NORTHEAST UTILITIES

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April 17, 1989

Docket Nos. 50-245
50-336
50-423
B13180

Re: 10CFR50.63
Millstone Unit No. 1
ISAP Topic 1.106

Dr. T. E. Murley, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Gentlemen:

Millstone Nuclear Power Station, Unit Nos. 1, 2, and 3
Response to Station Blackout Rule

On June 21, 1988,(1) the Nuclear Regulatory Commission (NRC) amended its regulations in 10CFR50 (effective date July 21, 1988). 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. Licensees are expected to have the baseline assumptions, analyses, and related information used in their coping evaluation available for NRC Staff review. It also identifies the factors that must be considered in specifying the SBO duration. Section 50.63 requires that for the SBO 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 SBO duration including a justification for the selection based on the redundancy and reliability of the on-site emergency AC (EAC) 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 SBO events for the duration (as determined in 1 above) and for recovery therefrom.

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

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(1) 53 Federal Register 23203, June 21, 1988.

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10CFR50.63. RG 1.155 states that the NRC Staff has determined that Nuclear Management and Resources Council (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.

Northeast Nuclear Energy Company (NNECO) has evaluated Millstone Nuclear Power Station, Unit Nos. 1, 2, and 3, against the requirements of the SBO rule using guidance from NUMARC 87-00 except where RG 1.155 takes precedence.[(2)] NNECO has conservatively determined that Millstone Unit Nos. 1, 2, and 3 are 8-hour coping duration plants. The NRC Staff has identified utilization of an alternate AC (AAC) power source as the preferred method for reducing the risk of severe accidents resulting from SBO. Currently, there exists a 4-kV auxiliary bus which can be used to establish a crosstie between the Millstone Unit Nos. 1 and 2 on-site EAC power sources. This crosstie enables NNECO to consider the Unit Nos. 1 and 2 EAC power sources as AAC sources since they satisfy the Appendix B criteria of NUMARC 87-00 and are available within 1 hour to cope with an SBO. NNECO plans to extend the crosstie feature from Millstone Unit Nos. 1 and 2 to Millstone Unit No. 3 in order to also provide an AAC source for Millstone Unit No. 3.

The AAC power sources for Millstone Unit Nos. 1, 2, and 3 would be available within 1 hour of the onset of the SBO event and will have sufficient capacity and capability to operate systems necessary for coping with an SBO for the required SBO duration of 8 hours. An AC independent coping assessment was performed, using Section 7 of NUMARC 87-00 for the 1 hour necessary to bring the AAC power source on line. Further, 8-hour assessments have been performed for condensate inventory and compressed air. Since the AAC sources may not power heating, ventilation, and air conditioning (HVAC) in all dominant areas, those areas without HVAC will be assessed for reasonable assurance of operability of SBO response equipment by determining an expected temperature for an 8-hour loss of HVAC. Equations different from those provided in NUMARC 87-00 are appropriate and were used since Millstone Unit Nos. 1, 2, and 3 require an 8-hour ventilation coping assessment. However, NNECO has recently determined, based on NUMARC consultant guidance, that the equations used to calculate temperatures for potential dominant areas for an 8-hour loss of HVAC may have been incorrectly applied. Due to this incorrect application, the temperatures must be recalculated. This impacts our submittal regarding Part C.4 of Attachment Nos. 1, 2, and 3. NNECO will submit the correct temperature values on or before May 30, 1989.

The details of this SBO evaluation for Millstone Unit Nos. 1, 2, and 3 are provided in Attachment Nos. 1, 2, and 3, respectively. These attachments follow the standard SBO rule response format developed by NUMARC and formally

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(2) 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.

approved by the NRC[3] as providing an adequate level of information for the review. All documentation of the calculations and procedure reviews is maintained in our files and is available for NRC Staff review.

The NRC Staff states that a goal of the SBO rule is to maintain the frequency of core damage from SBO near or below 10^{-5} per reactor-year. In the supplementary information to the final rule, the NRC Staff states that the SBO rule must be met regardless of whether a plant-specific probabilistic risk assessment (PRA) currently meets this goal. The NRC Staff does not, on the other hand, preclude the licensee from identifying plant-specific PRA data to support a determination that SBO would have an acceptably small probability for causing core damage. Accordingly, NNECO reiterates our previous determinations that the core melt frequency (CMF) of SBO at Millstone Unit Nos. 1 and 3 from internally initiated events at power are approximately 9.96×10^{-7}[4] and 2.52×10^{-6}[5] per reactor year, respectively (i.e., exclusive of external events as defined in the PRA Procedure Guide NUREG/CR-2300). At this time, a CMF due to SBO at Millstone Unit No. 2 is not available, although a Level I PRA is in the process of being completed. This information, along with the results of the NUMARC 87-00 evaluation, therefore substantiates that the risk of core melt from SBO at the Millstone Nuclear Power Station is acceptably low.

The modifications and associated procedure changes to install the AAC source for Millstone Unit No. 3 as identified in Part A of Attachment No. 3 are tentatively planned to be completed within 2 years after notification is provided by the Director, Office of Nuclear Reactor Regulation, in accordance with 10CFR50.63(c)(3). The exact implementation schedule cannot be provided since (1) it is uncertain when NRC notification will be received, and (2) installation of the Millstone Unit No. 3 crosstie feature will involve refueling outages at Millstone Unit Nos. 1, 2, and 3. In addition, the procedure changes identified in Parts B and C of Attachment Nos. 1, 2, and 3 will be completed within 1 year after NRC notification. Procedure changes pertaining to severe weather will be completed by August 31, 1989.

We also wish to provide some comments on our decision to effect AAC availability for Millstone Unit No. 3. We thoroughly explored the option of demonstrating that Millstone Unit Nos. 1, 2, and 3 are 4-hour coping duration

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(3) A. C. Thadani letter to W. H. Rasin, dated October 7, 1988.

(4) E. J. Mroczka letter to U.S. NRC Document Control Desk, "Millstone Nuclear Power Station, Unit No. 1 Probabilistic Safety Study Update (Revision 2)," dated February 10, 1989.

