FPL Energy
Seabrook Station

FPL Energy Seabrook Station
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March 30, 2006

Docket No. 50-443
SBK-L-06072

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

Seabrook Station
Facility Operating License NPF-86

Response to Request for Additional Information Regarding License Amendment Request 05-11, "Changes to Technical Specification 3.8.3.1, Onsite Power Distribution, for Vital Inverter Allowed Outage Time"

References:

1. FPL Energy Seabrook, LLC letter (SBK-L-05260) to NRC, " Changes to Technical Specification 3.8.3.1, Onsite Power Distribution, for Vital Inverter Allowed Outage Time," December 6, 2005.

2. NRC letter to FPL Energy Seabrook, LLC, "Request for Additional Information Regarding License Amendment Request to Increase Technical Specification 3.8.3.1, "Onsite Power Distribution," Vital Inverter Allowed Outage Time (TAC No. MC9165), February 16, 2006.

By letter dated December 6, 2005 (Reference 1) FPL Energy Seabrook, LLC submitted license amendment request (LAR) 05-11. The LAR requested a revision to Technical Specification 3.8.3.1, "Onsite Power Distribution," to extend the allowed outage time for the two balance-of-plant vital inverters from 24 hours to seven days.

In Reference 2, the NRC requested additional information in order to complete its evaluation. Enclosed is the FPL Energy Seabrook, LLC response to the request for additional information.

Should you have any questions regarding this information, please contact Mr. James Peschel, Regulatory Programs Manager, at (603) 773-7194.

A001

Very truly yours,

FPL Energy Seabrook, LLC

Gene St. Pierre
Site Vice President

Enclosure

cc: S. J. Collins, NRC Region I Administrator
G. E. Miller, NRC Project Manager, Project Directorate I-2
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OATH AND AFFIRMATION

I, Gene St. Pierre, Site Vice President of FPL Energy Seabrook, LLC, hereby affirm that the information and statements contained within this response to the request for additional information to License Amendment Request 05-11 are based on facts and circumstances which are true and accurate to the best of my knowledge and belief.

Sworn and Subscribed
before me this

30th day of March, 2006

Gene St. Pierre
Site Vice President

Victoria Susan Robertson
Notary Public

VICTORIA SUSAN ROBERTSON
MY COMMISSION EXPIRES JAN. 15, 2008
NOTARY PUBLIC
NEW HAMPSHIRE

Enclosure to Letter SBK-L-06072

Response to Request for Additional Information (RAI) Regarding
License Amendment Request (LAR) 05-11, "Changes to Technical Specification 3.8.3.1, Onsite
Power Distribution, for Vital Inverter Allowed Outage Time

RAI 1.

With a longer allowed outage time for vital bus inverters associated with 120-volt (V) alternating current (ac) instrument buses 1E and 1F, provide any compensatory measures that would be taken before and during the time the instrument bus inverter is removed for an extended outage. For any compensatory measure, identify how those actions will be documented and controlled at Seabrook.

FPLE Response:

No compensatory measures will be taken prior to removing these inverters from service because they have no impact on risk. This would, by definition, put such maintenance in the "normal work controls" area of 10CFR50.65(a)(4) compliance (See NEI93-01, rev 3, and USNRC R.G. 1.182). Inverters 1-EDE-I-1-E and 1-EDE-I-1-F, however, are not included in the PRA model because their failure does not impact mitigative functions.

The inverters are not modeled because they do not solely support any mitigative functions (e.g. primarily indication or limited automatic operations that have reliable manual backup from the main control board) and failure of these inverters does not create an initiating event. Failure of these inverters does not impact containment function or increase the likelihood of a containment bypass event. These inverters do not supply power to the reactor protection system (RPS). Seabrook Station operating experience demonstrates that failure of these inverters does not perturb the plant.

Upon inverter failure, there is an automatic transfer to a maintenance power supply. This maintenance supply is diesel backed, so inverter failure only represents a marginal loss of redundant supply (i.e. DC power input) to the associated loads, but does not fail any equipment. The maintenance supplies (i.e. 1-EDE-MCC-531, 1-EDE-MCC-631) for both of the subject inverters are included in the PRA model.

RAI 2.

When an inverter is taken out of service, and upon a loss-of-offsite power (LOOP) or LOOP/loss-of-coolant-accident (LOCA) event, the 120-V ac instrument bus that is being powered by its maintenance power supply will lose its power for ten seconds until the associated emergency diesel generator (EDG) re-energizes the bus.

a. Provide an evaluation of the effects of a short-term loss of power to the 120-V ac instrument panels (EDE-PP1F, EDE-PP-11F, EDE-PP1E, and EDE-PP-11F) in terms of inadvertent equipment operation and required contingency operator actions. Also, provide an evaluation of the effects of a short-term loss of power caused by a LOOP or LOOP/LOCA and a subsequent restoration of power to the motor control centers by the EDG.

b. Provide the plant procedure references for these contingency actions.

FPLE Response:

The instrument buses (EDE-PP1F, EDE-PP-11F, EDE-PP1E, and EDE-PP-11F) are normally energized from their respective inverters, EDE-I-1E and 1-EDE-I-1F, and the buses remain energized during a loss of offsite power (LOOP). If an inverter is removed from service, the associated instrument buses are energized from a maintenance source, which is an EDG-backed motor control center (MCC). The change proposed in LAR 05-11 allows an inverter to remain out of service for up to seven days while its associated instrument buses are energized from the maintenance source. If a LOOP occurred while an inverter was out of service, the instrument buses aligned to the maintenance source would de-energize for approximately ten seconds until the EDG re-energized the MCC that powers the maintenance source.

The evaluation of a LOOP performed for this RAI considered a complete loss of offsite power to the safety-related and non-safety-related electrical buses. With the exception of the inverter that is assumed out-of-service, all other equipment was assumed to be in service and operating as designed. The evaluation also considered a loss-of-coolant accident (LOCA) coincident with the LOOP. The LOOP was used throughout the evaluation to include both LOOP and LOOP/LOCA unless otherwise noted. The effect of the loss of power was evaluated for plant Modes 1-4, which are the applicable modes for Technical Specification (TS) 3.8.3.1, "Onsite Power Distribution."

