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Dominion®

June 30, 2015

U.S Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Serial No	15-297
NSSL/MLC	R0
Docket Nos.	50-336/50-423
License Nos.	DPR-65/NPF-49

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNITS 2 AND 3
LICENSE AMENDMENT REQUEST FOR REMOVAL OF SEVERE LINE OUTAGE DETECTION FROM THE OFFSITE POWER SYSTEM

Pursuant to 10 CFR 50.90, Dominion Nuclear Connecticut, Inc. (DNC) hereby requests amendments to Facility Operating License No. DPR-65 for Millstone Power Station Unit 2 (MPS2) and to Facility Operating License No. NPF-49 for Millstone Power Station Unit 3 (MPS3). The proposed amendments would revise the MPS2 and MPS3 Final Safety Analysis Reports (FSARs) to: 1) delete the information pertaining to the severe line outage detection (SLOD) special protection system, 2) update the description of the tower structures associated with the four offsite transmission lines feeding Millstone Power Station (MPS), and 3) describe how the current offsite power source configuration and design satisfies the requirements of General Design Criteria (GDC) -17, "Electric Power Systems" and GDC-5, "Sharing of Structures, Systems, and Components." The amendments also request Nuclear Regulatory Commission (NRC) approval of a new Technical Requirements Manual (TRM) requirement, "Offsite Line Power Sources," for MPS2 and MPS3. With one offsite transmission line nonfunctional, the TRM requirement would allow 72 hours to restore the nonfunctional line with a provision to allow up to 14 days if specific TRM action requirements are met.

Attachment 1 provides a description and assessment of the proposed amendments for MPS2 and MPS3. Attachments 2 and 3 provide the marked-up FSAR pages for MPS2 and MPS3, respectively. The new proposed TRM requirements for offsite line power sources for MPS2 and MPS3 are provided in Attachments 4 and 5, respectively.

Attachment 6 is a letter from ISO-New England which describes the ISO-New England Millstone Facility Out Guide. Due to ISO-New England Information Policy restrictions, if NRC desires to obtain this document for review, a request for this document must be made by the NRC and cannot be made by DNC for NRC. As stated in the ISO-New England letter, this proprietary document can be made available to the NRC upon a direct [written] request to ISO-New England.

To facilitate NRC's review of this LAR, the historical regulatory correspondence related to establishing the original design and licensing basis for the MPS3 offsite power sources is provided in Attachment 7.

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DNC has reviewed the three criteria set forth in 10 CFR 50.92(c) and determined that the proposed amendments do not involve a significant hazards consideration. The Facility Safety Review Committee has reviewed and concurred with the determinations herein.

Issuance of these amendments is requested by June 30, 2016 with the amendments to be implemented within 60 days after NRC approval.

In accordance with 10 CFR 50.91(b), a copy of this request is being provided to the State of Connecticut.

Should you have any questions in regard to this submittal, please contact Wanda Craft at (804) 273-4687.

Sincerely,

Mark D. Sartain
Vice President – Nuclear Engineering

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Mark D. Sartain, who is Vice President – Nuclear Engineering of Dominion Nuclear Connecticut, Inc. He has affirmed before me that he is duly authorized to execute and file the foregoing document in behalf of that Company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 30th day of June, 2015.

My Commission Expires: 12/31/16

Notary Public

CRAIG D SLY
Notary Public
Commonwealth of Virginia
Reg. # 7518653
My Commission Expires December 31, 2016

Commitments: None.

Attachments:

1. Evaluation of Proposed License Amendments (MPS2 and MPS3)
2. Mark-up of Proposed FSAR Changes (MPS2)
3. Mark-up of Proposed FSAR Changes (MPS3)
4. New Technical Requirement for Offsite Line Power Sources, For Information Only (MPS2)
5. New Technical Requirement for Offsite Line Power Sources, For Information Only (MPS3)
6. ISO-New England Millstone Facility Out Guide Letter
7. Historical Regulatory Correspondence Pertaining to MPS3 Offsite Power Sources

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ATTACHMENT 1

EVALUATION OF PROPOSED LICENSE AMENDMENTS

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNITS 2 AND 3

Evaluation of Proposed License Amendments

1.0 Summary Description

Pursuant to 10 CFR 50.90, Dominion Nuclear Connecticut, Inc. (DNC) hereby requests amendments to Facility Operating License No. DPR-65 for Millstone Power Station Unit 2 (MPS2) and to Facility Operating License No. NPF-49 for Millstone Power Station Unit 3 (MPS3). The proposed amendments would revise the MPS2 and MPS3 Final Safety Analysis Reports (FSARs) to: 1) delete the information pertaining to the severe line outage detection (SLOD) special protection system, 2) update the description of the tower structures associated with the four offsite transmission lines feeding Millstone Power Station (MPS), and 3) describe how the current offsite power source configuration and design satisfies the requirements of General Design Criteria (GDC) -17, "Electric Power Systems" (Reference 7.1) and GDC-5, "Sharing of Structures, Systems, and Components" (Reference 7.16). The amendments also request Nuclear Regulatory Commission (NRC) approval of a new Technical Requirements Manual (TRM) requirement, "Offsite Line Power Sources," for MPS2 and MPS3. With one offsite transmission line nonfunctional, the TRM requirement would allow 72 hours to restore the nonfunctional line with a provision to allow up to 14 days if specific TRM action requirements are met.