(5) J. F. Opeka letter to W. R. Denton, "Millstone Nuclear Power Station, Unit No. 3 Response to Information Requested Regarding Station Blackout," dated March 18, 1986.

plants by appropriately crediting a variety of salt spray mitigation features, most of which have already been implemented. This would have enabled NNECO to demonstrate compliance with 10CFR50.63 without requiring installation of the crosstie feature to Millstone Unit No. 3. However, in recognition of the safety benefits and desirability of AAC, we chose to rely on AAC to demonstrate 10CFR50.63 compliance. This in no way diminishes the effectiveness of the salt spray mitigation features which provide further assurance that the risk associated with an SBO event at the Millstone site has been minimized to the maximum extent feasible. Attachment No. 4 summarizes the salt spray mitigation features that have been implemented at the Millstone Nuclear Power Station, Unit Nos. 1, 2, and 3.

If you have any questions, please contact us.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

E. J. Mroczka
Senior Vice President

cc: W. T. Russell, Region I Administrator
M. L. Boyle, NRC Project Manager, Millstone Unit No. 1
G. S. Vissing, NRC Project Manager, Millstone Unit No. 2
D. H. Jaffe, NRC Project Manager, Millstone Unit No. 3
W. J. Raymond, Senior Resident Inspector, Millstone Unit Nos. 1, 2, and 3

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
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NUMARC
Suite 300
1776 Eye Street, NW
Washington, DC 20006-2496

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(6) E. J. Mroczka letter to U.S. Nuclear Regulatory Commission Document Control Desk, "Millstone Unit No. 1 Integrated Safety Assessment Program," dated November 9, 1988.

Docket No. 50-245
B13180
ISAP Topic 1.106

Attachment No. 1

Millstone Nuclear Power Station, Unit No. 1
Response to SBO Rule

April 1989

Millstone Unit No. 1
Response to SBO Rule

A. Proposed Station Blackout (SBO) Duration

Please note, as part of the Millstone Unit No. 1 Integrated Safety Assessment Program (ISAP), Topic 1.106[6] was assigned for tracking ISAP evaluations/rankings of SBO-required modifications and industry initiatives.

NUMARC 87-00 Section 3 was used to determine a proposed SBO duration of 8 hours.

The following plant factors were identified in determining the proposed SBO duration:

1. AC Power Design Characteristic Group is P3 based on:

   a. Expected frequency of grid-related loss of off-site power (LOOP) does not exceed once per 20 years (NUMARC 87-00, 3.2.1, Part 1A, p. 3-3).

   b. Estimated frequency of LOOP due to extremely severe weather (ESW) places the plant in ESW Group 5 (NUMARC 87-00, Section 3.2.1, Part 1B, p. 3-4).

   c. Estimated frequency of LOOP due to severe weather (SW)[1] places the plant in SW Group 5 (NUMARC 87-00, Section 3.2.1, Part 1C, p. 3-7).

   d. The off-site power system is in the I3 Group (NUMARC 87-00, Section 3.2.1, Part 1D, p. 3-10).

2. The emergency AC (EAC) power configuration group is C based on (NUMARC 87-00, Section 3.2.2, Part 2C, p. 3-13):

   a. There are two EAC power supplies, an emergency diesel generator (EDG) and a gas turbine generator (GTG), not credited as alternate AC (AAC) power sources (NUMARC 87-00, Section 3.2.2, Part 2A, p. 3-15).

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(1) In accordance with NUMARC and NRC guidance, NNECO has used C=0.78 for sites vulnerable to the effects of salt spray for the purposes of this submittal. However, NNECO believes that the design and procedure modifications implemented as described in Attachment No. 4 have significantly reduced the effects of salt spray at the Millstone Nuclear Power Station and minimized the potential for LOOP due to such effects.

b. One EAC power supply is necessary to operate safe shutdown equipment following a LOOP (NUMARC 87-00, Section 3.2.2, Part 2B, p. 3-15).

3. The target EAC reliability is 0.975.

A target EAC reliability of 0.975 was selected based on having a nuclear unit average EAC reliability for the last 20 demands greater than 0.90[2] consistent with NUMARC 87-00, Section 3.2.4.

This target reliability is justified by reviewing the GTG reliability data which show recent improvements. It is expected that the reliability will continue to improve based on the following modifications that have or will be implemented:

a. The original carbon steel piping and fittings in the GTG air start system are being replaced with stainless steel. This replacement is scheduled for completion during the 1989 refueling outage (currently in progress). Failures of the air start motor should be decreased since fewer rust particles will travel into this system.

b. The GTG air start system was modified to provide automatic closure of the air shutoff valve when the GTG fails to start. This was done to increase GTG start reliability by minimizing the accumulation of starting air contaminants in the regulator valve.

c. The GTG start logic will be modified during the 1989 refueling outage to bypass certain emergency GTG protective trips that are not presently bypassed during emergency operation. In addition, the high lube oil temperature trip will be modified to include a coincident two-out-of-two logic scheme. These modifications and their benefits to GTG reliability are discussed in ISAP Topic 1.01, "GTG Start Logic Modifications."[3]

d. The existing electronic devices in the gas turbine governor system will be replaced with "state-of-the-art" microprocessors during the 1989 refueling outage. As a result of ISAP

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(2) The actual average reliability for both the GTG and EDG combined for the last 20 demands is 0.975.

(3) E. J. Mroczka letter to U.S. Nuclear Regulatory Commission Document Control Desk, "Millstone Unit No. 1 Integrated Safety Assessment Program," dated November 9, 1988.

Topic 2.100, "Emergency Gas Turbine Generator Reliability Study," this modification was proposed and is being conducted under ISAP Topic 2.112, "Gas Turbine Governor Control System Replacement."[4]

4. An AAC power source will be utilized at Millstone Unit No. 1 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 1 hour of the onset of the SBO event and has sufficient capacity and capability to operate systems necessary for coping with an SBO for the required SBO duration of 8 hours to bring and maintain the plant in safe shutdown. An AC independent coping analysis was performed for the 1 hour required to bring the AAC power source on line.

   In 1983, a project was initiated to specifically address a means of cross-connecting EDG and GTG supplies between Millstone Unit No. 1 and Millstone Unit No. 2 for storm-caused blackout scenarios. In December 1984, the backfeed concept was proposed as an alternative fix for a postulated Appendix R fire. This fix was formally docketed as an NRC commitment in the Millstone Unit No. 1 Appendix R Review.[5]

   Unlike SBO, which requires AAC to be available within 1 hour, the NRC Staff has approved a 4-hour duration in order to bring the AAC power source on line for Millstone Unit No. 1 Appendix R compliance.[6] The same 4-hour scenario for Millstone Unit No. 2 to align the crosstie is pending NRC Staff approval.[7] The distinction between the Appendix R 4-hour duration and the SBO 1-hour duration

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(4) Ibid.