The design basis time for the emergency diesel generators (EDG) to energize the emergency buses after a LOOP is 12 seconds, 2 seconds for detection and 10 seconds for EDG start. LAR 05-11 indicated that the instrument buses would be de-energized for approximately 10 seconds until the EDG starts and re-energizes the instrument panels. The 10-second time represents actual response data versus a design basis value. The 10-second value was used in the above RAI so it was used throughout this evaluation. The specific time (10 or 12 seconds) has no significant effect on the evaluation results.

Contingency operator actions are considered specific operator actions required to cope with the LOOP because of the abnormal electrical lineup with the instrument bus on its maintenance supply. Contingency operator actions do not include actions already directed in existing operating procedures.

Instrument Buses

Table 1, Effects of Loss of Power to AC Instrument Buses (attached), provides a listing of the instrument bus circuits and the effects of a short-term loss of power in terms of inadvertent equipment operation and required contingency operator actions. Non-safety related instrument bus ED-PP-12E was also included since it is supplied from EDE-PP-1E. The tables for EDE-PP-1E, EDE-PP-11E and EDE-PP-12E apply to these panels while they are energized from their maintenance source (EDE-I-1E out-of-service) and the redundant train inverter, EDE-I-1F, is in service. Similarly, the tables for EDE-PP-1F and EDE-PP-11F apply with these panels on their maintenance source (EDE-I-1F out-of-service) and EDE-I-1E in service.

Indication and alarm circuits are not individually listed where the indication and alarm circuits are restored to pre-LOOP conditions with no required contingency operator actions. The evaluation assumed that the operators would not take incorrect actions based on the disabled indications within the ten seconds that it takes the EDG to restore power.

Motor Control Centers

The EDG loading sequence is designed to automatically start all MCC loads required to initially cope with a LOOP. No contingency operator actions are required for MCC loads as a result of the abnormal electrical lineup with the instrument buses on their MCC maintenance supply. Existing operating procedures direct the operators to manually start any additional MCC loads required for long term coping with the LOOP and to safely shutdown the plant.

Conclusion

FPL Energy Seabrook evaluated the effects of a short-term power loss to inverter EDE-I-1E and EDE-I-1F instrument buses and the EDG-backed MCCs in the event that the instrument buses were being supplied by their respective maintenance supplies during a loss of offsite power. The effect of this short-term power loss was evaluated in terms of inadvertent equipment operation and required contingency operator actions. The evaluation concluded that no contingency operator actions are required to respond to inadvertent equipment operation resulting from the short-term power loss. Seabrook's response to the LOOP and LOOP/LOCA would be a combination of automatic equipment operation and operator actions already directed in existing operating procedures.

RAI 3.

As stated in Regulatory Guide 1.17, "An Approach for Plant-Specific, Risk-Informed Decision Making Technical Specification," a TS change may be requested to reduce unnecessary burdens in complying with current TS requirements, based on the operating history or the plant or the industry in general. Provide maintenance (e.g., time to repair and test) and operating (e.g., maintenance power supply and inverter failure rates) data to support the extended outage time.

FPLE Response:

Based on a review of work history, the Elgar UPSs have lost output at Seabrook Station a total of 6 times since the plant has been in operation. EDE-I-1-F lost output on 11/29/05, and the last UPS output failure for EDE-I-1-E occurred on 7/18/00.

The amount of time to repair a failure of one of the two Elgar Uninterruptible Power Supplies (UPSs), Model UPS 253-109, is estimated based on either of two failure scenarios: (1) an intermittent connection/connector problem, or (2) a circuit board failure.

Failure Scenario 1

Based on industry operating experience, the failure mode could be an intermittent connection/connector problem. Assuming this connector could be located on the backplane, as was the case at Nine Mile 2 (Ref OE21560), the following steps would be necessary to affect the repair.

First, initial troubleshooting would need to inspect the UPS for obvious signs of damage. In this case, no damage would be visible so any blown fuses would be replaced and the UPS restarted to determine if the problem recurs. For the purposes of this estimate, it is assumed the problem did repeat. The second step would be to develop a troubleshooting plan that would direct a sequence of control card substitutions with available spares from inventory (it is assumed that spare parts are available on site in sufficient quantity to allow this process to be implemented). Between each card substitution, the equipment danger tagging process would need to be followed. For this example, it is reasonable to assume there could be as many as seven circuit boards that would need to be replaced one at a time. After starting and stopping the UPS for all potential causes for the seven circuit boards the problem would not be resolved. This would result in a need to revise the troubleshooting plan. Assuming industry experience was reviewed, the revised plan would include heating and agitating the critical circuit connections. Once the affected connection was discovered, the direction to repair the connection would be developed. Removal of the backplane would require a considerable portion of the UPS to be disassembled. Once removed, the backplane repair could be implemented by replacement of the bad connector. Reinstallation and assembly of the UPS would then follow. Finally, the appropriate retest for all the disturbed components would need to be performed. Based on conversations with industry peers and qualified electrical maintenance department personnel, the total duration of this repair effort would be approximately 5 to 6 days around the clock.

Failure Scenario 2

The industry experience with Elgar UPSs also indicates the potential for a circuit board to fail due to a discreet electronic component failure (Ref OE19830). In this example, we assumed that the failure occurred on the analog logic circuit board. Further, we assumed the circuit board could not be repaired and required replacement. This particular circuit card has many setpoints that require setting and functional testing with a load bank to verify they are set correctly. Based on discussions with qualified personnel, the estimated time to perform the repair, setpoint calibration, and retest is four days, working continuously around the clock.

Routine Maintenance

The time required to perform routine preventative maintenance (PM) is based on the total time required to complete the individual PM activities listed below. The estimated times are based on historical performance and consultation with the responsible maintenance department supervisor and a qualified electrician. The total time to perform these activities is based on the need to perform each activity in series.