2.0 Proposed License Amendment

2.1 FSAR Changes to Reflect Modification of Tower Structures and Removal of SLOD

DNC proposes to revise the MPS2 and MPS3 FSARs to: 1) delete the information pertaining to the SLOD special protection system which was removed from service in December 2012, 2) update the description of the tower structures associated with the four offsite transmission lines feeding Millstone Power Station, and 3) describe how the current offsite power source configuration and design satisfies the requirements of GDC-17 and GDC-5. The proposed changes to the MPS2 and MPS3 FSARs are provided in Attachments 2 and 3, respectively.

2.2 New TRM Requirement for Offsite Line Power Sources

DNC proposes to add a new technical requirement, "Offsite Line Power Sources," to the MPS2 and MPS3 TRM. The TRMs would require that the four offsite transmission lines be functional when MPS output exceeds 1650 megawatts electric (MW_e) net. With one offsite line nonfunctional, the TRM requirements would allow 72 hours to restore the nonfunctional line with a provision to allow up to 14 days if specific TRM actions are met. Attachments 4 and 5 provide the new technical requirements for offsite line power sources for MPS2 and MPS3, respectively. Implementation of these technical requirements is contingent upon NRC approval of this license amendment request.

3.0 System Description and Background

MPS is a three unit site with two operating reactors. Millstone Power Station Unit 1 (MPS1), which received its provisional operating license on October 7, 1970, was permanently shut down on July 21, 1998. MPS2, which received its initial operating license on September 26, 1975, has a licensed reactor power output of 2700 megawatts thermal (MWt) with a gross electrical output of approximately 935 MWe. MPS3, which received its initial operating license on January 31, 1986, has a licensed reactor power output of 3650 MWt with a gross electrical output of approximately 1296 MWe.

3.1 Offsite Power System

The net electrical output of the main generators for MPS2 and MPS3 is delivered to a common 345 kV high voltage switchyard, which is located within the owner controlled area of the site. The MPS switchyard is designated as "Millstone 15G" by the transmission operator. The MPS switchyard consists of two 345 kV buses (A and B) and ten 345 kV circuit breakers arranged in a combination breaker and a half and double breaker-double bus switching arrangement. The switchyard interconnects four 345 kV transmission lines, two 345 kV tie lines to the MPS2 and MPS3 generator step-up (GSU) transformers, and two 345 kV tie lines to the reserve station service transformers (RSSTs). The MPS1 GSU transformer and RSST are no longer in service.

