Response to

Request for Additional Information No. 11 Supplement 2, Revision 0

6/16/2008

U.S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 08.03.01 – AC Power Systems (Onsite)
SRP Section: 08.03.02 – DC Power Systems (Onsite)
Application Section: FSAR Chapter 8
EE Branch

Question 08.03.01-1:

Page 8.3-3 (8.3.1.1.1) of the FSAR states that "a loss of voltage at one of 6.9 kV (BDA) buses initiates an automatic fast transfer of the offsite power source, maintaining offsite power to all four divisions by switching the affected bus power supply to the unaffected EAT. The fast transfer minimizes voltage decay and frequency difference to limit motor torque during the transfer, thus minimizing equipment degradation." Explain how the automatic fast transfer scheme works and how the scheme prevents transfer into a faulted bus. Elaborate on whether any single failure vulnerability exists with the transfer scheme between the motive (AC) and control power (DC) within the affected divisions. Is the same transfer scheme used for NPSS?

Response to Question 08.03.01-1:

The emergency power supply system (EPSS) fast transfer is a non-safety-related bus transfer that improves the reliability of offsite power by initiating a transfer in specific fault conditions that would otherwise result in the loss of offsite power (LOOP) to EPSS switchgear. A failure in the fast transfer scheme does not affect the capability of the Class 1E emergency diesel generators (EDG) to perform their safety function of supplying electrical power to the EPSS buses in a loss of voltage condition. The offsite power system is designed to remain on the preferred source, offsite power, whenever possible. Otherwise, depending on the postulated failures, the buses will ultimately revert to their safety-related power source, the EDGs.

The single point vulnerabilities that can affect the fast transfer are limited to those that will affect a single division. These potential failures beyond the initiating event (emergency auxiliary transformer (EAT) failure) are no different for the fast transfer logic than for a residual voltage bus transfer. For example, the failure of a circuit breaker in the transfer scheme (either normal or alternate) to a BDA bus will limit the impact to that specific division. Additionally, the DC control power that supports the transfer (control power for circuit breaker tripping coils and transfer supervision) is supplied by the Class 1E uninterruptible power supply system of the respective division; therefore, a failure in the control power function is limited to the affected division. In the case of a divisional DC system failure, that division EDG may also be affected. In the case of an offsite power supply breaker failure to close unrelated to a divisional DC system failure, that division EDG will start and re-energize the bus.

In each of these conditions where an additional failure beyond the initiating event results in the loss of power to an EPSS division, the remaining three divisions are capable of maintaining plant safe operations (as limited by applicable technical specification required actions) and mitigating design basis events.

A fast transfer of the EPSS buses to an alternate emergency auxiliary transformer (EAT) is initiated by a fault related to the normal EAT supply to the bus. The transformer protection (e.g., transformer differential current) that will isolate the faulted transformer also initiates the fast transfer. The dead bus time, or the time from contact parting to contact touching of the opening and closing circuit breakers, is typically limited to three to five cycles. Synchronism of the two sources prior to the fast transfer is verified by a synch check relay, which verifies that the phase angle between the motor bus (e.g., BDA) voltage and the alternate source voltage is within acceptable limits prior to closing the alternate source breaker. This synch check function is accomplished with a two-out-of-three logic scheme that prevents a single failure in the synch check function from permitting a bus transfer to an out-of-phase source.

A bus transfer example illustrates how the fast bus transfer scheme prevents either transfer of a faulted bus to an unaffected bus or transfer of an unaffected bus onto a faulted bus. The example will also demonstrate the limit of plant impact if component failure allows the transfer with unacceptable conditions. U.S. EPR FSAR Tier 2, Figure 8.3-2—Emergency Power Supply System Single Line Drawing, Sheet 1 of 3 illustrates the following description. A fault on EAT supply 30BDT01, EPSS buses 31BDA and 33BDA normal supply will initiate the transfer of those buses to the alternate EAT supply, 30BDT02. The transfer involves opening the normal supply circuit breaker and closing the alternate supply circuit breaker using the previously described fast transfer scheme. Because the transfer is initiated by a transformer fault, a faulted bus will not be transferred. The bus is transferred onto the alternate EAT secondary winding, which verifies that the bus is not transferred onto a bus that has the potential to be faulted. If there is a bus (e.g., BDA) fault, the bus protection will trip open and lockout any source breaker associated with affected bus. This protection will prevent transfer of a faulted bus onto a transformer secondary winding that is shared with another bus. For example, a 32BDA bus fault will trip and lockout the source breakers associated with 32BDA (normal and alternate offsite power source and EDG output circuit breakers). A transfer of 31BDA (shares 30BDT02 X winding) would be unaffected by the fault on 32BDA since 32BDA source breakers are locked out.

Because the auxiliary transformer protection is provided by diverse actuations, a single failure in a transformer protection device will not prevent the protection of the transformer. For example, a transformer internal fault will likely actuate several protection relays (e.g., sudden pressure, overcurrent, differential current). Single failure of one of the detection and actuation devices will not prevent the isolation of the transformer by the remaining protection devices. If there is an inadvertent actuation of one of the transformer protection devices, one of two possible outcomes will occur:

- The supported buses will be fast transferred to the alternate transformer. The alternate transformer is sized to support the loads transferred to it, so there is no impact to plant operation or safety function capability. The fast transfer limits the impact to plant operation to the transformer removed from service.
- If the actuation device does not feed into the fast transfer scheme, the transformer protection action will occur to isolate the affected transformer. Because the device does not feed into the fast transfer scheme, the fast transfer does not take place based upon transformer fault; instead, it isolates the transformer as a source to the supported bus. For the EPSS, the EDGs assigned to the affected buses will auto-start on bus undervoltage and connect to the respective BDA bus and re-power the division. The bus can be manually paralleled with the alternate EAT, and loads transferred from the EDG. Safety function capability is maintained during this time.

The transfer scheme used for the normal power supply system (NPSS) is similar to that of the EPSS because the transfer is initiated based on a normal auxiliary transformer (NAT) fault. However, the NPSS transfer scheme uses a supervised design that will consider the phase angle acceptable not only if it is within the phase angle limit, but also if it moves into the phase angle limit during the fast transfer enable window. Incoming circuit breaker closing is also supervised by an upper and lower voltage limit check on the new source. In addition to the fast transfer initiated by NAT failure, the NPSS has a residual voltage transfer initiate on a bus undervoltage condition.

U.S. EPR FSAR Tier 2, Section 8.3.1.1.1 will be revised to delete the phrase, “that results in a loss of voltage at a BDA bus.”

FSAR impact

U.S. EPR FSAR Tier 2, Section 8.3.1.1.1 will be revised as described in the response and as indicated in the enclosed markup.

Question 08.03.01-2:

Page 8.3-3 (8.3.1.1.1) of the FSAR states that "EPSS divisions are functionally independent and physically separated from the others during normal bus alignments." It also states that "alternate feeds are provided between EPSS divisions to provide normal and standby power to required safety-related systems, safety-related support systems, or components that do not have four 100 percent redundant trains when certain electrical components, including EDGs, are out of service." List all ESF loads on EPSS buses and identify equipment that are needed for 100 percent redundancy in each division (and its divisional pairs) for safety-related functions to mitigate loss of offsite power event (LOOP) and the accident with LOOP. FEMA performed on Table 8.2-3 states that EUPS loads division 1 and 2 are powered from the battery for two hours. Explain what this means.

Response to Question 08.03.01-2:

The list of engineered safety feature (ESF) loads supplied by the emergency power supply system (EPSS) and Class 1E uninterruptible power supply system (EUPS) is provided in Table 08.03.01-2-1—Engineered Safety Feature Loads. Individual system and component redundancy requirements are found in the individual system descriptions in U.S. EPR FSAR Tier 2, Chapter 6. Actuation of engineered safety features is described in U.S. EPR FSAR Tier 2, Section 7.3. Additional information on ESF loads that support containment isolation is found in U.S. EPR FSAR Tier 2, Table 6.2.4-1—Containment Isolation Valve and Actuator Data. In general, systems that have four train redundancy in accordance with the N+2 philosophy (one train out of service for maintenance, one train lost to single failure, one train affected by the initiating event, and the remaining train is capable of completing the safety function) are supplied by EPSS division buses associated with that train. Systems and components that have two redundant trains (e.g., annulus ventilation, extra boration, and primary containment isolation) have components that satisfy the safety function separated between the divisional pairs. Table 08.03.01-2-1 power supply bus assignments in conjunction with system descriptions provided in the U.S. EPR FSAR demonstrates the U.S. EPR capability to complete safety-related functions that mitigate LOOP and design basis accidents (DBA) concurrent with LOOP.

U.S. EPR FSAR Tier 2, Table 8.2-3—Onsite AC Power System Failure Modes and Effects Analysis (FMEA), item numbers 29 through 32, demonstrate U.S. EPR capability to complete safety-related functions during DBA conditions concurrent with a LOOP and an emergency diesel generator (EDG) initially out of service for maintenance with the alternate feed installed as described in U.S. EPR FSAR Tier 2, Section 8.3.1.1.1. In this initial configuration, the emergency power supplied by the remaining EDGs following a single failure is sufficient to complete safety-related functions for DBA mitigation in most instances. For example, in U.S. EPR FSAR Tier 2, Table 8.2-3, item 29 Division 1 EDG is assumed out of service with the alternate feed to Division 1 buses supplied by Division 2 as an initial condition. In this condition, a failure of EDG 2 during a LOOP will result in the loss of EPSS buses in Division 1 and Division 2. The safety-related functions supported by Division 3 and Division 4 EDGs are sufficient to complete safety-related functions to mitigate the DBA in most cases. The Division 1 and Division 2 EUPS loads that are powered from the respective EUPS battery for two hours following loss of Division 1 and 2 EDG provide additional power for at least two hours that will assist in event mitigation (e.g., power to instrument and control systems and special emergency lighting in the main control room (MCR)).

In certain postulated accidents with assumed single failures, the EUPS is credited as being available to provide power to certain components to perform the required safety function when the associated EPSS divisional buses are unavailable. An example of crediting the EUPS during the first two hours of an event to perform the safety function of the emergency feedwater system (EFWS) is shown in U.S. EPR FSAR Tier 2, Table 10.4.9-2—Emergency Feedwater System Failure Analysis, where the component failure is the EDG. In alternate feed mode, U.S. EPR FSAR Tier 2, Table 8.2-3 FMEA demonstrates the capability of the EUPS to power the required supported loads from the battery for two hours, which maintains the safety analysis assumptions.

The capability of EUPS Divisions 1 and 2 to provide power to supplied loads for two hours following loss of the associated battery charger is applicable to U.S. EPR FSAR Tier 2, Table 8.2-3 FMEA items 29 and 30, while the capability of EUPS Divisions 3 and 4 to provide power to supplied loads for two hours following loss of the associated battery charger is applicable to items 31 and 32.

FSAR Impact:

U.S. EPR FSAR Tier 1, Table 2.6.1-2 and Table 2.6.6-2 will be revised as described in the response and indicated on the enclosed markup.

