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SCE&G® A SCANA COMPANY

December 17, 2014
RC-14-0197

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

Dear Sir/Madam:

Subject: VIRGIL C. SUMMER NUCLEAR STATION (VCSNS) UNIT 1
DOCKET NO. 50-395
OPERATING LICENSE NO. NPF-12
SOUTH CAROLINA ELECTRIC & GAS (SCE&G) EXPEDITED SEISMIC EVALUATION PROCESS REPORT (CEUS SITES), RESPONSE TO NRC REQUEST FOR INFORMATION PURSUANT TO 50.54(f) REGARDING RECOMMENDATION 2.1 OF THE NEAR-TERM TASK FORCE REVIEW OF INSIGHTS FROM THE FUKUSHIMA DAI-ICHI ACCIDENT

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*, dated March 12, 2012

2. NEI Letter, *Proposed Path Forward for NTTF Recommendation 2.1: Seismic Reevaluations*, dated April 9, 2013, ADAMS Accession No. ML13101A379

3. NRC Letter, *Electric Power Research Institute Report 3002000704, "Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic," as an Acceptable Alternative to the March 12, 2012, Information Request for Seismic Reevaluations*, dated May 7, 2013, ADAMS Accession No. ML13106A331

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued a 50.54(f) letter to all power reactor licensees and holders of construction permits in active or deferred status. Enclosure 1 of Reference 1 requested each addressee located in the Central and Eastern United States (CEUS) to submit a Seismic Hazard Evaluation and Screening Report within 1.5 years from the date of Reference 1.

In Reference 2, the Nuclear Energy Institute (NEI) requested NRC agreement to delay submittal of the final CEUS Seismic Hazard Evaluation and Screening Reports so that an update to the Electric Power Research Institute (EPRI) ground motion attenuation model could be completed and used to develop that information. NEI proposed that descriptions of subsurface materials and properties and base case velocity profiles be submitted to the NRC by September 12, 2013, with the remaining seismic hazard and screening information submitted by March 31, 2014. NRC agreed with that proposed path forward in Reference 3.

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NRR

Reference 1 requested that licensees provide interim evaluations and actions taken or planned to address the higher seismic hazard relative to the design basis, as appropriate, prior to completion of the risk evaluation. In accordance with the NRC endorsed guidance in Reference 3, the attached Expedited Seismic Evaluation Process Report for VCSNS provides the information described in Section 7 of Reference 3 in accordance with the schedule identified in Reference 2.

This letter contains new regulatory commitments. These regulatory commitments are listed in Attachment I Section 8.4 Summary of Regulatory Commitments and Attachment II Regulatory Commitments.

Should you have any questions concerning the content of this letter, please contact Bruce L. Thompson at (803) 931-5042.

I declare under penalty of perjury that the foregoing is true and correct.

12/17/14
Executed on

Thomas D. Gatlin

BJD/TDG/wt

Attachments:
I. Expedited Seismic Evaluation Process Report for V.C. Summer Nuclear Station
II. Regulatory Commitments

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RTS (CR-12-01097)
File (815.07)
PRSF (RC-14-0197)

VIRGIL C. SUMMER NUCLEAR STATION (VCSNS) UNIT 1

Attachment I

Expedited Seismic Evaluation Process Report for V.C. Summer Nuclear Station

SOUTH CAROLINA ELECTRIC & GAS COMPANY

VIRGIL C. SUMMER NUCLEAR STATION UNIT 1

NUCLEAR OPERATIONS

NUCLEAR OPERATIONS

COPY NO. ___________

ENGINEERING SERVICES TECHNICAL REPORT

TR00080-005

Expedited Seismic Evaluation Process Report for V.C. Summer Nuclear Station

REVISION 0

Jeremy Graham ORIGINATOR	12/10/14 DATE
Dale Krause REVIEWER	12/11/14 DATE
Craig A. Calvert APPROVAL AUTHORITY	12/15/2014 DATE

RECORD OF CHANGES

CHANGE LETTER	TYPE CHANGE	APPROVAL DATE	CANCELLATION DATE	CHANGE LETTER	TYPE CHANGE	APPROVAL DATE	CANCELLATION DATE

Expedited Seismic Evaluation Process Report for V.C. Summer Nuclear Station

Table of Contents

Attachments:

1.0 Purpose and Objective

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. Depending on the comparison between the reevaluated seismic hazard and the current design basis, further risk assessment may be required. Assessment approaches acceptable to the staff include a seismic probabilistic risk assessment (SPRA), or a seismic margin assessment (SMA). Based upon the assessment results, the NRC staff will determine whether additional regulatory actions are necessary.

This report describes the Expedited Seismic Evaluation Process (ESEP) undertaken for V.C. Summer Nuclear Station Unit 1 (VCSNS). The intent of the ESEP is to perform an interim action in response to the NRC's 50.54(f) letter [1] to demonstrate seismic margin through a review of a subset of the plant equipment that can be relied upon to protect the reactor core following beyond design basis seismic events.

The ESEP is implemented using the methodologies in the NRC endorsed guidance in EPRI 3002000704, *Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic* [2].

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

2.0 Brief Summary of the FLEX Seismic Implementation Strategies

The VCSNS FLEX response strategies for reactor core cooling and heat removal, reactor inventory control/long-term subcriticality, core cooling and heat removal (Modes 5 and 6) and containment function are summarized below. This summary is derived from the VCSNS Overall Integrated Plan (OIP) and subsequent updates in Response to the March 12, 2012, Commission Order EA-12-049 [3a-e]. A simplified diagram of the fluid paths can be found in Figure 11 of the latest OIP [3e], "FLEX Strategy Conceptual Mechanical Diagram."

Reactor core cooling and heat removal is achieved via steam release from the Steam Generators (SGs) with SG makeup from the Turbine Driven Emergency Feedwater Pump

(TDEFP) during FLEX Phase 1 with suction from the Condensate Storage Tank (CST). Maintaining core cooling and heat removal will rely upon the continued operation of the TDEFP, which is capable of feeding the steam generators as long as there is an ample steam supply to drive the TDEFP's turbine.

During Phase 2 and beyond, the reactor core cooling strategy is to connect and repower a Motor Driven Emergency Feedwater Pump (MDEFP) for injection into the steam generators in the event that the TDEFP fails or when ample steam is no longer available to drive the TDEFP's turbine. The Emergency Feed Water flow control valves and Main Steam (MS) Power-Operated Relief Valves (PORVs) are also required to provide reactor core heat-removal capability. The portable Phase 2 reactor core heat removal is achieved via the credited B.5.b connection or via the new FLEX mechanical connections located in the Intermediate Building. The Phase 2 strategy only requires manipulation of manual valves.

Reactor inventory control/long-term subcriticality strategy from normal operation and Modes 5 and 6 conditions consists of a portable reactor coolant system makeup pump taking suction from the Boric Acid Tanks and supplying borated water via Reactor Coolant System (RCS) make-up connections.

RCS inventory control relies upon shrink, passive reactor coolant pump seal leakage, and letdown via head-vents and/or PORVs. The reactor coolant pump seal leak-off is manually isolated to conserve inventory and maintain leak-off flow within the Reactor Building. To ensure SG continued heat removal capability, accumulator isolation valves are electrically closed during the cooldown to prevent nitrogen injection into the reactor coolant system.

There are no Phase 1 or Phase 2 FLEX actions to maintain containment integrity. Phase 3 entails repowering select reactor building cooling unit (RBCU) fans inside of containment using portable generators. Cooling water is provided via a portable pump with suction from the Service Water Pond discharging to new manually operated service water makeup connections to the RBCUs.

Necessary electrical components are outlined in the VCSNS FLEX OIP submittal [3e]. The strategy entails utilizing two portable 1MW generators to repower a 7.2 kV vital bus and subsequently repowering an MDEFP, 480 V motor control centers, an RBCU fan, vital batteries and associated chargers, as well as monitoring instrumentation required for core cooling, reactor coolant inventory, and containment integrity.

3.0 Equipment Selection Process and ESEL

The selection of equipment for the Expedited Seismic Equipment List (ESEL) followed the guidelines of EPRI 3002000704 [2]. The ESEL for Unit 1 is presented in Attachment A. Development of the ESEL is documented in Westinghouse correspondence "V. C. Summer Unit 1 Expedited Seismic Equipment List" [19], whereas the final ESEL is documented in attachment 5 to Westinghouse Correspondence LTR-RAM-I-14-064, Revision 1 [20].

3.1 Equipment Selection Process and ESEL

The selection of equipment to be included on the ESEL was based on installed plant equipment credited in the FLEX strategies during Phase 1, 2 and 3 mitigation of a Beyond Design Basis External Event (BDBEE), as outlined in the latest VCSNS OIP [3e] in Response to the March 12, 2012, Commission Order EA-12-049. The OIP provides the VCSNS FLEX mitigation strategy and serves as the basis for equipment selected for the ESEP.

The scope of "installed plant equipment" includes equipment relied upon for the FLEX strategies to sustain the critical functions of core cooling and containment integrity consistent with the VCSNS OIP [3e]. FLEX recovery actions are excluded from the ESEP scope per EPRI 3002000704 [2]. The overall list of planned FLEX modifications and the scope for consideration herein is limited to those required to support core cooling, reactor coolant inventory and subcriticality, and containment integrity functions. Portable and pre-staged FLEX equipment (not permanently installed) are excluded from the ESEL per EPRI 3002000704 [2].

The ESEL component selection followed the EPRI guidance outlined in Section 3.2 of EPRI 3002000704 [2].

1. The scope of components is limited to that required to accomplish the core cooling and containment safety functions identified in Table 3-2 of EPRI 3002000704 [2]. The instrumentation monitoring requirements for core cooling/containment safety functions are limited to those outlined in the EPRI 3002000704 [2] guidance, and are a subset of those outlined in the VCSNS OIP [3e].
2. The scope of components is limited to installed plant equipment and FLEX connections necessary to implement the VCSNS OIP [3e] as described in Section 2.
3. The scope of components assumes the credited FLEX connection modifications are implemented, and are limited to those required to support a single FLEX success path (i.e., either "Primary" or "Back-up/Alternate").
4. The "Primary" FLEX success path is to be specified. Selection of the "Back-up/Alternate" FLEX success path must be justified.
5. Phase 3 coping strategies are included in the ESEP scope, whereas recovery strategies are excluded.
6. Structures, systems, and components excluded per the EPRI 3002000704 [2] guidance are:
   - Structures (e.g. containment, reactor building, control building, auxiliary building, etc.)
   - Piping, cabling, conduit, Heating, Ventilation, and Air Conditioning (HVAC), and their supports.
   - Manual valves, check valves, and rupture disks, except for manual valves that are required to change state as part of the FLEX mitigation strategies and are operated using reach rods.

- Power-operated valves not required to change state as part of the FLEX mitigation strategies.
- Nuclear Steam Supply System (NSSS) components (e.g., Reactor Vessel (RV) and internals, Reactor Coolant Pumps (RCPs) and seals, etc.)
- Very small passive components such as line-mounted strainers, accumulators, and orifices.
- Portions of systems that are not used as transport mechanisms for delivering required flows, such as components beyond boundary valves.
- Electrical equipment not specifically relied upon to perform the FLEX functions, such as power sources and distribution not directly supporting FLEX active components.
- Controls for which plant procedures provide instructions for manual operation (in the event of control system, component, permissive, or interlock failures) that ensure performance of the FLEX function.
- Portions of installed equipment (and FLEX connections) that are not relied upon in the FLEX strategy to sustain the critical functions of core cooling and containment integrity (according to Section 3.2 within Reference 2, and Tables D-1 and D-2 within Reference 21).

7. For cases in which neither train was specified as a primary or back-up strategy, only one train component (generally 'A' train) is included in the ESEL.

3.1.1 ESEL Development

The ESEL was developed by reviewing the VCSNS OIP [3a-e] to determine the major equipment involved in the FLEX strategies. Further reviews of plant drawings (e.g., Piping and Instrumentation Diagrams (P&IDs) and Electrical One Line Diagrams) were performed to identify the boundaries of the flow paths to be used in the FLEX strategies and to identify specific components in the flow paths needed to support implementation of a single success path for the FLEX strategies supporting the core cooling and containment integrity FLEX functions.

Boundaries were established at an electrical or mechanical isolation device (e.g., isolation amplifier, valve, etc.) in branch circuits/branch lines off the defined strategy electrical or fluid flow path. P&IDs were the primary reference documents used to identify mechanical components and instrumentation. The flow paths used for FLEX strategies were selected and specific components were identified using detailed equipment and instrument drawings, piping isometrics, electrical schematics and one-line drawings, system descriptions, design basis documents, etc., as necessary. The P&IDs were also used to determine the normal position of system valves and the valve positioning required in order to align the system in support of the FLEX functions. Isometric drawings were used to determine if any manual valves required to operate in support of the FLEX functions can be operated using reach rods, since manual valves with reach rods must be included on the ESEL.

The electrical equipment required to support the mechanical components used in the FLEX strategies evaluated for the ESEL was evaluated for its inclusion on the ESEL using electrical drawings and the guidance in [2], Section 3.

3.1.2 Power Operated Valves

Page 3-3 of EPRI 3002000704 [2] notes that power operated valves not required to change state are excluded from the ESEL. Page 3-2 of EPRI 3002000704 [2] also notes that "functional failure modes of electrical and mechanical portions of the installed Phase 1 equipment should be considered (e.g., RCIC/AFW trips)." To address this concern, the following guidance is applied in the VCSNS ESEL for functional failure modes associated with power operated valves:

- Power operated valves that remain energized during the Extended Loss of all AC Power (ELAP) events (such as DC powered valves), were included on the ESEL.
- Power operated valves not required to change state as part of the FLEX mitigation strategies were not included on the ESEL. The seismic event also causes the ELAP event; therefore, the valves are incapable of spurious operation, as they would be de-energized.
- Power operated valves not required to change state as part of the FLEX mitigation strategies during Phase 1, and are re-energized and operated during subsequent Phase 2 and 3 strategies, were not evaluated for spurious valve operation, as the seismic event that caused the ELAP has passed before the valves are re-powered.

3.1.3 Pull Boxes

Pull boxes were deemed unnecessary to add to the ESELs, as these components provide completely passive locations for pulling or installing cables. No breaks or connections in the cabling are included in pull boxes. Pull boxes were considered part of conduit and cabling, which are excluded in accordance with EPRI 3002000704 [2].

3.1.4 Termination Cabinets

Termination cabinets, including cabinets necessary for FLEX Phase 2 and Phase 3 connections, provide consolidated locations for permanently connecting multiple cables. The termination cabinets and the internal connections provide a completely passive function; however, the cabinets are included in the ESEL to ensure industry knowledge on panel/anchorage failure vulnerabilities is addressed.

Examples of termination cabinets on the VCSNS ESEL include the XPN-7100 series. Items #138 and 142-150 within Attachment A are several examples of termination cabinets included on the ESEL.

3.1.5 Critical Instrumentation Indicators

Critical indicators and recorders are typically physically located on panels/cabinets and are included as separate components; however, seismic evaluation of the instrument indication may be included in the panel/cabinet seismic evaluation (rule-of-the-box).

All main control board panels (XCP-6100 series) fall in this category and are on the electrical ESEL for VCSNS. Examples within Attachment A include items #59, 61, 62, 66, 67, 177, 178, 179, 180, and 181.

3.1.6 Phase 2 and Phase 3 Piping Connections

Item 2 in Section 3.1 above notes that the scope of equipment in the ESEL includes "... FLEX connections necessary to implement the VCSNS OIP [3e] as described in Section 2." Item 3 in Section 3.1 also notes that "The scope of components assumes the credited FLEX connection modifications are implemented, and are limited to those required to support a single FLEX success path (i.e., either "Primary" or "Back-up/Alternate")."

Item 6 in Section 3.1 above goes on to explain that "Piping, cabling, conduit, HVAC, and their supports" are excluded from the ESEL scope in accordance with EPRI 3002000704 [2].