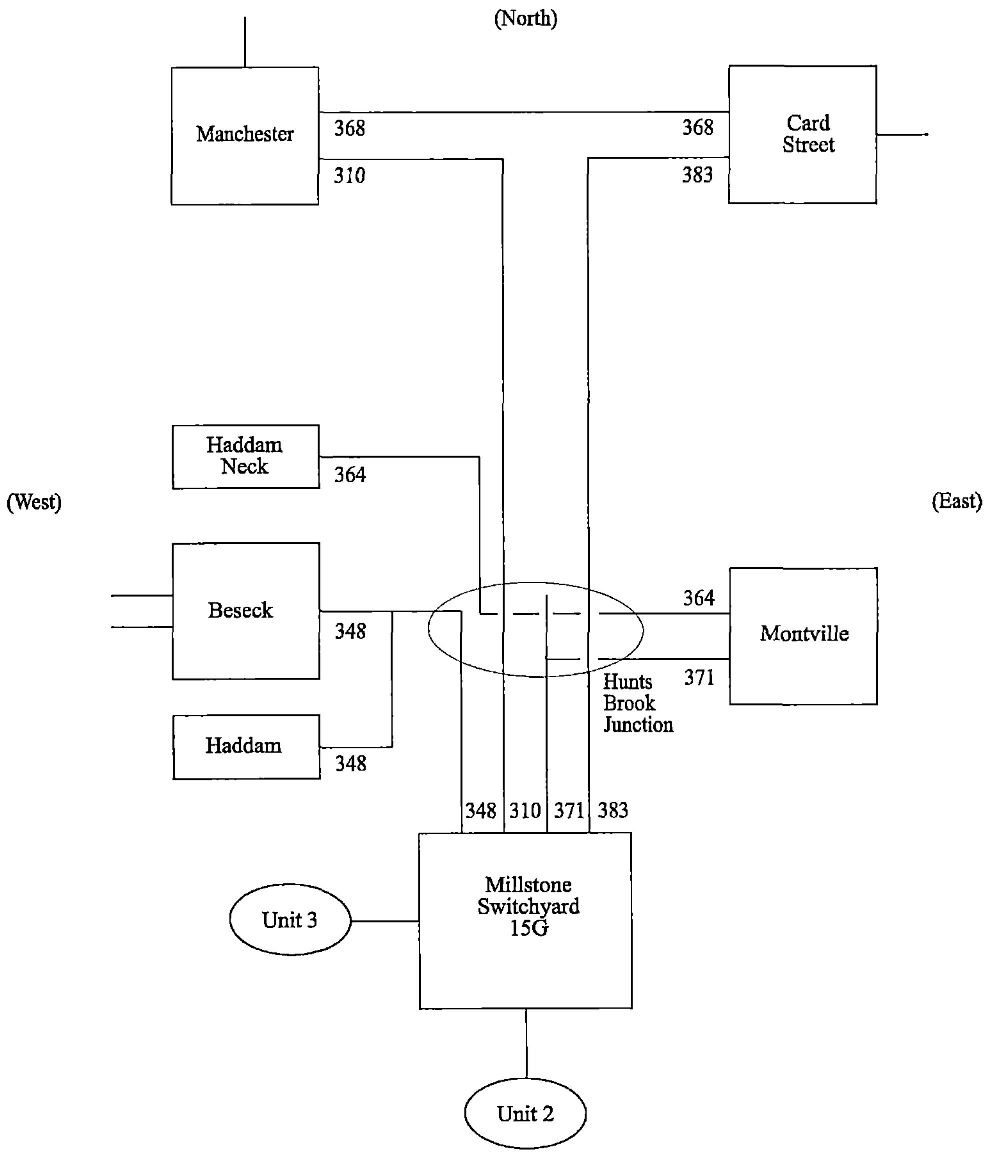
The four 345 kV transmission lines which comprise the MPS offsite power supply connect to the Eversource (formerly Northeast Utilities) 345 kV transmission network at four separate substations. Two of the four MPS transmission lines (designated as Lines 371 and 383) feed substations that serve the eastern part of Connecticut. The other two transmission lines (designated as Lines 348 and 310) feed substations that serve the central part of Connecticut. The four 345 kV transmission lines which terminate at the MPS switchyard are:

- Line Number 348: Millstone to Haddam and Beseck Substation
- Line Number 310: Millstone to Manchester Substation
- Line Number 371: Millstone to Montville Substation (Line Number 364: Montville Substation to Haddam Neck)
- Line Number 383: Millstone to Card Substation

The four 345 kV transmission lines (Lines 348, 310, 371, and 383) proceed north, in parallel, on a common Right-of-Way (ROW). After approximately nine miles, two of the four lines change direction (Line 371 turns east and Line 348 turns west) at the Hunts Brook Junction. Line 364, which proceeds east-west through Hunts Brook Junction, is considered part of Line 371 since it is the only other 345 kV line connected to the Montville Substation. Therefore, because of this condition, Line 371 is crossed over by Lines 383 and 310 at Hunts Brook Junction (See Figure 1).

