NO	EDGD SHUTDOWN AUXILIARY RELAY	SQUARE D	KPD-13	93ECP-D	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93FTS1A-1EDGA13	ND/NO	TIE A/C FAIL TO SYNCH RELAY	SQUARE D	KPD-13	93FPAC	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93FTS1A-1EDGB13	ND/NO	TIE B/D FAIL TO SYNCH RELAY	SQUARE D	KPD-13	93FPBD	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93FTS2A-1EDGA13	ND/NO	TIE A/C FAIL TO SYNCH RELAY	SQUARE D	KPD-13	93FPAC	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93FTS2A-1EDGB13	ND/NO	TIE B/D FAIL TO SYNCH RELAY	SQUARE D	KPD-13	93FPBD	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93-40X1-1EDGB12	ND/NO	EDG B FIELD FAILURE RELAY	SQUARE D	KPD-13	93ECP-B	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47
EDG	93-40X1-1EDGA12	ND/NO	EDG A FIELD FAILURE RELAY	SQUARE D	KPD-13	93ECP-B	272	SWGR	2.082	14.200	14.200	1.50	1.00	9.467	4.55	0.759	14.200	14.200	1.50	1.00	9.467	12.47

Table A-3: GE PJC Series Relay Margin

									High Frequency Horizontal							High Frequency Vertical						
SYSTEM	RELAY ID	Coil/ Contact	NOTES	MANUFACTURER	MODEL	CAB/RACK/ PANEL	ELEV	Box Type	$ICRS_c$ (g)	SA* (g)	SA_T (g)	F_k	F_{MS}	TRS SA_T*F_{MS}/F_k (g)	$TRS/ICRS_c$	$ICRS_c$ (g)	SA* (g)	SA_T (g)	F_k	F_{MS}	TRS SA_T*F_{MS}/F_k (g)	$TRS/ICRS_c$
4.16KV	71-50GS-1HOEB02	ND/NO	600 V EMERG SWGR TO 71T-14 & 71T-16 GROUND OVERCURRENT RELAY	GENERAL ELECTRIC CO	12PJC11AV1A	71-10660	272	SWGR	2.082	6.500	7.125	1.56	1.00	4.567	2.19	0.759	6.500	7.125	1.56	1.00	4.567	6.02
4.16KV	71-50GS-1HOEA02	ND/NO	AUX POWER TO 600V UNIT SUB INST GROUND OVERCURRENT RELAY IN NOTES: PART NO: 12PJC11AV1A PER WALKDOWN 12-1-94.	GENERAL ELECTRIC CO	PJC	71-10560	272	SWGR	2.082	6.500	7.125	1.56	1.00	4.567	2.19	0.759	6.500	7.125	1.56	1.00	4.567	6.02

B Components Identified for High Frequency Confirmation

Table B-1: Components Identified for High Frequency Confirmation

No.	Unit	Component					Enclosure			Component Evaluation	
		System	Relay ID	Component Description[1]	Manufacturer	Model[2]	Cab/Rack/ Panel	Bldg	Elev	Basis for Capacity	Evaluation Result
1	1	125VDC	71BMCC-3-OB1(MC), Relay 42/2O	DC Contactor for 13MOV-131	GENERAL ELECTRIC CO	IC28001607, AF3H per 1/26/2017 walkdown finding	71BMCC-3	RB	242	EPRI NP-5223-SLR1	Confirmed
2	1	125VDC	71BMCC-2-OA1(MC), Relay 42/2O	DC Contactor for 29MOV-77	GENERAL ELECTRIC CO	IC2800	71BMCC-2	RB	242	EPRI NP-5223-SLR1	Confirmed
3	1	4.16KV	71-50/51-A-1HOEA02	600V EMERG SWGR TO 71T-13 & 71T-15 INST/TIME OVERCURRENT PH A REL	GENERAL ELECTRIC CO	IAC51B	71-10560	EG	272	EPRI 3002002997	Confirmed
4	1	4.16KV	71-50/51-A-1HOEB02	600V EMERG SWGR TO 71T-14 & 71T-16 INST/TIME OVERCURRENT PH A REL	GENERAL ELECTRIC CO	IAC51B	71-10660	EG	272	EPRI 3002002997	Confirmed
5	1	4.16KV	71-50/51-B-1HOEA02	600V EMERG SWGR TO 71T-13 & 71T-15 INST/TIME OVERCURRENT PH B REL	GENERAL ELECTRIC CO	IAC51B	71-10560	EG	272	EPRI 3002002997	Confirmed
6	1	4.16KV	71-50/51-B-1HOEB02	600V EMERG SWGR TO 71T-14 & 71T-16 INST/TIME OVERCURRENT PH B REL	GENERAL ELECTRIC CO	IAC51B	71-10660	EG	272	EPRI 3002002997	Confirmed
7	1	4.16KV	71-50/51-C-1HOEA02	600V EMERG SWGR TO 71T-13 & 71T-15 INST/TIME OVERCURRENT PH C REL	GENERAL ELECTRIC CO	IAC51B	71-10560	EG	272	EPRI 3002002997	Confirmed
8	1	4.16KV	71-50/51-C-1HOEB02	600V EMERG SWGR TO 71T-14 & 71T-16 INST/TIME OVERCURRENT PH C REL	GENERAL ELECTRIC CO	IAC51B	71-10660	EG	272	EPRI 3002002997	Confirmed

[1] All of the relays on this table are normally de-energized (ND) and the applicable contact is normally open (NO) unless otherwise stated. All of the mechanical sensor switches (process switches) on this table are normally open (NO) unless otherwise stated.
[2] All relay model numbers are from the JAF Equipment Database unless otherwise noted.

