Commonwealth Edison
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April 17, 1989

Dr. Thomas E. Murley, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Dresden Station Units 2 and 3
Quad Cities Station Units 1 and 2
Zion Station Units 1 and 2
LaSalle County Station Units 1 and 2
Byron Station Units 1 and 2
Braidwood Station Units 1 and 2
Response to Station Blackout Rule
NRC Docket Nos. 50-237/249, 50-254/265, 50-295/304, 50-373/374, 50-454/455, and 50-456/457

Reference: (a) 10 CFR Part 50.63.

Dear Dr. Murley:

Reference (a) requires that each light-water-cooled nuclear power plant be able to withstand and recover from a station blackout (SBO) of a specified duration. Reference (a) also required that each licensee submit; 1) a proposed SBO duration, 2) a description of the procedures that will be implemented for SBO events, and 3) a list and proposed schedule for any equipment modifications and associated procedures necessary for the specified SBO duration.

This letter provides Commonwealth Edison's (Edison's) response to Reference (a). The response for each Edison station is provided in Attachments A through F of this letter.

Please address any questions that you or your staff may have concerning this response to this office.

Respectfully,

Milton H. Richter

M.H. Richter
Nuclear Licensing Administrator

Attachments

5620k
cc: A.B. Davis
Resident Inspectors D/QC/LSC/Z/BY/BW

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Attachment A

Response to Station Blackout Rule

for Braidwood Station

RESPONSE TO STATION BLACKOUT RULE
FOR BRAIDWOOD STATION
USING ALTERNATE AC POWER

On July 21, 1988, the Nuclear Regulatory Commission (NRC) amended its regulations in 10 CFR Part 50. A new section, 50.63, was added which requires that each light-water-cooled nuclear power plant be able to withstand and recover from a station blackout (SBO) of a specified duration. Utilities are expected to have the baseline assumptions, analyses, and related information used in their coping evaluation available for NRC review. The new section also identifies the factors that must be considered in specifying the station blackout duration. Section 50.63 requires that, for the station blackout duration, the plant be capable of maintaining core cooling and appropriate containment integrity. Section 50.63 further requires that each licensee submit the following information:

(1) A proposed station blackout duration including a justification for the selection based on the redundancy and reliability of the on-site emergency ac power sources, the expected frequency of loss of off-site power, and the probable time needed to restore off-site power;

(2) A description of the procedures that will be implemented for station blackout events for the duration (as determined in 1 above) and for recovery therefrom; and

(3) A list and proposed schedule for any needed modifications to equipment and associated procedures necessary for the specified SBO duration.

The NRC has issued Regulatory Guide (RG) 1.155, "Station Blackout," which describes a means acceptable to the NRC Staff for meeting the requirements of 10 CFR 50.63. Regulatory Guide 1.155 states that the NRC Staff has determined that NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," also provides guidance that is in large part identical to the RG 1.155 guidance and is acceptable to the NRC Staff for meeting these requirements.

Table 1 to RG 1.155 provides a cross-reference between RG 1.155 and NUMARC 87-00 and notes where the RG takes precedence.

Commonwealth Edison has evaluated Braidwood Station against the requirements of the SBO rule using guidance from NUMARC 87-00 and RG 1.155. The results of this evaluation are detailed below. (Applicable RG 1.155 table numbers and NUMARC 87-00 sections are shown in parentheses.)

A. Proposed Station Blackout Duration

RG 1.155 Table 2 was used to determine a proposed SBO duration of four hours.

The following station factors were identified in determining the proposed station blackout duration:

(1) The Offsite Power Design Characteristic Group is P1 (RG 1.155 Table 4), based on:

(a) Expected frequency of grid-related loss of off-site power does not exceed once per 20 years (NUREG-1032);

(b) Estimated frequency of loss of off-site power (LOOP) due to extremely severe weather places the station in ESW Group 1 (RG 1.155 Table 8);

(c) The Severe Weather Recovery (SWR) Group is 2 (RG 1.155 Table 7);

(d) Estimated frequency of LOOP due to severe weather places the station in SW Group 2 (RG 1.155 Table 6);

(e) The Independence of Off-Site Power Group is I2 (RG 1.155 Table 5).

(2) The Emergency AC Power Configuration Group is C (RG 1.155 Table 3), based on:

(a) There are two dedicated emergency ac (EAC) power supplies for each unit. These two dedicated EAC power supplies are not credited as Alternate AC (AAC) power sources for that unit. However, these sources are credited as AAC power supplies for the opposite unit. For AAC configuration of Braidwood Station, refer to item A.(4) below.

(b) One emergency ac power supply is necessary to operate safe shutdown equipment following a loss of off-site power for each unit.

(3) The target EDG reliability is 0.95.

A target EDG reliability of 0.95 was selected consistent with RG 1.155, Section 1.1 and NUMARC 87-00, Section 3.2.4, based on:

(a) Having a nuclear unit average EDG reliability for the last 20 demands greater than 0.90 for both units; and

(b) Having a nuclear unit average EDG reliability for the last 50 demands greater than 0.94 for Unit 1. Data not available for 50 load demands on Unit 2 EDGs due to limited operating history.

Due to limited operating history and unavailability of 100 load demands on Units 1 and 2 EDGs, the 100 demands reliability is not compared to 0.95.

(4) An Alternate AC (AAC) power source will be utilized at Braidwood Station which meets the criteria specified in Appendix B to NUMARC 87-00. The AAC source is an EAC power source which meets the assumptions in Section 2.3.1 of NUMARC 87-00.

The AAC power source is available within ten minutes of the onset of the station blackout event and has sufficient capacity and capability to operate systems necessary for coping with a station blackout for the required SBO duration of four hours to bring and maintain the station in a safe shutdown condition.

The Alternate AC configuration of Braidwood Station is similar to configuration 2B (dedicated diesels with cross-tie at multi-unit site) of NUMARC 87-00 Appendix C. Each unit of Braidwood Station has two emergency diesel generators that provide power to emergency 4.16kV buses (Divisions 11 and 12 for Unit 1, Divisions 21 and 22 for Unit 2). There is a manual cross-tie capability that exists between Division 11 of Unit 1 and Division 21 of Unit 2 (similarly, between Division 12 of Unit 1 and Division 22 of Unit 2). Upon loss of off-site power and failure of one unit's diesels to start, either one of the other unit's diesels is capable of providing power for safe shutdown of both units for a four-hour duration.

The capability for providing power to the blacked-out unit is possible with manual operation of cross-tie switchgear breakers from the Main Control Room.

B. Procedure Description

System power supply procedure on AC power restoration has been reviewed and modified to meet the guidelines in NUMARC 87-00 Section 4.2.2.

Station severe weather (tornado) procedure has been reviewed and determined to meet the guidelines in NUMARC 87-00 Section 4.2.3.

Station Procedures have been reviewed and changes necessary to meet NUMARC 87-00 will be implemented in the following area:

(1) Station blackout response per NUMARC 87-00, Section 4.2.1 for operator actions to:

(a) Start and load the Alternate AC source (the unblacked-out unit EDG) to the blacked-out unit;

(b) Ensure operation of the diesel driven AFW pump;

(c) Start a charging pump for reactor inventory control; and

(d) Restore off-site and EAC power when it becomes available.

C. Alternate AC (Ten-Minute) Coping Assessment

The AAC source has the capacity and capability to power the equipment necessary to cope with an SBO in accordance with NUMARC 87-00, Section 7 for the required coping duration determined in accordance with NUMARC 87-00, Section 3.2.5. The condensate inventory for decay heat removal, effects of loss of ventilation and reactor coolant inventory assessment is presented below. It is noted that, for the ten-minute Alternate AC method, Class 1E battery capacity, compressed air, and containment isolation need not be addressed.

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(1) Condensate Inventory for Decay Heat Removal (Section 7.2.1)

It has been determined from Section 7.2.1 of NUMARC 87-00 that 78,858 gallons of water per unit are required for decay heat removal without cooldown for four hours. The minimum permissible Condensate Storage Tank level per Technical Specifications provides 200,000 gallons of water per unit, which exceeds the required quantity for coping with a four-hour station blackout.

(2) Effects of Loss of Ventilation (Section 7.2.4)

The AAC power source provides power to HVAC systems serving dominant areas of concern. Therefore, the effects of loss of ventilation were not assessed.