Figure 1
Millstone Transmission System

Figure 1
Millstone Transmission System



Simplified Diagram of Millstone 345kV Transmission Lines

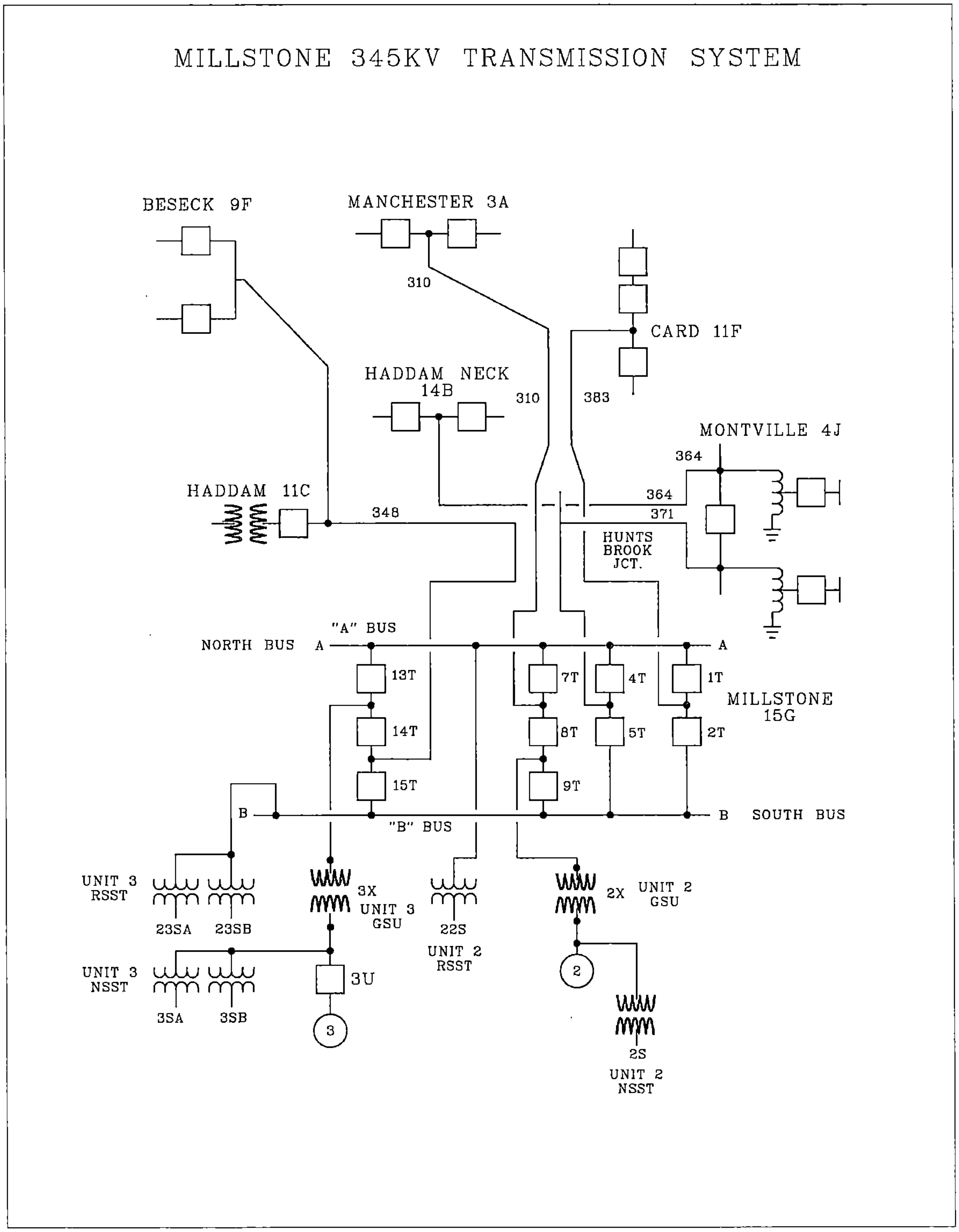
For MPS2, the preferred offsite power supply is the MPS2 RSST which is fed directly from the MPS switchyard. During normal operation, MPS2 station service loads are powered by the MPS2 Normal Station Service Transformer (NSST). The MPS2 RSST feeds power directly to the 4 kV safety-related buses (Buses 24C and 24D) and is available within eight cycles after a plant trip via the fast transfer scheme. The alternate offsite source is the 4 kV cross-tie to MPS3 via the non-safety-related 4 kV buses (34A or 34B) via manual controls. This power source directly feeds Bus 24E which can then be directed to either Bus 24C or 24D.

For MPS3, there are two physically independent transmission lines installed from the MPS switchyard to the onsite distribution system (safety buses). The preferred offsite power supply is the MPS3 NSST. The MPS3 NSST provides power directly to the non-safety-related 4kV buses (Buses 34A and 34B) which then directly feed the safety-related 4 kV buses through bus ties. This offsite connection through the NSST is immediately available after a plant trip. The alternate offsite source is the MPS3 RSST. The MPS3 RSST feeds power directly to the 4 kV safety-related buses (Buses 34C and 34D). This power source is available via transfer schemes after a plant trip, if the preferred offsite power source is not available.

The Independent System Operator (ISO) New England Millstone Facility Out Guide (Reference 7.20) represents the results of dynamic studies completed in accordance with North American Electric Reliability Corporation (NERC) reliability standards, Northeast Power Coordinating Council (NPCC) directories and ISO-New England procedures. The guide provides real-time guidance to posture MPS generation to maintain generator stability during a facility-out condition. The guide describes the limitations to MPS generation (MPS2 and MPS3) if there are two major elements (line + line, line + breaker, or breaker + breaker) out-of-service in the MPS switchyard. Additional potential contingencies are addressed continuously by ISO-New England and Connecticut Valley Electric Exchange which will drive MPS actions as appropriate.

A schematic of the MPS 345 kV transmission system is shown in Figure 2.

Figure 2
Millstone 345 KV Transmission System



3.2 Onsite Power System

The onsite power system for MPS2 is comprised of the MPS2 electric power systems out to, and including, the GSU transformers (which includes the MPS2 NSST). Similarly, the onsite power system for MPS3 is comprised of the MPS3 electric power systems out to, and including, the GSU transformers (which includes the MPS3 NSST).

The normal power systems for MPS2 and MPS3 include the equipment required to support the main turbine generator, plant systems, and equipment associated with the reactor. Normal operation for both units is when the main generator is transmitting electrical power through the GSU transformer bank and when plant auxiliaries are being supplied from the NSST.