		Component					Enclosure			Component Evaluation	
No.	Unit	System	Relay ID	Component Description[1]	Manufacturer	Model[2]	Cab/Rack/ Panel	Bldg	Elev	Basis for Capacity	Evaluation Result
9	1	4.16KV	71-50GS-1HOEA02	AUX POWER TO 600V UNIT SUB INST GROUND OVERCURRENT RELAY	GENERAL ELECTRIC CO	PJC	71-10560	EG	272	EPRI 3002002997	Confirmed
10	1	4.16KV	71-50GS-1HOEB02	600 V EMERG SWGR TO 71T-14 & 71T-16 GROUND OVERCURRENT RELAY	GENERAL ELECTRIC CO	12PJC11AV1A	71-10660	EG	272	EPRI 3002002997	Confirmed
11	1	600VAC	71MCC-152-OB4(MC), Relay 42/O	AC Contactor 29MOV-74	GENERAL ELECTRIC CO	CR109C0	71MCC-152	RB	272	EPRI NP-5223-SLR1	Confirmed
12	1	EDG	93-27/51-A-1EDGA08	EDG A PHASE A TIME-OVERCURRENT RELAY	GENERAL ELECTRIC CO	IJCV51A	71-10502	EG	272	EPRI NP-7147-SL-V2	Confirmed
13	1	EDG	93-27/51-A-1EDGB08	EDG B PHASE A TIME-OVERCURRENT RELAY	GENERAL ELECTRIC CO	IJCV51A	71-10602	EG	272	EPRI NP-7147-SL-V2	Confirmed
14	1	EDG	93-27/51-A-1EDGC08	EDG C PHASE A TIME-OVERCURRENT RELAY	GENERAL ELECTRIC CO	IJCV51A	71-10512	EG	272	EPRI NP-7147-SL-V2	Confirmed
15	1	EDG	93-27/51-A-1EDGD08	EDG D PHASE A TIME-OVERCURRENT RELAY	GENERAL ELECTRIC CO	IJCV51A	71-10612	EG	272	EPRI NP-7147-SL-V2	Confirmed
16	1	EDG	93-27/51-B-1EDGA08	EDG A PHASE B TIME-OVERCURRENT RELAY	GENERAL ELECTRIC	IJCV51A	71-10502	EG	272	EPRI NP-7147-SL-V2	Confirmed
17	1	EDG	93-27/51-B-1EDGB08	EDG B PHASE B TIME-OVERCURRENT RELAY	GENERAL ELECTRIC	IJCV51A	71-10602	EG	272	EPRI NP-7147-SL-V2	Confirmed
18	1	EDG	93-27/51-B-1EDGC08	EDG C PHASE B TIME-OVERCURRENT RELAY	GENERAL ELECTRIC	IJCV51A	71-10512	EG	272	EPRI NP-7147-SL-V2	Confirmed
19	1	EDG	93-27/51-B-1EDGD08	EDG D PHASE B TIME-OVERCURRENT RELAY	GENERAL ELECTRIC	IJCV51A	71-10612	EG	272	EPRI NP-7147-SL-V2	Confirmed
20	1	EDG	93-27/51-C-1EDGA08	EDG A PHASE C TIME-OVERCURRENT RELAY	GENERAL ELECTRIC	IJCV51A	71-10502	EG	272	EPRI NP-7147-SL-V2	Confirmed

No.	Unit	Component					Enclosure			Component Evaluation	
		System	Relay ID	Component Description[1]	Manufacturer	Model[2]	Cab/Rack/ Panel	Bldg	Elev	Basis for Capacity	Evaluation Result
21	1	EDG	93-27/51-C-1EDGB08	EDG B PHASE C TIME-OVERCURRENT RELAY	GENERAL ELECTRIC	IJCV51A	71-10602	EG	272	EPRI NP-7147-SL-V2	Confirmed
22	1	EDG	93-27/51-C-1EDGC08	EDG C PHASE C TIME-OVERCURRENT RELAY	GENERAL ELECTRIC	IJCV51A	71-10512	EG	272	EPRI NP-7147-SL-V2	Confirmed
23	1	EDG	93-27/51-C-1EDGD08	EDG D PHASE C TIME-OVERCURRENT RELAY	GENERAL ELECTRIC	IJCV51A	71-10612	EG	272	EPRI NP-7147-SL-V2	Confirmed
24	1	EDG	93-32/SI-1EDGA12	EDGA HIGH CIRC CURRENT SEAL IN RELAY	SQUARE D	KPD-13	93EGP-A	EG	272	EPRI TR-105988-V2	Confirmed
25	1	EDG	93-32/SI-1EDGB12	EDG B HIGH CIRC CURRENT SEAL IN RELAY	SQUARE D	KPD-13	93EGP-B	EG	272	EPRI TR-105988-V2	Confirmed
26	1	EDG	93-32/SI-1EDGC12	EDGC HIGH CIRC CURRENT SEAL IN RELAY	SQUARE D	KPD-13	93EGP-C	EG	272	EPRI TR-105988-V2	Confirmed
27	1	EDG	93-32/SI-1EDGD12	EDGD HIGH CIRC CURRENT SEAL IN RELAY	SQUARE D	KPD-13	93EGP-D	EG	272	EPRI TR-105988-V2	Confirmed
28	1	EDG	93-32-1EDGA09	EDG A HIGH CIRC CURRENT POWER RELAY	GENERAL ELECTRIC	ICW51A	93EGP-A	EG	272	SQURTS	Confirmed
29	1	EDG	93-32-1EDGB09	EDG B HIGH CIRC CURRENT POWER RELAY	GENERAL ELECTRIC CO	ICW51A	93EGP-B	EG	272	SQURTS	Confirmed
30	1	EDG	93-32-1EDGC09	EDG C HIGH CIRC CURRENT POWER RELAY	GENERAL ELECTRIC CO	ICW51A	93EGP-C	EG	272	SQURTS	Confirmed
31	1	EDG	93-32-1EDGD09	EDG D HIGH CIRC CURRENT POWER RELAY	GENERAL ELECTRIC CO	ICW51A	93EGP-D	EG	272	SQURTS	Confirmed
32	1	EDG	93-32X1-1EDGA12	HIGH CIRCULATING CURRENT SHUTDOWN RELAY	SQUARE D	KPD-13	93ECP-A	EG	272	EPRI TR-105988-V2	Confirmed
33	1	EDG	93-32X1-1EDGB12	EDG B HIGH CIRCULATING CURRENT ENG SHUTDOWN RELAY	SQUARE D	KPD-13	93ECP-B	EG	272	EPRI TR-105988-V2	Confirmed

No.	Unit	Component					Enclosure			Component Evaluation	
		System	Relay ID	Component Description[1]	Manufacturer	Model[2]	Cab/Rack/ Panel	Bldg	Elev	Basis for Capacity	Evaluation Result
34	1	EDG	93-32X1-1EDGC12	EDG C HIGH CIRCULATING CURRENT ENGINE SHUTDOWN RELAY	SQUARE D	KPD-13	93ECP-C	EG	272	EPRI TR-105988-V2	Confirmed
35	1	EDG	93-32X1-1EDGD12	EDG D HIGH CIRCULATING CURRENT ENG SHUTDOWN RELAY	SQUARE D	KPD-13	93ECP-D	EG	272	EPRI TR-105988-V2	Confirmed
36	1	EDG	93-40X1-1EDGA12	EDG A FIELD FAILURE RELAY	SQUARE D	KPD-13	93ECP-B	EG	272	EPRI TR-105988-V2	Confirmed
37	1	EDG	93-40X1-1EDGB12	EDG B FIELD FAILURE RELAY	SQUARE D	KPD-13	93ECP-B	EG	272	EPRI TR-105988-V2	Confirmed
38	1	EDG	93-40X1-1EDGC12	EDG C FIELD FAILURE RELAY	SQUARE D	KPD-13	93ECP-C	EG	272	EPRI TR-105988-V2	Confirmed
39	1	EDG	93-40X1-1EDGD12	EDG D FIELD FAILURE RELAY	SQUARE D	KPD-13	93ECP-D	EG	272	EPRI TR-105988-V2	Confirmed
40	1	EDG	93-62-1EDGA01	EDG A OUTPUT BREAKER VOLTAGE CHECK CLOSE INTERLOCK RELAY	AMERACE CORP	E7012PB	71-10502	EG	272	EPRI NP-7147-SL	Confirmed
41	1	EDG	93-62-1EDGA02	EDG A & EDG C OUTPUT BREAKERS CLOSE INTERLOCK RELAY	AMERACE CORP	E7012PB	71-10504	EG	272	EPRI NP-7147-SL	Confirmed
42	1	EDG	93-62-1EDGA12	EDG A HIGH CIRCULATING CURRENT INTERLOCK RELAY	AMERACE CORP	E7012PC	71-10502	EG	272	EPRI NP-7147-SL	Confirmed
43	1	EDG	93-62-1EDGB01	EDG B OUTPUT BREAKER VOLTAGE CHECK CLOSE INTERLOCK RELAY	AMERACE CORP	E7012PB004	71-10602	EG	272	EPRI NP-7147-SL	Confirmed
44	1	EDG	93-62-1EDGB02	EDG B & EDG D OUTPUT BREAKER CLOSE INTERLOCK RELAY	AMERACE CORP	E7012PB E7012PB004	71-10604	EG	272	EPRI NP-7147-SL	Confirmed