(3) Reactor Coolant Inventory (Section 2.5)

The AAC power source powers the necessary make-up systems to maintain adequate reactor coolant system inventory to ensure that the core is covered for the required coping duration.

D. Proposed Schedule

The system power supply ac power restoration procedure and the station tornado procedure have already been reviewed and modified.

The procedure changes for SBO discussed in Part B will be implemented one year after the notification provided by the Director, Office of Nuclear Reactor Regulation in accordance with 10 CFR 50.63(c)(3).

Attachment B

Response to Station Blackout Rule

for Byron Station

RESPONSE TO STATION BLACKOUT RULE
FOR BYRON STATION
USING ALTERNATE AC POWER

On July 21, 1988, the Nuclear Regulatory Commission (NRC) amended its regulations in 10 CFR Part 50. A new section, 50.63, was added which requires that each light-water-cooled nuclear power plant be able to withstand and recover from a station blackout (SBO) of a specified duration. Utilities are expected to have the baseline assumptions, analyses, and related information used in their coping evaluation available for NRC review. The new section also identifies the factors that must be considered in specifying the station blackout duration. Section 50.63 requires that, for the station blackout duration, the plant be capable of maintaining core cooling and appropriate containment integrity. Section 50.63 further requires that each licensee submit the following information:

(1) A proposed station blackout duration including a justification for the selection based on the redundancy and reliability of the on-site emergency ac power sources, the expected frequency of loss of off-site power, and the probable time needed to restore off-site power;

(2) A description of the procedures that will be implemented for station blackout events for the duration (as determined in 1 above) and for recovery therefrom; and

(3) A list and proposed schedule for any needed modifications to equipment and associated procedures necessary for the specified SBO duration.

The NRC has issued Regulatory Guide (RG) 1.155, "Station Blackout," which describes a means acceptable to the NRC Staff for meeting the requirements of 10 CFR 50.63. Regulatory Guide 1.155 states that the NRC Staff has determined that NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," also provides guidance that is in large part identical to the RG 1.155 guidance and is acceptable to the NRC Staff for meeting these requirements.

Table 1 to RG 1.155 provides a cross-reference between RG 1.155 and NUMARC 87-00 and notes where the RG takes precedence.

Commonwealth Edison has evaluated Byron Station against the requirements of the SBO rule using guidance from NUMARC 87-00 and RG 1.155. The results of this evaluation are detailed below. (Applicable RG 1.155 table numbers and NUMARC 87-00 sections are shown in parentheses.)

A. Proposed Station Blackout Duration

RG 1.155 Table 2 was used to determine a proposed SBO duration of four hours.

The following station factors were identified in determining the proposed station blackout duration:

(1) The Offsite Power Design Characteristic Group is P1 (RG 1.155 Table 4), based on:

(a) Expected frequency of grid-related loss of off-site power does not exceed once per 20 years (NUREG-1032);

(b) Estimated frequency of loss of off-site power (LOOP) due to extremely severe weather places the station in ESW Group 1 (RG 1.155 Table 8);

(c) The Severe Weather Recovery (SWR) Group is 2 (RG 1.155 Table 7);

(d) Estimated frequency of LOOP due to severe weather places the station in SW Group 2 (RG 1.155 Table 6);

(e) The Independence of Off-Site Power Group is I2 (RG 1.155 Table 5).

(2) The Emergency AC Power Configuration Group is C (RG 1.155 Table 3), based on:

(a) There are two dedicated emergency ac (EAC) power supplies for each unit. These two dedicated EAC power supplies are not credited as Alternate AC (AAC) power sources for that unit. However, these sources are credited as AAC power supplies for the opposite unit. For AAC configuration of Byron Station, refer to item A.(4) below.

(b) One emergency ac power supply is necessary to operate safe shutdown equipment following a loss of off-site power for each unit.

(3) The target EDG reliability is 0.95.

A target EDG reliability of 0.95 was selected consistent with RG 1.155, Section 1.1 and NUMARC 87-00, Section 3.2.4, based on:

(a) Having a nuclear unit average EDG reliability for the last 20 demands greater than 0.90 for both units;

(b) Having a nuclear unit average EDG reliability for the last 50 demands greater than 0.94 for both units; and

(c) Having a nuclear unit average EDG reliability for the last 100 demands greater than 0.95 for Unit 1. Data not available for 100 load demands on Unit 2 EDGs due to limited operating history.

(4) An Alternate AC (AAC) power source will be utilized at Byron Station which meets the criteria specified in Appendix B to NUMARC 87-00. The AAC source is an EAC power source which meets the assumptions in Section 2.3.1 of NUMARC 87-00.

The AAC power source is available within ten minutes of the onset of the station blackout event and has sufficient capacity and capability to operate systems necessary for coping with a station blackout for the required SBO duration of four hours to bring and maintain the station in a safe shutdown condition.

The Alternate AC configuration of Byron Station is similar to configuration 2B (dedicated diesels with cross-tie at multi-unit site) of NUMARC 87-00 Appendix C. Each unit of Byron Station has two emergency diesel generators that provide power to emergency 4.16kV buses (Divisions 11 and 12 for Unit 1, Divisions 21 and 22 for Unit 2). There is a manual cross-tie capability that exists between Division 11 of Unit 1 and Division 21 of Unit 2 (similarly, between Division 12 of Unit 1 and Division 22 of Unit 2). Upon loss of off-site power and failure of one unit's diesels to start, either one of the other unit's diesels is capable of providing power for safe shutdown of both units for a four-hour duration.

The capability for providing power to the blacked-out unit is possible with manual operation of cross-tie switchgear breakers from the Main Control Room.

B. Procedure Description

System power supply procedure on AC power restoration has been reviewed and modified to meet the guidelines in NUMARC 87-00 Section 4.2.2.

Station severe weather (tornado) procedure has been reviewed and determined to meet the guidelines in NUMARC 87-00 Section 4.2.3.

Station Procedures have been reviewed and changes necessary to meet NUMARC 87-00 will be implemented in the following area:

(1) Station blackout response per NUMARC 87-00, Section 4.2.1 for operator actions to:

(a) Start and load the Alternate AC source (the unblacked-out unit EDG) to the blacked-out unit;

(b) Ensure operation of the diesel driven AFW pump;

(c) Start a charging pump for reactor inventory control; and

(d) Restore off-site and EAC power when it becomes available.

C. Alternate AC (Ten-Minute) Coping Assessment

The AAC source has the capacity and capability to power the equipment necessary to cope with an SBO in accordance with NUMARC 87-00, Section 7 for the required coping duration determined in accordance with NUMARC 87-00, Section 3.2.5. The condensate inventory for decay heat removal, effects of loss of ventilation and reactor coolant inventory assessment is presented below. It is noted that, for the ten-minute Alternate AC method, Class 1E battery capacity, compressed air, and containment isolation need not be addressed.

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(1) Condensate Inventory for Decay Heat Removal (Section 7.2.1)

It has been determined from Section 7.2.1 of NUMARC 87-00 that 78,858 gallons of water per unit are required for decay heat removal without cooldown for four hours. The minimum permissible Condensate Storage Tank level per Technical Specifications provides 200,000 gallons of water per unit, which exceeds the required quantity for coping with a four-hour station blackout.

(2) Effects of Loss of Ventilation (Section 7.2.4)

The AAC power source provides power to HVAC systems serving dominant areas of concern. Therefore, the effects of loss of ventilation were not assessed.

(3) Reactor Coolant Inventory (Section 2.5)

The AAC power source powers the necessary make-up systems to maintain adequate reactor coolant system inventory to ensure that the core is covered for the required coping duration.

D. Proposed Schedule

The system power supply ac power restoration procedure and the station tornado procedure have already been reviewed and modified.

The procedure changes for SBO discussed in Part B will be implemented one year after the notification provided by the Director, Office of Nuclear Reactor Regulation in accordance with 10 CFR 50.63(c)(3).