The emergency systems at MPS2 and MPS3 include the electrical distribution equipment required to support the safe shutdown of the units and post-accident operations. Included in each unit's emergency system are two Emergency Diesel Generators (EDGs), 4 kV switchgear and extensions except those supplying the normal switchgear and RSST. Redundant safety-related loads are divided between trains so that the loss of either train does not impair fulfillment of the minimum shutdown safety requirements. There are no automatic connections between Class 1E buses and the loads of redundant trains.

The MPS2 EDGs supplying their respective 4 kV AC emergency bus receive an automatic start signal under either of the following conditions: 1) Engineered Safeguards Actuation System (ESAS) Level 1 Undervoltage actuation signal from the associated 4 kV AC emergency bus, 2) ESAS Safety Injection Actuation Signal (SIAS), or manually. For MPS3, EDGs are started on loss of power to the respective 4 kV bus to which each generator is connected, by a Safety Injection Signal, by a Containment Depressurization Actuation signal, or manually.

During certain design basis accidents for MPS2 and MPS3, the EDGs are designed to start, whether offsite power is available or not. For a loss of offsite power (LOOP) event, the EDGs will start and when rated voltage and frequency are met, power will be provided to the required safety loads. Additionally, failure of a single active component or train associated with one EDG does not result in the inability of the redundant EDG to provide emergency standby power. Each EDG is capable of producing enough power to supply its respective train.

Both MPS2 and MPS3 have the ability to cope with a loss of offsite power and emergency onsite alternating current (AC) power (defined as a Station Blackout (SBO) event) for up to eight hours. It is assumed that there will be no AC power available during the first hour of the SBO event except for battery-backed power supplies (i.e., vital 120V AC). In accordance with the SBO rule (Reference 7.2) and NUMARC 87-00 (Reference 7.3), only one Millstone unit will experience an SBO event at any one time. Therefore, following an SBO at one unit, at least one of the two EDGs would be available on the other unit.

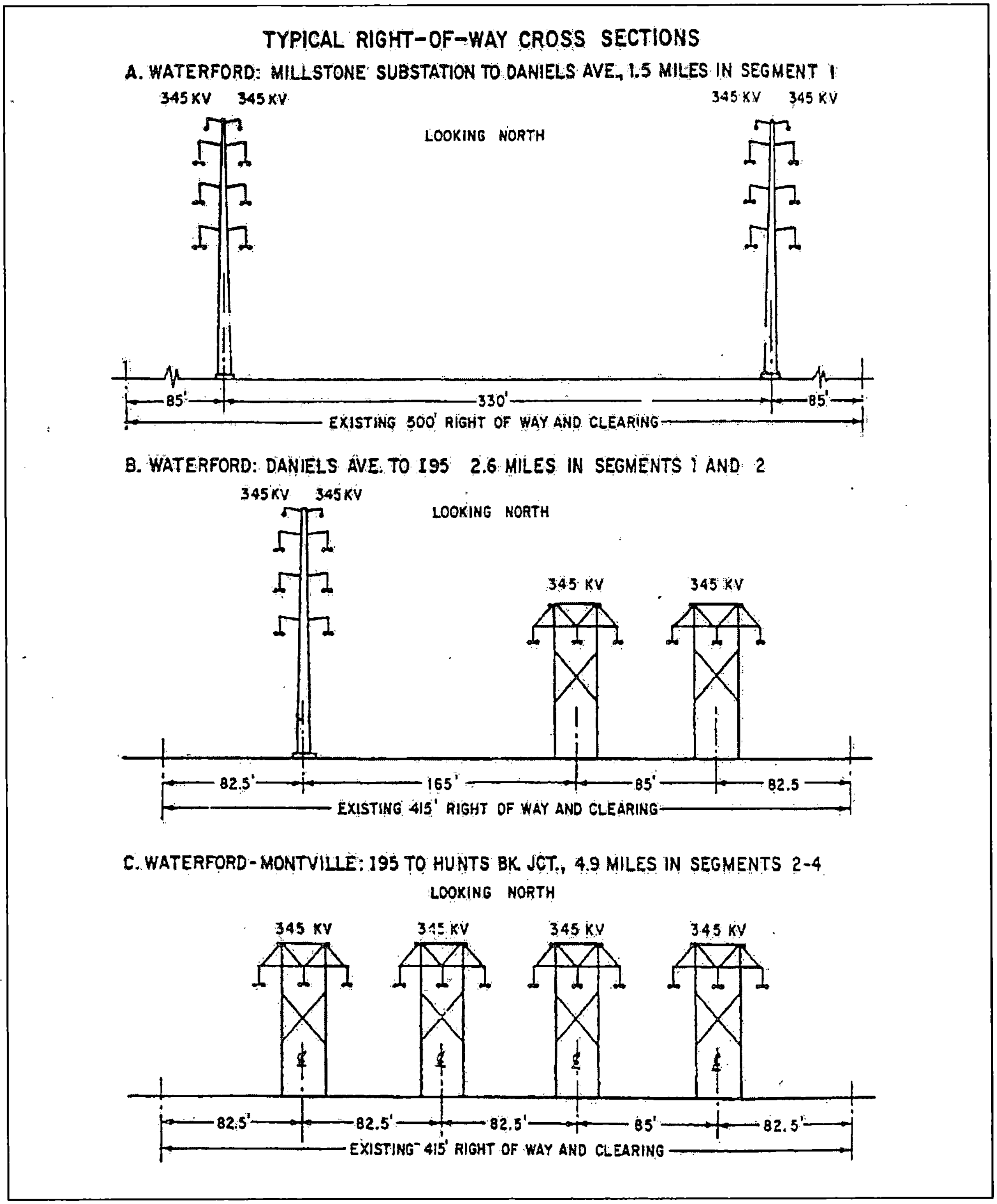
The alternate AC power source is comprised of the MPS3 SBO diesel generator and its support equipment, which is required to provide electric power to equipment necessary to maintain either unit in a safe condition. In the event of a MPS2 SBO, the MPS3 SBO diesel will be made available within one hour by MPS3 operator action and connected to MPS2 Bus 24E by MPS2 operator action.