Activity	Duration
1-EDE-I-1-E(F)-E731-0000, "Capacitor Replacement"	36 hours
1-EDE-I-1-E(F)–E730-0000, "UPS Inspection"	12 hours
1-EDE-I-1-E(F)-E730-5613, "UPS Setpoint Verification"	24 hours
Total Time:	72 hours

Table 1

Effects of Loss of Power to AC Instrument Buses

EDE-PP-1E	
Loss of Power Effect	**Systems Effect and Contingency Actions**
1. Lose the capability for the Train A level instruments on the Train A & the Train B primary component cooling water (PCCW) head tanks to initiate a low-low level signal to isolate the respective PCCW loops to containment. (circuit 1; MM-CP-152A)	No contingency action required. The Train B level instruments on the Train A & the Train B PCCW head tanks are still available to provide a low-low level signal to isolate the respective PCCW loops to containment. However, on power restoration by the EDG, the Train A level instruments may inadvertently initiate Train A & the Train B head tank low-low level signal causing isolation of Loops A & B PCCW to containment. The following equipment is effected. Lose PCCW to motor coolers for RCPs: The reactor coolant pumps (RCP) lose power on LOOP so loss of PCCW to RCP motor coolers not a concern. Lose PCCW to CAH fans: For a LOOP, the non-safety related containment structure cooling fans (CAH-FN) will restart at the appropriate emergency power sequencer (EPS) step after the EDG restores power. However, the CAH-FN will then trip from the lack of PCCW cooling flow. These non-safety related cooling fans are not required to cope with a LOOP. For a LOOP/LOCA, the CAH-FN are blocked from starting by the safety injection (SI) signal. Lose PCCW to containment air compressors: The non-safety related containment air compressors may trip on high temperature. However, these non-safety related compressors are not required to cope with a LOOP. Lose PCCW to reactor coolant drain tank (RCDT), pressurizer relief tank (PRT) and excess letdown heat exchangers: The RCDT, PRT and excess letdown heat exchanger are not required to cope with a LOOP. The operators would follow the applicable operating procedures to reopen the isolation valves and restart effected equipment as part of long-term plant restoration.
2. Lose the capability to automatically isolate PCCW Loop A to the waste process building on a Loop A PCCW head tank low level signal. (circuit 1; MM-CP-152A)	No contingency action required. Power restoration by the EDG may inadvertently initiate a PCCW Loop A head tank low level signal causing isolation of PCCW Loop A to the waste process building (WPB). Loads supplied by the WPB PCCW loop are not required to cope with a LOOP. The operators would follow the applicable operating procedures to reopen the isolation valves and restart effected equipment as part of long-term plant restoration.

EDE-PP-1E	
Loss of Power Effect	**Systems Effect and Contingency Actions**
3. Lose the capability to automatically isolate PCCW Loop A radiation monitor on a PCCW Loop A head tank low level signal. (circuit 1; MM-CP-152A)	No contingency action required. Power restoration by the EDG may inadvertently initiate a PCCW Loop A head tank low level signal causing isolation of PCCW Loop A radiation monitor. Radiation monitor not required to cope with a LOOP. The operators would follow the applicable operating procedures to reopen the isolation valves and restart effected equipment as part of long-term plant restoration.
4. Lose capability to automatically actuate the Train A service water cooling tower. (circuits 1; MM-CP-152A, &10)	No contingency action required. LOOP removes power from equipment actuated by a tower actuation signal. On power restoration, the Train A service water cooling tower actuation circuit is restored and the actuated equipment will operate when power is restored at the appropriate emergency sequencer step.
5. Lose automatic and manual temperature control for PCCW Loop A and the control valves go to the full cooling position. (circuits 2; MM-CP-108A, & 19; MM-CP-297A)	No contingency action required. On power restoration, the temperature control loop comes back on in the manual control mode, which results in the valves remaining in the full cooling position. Based on the evaluation included in Attachment 1, the equipment supplied by PCCW (i.e., equipment not isolated as described in Items 1, 2 & 3) will not be degraded by the cooler water and will be able to perform their required safety related functions to cope with the LOOP. The operators would follow the applicable operating procedures to restore temperature control as part of long-term plant restoration. In addition, the Train B PCCW system is still available to supply Train B safety related equipment required to cope with a LOOP.
6. Lose capability to modulate (auto position control) Loops 1 & 3 atmospheric steam dump valves (ASDV) from the local control panel. (circuit 2; MM-CP-108A)	No contingency action required. Normal control location is the main control room (remote) so normal control function is not affected. On power restoration, local position control is restored.
7. Lose capability to trip battery chargers EDE-BC-1A and EDE-BC-1C for an undervoltage on their respective dc bus (indicative of a bus fault). (circuits 5 & 6)	No contingency action required. On power restoration, the battery charger trip circuits are restored. A dc bus fault coincident with a LOOP need not be considered.
8. Lose capability to trip non-safety related inverter ED-I-2A dc supply breaker within 15 minutes when ED-I-2A is drawing current from safety related switchgear EDE-SWG-11C. (circuit 6)	No contingency action required. For a LOOP, ED-I-2A would draw current from EDE-SWG-11C for about 2 minutes until ac power is restored to ED-I-2A by the EDG. The 15-minute trip criteria would not be challenged. On power restoration, the trip circuit is restored.
9. Lose position control capability for letdown control valve CS-HCV-189 resulting in a valve close signal. (circuit 7; MM-UQ-771A)	No contingency action required. LOOP also removes power from the MOV so valve can not change position. On power restoration, position control capability is restored and CS-HCV-189 remains in previously selected position.
10. Lose position control capability for Train A RHR heat exchanger outlet flow control valve RH-HCV-606 resulting in a valve open signal. (circuit 7; MM-UQ-773A)	No contingency action required. RH-HCV-606 is maintained in the full open position to support the ECCS function during 100% power operation. On power restoration, RH-HCV-606 position control capability is restored.