No.	Unit	Component					Enclosure			Component Evaluation	
		System	Relay ID	Component Description[1]	Manufacturer	Model[2]	Cab/Rack/ Panel	Bldg	Elev	Basis for Capacity	Evaluation Result
45	1	EDG	93-62-1EDGB12	EDG B HIGH CIRCULATING CURRENT INTERLOCK RELAY	AMERACE CORP	E7012PC004	71-10602	EG	272	EPRI NP-7147-SL	Confirmed
46	1	EDG	93-62-1EDGC01	EDG C OUTPUT BREAKER VOLTAGE CHECK CLOSE INTERLOCK RELAY	AMERACE CORP	E7012PB	71-10512	EG	272	EPRI NP-7147-SL	Confirmed
47	1	EDG	93-62-1EDGC12	EDG C HIGH CIRCULATING CURRENT INTERLOCK RELAY	AMERACE CORP	E7012PC	71-10512	EG	272	EPRI NP-7147-SL	Confirmed
48	1	EDG	93-62-1EDGD01	EDG D OUTPUT BREAKER VOLTAGE CHECK CLOSE INTERLOCK RELAY	AMERACE CORP	E7012PB	71-10612	EG	272	EPRI NP-7147-SL	Confirmed
49	1	EDG	93-62-1EDGD12	EDG D HIGH CIRCULATING CURRENT INTERLOCKS RELAY	AMERACE CORP	E7012PC	71-10612	EG	272	EPRI NP-7147-SL	Confirmed
50	1	EDG	93-62X-1EDGA02	BUS 10500 EDG A & EDG C TIE AUX TIME DELAY RELAY	GENERAL ELECTRIC CO	HLA	71-10504	EG	272	EPRI NP-7147-SL	Confirmed
51	1	EDG	93-62X-1EDGB02	BUS 10600 EDG B & EDG D TIE AUX TIME DELAY RELAY	GENERAL ELECTRIC CO	HLA	71-10604	EG	272	EPRI NP-7147-SL	Confirmed
52	1	EDG	93-74C-1EDGA13	FORCE PARALLEL LOSS OF 125VDC CONTROL VOLTAGE RELAY Note: Relay is normally energized and Contact is normally open (NE/NO)	GENERAL ELECTRIC CO SQUARE D	CR2811 8501XUDO26V63Y4 14	93FPAC	EG	272	EPRI TR-105988-V2 EPRI 3002002997	Confirmed Confirmed
53	1	EDG	93-74C-1EDGB13	FORCE PARALLEL LOSS OF 125VDC CONTROL VOLTAGE RELAY Note: Relay is normally energized and Contact is normally open (NE/NO)	GENERAL ELECTRIC CO SQUARE D	CR2811 8501XUDO26V63Y4 14	93FPBD	EG	272	EPRI TR-105988-V2 EPRI 3002002997	Confirmed Confirmed

		Component					Enclosure			Component Evaluation	
No.	Unit	System	Relay ID	Component Description[1]	Manufacturer	Model[2]	Cab/Rack/ Panel	Bldg	Elev	Basis for Capacity	Evaluation Result
54	1	EDG	93-86X1-1EDGA12	GEN FAULT RELAY	SQUARE D	KPD-13	93ECP-A	EG	272	EPRI TR-105988-V2	Confirmed
55	1	EDG	93-86X1-1EDGB12	EDG B GEN FAULT RELAY	SQUARE D	KPD-13	93ECP-B	EG	272	EPRI TR-105988-V2	Confirmed
56	1	EDG	93-86X1-1EDGC12	EDG C GEN PROT RELAY	SQUARE D	KPD-13	93ECP-C	EG	272	EPRI TR-105988-V2	Confirmed
57	1	EDG	93-86X1-1EDGD12	EDG D GEN PROTECT RELAY	SQUARE D	KPD-13	93ECP-D	EG	272	EPRI TR-105988-V2	Confirmed
58	1	EDG	93-87-A-1EDGA07	EDG A PHASE A HIGHSPEED DIFFERENTIAL RELAY	GENERAL ELECTRIC CO	CFD12B	71-10502	EG	272	EPRI TR-105988-V2	Outlier
59	1	EDG	93-87-A-1EDGB07	EDG B PHASE A HIGHSPEED DIFFERENTIAL RELAY	GENERAL ELECTRIC CO	CFD12B	71-10602	EG	272	EPRI TR-105988-V2	Outlier
60	1	EDG	93-87-A-1EDGC07	EDG C PHASE A HIGHSPEED DIFFERENTIAL RELAY	GENERAL ELECTRIC CO	CFD12B	71-10512	EG	272	EPRI TR-105988-V2	Outlier
61	1	EDG	93-87-A-1EDGD07	EDG D PHASE A HIGHSPEED DIFFERENTIAL RELAY	GENERAL ELECTRIC CO	CFD12B	71-10612	EG	272	EPRI TR-105988-V2	Outlier
62	1	EDG	93-87-B-1EDGA07	EDG A PHASE B HIGHSPEED DIFFERENTIAL RELAY	GENERAL ELECTRIC	CFD12B	71-10502	EG	272	EPRI TR-105988-V2	Outlier
63	1	EDG	93-87-B-1EDGB07	EDG B PHASE B HIGHSPEED DIFFERENTIAL RELAY	GENERAL ELECTRIC	CFD12B	71-10602	EG	272	EPRI TR-105988-V2	Outlier
64	1	EDG	93-87-B-1EDGC07	EDG C PHASE B HIGHSPEED DIFFERENTIAL RELAY	GENERAL ELECTRIC	CFD12B	71-10512	EG	272	EPRI TR-105988-V2	Outlier
65	1	EDG	93-87-B-1EDGD07	EDG D PHASE B HIGHSPEED DIFFERENTIAL RELAY	GENERAL ELECTRIC	CFD12B	71-10612	EG	272	EPRI TR-105988-V2	Outlier
66	1	EDG	93-87-C-1EDGA07	EDG A PHASE C HIGH-SPEED DIFFERENTIAL RELAY	GENERAL ELECTRIC	CFD12B	71-10502	EG	272	EPRI TR-105988-V2	Outlier