(5) J. F. Opeka letter to C. I. Grimes, "Millstone Nuclear Power Station, Unit No. 1 Fire Protection Evaluation. 10CFR50, Appendix R Compliance Review," dated December 10, 1986.

(6) M. L. Boyle letter to E. J. Mroczka, "Safety Evaluation of the Post-Fire Safe Shutdown Methodology - Millstone Nuclear Power Station, Unit No. 1 (TAC No. 60188)," dated April 14, 1988.

(7) E. J. Mroczka letter to U.S. Nuclear Regulatory Commission Document Control Desk, "Fire Protection Evaluation--10CFR50, Appendix R Compliance Review--Shutdown System Availability in the Event of a Fire," dated May 29, 1987.

is necessary because more time is required to performed the following functions for Appendix R compliance:

a. Respond to and extinguish a fire.

b. Assure the plant is shut down safely and to assess the postfire equipment availability. It should be noted that a number of operators are also fire brigade members and may not initially be available to assist in the local equipment operations necessary during the worst-case fire scenario.

c. Align the AAC crosstie.

The current crosstie aligns the Millstone Unit No. 1 emergency bus through Bus 14H to the Millstone Unit No. 2 emergency Bus 24E. This allows Millstone Unit No. 1 to be powered by either of Millstone Unit No. 2 EDGs. Likewise, the crosstie allows Millstone Unit No. 2 to be powered by either the Millstone Unit No. 1 GTG or EDG. Figure 1-A provides a one-line diagram of this existing AAC.

On the basis of the crosstie capability between Millstone Unit No. 1 and Millstone Unit No. 2, credit will be taken for the on-site EAC source available at the nonblacked-out unit as an AAC source.

B. Procedure Description

1. The following procedures for AC power restoration have been reviewed and modified as necessary to meet the guidelines in NUMARC 87-00, Section 4.2.2:

   a. CONVEX Operating Instruction No. 006, "Restoration."

   b. CONVEX Operating Instruction No. 6913, "Millstone 15G."

   c. CONVEX Operating Instruction No. 8601, "Millstone 345 kV Substation Salt Decontamination."

   d. TD 250, "Load Shedding and Interruptible Loads."

   e. TD 503, "Transmission Line Patrols--Line Faults."

   f. TD 506, "Transmission Line Emergency Patrols--Regional/Area Assistance."

2. The following plant procedure for SW has been reviewed and will be modified as necessary by August 31, 1989 to meet the guidelines in NUMARC 87-00, Section 4.2.1.

   ONP 514A, "Natural Occurrences."

3. The following plant procedure for SBO response has been reviewed and procedure changes necessary to meet NUMARC 87-00, Section 4.2.1, will be implemented within 1 year after NRC notification is provided in accordance with 10CFR50.63(c)(3):

   ONP 503C, "Loss of Off-Site and On-Site AC Power (SBO)."

4. Procedure changes associated with any modifications required after assessing coping capability per NUMARC 87-00, Section 7, have been reviewed.

   No plant modifications or procedure changes are necessary, pending completion of the ventilation studies, as a result of the coping assessment.

C. <u>SBO Coping Assessment</u>

The AAC source described in Part A is currently available and does not require any modifications. Procedures currently exist to utilize this AAC power source; however, they will be modified when the crosstie feature is extended to include Millstone Unit No. 3.

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 (except for HVAC as discussed in the accompanying transmittal letter), for the required coping duration determined in accordance with NUMARC 87-00, Section 3.2.5.

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

   It has been determined as required by Section 7.2.1 of NUMARC 87-00 that 132,900 gallons of water are required for decay heat removal, cooldown, and reactor pressure vessel makeup over 8 hours. The minimum permissible condensate level from the fire water tanks per Technical Specifications provides 400,000 gallons of water which provides a usable volume that exceeds the required quantity for coping with an 8-hour SBO.

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

2. Class 1E Battery Capacity (Section 7.2.2)

   A battery capacity calculation has been performed pursuant to NUMARC 87-00, Section 7.2.2, and verifies that the Class 1E batteries have sufficient capacity to meet SBO loads for 1 hour.

3. Compressed Air (Section 7.2.3)

   No air-operated valves are relied upon to cope with an SBO for 8 hours.

4. Effects of Loss of Ventilation (Section 7.2.4)

   TO BE SUBMITTED BY MAY 30, 1989.

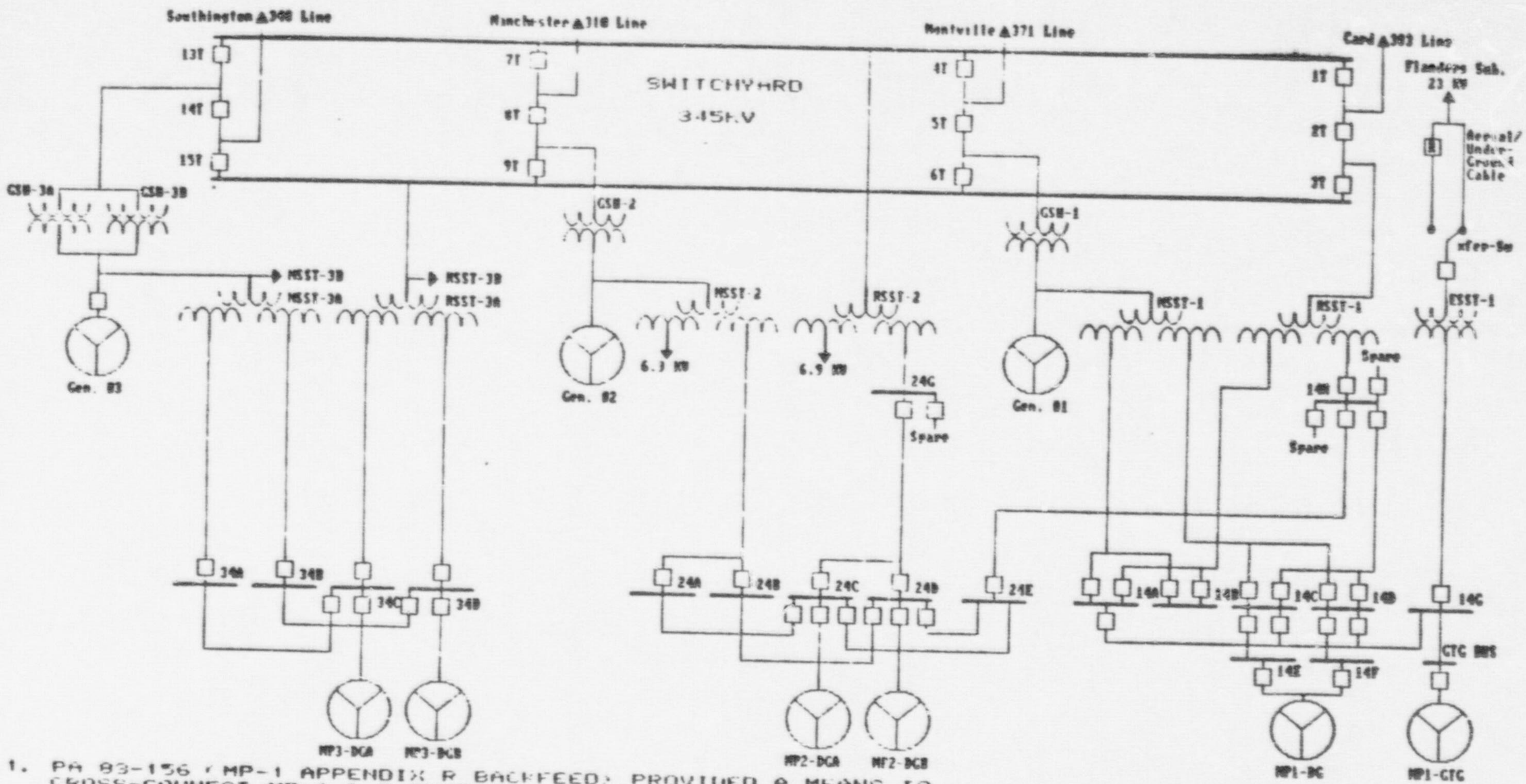
5. Containment Isolation (Section 7.2.5)