EDE-PP-1E	
Loss of Power Effect	**Systems Effect and Contingency Actions**
11. Lose position control for boron thermal regeneration (BTR) diversion valve CS-HCV-387 resulting in a valve open signal. Valve goes full open resulting in full flow through the BTR demineralizers and either full boration or full dilution depending on the current mode of operation. (circuit 7; MM-UQ-771A)	No contingency action required. Plant trips on LOOP. BTR not required to cope with LOOP.
12. Lose position control for residual heat removal (RHR) pumps to letdown heat exchanger CS-E-4 isolation valve CS-HCV-128 resulting in a valve close signal. Valve is closed in Modes 1-3. (circuit 7; MM-UQ-771A)	No contingency action required. On power restoration, position control is restored and CS-HCV-128 is restored to its previously selected position. If RHR purification flow to heat exchanger was being provided pre-LOOP, the valve would be closed for less than 10 seconds until the EDG restored power so there would be negligible effect on RHR purification.
13. Lose position control for charging pump to regen heat exchanger CS-E-2 isolation valve CS-HCV-182 resulting in a valve open signal. Valve is normally throttled to control RCP seal injection flow. (circuit 7; MM-UQ-771A)	No contingency action required. On power restoration, position control is restored and CS-HCV-182 is restored to its previously selected position. During the 10 seconds that the valve is full open, the charging pumps are not running (LOOP) so there would be negligible effect on RCP seal cooling.
14. Lose the non-safety related ATWS Mitigation System (AMS) signal to both the motor and turbine driven EFW pumps (FW-P-37A & 37B). (circuit 15; MM-CP-470)	No contingency action required. Both EFW pumps will start directly from the LOOP. On power restoration, the AMS start signals are restored.
15. Lose the capability to start, or maintain running, the Train B boric acid transfer pump on a non-safety related makeup water permissive. (circuit 15; MM-CP-470)	No contingency action required. LOOP also stops the Train B boric acid transfer pump. The non-safety related pump start signal is not required to cope with the LOOP. After pump power is restored, it can be manually started by the operators to support boration for plant shutdown as directed by existing operating procedures.
16. Lose the capability to automatically operate the circuit breaker for the backup group B pressurizer heaters on various non-safety related pressurizer level and pressure signals. Circuit breaker is normally open. (circuit 15; MM-CP-470)	No contingency action required. LOOP trips the pressurizer heater circuit breaker and blocks the auto operation signals until offsite power is restored. On power restoration by the EDG, the emergency power sequencer only permits manual breaker closure (i.e., no auto sequence step) as directed by existing operating procedures.
17. Lose the capability to open the Train B pressurizer power operated relief valve (PORV) block valve on various non-safety related pressurizer temperature and pressure signals. Valve is normally open. (circuit 15; MM-CP-470)	No contingency action required. LOOP also removes power from the MOV so valve could not open even if open signal was present. On power restoration, the Train B block valve open signals are restored and block valve would open (if closed) when its power is restored if an open signal was present.
18. Lose the capability to open the Train B pressurizer power operated relief valve (PORV) on various non-safety related pressurizer temperature and pressure signals. Valve is normally closed. (circuit 15; MM-CP-470)	No contingency action required. On power restoration, the Train B PORV open signals are restored. Assuming pressurizer temperature and pressure are normal pre-LOOP, temperature and pressure will not reach the applicable setpoints as a result of the LOOP. Also, these open signals are non-safety related. Pressurizer safety valves are relied upon for safety related pressure control.

EDE-PP-1E	
Loss of Power Effect	**Systems Effect and Contingency Actions**
19. Lose the Train A thermal barrier circulating water pump auto start signal on low thermal barrier flow. (circuit 19; MM-CP-297A)	No contingency action required. LOOP also removes power from the thermal barrier circulating water pump so the pump can not run even if an auto start signal is present. On power restoration, the low thermal barrier flow auto start signal capability is restored and the thermal barrier circulating water pump will start when its power is restored at the appropriate emergency power sequencer step.
20. Lose the capability to provide a close signal to the charging pump mini-flow isolation valve on hi pump flow and SI. (circuit 19; MM-CP-297A)	No contingency action required. LOOP also removes power from the changing pump and from the MOV so valve could not close even if close signal was present. On power restoration, the valve close signal capability is restored and charging pump mini-flow isolation valve would close when its power is restored if a hi pump flow or SI signal was present.
21. Lose the capability to provide a close signal to the emergency feedwater valves on high flow. (circuit 19; MM-CP-297A)	No contingency action required. LOOP also removes power from the MOVs so valves could not close even if close signal was present. On power restoration, the valve close signal capability is restored and the emergency feedwater valves would close if a high flow signal is present.
22. Lose the capability to trip the PCCW pumps on high PCCW header temperature. (circuit 19; MM-CP-297A)	No contingency action required. PCCW pumps are tripped (load shed) on LOOP and the auxiliary relay that provides the high temperature trip signal also loses power (MCC control power). On power restoration, high temperature trip capability is restored. The PCCW pumps will restart at the appropriate emergency power sequencer (EPS) step after the EDG restores power. Assuming PCCW temperature was normal pre-LOOP, a high temperature condition will not occur during the 10 seconds that the trip circuit is disabled because the heat exchanger valves go to full cooling (see Item 5 above).

EDE-PP-11E	
Loss of Power Effect	**Systems Effect and Contingency Actions**
1. Isolate the control building makeup air supply from loss of RM-RM-6506A and 6507A. (circuits 1 & 2)	No contingency action required. Main control room emergency clean-up filter system will start, and recirc and filter control room air. The filter/recirc mode is initiated on a LOOP even if the RMs are available. RM function restored on power restoration. Operators would then restore normal ventilation lineup as directed by existing operating procedures.
2. Lose the capability to manually or automatically start the EDG-1A room ventilation fans. The return air damper opens. (circuit 6)	No contingency action required. On power restoration, EDG-1A room ventilation fans are restored to service. Fans will automatically start in response to the LOOP/EDG start.
3. Lose capability for Train A control of the four MSIVs. (circuits 7 & 9)	No contingency action required. Train B control of the four MSIVs is still available. On power restoration, Train A MSIV control is restored.
4. RM-RM-6527A is disabled. Train A containment ventilation isolation (CVI) is generated. Containment on-line purge system isolates and loses ability to control containment pressure. Also, lose the containment pre-entry and refueling purge systems. (circuit 10)	No contingency action required. CVI signal closes COP-V-1 & 4/CAP-V-1 & 4, if open. Containment on-line purge, pre-entry, and refueling purge systems are not required to cope with LOOP. RM function restored on power restoration.
5. Lose the capability for the Train A high energy line break (HELB) isolation control system to close PAB auxiliary steam isolation valve AS-V-175, letdown isolation valve CS-V-149, and steam blow down isolation valves SB-V-1, 3, 5 & 7. (circuit 17; MM-CP-486A)	No contingency action required. Train B HELB provides redundant isolation capability. On power restoration, Train A HELB isolation capability is restored. The 10 second delay in initiation of the Train A HELB isolation signal is acceptable since the isolation function uses at least two MOVs (AS-V-175 and CS-V-149) that would not have power to operate until the EDG restores bus power.