No.	Unit	Component					Enclosure			Component Evaluation	
		System	Relay ID	Component Description[1]	Manufacturer	Model[2]	Cab/Rack/ Panel	Bldg	Elev	Basis for Capacity	Evaluation Result
67	1	EDG	93-87-C-1EDGB07	EDG B PHASE C HIGHSPEED DIFFERENTIAL RELAY	GENERAL ELECTRIC	CFD12B	71-10602	EG	272	EPRI TR-105988-V2	Outlier
68	1	EDG	93-87-C-1EDGC07	EDG C PHASE C HIGHSPEED DIFFERENTIAL RELAY	GENERAL ELECTRIC	CFD12B	71-10512	EG	272	EPRI TR-105988-V2	Outlier
69	1	EDG	93-87-C-1EDGD07	EDG D PHASE C HIGHSPEED DIFFERENTIAL RELAY	GENERAL ELECTRIC	CFD12B	71-10612	EG	272	EPRI TR-105988-V2	Outlier
70	1	EDG	93-ESR200-1EDGA12	EDG A ENG SPEED SENSING RELAY	SQUARE D	8501XUDO0408V63 per EC 16492 (WO 51203289)	93ECP-A	EG	272	EPRI 3002002997	Confirmed
71	1	EDG	93-ESR200-1EDGB12	EDG B ENG SPEED SENSING RELAY	SQUARE D	8501XUDO0408V63 per EC 13522 (WO 51204938)	93ECP-B	EG	272	EPRI 3002002997	Confirmed
72	1	EDG	93-ESR200-1EDGC12	EDG C ENG SPEED SENSING RELAY	SQUARE D	8501XUDO0408V63 per EC 14796 (WO 51192196)	93ECP-C	EG	272	EPRI 3002002997	Confirmed
73	1	EDG	93-ESR200-1EDGD12	EDG D ENGINE SPEED SENSING RELAY	SQUARE D	8501XUDO0408V63 per EC 16218 (WO 51201711)	93ECP-D	EG	272	EPRI 3002002997	Confirmed
74	1	EDG	93-ESR400-1EDGA12	EDG A ENG SPEED SENSING RELAY	GENERAL ELECTRIC CO SQUARE D	CR2811 8501XUDO0804V63 Y414	93ECP-A	EG	272	EPRI TR-105988-V2 EPRI 3002002997	Confirmed Confirmed
75	1	EDG	93-ESR400-1EDGB12	EDG B ENG SPEED SENSING RELAY	GENERAL ELECTRIC CO SQUARE D	CR2811 8501XUDO0408V63	93ECP-B	EG	272	EPRI TR-105988-V2 EPRI 3002002997	Confirmed Confirmed

		Component					Enclosure			Component Evaluation	
No.	Unit	System	Relay ID	Component Description[1]	Manufacturer	Model[2]	Cab/Rack/ Panel	Bldg	Elev	Basis for Capacity	Evaluation Result
76	1	EDG	93-ESR400-1EDGC12	EDG C ENG SPEED SENSING RELAY	GENERAL ELECTRIC CO SQUARE D	CR2811 8501XUDO0804V63 Y414	93ECP-C	EG	272	EPRI TR-105988-V2 EPRI 3002002997	Confirmed Confirmed
77	1	EDG	93-ESR400-1EDGD12	EDG D ENG SPEED SENSING RELAY	GENERAL ELECTRIC CO SQUARE D	CR2811 8501XUDO0408V63	93ECP-D	EG	272	EPRI TR-105988-V2 EPRI 3002002997	Confirmed Confirmed
78	1	EDG	93-ESR40-1EDGA12	EDG A ENG SPEED SENSING RELAY	SQUARE D	8501XUDO0408V63 per EC 16492 (WO 51203288)	93ECP-A	EG	272	EPRI 3002002997	Confirmed
79	1	EDG	93-ESR40-1EDGB12	EDG B ENG SPEED SENSING RELAY	SQUARE D	8501XUDO0408V63 per EC 13522 (WO 51204937)	93ECP-B	EG	272	EPRI 3002002997	Confirmed
80	1	EDG	93-ESR40-1EDGC12	EDG C ENG SPEED SENSING RELAY	SQUARE D	8501XUDO0408V63 per EC 14796 (WO 51192197)	93ECP-C	EG	272	EPRI 3002002997	Confirmed
81	1	EDG	93-ESR40-1EDGD12	EDG D ENG SPEED SENSING RELAY	SQUARE D	8501XUDO0408V63 per EC 16218 (WO 51201710)	93ECP-D	EG	272	EPRI 3002002997	Confirmed
82	1	EDG	93ESS-A	EDG A ELECTRONIC SPEED SWITCH	WOODWARD GOVERNOR	SST-2400A-8	93ECSP-A	EG	284	JAF Documentation [19]	Confirmed
83	1	EDG	93ESS-B	EDG B ELECTRONIC SPEED SWITCH	WOODWARD GOVERNOR	SST-2400A-8	93ECSP-B	EG	272	JAF Documentation [19]	Confirmed
84	1	EDG	93ESS-C	EDG C ELECTRONIC SPEED SWITCH	DYNALCO CORP	SST-2400A-8	93ECSP-C	EG	272	JAF Documentation [19]	Confirmed
85	1	EDG	93ESS-D	EDG D ELECTRONIC SPEED SWITCH	WOODWARD GOVERNOR	SST-2400A-8	93ECSP-D	EG	272	JAF Documentation [19]	Confirmed

		Component					Enclosure			Component Evaluation	
No.	Unit	System	Relay ID	Component Description[1]	Manufacturer	Model[2]	Cab/Rack/ Panel	Bldg	Elev	Basis for Capacity	Evaluation Result
86	1	EDG	93FTS1A-1EDGA13	TIE A/C FAIL TO SYNCH RELAY	SQUARE D	KPD-13	93FPAC	EG	272	EPRI TR-105988-V2	Confirmed
87	1	EDG	93FTS1A-1EDGB13	TIE B/D FAIL TO SYNCH RELAY	SQUARE D	KPD-13	93FPBD	EG	272	EPRI TR-105988-V2	Confirmed
88	1	EDG	93FTS2A-1EDGA13	TIE A/C FAIL TO SYNCH RELAY	SQUARE D	KPD-13	93FPAC	EG	272	EPRI TR-105988-V2	Confirmed
89	1	EDG	93FTS2A-1EDGB13	TIE B/D FAIL TO SYNCH RELAY	SQUARE D	KPD-13	93FPBD	EG	272	EPRI TR-105988-V2	Confirmed
90	1	EDG	93-K10-1EDGA01	EDG A ENG FAILURE AND GEN FIELD SHORTED RELAY	SQUARE D	8501XUDO0408V63 per EC 16492 (WO 51203292)	93ECP-A	EG	272	EPRI 3002002997	Confirmed
91	1	EDG	93-K10-1EDGB01	EDG B ENG FAILURE AND GEN FIELD SHORTED RELAY	SQUARE D	8501XUDO0408V63 per EC 13662 (WO 51204941)	93ECP-B	EG	272	EPRI 3002002997	Confirmed
92	1	EDG	93-K10-1EDGC01	EDG C ENG FAILURE AND GEN FIELD SHORTED RELAY	SQUARE D	8501XUDO0408V63 per EC 14318 (WO 51192205)	93ECP-C	EG	272	EPRI 3002002997	Confirmed
93	1	EDG	93-K10-1EDGD01	EDG D ENG FAILURE AND GEN FIELD SHORTED RELAY	SQUARE D	8501XUDO0408V63 per EC 16218 (WO 51201714)	93ECP-D	EG	272	EPRI 3002002997	Confirmed
94	1	EDG	93-K1-1EDGA12	EDG A AUTO START RELAY	ENGINE SYSTEMS, INC.	ESI50224 (ESI50224 is a combination of two Allen Bradley relays: models 700DC-PL and 700DC-PK; the pertinent chatter for this analysis is of the reset coil/contacts.)	93ECP-A	EG	272	JAF Documentation [20]	Confirmed