   The plant 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 SBO conditions can be positioned (with indication) independent of the blacked-out unit's preferred Class 1E AC power supplies.

   No plant modifications and/or associated procedure changes were determined to be required to ensure that appropriate containment integrity can be provided under SBO conditions.

6. Reactor Coolant Inventory (Section 2.5)

   The AAC power source provides power for systems to maintain adequate reactor coolant system inventory to ensure that the core is cooled for the required coping duration.



1. PA 83-156 (MP-1 APPENDIX R BACKFEED) PROVIDED A MEANS TO CROSS-CONNECT MP-1 & 2 EMERGENCY SUPPLIES
2. PA 83-156 PROVIDED TWO SPARE CIRCUIT BREAKERS TO FACILITATE FUTURE CONNECTIONS TO ESST-1 AND MP-3
3. SUBSTATION ENG. & DESIGN WORK UPGRADED THE FEEDER TO ESST-1 BY PROVIDING A DEDICATED AERIAL/UNDERGROUND CABLE AND A MEANS OF ISOLATING THE OLD NON-INSULATED CABLE RUN ONSITE

EXISTING DESIGN

R Recloser
NSST Normal Station Service Transformer
RSST Reserve Station Service Transformer
R.O. Normally Racked Out Breaker

FIGURE 1-A

Attachment No. 2

Millstone Nuclear Power Station, Unit No. 2
Response to SBO Rule

April 1989

Millstone Unit No. 2
Response to SBO Rule

A. Proposed SBO Duration

NUMARC 87-00 Section 3 was used to determine a proposed SBO duration of 8 hours.

The following plant factors were identified in determining the proposed SBO duration:

1. AC Power Design Characteristic Group is P3 based on:

   a. Expected frequency of grid-related loss of off-site power (LOOP) does not exceed once per 20 years (NUMARC 87-00, Section 3.2.1, Part 1A, p. 3-3).

   b. Estimated frequency of LOOP due to extremely severe weather (ESW) places the plant in ESW Group 5 (NUMARC 87-00, Section 3.2.1, Part 1B, p. 3-4).

   c. Estimated frequency of LOOP due to severe weather (SW)[1] places the plant in SW Group 5 (NUMARC 87-00, Section 3.2.1, Part 1C, p. 3-7).

   d. The off-site power system is in the I3 Group (NUMARC 87-00, Section 3.2.1, Part 1D, p. 3-10).

2. The emergency AC (EAC) power configuration group is C based on (NUMARC 87-00, Section 3.2.2, Part 2C, p. 3-13):

   a. There are two EAC power supplies not credited as alternate AC (AAC) power sources (NUMARC 87-00, Section 3.2.2, Part 2A, p. 3-15).

   b. One EAC power supply is necessary to operate safe shutdown equipment following a LOOP (NUMARC 87-00, Section 3.2.2, Part 2B, p. 3-15).

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(1) In accordance with NUMARC and NRC guidance, NNECO has used C=0.78 for sites vulnerable to the effects of salt spray for the purposes of this submittal. However, NNECO believes that the design and procedure modifications, implemented as described in Attachment No. 4 have significantly reduced the effects of salt spray at the Millstone Nuclear Power Station and minimized the potential for LOOP due to such effects.

3. The target emergency diesel generator (EDG) reliability is 0.975.

   A target EDG reliability of 0.975 was selected based on having a nuclear unit average EDG reliability for the last 100 demands greater than 0.95[2] consistent with NUMARC 87-00, Section 3.2.4.

4. An AAC power source will be utilized at Millstone Unit No. 2 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 source is a crosstie feature between the Millstone Unit Nos. 1 and 2 EACs.

   The AAC power source is available within 1 hour of the onset of the SBO event (please note our discussion on the distinction between Appendix R and SBO provided in Attachment No. 1, Part A.4.) and has sufficient capacity and capability to operate systems necessary for coping with an SBO for the required SBO duration of 8 hours to bring and maintain the plant in safe shutdown. An AC independent coping analysis was performed for the 1 hour required to bring the AAC power source on line.

   The detailed AAC source description and its one-line diagram are provided in Attachment No. 1, Part A.4.

B. <u>SBO Procedure Description</u>

1. The following plant procedures for AC power restoration have been reviewed and modified as necessary to meet the guidelines in NUMARC 87-00, Section 4.2.2:

   a. CONVEX Operating Instruction No. 006, "Restoration."

   b. CONVEX Operating Instruction No. 6913, "Millstone 15 G."

   c. CONVEX Operating Instruction No. 8601, "Millstone 345 kV Substation Salt Decontamination."

   d. TD 250, "Load Shedding and Interruptible Loads."

   e. TD 503, "Transmission Line Patrols--Line Faults."

   f. TD 506, "Transmission, On Line Emergency Patrols, Regional/Area Assistance."