Therefore, piping and pipe supports associated with FLEX Phase 2 and Phase 3 connections are excluded from the scope of the ESEP evaluation. However, any active valves in FLEX Phase 2 and Phase 3 connection flow path are included in the ESEL.

3.2 Justification for Use of Equipment That Is Not the Primary Means for FLEX Implementation

The primary flow paths for the Steam Generator (SG) makeup, Emergency Feedwater (EFW) steam supply, and containment integrity FLEX strategies were used for ESEL development, while the alternate flow path for the RCS makeup FLEX strategy was used rather than the primary flow path. The alternate flow path for RCS makeup, a portable makeup pump, meets the requirements of NEI 12-06 for use following a seismic event; however, the electrical supply for the primary flow path for RCS makeup is not seismically qualified and thus cannot be credited.

The VCSNS OIP [3e] provides two redundant primary means for providing RCS Inventory Control. From the VCSNS OIP [3e], "...RCS inventory and reactivity control involve use of the station's installed Alternate Seal Injection (ASI) positive-displacement (PD) pump or an on-site portable Reactor Makeup FLEX pump, referred to as the FX RCS MU PUMP".

The VCSNS strategy for RCS inventory control and boration strategy is to utilize the ASI pump for RCS injection, if the pump is running immediately after the ELAP. This method allows for minimal operator action and prevents damage to the RCP seals. It could take up to an hour before an ELAP is declared. The Emergency Operating

Procedures (EOP) have a step to identify if the ASI pump is running. If not, then the RCS makeup pump would be identified as the alternative/preferred method and made ready when manpower is available or before 17 hours. The use of a portable RCS makeup pump to an identified RCS connection point is the VCSNS credited seismic strategy for RCS inventory control and boration.

The complete ESEL for VCSNS is presented in Attachment A.

4.0 Ground Motion Response Spectrum (GMRS)

4.1 Plot of GMRS Submitted by SCE&G

The Rock Safe Shutdown Earthquake (SSE) Control Point is defined as top of competent rock at an approximate elevation of 350 feet, which is nominally 85 feet below plant grade elevation of 435 feet [4].

The GMRS plot and tabulated data for VCSNS are provided in Figure 4-1 and Table 4-1, respectively. Development of the VCSNS GMRS is documented in [4] and [25]. In accordance with the 50.54(f) letter and following the guidance in EPRI SPID [18], a Probabilistic Seismic Hazard Analysis (PSHA) was performed using the 2012 CEUS Seismic Source Characterization for Nuclear Facilities [22], a Regional Seismic Catalog Correction [22], and updated EPRI Ground Motion Model for the CEUS [24].

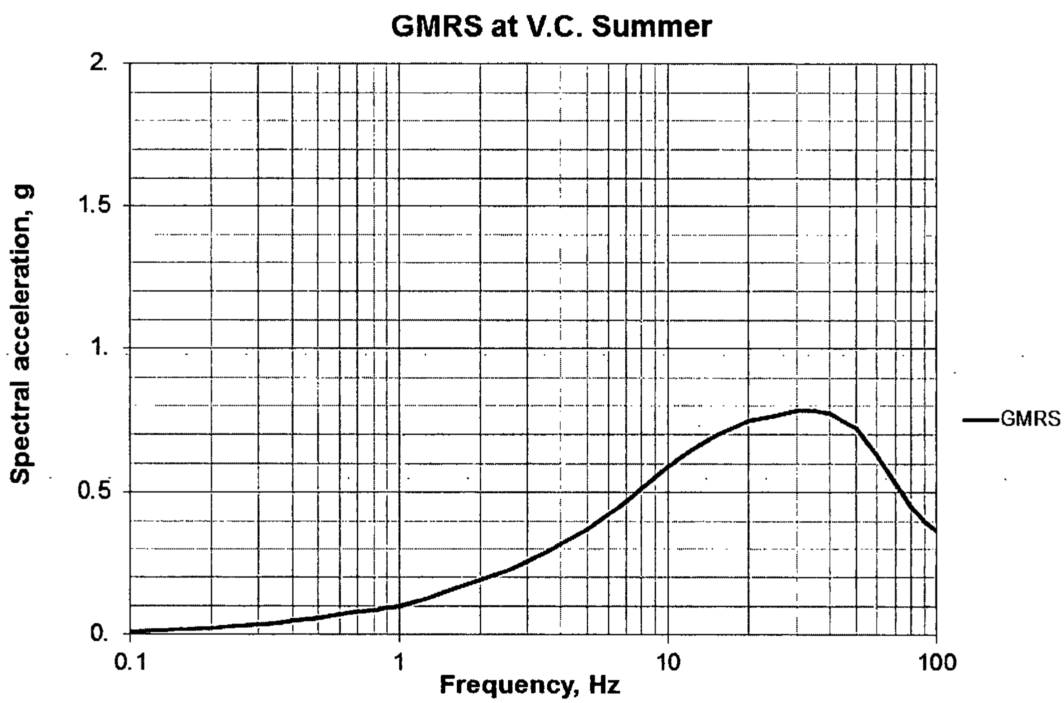

Figure 4-1: GMRS for VCSNS [4]

Table 4-1: GMRS for VCSNS [4]	
Freq. (Hz)	GMRS (g)
100	3.68E-01
90	3.98E-01
80	4.50E-01
70	5.30E-01
60	6.29E-01
50	7.20E-01
45	7.53E-01
40	7.74E-01
35	7.84E-01
30	7.82E-01
25	7.67E-01
20	7.44E-01
15	6.92E-01
12.5	6.49E-01
10	5.90E-01
9	5.54E-01
8	5.15E-01
7	4.71E-01
6	4.24E-01
5	3.73E-01
4	3.19E-01
3	2.58E-01
2.5	2.22E-01
2	1.91E-01
1.5	1.50E-01
1.25	1.25E-01
1	9.81E-02
0.9	9.30E-02
0.8	8.67E-02
0.7	7.90E-02
0.6	7.01E-02
0.5	5.98E-02
0.4	4.79E-02
0.3	3.59E-02
0.2	2.39E-02
0.167	2.00E-02
0.125	1.50E-02
0.1	1.20E-02

4.2 Comparison to SSE

The SSE is defined in terms of a Peak Ground Acceleration (PGA) and a design response spectrum. Table 4-2 shows the spectral acceleration values as a function of frequency for the 5% damped horizontal SSE. Figure 4-2 shows a comparison between the GMRS and SSE for VCSNS. In the 1 to 10 Hz part of the response spectrum, the GMRS exceeds the SSE. The GMRS also exceeds the SSE for frequencies above 10 Hz. In both frequency ranges, VCSNS screens in for a risk evaluation.

Table 4-2: SSE for VCSNS [4]

Freq. (Hz)	0.5	1	2.5	5	9	10	25	100
SA (g)	0.08	0.2	0.4	0.4	0.29	0.26	0.15	0.15

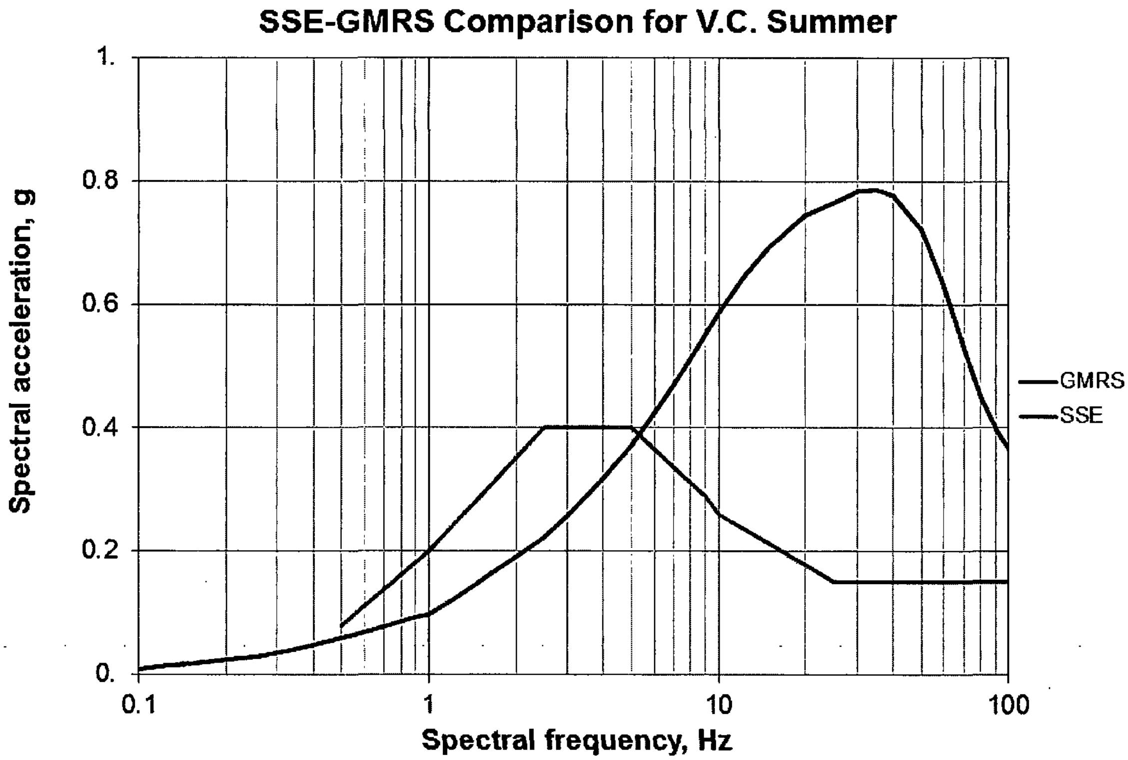

Figure 4-2: Comparison of VCSNS GMRS with SSE [4]

5.0 Review Level Ground Motion (RLGM)

5.1 Description of RLGM Selected

The RLGM was developed using Option 1 of EPRI Report 3002000704 [2] Section 4. Under this option, the RLGM is equal to the SSE scaled up by a factor.

Per Section 4 of this report, the maximum GMRS/SSE spectral ratio between 1 and 10 Hertz is equal to 2.3 and occurs at 10 Hertz. Therefore, the RLGM/SSE scale factor is equal to 2.0, which is the upper limit. The SSE and RLGM ground response spectra are plotted in Figure 5-1. The control point for the RLGM is the top of the bedrock. The high confidence of a low probability of failure (HCLPF) values reported herein are for reference to the top of bedrock control point.

For Condensate Storage Tank (CST, equipment ID XTK0008) only, the applied ground motion and HCLPF are based on the GMRS identified in Section 4 of this report. In that case, the GMRS represents the RLGM per EPRI 3002000704 [2] Section 4, Option 2. The CST is founded on a grade slab in the yard, and a soil-structure interaction analysis (SSI) was performed as part of the HCLPF analysis [11k].

The 5% damping RLGM horizontal GRS is provided in Table 5-1 and plotted in Figure 5-1. Note that the Vertical RLGM is 2/3 of horizontal RLGM.

Table 5-1: VCSNS Review Level Ground Motion Data at 5% Damping [11b]

Frequency (Hz)	Spectral Acceleration (g)
0.13	0.0122
0.55	0.2200
2.00	0.8000
6.00	0.8000
20.00	0.3000
40.00	0.3000
100.00	0.3000

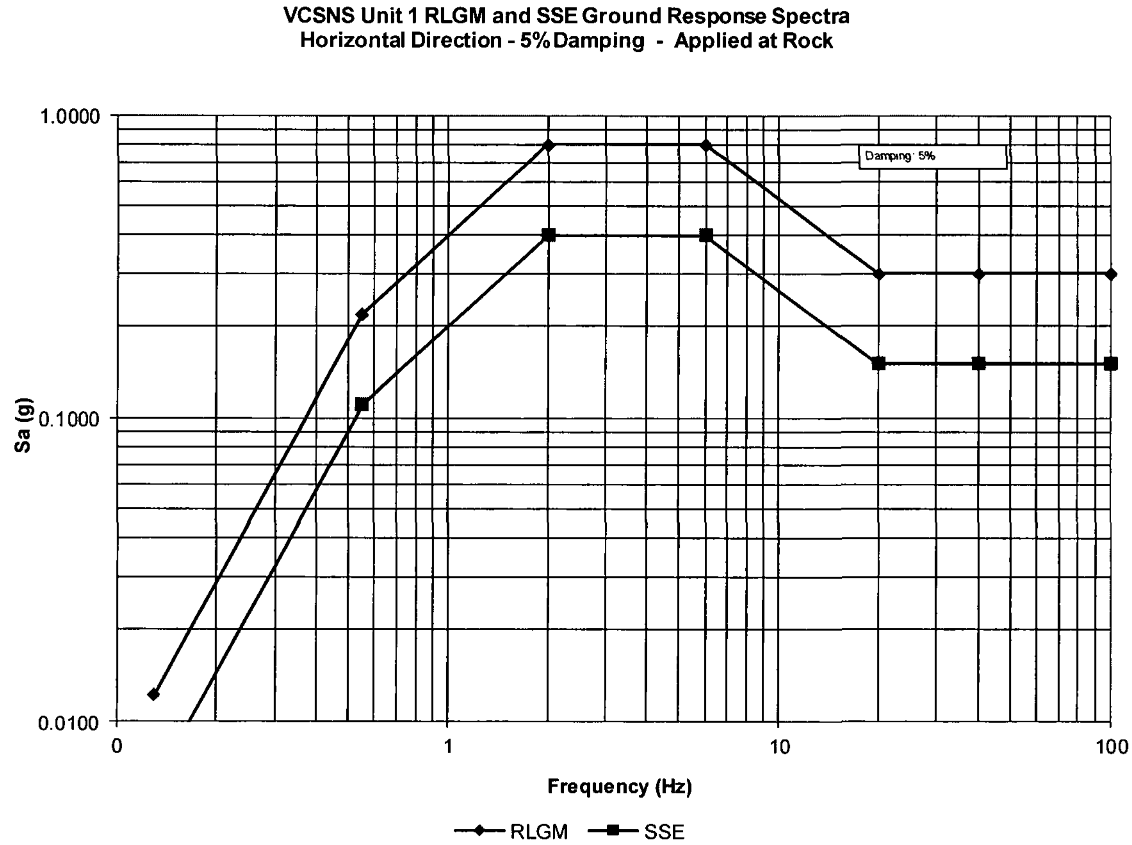

Figure 5-1: Ground Response Spectra [11b]

5.2 Method to Estimate ISRS

Plant design basis in-structure response spectra (ISRS) data are contained in plant specification SP-702-4461-00 [14]. SSE ISRS data in that document were digitized and scaled by a 2.0 factor to produce the RLGM seismic demand.

Generation of the design basis spectra is discussed in FSAR [5] Section 3.7. The SSE design basis ISRS obtained from SP-702-4461-00 are very conservative because they are based on 2% structural damping. This is because the SSE ISRS were obtained by scaling up the OBE ISRS with no credit taken for higher structural damping. A 2% damping level is conservative, but reasonable, for an OBE but is unrealistically low for beyond-SSE seismic loading. Therefore, when appropriate, the equipment HCLPF calculations for ESEP included a procedure to credit the benefit of higher effective structural damping. Further details on this topic are provided in supporting calculations [11].

6.0 Seismic Margin Evaluation Approach

The ESEP goal is to demonstrate that ESEL items have sufficient seismic capacity to meet or exceed the demand characterized by the RLGM. The seismic capacity is characterized as the PGA for which there is a HCLPF. The PGA is associated with a specific spectral shape, in this case the 5%-damped RLGM spectral shape. The HCLPF capacity must be equal to or greater than the RLGM PGA (= 0.30g). The criteria for seismic capacity determination are given in Section 5 of EPRI 3002000704 [2].

There are two basic approaches for developing HCLPF capacities:

1. Deterministic approach using the conservative deterministic failure margin (CDFM) methodology of EPRI NP-6041, A Methodology for Assessment of Nuclear Power Plant Seismic Margin (Revision 1) [6].
2. Probabilistic approach using the fragility analysis methodology of EPRI TR-103959, Methodology for Developing Seismic Fragilities [7].