		Component					Enclosure			Component Evaluation	
No.	Unit	System	Relay ID	Component Description[1]	Manufacturer	Model[2]	Cab/Rack/ Panel	Bldg	Elev	Basis for Capacity	Evaluation Result
95	1	EDG	93-K1-1EDGB12	EDG B AUTO START RELAY	ENGINE SYSTEMS, INC.	ESI50224	93ECP-B	EG	272	JAF Documentation [20]	Confirmed
96	1	EDG	93-K1-1EDGC12	EDG C AUTO START RELAY	ENGINE SYSTEMS, INC.	ESI50224	93ECP-C	EG	272	JAF Documentation [20]	Confirmed
97	1	EDG	93-K1-1EDGD12	EDG D AUTO START RELAY	ENGINE SYSTEMS, INC.	ESI50224	93ECP-D	EG	272	JAF Documentation [20]	Confirmed
98	1	EDG	93-K1VR-A	DIESEL GEN EXCITER-REGULATOR VOLTAGE SHUTDOWN RELAY	WESTINGHOUSE	MD110	93EGP-A	EG	272	EPRI NP-5223-SLR1	Confirmed
99	1	EDG	93-K1VR-B	DIESEL GEN EXCITER-REGULATOR VOLTAGE SHUTDOWN RELAY	WESTINGHOUSE	MD110	93EGP-B	EG	272	EPRI NP-5223-SLR1	Confirmed
100	1	EDG	93-K1VR-C	DIESEL GEN EXCITER-REGULATOR VOLTAGE SHUTDOWN RELAY	WESTINGHOUSE	MD110	93EGP-C	EG	272	EPRI NP-5223-SLR1	Confirmed
101	1	EDG	93-K1VR-D	DIESEL GEN EXCITER-REGULATOR VOLTAGE SHUTDOWN RELAY	WESTINGHOUSE	MD110	93EGP-D	EG	272	EPRI NP-5223-SLR1	Confirmed
102	1	EDG	93-K3VR-A	DIESEL GEN EXCITER-REGULATOR SENSING RELAY	POTTER & BRUMFIELD	PRD11AYO	93EGP-A	EG	272	EPRI 3002002997	Confirmed
103	1	EDG	93-K3VR-B	DIESEL GEN EXCITER-REGULATOR SENSING RELAY	POTTER & BRUMFIELD	PRD11AYO	93EGP-B	EG	272	EPRI 3002002997	Confirmed
104	1	EDG	93-K3VR-C	DIESEL GEN EXCITER-REGULATOR SENSING RELAY	POTTER & BRUMFIELD	PRD11 per Mod D1-98-023 (WO 52161266)	93EGP-C	EG	272	EPRI 3002002997	Confirmed
105	1	EDG	93-K3VR-D	DIESEL GEN EXCITER-REGULATOR SENSING RELAY	POTTER & BRUMFIELD	PRD11AYO	93EGP-D	EG	272	EPRI 3002002997	Confirmed
106	1	EDG	93-K4VR-A	DIESEL GEN EXCITER-REGULATOR RESET RELAY	POTTER & BRUMFIELD	PRD11DYO	93EGP-A	EG	272	EPRI 3002002997	Confirmed

No.	Unit	Component					Enclosure			Component Evaluation	
		System	Relay ID	Component Description[1]	Manufacturer	Model[2]	Cab/Rack/ Panel	Bldg	Elev	Basis for Capacity	Evaluation Result
107	1	EDG	93-K4VR-B	DIESEL GEN EXCITER-REGULATOR RESET RELAY	POTTER & BRUMFIELD	PRD11DYO	93EGP-B	EG	272	EPRI 3002002997	Confirmed
108	1	EDG	93-K4VR-C	DIESEL GEN EXCITER-REGULATOR RESET RELAY	POTTER & BRUMFIELD	PRD11 per mod D1-98-023 (WO 52161266)	93EGP-C	EG	272	EPRI 3002002997	Confirmed
109	1	EDG	93-K4VR-D	DIESEL GEN EXCITER-REGULATOR RESET RELAY	POTTER & BRUMFIELD	PRD11DYO	93EGP-D	EG	272	EPRI 3002002997	Confirmed
110	1	EDG	93-K8-1EDGA02	EDG-A AND C TIE BKR 10504 CLOSING CONTROL RELAY	GENERAL ELECTRIC CO SQUARE D SQUARE D	CR2811 8501XUD031V63 8501XUDO31V63Y4 14	93FPAC	EG	272	EPRI TR-105988-V2 EPRI 3002002997 EPRI 3002002997	Confirmed Confirmed Confirmed
111	1	EDG	93-K8-1EDGB02	EDG B-D TIE BKR 71-10604 CLOSE CONTROL RELAY	GENERAL ELECTRIC CO SQUARE D SQUARE D	CR2811 8501XUD031V63 8501XUDO31V63Y4 14	93FPBD	EG	272	EPRI TR-105988-V2 EPRI 3002002997 EPRI 3002002997	Confirmed Confirmed Confirmed
112	1	EDG	93-K9-1EDGA02	EDG-A AND C TIE BKR 10504 OPENING CONTROL RELAY	GENERAL ELECTRIC CO SQUARE D SQUARE D	CR2811 8501XUD031V63 8501XUDO31V63Y4 14	93FPAC	EG	272	EPRI TR-105988-V2 EPRI 3002002997 EPRI 3002002997	Confirmed Confirmed Confirmed

		Component					Enclosure			Component Evaluation	
No.	Unit	System	Relay ID	Component Description[1]	Manufacturer	Model[2]	Cab/Rack/ Panel	Bldg	Elev	Basis for Capacity	Evaluation Result
113	1	EDG	93-K9-1EDGB02	EDG B-D TIE BKR 71-10604 OPEN CONTROL RELAY	GENERAL ELECTRIC CO SQUARE D SQUARE D	CR2811 8501XUD031V63 8501XUDO31V63Y414	93FPBD	EG	272	EPRI TR-105988-V2 EPRI 3002002997 EPRI 3002002997	Confirmed Confirmed Confirmed
114	1	EDG	93SDR-1EDGA12	EDG A SHUTDOWN RELAY	GENERAL ELECTRIC CO SQUARE D	CR2811 8501XUDO0705V63Y414	93ECP-A	EG	272	EPRI TR-105988-V2 EPRI 3002002997	Confirmed Confirmed
115	1	EDG	93SDR-1EDGB12	EDG B SHUTDOWN RELAY	GENERAL ELECTRIC CO SQUARE D	CR2811 8501XUDO0705V63Y414	93ECP-B	EG	272	EPRI TR-105988-V2 EPRI 3002002997	Confirmed Confirmed
116	1	EDG	93SDR-1EDGC12	EDG C SHUTDOWN RELAY	SQUARE D	8501XUDO0705V63Y414	93ECP-C	EG	272	EPRI 3002002997	Confirmed
117	1	EDG	93SDR-1EDGD12	EDG D SHUTDOWN RELAY	GENERAL ELECTRIC CO SQUARE D	CR2811 8501XUDO0705V63Y414	93ECP-D	EG	272	EPRI TR-105988-V2 EPRI 3002002997	Confirmed Confirmed
118	1	EDG	93-SDRX-1EDGA12	EDGA SHUTDOWN AUXILIARY RELAY	SQUARE D	KPD-13	93ECP-A	EG	272	EPRI TR-105988-V2	Confirmed
119	1	EDG	93-SDRX-1EDGB12	EDGB SHUTDOWN AUXILIARY RELAY	SQUARE D	KPD-13	93ECP-B	EG	272	EPRI TR-105988-V2	Confirmed
120	1	EDG	93-SDRX-1EDGC12	EDGC SHUTDOWN AUXILIARY RELAY	SQUARE D	KPD-13	93ECP-C	EG	272	EPRI TR-105988-V2	Confirmed