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(2) The actual average reliability for both EDGs combined for the last 100 demands is 0.99.

g. OP 2351, "CONVEX--345 kV Switchyard."

h. OP 2343, "4160 Volt Electrical System."

2. The following plant procedure for SW has been reviewed and will be modified as necessary by August 31, 1989 to meet the guidelines in NUMARC 87-00, Section 4.2.1.

   AOP 2560, "Storms, High Winds or High Tide."

3. The following plant procedures for SBO response have been reviewed and changes necessary to meet NUMARC 87-00, Section 4.2.1, if any, will be implemented within 1 year after NRC notification is provided in accordance with 10CFR50.63(c)(3):

   a. EOP 2528, "Electrical Emergency."

   b. EOP 2530, "Unit 2 Station Blackout."

   c. OP 23470, "Backfeeding Unit 2."

   d. OP 2344A, "480 Volt Load Centers."

   e. OP 2345C, "125 Volt DC System."

   f. OP 2346A, "Emergency Diesel Generators."

   g. OP 2347A, "Reserve Station Service Transformer."

   h. OP 2384, "Engineered Safeguards Actuation System."

   i. OP 2332A, "Station Air."

   j. OP 2332B, "Instrument Air."

   k. OP 2319B, "Condensate Storage/Surge System."

   l. OP 2322, "Auxiliary Feedwater System."

   m. OP 2315A, "Control Room Air Conditioning."

   n. OP 2316D, "Vital Electrical Switchgear (Emergency Cooling)."

   o. OP 2315B, "Non Radioactive Ventilation."

   p. OP 2330C, "Chilled Water."

4. Procedure changes associated with any modifications required after assessing coping capability per NUMARC 87-00, Section 7, have been reviewed.

   No modifications or procedure changes are necessary, pending completion of the ventilation studies, as a result of the coping assessment.

C. SBO Coping Assessment

The AAC source described in Attachment No. 1, Part A.4, is currently available and does not require any modifications. Procedures currently exist to utilize this AAC power source; however, they will be modified when the crosstie feature is extended to Millstone Unit No. 3.

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 (except for HVAC as discussed in the accompanying transmittal letter), for the required coping duration determined in accordance with NUMARC 87-00, Section 3.2.5.

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

   It has been determined as required by Section 7.2.1 of NUMARC 87-00 that 136,000 gallons of water are required for decay heat removal and cooldown over 8 hours. The minimum permissible condensate storage tank level per Technical Specifications provides 150,000 gallons of water which provides a usable volume that exceeds the required quantity for coping with an 8-hour SBO.

   No plant modifications or procedure changes are needed to utilize this water source.

2. Class 1E Battery Capacity (Section 7.2.2)

   A battery capacity calculation has been performed pursuant to NUMARC 87-00, Section 7.2.2, and verifies that the Class 1E batteries have sufficient capacity to meet SBO loads for 1 hour.[3]

3. Compressed Air (Section 7.2.3)

   No air-operated valves are relied upon to cope with an SBO for 8 hours.

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(3) A calculation has shown that the Class 1E batteries have sufficient capacity to meet SBO loads for 8 hours.

4. Effects of Loss of Ventilation (Section 7.2.4)

TO BE SUBMITTED BY MAY 30, 1989.

5. Containment Isolation (Section 7.2.5)

The plant 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 SBO conditions can be positioned (with indication) independent of the preferred and blacked-out unit's Class 1E AC power supplies. No plant modifications and/or associated procedure changes were determined to be required to ensure that appropriate containment integrity can be provided under SBO conditions.

6. Reactor Coolant Inventory (Section 2.5)

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

Attachment No. 3

Millstone Nuclear Power Station, Unit No. 3
Response to SBO Rule

April 1989

Millstone Unit No. 3
Response to SBO Rule

A. Proposed SBO Duration

NUMARC 87-00 Section 3 was used to determine a proposed SBO duration of 8 hours.

The following plant factors were identified in determining the SBO duration:

1. AC Power Design Characteristic Group is P3 based on:

   a. Expected frequency of grid-related loss of off-site power (LOOP) does not exceed once per 20 years (NUMARC 87-00, Section 3.2.1, Part 1A, p. 3-3).

   b. Estimated frequency of LOOPs due to extremely severe weather (ESW) places the plant in ESW Group 5 (NUMARC 87-00, Section 3.2.1, Part 1B, p. 3-4).

   c. Estimated frequency of LOOPs due to severe weather (SW)(1) places the plant in SW Group 5 (NUMARC 87-00, Section 3.2.1, Part 1C, p. 3-7).

   d. The off-site power system is in the I1/2 Group (NUMARC 87-00, Section 3.2.1, Part 1D, p. 3-10).

2. The emergency AC (EAC) power configuration group is C based on (NUMARC 87-00, Section 3.2.2, Part 2C, p. 3-13).

   a. There are two EAC power supplies not credited as alternate AC (AAC) power sources (NUMARC 87-00, Section 3.2.2, Part 2A, p. 3-15).

   b. One EAC power supply is necessary to operate safe shutdown equipment following a LOOP (NUMARC 87-00, Section 3.2.2, Part 2B, p. 3-15).

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(1) In accordance with NUMARC and NRC guidance, NNECO has used C=0.78 for sites vulnerable to the effects of salt spray for the purposes of this submittal. However, NNECO believes that the design and procedure modifications implemented as described in Attachment No. 4 have significantly reduced the effects of salt spray at the Millstone Nuclear Power Station and minimized the potential for LOOP due to such effects.

3. The target emergency diesel generator (EDG) reliability is 0.975.

   A target EDG reliability of 0.975 was selected based on having a nuclear unit average EDG reliability for the last 100 demands greater than 0.95[2] consistent with NUMARC 87-00, Section 3.2.4.

4. An AAC power source will be utilized at Millstone Unit No. 3, which meets the criteria specified in Appendix B to NUMARC 87-00. The AAC source will be an EAC power source which meets the assumptions in Section 2.3.1 of NUMARC 87-00.

   The AAC power source will be available within 1 hour of the onset of the SBO event (please note our discussion on the distinction between Appendix R and SBO provided in Attachment No. 1, Part A.4) and will have sufficient capacity and capability to operate systems necessary for coping with an SBO for the required 8-hour SBO duration to bring and maintain the plant in safe shutdown. An AC independent coping analysis was performed for the 1 hour required to bring the AAC power source on line.

   In response to 10CFR50.63, a station electrical crosstie will be installed for SBO at Millstone Unit No. 3.