6.1 Summary of Methodologies Used

The seismic margins methodology of EPRI report NP-6041-SL [6] was applied for this effort. Use of this methodology comports with the EPRI 3002000704 Section 5. The primary tasks performed were:

- Generic seismic screening per NP-6041-SL Table 2-4.
- Performance of seismic walkdowns.
- Item-specific screening via walkdown, review of design data, and performance of screening calculations.
- Performance HCLPF calculations for screened-in equipment.

6.2 HCLPF Screening Process

6.2.1 Overview

The seismic margins screening methodology of NP-6041-SL was applied. The primary steps for this screening process are:

1. Apply NP-6041-SL Table 2-4 to determine which equipment items and failure modes may be screened-out on a generic basis.
2. For each equipment item, perform a seismic walkdown to verify generic screening may be applied and to verify the item does not have any specific seismic vulnerabilities.
3. Verify anchorage capacity.

The generic screening criteria of Table 2-4 are dependent on the applied screening level and are applicable to equipment located within 40 feet of plant grade. For VCSNS ESEP project:

- The peak 5% spectral acceleration of the RLGM is 0.80g. This level is on the boundary between the 1st and 2nd screening lanes of NP-6041-SL Table 2-4. As a conservative bound the 1.2g screening criteria of Table 2-4 were applied (2nd screening lane).

- A limited number of components in the RB were located above 40' from plant grade; all other equipment was located within 40' of plant grade.

For application to the ESEP, the differences between the 1st and 2nd screening lanes of NP-601-SL Table 2-4 are modest. Table 6-1 below summarizes application of Table 2-4 screening for the ESEP. Applied plant grade was Elevation 435'. This grade elevation was also used for screening under the seismic IPEEE [13]. Per the FSAR, this grade elevation is constant throughout the power block area.

After completion of the screening process, an item is either screened-out or screened-in. The presumptive seismic capacity of a screened-out item exceeds the applied screening level and no further evaluation is needed. An item that is initially screened-in requires a HCLPF analysis to address the failure mode cited by the seismic review team (SRT). The HCLPF capacity may or may not be above the screening level.

6.2.2 Generic Screening Results

Table 6-1 summarizes the generic screening results for the ESEL. Only the relevant equipment types are listed. Based on the generic screening:

- HCLPF analyses are required for atmospheric storage tanks
- Relay chatter requires evaluation

Other generic screening requirements were addressed by walkdown, design review and anchorage verification. These assessments are documented in the screening evaluation work sheets (SEWS) [12].

Table 6-1: Summary of Generic Screening per NP-6041-SL Table 2-4, 1.2g Screening Level

Equipment Type	Generic Screening Criteria	Screening Result
Active valves	Note (f) applies.	There are no extremely large extended operators on 2-inch or smaller piping. There are no MOVs on piping lines of 2 inch diameter or smaller in the scope.
Passive valves	No evaluation required.	
Heat exchangers	Notes (h), (i) apply.	There is only one small heat exchanger (TPP0008-

Table 6-1: Summary of Generic Screening per NP-6041-SL Table 2-4, 1.2g Screening Level		
Equipment Type	**Generic Screening Criteria**	**Screening Result**
		HE1) on the ESEL. Anchorage and load path were verified by bounding calculations. Potential failure modes of the heat exchanger body were addressed by walkdown and design review.
Atmospheric storage tanks	Evaluation required.	HCLPF analyses were performed for the atmospheric storage tanks.
Pressure vessels	Notes (h), (i) apply.	There is only one small pressure vessel (TPP0008-OR1) on the ESEL. Anchorage and load path were verified by bounding calculations. Potential failure modes of the vessel body were addressed by walkdown and design review.
Batteries and racks	Note (k) applies.	Batteries are in braced racks designed for seismic loads. A HCLPF analyses was performed for the battery rack anchorage.
Horizontal pumps	No evaluation required.	
Fans	Notes (n), (o) apply.	Notes (n), (o) were addressed by walkdown and screening. Vibration isolators are not present for any fans in the scope.
Air handlers	Notes (n), (o) apply.	Notes (n), (o) were addressed by walkdown and screening. Vibration isolators are not present for any air handlers in the scope.
Active electrical power distribution panels	Notes (s) and (t) apply.	Note (s) was addressed by walkdown and design review. Items containing in-scope relays are identified on the ESEL and are evaluated for relay chatter.
Passive electrical power distribution panels	Note (s) applies.	Note (s) was addressed by walkdown and design review.
Transformers	Notes (u) and (v) apply.	The ESEL includes dry-type transformers. A design review verified coil restraint. Anchorage was verified by bounding calculations.
Battery chargers & inverters	Note (w) applies.	Per walkdown and design review, the items on the ESEL are solid state units. Anchorage was verified by bounding calculations.
Instrumentation and control panels and racks	Notes (s) and (t) apply.	Note (s) was addressed by walkdown and design review. Items containing in-scope relays are identified on the ESEL and are evaluated for relay

Table 6-1: Summary of Generic Screening per NP-6041-SL Table 2-4, 1.2g Screening Level		
Equipment Type	**Generic Screening Criteria**	**Screening Result**
		chatter.
Temperature sensors; pressure and level sensors.	Note (x) applies.	Note (x) was addressed by walkdown and design review. Sensors in the scope were typically mounted in-line on piping.

Relevant notes from NP-6041-SL Table 2-4

f. Evaluation recommended for MOVs in piping lines of 2 inches diameter or less.
h. Margin evaluation only needs to consider anchorage and supports.
i. For vessels designed by dynamic analysis or equivalent static analysis enveloping vessel inertial and piping loading, only the anchorage and supports require evaluation. For vessels not meeting these criteria, all potential failure modes require evaluation.
k. Batteries mounted in braced racks designed for seismic loads or qualified by dynamic testing do not require evaluation. Rigid spacers between batteries and end restraints are required. Batteries should be tightly supported by side rails.
n. All units supported on vibration isolators require evaluation of anchorage.
o. Evaluation should focus on anchorage and supports.
s. Walkdown should be conducted to verify that the instruments are properly attached to the cabinets.
t. Relays, contactors, switches, and breakers must be evaluated for chatter and trip if functionality during strong shaking is required.
u. Anchorage evaluation required.
v. Liquid-filled transformers require evaluation of overpressure safety switches. The transformer coils should be restrained within the cabinet for dry transformers.
w. Solid state units require anchorage checks. Others require evaluation.
x. Insufficient data are available for screening guidelines. Emphasis should be on attachments.

6.3 Seismic Walkdown Approach

6.3.1 Walkdown Approach

Walkdowns followed the guidance of NP-6041-SL Section 2. Walkdowns were performed by two-person seismic review teams (SRTs) consisting of engineers with seismic experience. The SRT used NP-6041-SL Appendix F to evaluate item-specific equipment caveats. The SRT also recorded notes and took photographs of the item under review. A number of walkdown sessions were performed as indicated below. Reactor Building items were inspected during the week of April 21, 2014, while the plant was in a refueling outage.

Walkdown Date	SRT	Plant Support
Week of January 13, 2014	John J. O'Sullivan (S&A) Stephane Damolini (S&A)	Jeremy Graham (SCE&G) Dan Goldston (SCE&G)
Week of February 24, 2014	John J. O'Sullivan (S&A)	Jeremy Graham (SCE&G)

	Seth Baker (S&A)	
Week of April 21, 2014	John J. O'Sullivan (S&A) Seth Baker (S&A)	Eric Rumfelt (SCE&G) Courtney Tampas (SCE&G) Andrew Hall (SCE&G)

Walkdown findings for each item are documented in screening evaluation work sheets (SEWS) [12]. The SEWS notes also identify evaluations and reviews performed to support screening. Brief resumes of SRT members are provided in Attachment C.

6.3.2 Application of Previous Walkdown Information

New seismic walkdowns were performed for ESEL equipment. The results of the previous seismic margin evaluation, performed for the Seismic IPEEE program, were reviewed and used for background purposes only.

6.3.3 Significant Walkdown Findings

The walkdown and screening results are summarized in the following tables:

- Initially screened-in items selected for HCLPF analysis are listed in Table 6-2.
- Recommended actions to resolve miscellaneous screening issues are listed in Table 6-3.

The actions listed in Table 6-3 are related to issues such as seismic housekeeping, potential seismic interaction, and issues related to equipment caveats. These issues are planned to be resolved through the plant corrective action process (see Section 8.2). For each item, the basis for anchorage screening is identified in the individual SEWS [12]. Project calculations [11] were created to support anchorage screening and contain bounding anchorage calculations for various equipment types.

A select group of ESEL items was initially screened-in based on anchorage. For each of these items, a detailed analysis of the anchorage capacity was performed. The items are identified in Section 6.5.

Table 6-2: Items Selected for HCLPF Analysis

No.	ID	Description	Bldg	Elev (ft)	Basis for Selection
1.	XTK0025	REFUELING WATER STORAGE TANK	AB	412	Per NP-6041-SL Table 2-4 seismic capacity cannot be screened and HCLPF analysis is required for overall seismic capacity.
2.	XPN6004	BOP INSTRUMENT PANEL TRAIN A	CB	436	Floor embeds were visible along the front and rear edges of the line-up. The embedments do not extend the full length of XPN6004 and a shim plates were added. Because of the load path thru the shim and unique anchorage, the anchorage is not screened. Perform HCLPF analysis for anchorage.
3.	XBA-1A	125V DC DISTRIBUTION BUS 1A BATTERY	IB	412	Because the supported mass is relatively large the anchorage is not screened. Perform HCLPF analysis for anchorage. Analysis should address similar racks in the ESEP scope.
4.	XMC1DA2X	480V MCC XCM1DA2X	IB	463	The MCC is tall and narrow and is expected to have a low natural frequency. The base overturning load may be relatively large. Anchorage is not screened. Perform HCLPF analysis for MCC anchorage. Analysis should address all the MCC's in the ESEP scope (for example, apply bounding loads).
5.	XTK0008	CONDENSATE STORAGE TANK	YD	435	Per NP-6041-SL Table 2-4 seismic capacity cannot be screened and HCLPF analysis is required for overall seismic capacity.
6.	XAA0001A	RB COOLING UNIT 1A	RB	514	The item is a large custom air handling unit located more than 40' above grade. NP-6041-SL Table 2-4 screening cannot be directly applied. HCLPF analysis needs to address anchorage, overall structural integrity and functionality.
7.	XVT03164-SW	DRPI COOLING UNIT INLET HDR ISOL VALVE	RB	518	The item is an air operated valve (AOV) located more than 40' above grade. NP-6041-SL Table 2-4 screening cannot be directly applied. HCLPF analysis is needed to address functionality. Analysis to be performed should address similar items in RB.
8.	XVT03169-SW	DRPI COOLING UNIT OUTLET HDR ISOL VLV	RB	518	Conduit running along the wall is close to the bonnet. The clearance is 1.0". Because of the relatively high seismic input at high RB elevations and relatively small pipe diameter, analysis is required to verify acceptability of 1.0" clearance.

Table 6-2: Items Selected for HCLPF Analysis					
No.	ID	Description	Bldg	Elev (ft)	Basis for Selection
9.	XVG03108B-SW	RB COOLING UNIT 2A INLET ISOLATION VLV	RB	518	The item is a motor operated valve (MOV) located more than 40' above grade. NP-6041-SL Table 2-4 screening cannot be directly applied. HCLPF analysis is needed to address functionality. Analysis to be performed should address similar items in RB. Apply results to similar item XVG03109B-SW.
10.	DPN1HA	BATTERY MAIN DISTRIBUTION PANEL 1HA	IB	412	The cabinet is screened-in for ESEP relay chatter assessment. Evaluation of chatter/trip of main breaker is required. Apply results to similar item DPN1HB.
11.	XSW1DA1	Class IE 480 V SWGR bus XSW1DA1-ES	IB	463	The cabinet is screened-in for ESEP relay chatter assessment. Relay chatter needs to be evaluated for various relay. The HCLPF will be based on design basis seismic qualification testing of a switchgear assembly. Apply results to similar item XSW1DA2.
12.	XSW1DA	Class IE 7.2 kV SWGR bus XSW1DA-ES	IB	463	The cabinet is screened-in for ESEP relay chatter assessment. Relay chatter needs to be evaluated for various relay. The HCLPF will be based on design basis seismic qualification testing of a switchgear assembly.

Table 6-3: Required Follow-up Actions to Resolve Screening Issues

No.	ID	Description	Bldg	Elev (ft)	Issue	Actions
1.	XVG01611A-FW	MAIN FW TO STM GEN A HDR ISOL	AB	436	A flexible electrical conduit attached to a pressure tap on north side of operator has limited slack. The electrical connection may be vulnerable to seismic motion of the valve.	Provide slack to preclude unacceptable stress on attached line. It appears that slack is available and a relocation of the first support will suffice. VCSNS Work Order #1414403 has been written to perform rework.
2.	IPV02000-MS	MAIN STEAM HEADER A POWER RELIEF VALVE	AB	436	A small nozzle for a pressure tap on a device attached to the valve is very close to the adjacent hand rail. The valve motion is limited by nearby pipe support so banging of the rail on the nozzle is primary issue.	Modify the handrail to provide sufficient shake space. ECR 51004 has been issued to rework handrail.
3.	XBA-1A	125V DC DISTRIBUTION BUS 1A BATTERY	IB	412	Battery rack with two rows and two tiers per row. Spacers are present on sides of batteries. Gap at front rail varies from 0" to 1/4". It appears that potential seismic front/back motion of the batteries due to front rail gaps can be accommodated by flexibility of the bus bars. However, NP-6041-SL Appendix F guidance states that batteries should be "encased by rack framework" or shimmed to produced "close-fitting rails".	Modify rack to reduce front rail gaps (for example, install shims behind rail attachment points to build out the rail). ECR51010 has been initiated to resolve the identified condition.
4.	XBA-1B	125V DC DISTRIBUTION BUS 1B BATTERY	IB	412	Battery racks similar to XBA-1A. Refer to notes for that item.	See actions for XBA-1A

Table 6-3: Required Follow-up Actions to Resolve Screening Issues

No.	ID	Description	Bldg	Elev (ft)	Issue	Actions
5.	XVT02843B-MS	MS HEADER B MOIST COLLECTOR DRAIN VLV	IB	436	Clearance to a nearby 3x3 angle post is a potential hazard. It is estimated that about 1/2" of motion along the pipe axial direction would cause impact of bonnet on corner of post and this is the critical clearance.	It appears the top of the 3x3 post can be trimmed without adverse effects. Trim the 3x3 angle to preclude interaction. ECR51010 has been initiated to resolve the identified condition
6.	XVG01611C-FW	MAIN FW TO STM GEN C HDR ISOL	IB	436	A flexible electrical conduit attached to a pressure tap on north side of operator has minimal slack. The electrical connection appears to be vulnerable to seismic motion of valve.	Provide slack to preclude unacceptable stress on attached line. It appears that slack is available and a minor modification of the first support will suffice. VCSNS Work Order #1414404 has been written to perform rework.
7.	IPT03632	EF PUMP SUCT HDR PRESSURE TRANSMITTER	DB	412	Tubing from pipe to PT is vulnerable to impact from a hanging light. The impact on tubing near root valve IPT03632-HR-EF appears possible.	Either restrain the light or move the light higher such that impact on tubing is precluded. VCSNS Work Order #1414405 has been written to perform rework.
8.	XPN7200A	Control Room Evacuation Panel (CREP A)	IB	436	A tool locker is located behind the cabinet, about 10" away. Locker is unanchored and is a potential interaction hazard.	Move and/or restrain the locker such that interaction is precluded. ECR51010 has been initiated to resolve the identified condition
9.	XVT03164-SW	DRPI COOLING UNIT INLET HDR ISOL VALVE	RB	518	The hand wheel on the operator is 0.25" from a hand rail. Seismic shaking may produce interaction.	Modify the handrail to preclude interaction. ECR51010 has been initiated to resolve the identified condition

6.4 HCLPF Calculation Process

All HCLPF values were calculated using the conservative, deterministic failure margin (CDFM) criteria of NP-6041-SL. CDFM analysis criteria are summarized in NP-6041-SL Table 2-5.