ED-PP-12E	
Loss of Power Effect	**Systems Effect and Contingency Actions**
1. Lose capability to provide a permissive to automatically operate the non-safety related pressurizer relief tank recirc pump (RC-P-271) based on pressurizer relief tank temperature. (circuit 10; MM-CP-6)	No contingency action required. The motor control center for the pressurizer relief tank recirc pump is not EDG backed so there would be no power to operate the pump.
2. Lose seal pressure start permissive for non-safety related reactor coolant pump RC-P-1B. (circuit 10; MM-CP-6)	No contingency action required. RCPs stop on the LOOP.
3. Lose capability for the non-safety related pressurizer heater backup groups A & B circuit breakers to auto close on high pressurizer level and auto trip on low pressurizer level. (circuit 10; MM-CP-6)	No contingency action required. LOOP trips (load sheds) the backup group A & B pressurizer heater circuit breakers. On power restoration by the EDGs, the auto trip capability is restored but the emergency power sequencers only permit manual circuit breaker closure (i.e., no auto sequence step). Operators will manually control the backup group pressurizer heaters to control pressurizer pressure as directed by existing operating procedures.
4. Lose capability for the non-safety related pressurizer heater backup groups C & D circuit breakers to auto close on high pressurizer level, and the control and backup groups C & D to auto trip on low pressurizer level. (circuit 10; MM-CP-6)	No contingency action required. The power supplies for the control and backup groups C & D are non-EDG backed.
5. Lose capability to close letdown isolation valves RC-LCV-459 & RC-LCV-460, and letdown heat exchanger isolation valve CS-V-145 on a non-safety related pressurizer level low signal. (circuit 10; MM-CP-6)	No contingency action required. Closure of these valves is not required to cope with a LOOP. Emergency operating procedures for reactor trip and safety injection manually isolate letdown (close CS-V-145) if these valves do not auto close. In addition, letdown is automatically isolated on a safety injection/containment isolation signal (LOOP/LOCA). On power restoration, the low pressurizer level close signal is restored.
6. Lose auto control rod withdrawal capability. (circuit 10; MM-CP-6)	No contingency action required. The plant will trip on the LOOP so rod withdrawal capability is not required.
7. Lose temperature control for the non-safety related boron thermal regeneration system (BTRS) heat exchangers. (circuit 10; MM-CP-6)	No contingency action required. Plant trips on LOOP. BTRS not required to cope with LOOP.
8. Lose speed control for the non-safety related positive displacement charging pump (PDP). Control goes to maximum speed. (circuit 10; MM-CP-6)	No contingency action required. The PDP does not have a EDG backed power source.
9. Lose non-safety related position control for charging system flow control valve (CS-FCV-121); valve goes full open. (circuit 10; MM-CP-6)	No contingency action required. Position control not required to cope with LOOP or LOOP/LOCA. LOOP/LOCA analysis assumes this valve fails open. On power restoration, position control capability is restored. Valve is normally about full open so there is minimal effect of loss of position control. Also, during the time that the valve is full open, the charging pumps have no power so there is negligible effect on RCS inventory and pressurizer level.

ED-PP-12E	
Loss of Power Effect	**Systems Effect and Contingency Actions**
10. Lose capability to open the Train B pressurizer power operated relief valve (PORV: RC-PCV-456B) on a non-safety related high pressurizer pressure signal. (circuit 10; MM-CP-6)	No contingency action required. On power restoration, high pressurizer pressure PORV open capability is restored. Assuming pressurizer pressure is normal pre-LOOP, pressure will not reach the applicable setpoint as a result of the LOOP. Also, this open signal is non-safety related. Pressurizer safety valves are relied upon for safety related pressure control.
11. Steam generator level control is degraded resulting in a potential reactor trip on steam generator low level. (circuit 10; MM-CP-6)	No contingency action required. Plant trips on the LOOP. The emergency feedwater (EFW) pumps are automatically started and the operators manually control steam generator level as directed by existing operating procedures.
12. Lose the capability to divert volume control tank (VCT) makeup flow on high VCT level. Also, causes a one out of two channel trip for transfer from the VCT to the reactor water storage tank (RWST) on VCT low level. (circuit 11; MM-CP-8)	No contingency action required. Assuming normal VCT level (programmed for 50%) pre-LOOP, high level diversion would not be required during the 10 seconds until the EDG restores power. For LOOP and LOOP/LOCA, the low VCT tank level transfer from the VCT to the RWST will still operate. Also, for a LOOP/LOCA, the automatic transfer of charging pump suction from the VCT to the RWST by the safety injection signal will still operate. On power restoration, the high-level diversion capability is restored and the low-level channel resets.
13. Lose seal pressure start permissive for non-safety related reactor coolant pump RC-P-1D. (circuit 11; MM-CP-8)	No contingency action required. RCPs stop on LOOP.
14. Steam generator level control is degraded resulting in a potential reactor trip on steam generator low level. (circuit 11; MM-CP-8)	No contingency action required. Plant trips on the LOOP. The emergency feedwater (EFW) pumps are automatically started and the operators manually control steam generator level as directed by existing operating procedures.
15. Lose capability to open the Train B pressurizer power operated relief valve (PORV: RC-PCV-456B) and the PORV block valve (RC-V-124) on a non-safety related high pressurizer pressure signal. (circuit 11; MM-CP-8)	No contingency action required. On power restoration, high pressurizer pressure PORV and block valve open capability is restored. Assuming pressurizer pressure is normal pre-LOOP, pressure will not reach the applicable setpoint as a result of the LOOP. Also, this open signal is non-safety related. Pressurizer safety valves are relied upon for safety related pressure control.
16. Lose capability to open the Train B pressurizer power operated relief valve (PORV: RC-PCV-456B) for low temperature over pressure protection (LTOP). (circuit 11; MM-CP-8)	No contingency action required. On power restoration, the PORV LTOP open capability is restored. LTOP protection not required at 100% power.
17. Lose a temperature control signal which is part of the Train A pressurizer power operated relief valve (PORV: RC-PCV-456A) and PORV block valve (RC-V-122) low temperature over pressure protection (LTOP). (circuit 11; MM-CP-8)	No contingency action required. Loss of the temperature control signal provides an arming signal to the Train A PORV; the PORV does not open because the actual LTOP signal is provided from a different control panel that still has an inverter supply. Loss of the temperature control signal also provides an open demand to the already open PORV block valve. On power restoration, the temperature control signal is restored. LTOP protection not required at 100% power.