Attachment C

Response to Station Blackout Rule

for Dresden Station

RESPONSE TO STATION BLACKOUT RULE
FOR DRESDEN STATION
USING AC INDEPENDENT STATION BLACKOUT RESPONSE POWER

On July 21, 1988, the Nuclear Regulatory Commission (NRC) amended its regulations in 10 CFR Part 50. A new section, 50.63, was added which requires that each light-water-cooled nuclear power plant be able to withstand and recover from a station blackout (SBO) of a specified duration. Utilities are expected to have the baseline assumptions, analyses, and related information used in their coping evaluation available for NRC review. The new section also identifies factors that must be considered in specifying the station blackout duration. Section 50.63 requires that, for the station blackout duration, the plant be capable of maintaining core cooling and appropriate containment integrity. Section 50.63 further requires that each licensee submit the following information:

(1) A proposed station blackout duration including a justification for the selection based on the redundancy and reliability of the on-site emergency ac power sources, the expected frequency of loss of off-site power, and the probable time needed to restore off-site power;

(2) A description of the procedures that will be implemented for station blackout events for the duration (as determined in 1 above) and for recovery therefrom; and

(3) A list and proposed schedule for any needed modifications to equipment and associated procedures necessary for the specified SBO duration.

The NRC has issued Regulatory Guide (RG) 1.155, "Station Blackout," which describes a means acceptable to the NRC Staff for meeting the requirements of 10 CFR 50.63. Regulatory Guide 1.155 states that the NRC Staff has determined that NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," also provides guidance that is in large part identical to the RG 1.155 guidance and is acceptable to the NRC Staff for meeting these requirements.

Table 1 to RG 1.155 provides a cross-reference between RG 1.155 and NUMARC 87-00 and notes where the RG takes precedence.

Commonwealth Edison has evaluated Dresden Station against the requirements of the SBO rule using guidance from NUMARC 87-00 and RG 1.155. The results of this evaluation are detailed below. (Applicable RG 1.155 table numbers and NUMARC 87-00 sections are shown in parentheses.)

A. Proposed Station Blackout Duration

RG 1.155 Table 2 was used to determine a proposed SBO duration of four hours. No modifications were required to attain this proposed coping duration category.

The following station factors were identified in determining the proposed station blackout duration:

(1) The Offsite Power Design Characteristic Group is P1 (RG 1.155 Table 4), based on:

(a) Expected frequency of grid-related loss of off-site power does not exceed once per 20 years (NUREG-1032);

(b) Estimated frequency of loss of off-site power (LOOP) due to extremely severe weather places the station in ESW Group 1 (RG 1.155 Table 8);

(c) The Severe Weather Recovery (SWR) Group is 2 (RG 1.155 Table 7);

(d) Estimated frequency of LOOP due to severe weather places the station in SW Group 2 (RG 1.155 Table 6);

(e) The Independence of Off-Site Power Group is I2 (RG 1.155 Table 5).

The following is a discussion of assigning I2 category for independence of off-site power group for Dresden Station. Unit 2 is described below, Unit 3 is similar.

The normal source of ac power to 4kV bus 23-1 is the main generator via unit auxiliary transformer (UAT) 21. The 4kV bus 24-1 is normally connected to the preferred off-site power source via reserve auxiliary transformer (RAT) 22 (see attached one-line diagram of Dresden emergency power system). Either bus 23-1 or 24-1 can provide power to loads necessary for safe shutdown of the unit.

If the normal source of power to bus 23-1 fails, there is an automatic transfer to a preferred ac power source via RAT 22.

If the normal source of power to bus 24-1 fails, there is an automatic transfer to an alternate ac power source via the UAT 21. In addition, if UAT 21 fails, or becomes unavailable, there is a manual transfer to another alternate ac power source via bus 34-1 of Unit 3.

Unit 2 could operate with both buses 23-1 and 24-1 powered from the preferred power source via RAT 22. In addition, Unit 2 could safely be shut down with loss of both the UAT and RAT of Unit 2 by having bus 24-1 receiving power from bus 34-1 of Unit 3. Based on the above discussion, category I2 is assigned to Dresden Station independence of off-site power group.

(2) The Emergency AC Power Configuration Group is C (RG 1.155 Table 3), based on:

(a) A total of three dedicated and shared emergency ac power supplies, not credited as Alternate AC power sources, are located at the station (both units);

(b) The following modification will be implemented to attain the proposed Emergency AC Power Configuration Group:

Swing EDG (EDG 2/3) breaker logic/interlocks will be modified to allow simultaneous and manual loading capability of both units' 4.16kV buses (23-1 and 33-1) from the Control Room. The swing EDG, with its existing configuration, will automatically start and load to one unit's 4.16kV bus upon detection of loss of power. Subsequent to automatic closing of one unit's 4.16kV bus (23-1 or 33-1) feeder breaker, the opposite unit's 4.16kV bus feeder breaker will be prevented from closing remotely (from Control Room) or automatically (if there is no accident signal). However, with the existing configuration, the opposite unit's bus feeder breaker can be closed locally. Therefore, this modification is proposed to enhance the remote operation capability of the EDG 2/3 breakers. Subsequent to the implementation of the proposed modification, the operator will be able to manually/remotely load the opposite unit's 4.16kV bus from EDG 2/3 from the Control Room.

A minimum of one emergency ac power supply will be adequate to operate the safe shutdown equipment of both units simultaneously following a loss of off-site power. Presently, due to the design of the Emergency Power System, two out of three (2/3) EDGs are required, with no manual actions performed outside of the Control Room, to provide power for safe shutdown of both units. Implementation of the modification described above will simplify and enhance the capability to simultaneously power two 4.16kV ESF buses (one per unit) from one EDG. Simultaneously powering two ESF buses (one per unit) will require manual operator action from the Control Room to:

- shed some loads that are not required for stable hot shutdown from one unit's ESF bus, and

- manually energize the opposite unit's ESF bus and load the minimum safe shutdown equipment necessary for stable hot shutdown.

(3) The target EDG reliability is 0.95.

A target EDG reliability of 0.95 was selected based on having a nuclear unit average EDG reliability for the last 100 demands greater than 0.95, consistent with RG 1.155 Section 1.1 and NUMARC 87-00, Section 3.2.4. In addition, review of EDG data indicated that the nuclear unit average EDG reliability for the last 20 and 50 demands was greater than 0.90 and 0.94, respectively.

B. Procedure Description

System power supply and station procedures have been reviewed and modified to meet the guidelines in NUMARC 87-00, Section 4 in the following areas:

(1) AC power restoration (system power supply procedure) per NUMARC 87-00, Section 4.2.2;

(2) Severe weather (station tornado procedure) per NUMARC 87-00, Section 4.2.3.

Station procedures have been reviewed and changes necessary to meet NUMARC 87-00 will be implemented in the following areas:

(1) Station blackout response per NUMARC 87-00, Section 4.2.1 for operator action to:

(a) Ensure safe shutdown equipment will function without ac power;

(b) Ensure operation of Isolation Condenser (IC) for decay heat removal function;

(c) Ensure operation of diesel-driven fire pump for IC inventory makeup; and

(d) Restore off-site and EAC power when it becomes available.

(2) Procedure changes associated with any modifications required after assessing coping capability per NUMARC 87-00, Section 7.

C. AC Independent Coping Assessment

The ability of Dresden Station to cope with a station blackout for four hours, in accordance with NUMARC 87-00 Section 3.2.5 and as determined in Part A above, was assessed using NUMARC 87-00 Section 7, with the following results:

(1) Condensate Inventory for Decay Heat Removal (Section 7.2.1)

The isolation condenser will be utilized for decay heat removal. The isolation condenser inventory will be supplied from fire water provided by the diesel-driven fire pump. This pump takes suction from the river, which provides an inexhaustible supply of water. Thus, it is not necessary to address Condensate Storage Tank inventory for station blackout coping capability.

(2) Class 1E Batteries Capacity (Section 7.2.2)

A battery capacity calculation verifies that the Class 1E batteries have sufficient capacity to meet station blackout loads for four hours assuming loads not needed to cope with a station blackout are stripped. These loads will be identified in station procedures.

(3) Compressed Air (Section 7.2.3)

No air-operated valves are relied upon to cope with a station blackout for four hours.

(4) Effects of Loss of Ventilation (Section 7.2.4)

(a) The isolation condenser (IC) will be utilized for decay heat removal. The IC is located in an open area of the Reactor Building. This building is not considered a dominant area of concern because of its large volume.

(b) Effects of loss of ventilation for HPCI Room has not been assessed since HPCI is not credited for providing reactor inventory makeup and decay heat removal function.

(c) Main steam tunnel temperature for a station blackout condition has not been analyzed since safe shutdown equipment credited for station blackout are not located in the main steam tunnel.