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BDA	**32BDA**	**33BDA**	**34BDA**
JND	Medium Head Safety Injection Pump (JND10AP001)	Medium Head Safety Injection Pump (JND20AP001)	Medium Head Safety Injection Pump (JND30AP001)	Medium Head Safety Injection Pump (JND40AP001)
JNG		Low Head Safety Injection Pump (JNG20AP001) [a]	Low Head Safety Injection Pump (JNG30AP001) [a]	
KAA	Component Cooling Water Pump (KAA10AP001)	Component Cooling Water Pump (KAA20AP001)	Component Cooling Water Pump (KAA30AP001)	Component Cooling Water Pump (KAA40AP001)
LAS		Emergency Feed Water Pump (LAS21AP001) [a]	Emergency Feed Water Pump (LAS31AP001) [a]	
	31BDB	**32BDB**	**33BDB**	**34BDB**
QKA	Safety Chilled Water Compressor skid (QKA10GH001)	Safety Chilled Water Compressor skid (QKA20GH001)	Safety Chilled Water Compressor skid (QKA30GH001)	Safety Chilled Water Compressor skid (QKA40GH001)
	31BDC			**34BDC**
LAS	Emergency Feed Water Pump (LAS11AP001) [b]			Emergency Feed Water Pump (LAS41AP001) [b]
JNG	Low Head Safety Injection Pump (JNG10AP001) [b]			Low Head Safety Injection Pump (JNG40AP001) [b]
	31BDD	**32BDD**	**33BDD**	**34BDD**
PEB	Essential Service Water Pump (PEB10AP001)	Essential Service Water Pump (PEB20AP001)	Essential Service Water Pump (PEB30AP001)	Essential Service Water Pump (PEB40AP001)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BMA	**32BMA**	**33BMA**	**34BMA**
SAD	Emergency Power Generation Building Supply Fan (SAD11AN001)	Emergency Power Generation Building Supply Fan (SAD21AN001)	Emergency Power Generation Building Supply Fan (SAD31AN001)	Emergency Power Generation Building Supply Fan (SAD41AN001)
	Emergency Power Generation Building Supply Fan (SAD11AN002)	Emergency Power Generation Building Supply Fan (SAD21AN002)	Emergency Power Generation Building Supply Fan (SAD31AN002)	Emergency Power Generation Building Supply Fan (SAD41AN002)
	Emergency Power Generation Building Exhaust Fan (SAD15AN001)	Emergency Power Generation Building Exhaust Fan (SAD25AN001)	Emergency Power Generation Building Exhaust Fan (SAD35AN001)	Emergency Power Generation Building Exhaust Fan (SAD45AN001)
	Emergency Power Generation Building Exhaust Fan (SAD15AN002)	Emergency Power Generation Building Exhaust Fan (SAD25AN002)	Emergency Power Generation Building Exhaust Fan (SAD35AN002)	Emergency Power Generation Building Exhaust Fan (SAD45AN002)
	Diesel Hall Fan / Heater (SAD14AH001)	Diesel Hall Fan / Heater (SAD24AH001)	Diesel Hall Fan / Heater (SAD34AH001)	Diesel Hall Fan / Heater (SAD44AH001)
	Diesel Hall Fan / Heater (SAD14AH002)	Diesel Hall Fan / Heater (SAD24AH002)	Diesel Hall Fan / Heater (SAD34AH002)	Diesel Hall Fan / Heater (SAD44AH002)
	Diesel Hall Fan / Heater (SAD14AH003)	Diesel Hall Fan / Heater (SAD24AH003)	Diesel Hall Fan / Heater (SAD34AH003)	Diesel Hall Fan / Heater (SAD44AH003)
	Diesel Hall Fan / Heater (SAD14AH004)	Diesel Hall Fan / Heater (SAD24AH004)	Diesel Hall Fan / Heater (SAD34AH004)	Diesel Hall Fan / Heater (SAD44AH004)
EUPS		EUPS Battery Charger (32BTP01GR001) [c]	EUPS Battery Charger (33BTP01GR001) [c]	
	31BMB	**32BMB**	**33BMB**	**34BMB**
EUPS	EUPS Battery Charger (31BTP02GR001)	EUPS Battery Charger (32BTP02GR001)	EUPS Battery Charger (33BTP02GR001)	EUPS Battery Charger (34BTP02GR001)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BMB	**32BMB**	**33BMB**	**34BMB**
JDH	Extra Borating Pump (JDH10AP001)			Extra Borating Pump (JDH40AP001)
	31BMC			**34BMC**
EUPS	EUPS Battery Charger (31BTP01GR001) [d]			EUPS Battery Charger (34BTP01GR001) [d]
	31BMD	**32BMD**	**33BMD**	**34BMD**
PED	Essential Service Water Fan (PED10AN001)	Essential Service Water Fan (PED20AN001)	Essential Service Water Fan (PED30AN001)	Essential Service Water Fan (PED40AN001)
	Essential Service Water Fan (PED10AN002)	Essential Service Water Fan (PED20AN002)	Essential Service Water Fan (PED30AN002)	Essential Service Water Fan (PED40AN002)
	31BNA01	**32BNA01**	**33BNA01**	**34BNA01**
XJ	EDG Fuel Oil Transfer Pump (XJN10AP100A-M)	EDG Fuel Oil Transfer Pump (XJN20AP100A-M)	EDG Fuel Oil Transfer Pump (XJN30AP100A-M)	EDG Fuel Oil Transfer Pump (XJN40AP100A-M)
	EDG Fuel Oil Transfer Pump (XJN10AP100B-M)	EDG Fuel Oil Transfer Pump (XJN20AP100B-M)	EDG Fuel Oil Transfer Pump (XJN30AP100B-M)	EDG Fuel Oil Transfer Pump (XJN40AP100B-M)
	EDG Expansion Tank Fill Valve (XJG10AA150-Y)	EDG Expansion Tank Fill Valve (XJG20AA150-Y)	EDG Expansion Tank Fill Valve (XJG30AA150-Y)	EDG Expansion Tank Fill Valve (XJG40AA150-Y)
	EDG Expansion Tank Fill Valve (XJG10AA151-Y)	EDG Expansion Tank Fill Valve (XJG20AA151-Y)	EDG Expansion Tank Fill Valve (XJG30AA151-Y)	EDG Expansion Tank Fill Valve (XJG40AA151-Y)
	EDG Intercooler Water Temperature Control Valve (XJG10AA121-M)	EDG Intercooler Water Temperature Control Valve (XJG20AA121-M)	EDG Intercooler Water Temperature Control Valve (XJG30AA121-M)	EDG Intercooler Water Temperature Control Valve (XJG40AA121-M)
	EDG Auxiliary Fuel Oil Pump (XJN10AP120-M)	EDG Auxiliary Fuel Oil Pump (XJN20AP120-M)	EDG Auxiliary Fuel Oil Pump (XJN30AP120-M)	EDG Auxiliary Fuel Oil Pump (XJN40AP120-M)
	EDG Lube Oil Sump Tank Fill Valve (XJV10AA154-Y)	EDG Lube Oil Sump Tank Fill Valve (XJV20AA154-Y)	EDG Lube Oil Sump Tank Fill Valve (XJV30AA154-Y)	EDG Lube Oil Sump Tank Fill Valve (XJV40AA154-Y)
	EDG Jacket Water Temperature Control Valve (XJG10AA111-M)	EDG Jacket Water Temperature Control Valve (XJG20AA111-M)	EDG Jacket Water Temperature Control Valve (XJG30AA111-M)	EDG Jacket Water Temperature Control Valve (XJG40AA111-M)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNA01	**32BNA01**	**33BNA01**	**34BNA01**
XJ	EDG Lube Oil Temperature Control Valve XJV10AA111-M	EDG Lube Oil Temperature Control Valve XJV20AA111-M	EDG Lube Oil Temperature Control Valve XJV30AA111-M	EDG Lube Oil Temperature Control Valve XJV40AA111-M
SAD	EDG Main Fuel Oil Tank Room Fan (SAD16AN001)	EDG Main Fuel Oil Room Fan (SAD26AN001)	EDG Main Fuel Oil Tank Room Fan (SAD36AN001)	EDG Main Fuel Oil Tank Room Fan (SAD46AN001)
	EDG Electric Room Supply Control Damper (SAD13AA001)	EDG Electric Room Supply Control Damper (SAD23AA001)	EDG Electric Room Supply Control Damper (SAD33AA001)	EDG Electric Room Supply Control Damper (SAD43AA001)
	EDG Electric Room Chiller Unit (SAD13AC101)	EDG Electric Room Chiller Unit (SAD23AC101)	EDG Electric Room Chiller Unit (SAD33AC101)	EDG Electric Room Chiller Unit (SAD43AC101)
	EDG Electric Room Supply Heater (SAD13AH001)	EDG Electric Room Supply Heater (SAD23AH001)	EDG Electric Room Supply Heater (SAD33AH001)	EDG Electric Room Supply Heater (SAD43AH001)
	EDG Electric Room Supply Fan (SAD13AN001)	EDG Electric Room Supply Fan (SAD23AN001)	EDG Electric Room Supply Fan (SAD33AN001)	EDG Electric Room Supply Fan (SAD43AN001)
	31BNA02	**32BNA02**	**33BNA02**	**34BNA02**
SAB		Main Control Room Ventilation Makeup Air Heater (SAB02AH001A/B/C) [e]	Main Control Room Ventilation Makeup Air Heater (SAB03AH001A/B/C) [e]	
		Main Control Room Ventilation Supply Air Fan (SAB02AN001) [i]	Main Control Room Ventilation Supply Air Fan (SAB03AN001) [i]	
KLC		MHSI/LHSI Pump Rooms Recirc Cooling Unit Fan (KLC52AN001) [e]	MHSI/LHSI Pump Rooms Recirc Cooling Unit Fan (KLC53AN001) [e]	

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB01	**32BNB01**	**33BNB01**	**34BNB01**
SAB	Main Control Room Ventilation Supply Air Fan (SAB01AN001) [j]			Main Control Room Ventilation Supply Air Fan (SAB04AN001) [j]
	Main Control Room Ventilation Iodine Filtration Train Supply Fan (SAB11AN001)			Main Control Room Ventilation Iodine Filtration Train Supply Fan (SAB14AN001)
	Main Control Room Ventilation Iodine Filtration Train Heater (SAB11AH001)			Main Control Room Ventilation Iodine Filtration Train Heater (SAB14AH001)
SAC	Electrical Division of Safeguard Building Ventilation System Exhaust Fan (SAC31AN001)	Electrical Division of Safeguard Building Ventilation System Exhaust Fan (SAC32AN001)	Electrical Division of Safeguard Building Ventilation System Exhaust Fan (SAC33AN001)	Electrical Division of Safeguard Building Ventilation System Exhaust Fan (SAC34AN001)
	Electrical Division of Safeguard Building Ventilation System Supply Air Heater (SAC01AH002A/B/C/D)	Electrical Division of Safeguard Building Ventilation System Supply Air Heater (SAC02AH002A/B/C/D)	Electrical Division of Safeguard Building Ventilation System Supply Air Heater (SAC03AH002A/B/C/D)	Electrical Division of Safeguard Building Ventilation System Supply Air Heater (SAC04AH002A/B/C/D)
	Electrical Division of Safeguard Building Ventilation System Supply Air Fan (SAC01AN001)	Electrical Division of Safeguard Building Ventilation System Supply Air Fan (SAC02AN001)	Electrical Division of Safeguard Building Ventilation System Supply Air Fan (SAC03AN001)	Electrical Division of Safeguard Building Ventilation System Supply Air Fan (SAC04AN001)
	EUPS Battery Room Exhaust Fan (SAC51AN001)	EUPS Battery Room Exhaust Fan (SAC52AN001)	EUPS Battery Room Exhaust Fan (SAC53AN001)	EUPS Battery Room Exhaust Fan (SAC54AN001)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB01	**32BNB01**	**33BNB01**	**34BNB01**
SAC	Emergency Feed Water Pump Room Recirc Fan (SAC61AN001)	Emergency Feed Water Pump Room Recirc Fan (SAC62AN001)	Emergency Feed Water Pump Room Recirc Fan (SAC63AN001)	Emergency Feed Water Pump Room Recirc Fan (SAC64AN001)
		KAA Pump Room Recirculation Fan (SAC62AN002) [e]	KAA Pump Room Recirculation Fan (SAC63AN002) [e]	
KLA	Containment Purge Low Flow Exhaust Fan (KLA21AN001)			Containment Purge Low Flow Exhaust Fan (KLA22AN001)
	Containment Ventilation System Radiological Filter Air Heater (KLA21AH005)			Containment Ventilation System Radiological Filter Air Heater (KLA22AH005)
KLB	Annulus Ventilation Exhaust Fan (KLB21AN001)			Annulus Ventilation Exhaust Fan (KLB24AN001)
	Annulus Ventilation Electric Heater (KLB21AH001)			Annulus Ventilation Electric Heater (KLB24AH001)
KLC	KAA/LAR Room Cooling Fan (KLC51AN002)	KAA/LAR Room Cooling Fan (KLC52AN002)	KAA/LAR Room Cooling Fan (KLC53AN002)	KAA/LAR Room Cooling Fan (KLC54AN002)
	Accident Iodine Exhaust Train Heater (KLC41AH001)			Accident Iodine Exhaust Train Heater (KLC42AH001)
	Accident Iodine Exhaust Train Fan (KLC41AN001)			Accident Iodine Exhaust Train Fan (KLC42AN001)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB01	**32BNB01**	**33BNB01**	**34BNB01**
KLL	Extra Borating System Pump Room Heater (KLL61AH001/002)			Extra Borating System Pump Room Heater (KLL64AH001/002)
	Extra Borating System Pump Room Recirc Cooling Unit (KLL61AN001)			Extra Borating System Pump Room Recirc Cooling Unit (KLL64AN001)
	Extra Borating System Pipe Chase Heaters (KLL61AH003/004)			Extra Borating System Pipe Chase Heaters (KLL64AH003/004)
	Fuel Pool Cooling Pump Room Recirc Cooling Unit (KLL61AN002/003)			Fuel Pool Cooling Pump Room Recirc Cooling Unit (KLL64AN002/003)
LAB	Main Feedwater Full Load Isolation Valve (LAB60AA001) Fast Closure Pilot Solenoid Valve (LAB60AA722)		Main Feedwater Full Load Isolation Valve (LAB60AA001) Fast Closure Pilot Solenoid Valve (LAB60AA712)	
		Main Feedwater Full Load Isolation Valve (LAB70AA001) Fast Closure Pilot Solenoid Valve (LAB70AA722)		Main Feedwater Full Load Isolation Valve (LAB70AA001) Fast Closure Pilot Solenoid Valve (LAB70AA712)
	Main Feedwater Full Load Isolation Valve (LAB80AA001) Fast Closure Pilot Solenoid Valve (LAB80AA712)		Main Feedwater Full Load Isolation Valve (LAB80AA001) Fast Closure Pilot Solenoid Valve (LAB80AA722)	