For structural failure modes, the HCLPF capacity is equal to the earthquake magnitude at which the strength limit is reached. For equipment functionality failure modes, experience data or available test response spectra (TRS) are typically used to define the HCLPF capacity. The methods of NP-6041-SL Appendix Q were applied for functionality evaluations.

6.5 Functional Evaluations of Relays

Verification of functional capacity for equipment mounted within 40' of grade was addressed by application NP-6041-SL Table 2-4 generic screening criteria as described above. For equipment mounted higher than 40' above grade and for in-scope relays, the methods of NP-6041-SL Appendix Q were applied for functionality evaluations. In those cases, the seismic capacity was based upon one of the following:

- Test response spectra (TRS) from plant-specific seismic qualification reports.
- Generic equipment ruggedness spectra (GERS) from EPRI report NP-5223-SL [9].
- Experience based seismic capacity per the guidelines of EPRI TR-1019200 [8].

The ESEP relay functional evaluations are documented in a supporting calculation [11i].

6.6 Tabulated ESEL HCLPF Values (Including Key Failure Modes)

Table 6-4 lists HCLPF analysis results for screened-in items. The failure modes analyzed are identified. Project calculation documents that contain the detailed HCLPF calculations are also identified.

For the following discussion, define an "ESEP outlier" as an item whose HCLPF capacity is less than the RLGM. There are currently four ESEP outliers:

1. XSW1DA (relay chatter)
2. XSW1DA1 (relay chatter)
3. XSW1DA2 (relay chatter, XSW1DA1 results are applicable)
4. XVT03169-SW (functionality)

Note that for the CST, the applied ground motion and HCLPF are based on the GMRS. The CST is founded on a slab-on-grade in the yard and a detailed soil-structure interaction analysis (SSI) was performed to develop realistic seismic demand. The GMRS has a horizontal PGA of 0.37g and the CST HCLPF is more than double that level (acceptable with large margin).

Relay Chatter Failure Modes

Switchgear XSW1DA, XSW1DA1 and XSW1DA2 are ESEP-outliers with respect to relay chatter. Credit for operator action may resolve the relay chatter failure modes. The approach for resolution is discussed in Section 8.2.

Items with Functional or Structural Failure Modes

The valve XVT03169-SW is located at a high elevation of the RB and application of a relatively large lateral seismic load was required. The failure mode is related to lateral seismic displacement of the valve. A modification for XVT03169-SW would involve providing more side-side shake space (currently 1" is available between the valve and a wall conduit). Alternatively, the supporting piping could be locally stiffened.

Tabulated HCLPF Values

The HCLPF values for all ESEL items are tabulated in Attachment B. In general, the HCLPF for a screened-out item equals or exceeds the RLGM.

HCLPF $\geq$ 0.30g HCLPF for screened-out items and failure modes

Unless justified by calculations, the above HCLPF is applicable for screened-out items and covers all relevant failure modes.

For the items listed in Table 6-4, the listed HCLPF values and failure modes are controlling except for those items cited in Note 5. For those items, the functionality limit is lower than the anchorage HCLPF and is controlling.

Table 6-4: HCLPF Analysis Results						
ID	Description	Bldg	Elev (ft)	HCLPF (g)	Failure Mode Analyzed	Reference (see [11])
XTK0025	REFUELING WATER STORAGE TANK	AB	412	0.32	Anchorage, due to overturning moment.	13C4188-ESEP-CAL-005
XPN6004	BOP INSTRUMENT PANEL TRAIN A	CB	436	1.07	Anchorage, load path (see Note 5).	13C4188-ESEP-CAL-006
XBA-1A	125V DC DISTRIBUTION BUS 1A BATTERY	IB	412	1.16	Anchorage, concrete breakout (see Note 5).	13C4188-ESEP-CAL-006
DPN1HA	BATTERY MAIN DISTR PANEL 1HA	IB	412	0.35	Functionality, including main breaker trip.	13C4188-ESEP-CAL-009
XSW1DA	CLASS IE 7.2 KV SWGR BUS XSW1DA-ES	IB	463	0.20	Relay chatter.	13C4188-ESEP-CAL-009
XSW1DA1	CLASS IE 480 V SWGR BUS XSW1DA1-ES	IB	463	0.24	Relay chatter.	13C4188-ESEP-CAL-009
XMC1DA2X	480V MCC XCM1DA2X	IB	463	0.38	Anchorage, embedment steel stress (see Note 5).	13C4188-ESEP-CAL-006
XAA0001A	RB COOLING UNIT 1A	RB	514	0.35	Overall structural integrity.	13C4188-ESEP-CAL-008
XVT03164-SW	DRPI COOLING UNIT INLET HDR ISOL VLV	RB	518	0.44	Functionality.	13C4188-ESEP-CAL-010
XVT03169-SW	DRPI COOLING UNIT OUTLET HDR ISOL VLV	RB	518	0.24	Impaired functionality due to seismic interaction (impact with wall conduit).	13C4188-ESEP-CAL-010
XVG03108B-SW	RB COOLING UNIT 2A INLET ISOLATION VLV	RB	518	0.82	Functionality.	13C4188-ESEP-CAL-010
XTK0008	CONDENSATE STORAGE TANK	YD	435	0.88 (See Note 4)	Sliding due to exceedance of base shear capacity.	13C4188-ESEP-CAL-004

Table 6-4 Notes

1. The listed HCLPF value is for comparison to the horizontal PGA at the bedrock surface.
2. The listed Reference is an S&A project calculation document.
3. Results for XSW1DA1 are applicable to XSW1DA2; results for DPN1HA are applicable to DPN1HB.
4. For CST only, the applied ground motion and HCLPF are based on the GMRS; the GMRS has a 0.37g horizontal PGA at rock.
5. Where Note 5 is cited, the screening limit for functionality is lower than the listed anchorage HCLPF.

7.0 Inaccessible Items

Sufficient access was provided for all ESEL items and no additional walkdowns are required. In-containment items were accessed during the spring 2014 refueling outage.

8.0 ESEP Conclusions and Results

8.1 Supporting Information

VCSNS has performed the ESEP as an interim action in response to the NRC's 50.54(f) letter [1]. It was performed using the methodologies in the NRC endorsed guidance in EPRI 3002000704 [2].

The ESEP provides an important demonstration of seismic margin and expedites plant safety enhancements through evaluations and potential near-term modifications of plant equipment that can be relied upon to protect the reactor core following beyond design basis seismic events.

The ESEP is part of the overall VCSNS response to the NRC's 50.54(f) letter [1]. On March 12, 2014, the Nuclear Energy Institute (NEI) submitted to the NRC results of a study [15] of seismic core damage risk estimates based on updated seismic hazard information as it applies to operating nuclear reactors in the Central and Eastern United States (CEUS). The study concluded that "site-specific seismic hazards show that there [...] has not been an overall increase in seismic risk for the fleet of U.S. plants" based on the re-evaluated seismic hazards. As such, the "current seismic design of operating reactors continues to provide a safety margin to withstand potential earthquakes exceeding the seismic design basis."

The NRC's May 9, 2014 NTTF 2.1 Screening and Prioritization letter [17] concluded that the "fleetwide seismic risk estimates are consistent with the approach and results used in the GI-199 safety/risk assessment." The letter also stated that "As a result, the staff has confirmed that the conclusions reached in GI-199 safety/risk assessment remain valid and that the plants can continue to operate while additional evaluations are conducted."

An assessment of the change in seismic risk for VCSNS was included in the fleet risk evaluation submitted in the March 12, 2014 NEI letter [15] therefore, the conclusions in the NRC's May 9 letter [17] also apply to VCSNS.

In addition, the March 12, 2014 NEI letter [15] provided an attached "Perspectives on the Seismic Capacity of Operating Plants," which (1) assessed a number of qualitative reasons why the design of SSCs inherently contain margin beyond their design level, (2) discussed industrial seismic experience databases of performance of industry facility components similar to nuclear SSCs, and (3) discussed earthquake experience at operating plants.

The fleet of currently operating nuclear power plants was designed using conservative practices, such that the plants have significant margin to withstand large ground motions safely. This has been borne out for those plants that have actually experienced significant earthquakes. The seismic design process has inherent (and intentional) conservatisms, which result in significant seismic margins within structures, systems and components (SSCs). These conservatisms are reflected in several key aspects of the seismic design process, including:

- Safety factors applied in design calculations
- Damping values used in dynamic analysis of SSCs
- Bounding synthetic time histories for in-structure response spectra calculations
- Broadening criteria for in-structure response spectra
- Response spectra enveloping criteria typically used in SSC analysis and testing applications
- Response spectra based frequency domain analysis rather than explicit time history based time domain analysis
- Bounding requirements in codes and standards
- Use of minimum strength requirements of structural components (concrete and steel)
- Bounding testing requirements, and
- Ductile behavior of the primary materials (that is, not crediting the additional capacity of materials such as steel and reinforced concrete beyond the essentially elastic range, etc.).

These design practices combine to result in margins such that the SSCs will continue to fulfill their functions at ground motions well above the SSE.

The intent of the ESEP is to perform an interim action in response to the NRC's 50.54(f) letter [1] to demonstrate seismic margin through a review of a subset of the plant equipment that can be relied upon to protect the reactor core following beyond design basis seismic events. In order to complete the ESEP in an expedited amount of time, the RLGM used for the ESEP evaluation is a scaled version of the plant's SSE rather than the actual GMRS. To more fully characterize the risk impacts of the seismic ground motion represented by the GMRS on a plant specific basis, a more detailed seismic risk assessment (SPRA or risk-based SMA) is to be performed in accordance with EPRI 1025287 [18]. As identified in the VCSNS Seismic Hazard and GMRS submittal [4], VCSNS screens in for a risk evaluation. The complete risk evaluation will more completely characterize the probabilistic seismic ground motion input into the plant, the plant response to that probabilistic seismic ground motion input, and the resulting plant risk characterization. VCSNS will complete that evaluation in accordance with the schedule identified in the NRC's May 9, 2014 letter [17].

8.2 Identification of Planned Modifications

Insights from the ESEP identified the following four items where the HCLPF is below the RLGM and plant modifications will be made in accordance with EPRI 3002000704 [2] to enhance the seismic capacity of the plant.

1. 7.2KV Switchgear XSW1DA had a functional failure mode HCLPF for relay chatter below the RLGM. Modification of the FLEX Support Procedures to explicitly direct the operator(s) to reset the relays is planned.

2. 480V Switchgear XSW1DA1 had a functional failure mode HCLPF for relay chatter below the RLGM. Modification of the FLEX Support Procedures to explicitly direct the operator(s) to reset the relays is planned.
3. 480V Switchgear XSW1DA2 had a functional failure mode HCLPF for relay chatter below the RLGM. Modification of the FLEX Support Procedures to explicitly direct the operator(s) to reset the relays is planned.
4. Service Water isolation valve XVT03169-SW had a functional failure mode due to seismic spatial interaction with nearby conduit resulting in a HCLPF capacity below the RLGM. A modification is planned to provide additional seismic margin by either modifying the conduit or modifying piping system supports.

Additionally, during the screening process, the following five follow-up actions requiring modifications to resolve screening issues were identified. The screening issues are related to items such as seismic housekeeping, potential seismic interaction, and issues related to equipment caveats.

1. Main Steam Header Relief valve IPV02000-MS has a small nozzle for pressure tap located very close to adjacent handrail. A modification is planned to provide sufficient shake space.
2. 125V DC Distribution bus battery XBA-1A has a small gap between the battery cells and front rail of the rack. EPRI NP-6041 Appendix F recommends shimming all rails to a very close fit. A modification is planned to modify rack to reduce gaps.
3. 125V DC Distribution bus battery XBA-1B has a small gap between the battery cells and front rail of the rack. EPRI NP-6041 Appendix F recommends shimming all rails to a very close fit. A modification is planned to modify rack to reduce gaps.
4. Main Steam Header drain valve XVT02843B-MS has potential for seismic interaction with nearby steel angle pipe support. A modification is planned to trim the top of the nearby steel angle support to preclude potential seismic interaction.
5. Service water isolation valve XVT03164-SW has potential for seismic interaction with the hand wheel operator and nearby hand rail. A modification is planned to modify handrail to preclude seismic interaction.

8.3 Modification Implementation Schedule

Plant modifications will be performed in accordance with the schedule identified in NEI letter dated April 9, 2013 [16], which states that plant modifications not requiring a planned refueling outage will be completed by December 2016, and modifications requiring a refueling outage will be completed within two planned refueling outages after December 31, 2014. Section 8.4 contains the regulatory commitment dates to complete planned plant modifications as a result of ESEP. Referencing Section 8.4, Action Items 1, 2, 3, and 5 are expected to be complete by December 2015 to support FLEX Program Implementation. Action Items 4, 6, 7, and 9 are required to be performed during a refueling outage and are therefore expected to be completed by spring 2017. Action

Item 8 is not required to be performed during a refueling outage, with the expected completion date being prior to December 2016.

8.4 Summary of Regulatory Commitments

The following actions have been added to VCSNS Corrective Action Program in CR-12-01097, and will be performed as a result of the ESEP.

Action #	Equipment ID	Equipment Description	Action Description	Completion Date
1	XSW1DA	7.2KV Switchgear	Modify FLEX Support Procedures to include operator actions to reset relays with HCLPF values less than the RLGM.	December 2016
2	XSW1DA1	480V Switchgear	Modify FLEX Support Procedures to include operator actions to reset relays with HCLPF values less than the RLGM.	December 2016
3	XSW1DA2	480V Switchgear	Modify FLEX Support Procedures to include operator actions to reset relays with HCLPF values less than the RLGM.	December 2016
4	XVT03169-SW	DRPI Cooling Unit Outlet Header Isolation Valve	Modify the seismic interaction to provide sufficient shake space, or modify piping system supports such that HCLPF > GMRS.	No later than the end of the second Unit 1 refueling outage after December 31, 2014 (Tentative Spring 2017)
5	IPV02000-MS	Main Steam Header Power Relief Valve	Modify valve or handrail to provide sufficient shake space.	December 2016
6	XBA-1A	125V DC Distribution Bus Battery	Modify rack to reduce front rail gaps.	No later than the end of the second Unit 1 refueling outage after December 31, 2014 (Tentative Spring 2017)

Action #	Equipment ID	Equipment Description	Action Description	Completion Date
7	XBA-1B	125V DC Distribution Bus Battery	Modify rack to reduce front rail gaps.	No later than the end of the second Unit 1 refueling outage after December 31, 2014 (Tentative Spring 2017)
8	XVT02843B-MS	Main Steam Header Drain Valve	Trim the steel angle post to mitigate potential seismic interaction.	December 2016
9	XVT03164-SW	DRPI Cooling Unit Inlet Header Isolation Valve	Modify the handrail to mitigate potential seismic interaction.	No later than the end of the second Unit 1 refueling outage after December 31, 2014 (Tentative Spring 2017)

9.0 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.

2. Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1 – Seismic. EPRI, Palo Alto, CA: May 2013. 3002000704.

3. Virgil C. Summer Nuclear Station Unit 1 OIP's

   a. SCE&G Correspondence RC-13-0028, "Virgil C. Summer Nuclear Station Unit 1 Docket No. 50-285 Operating License No. NPF-12 South Carolina Electric & Gas Company's Overall Integrated Plan as Required by March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)," Attachment, "South Carolina Electric & Gas Company Virgil C. Summer Nuclear Station Unit 1 Mitigation Strategies (FLEX) Overall Integrated Implementation Plan," Revision 0, February 28, 2013. (ADAMS Accession Number ML13063A150)
   b. SCE&G's First Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated August 28, 2013.
   c. SCE&G's Second Six-Month Status Report in Response to March 12,2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 27, 2014.
   d. SCE&G's Third Six-Month Status Report in Response to March 12,2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated August 28, 2014.
   e. SCE&G Technical Report TR00080-002, "FLEX Overall Integrated Plan (OIP)," Revision 1, October 2, 2014.