ED-PP-12E	
Loss of Power Effect	**Systems Effect and Contingency Actions**
18. Lose capability to control the condenser steam dump valves in the pressure mode. (circuit 11; MM-CP-8)	No contingency action required. Condenser steam dump valves are normally controlled in the T_{AVE} mode at 100% power. The pressure mode is normally in manual. On power restoration, the pressure control system comes back in the manual mode, which is its normal mode.
19. Lose capability to control letdown flow pressure; pressure control valve (CS-PCV-131) fails open. (circuit 11; MM-CP-8)	No contingency action required. Letdown flow is isolated for LOOP and LOOP/LOCA (see item 5 above) so pressure control is not needed.
20. Lose capability to control letdown flow temperature; temperature control valve CS-TV-130 fails closed. (circuit 11; MM-CP-8)	No contingency action required. Letdown flow is isolated for LOOP and LOOP/LOCA (see item 5 above) so temperature control is not needed.
21. Lose position control capability for Train B RHR heat exchanger bypass valve RH-FCV-619 resulting in a valve close signal. (circuit 11; MM-CP-8)	No contingency action required. RH-FCV-619 is maintained in the full closed position to support the ECCS function during 100% power operation. On power restoration, RH-FCV-619 position control capability is restored.
22. Lose average T_{AVE} temperature input to the pressurizer level control system which would cause flow control valve CS-FCV-121 to modulate closed; however, valve control circuit is lost per item 9 above so valve goes open. (circuit 11; MM-CP-8)	No contingency action required. Position control not required to cope with LOOP or LOOP/LOCA. LOOP/LOCA analysis assumes this valve fails open.
23. Lose capability to automatically open the condenser steam dump valves on non-safety related control signal. (circuit 11; MM-CP-8)	No contingency action required. Operation of the condenser steam dump valves is not required to cope with a LOOP. The main steam safety valves can automatically open, or the ASDVs can be manually opened by the operators as directed by existing procedures, to control steam generator pressure. On power restoration, the condenser steam dump control system is restored.
24. Lose capability to load the main turbine. (circuit 11; MM-CP-8)	No contingency action required. The turbine will trip on LOOP so turbine loading is not required.
25. Lose auto and manual control rod withdrawal capability. (circuit 11; MM-CP-8)	No contingency action required. The plant will trip on the LOOP so rod withdrawal capability is not required.

EDE-PP-1F	
Loss of Power Effect	**Systems Effect and Contingency Actions**
1. Lose the capability for the Train B level instruments on the Train A & the Train B PCCW head tanks to initiate a low-low level signal to isolate the respective PCCW loops to containment. (circuit 1; MM-CP-152B)	No contingency action required. The Train A level instruments on the Train A & the Train B PCCW head tanks are still available to provide a low-low level signal to isolate the respective PCCW loops to containment. However, on power restoration by the EDG, the Train B level instruments may inadvertently initiate Train A & the Train B head tank low-low level signal causing isolation of Loops A & B PCCW to containment. The following equipment is effected. Lose PCCW to motor coolers for RCPs: The reactor coolant pumps (RCP) lose power in LOOP so loss of PCCW to RCP motor coolers not a concern. Lose PCCW to CAH fans: The CAH-FN are tripped (load shed) on LOOP. For a LOOP, the non-safety related containment structure cooling fans (CAH-FN) will restart at the appropriate emergency power sequencer (EPS) step after the EDG restores power. However, the CAH-FN will then trip from the lack of PCCW cooling flow. These non-safety related cooling fans are not required to cope with a LOOP. For a LOOP/LOCA, the CAH-FN are blocked from starting by the safety injection (SI) signal. Lose PCCW to containment air compressors: The non-safety related containment air compressors may trip on high temperature. However, these non-safety-related compressors are not required to cope with a LOOP. Lose PCCW to the reactor coolant drain tank (RCDT), pressurizer relief tank (PRT) and excess letdown heat exchangers: The RCDT, PRT and excess letdown heat exchangers are not required to cope with a LOOP. The operators would follow the applicable operating procedures to reopen the isolation valves and restart effected equipment as part of long-term plant restoration.
2. Lose the capability to automatically isolate PCCW Loop B to the waste process building on a PCCW Loop B head tank low level signal. (circuit 1; MM-CP-152B)	No contingency action required. Power restoration by the EDG may inadvertently initiate a PCCW Loop B head tank low level signal causing isolation of PCCW Loop B to the waste process building (WPB). Loads supplied by the WPB PCCW loop are not required to cope with LOOP. The operators would follow the applicable operating procedures to reopen the isolation valves and restart effected equipment as part of long-term plant restoration.
3. Lose the capability to automatically isolate PCCW Loop B radiation monitor on a PCCW Loop B head tank low level signal. (circuit 1; MM-CP-152B)	No contingency action required. Power restoration by the EDG may inadvertently initiate a PCCW Loop B head tank low level signal causing isolation of PCCW Loop B radiation monitor. Radiation monitor not required to cope with LOOP. The operators would follow the applicable operating procedures to reopen the isolation valves and restart effected equipment as part of long-term plant restoration.