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB01	**32BNB01**	**33BNB01**	**34BNB01**
LAB		Main Feedwater Full Load Isolation Valve (LAB90AA001) Fast Closure Pilot Solenoid Valve (LAB90AA712)		Main Feedwater Full Load Isolation Valve (LAB90AA001) Fast Closure Pilot Solenoid Valve (LAB90AA722)
QKA	Safety Chilled Water System Pumps (QKA10AP107/108)	Safety Chilled Water System Pumps (QKA20AP107/108)	Safety Chilled Water System Pumps (QKA30AP107/108)	Safety Chilled Water System Pumps (QKA40AP107/108)
	Safety Chilled Water System Condenser Fans (QKA10GH002R)			Safety Chilled Water System Condenser Fans (QKA40GH002R)
	31BNB02	**32BNB02**	**33BNB02**	**34BNB02**
JND	MHSI Pump Large Minimum Flow Isolation Valve (JND10AA005)	MHSI Pump Large Minimum Flow Isolation Valve (JND20AA005)	MHSI Pump Large Minimum Flow Isolation Valve (JND30AA005)	MHSI Pump Large Minimum Flow Isolation Valve (JND40AA005)
	MHSI Pump Small Minimum Flow Isolation Valve (JND10AA004)	MHSI Pump Small Minimum Flow Isolation Valve (JND20AA004)	MHSI Pump Small Minimum Flow Isolation Valve (JND30AA004)	MHSI Pump Small Minimum Flow Isolation Valve (JND40AA004)
JNG	LHSI Pump Minimum Flow Lift Check Valve (JNG10AA004)	LHSI Pump Minimum Flow Lift Check Valve (JNG20AA004)	LHSI Pump Minimum Flow Lift Check Valve (JNG30AA004)	LHSI Pump Minimum Flow Lift Check Valve (JNG40AA004)
	LHSI Pump Minimum Flow Lift Check Valve (JNG10AA003)	LHSI Pump Minimum Flow Lift Check Valve (JNG20AA003)	LHSI Pump Minimum Flow Lift Check Valve (JNG30AA003)	LHSI Pump Minimum Flow Lift Check Valve (JNG40AA003)
	LHSI Pump IRWST Suction Line Isolation Valve (JNG10AA001)	LHSI Pump IRWST Suction Line Isolation Valve (JNG20AA001)	LHSI Pump IRWST Suction Line Isolation Valve (JNG30AA001)	LHSI Pump IRWST Suction Line Isolation Valve (JNG40AA001)
	LHSI Sample Line Isolation Valve (JNG10AA601)	LHSI Sample Line Isolation Valve (JNG20AA601)	LHSI Sample Line Isolation Valve (JNG30AA601)	LHSI Sample Line Isolation Valve (JNG40AA601)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB02	**32BNB02**	**33BNB02**	**34BNB02**
JNG	LHSI Sample Line Isolation Valve (JNG10AA602)	LHSI Sample Line Isolation Valve (JNG20AA602)	LHSI Sample Line Isolation Valve (JNG30AA602)	LHSI Sample Line Isolation Valve (JNG40AA602)
	LHSI Sample Line Isolation Valve (JNG10AA603)	LHSI Sample Line Isolation Valve (JNG20AA603)	LHSI Sample Line Isolation Valve (JNG30AA603)	LHSI Sample Line Isolation Valve (JNG40AA603)
	LHSI HX Control Valve (JNG10AA102)	LHSI HX Control Valve (JNG20AA102)	LHSI HX Control Valve (JNG30AA102)	LHSI HX Control Valve (JNG40AA102)
	LHSI HX Pre-Valve (JNG10AA104)	LHSI HX Pre-Valve (JNG20AA104)	LHSI HX Pre-Valve (JNG30AA104)	LHSI HX Pre-Valve (JNG40AA104)
	Accumulator Safety Injection Isolation Valve (JNG13AA008)	Accumulator Safety Injection Isolation Valve (JNG23AA008)	Accumulator Safety Injection Isolation Valve (JNG33AA008)	Accumulator Safety Injection Isolation Valve (JNG43AA008)
	Accumulator Safety Injection Fill Valve (JNG13AA002)	Accumulator Safety Injection Fill Valve (JNG23AA002)	Accumulator Safety Injection Fill Valve (JNG33AA002)	Accumulator Safety Injection Fill Valve (JNG43AA002)
	SIS Dead Leg (Hot) Pressurization Isolation Valve (JNG15AA001)	SIS Dead Leg (Hot) Pressurization Isolation Valve (JNG25AA001)	SIS Dead Leg (Hot) Pressurization Isolation Valve (JNG35AA001)	SIS Dead Leg (Hot) Pressurization Isolation Valve (JNG45AA001)
	SIS Dead Leg (Hot) Pressurization Isolation Valve (JNG15AA002)	SIS Dead Leg (Hot) Pressurization Isolation Valve (JNG25AA002)	SIS Dead Leg (Hot) Pressurization Isolation Valve (JNG35AA002)	SIS Dead Leg (Hot) Pressurization Isolation Valve (JNG45AA002)
	SIS Train 1 Dead Leg (CVCS Letdown line) Pressurization Isolation Valve (JNG15AA003)	SIS Train 2 Dead Leg (CVCS Letdown line) Pressurization Isolation Valve (JNG25AA003)	SIS Train 3 Dead Leg (CVCS Letdown line) Pressurization Isolation Valve (JNG35AA003)	SIS Train 4 Dead Leg (CVCS Letdown line) Pressurization Isolation Valve (JNG45AA003)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB02	**32BNB02**	**33BNB02**	**34BNB02**
JNA	RHR Hot Leg Suction Line Isolation Valve (JNA10AA001)	RHR Hot Leg Suction Line Isolation Valve (JNA20AA001)	RHR Hot Leg Suction Line Isolation Valve (JNA30AA001)	RHR Hot Leg Suction Line Isolation Valve (JNA40AA001)
	LHSI HX Bypass Control Valve (JNA10AA101)	LHSI HX Bypass Control Valve (JNA20AA101)	LHSI HX Bypass Control Valve (JNA30AA101)	LHSI HX Bypass Control Valve (JNA40AA101)
			LHSI HX Bypass Isolation Valve on Purification Line to CVCS (JNA30AA004)	LHSI HX Bypass Isolation Valve on Purification Line to CVCS (JNA40AA004)
			LHSI HX Bypass Throttle Valve on Purification Line to CVCS (JNA30AA103)	LHSI HX Bypass Throttle Valve on Purification Line to CVCS (JNA40AA103)
KAA	CCWS Switchover Valve Solenoid (KAA10AA032A)	CCWS Switchover Valve Solenoid (KAA20AA032A)	CCWS Switchover Valve Solenoid (KAA30AA032A)	CCWS Switchover Valve Solenoid (KAA40AA032A)
	CCWS Switchover Valve Solenoid (KAA40AA032B)	CCWS Switchover Valve Solenoid (KAA30AA032B)	CCWS Switchover Valve Solenoid (KAA20AA032B)	CCWS Switchover Valve Solenoid (KAA10AA032B)
	CCWS Switchover Valve Hydraulic Pump (KAA10AP032)	CCWS Switchover Valve Hydraulic Pump (KAA20AP032)	CCWS Switchover Valve Hydraulic Pump (KAA30AP032)	CCWS Switchover Valve Hydraulic Pump (KAA40AP032)
	CCWS Switchover Valve Solenoid (KAA10AA033A)	CCWS Switchover Valve Solenoid (KAA20AA033A)	CCWS Switchover Valve Solenoid (KAA30AA033A)	CCWS Switchover Valve Solenoid (KAA40AA033A)
	CCWS Switchover Valve Solenoid (KAA40AA033B)	CCWS Switchover Valve Solenoid (KAA30AA033B)	CCWS Switchover Valve Solenoid (KAA20AA033B)	CCWS Switchover Valve Solenoid (KAA10AA033B)
	CCWS Switchover Valve Hydraulic Pump (KAA10AP033)	CCWS Switchover Valve Hydraulic Pump (KAA20AP033)	CCWS Switchover Valve Hydraulic Pump (KAA30AP033)	CCWS Switchover Valve Hydraulic Pump (KAA40AP033)
	CCWS Switchover Valve Hydraulic Pump (KAA10AP006A)	CCWS Switchover Valve Hydraulic Pump (KAA20AP006A)	CCWS Switchover Valve Hydraulic Pump (KAA30AP006A)	CCWS Switchover Valve Hydraulic Pump (KAA40AP006A)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB02	**32BNB02**	**33BNB02**	**34BNB02**
KAA	CCWS Switchover Valve Hydraulic Pump (KAA40AP006B)	CCWS Switchover Valve Hydraulic Pump (KAA30AP006B)	CCWS Switchover Valve Hydraulic Pump (KAA20AP006B)	CCWS Switchover Valve Hydraulic Pump (KAA10AP006B)
	CCWS Switchover Valve Hydraulic Pump (KAA10AP010A)	CCWS Switchover Valve Hydraulic Pump (KAA20AP010A)	CCWS Switchover Valve Hydraulic Pump (KAA30AP010A)	CCWS Switchover Valve Hydraulic Pump (KAA40AP010A)
	CCWS Isolation Valve LHSI HX (KAA12AA005)	CCWS Isolation Valve LHSI HX (KAA22AA005)	CCWS Isolation Valve LHSI HX (KAA32AA005)	CCWS Isolation Valve LHSI HX (KAA42AA005)
	CCWS Surge Tank Makeup Valve (KAA10AA027)	CCWS Surge Tank Makeup Valve (KAA20AA027)	CCWS Surge Tank Makeup Valve (KAA30AA027)	CCWS Surge Tank Makeup Valve (KAA40AA027)
	CCWS HX Bypass Control Valve (KAA10AA112)	CCWS HX Bypass Control Valve (KAA20AA112)	CCWS HX Bypass Control Valve (KAA30AA112)	CCWS HX Bypass Control Valve (KAA40AA112)
	CCWS Switchover Valve Hydraulic Pump (KAA40AP010B)	CCWS Switchover Valve Hydraulic Pump (KAA30AP010B)	CCWS Switchover Valve Hydraulic Pump (KAA20AP010B)	CCWS Switchover Valve Hydraulic Pump (KAA10AP010B)
		CCWS Flow Control to SCWS Chiller (KAA22AA101)	CCWS Flow Control to SCWS Chiller (KAA32AA101)	
		LHSI Pump Seal Fluid Cooling Isolation Valve (KAA22AA013)	LHSI Pump Seal Fluid Cooling Isolation Valve (KAA32AA013)	