(d) Control Room and Auxiliary Electric Equipment Rooms

The assumption in NUMARC 87-00, Section 2.7.1 that temperatures in the Control Room and Auxiliary Electric Equipment Rooms will not exceed 120°F during a station blackout has been assessed.

Temperatures in the Control Room and Auxiliary Electric Equipment Rooms at Dresden Station do not exceed 120°F during a station blackout. Therefore, the Control Room and Auxiliary Electric Equipment Rooms are not dominant areas of concern.

No modification is required to provide reasonable assurance of equipment operability in the above rooms. However, procedure changes are required for opening access doors for ensuring the temperatures will remain below 120°F.

(5) Containment Isolation (Section 7.2.5)

The station list of containment isolation valves has been reviewed to verify that valves which must be capable of being closed or that must be operated (cycled) under station blackout conditions can be positioned (with indication) independent of the preferred and blacked-out unit's Class 1E power supplies. The valves that require local manual operator action for containment isolation purposes will be identified in station procedures.

(6) Reactor Coolant Inventory (Section 2.5)

The ability to maintain adequate reactor coolant system inventory to ensure that the core is cooled has been assessed for four hours. A plant-specific analysis was used for this assessment. The expected rates of reactor coolant inventory loss under SBO conditions (utilizing isolation condenser for decay heat removal without cooldown) do not result in core uncovery in an SBO of four hours. Therefore, make-up systems are not required to maintain reactor inventory while utilizing the isolation condenser for decay heat removal.

D. Proposed Modification and Schedule

The modification and associated procedure changes identified in Parts A and B are expected to be completed, as outage schedules permit, two years after the notification provided by the Director, Office of Nuclear Reactor Regulation in accordance with 10 CFR 50.63(c)(3).

The system power supply ac power restoration procedure and the station tornado procedure have already been reviewed and modified.

The procedure changes for SBO discussed in Parts B and C (not associated with a modification) will be implemented one year after the notification provided by the Director, Office of Nuclear Reactor Regulation in accordance with 10 CFR 50.63(c)(3).

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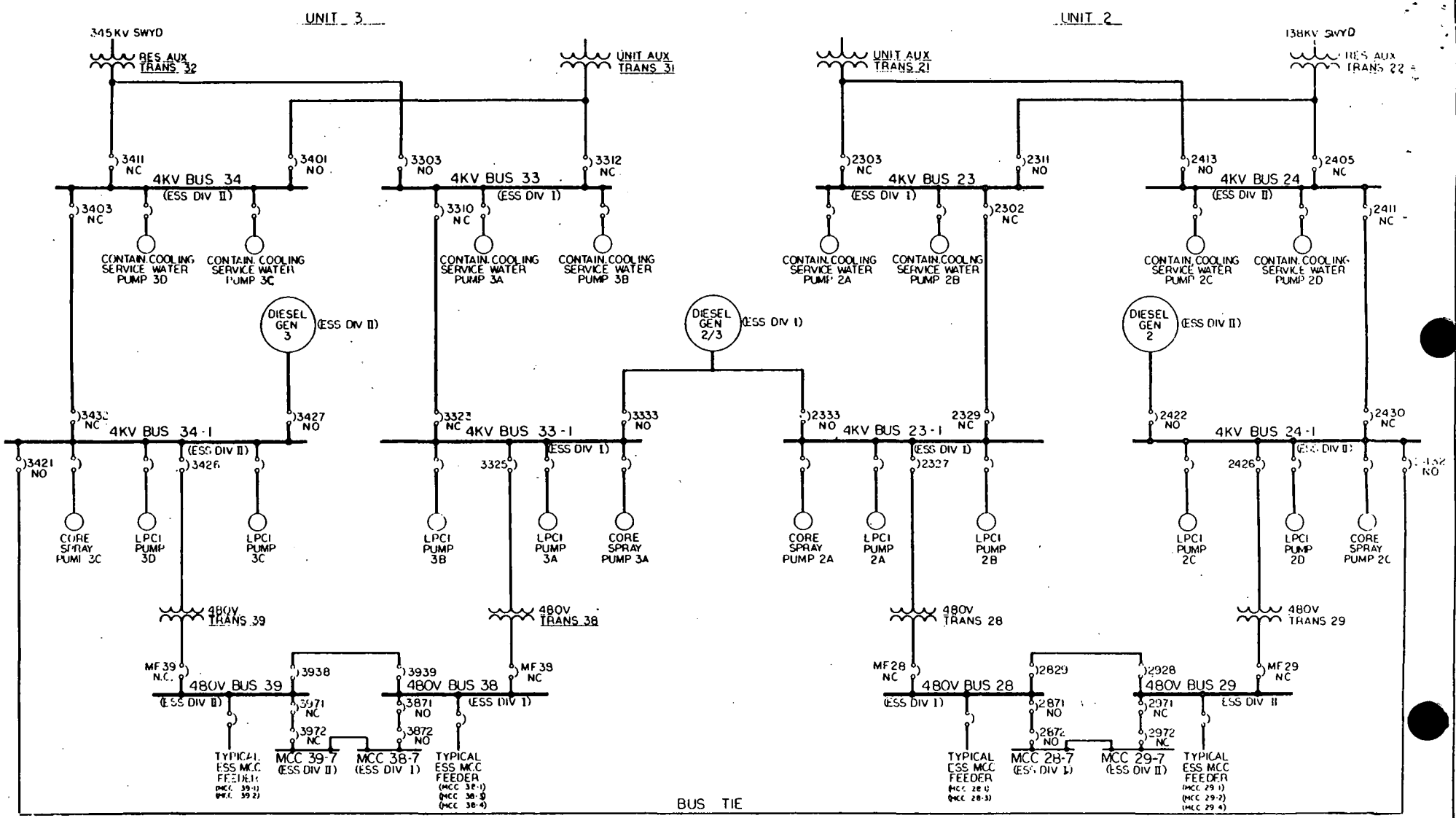
DRESDEN STATION



FOR INFORMATION ONLY

NUCLEAR SAFETY RELATED
EQUIPMENT IS SHOWN ON THIS DRAWING

DRAWING RELEASE RECORD			DRAWN
REV	DATE	DESCRIPTION	CHECKED
			ENGR APPROVAL

SINGLE LINE DIAGRAM
EMERGENCY POWER SYSTEM
DRESDEN NUCLEAR POWER STATION
UNIT 2 & 3
GENERAL ELECTRIC CO.
FOR
COMMONWEALTH EDISON CO.
CHICAGO, ILLINOIS

DWG	NONE
DRAWN	G. VASS
CHECKED	
ENGR	
APPROVED	

SARGENT & LUNDY INCORPORATED ENGINEERS CHICAGO

12E-2328

Attachment D

Response to Station Blackout Rule

for LaSalle County Station

RESPONSE TO STATION BLACKOUT RULE
FOR LASALLE STATION
USING AC INDEPENDENT STATION BLACKOUT RESPONSE POWER

On July 21, 1988, the Nuclear Regulatory Commission (NRC) amended its regulations in 10 CFR Part 50. A new section, 50.63, was added which requires that each light-water-cooled nuclear power plant be able to withstand and recover from a station blackout (SBO) of a specified duration. Utilities are expected to have the baseline assumptions, analyses, and related information used in their coping evaluation available for NRC review. The new section also identifies factors that must be considered in specifying the station blackout duration. Section 50.63 requires that, for the station blackout duration, the plant be capable of maintaining core cooling and appropriate containment integrity. Section 50.63 further requires that each licensee submit the following information:

(1) A proposed station blackout duration including a justification for the selection based on the redundancy and reliability of the on-site emergency ac power sources, the expected frequency of loss of off-site power, and the probable time needed to restore off-site power;

(2) A description of the procedures that will be implemented for station blackout events for the duration (as determined in 1 above) and for recovery therefrom; and

(3) A list and proposed schedule for any needed modifications to equipment and associated procedures necessary for the specified SBO duration.

The NRC has issued Regulatory Guide (RG) 1.155, "Station Blackout," which describes a means acceptable to the NRC Staff for meeting the requirements of 10 CFR 50.63. Regulatory Guide 1.155 states that the NRC Staff has determined that NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," also provides guidance that is in large part identical to the RG 1.155 guidance and is acceptable to the NRC Staff for meeting these requirements.

Table 1 to RG 1.155 provides a cross-reference between RG 1.155 and NUMARC 87-00 and notes where the RG takes precedence.