EDE-PP-1F	
Loss of Power Effect	**Systems Effect and Contingency Actions**
4. Lose automatic and manual temperature control for PCCW Loop B and the control valves go to the full cooling position. (circuits 1; MM-CP-152B, & 2; MM-CP-103B)	No contingency action required. On power restoration, the temperature control loop comes back on in the manual control mode, which results in the valves remaining in the full cooling position. Based on the evaluation included in Attachment 1, the equipment supplied by PCCW (i.e., equipment not isolated as described in Items 1, 2 & 3) will not be degraded by the cooler water and will be able to perform their required safety related functions to cope with the LOOP. The operators would follow the applicable operating procedures to restore temperature control as part of long-term plant restoration. In addition, the Train A PCCW system is still available to supply Train A safety related equipment required to cope with a LOOP.
5. Lose capability to automatically actuate the Train B service water cooling tower. (circuits 1; MM-CP-152B, &10)	No contingency action required. LOOP removes power from equipment actuated by a tower actuation signal. Train B service water cooling tower actuation circuit restored on EDG power restoration and the actuated equipment will operate when power is restored at the appropriate emergency sequencer step.
6. Lose capability to modulate feedwater bypass valves FW-LV-4210 and FW-LV-4240; valves will go closed. (circuit 1; MM-CP-152B)	No contingency action required. The plant will trip on LOOP. Feedwater bypass valves are normally closed above 15-20% power. The valves closing at power levels <15-20% power is not a concern because the emergency feedwater (EFW) system will start on the LOOP to supply feedwater to the steam generators. On power restoration, the control loops will come back up in manual control with the valves closed. The valves are not required to cope with a LOOP.
7. Lose the capability to trip the PCCW pumps on high PCCW header temperature. (circuits 1; MM-CP-152B)	No contingency action required. PCCW pumps are tripped (load shed) on LOOP and the auxiliary relay that provides the high temperature trip signal also loses power (MCC control power). On power restoration, high temperature trip capability is restored. The PCCW pumps will restart at the appropriate emergency power sequencer (EPS) step after the EDG restores power. Assuming PCCW temperature was normal pre-LOOP, a high temperature trip condition will not occur during the 10 seconds that the trip circuit is disabled because the heat exchanger valves go to full cooling (see Item 4 above).
8. Lose capability to modulate (auto position control) of Loops 2 & 4 atmospheric steam dump valves (ASDV) from the main control room and from the local control panel. (circuits 1; MM-CP-152B, & 2; MM-CP-103B)	No contingency action required. ASDVs are normally closed at 100% power. On power restoration, the control loops will come back up in manual control with the ASDVs closed. If the operators need to manually open the ASDVs to cope with the LOOP, they will use the safety related jog controls as directed by existing operating procedures. The transmitters that input to the automatic modulation instrumentation loop are non-safety related. The operators can switch back to automatic control as part of the long-term restoration actions.
9. Lose capability to trip battery chargers EDE-BC-1B and EDE-BC-1D for an undervoltage on their respective dc bus (indicative of a bus fault). (circuits 5 & 6)	No contingency action required. On power restoration, the battery charger trip circuits are restored. A dc bus fault coincident with a LOOP need not be considered.

EDE-PP-1F	
Loss of Power Effect	**Systems Effect and Contingency Actions**
10. Lose position control capability for letdown control valve CS-HCV-190 resulting in a valve close signal. (circuit 7; MM-UQ-772A)	No contingency action required. LOOP also removes power from the MOV so valve can not change position. On power restoration, position control is restored and CS-HCV-190 remains in previously selected position.
11. Lose position control for excess letdown heat exchanger outlet flow control valve CS-HCV-123 resulting in a valve close signal. Valve is normally closed. (circuit 7; MM-UQ-772A)	No contingency action required. On power restoration, flow control is restored and CS-HCV-123 is restored to its previously selected position. For normal system operation, excess letdown is not used and it is not required to cope with a LOOP.
12. Lose position control capability for Train B RHR heat exchanger outlet flow control valve RH-HCV-607 resulting in a valve open signal. (circuit 7; MM-UQ-774A)	No contingency action required. RH-HCV-607 is maintained in the full open position to support the ECCS function during 100% power operation. On power restoration, RH-HCV-607 position control capability is restored.
13. Lose capability to trip the turbine generator on Train B steam generator high-high level/safety injection or reactor trip signal. (circuit 15; MM-CP-470)	No contingency action required. Train A steam generator high-high level/safety injection and reactor trip signals still available to the turbine generator backup trip circuit. Trip signals restored on EDG power restoration.
14. Lose capability to trip the steam generator feed pump FW-P-32B turbine on steam generator high-high level, safety injection or low Tavg with reactor trip which constitutes a feedwater isolation signal. (circuit 15; MM-CP-470)	No contingency action required. Trip not required to cope with LOOP. These trips minimize feedwater system transients caused by a feedwater system isolation after a plant trip. The low Tavg setpoint for the low Tavg with reactor trip feed pump trip signal was decreased as part of a design change to minimize feedwater system transients caused by a feedwater system isolation after a plant trip. Feed reg valve and feedwater isolation valve timing changes are still in place to minimize feedwater system transients. Trip signals restored on EDG power restoration.
15. Lose capability to limit speed of both feed pumps to 4400 RPM on reactor trip signal, steam generator high-high level or safety injection. (circuit 15; MM-CP-470)	No contingency action required. This speed reduction is not required to cope with LOOP. This speed reduction signal was installed as part of a design change to minimize feedwater system transients caused by a feedwater system isolation after a plant trip. Feed reg valve and feedwater isolation valve timing changes are still in place to minimize feedwater system transients. Speed control restored on EDG power restoration.
16. Lose the capability to trip the control room exhaust fan on a Train B make-up air filter recirc signal. (circuit 15; MM-CP-470)	No contingency action required. The control room exhaust fan will actually stop operating on the LOOP so the make-up air filter recirc signal trip is not needed. Fan has a non-EDG backed power supply.
17. Lose the non-safety related ATWS Mitigation System (AMS) signal to the Train A start circuit for the turbine driven EFW pump (FW-P-37A). (circuit 15; MM-CP-470)	No contingency action required. Both EFW pumps will start directly from the LOOP. On power restoration, AMS start signal is restored.
18. Lose the capability to block manual rod withdrawal on intermediate range high flux level. (circuit 15; MM-CP-470)	No contingency action is required. The plant will trip on the LOOP so rod withdrawal capability is not required.

EDE-PP-1F	
Loss of Power Effect	**Systems Effect and Contingency Actions**
19. Lose the Train B thermal barrier circulating water pump auto start signal on low thermal barrier flow. (circuit 19; MM-CP-297B)	No contingency action required. LOOP also removes power from the thermal barrier circulating water pump so the pump can not run even if an auto start signal is present. On power restoration, the low thermal barrier flow auto start signal capability is restored and the thermal barrier circulating water pump will start when its power is restored at the appropriate emergency power sequencer step.
20. Lose the capability to provide a close signal to the charging pump mini-flow isolation valve on hi pump flow and SI. (circuit 19; MM-CP-297B)	No contingency action required. LOOP also removes power from the charging pump and from the MOV so valve could not close even if close signal was present. On power restoration, the valve close signal capability is restored and charging pump mini-flow isolation valve would close when its power is restored if a hi pump flow or SI signal was present.
21. Lose the capability to provide a close signal to the emergency feedwater valves on high flow. (circuit 19; MM-CP-297B)	No contingency action required. LOOP also removes power from the MOVs so valves could not close even if close signal was present. On power restoration, the valve close signal capability is restored and the emergency feedwater valves would close if a high flow signal is present.