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB02	**32BNB02**	**33BNB02**	**34BNB02**
KAB	CCWS Non-Safety-Related User Isolation Valve Solenoid (KAB80AA015A)	CCWS Non-Safety-Related User Isolation Valve Solenoid (KAB80AA015B)	CCWS Non-Safety-Related User Isolation Valve Solenoid (KAB50AA006B)	CCWS Non-Safety-Related User Isolation Valve Solenoid (KAB50AA006A)
	CCWS Non-Safety-Related User Isolation Valve Solenoid (KAB80AA016A)	CCWS Non-Safety-Related User Isolation Valve Solenoid (KAB80AA016B)	CCWS Non-Safety-Related User Isolation Valve Solenoid (KAB50AA001B)	CCWS Non-Safety-Related User Isolation Valve Solenoid (KAB50AA001A)
	CCWS Non-Safety-Related User Isolation Valve Solenoid (KAB80AA019A)	CCWS Non-Safety-Related User Isolation Valve Solenoid (KAB80AA019B)	CCWS Non-Safety-Related User Isolation Valve Solenoid (KAB50AA004B)	CCWS Non-Safety-Related User Isolation Valve Solenoid (KAB50AA004A)
	CCWS Non-Safety-Related User Isolation Valve Hydraulic Pump (KAB80AP015)			CCWS Non-Safety-Related User Isolation Valve Hydraulic Pump (KAB80AP06)
	CCWS Non-Safety-Related User Isolation Valve Hydraulic Pump (KAB80AP016)			CCWS Non-Safety-Related User Isolation Valve Hydraulic Pump (KAB50AP001)
	CCWS Non-Safety-Related User Isolation Valve Hydraulic Pump (KAB80AP019)			CCWS Non-Safety-Related User Isolation Valve Hydraulic Pump (KAB50AP004)
	CCWS Isolation Valve FPCS HX (KAB10AA134)			CCWS Isolation Valve FPCS HX (KAB20AA134)
QKA	Safety Chilled Water Chiller Bypass Valve (QKA10AA101)	Safety Chilled Water Chiller Bypass Valve (QKA20AA101)	Safety Chilled Water Chiller Bypass Valve (QKA30AA101)	Safety Chilled Water Chiller Bypass Valve (QKA40AA101)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB02	**32BNB02**	**33BNB02**	**34BNB02**
QKB	MCR Ventilation Safety Chilled Water Control Valve (QKB10AA101)	MCR Ventilation Safety Chilled Water Control Valve (QKB20AA101)	MCR Ventilation Safety Chilled Water Control Valve (QKB30AA101)	MCR Ventilation Safety Chilled Water Control Valve (QKB40AA101)
QKC	LHSI Pump Cooler Control Valve (QKC10AA025)			LHSI Pump Cooler Control Valve (QKC40AA025)
	Safeguard Building HVAC Safety Chill Water Control Valve (QKC10AA101)	Safeguard Building HVAC Safety Chill Water Control Valve (QKC20AA101)	Safeguard Building HVAC Safety Chill Water Control Valve (QKC30AA101)	Safeguard Building HVAC Safety Chill Water Control Valve (QKC40AA101)
LAR	Emergency Feed Water Flow Control Valve (LAR11AA103)	Emergency Feed Water Flow Control Valve (LAR21AA103)	Emergency Feed Water Flow Control Valve (LAR31AA103)	Emergency Feed Water Flow Control Valve (LAR41AA103)
				Demineralized Water Makeup to EFW Isolation Valve (LAR04AA001)
LAB	Main Feedwater PCIV (LAB60AA002)	Main Feedwater PCIV (LAB70AA002)	Main Feedwater PCIV (LAB80AA002)	Main Feedwater PCIV (LAB90AA002)
	Main Feedwater Low Load Isolation Valve (LAB84AA001)	Main Feedwater Low Load Isolation Valve (LAB94AA001)	Main Feedwater Low Load Isolation Valve (LAB64AA001)	Main Feedwater Low Load Isolation Valve (LAB74AA001)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB02	**32BNB02**	**33BNB02**	**34BNB02**
LBA	Main Steam Warming Isolation Valve (LBA14AA001)	Main Steam Warming Isolation Valve (LBA24AA001)	Main Steam Warming Isolation Valve (LBA34AA001)	Main Steam Warming Isolation Valve (LBA44AA001)
	Main Steam Warming Control Valve (LBA34AA101)	Main Steam Warming Control Valve (LBA44AA101)	Main Steam Warming Control Valve (LBA14AA101)	Main Steam Warming Control Valve (LBA24AA101)
	Main Steam Isolation Bypass Drain Valve (LBA40AA442)	Main Steam Isolation Bypass Drain Valve (LBA30AA442)	Main Steam Isolation Bypass Drain Valve (LBA20AA442)	Main Steam Isolation Bypass Drain Valve (LBA10AA442)
	Main Steam Isolation Bypass Drain Valve (LBA10AA441)	Main Steam Isolation Bypass Drain Valve (LBA20AA441)	Main Steam Isolation Bypass Drain Valve (LBA30AA441)	Main Steam Isolation Bypass Drain Valve (LBA40AA441)
	Main Steam Isolation Bypass Drain Valve (LBA30AA444)	Main Steam Isolation Bypass Drain Valve (LBA40AA444)	Main Steam Isolation Bypass Drain Valve (LBA10AA444)	Main Steam Isolation Bypass Drain Valve (LBA20AA444)
PED	ESW Cooling Tower Return Bypass Valve (PED10AA011)	ESW Cooling Tower Return Bypass Valve (PED20AA011)	ESW Cooling Tower Return Bypass Valve (PED30AA011)	ESW Cooling Tower Return Bypass Valve (PED40AA011)
	ESW Cooling Tower Return Isolation Valve (PED10AA010)	ESW Cooling Tower Return Isolation Valve (PED20AA010)	ESW Cooling Tower Return Isolation Valve (PED30AA010)	ESW Cooling Tower Return Isolation Valve (PED40AA010)
	ESW Pump Discharge Isolation Valve (PED10AA005)	ESW Pump Discharge Isolation Valve (PED20AA005)	ESW Pump Discharge Isolation Valve (PED30AA005)	ESW Pump Discharge Isolation Valve (PED40AA005)
	ESW Pump Minimum Flow Line Isolation Valve (PED10AA002)	ESW Pump Minimum Flow Line Isolation Valve (PED20AA002)	ESW Pump Minimum Flow Line Isolation Valve (PED30AA002)	ESW Pump Minimum Flow Line Isolation Valve (PED40AA002)
	ESW Blowdown Isolation Valve (PED10AA016)	ESW Blowdown Isolation Valve (PED20AA016)	ESW Blowdown Isolation Valve (PED30AA016)	ESW Blowdown Isolation Valve (PED40AA016)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB02	**32BNB02**	**33BNB02**	**34BNB02**
PED	ESW Blowdown Isolation Valve (PED10AA003)	ESW Blowdown Isolation Valve (PED20AA003)	ESW Blowdown Isolation Valve (PED30AA003)	ESW Blowdown Isolation Valve (PED40AA003)
	ESW emergency makeup water system isolation valve (PED10AA021)	ESW emergency makeup water system isolation valve (PED20AA021)	ESW emergency makeup water system isolation valve (PED30AA021)	ESW emergency makeup water system isolation valve (PED40AA021)
	ESW normal makeup water system Isolation Valve (PED10AA019)	ESW normal makeup water system Isolation Valve (PED20AA019)	ESW normal makeup water system Isolation Valve (PED30AA019)	ESW normal makeup water system Isolation Valve (PED40AA019)
JDH	Extra Borating System Cold Leg Injection Line Isolation Valve (JDH10AA015)	Extra Borating System Cold Leg Injection Line Isolation Valve (JDH20AA015)	Extra Borating System Cold Leg Injection Line Isolation Valve (JDH30AA015)	Extra Borating System Cold Leg Injection Line Isolation Valve (JDH40AA015)
	Extra Borating System Test Line Isolation Valve (JDH10AA008)			Extra Borating System Test Line Isolation Valve (JDH40AA008)
SAB	MCR Ventilation Volume Control Damper (SAB01AA012)	MCR Ventilation Volume Control Damper (SAB02AA012)	MCR Ventilation Volume Control Damper (SAB03AA012)	MCR Ventilation Volume Control Damper (SAB04AA012)
	MCR Iodine Filtration Isolation Damper (SAB11AA003)			MCR Iodine Filtration Isolation Damper (SAB14AA003)
	MCR Iodine Filtration Isolation Damper (SAB11AA001)			MCR Iodine Filtration Isolation Damper (SAB14AA001)
	MCR Iodine Filtration Recirculation Isolation Damper (SAB11AA004)			MCR Iodine Filtration Recirculation Isolation Damper (SAB14AA004)
	MCR Kitchen and Sanitary Room Exhaust Isolation Valve (SAB42AA001)			MCR Kitchen and Sanitary Room Exhaust Isolation Valve (SAB42AA002)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB02	**32BNB02**	**33BNB02**	**34BNB02**
SAC	Safeguard Building Electrical Division Ventilation Outside Air Control Damper (SAC01AA004)	Safeguard Building Electrical Division Ventilation Outside Air Control Damper (SAC02AA004)	Safeguard Building Electrical Division Ventilation Outside Air Control Damper (SAC03AA004)	Safeguard Building Electrical Division Ventilation Outside Air Control Damper (SAC04AA004)
	EUPS Battery Room Ventilation Heater (SAC11AH001)	EUPS Battery Room Ventilation Heater (SAC12AH001)	EUPS Battery Room Ventilation Heater (SAC13AH001)	EUPS Battery Room Ventilation Heater (SAC14AH001)
KLA	Containment Purge Low Flow Exhaust Filter Inlet Isolation Damper (KLA21AA004)			Containment Purge Low Flow Exhaust Filter Inlet Isolation Damper (KLA22AA004)
	Containment Purge Low Flow Exhaust Filter Outlet Isolation Damper (KLA21AA007)			Containment Purge Low Flow Exhaust Filter Outlet Isolation Damper (KLA22AA007)
KLC		Safeguard Building Supply Air Isolation Damper (KLC12AA004)	Safeguard Building Supply Air Isolation Damper (KLC12AA005)	
		Safeguard Building Supply Air Isolation Damper (KLC13AA005)	Safeguard Building Supply Air Isolation Damper (KLC13AA004)	
	Safeguard Building Supply Air Isolation Damper (KLC11AA004)			Safeguard Building Supply Air Isolation Damper (KLC11AA005)
	Safeguard Building Supply Air Isolation Damper (KLC14AA005)			Safeguard Building Supply Air Isolation Damper (KLC14AA004)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB02	**32BNB02**	**33BNB02**	**34BNB02**
KLC	Safeguard Building Supply Air Volume Control Damper (KLC11AA003)	Safeguard Building Supply Air Volume Control Damper (KLC12AA003)	Safeguard Building Supply Air Volume Control Damper (KLC13AA003)	Safeguard Building Supply Air Volume Control Damper (KLC14AA003)
	Safeguard Building Exhaust Air Volume Control Damper (KLC21AA006)	Safeguard Building Exhaust Air Volume Control Damper (KLC22AA006)	Safeguard Building Exhaust Air Volume Control Damper (KLC23AA006)	Safeguard Building Exhaust Air Volume Control Damper (KLC24AA006)
	Safeguard Building Exhaust Air Isolation Damper (KLC21AA007)			Safeguard Building Exhaust Air Isolation Damper (KLC21AA008)
	Safeguard Building Exhaust Air Isolation Damper (KLC24AA008)			Safeguard Building Exhaust Air Isolation Damper (KLC24AA007)
		Safeguard Building Exhaust Air Isolation Damper (KLC22AA007)	Safeguard Building Exhaust Air Isolation Damper (KLC22AA008)	
		Safeguard Building Exhaust Air Isolation Damper (KLC23AA008)	Safeguard Building Exhaust Air Isolation Damper (KLC23AA007)	
	Safeguard Building Alternate Exhaust Air Path Isolation Damper (KLC31AA001)	Safeguard Building Alternate Exhaust Air Path Isolation Damper (KLC32AA001)	Safeguard Building Alternate Exhaust Air Path Isolation Damper (KLC33AA001)	Safeguard Building Alternate Exhaust Air Path Isolation Damper (KLC34AA001)
	Safety Injection/Residual Heat Removal Pump Room Ventilation Isolation Damper (KLC11AA007)			Safety Injection/Residual Heat Removal Pump Room Ventilation Isolation Damper (KLC14AA007)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB02	**32BNB02**	**33BNB02**	**34BNB02**
KLC	Containment Low Flow Purge Isolation from Safeguard Building Ventilation (KLC45AA005)			Containment Low Flow Purge Isolation from Safeguard Building Ventilation (KLC45AA006)
	Safety Injection/Residual Heat Removal Pump Room Ventilation Isolation Damper (KLC21AA005)			Safety Injection/Residual Heat Removal Pump Room Ventilation Isolation Damper (KLC24AA005)
	Safeguard Building Ventilation Accident Iodine Exhaust Filtration System Inlet Isolation Damper (KLC41AA001)			Safeguard Building Ventilation Accident Iodine Exhaust Filtration System Inlet Isolation Damper (KLC42AA001)
	Safeguard Building Ventilation Accident Iodine Exhaust Filtration System Outlet Isolation Damper (KLC41AA002)			Safeguard Building Ventilation Accident Iodine Exhaust Filtration System Outlet Isolation Damper (KLC42AA002)
	Safeguard Building Ventilation / Fuel Building Ventilation Boundary Isolation Damper (KLC45AA003)			Safeguard Building Ventilation / Fuel Building Ventilation Boundary Isolation Damper (KLC45AA004)
	Safeguard Building Ventilation Accident Exhaust Duct Isolation Damper (KLC45AA001)			Safeguard Building Ventilation Accident Exhaust Duct Isolation Damper (KLC45AA002)
	KAA/LAR Valve Room Isolation Damper (KLC11AA008)			KAA/LAR Valve Room Isolation Damper (KLC24AA002)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB02	**32BNB02**	**33BNB02**	**34BNB02**
KLL	Fuel Building Cell 5 Exhaust Isolation Damper (KLL41AA101)			Fuel Building Cell 5 Exhaust Isolation Damper (KLL44AA101)
	Fuel Building Cell 5 Supply Isolation Damper (KLL31AA049)			Fuel Building Cell 5 Supply Isolation Damper (KLL34AA090)
	Fuel Building Cell 4 Exhaust Isolation Damper (KLL41AA100)			Fuel Building Cell 4 Exhaust Isolation Damper (KLL44AA100)
	Fuel Building Cell 4 Supply Air Isolation Damper (KLL31AA090)			Fuel Building Cell 4 Supply Air Isolation Damper (KLL34AA065)
	Fuel Building Cell 4 Exhaust to Safeguard Building Ventilation Isolation Damper (KLL21AA004)			Fuel Building Cell 4 Exhaust to Safeguard Building Ventilation Isolation Damper (KLL24AA004)
	Fuel Handling Hall Exhaust Isolation Damper (KLL21AA002)			Fuel Handling Hall Exhaust Isolation Damper (KLL24AA002)
	Fuel Handling Hall Supply Isolation Damper (KLL11AA002)			Fuel Handling Hall Supply Isolation Damper (KLL14AA002)
	Equipment Hatch Area Exhaust Isolation Damper (KLL21AA001)			Equipment Hatch Area Exhaust Isolation Damper (KLL24AA001)
	Equipment Hatch Area Supply Isolation Damper (KLL11AA001)			Equipment Hatch Area Supply Isolation Damper (KLL14AA001)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB02	**32BNB02**	**33BNB02**	**34BNB02**
KLL	Emergency Airlock Area Exhaust Isolation Damper (KLL21AA003)			Emergency Airlock Area Exhaust Isolation Damper (KLL24AA003)
	Emergency Airlock Area Supply Isolation Damper (KLL11AA003)			Emergency Airlock Area Supply Isolation Damper (KLL14AA003)
KUA		RCS Crossover Leg 3 Sample Isolation Valve (KUA30AA002)		
			RCS Hot Leg 1 Sample Isolation Valve (KUA10AA002)	
			Pressurizer Sample Isolation Valve (KUA20AA001)	
	31BNB03	**32BNB03**	**33BNB03**	**34BNB03**
SCB				Instrument Air Header Containment Isolation Valve (SCB01AA001)
JND	MHSI Discharge Line Containment Isolation Valve (JND10AA002)	MHSI Discharge Line Containment Isolation Valve (JND20AA002)	MHSI Discharge Line Containment Isolation Valve (JND30AA002)	MHSI Discharge Line Containment Isolation Valve (JND40AA002)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB03	**32BNB03**	**33BNB03**	**34BNB03**
JNG	LHSI Main Discharge Line Containment Isolation Valve (JNG10AA060)	LHSI Main Discharge Line Containment Isolation Valve (JNG20AA060)	LHSI Main Discharge Line Containment Isolation Valve (JNG30AA060)	LHSI Main Discharge Line Containment Isolation Valve (JNG40AA060)
	LHSI Bypass Discharge Line Containment Isolation Valve (JNG10AA061)	LHSI Bypass Discharge Line Containment Isolation Valve (JNG20AA061)	LHSI Bypass Discharge Line Containment Isolation Valve (JNG30AA061)	LHSI Bypass Discharge Line Containment Isolation Valve (JNG40AA061)
	LHSI Hot Leg Injection Line Containment Isolation Valve (JNG12AA001)	LHSI Hot Leg Injection Line Containment Isolation Valve (JNG22AA001)	LHSI Hot Leg Injection Line Containment Isolation Valve (JNG32AA001)	LHSI Hot Leg Injection Line Containment Isolation Valve (JNG42AA001)
				SAHRS-IRWSTS 1st Isolation Valve (JNG40AA007)
				SAHRS-IRWSTS 2ND Isolation Valve (JNG40AA008)
JDH	Extra Borating System Containment Isolation Valve (JDH10AA006)			Extra Borating System Containment Isolation Valve (JDH40AA006)
JNA	RHR Hot Leg Suction Line Containment Isolation Valve (JNA10AA003)	RHR Hot Leg Suction Line Containment Isolation Valve (JNA20AA003)	RHR Hot Leg Suction Line Containment Isolation Valve (JNA30AA003)	RHR Hot Leg Suction Line Containment Isolation Valve (JNA40AA003)
JNK	IRWST Three-way Isolation Valve for SIS (JNK10AA001)	IRWST Three-way Isolation Valve for SIS (JNK20AA001)	IRWST Three-way Isolation Valve for SIS (JNK30AA001)	IRWST Three-way Isolation Valve for SIS (JNK40AA001)
				SAHRS Suction Valve From IRWST Containment Isolation Valve (JNK11AA009)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB03	**32BNB03**	**33BNB03**	**34BNB03**
JNK	IRWST Containment Isolation Valve For CVCS (JNK10AA009)			IRWST Containment Isolation Valve for CVCS (JNK10AA013)
JEW	RCP Seal Leakoff Containment Isolation Valve (JEW50AA002)			
	RCP Seal Water Injection Line Containment Isolation Valve (JEW01AA005)			
JMQ	SAHRS Suction Valve from IRWST Containment Isolation Valve (JMQ40AA001)			
				SAHRS Spray Line Containment Isolation Valve (JMQ41AA001)
				SAHRS Back Flushing Line Containment Isolation Valve (JMQ43AA001)
				SARHRS Active Flooding Line Containment Isolation Valve (JMQ42AA001)
JMM	Containment Inflating/Deflating Subsystem Containment Isolation Valve (JMM10AA007) [g]			

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB03	**32BNB03**	**33BNB03**	**34BNB03**
KAB	CCWS Common Train CVCS and RCP 1 and RCP 2 Motor Cooler Return Line Containment Isolation Valve (KAB60AA019) [g]			CCWS Common Train CVCS and RCP 3 and RCP 4 Motor Cooler Return Line Containment Isolation Valve (KAB70AA019) [g]
	CCWS Common Train CVCS and RCP 1 and RCP 2 Motor Cooler Supply Line Containment Isolation Valve (KAB60AA013)			CCWS Common Train CVCS and RCP 3 and RCP 4 Motor Cooler Supply Line Containment Isolation Valve (KAB70AA013)
	CCWS Common Train RCP 1 and RCP 2 Thermal Barrier Supply Line Containment Isolation Valve (KAB30AA049)			CCWS Common Train RCP 3 and RCP 4 Thermal Barrier Supply Line Containment Isolation Valve (KAB30AA053)
	CCWS Common Train Reactor Building HVAC Return Line Containment Isolation Valve (KAB40AA006) [g]			
	CCWS Common Train Reactor Building HVAC Supply Line Containment Isolation Valve (KAB40AA001)			