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    b. 13C4188-ESEP-CAL-002 Rev. 2, Review Level Ground Motion for ESEP.
    c. 13C4188-ESEP-CAL-003 Rev. 1, Procedure to Determine RLGM In-Structure Seismic Demand for Equipment.
    d. 13C4188-ESEP-CAL-004 Rev. 1, HCLPF Seismic Capacity of Condensate Storage Tank.
    e. 13C4188-ESEP-CAL-005 Rev. 1, HCLPF Seismic Capacity of Refueling Water Storage Tank.
    f. 13C4188-ESEP-CAL-006 Rev. 0, HCLPF Seismic Capacity Evaluations for Selected Equipment.
    g. 13C4188-ESEP-CAL-007 Rev. 0, Anchorage Screening for ESEP.
    h. 13C4188-ESEP-CAL-008 Rev. 0, HCLPF Seismic Capacity Evaluation for Reactor Building Cooling Unit XAA0001A.
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    j. 13C4188-ESEP-CAL-010 Rev. 0, HCLPF Seismic Analysis of Selected RB Equipment.
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Attachment A

VCSNS Unit 1 ESEL[1]

[1] The complete list of equipment investigated for inclusion in the ESEL is documented in Reference 20. Reference 20 includes the valve operating states, as well as rationales for exclusion for any component which was determined to be appropriate to exclude from the ESEL. A summary list of the components, which were ultimately determined to be appropriate for inclusion in the ESEL, is provided herein.

ESEL Item Num	Equipment		Operating State[1]		Notes/Comments
	ID	Description	Normal State	Desired State	
1	IFE03525	TURB DRIVEN EF PUMP DISCH FLOW ELEMENT	N/A	N/A	OIP, Page 14, D-302-085
2	IFT03531	SG A MTR DR EF PUMP DISCH HDR FLOW XMTR	N/A	N/A	OIP, D-302-085
3	IFT03541	SG B MTR DR EF PUMP DISCH HDR FLOW XMTR	N/A	N/A	OIP, D-302-085
4	IFT03551	SG C MTR DR EF PUMP DISCH HDR FLOW XMTR	N/A	N/A	OIP, D-302-085
5	IFT03561	STEAM GEN A EF SUPPLY HEADER FLOW XMTR	N/A	N/A	OIP, D-302-085
6	IFT03571	STEAM GEN B EF SUPPLY HEADER FLOW XMTR	N/A	N/A	OIP, D-302-085
7	IFT03581	STEAM GEN C EF SUPPLY HEADER FLOW XMTR	N/A	N/A	OIP, D-302-085
8	IFV02030-MS	EF PUMP TURB STEAM SUPPLY FLOW CONT VLV	Closed	Open / Closed	OIP, Page 14, D-302-011
9	IFV02030-O-MS	OPER-EF PP TURB STM SUP FLOW CONT VLV	N/A	N/A	OIP, Page 14, D-302-011
10	IFV03531-EF	SG A MTR DR EF PUMP FLOW CONTROL VALVE	Open	Open / Closed	OIP, D-302-085
11	IFV03531-O-EF	OPER-SG A MTR DR EF PUMP FLOW CONT VLV	N/A	N/A	OIP, D-302-085
12	IFV03536-EF	SG A TURB DR EF PUMP FLOW CONTROL VALVE	Open	Open / Closed	OIP, Page 14, D-302-085
13	IFV03536-O-EF	OPER-SG A TURB DR EF PUMP FLOW CONT VLV	N/A	N/A	OIP, Page 14, D-302-085
14	IFV03541-EF	SG B MTR DR EF PUMP FLOW CONTROL VALVE	Open	Open / Closed	OIP, D-302-085

ESEL Item Num	Equipment		Operating State[1]		Notes/Comments
	ID	Description	Normal State	Desired State	
15	IFV03541-O-EF	OPER-SG B MTR DR EF PUMP FLOW CONT VLV	N/A	N/A	OIP, D-302-085
16	IFV03546-EF	SG B TURB DR EF PUMP FLOW CONTROL VALVE	Open	Open / Closed	OIP, Page 14, D-302-085
17	IFV03546-O-EF	OPER-SG B TURB DR EF PUMP FLOW CONT VLV	N/A	N/A	OIP, Page 14, D-302-085
18	IFV03551-EF	SG C MTR DR EF PUMP FLOW CONTROL VALVE	Open	Open / Closed	OIP, D-302-085
19	IFV03551-O-EF	OPER-SG C MTR DR EF PUMP FLOW CONT VLV	N/A	N/A	OIP, D-302-085
20	IFV03556-EF	SG C TURB DR EF PUMP FLOW CONTROL VALVE	Open	Open / Closed	OIP, Page 14, D-302-085
21	IFV03556-O-EF	OPER-SG C TURB DR EF PUMP FLOW CONT VLV	N/A	N/A	OIP, Page 14, D-302-085
22	ILT03631	CONDENSATE STORAGE TANK LEVEL XMTR	N/A	N/A	OIP, Page 14, D-302-085
23	IPS03504	MDEFP A SUCT PRESS SW LO PRESS ALARM	N/A	N/A	OIP, D-302-085
24	IPS03524	TURB DR EF PUMP SUCT LP ALARM SWITCH	N/A	N/A	OIP, Page 17, D-302-085
25	IPT00474	SG A MAIN STEAM HDR PRESS TRANSMITTER	N/A	N/A	D-302-011
26	IPT00475	SG A MAIN STEAM HDR PRESS TRANSMITTER	N/A	N/A	D-302-011
27	IPT00476	SG A MAIN STEAM HDR PRESS TRANSMITTER	N/A	N/A	D-302-011
28	IPT00484	SG B MAIN STEAM HDR PRESS TRANSMITTER	N/A	N/A	D-302-011

ESEL Item Num	Equipment		Operating State[1]		Notes/Comments
	ID	Description	Normal State	Desired State	
29	IPT00485	SG B MAIN STEAM HDR PRESS TRANSMITTER	N/A	N/A	D-302-011
30	IPT00486	SG B MAIN STEAM HDR PRESS TRANSMITTER	N/A	N/A	D-302-011
31	IPT00494	SG C MAIN STEAM HDR PRESS TRANSMITTER	N/A	N/A	D-302-011
32	IPT00495	SG C MAIN STEAM HDR PRESS TRANSMITTER	N/A	N/A	D-302-011
33	IPT00496	SG C MAIN STEAM HDR PRESS TRANSMITTER	N/A	N/A	D-302-011
34	IPT02000	STEAM GENERATOR A OUTLET PRESSURE XMTR	N/A	N/A	D-302-011
35	IPT02000A	STEAM GENERATOR A OUTLET PRESSURE XMTR	N/A	N/A	D-302-011
36	IPT02010	STEAM GENERATOR B OUTLET PRESSURE XMTR	N/A	N/A	D-302-011
37	IPT02010A	STEAM GENERATOR B OUTLET PRESSURE XMTR	N/A	N/A	D-302-011
38	IPT02020	STEAM GENERATOR C OUTLET PRESSURE XMTR	N/A	N/A	D-302-011
39	IPT02020A	STEAM GENERATOR C OUTLET PRESSURE XMTR	N/A	N/A	D-302-011
40	IPT02032	EF PUMP TURBINE MS SUP HDR PRESS XMTR	N/A	N/A	OIP, Page 17, D-302-011
41	IPT03563	STEAM GEN A EF SUPPLY HEADER PRESS XMTR	N/A	N/A	D-302-085
42	IPT03573	STEAM GEN B EF SUPPLY HEADER PRESS XMTR	N/A	N/A	D-302-085

ESEL Item Num	Equipment		Operating State[1]		Notes/Comments
	ID	Description	Normal State	Desired State	
43	IPT03583	STEAM GEN C EF SUPPLY HEADER PRESS XMTR	N/A	N/A	D-302-085
44	IPT03632	EF PUMP SUCT HDR PRESSURE TRANSMITTER	N/A	N/A	D-302-085
45	IPT03633	EF PUMP SUCT HDR PRESSURE TRANSMITTER	N/A	N/A	D-302-085
46	IPT03634	EF PUMP SUCT HDR PRESSURE TRANSMITTER	N/A	N/A	D-302-085
47	IPT03635	EF PUMP SUCT HDR PRESSURE TRANSMITTER	N/A	N/A	D-302-085
48	IPV02000-MS	MAIN STEAM HEADER A POWER RELIEF VALVE	Closed	Closed, Open, or Throttled	OIP, Page 14, D-302-011
49	IPV02000-O-MS	OPER-MAIN STEAM HDR A POWER RELIEF VLV	N/A	N/A	OIP, Page 14, D-302-011
50	IPV02010-MS	MAIN STEAM HEADER B POWER RELIEF VALVE	Closed	Closed, Open, or Throttled	OIP, Page 14, D-302-011
51	IPV02010-O-MS	OPER-MAIN STEAM HDR B POWER RELIEF VLV	N/A	N/A	OIP, Page 14, D-302-011
52	IPV02020-MS	MAIN STEAM HEADER C POWER RELIEF VALVE	Closed	Closed, Open, or Throttled	OIP, Page 14, D-302-011
53	IPV02020-O-MS	OPER-MAIN STEAM HDR C POWER RELIEF VLV	N/A	N/A	OIP, Page 14, D-302-011
54	TPP0008	EMERGENCY FEEDWATER PUMP TURBINE	N/A	N/A	OIP, Page 17, D-302-085
55	TPP0008-HE1	EF PUMP TURBINE LUBE OIL HEAT EXCHANGER	N/A	N/A	OIP, Page 17, D-302-085
56	TPP0008-OR1	EF PUMP TURBINE LUBE OIL RESERVOIR	N/A	N/A	OIP, Page 17, D-302-085

ESEL Item Num	Equipment		Operating State[1]		Notes/Comments
	ID	Description	Normal State	Desired State	
57	TPP0008-PP1	EF PUMP TURBINE LUBE OIL ROTARY PUMP	N/A	N/A	OIP, Page 17, D-302-085
58	TPP0008-SC1	EF PUMP TURBINE SPEED CONTROL GOVERNOR	N/A	N/A	OIP, Page 17, D-302-085
59	XPP0008	EMERG FEEDWATER TURBINE DRIVEN PUMP	N/A	N/A	OIP, Page 14, D-302-085
60	XPP0021A	EMERGENCY FEEDWATER PUMP A	N/A	N/A	OIP, D-302-085
61	XTK0008	CONDENSATE STORAGE TANK	N/A	N/A	OIP, Page 14, D-302-085, D-302-101
62	XTK0025	REFUELING WATER STORAGE TANK	N/A	N/A	OIP, Page 22, D-302-651
63	XVG01611A-FW	MAIN FW TO STM GEN A HDR ISOL	Open	Closed	D-302-083
64	XVG01611A-O-FW	OPER-MAIN FW TO STM GEN A HDR ISOL	N/A	N/A	D-302-083
65	XVG01611B-FW	MAIN FW TO STM GEN B HDR ISOL	Open	Closed	D-302-083
66	XVG01611B-O-FW	OPER-MAIN FW TO STM GEN B HDR ISOL	N/A	N/A	D-302-083
67	XVG01611C-FW	MAIN FW TO STM GEN C HDR ISOL	Open	Closed	D-302-083
68	XVG01611C-O-FW	OPER-MAIN FW TO STM GEN C HDR ISOL	N/A	N/A	D-302-083
69	XVM02801A-MS	MAIN STEAM HEADER A ISOLATION VALVE	Open	Open or Throttled	D-302-011
70	XVM02801A-O-MS	OPER-MAIN STEAM HEADER A STOP VALVE	N/A	N/A	D-302-011
71	XVM02801B-MS	MAIN STEAM HEADER B ISOLATION VALVE	Open	Open or Throttled	D-302-011
72	XVM02801B-O-MS	OPER-MAIN STEAM HEADER B STOP VALVE	N/A	N/A	D-302-011
73	XVM02801C-MS	MAIN STEAM HEADER C ISOLATION VALVE	Open	Open or Throttled	D-302-011

ESEL Item Num	Equipment		Operating State[1]		Notes/Comments
	ID	Description	Normal State	Desired State	
74	XVM02801C-O-MS	OPER-MAIN STEAM HEADER C STOP VALVE	N/A	N/A	D-302-011
75	XVM11025-EF	EF PUMP TURBINE SPEED CONT GOVERNOR VLV	Open	Open or Throttled	OIP, Page 14, D-302-011
76	XVS02806A-MS	MAIN STEAM HEADER A SAFETY VALVE	Closed	Closed or Open	D-302-011
77	XVS02806B-MS	MAIN STEAM HEADER A SAFETY VALVE	Closed	Closed or Open	D-302-011
78	XVS02806C-MS	MAIN STEAM HEADER A SAFETY VALVE	Closed	Closed or Open	D-302-011
79	XVS02806D-MS	MAIN STEAM HEADER A SAFETY VALVE	Closed	Closed or Open	D-302-011
80	XVS02806E-MS	MAIN STEAM HEADER A SAFETY VALVE	Closed	Closed or Open	D-302-011
81	XVS02806F-MS	MAIN STEAM HEADER B SAFETY VALVE	Closed	Closed or Open	D-302-011
82	XVS02806G-MS	MAIN STEAM HEADER B SAFETY VALVE	Closed	Closed or Open	D-302-011
83	XVS02806H-MS	MAIN STEAM HEADER B SAFETY VALVE	Closed	Closed or Open	D-302-011
84	XVS02806I-MS	MAIN STEAM HEADER B SAFETY VALVE	Closed	Closed or Open	D-302-011
85	XVS02806J-MS	MAIN STEAM HEADER B SAFETY VALVE	Closed	Closed or Open	D-302-011
86	XVS02806K-MS	MAIN STEAM HEADER C SAFETY VALVE	Closed	Closed or Open	D-302-011
87	XVS02806L-MS	MAIN STEAM HEADER C SAFETY VALVE	Closed	Closed or Open	D-302-011
88	XVS02806M-MS	MAIN STEAM HEADER C SAFETY VALVE	Closed	Closed or Open	D-302-011
89	XVS02806N-MS	MAIN STEAM HEADER C SAFETY VALVE	Closed	Closed or Open	D-302-011
90	XVS02806P-MS	MAIN STEAM HEADER C SAFETY VALVE	Closed	Closed or Open	D-302-011
91	XVT02843A-MS	MS HEADER A MOIST COLLECTOR DRAIN VLV	Open	Closed, Open, or Throttled	D-302-011

ESEL Item Num	Equipment		Operating State[1]		Notes/Comments
	ID	Description	Normal State	Desired State	
92	XVT02843A-O-MS	OPER-MS HDR A MOIST COLLECTOR DRN VLV	N/A	N/A	D-302-011
93	XVT02843B-MS	MS HEADER B MOIST COLLECTOR DRAIN VLV	Open	Closed, Open, or Throttled	D-302-011
94	XVT02843B-O-MS	OPER-MS HDR B MOIST COLLECTOR DRN VLV	N/A	N/A	D-302-011
95	XVT02843C-MS	MS HEADER C MOIST COLLECTOR DRAIN VLV	Open	Closed, Open, or Throttled	D-302-011
96	XVT02843C-O-MS	OPER-MS HDR C MOIST COLLECTOR DRN VLV	N/A	N/A	D-302-011
97	XVT02865-MS	EF PUMP TURB MAIN STEAM THROTTLE VALVE	Throttled	Throttled	OIP, Page 14, D-302-011
98	XVT02865-O-MS	OPER-EF PP TURB MAIN STEAM THROTTLE VLV	N/A	N/A	OIP, Page 14, D-302-011
99	XVT02877A-MS	MS HEADER A MOIST COLLECTOR DRAIN VLV	Open	Closed, Open, or Throttled	D-302-011
100	XVT02877B-MS	MS HEADER C MOIST COLLECTOR DRAIN VLV	Open	Closed, Open, or Throttled	D-302-011
101	IFT00475	SG A STEAM FLOW DP XMTR	N/A	N/A	D-302-011
102	IFT00475A	NARROW RANGE STEAM FLOW	N/A	N/A	D-302-011
103	IFT00485	SG B STEAM FLOW DP XMTR	N/A	N/A	D-302-011
104	IFT00485A	NARROW RANGE STEAM FLOW	N/A	N/A	D-302-011
105	IFT00495	SG C STEAM FLOW DP XMTR	N/A	N/A	D-302-011
106	IFT00495A	NARROW RANGE STEAM FLOW	N/A	N/A	D-302-011
107	IPI03521	TURB DR EF PP EF SUP HDR SUCT PRESS IND	N/A	N/A	E-302-085