Commonwealth Edison has evaluated LaSalle Station against the requirements of the SBO rule using guidance from NUMARC 87-00 and RG 1.155. The results of this evaluation are detailed below. (Applicable RG 1.155 table numbers and NUMARC 87-00 sections are shown in parentheses.)

A. <u>Proposed Station Blackout Duration</u>

RG 1.155 Table 2 was used to determine a proposed SBO duration of four hours. No modifications were required to attain this proposed coping duration category.

The following station factors were identified in determining the proposed station blackout duration:

(1) The Offsite Power Design Characteristic Group is P1 (RG 1.155 Table 4), based on:

(a) Expected frequency of grid-related loss of off-site power does not exceed one per 20 years (NUREG-1032);

(b) Estimated frequency of loss of off-site power (LOOP) due to extremely severe weather places the station in ESW Group 1 (RG 1.155 Table 8);

(c) The Severe Weather Recovery (SWR) Group is 2 (RG 1.155 Table 7);

(d) Estimated frequency of LOOP due to severe weather places the station in SW Group 2 (RG 1.155 Table 6);

(e) The Independence of Off-Site Power Group is I2 (RG 1.155 Table 5).

(2) The Emergency AC Power Configuration Group is C (RG 1.155 Table 3), based on:

(a) A total of three dedicated and shared emergency ac power supplies, not credited as Alternate AC power sources and not including the HPCS diesels, are located at the station (both units);

(b) The following changes will be implemented to enhance the Emergency AC Power Configuration:

1. DG 1A and DG 2A, with their existing configuration, will automatically start and load to their associated unit's 4.16KV bus upon detection of the loss of power (DG 1A to Unit 1 bus 142-Y, DG 2A to Unit 2 bus 242-Y). Subsequently, one of the two series cross connect breakers between buses 142-Y and 242-Y is prevented from closing remotely from the Control Room. Electrical interlocks can be defeated locally to manually close this cross connect breaker. Plant changes will be initiated to facilitate the cross connect capability which allows simultaneous loading of buses 142-Y and 242-Y to either DG 1A or DG 2A by defeating interlocks. The second bus will not load onto the diesel generator automatically but will require deliberate operator action.

2. Swing DG 0, with its existing configuration, will automatically start and load to either bus 141-Y or bus 241-Y upon detection of the loss of power. Subsequently, one of the two series cross connect breakers between buses 141-Y and 241-Y is prevented from closing remotely from the Control Room. Electrical interlocks can be defeated locally to manually close this cross connect breaker. Plant changes will be initiated to facilitate the cross connect capability which allows simultaneous loading of buses 141-Y and 241-Y to DG 0 by defeating interlocks. The second bus will not load onto the diesel generator automatically but will require deliberate operator action.

These changes will not affect the control or operation of the unit tie breakers during normal operation.

A minimum of one emergency ac power supply is adequate to operate the safe shutdown equipment of both units simultaneously following a loss of off-site power. Simultaneously powering two ESF buses (one per unit) will require manual operator action, including:

- shed some loads that are not required for stable hot shutdown from one unit's ESF bus, and
- manually energize the opposite unit's ESF bus and load the minimum safe shutdown equipment necessary for stable hot shutdown.

(3) The target EDG reliability is 0.95.

A target EDG reliability of 0.95 was selected based on having a nuclear unit average EDG reliability for the last 100 demands greater than 0.95, consistent with RG 1.155 Section 1.1 and NUMARC 87-00, Section 3.2.4. In addition, review of EDG data indicated that the nuclear unit average EDG reliability for the last 20 and 50 demands was greater than 0.90 and 0.94, respectively.

B. Procedure Description

The AC power restoration (system power supply procedure) has been reviewed and modified to meet the guidelines in NUMARC 87-00, Section 4.2.2.

The LSCS housekeeping program includes periodic inspections of the site which assures that excessive debris that could become missiles is identified. This satisfies the intent of the severe weather actions per NUMARC 87-00 Section 4.2.3.

Station procedures have been reviewed and changes necessary to meet NUMARC 87-00 will be implemented in the following areas:

(1) Station blackout response per NUMARC 87-00, Section 4.2.1 for operator actions to:

(a) Ensure safe shutdown equipment will function without ac power;

(b) Ensure operation of RCIC for reactor inventory and decay heat removal function; and

(c) Restore off-site and AC power when it becomes available.

(2) Procedure changes associated with any modifications required after assessing coping capability per NUMARC 87-00, Section 7.

C. AC Independent Coping Assessment

The ability of LaSalle Station to cope with a station blackout for four hours, in accordance with NUMARC 87-00 Section 3.2.5 and as determined in Part A above, was assessed using NUMARC 87-00 Section 7, with the following results:

(1) Condensate Inventory for Decay Heat Removal (Section 7.2.1)

RCIC will be utilized for decay heat removal. RCIC will be taking suction from the suppression pool and discharging into the reactor while having the recirculation path back to the suppression pool available, when required. The suppression pool contains adequate water inventory for condensing steam released from the reactor, condensing steam exhausted from the RCIC turbine, and providing water for reactor inventory and decay heat removal via the RCIC pump. Thus, it is not necessary to address Condensate Storage Tank inventory for the station blackout coping capability.

For the purposes described above, the station procedures for SBO will contain the steps associated with automatic or manual transfer of RCIC suction to the suppression pool from the CST, when this normal supply of water reaches a low level.

HPCS provides an alternate method for accomplishing the reactor inventory make up control and decay heat removal function in conjunction with the SRV's. The HPCS pump and support equipment, while being powered from their own EDG can be utilized to achieve and maintain safe shutdown for the four-hour SBO coping duration. The system is safety-related with a class 1E dedicated diesel generator, independent of the other diesel generators and self contained.

(2) Class 1E Batteries Capacity (Section 7.2.2)

The 125V Divisions 1 and 2 and 250V Class 1E batteries were determined to be inadequate to meet station blackout loads for four hours. The following modifications and procedure changes are necessary to provide a four-hour capacity:

(a) The existing 125V Divisions 1 and 2 and 250V Class 1E batteries will be replaced with larger capacity batteries.

(b) The new batteries will have sufficient capacity to meet station blackout loads for four hours assuming that loads not needed to cope with a station blackout are stripped. These loads will be identified in the station procedures.

(3) Compressed Air (Section 7.2.3)

Instrument nitrogen is required for the relief mode operation of the main steamline safety/relief valves. An analysis assures that the existing nitrogen bottle banks are sufficient to support SRV actuations for the four-hour coping duration. As a backup, the mechanical safety mode of SRV operation is available independent of nitrogen bottles to control pressure.

(4) Effects of Loss of Ventilation (Section 7.2.4)

(a) The maximum ambient air temperature for a four-hour SBO has been calculated for the following dominant area of concern:

AREA	TEMPERATURE
RCIC Room	153°F

The operability of station blackout response equipment in the above dominant area of concern has been assessed using Appendix F to NUMARC 87-00 and the Topical Report. No modification or procedure changes are required to provide reasonable assurance for equipment operability.

(b) HPCS provides an alternate method to RCIC for providing reactor inventory makeup and decay heat removal. The HPCS Room ventilation system will be available when the HPCS pump is available. Thus, the loss of the ventilation system for HPCS need not be addressed.

(c) Main steam tunnel temperature for a station blackout condition has not been analyzed based on the following: Safe shutdown equipment credited for station blackout and RCIC isolation temperature instrumentation are not located in the main steam tunnel.

(d) Control Room and Auxiliary Electric Equipment Rooms

The assumption in NUMARC 87-00, Section 2.7.1 that the temperature in the Control Room and Auxiliary Electric Equipment Rooms will not exceed 120°F during a station blackout has been assessed.

The temperatures in the Control Room and Auxiliary Electric Equipment Rooms at LaSalle Station do not exceed 120°F during a station blackout. Therefore, the Control Room and Auxiliary Electric Equipment Rooms are not dominant areas of concern.

No modification is required to provide reasonable assurance of equipment operability in the above rooms. However, procedure changes are required for opening access and cabinet/panel doors in the Auxiliary Electric Equipment Rooms.

(5) Containment Isolation (Section 7.2.5)

The station list of containment isolation valves has been reviewed to verify that valves which must be capable of being closed or operated (cycled) under station blackout conditions can be positioned (with indication) independent of the preferred and blacked-out unit's Class 1E power supplies. The valves that require manual operator action locally for containment isolation purposes will be identified in the station procedures.