EDE-PP-11F	
Loss of Power Effect	**Systems Effect and Contingency Actions**
1. Isolate the control building makeup air supply from loss of RM-RM-6506B and 6507B. (circuits 1 & 2)	No contingency action required. Main control room emergency clean-up filter system will start, and recirc and filter control room air. The filter/recirc mode is initiated on a LOOP even if the RMs are available. RM function restored on power restoration. Operators would then restore normal ventilation lineup as directed by existing operating procedures.
2. Lose the capability to manually or automatically start the EDG-1B room ventilation fans. The return air damper opens. (circuit 6)	No contingency action required. On power restoration, EDG-1B room ventilation fans are restored to service. Fans will automatically start in response to the LOOP/EDG start.
3. Lose capability for the Train B control of the four MSIVs (circuits 7 & 9).	No contingency action required. Train A control of the four MSIVs is still available. On power restoration, Train B MSIV control is restored.
4. RM-RM-6527B is disabled. Train B containment ventilation isolation (CVI) is generated. Containment on-line purge system isolates and loses ability to control containment pressure. Also, lose the containment pre-entry and refueling purge systems. (circuit 10)	No contingency action required. CVI signal closes COP-V-2 & 3/CAP-V-2 & 3 if open. Containment on-line purge, pre-entry, and refueling purge systems are not required to cope with LOOP. RM function restored on power restoration.
5. Lose the capability for the Train B high energy line break (HELB) isolation control system to close PAB auxiliary steam isolation valve AS-V-176, letdown isolation valve CS-V-150, and steam blow down isolation valves SB-V-9, 10, 11 & 12. (circuit 17; MM-CP-485B)	No contingency action required. Train A HELB provides redundant isolation capability. On power restoration, Train B HELB isolation capability is restored. The 10 second delay in initiation of the Train B HELB isolation signal is acceptable since the isolation function uses one MOV (AS-V-176) that would not have power to operate until the EDG restores bus power.

Attachment 1

Primary Component Cooling Water Temperature Transient

The CC system and components cooled thereby have been reviewed for the affect of a temperature excursion resulting from the heat exchanger bypass valve (1-CC-TV-2171-2) failing closed and the outlet temperature control valve (1-CC-TV-2171-1) failing open. Based upon the system heat load, the resultant temperature is estimated to be approximately 40°F. The review scope was limited to the flow path that exists following the isolations that occur on head tank low and low-low level. The evaluations in the above tables for EDE-PP-1E, Item 1, and EDE-PP-1F, Item 1, indicate that these isolations may or may not occur directly as a result of the short-term power loss. If these isolations do not occur, then the worst case effect on the non-safety-related components supplied by that portion of the PCCW system would be a leak. The leak would eventually result in a reduction in head tank level and isolations on low and low-low level assuring adequate PCCW flow to the safety related components analyzed below. Therefore, no further evaluation is required of the components in the isolated loops. Installed instrumentation was assumed not to be affected. Train A was reviewed. Train B is similar but also contains CS-P-128. This pump is qualified to 35°F per NAH-03-100.

The affected components are:

CC-E-17A	CC-P-11A	CC-P-11C	CC-TK-19A	CS-P-2A	EAH-AC-2A
SF-E-15A	SS-E-186	CS-E-4	CS-E-5A	CBS-E-16A	CBS-P-9A
RH-E-9A	RH-P-8A	SI-P-6A	CC-E-153A/B	CC-P-322A/B	
RC-P-1A (thermal barrier heat exchanger)			RC-P-1B (thermal barrier heat exchanger)		
RC-P-1C (thermal barrier heat exchanger)			RC-P-1D (thermal barrier heat exchanger)		

Of these, CS-P-2A, CS-E-4, CS-E-5A, RH-E-9A, RH-P-8A, and SI-P-6A are qualified to 35°F per NAH-03-100. CC-E-17A is specified for 32°F per Specification S-S-1-E-0073. CC-P-11A & 11C, SF-E-15A, and CBS-E-16A are qualified to 40°F as documented either in the specification or foreign print.

CBS-P-9A is designed to pump 40°F fluid (Ref. FP52764). The CC system supplies cooling water to the pump mechanical seal coolers. The decreased temperature will not adversely affect the operation of the pump.

No minimum temperature specification was identified for EAH-AC-2A; the lower CC temperatures are not expected to adversely impact this cooling unit. Calculation 4.4.17.03F, TP Sheet T3 documents a minimum temperature of 34°F for this component.

The thermal barrier cooling loop is affected by this transient. Pumps CC-P-322A and 322B will not experience the minimum temperature seen in the main CC loop since the RCP thermal barrier heat exchangers will continue to be a heat load on the system and the pumps are located upstream of the thermal barrier loop heat exchangers. The specification for these pumps cites a 50°F minimum temperature. Temperatures below this value may result in degradation of the pump, but are not expected to cause an acute affect. Calculation 4.4.17.03F, TP Sheets T52 and T59 document a minimum temperature of 34°F for these components.

No minimum temperature is specified for the thermal barrier loop heat exchangers (CC-E-153-A/B); the cold CC water will be contained on the tube side of the exchanger, temperature drop on the shell side will be mitigated by the RCP heat load. Since the thermal barrier heat exchangers are operated in series, overall thermal barrier temperature will be further mitigated by the warmer CC flow in the unaffected heat exchanger. Calculation 4.4.17.03F, TP Sheets T48 and T49 document a minimum temperature of 34°F for these components.

The RCP thermal barrier heat exchangers are qualified to 35°F per NAH-03-100.

The PCCW head tank, CC-TK-19A, is not in the process flow path and will not experience the full transient. Calculation 4.4.17.03F, TP Sheet T40 documents a minimum temperature of 34°F for this component.

SS-E-186 is in a normally isolated flow path and is not affected.