3.3 Elimination of Double Circuit Towers and SLOD

At the time of initial MPS3 licensing, the four 345 kV transmission lines leaving the MPS switchyard followed a common ROW to Hunts Brook Junction. From MPS to Daniels Avenue, the four lines were routed on two double-circuit towers (DCTs) (i.e., two transmission lines sharing a common tower). From Daniels Avenue to Interstate 95, the lines were routed on one DCT and two single circuit towers (SCTs). A simplistic representation of the original DCT design is provided below in Figure 3.

Figure 3

Double Circuit Tower (DCT) Design



Northeast Power Coordinating Council (NPCC) Regional Reliability Reference Directory #1, "Design and Operation of the Bulk Power System" (Reference 7.4), requires a phase to ground fault on different phases of each of two adjacent transmission lines on multiple circuit towers be considered as a normal contingency in stability studies when using DCTs. The grid stability studies performed at the time of original licensing of MPS3 showed that with one 345 kV line out of service associated with one DCT, offsite stability would not be maintained with the loss of two 345 kV lines on the other DCT with MPS output greater than 1200 MWe.

To address the grid stability concerns with the DCT design during initial licensing of MPS3, Northeast Utilities installed SLOD to assist in minimizing the probability of coincident loss of both offsite supplies and loss of a nuclear power unit. The SLOD function was credited in both the MPS2 and MPS3 FSARs for GDC-17 compliance by ensuring offsite power was maintained to the MPS switchyard under certain scenarios (e.g., DCT faults).