ESEL Item Num	Equipment		Operating State[1]		Notes/Comments
	ID	Description	Normal State	Desired State	
108	IFT03525	TURBINE DR EF PUMP DISCHARGE FLOW XMTR	N/A	N/A	E-302-085
109	IPI03527	TURBINE DR EF PUMP DISCHARGE PRESS IND	N/A	N/A	E-302-085
110	IFE03531	SG A MTR DR EF PUMP DISCH HDR FLOW ELEM	N/A	N/A	E-302-085
111	IFE03561	STEAM GEN A EF SUPPLY HEADER FLOW ELEM	N/A	N/A	E-302-085
112	IFE03541	SG B MTR DR EF PUMP DISCH HDR FLOW ELEM	N/A	N/A	E-302-085
113	IFE03571	STEAM GEN B EF SUPPLY HEADER FLOW ELEM	N/A	N/A	E-302-085
114	IFE03551	SG C MTR DR EF PUMP DISCH HDR FLOW ELEM	N/A	N/A	E-302-085
115	IFE03581	STEAM GEN C EF SUPPLY HEADER FLOW ELEM	N/A	N/A	E-302-085
116	IPI00950	CONTAINMENT PRESSURE, PRESSURE IND I	N/A	N/A	OIP, Page 27
117	ITI09201A	REACTOR BLDG AMBIENT TEMP INDICATOR	N/A	N/A	OIP, Page 27
118	IPI03512	MOTOR DRIVEN EF PUMP A SUCT PRESS IND	N/A	N/A	D-302-085
119	IFI03525	TDEFP DISCHARGE FLOW INDICATOR	N/A	N/A	OIP, Page 14, D-302-085
120	IPT00950	REACTOR CONTAINMENT PRESSURE XMTR	N/A	N/A	OIP, Page 27
121	ITE09201	REACTOR BLDG TEMP ELEM	N/A	N/A	OIP, Page 27
122	XAA0001A	RB COOLING UNIT 1A	N/A	N/A	OIP, Page 30, D-302-222

ESEL Item Num	Equipment		Operating State[1]		Notes/Comments
	ID	Description	Normal State	Desired State	
123	XAH0024A	BATT & CHG ROOM AIR HANDLING UNIT A	N/A	N/A	OIP, Page 46
124	XFN0038A	BATT&CHG RM AIR HANDLING UNIT A SUP FAN	N/A	N/A	OIP, Page 46
125	XFN0038A-M	BATT&CHG RM AH UNIT A SUPPLY FAN MOTOR	N/A	N/A	OIP, Page 46
126	XFN0039A	BATTERY ROOM EXHAUST FAN A	N/A	N/A	OIP, Page 46
127	XFN0039A-M	BATTERY ROOM EXHAUST FAN A MOTOR	N/A	N/A	OIP, Page 46
128	XFN0064A	REACTOR BLDG COOLING UNIT 1A EMERG FAN	N/A	N/A	OIP, Page 30, D-302-222
129	IYE40000	RBCU FAN XFN0064A VIBRATION SENSOR	N/A	N/A	OIP, Page 30, D-302-222
130	XVR13142A-SW	SW PIPING RELIEF VALVE	Closed	Closed or Open	OIP, Page 30, D-302-222
131	IFE04466	SW BOOSTER PUMP A DISCHARGE FLOW ELEM	N/A	N/A	OIP, Page 30, D-302-222
132	IFT04466	SW BOOSTER PUMP A DISCHARGE FLOW XMTR	N/A	N/A	OIP, Page 30, D-302-222
133	IFI04466	SW BOOSTER PUMP A DISCHARGE FLOW IND	N/A	N/A	OIP, Page 30, D-302-222
134	XVB03110A-SW	RBCU 1A&2A CI SYS SUPPLY ISOLATION VLV	Open	Closed	OIP, Page 30, D-302-222
135	XVB03110A-O-SW	OPER-RBCU 1A&2A CI SYS SUPPLY ISOL VLV	N/A	N/A	OIP, Page 30, D-302-222
136	XVR03146A-SW	RB CLG UNIT 1A OUTLET HDR RELIEF VALVE	Closed	Closed or Open	OIP, Page 30, D-302-222
137	XVT03164-SW	DRPI COOLING UNIT INLET HDR ISOL VALVE	Open	Closed	OIP, Page 30, D-302-222

ESEL Item Num	Equipment		Operating State[1]		Notes/Comments
	ID	Description	Normal State	Desired State	
138	XVT03164-O-SW	OPER-DRPI CLG UNIT INLET HDR ISOL VALVE	N/A	N/A	OIP, Page 30, D-302-222
139	XVG03108B-SW	RB COOLING UNIT 2A INLET ISOLATION VLV	Open	Closed	OIP, Page 30, D-302-222
140	XVG03108B-O-SW	OPER-RB COOLING UNIT 2A INLET ISOL VLV	N/A	N/A	OIP, Page 30, D-302-222
141	XVG03109B-SW	RB COOLING UNIT 2A OUTLET ISOLATION VLV	Open	Closed	OIP, Page 30, D-302-222
142	XVG03109B-O-SW	OPER-RB COOLING UNIT 2A OUTLET ISOL VLV	N/A	N/A	OIP, Page 30, D-302-222
143	XVT03169-SW	DRPI COOLING UNIT OUTLET HDR ISOL VLV	Open	Closed	OIP, Page 30, D-302-222
144	XVT03169-O-SW	OPER-DRPI CLG UNIT OUTLET HDR ISOL VLV	N/A	N/A	OIP, Page 30, D-302-222
145	XVG03111A-SW	RBCU 1A&2A CI SYS RETURN ISOLATION VLV	Open	Closed	OIP, Page 30, D-302-222
146	XVG03111A-O-SW	OPER-RBCU 1A&2A CI SYS RETURN ISOL VLV	N/A	N/A	OIP, Page 30, D-302-222
147	ITE04467	RBCU SW RETURN HEADER A TEMP ELEMENT	N/A	N/A	OIP, Page 30, D-302-222
148	ITI04467	RBCU RETURN HDR A TEMP INDICATOR	N/A	N/A	OIP, Page 30, D-302-222
149	IFE04468	SW POND RBCU RET HDR A INLET FLOW ELEM	N/A	N/A	OIP, Page 30, D-302-222
150	IFT04468	SW POND RBCU RET HDR A INLET FLOW XMTR	N/A	N/A	OIP, Page 30, D-302-222
151	IFI04468	RBCU RETURN HDR A FLOW INDICATOR	N/A	N/A	OIP, Page 30, D-302-222
152	IPT04528	SW POND RBCU RET HDR A INLET PRESS XMTR	N/A	N/A	OIP, Page 30, D-302-222

ESEL Item Num	Equipment		Operating State[1]		Notes/Comments
	ID	Description	Normal State	Desired State	
153	IPI04528	SW FROM RBCU LOOP A PRESS INDICATOR	N/A	N/A	OIP, Page 30, D-302-222
154	IFE00975	LOOP A COLD LEG FLOW ELEMENT	N/A	N/A	E-302-691
155	IFE00976	LOOP B COLD LEG FLOW ELEMENT	N/A	N/A	E-302-691
156	IFE00977	LOOP C COLD LEG FLOW ELEMENT	N/A	N/A	E-302-691
157	APN5901	120 VOLT VITAL AC DISTR PANEL 1, NSSS	N/A	N/A	E-206-005, E-206-054, E-206-062-SH 1
158	APN5902	120 VOLT VITAL AC DISTR PANEL 2, NSSS	N/A	N/A	E-206-005, E-206-054, E-206-062-SH 1
159	APN5903	120 VOLT VITAL AC DISTR PANEL 3, NSSS	N/A	N/A	E-206-005, E-206-054, E-206-062-SH 2
160	APN5904	120 VOLT VITAL AC DISTR PANEL 4, NSSS	N/A	N/A	E-206-005, E-206-054, E-206-062-SH 2
161	APN5907	120 VOLT VITAL AC DISTR PANEL 7, NSSS	N/A	N/A	E-206-005, E-206-054, E-206-062-SH 1
162	APN5908	120 VOLT VITAL AC DISTR PANEL 8, NSSS	N/A	N/A	E-206-005, E-206-054, E-206-062-SH 1
163	DPN1HA[2]	BATTERY MAIN DISTRIBUTION PANEL 1HA	N/A	N/A	E-206-005, E-206-062-SH 3
164	DPN1HA1	125V DC DISTRIBUTION PANEL 1HA1	N/A	N/A	E-206-005, E-206-062-SH 3
165	DPN1HB[2]	BATTERY MAIN DISTRIBUTION PANEL 1HB	N/A	N/A	E-206-005, E-206-062-SH 4
166	DPN1HB1	DC DISTRIBUTION PANEL 1HB1	N/A	N/A	E-206-005, E-206-062-SH 4
167	XBA-1A[2]	125V DC DISTRIBUTION BUS 1A BATTERY	N/A	N/A	E-206-005
168	XBA-1B[2]	125V DC DISTRIBUTION BUS 1B BATTERY	N/A	N/A	E-206-005
169	XBC-1A	125V DC DISTRI BUS 1A BATTERY CHARGER	N/A	N/A	E-206-005

ESEL Item Num	Equipment		Operating State[1]		Notes/Comments
	ID	Description	Normal State	Desired State	
170	XBC-1A-1B	125V DC DISTRI BUS 1A-1B BACKUP BATTERY CHARGER ("Swing charger")	N/A	N/A	E-206-005
171	XCP6103	MCB XCP-6103	N/A	N/A	E-206-080, 1MS-28-026, Sh. 3, 1MS-28-026, Sh. 4
172	XCP6104	MCB XCP-6104	N/A	N/A	E-206-080, 1MS-28-026, Sh. 3, 1MS-28-026, Sh. 4
173	XCP6106	MCB XCP-6106	N/A	N/A	E-206-080, 1MS-28-026, Sh. 5, 1MS-28-026, Sh. 6
174	XCP6107	MCB XCP-6107	N/A	N/A	E-206-080, 1MS-28-026, Sh. 5, 1MS-28-026, Sh. 6
175	XCP6108	MCB XCP-6108	N/A	N/A	1MS-28-026, Sh. 7, E-206-022
176	XCP6110	MCB XCP-6110	N/A	N/A	1MS-28-026, Sh. 17, 1MS-28-026, Sh. 18, E-206-022
177	XCP6111	MCB XCP-6111	N/A	N/A	E-206-080, 1MS-28-026, Sh. 19, 1MS-28-026, Sh. 20
178	XCP6112	MCB XCP-6112	N/A	N/A	E-206-080, 1MS-28-026, Sh. 21, 1MS-28-026, Sh. 22
179	XCP6113	MCB XCP-6113	N/A	N/A	E-206-080, 1MS-28-026, Sh. 23, 1MS-28-026, Sh. 24
180	XCP6114	MCB XCP-6114	N/A	N/A	1MS-28-026, Sh. 30, 1MS-28-026, Sh. 31
181	XIT5901	120 VAC VITAL BUS 10 KVA UPS XIT5901	N/A	N/A	E-206-005, E-206-054, E-206-062-SH 1
182	XIT5902	120 VAC VITAL BUS 10 KVA UPS XIT5902	N/A	N/A	E-206-005, E-206-054, E-206-062-SH 1
183	XIT5903	120 VAC VITAL BUS 10 KVA UPS XIT5903	N/A	N/A	E-206-005, E-206-054, E-206-062-SH 2
184	XIT5904	120 VAC VITAL BUS 10 KVA UPS XIT5904	N/A	N/A	E-206-005, E-206-054, E-206-062-SH 2
185	XMC1DA2X	480V MCC XMC1DA2X	N/A	N/A	E-206-005, E-206-034, E-206-047
186	XMC1DA2Y	480V MCC XMC1DA2Y	N/A	N/A	E-206-005, E-206-034, E-206-047, E-206-054
187	XPN6001	BOP Instrument Panel Train A	N/A	N/A	E-206-062-SH 1
188	XPN6002	BOP Instrument Panel Train B	N/A	N/A	E-206-062-SH 2

ESEL Item Num	Equipment		Operating State[1]		Notes/Comments
	ID	Description	Normal State	Desired State	
189	XPN6004	BOP Instrument Panel Train A	N/A	N/A	E-206-062-SH 1
190	XPN6005	BOP Instrument Panel Train B	N/A	N/A	E-206-062-SH 2
191	XPN6020	ESF Load Sequence Panel, Train A	N/A	N/A	E-206-062-SH 1
192	XPN7001	Process I&C Rack Protection Set I	N/A	N/A	E-206-062-SH 1
193	XPN7002	Process I&C Rack Protection Set II	N/A	N/A	E-206-062-SH 1
194	XPN7003	Process I&C Rack Protection Set III	N/A	N/A	E-206-062-SH 2
195	XPN7004	Process I&C Rack Protection Set IV	N/A	N/A	E-206-062-SH 2
196	XPN7005	Process I&C Rack Cont Group 1	N/A	N/A	E-206-062-SH 1
197	XPN7006	Process I&C Rack Cont Group 2	N/A	N/A	E-206-062-SH 1
198	XPN7007	Process I&C Rack Cont Group 3	N/A	N/A	E-206-062-SH 2
199	XPN7010	Solid State Protection System Cabinet Train A	N/A	N/A	E-206-062-SH 1 & 2, B-208-094
200	XPN7020	Solid State Protection System (SSPS) Cabinet Train B	N/A	N/A	E-206-062-SH 1 & 2, B-208-094
201	XPN7034	Aux Safeguards Cabinet Train A	N/A	N/A	E-206-062-SH 3
202	XPN7035	Aux Safeguards Cabinet Train B	N/A	N/A	E-206-062-SH 4
203	XPN7106	MAIN CONTROL BOARD TERMINATION CABINET XPN7106	N/A	N/A	E-206-062-SH 3, E-206-080
204	XPN7107	MAIN CONTROL BOARD TERMINATION CABINET XPN7107	N/A	N/A	B-208-032-EF54
205	XPN7108	MAIN CONTROL BOARD TERMINATION CABINET XPN7108	N/A	N/A	B-208-032-EF54

ESEL Item Num	Equipment		Operating State[1]		Notes/Comments
	ID	Description	Normal State	Desired State	
206	XPN7113	Main Control Board Instrument Bus 2 Channel D	N/A	N/A	E-206-062-SH 1
207	XPN7114	MAIN CONTROL BOARD TERMINATION CABINET XPN7114	N/A	N/A	B-208-032-EF37A,B, B-208-032-EF38A,B, E-811-017, B-208-032-EF39A,B
208	XPN7119	MAIN CONTROL BOARD TERMINATION CABINET XPN7119	N/A	N/A	B-208-032-EF34A,B, B-208-032-EF36A,B
209	XPN7120	MAIN CONTROL BOARD TERMINATION CABINET XPN7120	N/A	N/A	E-811-017, B-208-032-EF54
210	XPN7121	MAIN CONTROL BOARD TERMINATION CABINET XPN7121	N/A	N/A	B-208-032-EF35A,B
211	XPN7124	MAIN CONTROL BOARD TERMINATION CABINET XPN7124	N/A	N/A	B-208-032-EF34A,B, B-208-032-EF35A,B, B-208-032-EF36A,B, E-811-019
212	XPN7130	MAIN CONTROL BOARD TERMINATION CABINET XPN7130	N/A	N/A	E-206-062-SH 4, E-206-080
213	XPN7200A	Control Room Evacuation Panel (CREP A)	N/A	N/A	E-206-062-SH 3, E-206-042-SH 1
214	XPN7200B	Control Room Evacuation Panel (CREP B)	N/A	N/A	E-206-062-SH 4, E-206-042 SH 1
215	XPN7213	Control Room Evacuation Panel (CREP) Process Cabinet	N/A	N/A	E-206-062-SH 4
216	XSW1DA[2]	Class IE 7.2 kV SWGR bus XSW1DA-ES	N/A	N/A	E-206-005, E-206-022
217	XSW1DA1[2]	Class IE 480 V SWGR bus XSW1DA1-ES	N/A	N/A	E-206-005, E-206-034, E-206-047
218	XSW1DA2[2]	Class IE 480 V SWGR bus XSW1DA2-ES	N/A	N/A	E-206-005, E-206-034, E-206-047

Notes
1. The operating states for the equipment selected for inclusion on the ESEL can be found in Attachment 5 of Reference 20.
2. These components were identified to have lockout relays, which were considered in this analysis. For more information regarding the identification of these lockout relays, see tab "VCSNS U1 Elec ESEL Relay List" within Attachment 5 of Reference 20.