No.	Unit	Component					Enclosure			Component Evaluation	
		System	Relay ID	Component Description[1]	Manufacturer	Model[2]	Cab/Rack/ Panel	Bldg	Elev	Basis for Capacity	Evaluation Result
121	1	EDG	93-SDRX-1EDGD12	EDGD SHUTDOWN AUXILIARY RELAY	SQUARE D	KPD-13	93ECP-D	EG	272	EPRI TR-105988-V2	Confirmed
122	1	EDG	93TD10-1EDGA12	EDG A LOSS OF FIELD RELAY	AMERACE CORP	E7012PD	93ECP-A	EG	272	EPRI NP-7147-SL	Confirmed
123	1	EDG	93TD10-1EDGB12	EDG B LOSS OF FIELD RELAY	AMERACE CORP	E7012PD004	93ECP-B	EG	272	EPRI NP-7147-SL	Confirmed
124	1	EDG	93TD10-1EDGC12	EDG C LOSS OF FIELD RELAY	AMERACE CORP	E7012PD	93ECP-C	EG	272	EPRI NP-7147-SL	Confirmed
125	1	EDG	93TD10-1EDGD12	EDG D LOSS OF FIELD RELAY	AMERACE CORP	E7012PD004	93ECP-D	EG	272	EPRI NP-7147-SL	Confirmed
126	1	EDG	93TD5-1EDGA12	EDG A DIESEL FAIL TO START RELAY	AMERACE CORP	E7014PC	93ECP-A	EG	272	EPRI 3002002997	Confirmed
127	1	EDG	93TD5-1EDGB12	EDG B DIESEL FAIL TO START RELAY	AMERACE CORP	E7014PC004	93ECP-B	EG	272	EPRI 3002002997	Confirmed
128	1	EDG	93TD5-1EDGC12	EDG C DIESEL FAIL TO START RELAY	AMERACE CORP	E7014PC	93ECP-C	EG	272	EPRI 3002002997	Confirmed
129	1	EDG	93TD5-1EDGD12	EDG D DIESEL FAIL TO START RELAY	AMERACE CORP	E7014PC004	93ECP-D	EG	272	EPRI 3002002997	Confirmed
130	1	EDG	93TD6-1EDGA12	EDG A ENGINE START BYPASS INTERLOCK RELAY	AMERACE CORP	E7012PD	93ECP-A	EG	272	EPRI NP-7147-SL	Confirmed
131	1	EDG	93TD6-1EDGB12	EDG B ENGINE START BYPASS INTERLOCK RELAY	AMERACE CORP	E7012PD004	93ECP-B	EG	272	EPRI NP-7147-SL	Confirmed
132	1	EDG	93TD6-1EDGC12	EDG C ENGINE START BYPASS INTERLOCK RELAY	AMERACE CORP	E7012PD	93ECP-C	EG	272	EPRI NP-7147-SL	Confirmed
133	1	EDG	93TD6-1EDGD12	EDG D ENGINE START BYPASS INTERLOCK RELAY	AMERACE CORP	E7014PC004	93ECP-D	EG	272	EPRI 3002002997	Confirmed

No.	Unit	Component					Enclosure			Component Evaluation	
		System	Relay ID	Component Description[1]	Manufacturer	Model[2]	Cab/Rack/ Panel	Bldg	Elev	Basis for Capacity	Evaluation Result
134	1	EDG	93TD8M-1EDGA13	EDG A & EDG C FORCE PARALLEL LOGIC RELAY	AMERACE CORP	E7014PC	93FPAC	EG	272	EPRI 3002002997	Confirmed
135	1	EDG	93TD8M-1EDGB13	EDG B & EDG D FORCE PARALLEL LOGIC RELAY	AMERACE CORP	E7014PC	93FPBD	EG	272	EPRI 3002002997	Confirmed
136	1	EDG	93TD9M -1EDGB13	EDG B & EDG D FORCE PARALLEL LOGIC RELAY	AMERACE CORP	E7014PC	93FPBD	EG	272	EPRI 3002002997	Confirmed
137	1	EDG	93TD9M-1EDGA13	EDG A & EDG C FORCE PARALLEL LOGIC RELAY	AMERACE CORP	E7014PC	93FPAC	EG	272	EPRI 3002002997	Confirmed
138	1	EDG	93TD9X-1EDGA13	EDG A AND C FORCE PARALLEL LOGIC RELAY	GENERAL ELECTRIC CO SQUARE D	CR2811 8501XUDO0705V63 Y414	93FPAC	EG	272	EPRI TR-105988-V2 EPRI 3002002997	Confirmed Confirmed
139	1	EDG	93TD9X-1EDGB13	EDG B AND D FORCE PARALLEL LOGIC RELAY	GENERAL ELECTRIC CO SQUARE D	CR2811 8501XUDO	93FPBD	EG	272	EPRI TR-105988-V2 EPRI 3002002997	Confirmed Confirmed
140	1	EDG	93TS-3A	EDG A JACKET WATER HIGH TEMP SHUTDOWN SWITCH	SQUARE D ENGINE SYSTEMS, INC ENGINE SYSTEMS, INC	9025 9544836 8/12/2009 ESI50415 12/10/2010	N/A	EG	272	SQURTS EPRI NP-5223-SLR1 EPRI NP-5223-SLR1	Confirmed Confirmed Confirmed
141	1	EDG	93TS-3B	EDG B JACKET WATER HIGH TEMP SHUTDOWN SWITCH	SQUARE D ENGINE SYSTEMS, INC	9025 9544836 8/12/2009	N/A	EG	272	SQURTS EPRI NP-5223-SLR1	Confirmed Confirmed