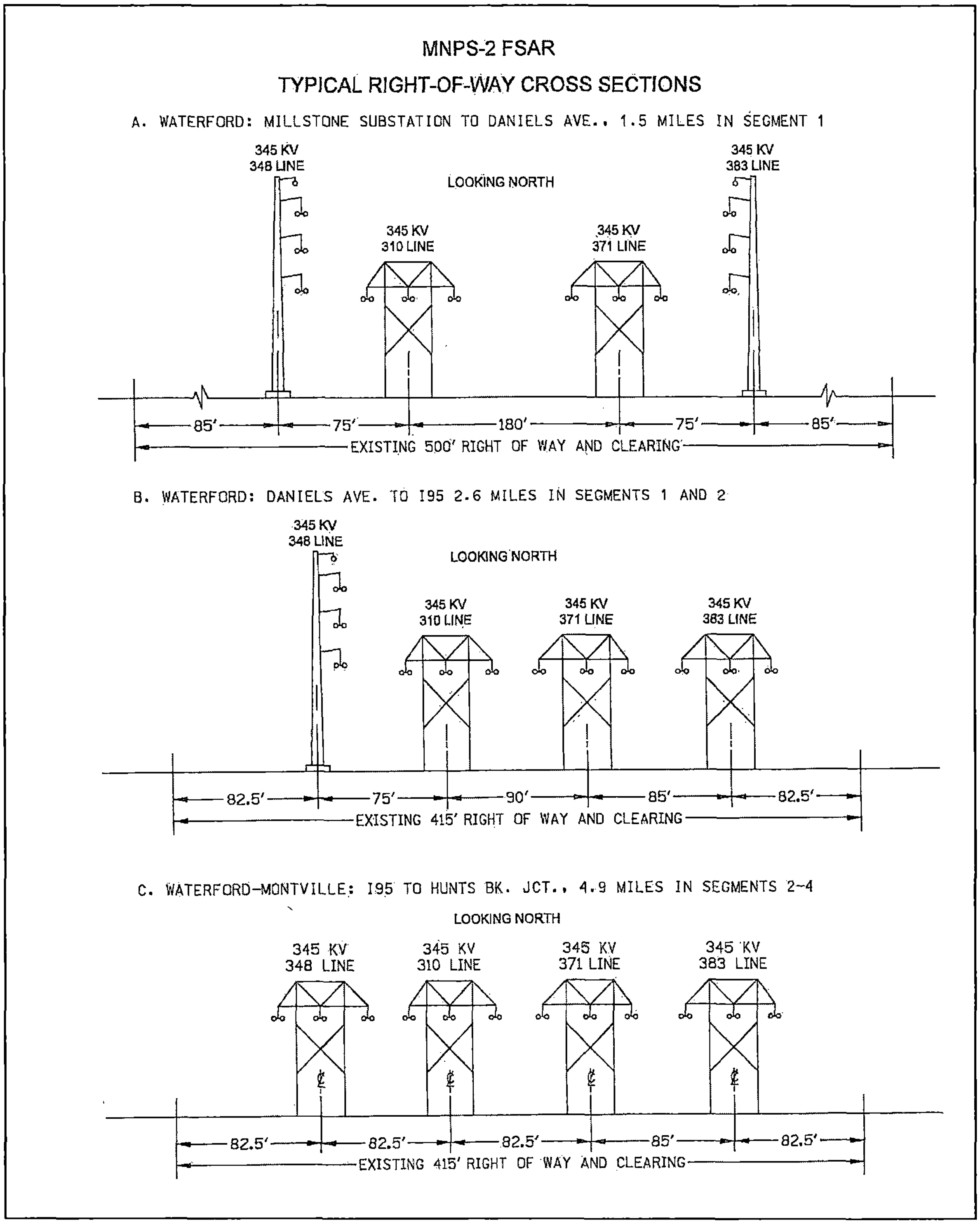
SLOD was also credited as an additional defense-in-depth feature for multiple circuit breaker failure scenarios associated with the 345 kV breakers in the MPS switchyard. The 345 kV switchyard is designed so that the loss of more than one transmission line due to failure of a breaker to trip requires at least two circuit breakers to simultaneously fail to operate. The failure of a single 345 kV breaker to trip when required is considered a highly unusual occurrence. SLOD was relied upon for protection in the unlikely event of three 345 kV breakers failing to operate simultaneously (see Northeast Utilities letter dated August 1, 1983 in Attachment 7).

In 2010, Northeast Utilities began the approval process for removal of SLOD and modification of the DCT design which was viewed by the transmission line owner and operator as an overall improvement to grid reliability. Although SLOD was designed as a NPCC Type I special protection system, over time the transmission system had evolved with new contingencies that SLOD would not detect. In addition, it was determined that SLOD could unintentionally arm as occurred in early 2011. As a result, Northeast Utilities obtained transmission regulatory approval to modify the transmission tower design from DCTs to SCTs and disable SLOD.

In December 2012, Northeast Utilities completed the portion of the project that modified the DCT design for the 345 kV transmission lines leaving MPS. Specifically, the modification entailed relocating one of the two 345 kV transmission lines from each of the two existing DCTs onto a new SCT so that each 345 kV transmission line was on its own separate transmission tower. In conjunction with modification of the DCT design, SLOD was also disabled. The transmission line configurations at each of the four substations and Hunts Brook Junction remained unchanged.

A simplistic representation of the new SCT design is shown in Figure 4.

Figure 4
Single Circuit Tower (SCT) Design



With modification of the DCTs to SCTs, ISO-New England no longer considered double line-to-line ground faults a normal contingency.

With the four transmission lines separated onto SCTs, Northeast Utilities considered leaving SLOD in service as an additional defense-in-depth measure. However, since SLOD created an unnecessary risk of misoperation and transmission operator burdens, Northeast Utilities decided to remove SLOD from service. Dominion agreed with this decision since it would eliminate a potential misoperation of SLOD which could inadvertently trip MPS3. Therefore, SLOD was removed to eliminate a special protection scheme, thereby improving station service grid reliability and operational safety.

3.4 Millstone Power Station LOOP Event

On May 25, 2014, a single fault on the transmission system, combined with a relay misoperation, resulted in a LOOP to MPS. The event was initiated when a motor-operated disconnect switch on Line 383 failed, causing the transmission line to trip. At the time of the event, Line 371 was out of service for a scheduled relay scheme upgrade. A line protection relay misoperation due to an incorrect relay setting on a third 345 kV line (Line 310) caused that line to trip, placing the entire MPS generating output on the last remaining transmission line (Line 348). Line 348 subsequently tripped because its relays experienced large swings in power and voltage as a result of the instability, ultimately causing the disconnection of station output from the grid and a complete LOOP to MPS.