   The existing 4-kV electrical crosstie scheme between Millstone Unit No. 1 and Millstone Unit No. 2 will be extended to encompass Millstone Unit No. 3. This extended scheme will take credit for the availability of any one of the existing EAC sources, at either of the two nonblacked-out units, as an AAC in the event of SBO and will provide the Millstone Unit No. 3 with an AAC source fully meeting the intent of the SBO rule. Figure 3-A shows the one-line diagram for this modification.

B. Procedure Description

1. The following plant procedures AC power restoration have been reviewed and modified, as necessary, to meet the guidelines in NUMARC 87-00, Section 4.2.2:

   a. CONVEX Operating Instruction No. 006, "Restoration."

   b. CONVEX Operating Instruction No. 6913, "Millstone 15 G."

   c. CONVEX Operating Instruction No. 8601, "Millstone 345 kV

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(2) The actual average reliability for both EDGs combined for the last 100 demands is .98.

Substation Salt Decontamination."

d. TD 250, "Load Shedding and Interruptible Loads."

e. TD 503, "Transmission Line Patrols--Line Faults."

f. TD 506, "Transmission Line Emergency Patrols--Regional/Area Assistance."

2. The following plant procedure for SW has been reviewed and will be modified as necessary by August 31, 1989 to meet the guidelines in NUMARC 87-00, Section 4.2.1:

   AOP 3569, "Severe Weather Conditions."

3. The following plant procedures for SBO have been reviewed and procedure changes necessary to meet NUMARC 87-00, Section 4.2.1, within 1 year after NRC notification is provided in accordance with 10CFR50.63(c)(3) will be implemented:

   a. EOP 35 ECA-0.0, "Loss of All AC Power."

   b. EOP 35 ECA-0.1, "Loss of All AC Power Recovery Without SI Required."

   c. EOP 35 ECA-0.2, "Loss of All AC Power Recovery with SI Required."

4. Procedure changes associated with any modifications required after assessing coping capability per NUMARC 87-00, Section 7, have been reviewed.

   Modifications and associated procedure changes to install the crosstie feature at Millstone Unit No. 3 (described in Part C) are tentatively planned to be completed within 2 years after NRC notification is provided in accordance with 10CFR50.63(c)(3). No procedures changes are necessary, pending completion of the ventilation systems, as a result of the coping assessment.

C. <u>SBO Coping Assessment</u>

To install the proposed crosstie extension and thus provide for an AAC power source for Millstone Unit No. 3, the following hardware modifications are planned to be installed (see the attached one-line diagram in Figure 3-A) and associated procedure changes completed within approximately 2 years after NRC notification is provided in accordance with 10CFR50.63(c)(3):

1. Installation of a cable run from Bus 14H to the selected Millstone Unit No. 3 safety bus through an interlocking scheme to permit selection of either Bus 34C or 34D.

2. Addition of one circuit breaker each to both 4-kV Buses 34C and 34D. This installation will require the use of breaker switchgear extensions to both buses owing to space limitations.

3. Modification to the 14H bus protection scheme to use the bus differential relaying provided to enhance the overcurrent coordination.

All analyses will be completed to take credit for the availability of any one of the existing EAC sources, at either of the two nonblacked-out units, as an AAC source to the unit that is blacked-out.

In 1987, 4-kV Bus 14H was installed to provide crosstie capability between Millstone Unit No. 1 and Millstone Unit No. 2 as part of the 10CFR50.48 compliance effort. The existing procedures for safe operation of the crosstie will be expanded to include operation of the Millstone Unit No. 3 extension.

The AAC source will have the capacity and capability to power the equipment necessary to cope with a SBO in accordance with NUMARC 87-00, Section 7 (except for HVAC as discussed in the accompanying transmittal letter), for the required coping duration determined accordance with NUMARC 87-00, Section 3.2.5.

1. Condensate Inventory For Decay Heat Removal (Section 7.2.1)

   It has been determined as required by Section 7.2.1 of NUMARC 87-00 that 166,000 gallons of water are required for decay heat removal and cooldown over 8 hours. The minimum permissible condensate level for the demineralizer water storage tank per Technical Specifications provides 334,000 gallons of water, which provides a usable volume that exceeds the required quantity for coping with an 8-hour SBO.

   No plant modifications or procedure changes are needed to utilize this water source.

2. Class 1E Battery Capacity (Section 7.2.2)

   A battery capacity calculation has been performed pursuant to NUMARC 87-00, Section 7.2.2, and verifies that the Class 1E batteries have sufficient capacity to meet SBO loads for 1 hour.

3. Compressed Air (Section 7.2.3)

No air-operated valves are relied upon to cope with an SBO for 8 hours.

4. Effects of Loss of Ventilation (Section 7.2.4)

TO BE SUBMITTED MAY 30, 1989.