No.	Unit	Component					Enclosure			Component Evaluation	
		System	Relay ID	Component Description[1]	Manufacturer	Model[2]	Cab/Rack/ Panel	Bldg	Elev	Basis for Capacity	Evaluation Result
142	1	EDG	93TS-3C	EDG C JACKET WATER HIGH TEMP SHUTDOWN SWITCH	SQUARE D ENGINE SYSTEMS, INC	9025 9544836 8/12/2009	N/A	EG	272	SQURTS EPRI NP-5223-SLR1	Confirmed Confirmed
143	1	EDG	93TS-3D	EDG D JACKET WATER HIGH TEMP SHUTDOWN SWITCH	SQUARE D ENGINE SYSTEMS, INC	9025 9544836 8/12/2009	N/A	EG	272	SQURTS EPRI NP-5223-SLR1	Confirmed Confirmed
144	1	RCIC	02F-K3A	RCIC STEAM LEAK DETECTION HIGH TEMP TRIP RELAY	GENERAL ELECTRIC CO	12HGA11J70	09-21	CR	300	EPRI 3002002997	Confirmed
145	1	RCIC	02F-K3B	RCIC STEAM LEAK DETECTION HIGH TEMP TRIP RELAY	GENERAL ELECTRIC CO	12HGA11J70	09-21	CR	300	EPRI 3002002997	Confirmed
146	1	RCIC	13A-K113A	LOGIC RELAY	AGASTAT RELAY (AMERACE)	EGPBC2004003	09-95	RR	284	EPRI 3002002997	Confirmed
147	1	RCIC	13A-K113B	LOGIC RELAY	AGASTAT RELAY (AMERACE)	EGPBC2004003	09-96	RR	284	EPRI 3002002997	Confirmed
148	1	RCIC	13A-K114A	LOGIC RELAY	AGASTAT RELAY (AMERACE)	EGPBC2004003	09-95	RR	284	EPRI 3002002997	Confirmed
149	1	RCIC	13A-K114B	LOGIC RELAY	AGASTAT RELAY (AMERACE)	EGPBC2004003	09-96	RR	284	EPRI 3002002997	Confirmed
150	1	RCIC	13A-K115A	LOGIC RELAY	AGASTAT RELAY (AMERACE)	EGPBC2004003	09-95	RR	284	EPRI 3002002997	Confirmed
151	1	RCIC	13A-K115B	LOGIC RELAY	AGASTAT RELAY (AMERACE)	EGPBC2004003	09-96	RR	284	EPRI 3002002997	Confirmed

No.	Unit	Component					Enclosure	Bldg	Elev	Component Evaluation	
		System	Relay ID	Component Description[1]	Manufacturer	Model[2]	Cab/Rack/ Panel			Basis for Capacity	Evaluation Result
152	1	RCIC	13A-K116A	LOGIC RELAY	AGASTAT RELAY (AMERACE)	EGPBC2004003	09-95	RR	284	EPRI 3002002997	Confirmed
153	1	RCIC	13A-K116B	LOGIC RELAY	AGASTAT RELAY (AMERACE)	EGPBC2004003	09-96	RR	284	EPRI 3002002997	Confirmed
154	1	RCIC	13A-K12	LOGIC RELAY	GENERAL ELECTRIC CO	12HGA11A52F	09-30	RR	284	EPRI NP-7147-SL	Confirmed
155	1	RCIC	13A-K125A	LOGIC RELAY	AGASTAT RELAY (AMERACE)	EGPBC2004003	09-95	RR	284	EPRI 3002002997	Confirmed
156	1	RCIC	13A-K125B	LOGIC RELAY	AGASTAT RELAY (AMERACE)	EGPBC2004003	09-96	RR	284	EPRI 3002002997	Confirmed
157	1	RCIC	13A-K126A	LOGIC RELAY	AGASTAT RELAY (AMERACE)	EGPBC2004003	09-95	RR	284	EPRI 3002002997	Confirmed
158	1	RCIC	13A-K126B	LOGIC RELAY	AGASTAT RELAY (AMERACE)	EGPBC2004003	09-96	RR	284	EPRI 3002002997	Confirmed
159	1	RCIC	13A-K15	LOGIC RELAY	GENERAL ELECTRIC CO	12HFA151A2F	09-30	RR	284	EPRI 3002002997	Confirmed
160	1	RCIC	13A-K29	LOGIC RELAY	GENERAL ELECTRIC CO	12HGA11A52F	09-30	RR	284	EPRI NP-7147-SL	Confirmed
161	1	RCIC	13A-K32	LOGIC RELAY	GENERAL ELECTRIC CO	12HGA11A52F	09-33	RR	284	EPRI NP-7147-SL	Confirmed
162	1	RCIC	13A-K33	LOGIC RELAY	GENERAL ELECTRIC CO	12HFA151A2F	09-33	RR	284	EPRI 3002002997	Confirmed

		Component					Enclosure			Component Evaluation	
No.	Unit	System	Relay ID	Component Description[1]	Manufacturer	Model[2]	Cab/Rack/ Panel	Bldg	Elev	Basis for Capacity	Evaluation Result
163	1	RCIC	13A-K39	LOGIC RELAY	GENERAL ELECTRIC CO	12HGA11A52F	09-33	RR	284	EPRI NP-7147-SL	Confirmed
164	1	RCIC	13A-K49	LOGIC RELAY	GENERAL ELECTRIC	IC2800-1607AD	09-30	RR	284	EPRI NP-5223-SLR1	Confirmed
165	1	RCIC	13A-K6	LOGIC RELAY	GENERAL ELECTRIC CO	12HGA11A52F	09-30	RR	284	EPRI NP-7147-SL	Confirmed
166	1	RCIC	13A-K7	LOGIC RELAY	GENERAL ELECTRIC CO	12HGA11A52F	09-30	RR	284	EPRI NP-7147-SL	Confirmed
167	1	RCIC	13A-K8	LOGIC RELAY	GENERAL ELECTRIC CO	12HGA11A52F	09-30	RR	284	EPRI NP-7147-SL	Confirmed
168	1	RCIC	13PS-67A	RCIC PUMP INLET LOW PRESS SWITCH	STATIC-O-RING (SOR)	54N6-B118-M9-C1A-JJTTNQ	25-58	RB	242	SQURTS	Confirmed
169	1	RCIC	13PS-72A	RCIC TURB EXH DISCH TO SUPPR POOL PRESS SWITCH	STATIC-O-RING (SOR)	6N6-B3-U8-C1A-JJTTNQ	25-58	RB	242	SQURTS	Confirmed
170	1	RCIC	13PS-72B	RCIC TURB EXH DISCH TO SUPPR POOL PRESS SWITCH	STATIC-O-RING (SOR)	6N6-B3-U8-C1A-JJTTNQ	25-58	RB	242	SQURTS	Confirmed
171	1	RCIC	13PS-78A	RCIC TURB EXH RUPTURE DISC PRESS SWITCH	STATIC-O-RING (SOR)	4N6-B5-NX-C1A-JJTTX6	25-58	RB	242	SQURTS	Confirmed
172	1	RCIC	13PS-78B	RCIC TURB EXH RUPTURE DISC PRESS SWITCH	STATIC-O-RING (SOR)	4N6-B5-NX-C1A-JJTTX6	25-58	RB	242	SQURTS	Confirmed
173	1	RCIC	13PS-78C	RCIC TURB EXH RUPTURE DISC PRESS SWITCH	STATIC-O-RING (SOR)	4N6-B5-NX-C1A-JJTTX6	25-58	RB	242	SQURTS	Confirmed
174	1	RCIC	13PS-78D	RCIC TURB EXH RUPTURE DISC PRESS SWITCH	STATIC-O-RING (SOR)	4N6-B5-NX-C1A-JJTTX6	25-58	RB	242	SQURTS	Confirmed

Table B-2: Reactor Coolant Leak Path Valve Identification for High Frequency Confirmation