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB03	**32BNB03**	**33BNB03**	**34BNB03**
KAB	CCWS Common Train RCP 1 and RCP 2 Thermal Barrier Return Line Containment Isolation Valve (KAB30AA052) [g]			CCWS Common Train RCP 3 and RCP 4 Thermal Barrier Return Line Containment Isolation Valve (KAB30AA056) [g]
KLA	Containment Purge Low Airflow Loop Supply Section (KLA 1) Containment Isolation Solenoid Valve (KLA10AA001A) [h]			Containment Purge Low Airflow Loop Supply Section (KLA 1) Containment Isolation Solenoid Valve (KLA10AA001B) [h]
	Containment Purge Low Airflow Loop Exhaust Section (KLA 2) Containment Isolation Solenoid Valve (KLA20AA003B) [h]			Containment Purge Low Airflow Loop Exhaust Section (KLA 2) Containment Isolation Solenoid Valve (KLA20AA003A) [h]
	Containment Purge Full Airflow Loop Supply Section (KLA 3) Containment Isolation Solenoid Valve (KLA30AA002A) [h]			
				Containment Purge Full Airflow Loop Exhaust Section (KLA 4) Containment Isolation Solenoid Valve (KLA40AA002A) [h]

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB03	**32BNB03**	**33BNB03**	**34BNB03**
QUC	SG Secondary Sampling Containment Isolation Valve (QUC12AA001) [g]			
	SG Secondary Sampling Containment Isolation Valve (QUC11AA001) [g]			
				SG Secondary Sampling Containment Isolation Valve (QUC13AA001) [g]
				SG Secondary Sampling Containment Isolation Valve (QUC14AA001) [g]
KUL	Severe Accident Containment Atmosphere Sample Line Containment Isolation Valve (KUL51AA002)			Severe Accident Containment Atmosphere Sample Line Containment Isolation Valve (KUL51AA003)
	Severe Accident Containment Atmosphere Sample Line Containment Isolation Valve (KUL52AA002)			Severe Accident Containment Atmosphere Sample Line Containment Isolation Valve (KUL52AA003)
KBA	CVCS Charging Line Containment Isolation Valve (KBA34AA002)			
				CVCS Letdown Line Containment Isolation Valve (KBA14AA003) [g]

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB03	**32BNB03**	**33BNB03**	**34BNB03**
KPL				Pressurizer Relief Tank and Reactor Coolant Drain Tank Purge Return Line Containment Isolation Valve (KPL85AA004)
				Pressurizer Relief Tank and Reactor Coolant Drain Tank Purge Supply Line Containment Isolation Valve (KPL84AA002)
GHC	Demineralized Water Containment Isolation Valve (GHC74AA001) [g]			
KTA	Reactor Coolant Drain Tank Drain Line Containment Isolation Valve (KTA10AA018) [g]			
KTC				Reactor Building Sump Containment Isolation Valve (KTC10AA006) [g]
				Chemical Drain Reinjection Line Containment Isolation Valve (KTC10AA010)
KTD				Annulus Drain Isolation Valve (KTD10AA025)
				Reactor Building Floor Drain Pump Discharge Line Containment Isolation Valve (KTD10AA015) [g]

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB03	**32BNB03**	**33BNB03**	**34BNB03**
KUA	RCS Crossover Leg 3 Sample Isolation Valve (KUA30AA004) [g]			
				RCS Hot Leg 1 Sample Isolation Valve (KUA10AA004) [g]
				Pressurizer Sample Line Containment Isolation Valve (KUA20AA003) [g]
KUB				SIS Accumulator Sample Line Containment Isolation Valve (KUB10AA002) [g]
FAL	Fuel Pool Purification System Suction Containment Isolation Valve (FAL12AA002) [g]			
	Fuel Pool Purification System Containment Isolation Valve (FAL15AA002)			
QJB	Nitrogen Distribution System Containment Isolation Valve (QJB40AA001) [g]			
	Nitrogen Distribution System Containment Isolation Valve (QJB40AA003) [g]			

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB03	32BNB03	33BNB03	34BNB03
QNJ				Operational Chilled Water Supply Containment Isolation Valve (QNJ41AA002)
				Operational Chilled Water Return Containment Isolation Valve (QNJ41AA028) [g]
JMU			Hydrogen Monitoring System Containment Isolation Valve (JMU50AA075)	Hydrogen Monitoring System Containment Isolation Valve (JMU50AA076)
			Hydrogen Monitoring System Containment Isolation Valve (JMU50AA077)	Hydrogen Monitoring System Containment Isolation Valve (JMU50AA078)
			Hydrogen Monitoring System Containment Isolation Valve (JMU50AA079)	Hydrogen Monitoring System Containment Isolation Valve (JMU50AA080)
			Hydrogen Monitoring System Containment Isolation Valve (JMU50AA081)	Hydrogen Monitoring System Containment Isolation Valve (JMU50AA082)
			Hydrogen Monitoring System Containment Isolation Valve (JMU50AA084)	Hydrogen Monitoring System Containment Isolation Valve (JMU50AA083)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB03	**32BNB03**	**33BNB03**	**34BNB03**
JMU	Hydrogen Monitoring System Containment Isolation Valve (JMU51AA086)	Hydrogen Monitoring System Containment Isolation Valve (JMU51AA085)		
	Hydrogen Monitoring System Containment Isolation Valve (JMU51AA088)	Hydrogen Monitoring System Containment Isolation Valve (JMU51AA087)		
	Hydrogen Monitoring System Containment Isolation Valve (JMU51AA090)	Hydrogen Monitoring System Containment Isolation Valve (JMU51AA089)		
	Hydrogen Monitoring System Containment Isolation Valve (JMU51AA092)	Hydrogen Monitoring System Containment Isolation Valve (JMU51AA091)		
	Hydrogen Monitoring System Containment Isolation Valve (JMU51AA093)	Hydrogen Monitoring System Containment Isolation Valve (JMU51AA094)		
LCQ		Steam Generator Blowdown Flash Line Containment Isolation Valve (LCQ52AA002)		
				Steam Generator Blowdown Condensate Line Containment Isolation Valve (LCQ51AA003)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BNB03	**32BNB03**	**33BNB03**	**34BNB03**
LCA		Steam Generator Blowdown Cooler Condensate Return Line Containment Isolation Valve (LCA90AA006)		
		Steam Generator Blowdown Cooler Condensate Supply Line Containment Isolation Valve (LCA90AA003)		
	31BNC01	**32BNC01**	**33BNC01**	**34BNC01**
SAB	Main Control Room Ventilation Makeup Air Heater (SAB01AH001A/B/C) [j]			Main Control Room Ventilation Makeup Air Heater (SAB04AH001A/B/C) [j]
SAC	KAA Pump Room Recirculation Fan (SAC61AN002) [i]			KAA Pump Room Recirculation Fan (SAC64AN002) [i]
KLC	JMU/KUL Sample Room Recirculation Fan (KLC51AN003)			JMU/KUL Sample Room Recirculation Fan (KLC54AN003)
	MHSI/LHSI Pump Rooms Recirculation Fan (KLC51AN001) [j]			MHSI/LHSI Pump Rooms Recirculation Fan (KLC54AN001) [j]

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BND01	**32BND01**	**33BND01**	**34BND01**
SAQ	ESW Building Recirculation Fan (SAQ01AN001)	ESW Building Recirculation Fan (SAQ02AN001)	ESW Building Recirculation Fan (SAQ03AN001)	ESW Building Recirculation Fan (SAQ04AN001)
PED	ESW Emergency Makeup Pump (PED10AP001)	ESW Emergency Makeup Pump (PED20AP001)	ESW Emergency Makeup Pump (PED30AP001)	ESW Emergency Makeup Pump (PED40AP001)
PEB	ESW Debris Filter Control (PEB10GH001)	ESW Debris Filter Control (PEB20GH001)	ESW Debris Filter Control (PEB30GH001)	ESW Debris Filter Control (PEB40GH001)
	31BRA	**32BRA**	**33BRA**	**34BRA**
SAB	Main Control Room Ventilation Exhaust Isolation Damper (SAB45AA003)			Main Control Room Ventilation Exhaust Isolation Damper (SAB45AA004)
	MCR Ventilation Inlet Isolation Damper (SAB01AA002)	MCR Ventilation Inlet Isolation Damper (SAB02AA002)	MCR Ventilation Inlet Isolation Damper (SAB03AA002)	MCR Ventilation Inlet Isolation Damper (SAB04AA002)
	MCR Ventilation Inlet Isolation Damper (SAB02AA003)	MCR Ventilation Inlet Isolation Damper (SAB01AA003)	MCR Ventilation Inlet Isolation Damper (SAB04AA003)	MCR Ventilation Inlet Isolation Damper (SAB03AA003)
SAC	Electrical Division of Safeguard Building Ventilation System Exhaust Control Damper (SAC31AA002)	Electrical Division of Safeguard Building Ventilation System Exhaust Control Damper (SAC32AA002)	Electrical Division of Safeguard Building Ventilation System Exhaust Control Damper (SAC33AA002)	Electrical Division of Safeguard Building Ventilation System Exhaust Control Damper (SAC34AA002)
	Electrical Division of Safeguard Building Ventilation System Mixing Control Damper (SAC01AA003)	Electrical Division of Safeguard Building Ventilation System Mixing Control Damper (SAC02AA003)	Electrical Division of Safeguard Building Ventilation System Mixing Control Damper (SAC03AA003)	Electrical Division of Safeguard Building Ventilation System Mixing Control Damper (SAC04AA003)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BRA	**32BRA**	**33BRA**	**34BRA**
SAC	EUPS Battery Room Exhaust Isolation Damper (SAC51AA003)	EUPS Battery Room Exhaust Isolation Damper (SAC52AA003)	EUPS Battery Room Exhaust Isolation Damper (SAC53AA003)	EUPS Battery Room Exhaust Isolation Damper (SAC54AA003)
SCB	Instrument Air Header Containment Isolation Valve (SCB01AA002) [f]			
GHC				Demineralized Water Distribution Line Containment Isolation Valve (GHC74AA002) [f]
KUA				RCS Crossover Leg 3 Sample Isolation Valve (KUA30AA003) [f]
	RCS Hot Leg 1 Sample Isolation Valve (KUA10AA003) [f]			
	Pressurizer Sample Line Containment Isolation Valve (KUA20AA002) [f]			
KUB	SIS Accumulator Sample Line Containment Isolation Valve (KUB10AA001) [f]			
FAL				Fuel Pool Purification System Suction Containment Isolation Valve (FAL12AA001) [f]

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BRA	32BRA	33BRA	34BRA
KAB				CCWS Common Train CVCS and RCP 1 and RCP 2 Motor Cooler Return Line Containment Isolation Valve (KAB60AA018) [f]
				CCWS Common Train Reactor Building HVAC Return Line Containment Isolation Valve (KAB40AA012) [f]
				CCWS Common Train RCP 1 and RCP 2 Thermal Barrier Return Line Containment Isolation Valve (KAB30AA051) [f]
	CCWS Train CVCS and RCP 3 and RCP 4 Motor Cooler Return Line Containment Isolation Valve (KAB70AA018) [f]			
	CCWS Common Train RCP 3 and RCP 4 Thermal Barrier Return Line Containment Isolation Valve (KAB30AA055) [f]			

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BRA	**32BRA**	**33BRA**	**34BRA**
JMM				Containment Inflating/Deflating Subsystem Containment Isolation Valve (JMM10AA006) [f]
	Containment Leakage Exhaust Subsystem Containment Isolation Valve (JMM23AA001)			Containment Leakage Exhaust Subsystem Containment Isolation Valve (JMM23AA002)
QJB				Nitrogen Distribution System Containment Isolation Valve (QJB40AA002) [f]
				Nitrogen Distribution System Containment Isolation Valve (QJB40AA004) [f]
LCQ			Steam Generator Blowdown Flash Line Containment Isolation Valve (LCQ52AA001) [f]	
	Steam Generator Blowdown Condensate Line Containment Isolation Valve (LCQ51AA002) [f]			
	SG Hot Leg Blowdown Isolation Valve (LCQ10AA001)	SG Hot Leg Blowdown Isolation Valve (LCQ20AA001)	SG Hot Leg Blowdown Isolation Valve (LCQ30AA001)	SG Hot Leg Blowdown Isolation Valve (LCQ40AA001)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BRA	**32BRA**	**33BRA**	**34BRA**
LCQ	SG Cold Leg Blowdown Isolation Valve (LCQ10AA002)	SG Cold Leg Blowdown Isolation Valve (LCQ20AA002)	SG Cold Leg Blowdown Isolation Valve (LCQ30AA002)	SG Cold Leg Blowdown Isolation Valve (LCQ40AA002)
		SG Common Blowdown Isolation Valve (LCQ30AA003)	SG Common Blowdown Isolation Valve (LCQ10AA003)	
		SG Common Blowdown Isolation Valve (LCQ40AA003)	SG Common Blowdown Isolation Valve (LCQ20AA003)	
LCA			SG Blowdown Cooler Condensate Return Line Containment Isolation Valve (LCA90AA005) [f]	
KPL	Pressurizer Relief Tank and Reactor Coolant Drain Tank Purge Return Line Containment Isolation Valve (KPL85AA003) [f]			
	Pressurizer Relief Tank and Reactor Coolant Drain Tank Purge Supply Line Containment Isolation Valve (KPL84AA003) [f]			
QNJ	Operational Chilled Water Return Containment Isolation Valve (QNJ41AA027) [f]			