(6) Reactor Coolant Inventory (Section 2.5)

The ability to maintain adequate reactor coolant system inventory to ensure that the core is cooled has been assessed for four hours. RCIC, which will be utilized for decay heat removal during an SBO event, will also provide the reactor coolant inventory. Thus, make-up systems in addition to RCIC are not required to maintain core cooling.

D. Proposed Modification and Schedule

The modifications and associated procedure changes identified in Part C above will be completed during the refueling outages tentatively scheduled to begin in May 1991 for Unit 1 (fourth refuel outage) and December 1991 for Unit 2 (fourth refuel outage).

The system power supply ac power restoration procedure has already been reviewed and modified.

The procedure changes for SBO (not associated with a modification) will be implemented one year after the notification provided by the Director, Office of Nuclear Reactor Regulation in accordance with 10 CFR 50.63 (c) (3).

TK/mtm/9796L

Attachment E

Response to Station Blackout Rule

for Quad Cities Station

RESPONSE TO STATION BLACKOUT RULE
FOR QUAD CITIES STATION
USING AC INDEPENDENT STATION BLACKOUT RESPONSE POWER

On July 21, 1988, the Nuclear Regulatory Commission (NRC) amended its regulations in 10 CFR Part 50. A new section, 50.63, was added which requires that each light-water-cooled nuclear power plant be able to withstand and recover from a station blackout (SBO) of a specified duration. Utilities are expected to have the baseline assumptions, analyses, and related information used in their coping evaluation available for NRC review. The new section also identifies factors that must be considered in specifying the station blackout duration. Section 50.63 requires that, for the station blackout duration, the plant be capable of maintaining core cooling and appropriate containment integrity. Section 50.63 further requires that each licensee submit the following information:

(1) A proposed station blackout duration including a justification for the selection based on the redundancy and reliability of the on-site emergency ac power sources, the expected frequency of loss of off-site power, and the probable time needed to restore off-site power;

(2) A description of the procedures that will be implemented for station blackout events for the duration (as determined in 1 above) and for recovery therefrom; and

(3) A list and proposed schedule for any needed modifications to equipment and associated procedures necessary for the specified SBO duration.

The NRC has issued Regulatory Guide (RG) 1.155, "Station Blackout," which describes a means acceptable to the NRC Staff for meeting the requirements of 10 CFR 50.63. Regulatory Guide 1.155 states that the NRC Staff has determined that NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," also provides guidance that is in large part identical to the RG 1.155 guidance and is acceptable to the NRC Staff for meeting these requirements.

Table 1 to RG 1.155 provides a cross-reference between RG 1.155 and NUMARC 87-00 and notes where the RG takes precedence.

Commonwealth Edison has evaluated Quad Cities Station against the requirements of the SBO rule using guidance from NUMARC 87-00 and RG 1.155. The results of this evaluation are detailed below. (Applicable RG 1.155 table numbers and NUMARC 87-00 sections are shown in parentheses.)

A. Proposed Station Blackout Duration

RG 1.155 Table 2 was used to determine a proposed SBO duration of four hours. No modifications were required to attain this proposed coping duration category.

The following station factors were identified in determining the proposed station blackout duration:

(1) The Offsite Power Design Characteristic Group is P1 (RG 1.155 Table 4), based on:

(a) Expected frequency of grid-related loss of off-site power does not exceed once per 20 years (NUREG-1032);

(b) Estimated frequency of loss of off-site power (LOOP) due to extremely severe weather places the station in ESW Group 1 (RG 1.155 Table 8);

(c) The Severe Weather Recovery (SWR) Group is 2 (RG 1.155 Table 7);

(d) Estimated frequency of LOOP due to severe weather places the station in SW Group 2 (RG 1.155 Table 6);

(e) The Independence of Off-Site Power Group is I2 (RG 1.155 Table 5).

The following is a discussion of assigning I2 category for independence of off-site power group for Quad Cities Station. Unit 1 is described below, Unit 2 is similar.

The normal source of ac power to 4kV bus 14-1 is the main generator via unit auxiliary transformer (UAT) 11. The 4kV bus 13-1 is normally connected to the preferred off-site power source via reserve auxiliary transformer (RAT) 12 (see attached one-line diagram of Quad Cities emergency power system). Either bus 13-1 or 14-1 can provide power to loads necessary for safe shutdown of the unit.

If the normal source of power to bus 14-1 fails, there is an automatic transfer to a preferred ac power source via RAT 12. In addition, if RAT 12 fails, there is a manual transfer to an alternate ac power source via bus 24-1 of Unit 2.

If the normal source of power to bus 13-1 fails, there is an automatic transfer to an alternate ac power source via the UAT 11.

Unit 1 could operate with both buses 13-1 and 14-1 powered from the preferred power source via RAT 12. In addition, Unit 1 could safely be shut down with loss of both the UAT and RAT of Unit 1 by having bus 14-1 receiving power from bus 24-1 of Unit 2. Based on the above discussion, category I2 is assigned to Quad Cities Station Independence of Off-Site Power Group.

(2) The Emergency AC Power Configuration Group is C (RG 1.155 Table 3), based on:

(a) A total of three dedicated and shared emergency ac power supplies, not credited as Alternate AC power sources, are located at the station (both units);

(b) The following modification will be implemented to attain the proposed Emergency AC Power Configuration Group:

Swing EDG (EDG 1/2) breaker logic/interlocks will be modified to allow simultaneous and manual loading capability of both units' 4.16kV buses (13-1 and 23-1) from the Control Room. The swing EDG, with its existing configuration, will automatically start and load to one unit's 4.16kV bus upon detection of loss of power. Subsequent to automatic closing of one unit's 4.16kV ESF bus (13-1 or 23-1) feeder breaker, the opposite unit's 4.16kV bus feeder breaker will be prevented from closing remotely (from Control Room) or automatically (if there is no accident signal). However, with the existing configuration, the opposite unit's bus feeder breaker can be closed locally. Therefore, this modification is proposed to enhance the remote operation capability of the EDG 1/2 breakers. Subsequent to the implementation of the proposed modification, the operator will be able to manually/remotely load the opposite unit's 4.16kV bus from EDG 1/2 from the Control Room.

A minimum of one emergency ac power supply will be adequate to operate the safe shutdown equipment of both units simultaneously following a loss of off-site power. Presently, due to the design of the Emergency Power System, two out of three (2/3) EDGs are required, with no manual actions performed outside of the Control Room, to provide power for safe shutdown of both units. Implementation of the modification described above will simplify and enhance the capability to simultaneously power two 4.16kV ESF buses (one per unit) from one EDG. Simultaneously powering two ESF buses (one per unit) will require manual operator action from the Control Room to:

- shed some loads that are not required for stable hot shutdown from one unit's ESF bus, and

- manually energize the opposite unit's ESF bus and load the minimum safe shutdown equipment necessary for stable hot shutdown.

(3) The target EDG reliability is 0.95.

A target EDG reliability of 0.95 was selected based on having a nuclear unit average EDG reliability for the last 100 demands greater than 0.95, consistent with RG 1.155 Section 1.1 and NUMARC 87-00, Section 3.2.4. In addition, review of EDG data indicated that the nuclear unit average EDG reliability for the last 20 and 50 demands was greater than 0.90 and 0.94, respectively.

B. Procedure Description

System power supply and station procedures have been reviewed and modified to meet the guidelines in NUMARC 87-00, Section 4 in the following areas:

(1) AC power restoration (system power supply procedure) per NUMARC 87-00, Section 4.2.2;

(2) Severe weather (station tornado procedure) per NUMARC 87-00, Section 4.2.3.

Station procedures have been reviewed and changes necessary to meet NUMARC 87-00 will be implemented in the following areas:

(1) Station blackout response per NUMARC 87-00, Section 4.2.1 for operation actions to:

(a) Ensure safe shutdown equipment will function without ac power;

(b) Ensure operation of RCIC for reactor inventory and decay heat removal function; and

(c) Restore off-site and EAC power when it becomes available.

(2) Procedure changes associated with any modifications required after assessing coping capability per NUMARC 87-00, Section 7.