Attachment B

ESEP HCLPF Values and Failure Modes Tabulation

HCLPF values are listed in Table B-1. These notes are applicable:

1. The listed HCLPF value is for comparison to the horizontal PGA at the bedrock surface.
2. Items covered by the NP-6041-SL "rule of the box" are identified in Table B-2. In each case, the HCLPF value for the parent item applies.
3. Results take credit for planned resolution of screening issues cited in Table 6-3.
4. For the CST only (XTK0008), the applied ground motion was based on the GMRS.
5. The "Class" value for each item refers to the equipment class per the SQUG-GIP [10].

Table B-1: ESEL HCLPF Values							
No.	ID	Description	Bldg	Elev (ft)	Class	HCLPF (g)	Controlling Failure Mode
1	IFE03561	STEAM GEN A EF SUPPLY HEADER FLOW ELEM	AB	412	0	≥ 0.30	Screened
2	XMC1DA2Y	480V MCC XMC1DA2Y	AB	412	1	≥ 0.30	Screened
3	IFT03561	STEAM GEN A EF SUPPLY HEADER FLOW XMTR	AB	412	18	≥ 0.30	Screened
4	IPT03563	STEAM GEN A EF SUPPLY HEADER PRESS XMTR	AB	412	18	≥ 0.30	Screened
5	XTK0025	REFUELING WATER STORAGE TANK	AB	412	21	0.32	Overturning moment capacity.
6	IFE04466	SW BOOSTER PUMP A DISCHARGE FLOW ELEM	AB	436	0	≥ 0.30	Screened
7	IFE04468	SW POND RBCU RET HDR A INLET FLOW ELEM	AB	436	0	≥ 0.30	Screened
8	IPV02000-MS	MAIN STEAM HEADER A POWER RELIEF VALVE	AB	436	7	≥ 0.30	Screened
9	XVG01611A-FW	MAIN FW TO STM GEN A HDR ISOL	AB	436	7	≥ 0.30	Screened
10	XVS02806A-MS	MAIN STEAM HEADER A SAFETY VALVE	AB	436	7	≥ 0.30	Screened
11	XVS02806B-MS	MAIN STEAM HEADER A SAFETY VALVE	AB	436	7	≥ 0.30	Screened
12	XVS02806C-MS	MAIN STEAM HEADER A SAFETY VALVE	AB	436	7	≥ 0.30	Screened
13	XVS02806D-MS	MAIN STEAM HEADER A SAFETY VALVE	AB	436	7	≥ 0.30	Screened
14	XVS02806E-MS	MAIN STEAM HEADER A SAFETY VALVE	AB	436	7	≥ 0.30	Screened
15	XVT02877A-MS	MS HEADER A MOIST COLLECTOR DRAIN VLV	AB	436	7	≥ 0.30	Screened
16	IFT04466	SW BOOSTER PUMP A DISCHARGE FLOW XMTR	AB	436	18	≥ 0.30	Screened
17	IFT04468	SW POND RBCU RET HDR A INLET FLOW XMTR	AB	436	18	≥ 0.30	Screened

Table B-1: ESEL HCLPF Values							
No.	ID	Description	Bldg	Elev (ft)	Class	HCLPF (g)	Controlling Failure Mode
18	IPT00474	SG A MAIN STEAM HDR PRESS TRANSMITTER	AB	436	18	≥ 0.30	Screened
19	IPT00475	SG A MAIN STEAM HDR PRESS TRANSMITTER	AB	436	18	≥ 0.30	Screened
20	IPT00476	SG A MAIN STEAM HDR PRESS TRANSMITTER	AB	436	18	≥ 0.30	Screened
21	IPT02000	STEAM GENERATOR A OUTLET PRESSURE XMTR	AB	436	18	≥ 0.30	Screened
22	IPT02000A	STEAM GENERATOR A OUTLET PRESSURE XMTR	AB	436	18	≥ 0.30	Screened
23	IPT04528	SW POND RBCU RET HDR A INLET PRESS XMTR	AB	436	18	≥ 0.30	Screened
24	XVB03110A-SW	RBCU 1A&2A CI SYS SUPPLY ISOLATION VLV	AB	463	8	≥ 0.30	Screened
25	XVG03111A-SW	RBCU 1A&2A CI SYS RETURN ISOLATION VLV	AB	463	8	≥ 0.30	Screened
26	IPT00950	REACTOR CONTAINMENT PRESSURE XMTR	AB	463	18	≥ 0.30	Screened
27	ITE04467	RBCU SW RETURN HEADER A TEMP ELEMENT	AB	463	19	≥ 0.30	Screened
28	APN5901	120 VOLT VITAL AC DISTR PANEL 1, NSSS	CB	436	14	≥ 0.30	Screened
29	APN5902	120 VOLT VITAL AC DISTR PANEL 2, NSSS	CB	436	14	≥ 0.30	Screened
30	APN5903	120 VOLT VITAL AC DISTR PANEL 3, NSSS	CB	436	14	≥ 0.30	Screened
31	APN5904	120 VOLT VITAL AC DISTR PANEL 4, NSSS	CB	436	14	≥ 0.30	Screened
32	APN5907	120 VOLT VITAL AC DISTR PANEL 7, NSSS	CB	436	14	≥ 0.30	Screened
33	APN5908	120 VOLT VITAL AC DISTR PANEL 8, NSSS	CB	436	14	≥ 0.30	Screened
34	XIT5901	120 VAC VITAL BUS 10 KVA UPS XIT5901	CB	436	16	≥ 0.30	Screened

Table B-1: ESEL HCLPF Values

No.	ID	Description	Bldg.	Elev. (ft)	Class	HCLPF (g)	Controlling Failure Mode
35	XIT5902	120 VAC VITAL BUS 10 KVA UPS XIT5902	CB	436	16	≥ 0.30	Screened
36	XIT5903	120 VAC VITAL BUS 10 KVA UPS XIT5903	CB	436	16	≥ 0.30	Screened
37	XIT5904	120 VAC VITAL BUS 10 KVA UPS XIT5904	CB	436	16	≥ 0.30	Screened
38	XPN6001	BOP Instrument Panel Train A	CB	436	20	≥ 0.30	Screened
39	XPN6002	BOP Instrument Panel Train B	CB	436	20	≥ 0.30	Screened
40	XPN6004	BOP Instrument Panel Train A	CB	436	20	≥ 0.30	Screened
41	XPN6005	BOP Instrument Panel Train B	CB	436	20	≥ 0.30	Screened
42	XPN6020	ESF Load Sequence Panel, Train A	CB	436	20	≥ 0.30	Screened
43	XPN7001	Process I&C Rack Protection Set I	CB	436	20	≥ 0.30	Screened
44	XPN7002	Process I&C Rack Protection Set II	CB	436	20	≥ 0.30	Screened
45	XPN7003	Process I&C Rack Protection Set III	CB	436	20	≥ 0.30	Screened
46	XPN7004	Process I&C Rack Protection Set IV	CB	436	20	≥ 0.30	Screened
47	XPN7005	Process I&C Rack Cont Group 1	CB	436	20	≥ 0.30	Screened
48	XPN7006	Process I&C Rack Cont Group 2	CB	436	20	≥ 0.30	Screened
49	XPN7007	Process I&C Rack Cont Group 3	CB	436	20	≥ 0.30	Screened
50	XPN7010	Solid State Protection System Cabinet Train A	CB	436	20	≥ 0.30	Screened
51	XPN7020	Solid State Protection System (SSPS) Cabinet Train B	CB	436	20	≥ 0.30	Screened

Table B-1: ESEL HCLPF Values							
No.	ID	Description	Bldg	Elev (ft)	Class	HCLPF (g)	Controlling Failure Mode
52	XPN7034	Aux Safeguards Cabinet Train A	CB	436	20	≥ 0.30	Screened
53	XPN7035	Aux Safeguards Cabinet Train B	CB	436	20	≥ 0.30	Screened
54	XPN7106	MAIN CONTROL BOARD TERMINATION CABINET XPN7106	CB	448	20	≥ 0.30	Screened
55	XPN7107	MAIN CONTROL BOARD TERMINATION CABINET XPN7107	CB	448	20	≥ 0.30	Screened
56	XPN7108	MAIN CONTROL BOARD TERMINATION CABINET XPN7108	CB	448	20	≥ 0.30	Screened
57	XPN7113	Main Control Board Instrument Bus 2 Channel D	CB	448	20	≥ 0.30	Screened
58	XPN7114	MAIN CONTROL BOARD TERMINATION CABINET XPN7114	CB	448	20	≥ 0.30	Screened
59	XPN7119	MAIN CONTROL BOARD TERMINATION CABINET XPN7119	CB	448	20	≥ 0.30	Screened
60	XPN7120	MAIN CONTROL BOARD TERMINATION CABINET XPN7120	CB	448	20	≥ 0.30	Screened
61	XPN7121	MAIN CONTROL BOARD TERMINATION CABINET XPN7121	CB	448	20	≥ 0.30	Screened
62	XPN7124	MAIN CONTROL BOARD TERMINATION CABINET XPN7124	CB	448	20	≥ 0.30	Screened
63	XPN7130	MAIN CONTROL BOARD TERMINATION CABINET XPN7130	CB	448	20	≥ 0.30	Screened
64	XCP6103	MCB XCP-6103	CB	463	20	≥ 0.30	Screened
65	XCP6104	MCB XCP-6104	CB	463	20	≥ 0.30	Screened
66	XCP6106	MCB XCP-6106	CB	463	20	≥ 0.30	Screened

Table B-1: ESEL HCLPF Values							
No.	ID	Description	Bldg	Elev (ft)	Class	HCLPF (g)	Controlling Failure Mode
67	XCP6107	MCB XCP-6107	CB	463	20	≥ 0.30	Screened
68	XCP6108	MCB XCP-6108	CB	463	20	≥ 0.30	Screened
69	XCP6110	MCB XCP-6110	CB	463	20	≥ 0.30	Screened
70	XCP6111	MCB XCP-6111	CB	463	20	≥ 0.30	Screened
71	XCP6112	MCB XCP-6112	CB	463	20	≥ 0.30	Screened
72	XCP6113	MCB XCP-6113	CB	463	20	≥ 0.30	Screened
73	XCP6114	MCB XCP-6114	CB	463	20	≥ 0.30	Screened
74	IPT03632	EF PUMP SUCT HDR PRESSURE TRANSMITTER	DB	412	18	≥ 0.30	Screened
75	IPT03633	EF PUMP SUCT HDR PRESSURE TRANSMITTER	DB	412	18	≥ 0.30	Screened
76	IPT03634	EF PUMP SUCT HDR PRESSURE TRANSMITTER	DB	412	18	≥ 0.30	Screened
77	IPT03635	EF PUMP SUCT HDR PRESSURE TRANSMITTER	DB	412	18	≥ 0.30	Screened
78	IFE03525	TURB DRIVEN EF PUMP DISCH FLOW ELEMENT	IB	412	0	≥ 0.30	Screened
79	IFE03541	SG B MTR DR EF PUMP DISCH HDR FLOW ELEM	IB	412	0	≥ 0.30	Screened
80	IFE03571	STEAM GEN B EF SUPPLY HEADER FLOW ELEM	IB	412	0	≥ 0.30	Screened
81	IFE03581	STEAM GEN C EF SUPPLY HEADER FLOW ELEM	IB	412	0	≥ 0.30	Screened
82	TPP0008	EMERGENCY FEEDWATER PUMP TURBINE	IB	412	5	≥ 0.30	Screened
83	XPP0008	EMERG FEEDWATER TURBINE DRIVEN PUMP	IB	412	5	≥ 0.30	Screened

Table B-1: ESEL HCLPF Values

No.	ID	Description	Bldg	Elev (ft)	Class	HCLPF (g)	Controlling Failure Mode
84	XPP0021A	EMERGENCY FEEDWATER PUMP A	IB	412	5	≥ 0.30	Screened
85	IFV02030-MS	EF PUMP TURB STEAM SUPPLY FLOW CONT VLV	IB	412	7	≥ 0.30	Screened
86	XVM11025-EF	EF PUMP TURBINE SPEED CONT GOVERNOR VLV	IB	412	7	≥ 0.30	Screened
87	XVR13142A-SW	SW PIPING RELIEF VALVE	IB	412	7	≥ 0.30	Screened
88	XVT02865-MS	EF PUMP TURB MAIN STEAM THROTTLE VALVE	IB	412	7	≥ 0.30	Screened
89	DPN1HA	BATTERY MAIN DISTRIBUTION PANEL 1HA	IB	412	14	0.35	Functionality, including breaker trip.
90	DPN1HA1	125V DC DISTRIBUTION PANEL 1HA1	IB	412	14	≥ 0.30	Screened
91	DPN1HB	BATTERY MAIN DISTRIBUTION PANEL 1HB	IB	412	14	0.35	Functionality, including breaker trip.
92	DPN1HB1	DC DISTRIBUTION PANEL 1HB1	IB	412	14	≥ 0.30	Screened
93	XBA-1A	125V DC DISTRIBUTION BUS 1A BATTERY	IB	412	15	≥ 0.30	Screened
94	XBA-1B	125V DC DISTRIBUTION BUS 1B BATTERY	IB	412	15	≥ 0.30	Screened
95	XBC-1A	125V DC DISTRI BUS 1A BATTERY CHARGER	IB	412	16	≥ 0.30	Screened
96	XBC-1A-1B	125V DC DISTRI BUS 1A-1B BACKUP BATTERY CHARGER ("Swing charger")	IB	412	16	≥ 0.30	Screened
97	IFT03525	TURBINE DR EF PUMP DISCHARGE FLOW XMTR	IB	412	18	≥ 0.30	Screened
98	IFT03531	SG A MTR DR EF PUMP DISCH HDR FLOW XMTR	IB	412	18	≥ 0.30	Screened
99	IFT03541	SG B MTR DR EF PUMP DISCH HDR FLOW XMTR	IB	412	18	≥ 0.30	Screened
100	IFT03551	SG C MTR DR EF PUMP DISCH HDR FLOW XMTR	IB	412	18	≥ 0.30	Screened