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BRA	**32BRA**	**33BRA**	**34BRA**
KBA	CVCS Letdown Path from Loop 1 Cross-over Leg Isolation Valve (KBA10AA001)			CVCS Letdown Path from Loop 1 Cross-over Leg Isolation Valve (KBA10AA002)
	Boron Dilution Prevention Isolation Valve (KBA21AA009)			Boron Dilution Prevention Isolation Valve (KBA21AA001)
	CVCS Letdown Line Containment Isolation Valve (KBA14AA002) [f]			
				Boron Dilution Prevention Isolation Valve (KBA25AA017)
QUC	SG Secondary Sampling Containment Isolation Valve (QUC14AA011) [f]			SG Secondary Sampling Containment Isolation Valve (QUC12AA011) [f]
	SG Secondary Sampling Containment Isolation Valve (QUC13AA011) [f]			SG Secondary Sampling Containment Isolation Valve (QUC11AA011) [f]
LAB	Main Feedwater Line Full Load Control Valve (LAB60AA101)	Main Feedwater Line Full Load Control Valve (LAB70AA101)	Main Feedwater Line Full Load Control Valve (LAB80AA101)	Main Feedwater Line Full Load Control Valve (LAB90AA101)
	Main Feedwater Line Low Load Control Valve (LAB64AA101)	Main Feedwater Line Low Load Control Valve (LAB74AA101)	Main Feedwater Line Low Load Control Valve (LAB84AA101)	Main Feedwater Line Low Load Control Valve (LAB94AA101)
	Main Feedwater Line Very Low Load Control Valve (LAB64AA102)	Main Feedwater Line Very Low Load Control Valve (LAB74AA102)	Main Feedwater Line Very Low Load Control Valve (LAB84AA102)	Main Feedwater Line Very Low Load Control Valve (LAB94AA102)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BRA	**32BRA**	**33BRA**	**34BRA**
LBA	SG Main Steam Relief Control Valve (LBA13AA101)	SG Main Steam Relief Control Valve (LBA23AA101)	SG Main Steam Relief Control Valve (LBA33AA101)	SG Main Steam Relief Control Valve (LBA43AA101)
KTA				Reactor Coolant Drain Tank Drain Line Containment Isolation Valve (KTA10AA017) [f]
KTC	Reactor Building Sump Containment Isolation Valve (KTC10AA005) [f]			
KTD	Reactor Building Floor Drain Pump Discharge Line Containment Isolation Valve (KTD10AA024) [f]			
KLB	Annulus Ventilation Normal Exhaust Isolation (KLB44AA002)			Annulus Ventilation Normal Exhaust Isolation (KLB44AA003)
	Annulus Ventilation Normal Supply Isolation (KLB34AA002)			Annulus Ventilation Normal Supply Isolation (KLB34AA003)
	Annulus Ventilation Filter Inlet Isolation Valve (KLB21AA003)			Annulus Ventilation Filter Inlet Isolation Valve (KLB24AA003)
	Annulus Ventilation Filter Outlet Isolation Valve (KLB21AA004)			Annulus Ventilation Filter Outlet Isolation Valve (KLB24AA004)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BRA	**32BRA**	**33BRA**	**34BRA**
LAR	EFW Pump Discharge Cross Connect Valve (LAR14AA001)	EFW Pump Discharge Cross Connect Valve (LAR24AA001)	EFW Pump Discharge Cross Connect Valve (LAR34AA001)	EFW Pump Discharge Cross Connect Valve (LAR44AA001)
	EFW to SG Level Control Valve (LAR11AA105)	EFW to SG Level Control Valve (LAR21AA105)	EFW to SG Level Control Valve (LAR31AA105)	EFW to SG Level Control Valve (LAR41AA105)
	SG EFW Isolation Valve (LAR11AA006)	SG EFW Isolation Valve (LAR21AA006)	SG EFW Isolation Valve (LAR31AA006)	SG EFW Isolation Valve (LAR41AA006)
QNJ	Operational Chilled Water Return Containment Isolation Valve (QNJ41AA027) [f]			
JNA	RHR Hot Leg Suction Line Isolation Valve (JNA20AA002)	RHR Hot Leg Suction Line Isolation Valve (JNA10AA002)	RHR Hot Leg Suction Line Isolation Valve (JNA40AA002)	RHR Hot Leg Suction Line Isolation Valve (JNA30AA002)
JNG	SIS Dead Leg (Hot) Pressurization Isolation Valve (JNG25AA004)	SIS Dead Leg (Hot) Pressurization Isolation Valve (JNG15AA004)	SIS Dead Leg (Hot) Pressurization Isolation Valve (JNG45AA004)	SIS Dead Leg (Hot) Pressurization Isolation Valve (JNG35AA004)
JEW				RCP Seal Leakoff Containment Isolation Valve (JEW50AA001)
PS	Protection System Cabinets	Protection System Cabinets	Protection System Cabinets	Protection System Cabinets
PACS	Priority Actuation Control System Cabinets	Priority Actuation Control System Cabinets	Priority Actuation Control System Cabinets	Priority Actuation Control System Cabinets
SAS	Safety Automation System Cabinets	Safety Automation System Cabinets	Safety Automation System Cabinets	Safety Automation System Cabinets

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BGA01	**32BGA01**	**33BGA01**	**34BGA01**
JYK	Containment High Range Radiation Monitor (JYK00GH007)	Containment High Range Radiation Monitor (JYK00GH111)	Containment High Range Radiation Monitor (JYK00GH112)	Containment High Range Radiation Monitor (JYK00GH008)
LBA	MSRIV Pilot Operated Relief Valve (LBA13AA722)	MSRIV Pilot Operated Relief Valve (LBA13AA723)	MSRIV Pilot Operated Relief Valve (LBA13AA726)	MSRIV Pilot Operated Relief Valve (LBA13AA727)
	MSRIV Pilot Operated Relief Valve (LBA23AA722)	MSRIV Pilot Operated Relief Valve (LBA23AA723)	MSRIV Pilot Operated Relief Valve (LBA23AA726)	MSRIV Pilot Operated Relief Valve (LBA23AA727)
	MSRIV Pilot Operated Relief Valve (LBA33AA722)	MSRIV Pilot Operated Relief Valve (LBA33AA723)	MSRIV Pilot Operated Relief Valve (LBA33AA726)	MSRIV Pilot Operated Relief Valve (LBA33AA727)
	MSRIV Pilot Operated Relief Valve (LBA43AA722)	MSRIV Pilot Operated Relief Valve (LBA43AA723)	MSRIV Pilot Operated Relief Valve (LBA43AA726)	MSRIV Pilot Operated Relief Valve (LBA43AA727)
	MSIV Fast Close Pilot Valve (LBA10AA712)	MSIV Fast Close Pilot Valve (LBA10AA722)	MSIV Fast Close Pilot Valve (LBA10AA713)	MSIV Fast Close Pilot Valve (LBA10AA723)
	MSIV Fast Close Pilot Valve (LBA20AA712)	MSIV Fast Close Pilot Valve (LBA20AA722)	MSIV Fast Close Pilot Valve (LBA20AA713)	MSIV Fast Close Pilot Valve (LBA20AA723)
	MSIV Fast Close Pilot Valve (LBA30AA712)	MSIV Fast Close Pilot Valve (LBA30AA722)	MSIV Fast Close Pilot Valve (LBA30AA713)	MSIV Fast Close Pilot Valve (LBA30AA723)
	MSIV Fast Close Pilot Valve (LBA40AA712)	MSIV Fast Close Pilot Valve (LBA40AA722)	MSIV Fast Close Pilot Valve (LBA40AA713)	MSIV Fast Close Pilot Valve (LBA40AA723)
XJ	EDG Air Start Solenoid Valve A (XJX10AA120A-Y)	EDG Air Start Solenoid Valve A (XJX20AA120A-Y)	EDG Air Start Solenoid Valve A (XJX30AA120A-Y)	EDG Air Start Solenoid Valve A (XJX40AA120A-Y)
	EDG Air Start Solenoid Valve B (XJX10AA120B-Y)	EDG Air Start Solenoid Valve B (XJX20AA120B-Y)	EDG Air Start Solenoid Valve B (XJX30AA120B-Y)	EDG Air Start Solenoid Valve B (XJX40AA120B-Y)
	EDG Governor Booster Valve A (XJX10AA028A-Y)	EDG Governor Booster Valve A (XJX20AA028A-Y)	EDG Governor Booster Valve A (XJX30AA028A-Y)	EDG Governor Booster Valve A (XJX40AA028A-Y)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BGA01	**32BGA01**	**33BGA01**	**34BGA01**
XJ	EDG Governor Booster Valve B (XJX10AA028B-Y)	EDG Governor Booster Valve B (XJX20AA028B-Y)	EDG Governor Booster Valve B (XJX30AA028B-Y)	EDG Governor Booster Valve B (XJX40AA028B-Y)
	EDG Shutdown Solenoid (XJX10AA101-Y)	EDG Shutdown Solenoid (XJX20AA101-Y)	EDG Shutdown Solenoid (XJX30AA101-Y)	EDG Shutdown Solenoid (XJX40AA101-Y)
	EDG Excitation Cubicle (XJX10GH001T)	EDG Excitation Cubicle (XJX20GH001T)	EDG Excitation Cubicle (XJX30GH001T)	EDG Excitation Cubicle (XJX40GH001T)
JEF	PSRV Solenoid Pilot Valve (JEF10AA717)	PSRV Solenoid Pilot Valve (JEF10AA718)		
			PSRV Solenoid Pilot Valve (JEF10AA727)	PSRV Solenoid Pilot Valve (JEF10AA728)
		PSRV Solenoid Pilot Valve (JEF10AA737)	PSRV Solenoid Pilot Valve (JEF10AA738)	
KAA	CCWS Switchover Valve Solenoid (KAA10AA006A)	CCWS Switchover Valve Solenoid (KAA10AA006B)	CCWS Switchover Valve Solenoid (KAA10AA006C)	CCWS Switchover Valve Solenoid (KAA10AA006D)
	CCWS Switchover Valve Solenoid (KAA20AA006A)	CCWS Switchover Valve Solenoid (KAA20AA006B)	CCWS Switchover Valve Solenoid (KAA20AA006C)	CCWS Switchover Valve Solenoid (KAA20AA006D)
	CCWS Switchover Valve Solenoid (KAA30AA006A)	CCWS Switchover Valve Solenoid (KAA30AA006B)	CCWS Switchover Valve Solenoid (KAA30AA006C)	CCWS Switchover Valve Solenoid (KAA30AA006D)
	CCWS Switchover Valve Solenoid (KAA40AA006A)	CCWS Switchover Valve Solenoid (KAA40AA006B)	CCWS Switchover Valve Solenoid (KAA40AA006C)	CCWS Switchover Valve Solenoid (KAA40AA006D)
	CCWS Switchover Valve Solenoid (KAA10AA010A)	CCWS Switchover Valve Solenoid (KAA10AA010B)	CCWS Switchover Valve Solenoid (KAA10AA010C)	CCWS Switchover Valve Solenoid (KAA10AA010D)
	CCWS Switchover Valve Solenoid (KAA20AA010A)	CCWS Switchover Valve Solenoid (KAA20AA010B)	CCWS Switchover Valve Solenoid (KAA20AA010C)	CCWS Switchover Valve Solenoid (KAA20AA010D)
	CCWS Switchover Valve Solenoid (KAA30AA010A)	CCWS Switchover Valve Solenoid (KAA30AA010B)	CCWS Switchover Valve Solenoid (KAA30AA010C)	CCWS Switchover Valve Solenoid (KAA30AA010D)
	CCWS Switchover Valve Solenoid (KAA40AA010A)	CCWS Switchover Valve Solenoid (KAA40AA010B)	CCWS Switchover Valve Solenoid (KAA40AA010C)	CCWS Switchover Valve Solenoid (KAA40AA010D)

Table 08.03.01-2-1—Engineered Safety Feature Loads
(41 Sheets)

System	Division 1	Division 2	Division 3	Division 4
	31BGA01	**32BGA01**	**33BGA01**	**34BGA01**
KLA	Containment Purge Full Airflow Loop Exhaust Section (KLA 4) Containment Isolation Solenoid Valve (KLA40AA001A) [f]			
				Containment Purge Low Airflow Loop Supply Section (KLA 1) Containment Isolation Solenoid Valve (KLA10AA003A) [f]
				Containment Purge Full Airflow Loop Supply Section (KLA 3) Containment Isolation Solenoid Valve (KLA30AA003A) [f]
	Containment Purge Low Airflow Loop Exhaust Section (KLA 2) Containment Isolation Solenoid Valve (KLA20AA001A) [f]			

Notes:

a) Component(s) redundant to this component are powered from BDC buses.

b) Component(s) redundant to this component are powered from BDA buses.

c) Component(s) redundant to this component are powered from BMC buses.

d) Component(s) redundant to this component are powered from BMA buses.

e) Component(s) redundant to this component are powered from BNC01 buses.

f) Component(s) redundant to this component are powered from BNB03 buses.

g) Component(s) redundant to this component are powered from BRA buses.

h) Component(s) redundant to this component are powered from BGA01 buses.

i) Component(s) redundant to this component are powered from BNB01 buses.

j) Component(s) redundant to this component are powered from BNA02 buses.

Question 08.03.02-3:

Page 8.3-49 (8.3.2.3.1) of the FSAR mentioned load flow studies performed for switchboards. Provide the results of dc load flow calculations and the assumptions used to demonstrate the adequacy of bus voltage values with these system loads and sources.

Response to Question 08.03.02-3:

U.S EPR FSAR Tier 2, Section 8.3.2.3.1 discusses the load flow simulation used to find the worst-case voltage levels at switchboards 31BUC, 32BUC, 33BUC and 34BUC. The DC load flow calculations are performed using a simplified model in the electrical transient analyzer program (ETAP).

During normal operation, the 250 Vdc load is powered from the battery chargers with the batteries floating on the system. As noted in U.S. EPR Tier 2, FSAR Section 8.3.2.3.1, it is assumed that there is a loss of power to the bus feeding the battery chargers so that only the battery is powering the loads. The loads are simulated as a static total load at the worst-case loading, which is the first minute of the battery duty cycle. The Class 1E uninterruptible power supply system (EUPS) ETAP calculations are performed with an initial no-load battery voltage no greater than the float voltage permitted by Technical Specification 3.8.6 Condition A. This initial no-load battery voltage is further reduced so as to not exceed the open circuit voltage (OCV) calculated from IEEE Std 450-2002, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications," Section A.3; i.e.:

$$\text{OCV} = (\text{Specific Gravity @ } 25°\text{C}) + 0.845$$

Battery models from C&D Technologies (Type LCY) and GNB (Type NCN) are considered during the initial battery sizing analysis. Both of these battery models have a nominal temperature-corrected specific gravity of 1.215, as shown in U.S. EPR FSAR Tier 2, Table 8.3-10—Onsite DC Power System Component Data Nominal Values. A specific gravity of 1.215 yields an OCV of 2.06V per cell; however, an additional margin of 0.005V per cell was used on the initial load flow simulation, resulting in 2.055V per cell and a battery terminal voltage of 246.6V. The battery sizing analysis is performed using the calculation methods in IEEE Std 485-1997 (R2003), "IEEE Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications," which also provides for temperature correction, a 10 percent design margin, and a 25 percent aging factor. The additional OCV margin allows for revision of cell parameters during detailed design and may be removed once a specific battery model is selected.

The batteries, DC switchboards, and inverters have been purposely placed as close together as practical. Architectural drawings are used to estimate the minimum practical cable lengths, taking into account the wall between the batteries and the DC switchboard and inverter equipment. It is assumed that cables are copper type THHN rated 90°C (40°C ambient/ 50°C rise). Since the worst loading occurs during the first minute, cable resistance is adjusted based on the normal heat, ventilation, air conditioning (HVAC) criteria for the respective rooms.