5. Containment Isolation (Section 7.2.5)

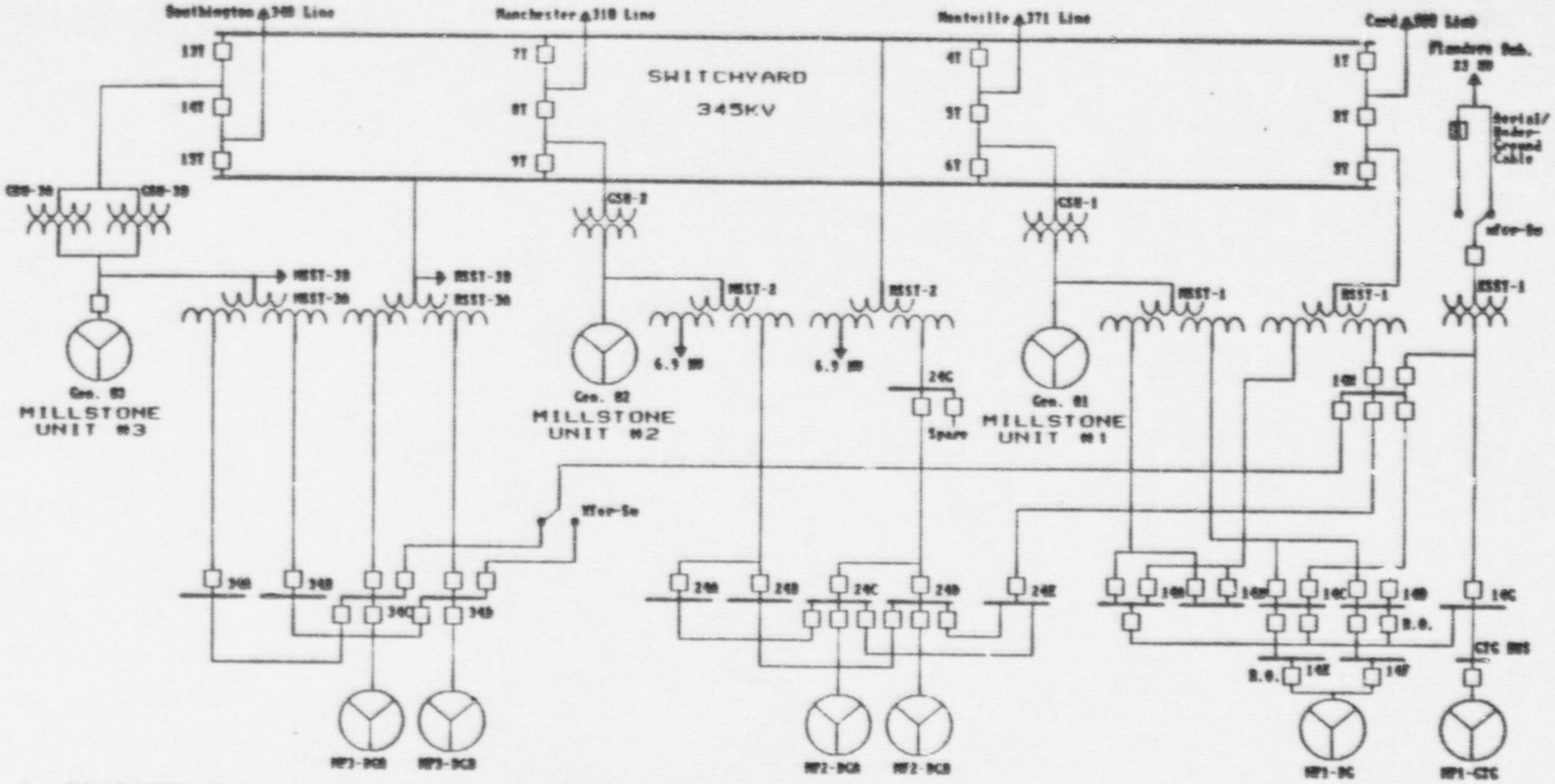
The plant list of containment isolation valves has been reviewed to verify that valves which must be capable of being closed or that must be operated (cycled) under SBO conditions can be positioned (with indication) independent of the preferred and blacked-out unit's Class 1E AC power supplies.

No plant modifications and/or associated procedure changes were determined to be required to ensure that appropriate containment integrity can be provided under SBO conditions.

6. Reactor Coolant Inventory (Section 2.5)

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

MILLSTONE STATION BLACKOUT ISSUE



1. PROPOSED CHANGES WOULD TIE IN ESST-1 AND MP-3 TO 4KV BUS 14H TO FACILITATE CONNECTION OF ESST-1 TO MP-2 & MP-3 AND ALLOW CROSS CONNECTION OF ANY OF THE SIX EMERGENCY GNEERATORS TO ANY ONE OF THE THREE UNITS

2. HARDWARE CHANGES WOULD REQUIRE A CABLE CONNECTION TO THE LOW SIDE OF ESST-1, A CABLE CONNECTION TO MILLSTONE UNIT 3, ONE ADDITIONAL CLASS 1E CIRCUIT BREAKER ON BOTH BUSES 34C & 34D AND AN INTERLOCKING TRANSFER SCHEME TO THOSE BUSES

PROPOSED DESIGN

Recloser

NSST Normal Station Service Transformer

RSST Reserve Station Service Transformer

ESST Emergency Station Service Transformer

R.O. Normally Racked Out Breaker

FIGURE 3-A

Docket Nos. 50-245
50-336
50-423
B13180

Attachment No. 4

Millstone Nuclear Power Station
Salt Spray Mitigation

April 1989

Salt Spray Mitigation

Although the Millstone Complex is located in an area susceptible to windblown salt spray under extreme severe weather conditions, the Millstone Nuclear Power Station is now less susceptible to damaging arcing and a loss of off-site power (LOOP) event related to salt contamination than in the recent past for the following reasons:

A. Lessons learned from the insulator salt contamination effects of Hurricanes Doria (1971), Belle (1976), Gloria (1985), and other less severe weather events, resulted in enhancement to all the 345-kV post type, 345-kV bushing type and distributing voltage porcelain through the installation of high creep insulators, as well as through thoroughly coating them with Sylgard, a sprayable room temperature vulcanized (RTV) silicone rubber coating. A project to coat all insulators with Sylgard is scheduled for completion in 1989.

   All 345-kV transmission line porcelain suspension disc insulator strings inside the Millstone Nuclear Power Station property boundary and up to two spans (approximately 1,500 feet) away from the 345-kV switchyard are being replaced with "Rodurflex," a high temperature vulcanized (HTV) silicone rubber insulator, to increase their capabilities to withstand contamination.

B. Several procedural changes have been implemented which are designed to ensure the Millstone Units are shutdown prior to any severe weather (e.g. hurricane) conditions. These procedures were successfully utilized and demonstrated during Hurricane Gloria.

C. An automatic pollution monitor (APM) consisting of an outdoor detector device, control panel, and recorder has been installed at the Millstone Nuclear Power Station to monitor salt contamination buildup. The APM detector includes a pilot insulator which is a small bare porcelain insulator. When the APM has detected that salt contamination has exceeded a predetermined level, the switchyard insulator washdown procedures will go into effect but not if the site is exposed to the effects of a hurricane. This may require a systematic de-energization of switchyard sections and transfer of all vital AC loads to the individual Unit on-site Emergency AC power sources. The range of this monitor has also been widened so that much higher salt contamination levels can be measured. Currently, the APM has a range of 0-0.25 mg/cm^2.

D. A new hydrant with dedicated hoses, four nozzles, washdown equipment (including an aerial bucket truck and portable grounds) has been installed in the 345-kV switchyard to wash the switchyard sections and plant insulators free from salt as soon as they are de-energized. This equipment will be stored in a new building within the switchyard.

NNECO believes that implementation of corrective actions since 1972 has systematically reduced the risk of insulation flashover damage and that consequently the potential for salt spray induced LOOP has been minimized. None of the replacement insulation replaced in 1972 and 1977 has ever flashed over during a subsequent salt spray event. A severe windblown salt spray event has not recurred since Hurricane Gloria and since the application of RTV.

Detailed Description of Salt Spray Enhancements

A. Approximately 182 station post insulators having standard creep of 231 inches were replaced by high creep (310 inches) station post insulators in 1972.