SYSTEM	VALVE	DESCRIPTION	RELAY FOR HFC
HPCI	23MOV-15	HPCI Turbine Steam Supply Inboard Containment Isolation Valve	NONE
HPCI	23MOV-16	HPCI Turbine Steam Supply Outboard Containment Isolation Valve	NONE
HPCI	23MOV-60	HPCI Turbine Steam Supply Outboard Containment Isolation Bypass Valve	NONE
RCIC	13MOV-15	RCIC Steam Supply Inboard Containment Isolation Valve	NONE
RCIC	13MOV-16	RCIC Steam Supply Outboard Containment Isolation Valve	NONE
CS	14SOV-13A	CS Reactor Isolation Testable Check Valve	NONE
CS	14AOV-13A	CS Reactor Isolation Testable Check Valve	N/A
CS	14SOV-13B	CS Reactor Isolation Testable Check Valve	NONE
CS	14AOV-13B	CS Reactor Isolation Testable Check Valve	N/A
RHR	10SOV-68A	RHR Testable LPCI Check Valve	NONE
RHR	10AOV-68A	RHR Testable LPCI Check Valve	N/A
RHR	10SOV-68B	RHR Testable LPCI Check Valve	NONE
RHR	10AOV-68B	RHR Testable LPCI Check Valve	N/A
RHR	10MOV-18	RHR Shutdown Cooling Inboard Isolation Valve	NONE
RHR	10MOV-17	RHR Shutdown Cooling Outboard Isolation Valve	NONE
SLC	11SLC-17	Standby Liquid Control Inboard Isolation Check Valve	N/A
RWCU	12MOV-15	RWCU suction Inboard Containment Isolation Valve	NONE
RWCU	12MOV-18	RWCU suction Outboard Containment Isolation Valve	NONE
SRV/ADS	02SOV-71A1	Automatic opening SOV for SRV	NONE
SRV	02SOV-71A2	Manual opening SOV for SRV	NONE
SRV	02RV-71A	Safety Relief Valve	N/A

SYSTEM	VALVE	DESCRIPTION	RELAY FOR HFC
SRV/ADS	02SOV-71B1	Automatic opening SOV for SRV	NONE
SRV	02SOV-71B2	Manual opening SOV for SRV	NONE
SRV	02RV-71B	Safety Relief Valve	N/A
SRV/ADS	02SOV-71C1	Automatic opening SOV for SRV	NONE
SRV	02SOV-71C2	Manual opening SOV for SRV	NONE
SRV	02RV-71C	Safety Relief Valve	N/A
SRV/ADS	02SOV-71D1	Automatic opening SOV for SRV	NONE
SRV	02SOV-71D2	Manual opening SOV for SRV	NONE
SRV	02RV-71D	Safety Relief Valve	N/A
SRV/ADS	02SOV-71E1	Automatic opening SOV for SRV	NONE
SRV	02SOV-71E2	Manual opening SOV for SRV	NONE
SRV	02RV-71E	Safety Relief Valve	N/A
SRV	02SOV-71F1	Automatic opening SOV for SRV	NONE
SRV	02SOV-71F2	Manual opening SOV for SRV	NONE
SRV	02RV-71F	Safety Relief Valve	N/A
SRV/ADS	02SOV-71G1	Automatic opening SOV for SRV	NONE
SRV	02SOV-71G2	Manual opening SOV for SRV	NONE
SRV	02RV-71G	Safety Relief Valve	N/A
SRV/ADS	02SOV-71H1	Automatic opening SOV for SRV	NONE
SRV	02SOV-71H2	Manual opening SOV for SRV	NONE
SRV	02RV-71H	Safety Relief Valve	N/A
SRV	02SOV-71J1	Automatic opening SOV for SRV	NONE

SYSTEM	VALVE	DESCRIPTION	RELAY FOR HFC
SRV	02SOV-71J2	Manual opening SOV for SRV	NONE
SRV	02RV-71J	Safety Relief Valve	N/A
SRV	02SOV-71K1	Automatic opening SOV for SRV	NONE
SRV	02SOV-71K2	Manual opening SOV for SRV	NONE
SRV	02RV-71K	Safety Relief Valve	N/A
SRV	02SOV-71L1	Automatic opening SOV for SRV	NONE
SRV	02SOV-71L2	Manual opening SOV for SRV	NONE
SRV	02RV-71L	Safety Relief Valve	N/A
FW	34FWS-28A	Feedwater "A" Line Inboard Isolation Check Valve	N/A
FW	34FWS-28B	Feedwater "B" Line Inboard Isolation Check Valve	N/A
MS	29SOV-80A1	MSIV Test SOV	NONE
MS	29SOV-80A2	MSIV AC Closure SOV	NONE
MS	29SOV-80A3	MSIV DC Closure SOV	NONE
MS	29AOV-80A	Main Steamline Isolation Valve	N/A
MS	29SOV-80B1	MSIV Test SOV	NONE
MS	29SOV-80B2	MSIV AC Closure SOV	NONE
MS	29SOV-80B3	MSIV DC Closure SOV	NONE
MS	29AOV-80B	Main Steamline Isolation Valve	N/A
MS	29SOV-80C1	MSIV Test SOV	NONE
MS	29SOV-80C2	MSIV AC Closure SOV	NONE
MS	29SOV-80C3	MSIV DC Closure SOV	NONE
MS	29AOV-80C	Main Steamline Isolation Valve	N/A

SYSTEM	VALVE	DESCRIPTION	RELAY FOR HFC
MS	29SOV-80D1	MSIV Test SOV	NONE
MS	29SOV-80D2	MSIV AC Closure SOV	NONE
MS	29SOV-80D3	MSIV DC Closure SOV	NONE
MS	29AOV-80D	Main Steamline Isolation Valve	N/A
MS	29MOV-74	Main Steamline Drain Inboard Valve	42/O
MS	29MOV-77	Main Steamline Drain Outboard Valve	42/2O
NB	02SOV-17	Reactor Vent Valve SOV	NONE
NB	02AOV-17	Reactor Vent Valve	N/A
NB	02SOV-18	Reactor Vent Valve SOV	NONE
NB	02AOV-18	Reactor Vent Valve	N/A
RWR	02-2RWR-13A	Mini-Purge Check Valve	N/A
RWR	02-2RWR-13B	Mini-Purge Check Valve	N/A
RWR	02-2SOV-39	Recirculation Pump Sampling Line Inboard Containment Isolation Valve	NONE
RWR	02-2AOV-39	Recirculation Pump Sampling Line Inboard Containment Isolation Valve	N/A
RWR	02-2SOV-40	Recirculation Pump Sampling Line Outboard Containment Isolation Valve	NONE
RWR	02-2AOV-40	Recirculation Pump Sampling Line Outboard Containment Isolation Valve	N/A
CRD	03SOV-120	HCU Control Rod Withdrawal Valve	NONE
CRD	03SOV-122	HCU Control Rod Withdrawal Valve	NONE
CRD	03SOV-121	HCU Control Rod Insertion Valve	NONE
CRD	03SOV-123	HCU Control Rod Insertion Valve	NONE
CRD	03SOV-117	HCU Control Rod Scram Valve	NONE
CRD	03SOV-118	HCU Control Rod Scram Valve	NONE

SYSTEM	VALVE	DESCRIPTION	RELAY FOR HFC
CRD	03AOV-126	HCU Control Rod Scram Valve	N/A
CRD	03AOV-127	HCU Control Rod Scram Valve	N/A
CRD	03HCU-138	HCU CRDM Cooling Water Check Valve	N/A