Division 1 and Division 4 EUPS battery loading is similar; therefore, Division 1 results are considered to also represent Division 4.

Likewise, Division 2 and Division 3 EUPS battery loading is similar; therefore, Division 3 results are considered to also represent Division 2.

DC Load Flow Calculation Results

The load flow calculation determines the voltage level at the battery terminals, DC switchboards 31/32/33/34BUC, and at the input to the inverters during the largest loading demand as determined by the EUPS battery duty cycle developed in accordance with IEEE Std 485-1997(R2003). The calculated lowest system voltages (rounded down) are shown in Table 08.03.02-3-1—EUPS Minimum Load Flow Voltages.

Final DC load flow calculation results updated with as-installed cables and equipment parameters verify:

- Adequate terminal voltage at field devices connected to the EUPS throughout the EUPS two hour battery duty cycle duration.
- The terminal voltage at field devices supplied by the EUPS system during EUPS battery charging conditions is within the design equipment rating.

The final DC load flow calculations will support U.S. EPR FSAR Tier 1, Section 2.5.2, ITAAC item 5.11.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Table 8.3.2-3-1—EUPS Minimum Load Flow Voltages

Component	Component Numbers	Minimum Value	Minimum (FSAR Table 8.3-10)
EUPS Batteries	31BTD01 34BTD01	213 VDC	210 VDC (1.75 VDC X 120 cells)
EUPS Batteries	32BTD01 33BTD01	210 VDC	210 VDC (1.75 VDC X 120 cells)
EUPS Inverters	31BRU01 34BRU01	208 VDC	200 VDC
EUPS Inverters	32BRU01 33BRU01	205 VDC	200 VDC
DC Switchboards	31BUC 34BUC	210 VDC	N/A
DC Switchboards	32BUC 33BUC	206 VDC	N/A

Question 08.03.02-5:

Page 8.3-50 (8.3.2.3.3) of the FSAR mentioned various dc system equipment sizing studies. Provide a summary of the sizing calculations for battery, charger, inverter, switchgear bus, and breakers, panels, and cables and assumptions used.

Response to Question 08.03.02-5:

EUPS Battery Sizing Assumptions

The following assumptions are made during the sizing of the Class 1E uninterruptible power supply (EUPS) system battery. Assumptions are applicable to both Division 1 and Division 3 unless indicated otherwise. Division 1 is loaded slightly greater than Division 4, so Division 1 battery sizing is also representative of Division 4. Division 3 is loaded slightly greater than Division 2, so Division 3 battery sizing is representative of Division 2.

- The scenario for when the most severe battery loading conditions occur is a simultaneous loss of offsite power (LOOP) and a large break loss of coolant accident (LOCA), with a subsequent failure of an emergency diesel generator (EDG) after successfully starting and connecting to its emergency power supply system (EPSS) BDA bus. At the end of the scenario, it is assumed that the EDG becomes available to re-power its bus and associated battery charger.
- At 0 seconds, Division 1 and Division 4 provide power for 18 circuit breaker tripping coils (e.g., reactor coolant pump (RCP), engineered safety feature (ESF) pumps, normal operating loads) and 21 contactors energize on 31/34BRA for inner containment isolation valves.
- At 0 seconds, Division 2 and Division 3 provide power for 14 circuit breaker tripping coils (e.g., RCPs, ESF pumps, normal operating loads) and 8 contactors energize on 23/33BRA for inner containment isolation valves.
- At 0 seconds, worst case EDG field flash duration of 10 seconds, EDG excitation cubicle control voltage power requirement doubles, two air start solenoids are powered, and two governor booster valves are powered.
- At 10 seconds, EDG output breaker closes but immediately trips.
- At 16.1 seconds, EDG shutdown solenoid is powered.
- At the conclusion of scenario, a worst case 10 second duration of EDG field flash, EDG excitation cubicle control voltage power requirement doubles with EDG output breaker closure immediately following, two air start solenoids are powered, and two governor booster valves are powered.
- Inverter efficiency is 87 percent.
- Minimum acceptable DC input voltage (for a 250 VDC nominal battery) that maintains inverter AC output voltage regulation of ± 2 percent nominal is 210 VDC.
- A 15 percent margin is included in the switchgear, load center (LC), motor control center (MCC), and control voltage power demand.

- 6.9 kV switchgear, LC, and MCC control voltage power requirements (including tripping and closing times) values are obtained from commercially available products. MCC control voltage is conservatively assumed for battery loading.
- The operating time of inner containment isolation valves, motor operated valves, and isolation dampers is one minute with inrush current for the first 5 seconds of operation at six times the required power.
- The specific number and times of main steam relief control valve (MSRCV) operation are not known, so they are assumed as continuous loads with power requirements of five times rated power.
- A 50 percent margin is included in instrumentation and controls (I&C) cabinet power supply demand to account for converter efficiency (≥ 85 percent) and I&C power supply requirement uncertainties.
- I&C cabinets are considered as continuous loads.
- I&C priority actuation and control system cabinets maximum power requirement per cabinet is assumed (included maximum AV-42 cards per cabinet, maximum fiber optic converters, maximum "Y" Profibus controllers and cabinet monitoring unit).
- A temperature of 65°F is assumed for sizing the battery. Accordingly, a temperature correction factor of 1.08 is applied to the cell capacity.
- A 10 percent design margin is assumed for cell size to allow for unforeseen additions to the EUPS system loads and less-than-optimum operating conditions of the battery due to improper maintenance, recent discharge, ambient temperatures lower than anticipated, or a combination of these factors.
- A 25 percent aging factor is assumed so the battery is capable of meeting its design loads throughout its service life.
- 120 cells per string are considered for the 250 VDC battery arrangements.
- Periods no less than one minute for duty cycle loads are considered. The duty cycle load is assumed to be the maximum load at any instant in periods no less than one minute.
- Feedwater valves supplied by the battery are considered to operate simultaneously to simulate worst case possible loading.

12UPS Battery Sizing Assumptions

The following assumptions are made during the sizing of the 12-hour uninterruptible power supply system (12UPS) battery. Assumptions are applicable to both train 1 and train 2. Train 1 was sized because the 12UPS train 1 has a slightly larger load than train 2.

- The worst case duty cycle used for the 12UPS is a LOOP event with a corresponding failure of all EDGs and station blackout diesel generators (SBODGs) to start. This is the start of the 12 hour battery duty cycle. At the end of the 12 hour scenario, it is assumed that the SBODG becomes available to re-power its bus and associated battery charger.
- At 0 seconds, control power is provided for circuit breaker tripping coils.
- At 14 minutes, the RCP standstill seal leakage recovery line isolation valves and nitrogen injection isolation valves operate.

- Outside containment isolation valves are operated at one hour into the duty cycle prior to operation of the severe accident depressurization valves used for severe accident mitigation. The valves are manually actuated in four different groups having at least a one second period between groups.
- Primary depressurization system valves are operated at three hours into the duty cycle.
- Nuclear Island non-safety-related loads (e.g., I&C systems) not needed for severe accident mitigation are disconnected at two hours.
- SBODG auxiliaries are supported throughout the 12 hour duty cycle.
- At the conclusion of the scenario, the SBODG is started and connected to the associated bus.
- Inverter efficiency is considered as 88 percent.
- Switchboard minimum voltage of 210 VDC provides a minimum 200 VDC voltage to the loads, assuming a 10 VDC voltage drop from the switchboard to the load.
- Minimum battery voltage is 217.2 VDC (1.81 VDC per cell) to account for voltage drop from the battery to 31/32/33/34BUE.
- A temperature of 65°F is assumed for sizing the battery. Accordingly, a temperature correction factor of 1.08 is applied to the cell capacity.
- A 10 percent design margin is assumed for cell size.
- A 25 percent aging factor is assumed so the battery is capable of meeting its design loads throughout its service life.
- 120 cells per string are considered for the 250 VDC battery arrangements.

DC/UPS Systems Battery Sizing Calculation Summary

DC/UPS battery sizing calculations for the EUPS and 12UPS batteries are performed in accordance with IEEE Std 485-1997(R2003), “IEEE Recommended Practice For Sizing Lead-Acid Batteries for Stationary Applications,” including duty cycle development and momentary, continuous, and non-continuous load application.

Results of EUPS and 12UPS battery sizing calculations are shown in U.S. EPR FSAR Tier 2, Table 8.3-11—Onsite DC Power System Component Data Nominal Values. Nominal values for 12UPS battery size have been updated to one string (120 cells) to provide approximately 2,400 Amp-hour.

DC/UPS System Battery Charger Assumptions and Sizing

The battery chargers for the EUPS and 12UPS are sized to be capable of recharging their respective batteries to approximately 95 percent capacity within 24 hours. This time is based on IEEE Std 946-2004, “IEEE Recommended Practice for the Design of DC Auxiliary Power Systems for Generating Stations,“ which recommends 8 to 24 hours for recharge of the battery after discharge testing and to recharge the battery to approximately 95 percent of capacity. U.S. EPR FSAR Tier 2, Section 8.3.2.1 and Section 8.3.2.3.3 will be revised to reflect the time to recharge the respective battery is 24 hours.

Battery charger sizing is performed in accordance with IEEE Std 946-2004 for each DC/UPS system. Results of battery charger sizing calculations for the EUPS and 12UPS systems are shown in U.S. EPR FSAR Tier 2, Table 8.3-11. The nominal value for 12UPS battery minimum required output current has been updated to 600 A.

DC/UPS System Inverter Assumptions and Sizing

EUPS inverter sizing assumptions are provided in the response to RAI 11 Supplement 1, Question 08.03.01-8.

The assumptions for sizing the 12UPS inverters are:

- A power factor of 0.8 is conservatively assumed for 12UPS loads powered from BRB, BRC, and BNB03 MCCs (except containment isolation valves).
- A power factor of 0.6 is conservatively assumed for containment isolation valves powered from BNB03 MCCs.
- The scenario for which the most severe inverter loading conditions occur is at the start of the severe accident scenario.
- A 10 percent design margin is assumed.
- Inverter efficiency is 88 percent.

Results of inverter sizing calculations for the EUPS and 12UPS systems are shown in U.S. EPR FSAR Tier 2, Table 8.3-11. Nominal value for 12UPS inverter size has been updated to 160 kVA.

Switchgear Bus, Breaker, Panel and Cable Sizing

DC bus ratings are based on meeting continuous load requirements and available short-circuit fault currents. EUPS DC bus (BUC) ratings are provided in U.S. EPR FSAR Tier 2, Table 8.3-11.

Distribution panels, circuit breakers, fused disconnects, and cables are sized in accordance with industry standards.

Verification that DC/UPS system equipment is adequately sized to perform the system function is performed with inspection, test, analysis, and acceptance criteria (ITAAC) closure in U.S. EPR FSAR Tier 1, Section 2.5.2 and Section 2.5.11 for the EUPS and 12UPS systems, respectively.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 8.3.2.1, Section 8.3.2.3.3, and Table 8.3-11 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

Table 2.6.1-2—Main Control Room Air Conditioning System Equipment I&C and Electrical Design (7 Sheets)

Equipment Description	Equipment Tag Number (1)	Equipment Location	IEEE Class 1E Source (2)	Failure Position	PACS	MCR / RSS Displays	MCR / RSS Controls
Recirculation and Air Conditioning Train 30SAB02							
Supply Air Fan	30SAB02AN001	Safeguard Building Division 2	Division 2^N	N/A	Yes	On-Off / On-Off	Run-Stop / Run-Stop
Motor Operated Damper	30SAB02AA012	Safeguard Building Division 2	Division 2^N Division 1^A	Close	Yes	Position / Position	Open-Close / Open-Close
Recirculation and Air Conditioning Train 30SAB03							
Supply Air Fan	30SAB03AN001	Safeguard Building Division 3	Division 3^N	N/A	Yes	On-Off / On-Off	Run-Stop / Run-Stop
Motor Operated Damper	30SAB03AA012	Safeguard Building Division 3	Division 3^N Division 4^A	Close	Yes	Position / Position	Open-Close / Open-Close
Recirculation and Air Conditioning Train 30SAB04							
Supply Air Fan	30SAB04AN001	Safeguard Building Division 3	Division 4^N Division 3^A	N/A	Yes	On-Off / On-Off	Run-Stop / Run-Stop
Motor Operated Damper	30SAB04AA012	Safeguard Building Division 3	Division 4^N Division 3^A	Open	Yes	Position / Position	Open-Close / Open-Close
Kitchen and Sanitary Exhaust 30SAB45							
Motor Operated Damper	30SAB45AA003	Safeguard Building Division 2	Division 1^N Division 2^A	Close	Yes	Position / Position	Open-Close / Open-Close
Motor Operated	30SAB45AA004	Safeguard Building	Division ~~2~~4^N	Close	Yes	Position /	Open-Close /

08.03.01-2

Table 2.6.1-2—Main Control Room Air Conditioning System Equipment I&C and Electrical Design (7 Sheets)

Equipment Description	Equipment Tag Number (1)	Equipment Location	IEEE Class 1E Source (2)	Failure Position	PACS	MCR / RSS Displays	MCR / RSS Controls
Damper		Division 2	Division ~~1~~3[A]			Position	Open-Close
			MCR Air Exhaust 30SAB42				
Motor Operated Damper	30SAB42AA001	Safeguard Building Division 2	Division 1[N] Division 2[A]	Open	Yes	Position / Position	Open-Close / Open-Close
Motor Operated Damper	30SAB42AA002	Safeguard Building Division 2	Division ~~2~~4[N] Division ~~1~~3[A]	Open	Yes	Position / Position	Open-Close / Open-Close
			Pressure Sensors				
Differential pressure across 30SAB11 iodine train filters	30SAB11CP001	Safeguard Building Division 2	N/A	N/A	N/A	Press / Press	N/A
Differential pressure across 30SAB14 iodine train filters	30SAB14CP001	Safeguard Building Division 3	N/A	N/A	N/A	Press / Press	N/A
Differential pressure between Main Control Room and reference rooms	30SAB32CP001 30SAB32CP002 30SAB32CP003	Safeguard Building Division 2	N/A	N/A	N/A	Press / Press	N/A
			Temperature Sensors				
Outside Air temperature sensors for trains	30SAB01CT001 30SAB02CT001	Safeguard Building Division 2	N/A	N/A	N/A	Temp / Temp	N/A