   Fifteen bushings were replaced with new bushings having higher high creep porcelain in 1977.

   Thirty-five coupling capacitor potential devices having standard insulation were replaced by high creep porcelain in 1977.

   Approximately 48 Cogenel assemblies and 24 current transformer bushings were replaced by high creep porcelain in 1977.

B. Two type ATB live tank power circuit breakers were replaced.

C. Twenty-three metal oxide (MOV) arresters were purchased to replace gap-type arresters on the Millstone Unit Nos. 1 and 2 transformers, the 6X spare transformer, and in the Millstone switchyard. All 23 MOV arresters were installed by the end of 1987. MOV arresters are not believed vulnerable to the internal failures that gap-type arresters have suffered within the industry, when subjected to external scintillations on contaminated porcelain. (Gap-type arresters failed during the 1976 and 1985 hurricanes). Also, the MOV arrester porcelain can endure roughly twice as much salt contamination without flashing over externally. The arrester porcelain was Sylgard coated in addition.

D. Trial application of Sylgard, a sprayable Room Temperature Vulcanized (RTV) silicone rubber coating (manufactured by Dow Corning), was successfully completed in early October 1986 on line-to-ground porcelain insulation of the 15G-9T-2 Cogenel breaker and its associated current-transformers. Prior to that, application experience was gained at distribution substations in Mystic and Stonington. In the first half of 1987 a coating of Sylgard was also applied to the 345-kV bushings of the spare main transformer now in service at Millstone Unit No. 1.

E. Procedures to facilitate de-energized washing were developed, including:

   1. Detailed switching instructions. (CONVEX Operating Instruction No. 8601--Millstone 345-kV Substation Salt Decontamination.)

2. Modifications of line and ground switch interlocking to permit closing of both during de-energized washing (reduces portable grounding needs, saving considerable time and effort).

3. Installation of more grounding studs.

4. Planned installation of six hydrants within the substation fence. In fact, only one hydrant was deemed practical and it has been installed.

5. Completion of a building (early 1989) in the switchyard to store equipment to facilitate washing.

6. Plans to use the wide range (0--0.25 mg/cm^2) automatic pollution monitor to provide intelligence on when to call for insulator washing.

F. In 1987-88, about 95 percent of the 345-kV porcelain insulation at the Millstone complex was coated with Sylgard (the remaining 5 percent will be completed during the Millstone Unit No. 1 outage scheduled for the Spring of 1989) and may be recoated, if necessary, on about a 10-year cycle. This action, together with the installation of MOV arresters to replace gap-type, will afford an increase in contamination withstand capability much larger than any achieved by previous porcelain upgrades. The increase is sufficient to withstand contamination levels more severe than analysis suggests may have occurred on site in the past. Testing at a high-voltage research center has demonstrated that a newly RTV coated multicone bus-support insulator performs substantially better than an uncoated insulator even after a ten-hour exposure to severe salt mist and arcing activity.

G. Transmission tie-line insulation and system transmission line insulation out to the second structures 1500 feet from the switchyard are being replaced (1988-89) with Rodurflex High Temperature Vulcanized (HTV) silicone polymeric compound insulators to maximize their contamination withstand capabilities. Contamination withstand capabilities matching that of an RTV-coated switchyard can be achieved by this action.

H. Portable washing capability and procedures for expediting that process will be maintained. This washing capability was an interim need during the long time it took to apply RTV to the insulation.

Application of Sylgard

The Sylgard RTV coating has been sold commercially for only a few years, but enjoys an ongoing 14-year record of successful field testing on over 50 transmission, distribution, and substation facilities; many in heavy contamination areas. This experience includes some severe salt-contamination environments. The manufacturer claims that Sylgard inhibits dry-band arcing by remaining water repellent even after long-term exposure to sunlight and weathering, corona, and contamination. This durable water repellency prevents the formation of continuous films of contaminated water on the insulator surface.

During NNECO's studies of RTV, user experts at Los Angeles Department of Water and Power, Pacific Gas and Electric Company, Florida Power and Light, Central Texas Power and Light, and Ontario Hydro were contacted. NNECO also met with the Dow Corning's scientist who developed Sylgard, and NNECO made a general presentation of NNECO's test program before a large group of international contamination experts associated with the IEEE Power Engineers Society's (PES) Working Group in insulator Contamination. All of the above have provided NNECO reasons to be encouraged about the successful application and long-life expectations (i.e., 10 years or more) of Sylgard in a variety of environments. Recoating will be necessary only when a significant loss of surface hydrophobicity becomes visually apparent; i.e., significant deterioration of water beading action.

During 1986, internationally recognized insulator contamination experts at the EPRI High Voltage Transmission Research Center (HVTRC) in Lenox, Massachusetts, under contract with NNECO, conducted a test program to further evaluate the RTV insulator coating. General Electric Company's Dr. Herman M. Schnieder, who is also the present Chairman of the large and distinguished IEEE PES Working Group on Insulator Contamination, was in charge of this program. Program tasks included field measurements and chemical analysis of "normal" contamination deposits at Millstone; measurement of the salinity of seawater at Millstone; tests to determine an efficient and effective way to artificially deposit relatively uniform salt deposits on an RTV-coated post insulator; flashover testing of Multicone post insulators, strings of high-leakage suspension disc insulators, and Cogenel breaker-support insulators (precontaminated) using the industry-accepted clean-fog technique in an indoor fog chamber; outdoor (natural humidity) flashover testing of the same precontaminated insulators; small-scale flashover tests using a fan-blown, salt-mist technique instead of the standard clean-fog technique; and a test demonstration of the 10-hour withstand of voltage stress and scintillation activity on contaminated insulators.

At the end of the test program, it was concluded, among other conclusions and recommendations, that:

A. High-voltage salt mist tests on Multicone insulators showed a dramatic improvement for RTV-coated units.

B. Comparison of a newly RTV-coated Multicone insulator with an uncoated insulator indicated substantially better performance for RTV coating event after a 10-hour exposure to mist.

C. RTV will improve the performance of other untested insulation to some degree and the weakest link (Cogenel) is significantly improved.

Conclusion

Based on the above information and the two volumes of supporting information that have been compiled to substantiate its validity, NNECO strongly believes the adverse effects of a salt spray event at the Millstone Nuclear Power Station have been significantly reduced. However, NNECO has voluntarily elected to install an AAC to demonstrate 10CFR50.63 compliance due to the safety benefits and desirability of AAC.