C. AC Independent Coping Assessment

The ability of Quad Cities Station to cope with a station blackout for four hours, in accordance with NUMARC 87-00 Section 3.2.5 and as determined in Part A above, was assessed using NUMARC 87-00 Section 7, with the following results:

(1) Condensate Inventory for Decay Heat Removal (Section 7.2.1)

It has been determined from Section 7.2.1 of NUMARC 87-00 that 55,543 gallons of water per unit, with a total of 111,087 gallons for both units, are required for decay heat removal without cooldown for four hours. The Condensate Storage Tank (per FSAR Section 4.5.3) maintains, in reserve for RCIC, a minimum volume of 90,000 gallons of water per tank, with a total of 180,000 gallons for two normally connected tanks in reserve for RCIC. This exceeds the required quantity for coping with a four-hour station blackout event.

No plant modifications or procedure changes are needed to utilize these water sources.

(2) Class 1E Batteries Capacity (Section 7.2.2)

A battery capacity calculation verifies that the Class 1E batteries have sufficient capacity to meet station blackout loads for four hours assuming loads not needed to cope with a station blackout are stripped. These loads will be identified in station procedures.

(3) Compressed Air (Section 7.2.3)

No air-operated valves are relied upon to cope with a station blackout for four hours.

(4) Effects of Loss of Ventilation (Section 7.2.4)

(a) The maximum ambient air temperature for a four-hour SBO has been calculated for the following dominant area of concern:

AREA	TEMPERATURE
RCIC Room	Less than 150°F

The operability of station blackout response equipment in the above dominant area of concern has been assessed. No modifications or procedure changes are required to provide reasonable assurance of equipment operability in the RCIC Room.

(b) Effects of loss of ventilation for HPCI Room has not been assessed since HPCI is not credited for providing reactor inventory makeup and decay heat removal function.

(c) Main steam tunnel temperature for a station blackout condition has not been analyzed since safe shutdown equipment credited for station blackout are not located in the main steam tunnel.

(b) Control Room and Auxiliary Electric Equipment Rooms

The assumption in NUMARC 87-00, Section 2.7.1 that temperatures in the Control Room and Auxiliary Electric Equipment Rooms will not exceed 120°F during a station blackout has been assessed.

Temperatures in the Control Room and Auxiliary Electric Equipment Rooms at Quad Cities Station do not exceed 120°F during a station blackout. Therefore, the Control Room and Auxiliary Electric Equipment Rooms are not dominant areas of concern.

No modification is required to provide reasonable assurance of equipment operability in the above

rooms. However, procedure changes are required for opening access doors for ensuring the temperatures will remain below 120°F.

(5) Containment Isolation (Section 7.2.5)

The station list of containment isolation valves has been reviewed to verify that valves which must be capable of being closed or that must be operated (cycled) under station blackout conditions can be positioned (with indication) independent of the preferred and blacked-out unit's Class 1E power supplies. The valves that require local manual operator action for containment isolation purposes will be identified in station procedures.

(6) Reactor Coolant Inventory (Section 2.5)

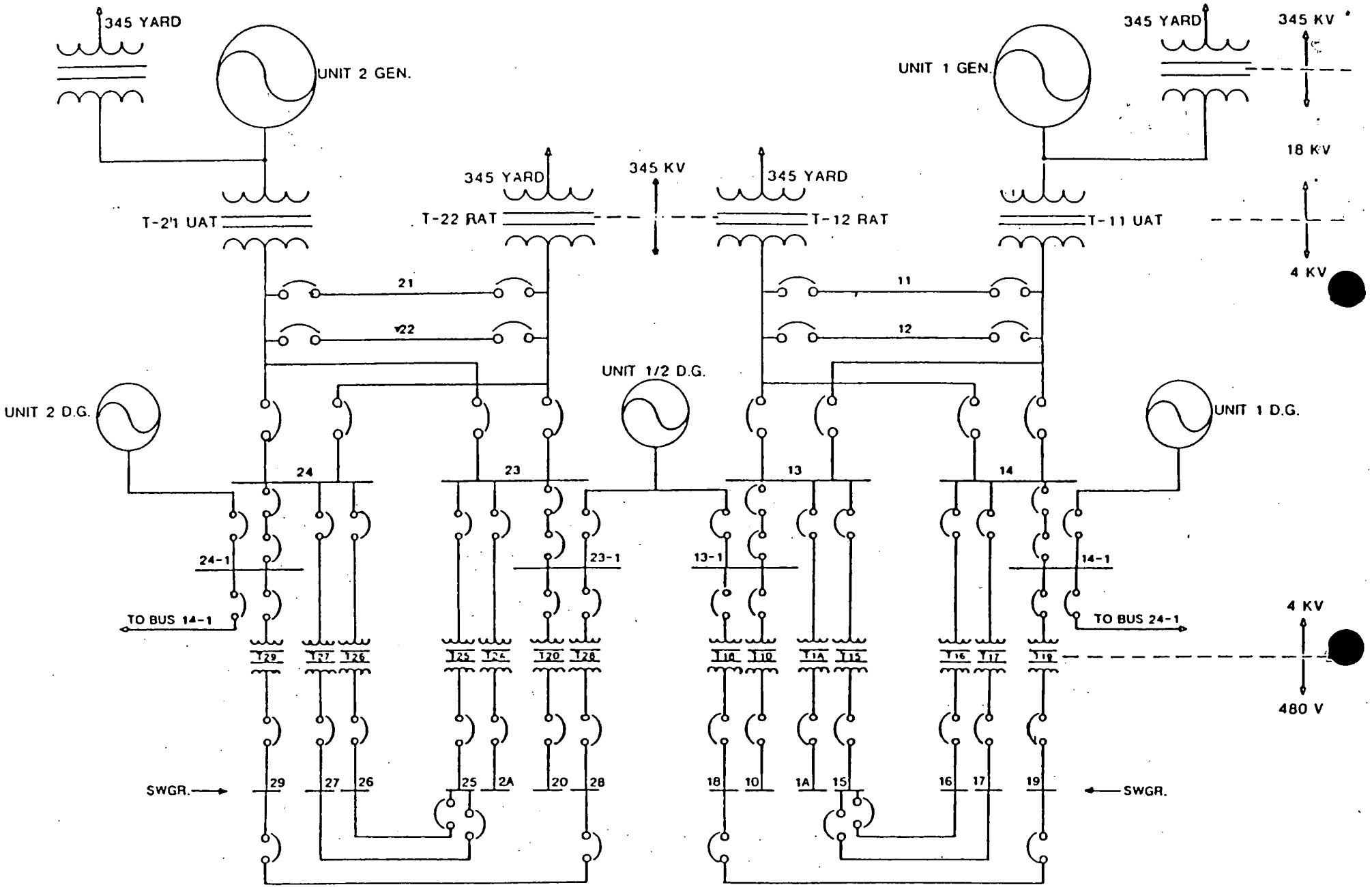
The ability to maintain adequate reactor coolant system inventory to ensure that the core is cooled has been assessed for four hours. RCIC, which will be utilized for decay heat removal during an SBO event, will also provide the reactor coolant inventory. Therefore, make-up systems in addition to RCIC are not required to maintain core cooling.

D. Proposed Modification and Schedule

The modification and associated procedure changes identified in Parts A and B are expected to be completed, as outage schedules permit, two years after the notification provided by the Director, Office of Nuclear Reactor Regulation in accordance with 10 CFR 50.63(c)(3).

The system power supply ac power restoration procedure and the station tornado procedure have already been reviewed and modified.

The procedure changes for SBO discussed in Parts B and C (not associated with a modification) will be implemented one year after the notification provided by the Director, Office of Nuclear Reactor Regulation in accordance with 10 CFR 50.63(c)(3).



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Attachment F

Response to Station Blackout Rule

for Zion Station

RESPONSE TO STATION BLACKOUT RULE
FOR ZION STATION
USING ALTERNATE AC POWER

On July 21, 1988, the Nuclear Regulatory Commission (NRC) amended its regulations in 10 CFR Part 50. A new section, 50.63, was added which requires that each light-water-cooled nuclear power plant be able to withstand and recover from a station blackout (SBO) of a specified duration. Utilities are expected to have the baseline assumptions, analyses, and related information used in their coping evaluation available for NRC review. The new section also identifies the factors that must be considered in specifying the station blackout duration. Section 50.63 requires that, for the station blackout duration, the plant be capable of maintaining core cooling and appropriate containment integrity. Section 50.63 further requires that each licensee submit the following information:

(1) A proposed station blackout duration including a justification for the selection based on the redundancy and reliability of the on-site emergency ac power sources, the expected frequency of loss of off-site power, and the probable time needed to restore off-site power;

(2) A description of the procedures that will be implemented for station blackout events for the duration (as determined in 1 above) and for recovery therefrom; and

(3) A list and proposed schedule for any needed modifications to equipment and associated procedures necessary for the specified SBO duration.