Table B-1: ESEL HCLPF Values							
No.	ID	Description	Bldg	Elev (ft)	Class	HCLPF (g)	Controlling Failure Mode
101	IFT03571	STEAM GEN B EF SUPPLY HEADER FLOW XMTR	IB	412	18	≥ 0.30	Screened
102	IFT03581	STEAM GEN C EF SUPPLY HEADER FLOW XMTR	IB	412	18	≥ 0.30	Screened
103	IPI03512	MOTOR DRIVEN EF PUMP A SUCT PRESS IND	IB	412	18	≥ 0.30	Screened
104	IPI03521	TURB DR EF PP EF SUP HDR SUCT PRESS IND	IB	412	18	≥ 0.30	Screened
105	IPI03527	TURBINE DR EF PUMP DISCHARGE PRESS IND	IB	412	18	≥ 0.30	Screened
106	IPS03504	MDEFP A SUCT PRESS SW LO PRESS ALARM	IB	412	18	≥ 0.30	Screened
107	IPS03524	TURB DR EF PUMP SUCT LP ALARM SWITCH	IB	412	18	≥ 0.30	Screened
108	IPT02032	EF PUMP TURBINE MS SUP HDR PRESS XMTR	IB	412	18	≥ 0.30	Screened
109	IPT03573	STEAM GEN B EF SUPPLY HEADER PRESS XMTR	IB	412	18	≥ 0.30	Screened
110	IPT03583	STEAM GEN C EF SUPPLY HEADER PRESS XMTR	IB	412	18	≥ 0.30	Screened
111	TPP0008-HE1	EF PUMP TURBINE LUBE OIL HEAT EXCHANGER	IB	412	21	≥ 0.30	Screened
112	TPP0008-OR1	EF PUMP TURBINE LUBE OIL RESERVOIR	IB	412	21	≥ 0.30	Screened
113	IFE03531	SG A MTR DR EF PUMP DISCH HDR FLOW ELEM	IB	423	0	≥ 0.30	Screened
114	IFV03531-EF	SG A MTR DR EF PUMP FLOW CONTROL VALVE	IB	423	7	≥ 0.30	Screened
115	IFV03536-EF	SG A TURB DR EF PUMP FLOW CONTROL VALVE	IB	423	7	≥ 0.30	Screened
116	IFV03541-EF	SG B MTR DR EF PUMP FLOW CONTROL VALVE	IB	423	7	≥ 0.30	Screened
117	IFV03546-EF	SG B TURB DR EF PUMP FLOW CONTROL VALVE	IB	423	7	≥ 0.30	Screened

Table B-1: ESEL HCLPF Values

No.	ID	Description	Bldg	Elev (ft)	Class	HCLPF (g)	Controlling Failure Mode
118	IFV03551-EF	SG C MTR DR EF PUMP FLOW CONTROL VALVE	IB	423	7	≥ 0.30	Screened
119	IFV03556-EF	SG C TURB DR EF PUMP FLOW CONTROL VALVE	IB	423	7	≥ 0.30	Screened
120	XFN0039A	BATTERY ROOM EXHAUST FAN A	IB	423	9	≥ 0.30	Screened
121	XAH0024A	BATT & CHG ROOM AIR HANDLING UNIT A	IB	423	10	≥ 0.30	Screened
122	IFE03551	SG C MTR DR EF PUMP DISCH HDR FLOW ELEM	IB	424	0	≥ 0.30	Screened
123	IPV02010-MS	MAIN STEAM HEADER B POWER RELIEF VALVE	IB	436	7	≥ 0.30	Screened
124	IPV02020-MS	MAIN STEAM HEADER C POWER RELIEF VALVE	IB	436	7	≥ 0.30	Screened
125	XVG01611B-FW	MAIN FW TO STM GEN B HDR ISOL	IB	436	7	≥ 0.30	Screened
126	XVG01611C-FW	MAIN FW TO STM GEN C HDR ISOL	IB	436	7	≥ 0.30	Screened
127	XVM02801A-MS	MAIN STEAM HEADER A ISOLATION VALVE	IB	436	7	≥ 0.30	Screened
128	XVM02801B-MS	MAIN STEAM HEADER B ISOLATION VALVE	IB	436	7	≥ 0.30	Screened
129	XVM02801C-MS	MAIN STEAM HEADER C ISOLATION VALVE	IB	436	7	≥ 0.30	Screened
130	XVS02806F-MS	MAIN STEAM HEADER B SAFETY VALVE	IB	436	7	≥ 0.30	Screened
131	XVS02806G-MS	MAIN STEAM HEADER B SAFETY VALVE	IB	436	7	≥ 0.30	Screened
132	XVS02806H-MS	MAIN STEAM HEADER B SAFETY VALVE	IB	436	7	≥ 0.30	Screened
133	XVS02806I-MS	MAIN STEAM HEADER B SAFETY VALVE	IB	436	7	≥ 0.30	Screened
134	XVS02806J-MS	MAIN STEAM HEADER B SAFETY VALVE	IB	436	7	≥ 0.30	Screened

Table B-1: ESEL HCLPF Values

No.	ID	Description	Bldg	Elev (ft)	Class	HCLPF (g)	Controlling Failure Mode
135	XVS02806K-MS	MAIN STEAM HEADER C SAFETY VALVE	IB	436	7	≥ 0.30	Screened
136	XVS02806L-MS	MAIN STEAM HEADER C SAFETY VALVE	IB	436	7	≥ 0.30	Screened
137	XVS02806M-MS	MAIN STEAM HEADER C SAFETY VALVE	IB	436	7	≥ 0.30	Screened
138	XVS02806N-MS	MAIN STEAM HEADER C SAFETY VALVE	IB	436	7	≥ 0.30	Screened
139	XVS02806P-MS	MAIN STEAM HEADER C SAFETY VALVE	IB	436	7	≥ 0.30	Screened
140	XVT02843A-MS	MS HEADER A MOIST COLLECTOR DRAIN VLV	IB	436	7	≥ 0.30	Screened
141	XVT02843B-MS	MS HEADER B MOIST COLLECTOR DRAIN VLV	IB	436	7	≥ 0.30	Screened
142	XVT02843C-MS	MS HEADER C MOIST COLLECTOR DRAIN VLV	IB	436	7	≥ 0.30	Screened
143	XVT02877B-MS	MS HEADER C MOIST COLLECTOR DRAIN VLV	IB	436	7	≥ 0.30	Screened
144	IPT00484	SG B MAIN STEAM HDR PRESS TRANSMITTER	IB	436	18	≥ 0.30	Screened
145	IPT00485	SG B MAIN STEAM HDR PRESS TRANSMITTER	IB	436	18	≥ 0.30	Screened
146	IPT00486	SG B MAIN STEAM HDR PRESS TRANSMITTER	IB	436	18	≥ 0.30	Screened
147	IPT00494	SG C MAIN STEAM HDR PRESS TRANSMITTER	IB	436	18	≥ 0.30	Screened
148	IPT00495	SG C MAIN STEAM HDR PRESS TRANSMITTER	IB	436	18	≥ 0.30	Screened
149	IPT00496	SG C MAIN STEAM HDR PRESS TRANSMITTER	IB	436	18	≥ 0.30	Screened
150	IPT02010	STEAM GENERATOR B OUTLET PRESSURE XMTR	IB	436	18	≥ 0.30	Screened
151	IPT02010A	STEAM GENERATOR B OUTLET PRESSURE XMTR	IB	436	18	≥ 0.30	Screened

Table B-1: ESEL HCLPF Values

No.	ID	Description	Bldg	Elev (ft)	Class	HCLPF (g)	Controlling Failure Mode
152	IPT02020	STEAM GENERATOR C OUTLET PRESSURE XMTR	IB	436	18	≥ 0.30	Screened
153	IPT02020A	STEAM GENERATOR C OUTLET PRESSURE XMTR	IB	436	18	≥ 0.30	Screened
154	XPN7200A	Control Room Evacuation Panel (CREP A)	IB	436	20	≥ 0.30	Screened
155	XPN7200B	Control Room Evacuation Panel (CREP B)	IB	436	20	≥ 0.30	Screened
156	XPN7213	Control Room Evacuation Panel (CREP) Process Cabinet	IB	436	20	≥ 0.30	Screened
157	XMC1DA2X	480V MCC XMC1DA2X	IB	463	1	≥ 0.30	Screened
158	XSW1DA1	Class IE 480 V SWGR bus XSW1DA1-ES	IB	463	2	0.24	Cited HCLPF is for relay chatter failure mode; other failure modes are screened and HCLPF ≥ 0.30g.
159	XSW1DA2	Class IE 480 V SWGR bus XSW1DA2-ES	IB	463	2	0.24	Cited HCLPF is for relay chatter failure mode; other failure modes are screened and HCLPF ≥ 0.30g.
160	XSW1DA	Class IE 7.2 kV SWGR bus XSW1DA-ES	IB	463	3	0.20	Cited HCLPF is for relay chatter failure mode; other failure modes are screened and HCLPF ≥ 0.30g.
161	IFE00975	LOOP A COLD LEG FLOW ELEMENT	RB	412	0	≥ 0.30	Screened
162	IFE00976	LOOP B COLD LEG FLOW ELEMENT	RB	412	0	≥ 0.30	Screened
163	IFE00977	LOOP C COLD LEG FLOW ELEMENT	RB	412	0	≥ 0.30	Screened
164	IFT00475	SG A STEAM FLOW DP XMTR	RB	463	18	≥ 0.30	Screened
165	IFT00475A	NARROW RANGE STEAM FLOW	RB	463	18	≥ 0.30	Screened
166	IFT00485	SG B STEAM FLOW DP XMTR	RB	463	18	≥ 0.30	Screened
167	IFT00485A	NARROW RANGE STEAM FLOW	RB	463	18	≥ 0.30	Screened

Table B-1: ESEL HCLPF Values							
No.	ID	Description	Bldg	Elev (ft)	Class	HCLPF (g)	Controlling Failure Mode
168	IFT00495	SG C STEAM FLOW DP XMTR	RB	463	18	≥ 0.30	Screened
169	IFT00495A	NARROW RANGE STEAM FLOW	RB	463	18	≥ 0.30	Screened
170	XAA0001A	RB COOLING UNIT 1A	RB	514	10	0.35	Overall structural integrity.
171	IYE40000	RBCU FAN XFN0064A VIBRATION SENSOR	RB	514	0	≥ 0.30	Screened
172	XVR03146A-SW	RB CLG UNIT 1A OUTLET HDR RELIEF VALVE	RB	518	7	≥ 0.30	Screened
173	XVT03164-SW	DRPI COOLING UNIT INLET HDR ISOL VALVE	RB	518	7	0.44	Functionality
174	XVT03169-SW	DRPI COOLING UNIT OUTLET HDR ISOL VLV	RB	518	7	0.24	Seismic interaction.
175	XVG03108B-SW	RB COOLING UNIT 2A INLET ISOLATION VLV	RB	518	8	0.82	Functionality
176	XVG03109B-SW	RB COOLING UNIT 2A OUTLET ISOLATION VLV	RB	518	8	0.82	Functionality
177	ITE09201	REACTOR BLDG TEMP ELEM	RB	518	19	≥ 0.30	Screened
178	ILT03631	CONDENSATE STORAGE TANK LEVEL XMTR	YD	435	18	≥ 0.30	Screened
179	XTK0008	CONDENSATE STORAGE TANK	YD	435	21	0.88	Sliding due to exceedance of base shear capacity.

Table B-2: ESEL Rule-of-Box Items				
ID	Description	Bdlg	Elev (ft)	Parent
IFI03525	TDEFP DISCHARGE FLOW INDICATOR	CB	463	XCP6103
IFI04466	SW BOOSTER PUMP A DISCHARGE FLOW IND	CB	463	XCP6103
IFI04468	RBCU RETURN HDR A FLOW INDICATOR	CB	463	XCP6103
IPI00950	CONTAINMENT PRESSURE, PRESSURE IND I	CB	463	XCP6103
IPI04528	SW FROM RBCU LOOP A PRESS INDICATOR	CB	463	XCP6103
ITI04467	RBCU RETURN HDR A TEMP INDICATOR	CB	463	XCP6103
ITI09201A	REACTOR BLDG AMBIENT TEMP INDICATOR	CB	463	XCP6103
TPP0008-PP1	EF PUMP TURBINE LUBE OIL ROTARY PUMP	IB	412	TPP0008
TPP0008-SC1	EF PUMP TURBINE SPEED CONTROL GOVERNOR	IB	412	TPP0008
XFN0038A-M	BATT&CHG RM AH UNIT A SUPPLY FAN MOTOR	IB	423	XAH0024A
XFN0039A-M	BATTERY ROOM EXHAUST FAN A MOTOR	IB	423	XFN0039A
XFN0038A	BATT&CHG RM AIR HANDLING UNIT A SUP FAN	IB	423	XAH0024A
XFN0064A	REACTOR BLDG COOLING UNIT 1A EMERG FAN	RB	514	XAA0001A

Notes
Valve operators on the ESEL are not listed above. The parent for each valve operator is the corresponding valve.

Attachment C

Seismic Review Team

The SRT consisted of seismic engineers from Stevenson & Associates. Brief resumes for team members are provided below.

John J. O'Sullivan, P.E.

Mr. O'Sullivan is a Senior Consultant in the S&A Boston office. He has managed and led seismic walkdowns and fragility analyses of structures and components for use in probabilistic risk assessments. Mr. O'Sullivan has 25 years of seismic experience serving the nuclear industry. Mr. O'Sullivan has participated in numerous USI A-46 and IPEEE projects in response to the requirements of Generic Letters 87-02 and 88-20. He recently led the seismic fragility analysis effort for the Palo Verde station to industry standard ASME/ANS RA-Sa-2009. Mr. O'Sullivan is a registered professional engineer (Massachusetts) and has a Master of Science in Structural Engineering from the Massachusetts Institute of Technology. He has received industry training as Seismic Capability Engineer (EPRI 5-day SQUG training), EPRI IPEEE Add-on, and Seismic Fragility training.

Stephane Damolini

Mr. Damolini is a Senior Engineer in the S&A Boston office. In his five years at Stevenson & Associates, he has performed multiple finite element analyses (including 3D building models and piping models) along with seismic fragility and HCLPF generation for structures, systems, and components. He also completed seismic walkdowns for the Seabrook and V.C. Summer nuclear stations. Mr. Damolini has a Master of Engineer in Civil/Structural Engineering from the Massachusetts Institute of Technology and a Master of Science in Civil Engineering and Construction from the École Spéciale des Travaux Publics (the number one Civil Engineering school in France). Mr. Damolini has been a SQUG Qualified Seismic Capability Engineer since 2011.

Seth Baker

Mr. Baker is a Senior Engineer in the S&A Boston office. He has performed structural engineering analysis & design, finite element analysis, structural mechanics evaluations, seismic qualification managed and seismic walkdowns. Mr. Baker has a Master of Science in Civil/Structural Engineering from Stanford University. He has received industry training as Seismic Capability Engineer (EPRI 5-day SQUG training) and completed the EPRI training for NTTF 2.3 plant seismic walkdowns.

VIRGIL C. SUMMER NUCLEAR STATION (VCSNS) UNIT 1

Attachment II

Regulatory Commitments

The following table identifies those actions committed to by SCE&G, Virgil C. Summer Nuclear Station in this document. Any other statements in this submittal are provided for information purposes and are not considered to be commitments. Please direct questions regarding these commitments to Mr. Bruce L. Thompson, Manager, Nuclear Licensing, (803) 931-5042.

Action #	Commitment	Due Date/ Event
1	Modify FLEX Support Procedures to include operator actions to reset relays with HCLPF values less than the RLGM for equipment id XSW1DA.	December 2016
2	Modify FLEX Support Procedures to include operator actions to reset relays with HCLPF values less than the RLGM for equipment id XSW1DA1.	December 2016
3	Modify FLEX Support Procedures to include operator actions to reset relays with HCLPF values less than the RLGM for equipment id XSW1DA2.	December 2016
4	Modify the seismic interaction to provide sufficient shake space, or modify piping system supports such that HCLPF > GMRS.	No later than the end of the second Unit 1 refueling outage after December 31, 2014 (Tentative Spring 2017)
5	Modify valve or handrail to provide sufficient shake space.	December 2016
6	Modify rack to reduce front rail gaps for equipment id XBA-1A.	No later than the end of the second Unit 1 refueling outage after December 31, 2014 (Tentative Spring 2017)
7	Modify rack to reduce front rail gaps for equipment id XBA-1B.	No later than the end of the second Unit 1 refueling outage after December 31, 2014 (Tentative Spring 2017)

Action #	Commitment	Due Date/ Event
8	Trim the steel angle post to mitigate potential seismic interaction.	December 2016
9	Modify the handrail to mitigate potential seismic interaction.	No later than the end of the second Unit 1 refueling outage after December 31, 2014 (Tentative Spring 2017)