08.03.01-2

Table 2.6.6-2—Safeguard Building Controlled-Area Ventilation System Equipment I&C and Electrical Design (~~8~~ 7 Sheets)

Equipment Description	Equipment Tag Number(1)	Equipment Location	IEEE Class 1E Source (2)	Failure Position	EQ – Harsh Env.	PACS	MCR / RSS Displays	MCR / RSS Controls
Air Supply Safeguard Building Division 1								
Motor Operated dampers	30KLC11 AA003 30KLC11 AA004	Safeguard Building 1 Safeguard Building 1	Division 1[N] Division 2 [A]	Close	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated damper	30KLC11 AA005	Safeguard Building 1	Division ~~2~~4[N] Division ~~1~~3 [A]	Close	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated dampers	30KLC11 AA007 30KLC11 AA008	Safeguard Building 1 Safeguard Building 1	Division 1[N] Division 2 [A]	Close	Yes	Yes	Position / Position	Open-Close / Open-Close
Air Supply Safeguard Building Division 2								
Motor Operated dampers	30KLC12 AA003 30KLC12 AA004	Safeguard Building 2 Safeguard Building 2	Division 2[N] Division 1[A]	Close	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated damper	30KLC12 AA005	Safeguard Building 2	Division ~~1~~3[N] Division ~~2~~4[A]	Close	Yes	Yes	Position / Position	Open-Close / Open-Close
Air Supply Safeguard Building Division 3								
Motor Operated damper	30KLC13 AA003 30KLC13 AA004	Safeguard Building 3 Safeguard Building 3	Division 3[N] Division 4[A]	Close	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated dampers	30KLC13 AA005	Safeguard Building 3	Division ~~4~~2[N] Division ~~3~~1[A]	Close	Yes	Yes	Position / Position	Open-Close / Open-

08.03.01-2

Table 2.6.6-2—Safeguard Building Controlled-Area Ventilation System Equipment I&C and Electrical Design (~~8~~ 7 Sheets)

Equipment Description	Equipment Tag Number(1)	Equipment Location	IEEE Class 1E Source (2)	Failure Position	EQ – Harsh Env.	PACS	MCR / RSS Displays	MCR / RSS Controls
								Close
Air Supply Safeguard Building Division 4								
Motor Operated dampers	30KLC14 AA003 30KLC14 AA004	Safeguard Building 4 Safeguard Building 4	Division 4N Division 3A	Close	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated damper	30KLC14 AA005	Safeguard Building 4	Division ~~3~~1N Division ~~4~~2A	Close	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated damper	30KLC14 AA007	Safeguard Building 4	Division 4N Division 3A	Close	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated dampers	30KLC24 AA002 30KLC24 AA003 30KLC24 AA004	Safeguard Building 4 Safeguard Building 4 Safeguard Building 4	Division 4N Division 3A	Close	Yes	Yes	Position / Position	Open-Close / Open-Close
Operational Air Exhaust								
Motor Operated dampers	30KLC21 AA005 30KLC21 AA006 30KLC21 AA007	Safeguard Building 1 Safeguard Building 1 Safeguard Building 1	Division 1N Division 2A	Close	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated damper	30KLC21 AA008	Safeguard Building 1	Division ~~2~~4N Division ~~1~~3A	Close	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated dampers	30KLC22 AA006 30KLC22 AA007	Safeguard Building 2 Safeguard Building 2	Division 2N Division 1A	Close	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated damper	30KLC22AA008	Safeguard Building 2	Division ~~1~~3N Division ~~2~~4A	Close	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated	30KLC23 AA006	Safeguard Building 3	Division 3N	Close	Yes	Yes	Position /	Open-Close /

08.03.01-2

Table 2.6.6-2—Safeguard Building Controlled-Area Ventilation System Equipment I&C and Electrical Design (~~8~~ 7 Sheets)

Equipment Description	Equipment Tag Number(1)	Equipment Location	IEEE Class 1E Source (2)	Failure Position	EQ – Harsh Env.	PACS	MCR / RSS Displays	MCR / RSS Controls
dampers	30KLC23 AA007	Safeguard Building 3	Division 4^{A}				Position	Open-Close
Motor Operated damper	30KLC23AA008	Safeguard Building 3	Division ~~4~~2^{N} Division ~~3~~1^{A}	Close	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated dampers	30KLC24 AA005 30KLC24 AA006 30KLC24 AA007	Safeguard Building 4 Safeguard Building 4 Safeguard Building 4	Division 4^{N} Division 3 ^{A}	Close	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated damper	30KLC24 AA008	Safeguard Building 4	Division ~~3~~1^{N} Division ~~4~~2^{A}	Close	Yes	Yes	Position / Position	Open-Close / Open-Close
Accident Air Exhaust								
Motor Operated damper	30KLC31 AA001	Safeguard Building 1	Division 1^{N} Division 2^{A}	Open	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated damper	30KLC32 AA001	Safeguard Building 2	Division 2^{N} Division 1^{A}	Open	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated damper	30KLC33 AA001	Safeguard Building 3	Division 3^{N} Division 4^{A}	Open	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated damper	30KLC34 AA001	Safeguard Building 4	Division 4^{N} Division 3^{A}	Open	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated damper	30KLC45 AA001	Fuel Building	Division 1^{N} Division 2^{A}	Open	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated damper	30KLC45 AA002	Fuel Building	Division 4^{N} Division 3^{A}	Open	Yes	Yes	Position / Position	Open-Close / Open-Close
Motor Operated damper	30KLC45 AA003	Fuel Building	Division 1^{N} Division 2^{A}	Open	Yes	Yes	Position / Position	Open-Close / Open-Close

08.03.01-2

percent voltage. The bus voltage is maintained at the nominal 100 percent following a ± ten percent deviation in the switchyard voltage combined with bus voltage changes as a result of changes in bus loading. The EPSS connection with offsite power utilizes no intervening non-Class 1E buses and does not share a common winding from the preferred power EATs with the non-Class 1E switchgear. This minimizes the probability that transients of non-safety-related loads will adversely affect the Class 1E equipment and eliminates additional failure points between the offsite source and the Class 1E equipment.

The EAT protection detects faults and initiates protection actions to minimize any potential damage to an EAT, while minimizing impact to the electrical distribution system by isolating the affected transformer in the event of a transformer fault. Protection devices installed for EAT protection include transformer differential, ground fault overcurrent, phase overcurrent and sudden pressure relays. An EAT related fault ~~that results in a loss of voltage at a BDA bus~~ initiates an automatic fast transfer of the offsite power source, maintaining offsite power to all four divisions by switching the affected bus power supply to the unaffected EAT. The combined four EPSS divisions load under postulated conditions are within the ratings of each of the EATs. The fast transfer minimizes voltage decay and frequency difference to limit motor torque during the transfer, thus minimizing equipment degradation.

08.03.01-1

The EPSS distribution switchgear and nominal bus voltages are shown in Table 8.3-2—Emergency Power Supply System Switchgear, Load Center and Motor Control Center Numbering and Nominal Voltage.

EPSS divisions are functionally independent and physically separated from the others during normal bus alignments. An alternate feed is provided between EPSS divisions 1 and 2 (first divisional pair) to provide the normal and standby source of power to required safety-related systems, safety-related support systems, or components that do not have the required redundancy when certain electrical components, including the division 1 emergency diesel generator (EDG), are out of service. A similar alternate feed provides standby power to EPSS division 2, from division 1 when certain electrical components, including the division 2 EDG are out of service. Similar alternate feeds are used between divisions 3 and 4 (second divisional pair).

The divisional pair functional independence and physical separation are in accordance with IEEE Std 603-1998 (Reference 1) for safety-related system independence. This is accomplished by the separation of safety-related components between divisional pairs. A single failure or internal hazard, or both, in one divisional pair can only affect that one divisional pair. Therefore, during design basis accidents coincident with a single failure to any electrical component in a divisional pair, the second divisional pair supports safety-related function completion in accordance with single failure criteria IEEE Std 379-2000 (Reference 2), as endorsed by RG 1.53.

Each 12UPS battery has adequate capacity for starting and operating connected loads for a minimum of two hours during a~~n~~ LOOP. Following the initial two hours, certain loads must be manually disconnected so the system has adequate capacity to complete its 12-hour beyond design basis, severe accident mission if required. During the entire 12-hour discharge time, assuming the loads are properly shed, the battery voltage does not drop below the minimum values required for the severe accident loads.

Each 12UPS battery charger supplies the normally operating assigned loads while maintaining the battery fully charged or recharging the battery following battery discharge. The standby battery charger has the same capacity as the normal battery chargers. The time to recharge the battery from a discharged state to approximately 95 percent capacity during operating conditions is ~~eight~~24 hours. 08.03.02-5

The inverters are equipped with a static bypass switch to provide power from the bypass source in case of inverter failure, high or low input voltage or output voltage.

The 12UPS provides power to non-safety-related I&C cabinets located in the S~~afeguard~~ B~~uilding~~s from 480 Vac MCCs and 250 Vdc switchboards through ~~ac~~AC/ ~~dc~~DC and ~~dc~~DC/~~dc~~DC converters, respectively. The converter cubicles are designed and operated similar to the EUPS converters described in Section 8.3.2.1.1.5.

NPSS trains 1 and 2 provide the normal power to the 12UPS battery chargers from load centers 31BFX and 32BFX, respectively. If ~~power~~voltage is lost ~~to~~on NPSS 6.9 kV switchgear 31BBH or 32BBH, the SBODGs automatically start and re-power their associated 31BBH and 32BBH. These switchgear supply the load centers (31BFX and 32BFX), therefore the SBODGs provide a standby source of power to the battery chargers.

The 12UPS components are equipped with local and remote indications and alarms that provide operators with accurate system status. The following 12UPS indications are provided in the MCR:

- The inverter supplied MCC bus voltage.
- The inverter common trouble alarm.
- The ~~dc~~DC system ground alarm.
- The ~~dc~~DC distribution bus voltage.
- The charger common trouble alarm.

The 12UPS system does not perform any safety-related functions. The 12UPS provides electrical power for beyond DBEs (e.g., severe accident and SBO). The severe accident loads are powered from MCCs 31BRB, 32BRB, 33BRB and 34BRB. The following are the severe accident loads.

Allowable voltage ranges for equipment connected to the ~~dc~~DC systems are provided in Table 8.3-11. The testing that demonstrates compliance with applicable design guidance and regulations, including acceptance criteria for battery and battery charger sizing, is described in Section 8.3.2.4.

8.3.2.3.2 Short-Circuit Studies

The ETAP ~~dc~~DC short-circuit module calculates the total fault current, current contributions from different sources, and the rise time constant of the total fault current in accordance with IEEE Std 946-2004 (Reference 41). The fault under consideration is a short circuit between the positive and the negative terminals at the fault location. The contributing sources to the short-circuit current are the battery charger and battery since there are no ~~dc~~DC motors connected to the ~~dc~~DC switchboards. The analyses are performed to evaluate acceptable equipment ratings for equipment such as circuit breakers, fuses and bus work.

For each study case, short-circuit current results are compared to and must be less than the acceptance criteria, which are the applicable circuit breaker interrupting ~~and close and latch ratings~~ and maximum bus bracing current capabilities. Table 8.3-11 provides nominal equipment ratings.

8.3.2.3.3 Equipment Sizing Studies

Equipment sizing for the EUPS MCCs and switchboard buses is developed by performing the load flow, voltage regulation, and short circuit analyses based on electrical distribution system load requirements. Worst-case loading is determined, and then equipment is selected that will envelop the load requirements that have been analyzed.

Battery sizing methodology is performed in accordance with IEEE Std 485-1997 (Reference 42). The battery sizing takes into account the worst-case battery load conditions to develop the duty cycle and~~:~~ it includes specific load characteristics such as in-rush current. Battery cell discharge performance characteristic curves are used to calculate the cell capacity necessary for satisfactory battery performance based on the worst-case duty cycle. Duty cycle development and load characteristics are shown in Table 8.3-13, Table 8.3-14, Table 8.3-15, and Table 8.3-16. Other considerations included in the cell size are a ten percent design margin, a minimum battery temperature of 65°F, and 25 percent margin as an aging factor.

EUPS battery charger sizing is performed in accordance with Reference 41. The time considered to recharge the battery from a fully discharged state, based on the worst-case duty cycle, to approximately 95 percent capacity during operating conditions, is ~~eight~~24 hours. 08.03.02-5

Table 8.3-11—Onsite DC Power System Component Data Nominal Values
Sheet 2 of 2

Component	Division/Train	Nominal Value
7. EUPS AC Distribution MCC	Divisions 1 and 4 & Divisions 2 and 3	Rated Maximum Voltage, 508 V Maximum Continuous Current, 2000 A Maximum Bus Bracing Current, 100 kA rms
8. 12UPS Batteries	Trains 1 and 2 08.03.02-5	~~240~~120 cells 2.22 V/cell nominal float voltage 2.33 V/cell equalize voltage ~~3616~~2400 AH at 12 hour rate to ~~1.75~~1.81 V/cell at 77 °F (1) 1.215 nominal specific gravity at 77 °F
9. 12UPS Battery Chargers	Trains 1 and 2 08.03.02-5	Rated nominal input voltage 480 Vac, 3 phase Rated maximum input voltage 508 Vac Rated minimum input voltage 424 Vac Rated nominal ac supply frequency 57 to 63 Hz Rated nominal output voltage 250 Vdc Required output current ~~800~~600 A (2)
10. 12UPS System Inverters	Trains 1 and 2 08.03.02-5	Rated nominal input voltage 250 Vdc Rated maximum input voltage 280 Vdc Rated minimum input voltage 210 Vdc Rated nominal output voltage 480 Vac 3 phase Rated power regulation ± ~~two~~2% Rated power ~~210~~160 kVA Rated nominal output frequency 60 ± ½%
11. 12UPS AC/DC Converters	Trains 1, 2, 3, and 4	Rated Nominal input voltage 480 Vac ± 2% Rated input frequency 60 Hz ± ½% Rated nominal output voltage 24 Vdc
12. 12UPS DC/DC Converters	Trains 1, 2, 3, and 4	Rated nominal input voltage 250 Vdc Rated maximum input voltage 280 Vdc Rated minimum input voltage 210 Vdc Rated nominal output voltage 24 Vdc

Notes:

1. Battery amp-hour rating for different discharge rates are in accordance with vendor specific performance characteristic curves.

2. Battery charger current limiter will limit output current to below 150 percent of the full load output current rating.

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