The NRC has issued Regulatory Guide (RG) 1.155, "Station Blackout," which describes a means acceptable to the NRC Staff for meeting the requirements of 10 CFR 50.63. Regulatory Guide 1.155 states that the NRC Staff has determined that NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," also provides guidance that is in large part identical to the RG 1.155 guidance and is acceptable to the NRC Staff for meeting these requirements.

Table 1 to RG 1.155 provides a cross-reference between RG 1.155 and NUMARC 87-00 and notes where the RG takes precedence.

Commonwealth Edison has evaluated Zion Station against the requirements of the SBO rule using guidance from NUMARC 87-00 and RG 1.155. The results of this evaluation are detailed below. (Applicable RG 1.155 table numbers and NUMARC 87-00 sections are shown in parentheses.)

A. Proposed Station Blackout Duration

RG 1.155, Table 2 was used to determine a proposed SBO duration of four hours.

The following station factors were identified in determining the proposed station blackout duration:

(1) The Offsite Power Design Characteristic Group is P1 (RG 1.155 Table 4), based on:

(a) Expected frequency of grid-related loss of off-site power does not exceed once per 20 years (NUREG-1032);

(b) Estimated frequency of loss of off-site power (LOOP) due to extremely severe weather places the station in ESW Group 1 (RG 1.155 Table 8);

(c) The Severe Weather Recovery (SWR) Group is 2 (RG 1.155 Table 7);

(d) Estimated frequency of LOOP due to severe weather places the station in SW Group 2 (RG 1.155 Table 6);

(e) The Independence of Off-Site Power Group is I2 (RG 1.155 Table 5).

(2) The Emergency AC Power Configuration Group is C (RG 1.155 Table 3), based on:

(a) There are two emergency ac power supplies not credited as Alternate AC power sources for each unit;

(b) One emergency ac power supply is necessary to operate safe shutdown equipment following a loss of off-site power for each unit.

(3) The target EDG reliability is 0.95.

A target EDG reliability of 0.95 was selected based on having a nuclear unit average EDG reliability for the last 100 demands greater than 0.95, consistent with RG 1.155 Section 1.1 and NUMARC 87-00, Section 3.2.4.

(4) An Alternate AC (AAC) power source will be utilized at Zion Station which meets the criteria specified in Appendix B to NUMARC 87-00. The AAC source is an EAC power source which meets the assumptions in Section 2.3.1 of NUMARC 87-00.

The AAC power source is available within ten minutes of the onset of the station blackout event and has sufficient capacity and capability to operate systems necessary for coping with a station blackout for the required SBO duration of four hours to bring and maintain one unit in a safe shutdown condition.

Five emergency diesel generators (EDGs) are installed at Zion Station. Each unit has two dedicated EDGs that provide ac power to safe shutdown equipment of that unit. Either one of these two dedicated EDGs is adequate for safe shutdown of that unit. A fifth EDG (EDG 0), a swing to either unit, is also installed at the station; it supplies ac power to 4.16kV Bus 147 for Unit 1, and Bus 247 for Unit 2. This swing diesel is designed to power one unit at a time. Upon loss of off-site power, EDG 0 will be automatically started and loaded to one unit's 4.16kV bus. EDG 0 can also be manually started from the Main Control Room and loaded to either unit's 4.16kV bus.

Upon a loss of offsite power event, EDG 0 will be automatically started and loaded to the bus from which the first undervoltage signal is received. EDG 0 can be transferred to the other unit's bus, if required, by remote manual operation from the Main Control Room. EDG 0 can provide power to one train of the blacked-out unit's safe shutdown equipment, with the exception of Bus 247 which does not provide power to any CCW pump. However, CCW will be provided to both units with the diesel(s) available from the unblacked-out unit.

B. Procedure Description

System power supply and station procedures have been reviewed and modified to meet the guidelines in NUMARC 87-00, Section 4 in the following areas:

(1) AC power restoration (system power supply procedure) per NUMARC 87-00, Section 4.2.2;

(2) Severe weather (station tornado procedure) per NUMARC 87-00, Section 4.2.3.

Station procedures have been reviewed and changes necessary to meet NUMARC 87-00 will be implemented in the following areas:

(1) Station blackout response per NUMARC 87-00, Section 4.2.1 for operator actions to:

(a) Start and load the Alternate AC source (EDG 0);

(b) Ensure operation of turbine-driven AFW pump;

(c) Start a charging pump for reactor inventory control; and

(d) Restore off-site and EAC power when it becomes available.

C. Alternate AC (Ten-Minute) Coping Assessment

The AAC source has the capacity and capability to power the equipment necessary to cope with an SBO in accordance with NUMARC 87-00, Section 7 for the required coping duration determined in accordance with NUMARC 87-00, Section 3.2.5.

The condensate inventory for decay heat removal, effects of loss of ventilation, and reactor coolant inventory assessments are presented below. It is noted that Class 1E battery capacity, compressed air, and containment isolation need not be addressed for the ten-minute Alternate AC method.

(1) Condensate Inventory for Decay Heat Removal (Section 7.2.1)

It has been determined from Section 7.2.1 of NUMARC 87-00 that 75,009 gallons of water per unit are required for decay heat removal without cooldown for four hours. The minimum permissible Condensate Storage Tank level per Technical Specifications provides 170,000 gallons of water per unit, which exceeds the required quantity for coping with a four-hour station blackout.

(2) Effects of Loss of Ventilation (Section 7.2.4)

(a) Zion Station turbine-driven auxiliary feedwater pumps (one per unit) are located in the Auxiliary Building. The Auxiliary Building ventilation exhaust fans (one per unit) will be available to remove the heat generated in the turbine-driven auxiliary feedwater pumps area.

(b) HVAC systems serving the following areas of concern may not be available:

- Main Control Room (MCR)
- Both units' Auxiliary Electric Equipment Rooms (AEERs)

The redundant trains of the MCR HVAC system are powered by Unit 1 "A" and Unit 2 "B" EDGs, and the redundant trains of AEERs HVAC system are powered by Units 1 and 2 "B" EDGs. Upon loss of off-site power and failure of a dedicated diesel generator of one unit to start, EDG 0 will be providing power to the blacked-out unit. If no additional failure is assumed on the unblacked-out unit, then one train of the MCR and AEERs HVAC system is available. However, if an additional single failure is assumed on the unblacked-out unit, then the MCR and/or AEERs HVAC system may not be available, depending upon the additional single failure.

The maximum bulk ambient temperatures of the Main Control Room and Auxiliary Electric Equipment Rooms at Zion Station have been calculated to not exceed 120^{o}F during the station blackout period. Therefore, these areas are not considered dominant areas of concern.

No modification is required to provide reasonable assurance of equipment operability. However, procedure changes are required for opening access doors to ensure temperatures in the Main Control Room and Auxiliary Electric Equipment Rooms will remain below 120^{o}F.

The operability of station blackout response equipment in the above areas has been assessed using Appendix F to NUMARC 87-00.

(3) Reactor Coolant Inventory (Section 2.5)

The AAC power source powers the necessary make-up systems to maintain adequate reactor coolant system inventory to ensure that the core is cooled for the required coping duration.

D. Proposed Modification and Schedule

The EDG 0 (Alternate AC source for both units) remote control switches and associated indication are mostly located on the Unit 1 main control board (MCB), with some available on the Unit 2 main control board. In order to transfer EDG 0 from Unit 1 Bus 147 to Unit 2 Bus 247, with the existing configuration, two operators are necessary, one on the Unit 1 MCB and the other on the Unit 2 MCB. DCRDR Modification M22-0-88-09, which is scheduled for completion in 1990, will provide additional switches on the Unit 2 MCB for EDG 0. This modification will enhance and simplify the EDG 0 control and transfer capability from the Unit 2 MCB.

The modification identified above is scheduled for completion in the year 1990.

The system power supply ac power restoration procedure and the station tornado procedure have already been reviewed and modified.

The procedure changes for SBO discussed in Parts B and C (not associated with a modification) will be implemented one year after the notification provided by the Director, Office of Nuclear Reactor Regulation in accordance with 10 CFR 50.63(c)(3).