In response to the May 25, 2014 dual unit trip and LOOP event, an NRC special inspection team (SIT) was dispatched to the station. After a comprehensive review of the sequence of events, equipment response, operator performance, and compliance with the NRC's rules and regulations, the NRC concluded that DNC should have performed a full 50.59 evaluation when eliminating SLOD and that removal of SLOD may have resulted in more than a minimal increase in the likelihood of occurrence of a malfunction of an SSC important to safety previously evaluated in the FSAR. Specifically, the SIT determined that DNC allowed a design change to the offsite power system (removal of SLOD), and failed to conduct a full 50.59 evaluation or provide a basis for the determination that the change did not require a license amendment in accordance with 10 CFR 50.59 (c)(2). The SIT concluded that the change may have resulted in more than a minimal increase in the likelihood of occurrence of an offsite power malfunction because the removal of SLOD decreased the reliability of the offsite power system, reduced the defense-in-depth, and disabled an automatic generator rejection function, which protected the offsite power sources during transients caused by grid-related conditions. The NRC team concluded that removal of SLOD contributed to the likelihood of a dual unit trip and LOOP to both units.

In a letter dated March 31, 2015 (Reference 7.5), in response to NRC's Notice of Violation (NOV), EA-14-126, dated August 28, 2014 (Reference 7.6), DNC committed to submit a LAR that: 1) describes the basis for continued compliance with GDC-17 after modifying the DCTs to SCTs and disabling SLOD, and 2) proposes changes to the

FSAR to reflect the currently installed configuration of the offsite power sources, including the modifications that replaced the DCT design with SCTs and removed SLOD. Additionally, DNC stated that the LAR would likely propose an AOT that would be applicable during the periods when a single offsite line is not in service (due to either an unplanned event or for planned maintenance activities on the transmission system) in conjunction with appropriate operational limitations designed to minimize the risk to the plant and maintain offsite grid stability. The submittal of this LAR is intended to meet the commitment made in the NOV response.

4.0 Technical Evaluation

4.1 FSAR Changes for Modification of Tower Structures and Removal of SLOD

Both MPS2 and MPS3 FSARs require revision to reflect modification of the 345 kV transmission line DCTs with SCTs and the removal of SLOD. Attachments 2 and 3 provide the marked-up FSAR pages for MPS2 and MPS3, respectively, to reflect the required changes.

FSAR Figures 8.1-1A (MPS2) and 8.2-1(MPS3) are being deleted since the DCT design has been modified to SCTs and they no longer provide useful information. The four lines are now on SCTs of various designs. Showing a simplified sketch of the various types of SCTs is unnecessary.

FSAR Figures 8.1-1B (MPS2) and 8.2-2 (MPS3), "Hunts Brook Junction," which were used to graphically display transmission line 364 crossing under transmission lines 383, 371 and 310, are being replaced with a more simplified block diagram which more clearly depicts the transmission line cross-overs at Hunts Brook Junction. Additionally, the current figures contain extraneous and outdated information (e.g., Connecticut Yankee is now decommissioned) that is either no longer relevant or not discussed in the FSARs.

The following discussion provides the basis for meeting GDC-17 and GDC-5 after the modification of DCTs to SCTs and removal of SLOD.

Compliance with GDC-17, Electric Power Systems

The intent of GDC-17 is to ensure electrical power is available to permit functioning of SSCs important to safety. GDC-17 invokes a number of requirements on both the onsite and offsite power systems (two connections from onsite to offsite power system, redundancy, single failure, reliability, etc.) to ensure this intent is met.

At the time of MPS3 licensing, Standard Review Plan (SRP) 8.1, "Electrical Power – Introduction," Revision 2, and SRP 8.2, "Offsite Power System," Revision 3, provided guidance for meeting the requirements GDC-17. Although the SRP was not in effect at the time of MPS2 licensing, DNC has used the guidance of the above mentioned SRP revisions to the extent possible (recognizing previous design commitments) for addressing compliance with the requirements of GDC-17 issued on February 20, 1971.

In later revisions of SRP 8.1 (i.e., Revision 4 - Reference 7.7) and SRP 8.2 (i.e., Revision 5 – Reference 7.8), the NRC provided staff interpretation of the SRP requirements for meeting GDC-17. The acceptance criteria provided in SRPs 8.1 and 8.2, for meeting the requirements of GDC-17, are the same. This approach to the SRP guidance was used as an aid to document how MPS meets the staff interpretation of GDC-17 with the modification of the DCTs to SCTs and the removal of SLOD.

Table 1 below summarizes each GDC-17 requirement, the NRC staff interpretation of each requirement in SRP 8.1 and SRP 8.2, and how MPS meets the NRC staff interpretation with the modification of the DCTs to SCTs and the removal of SLOD.

Table 1
Evaluation of Compliance with GDC-17 for Millstone Power Station

GDC-17	Staff Interpretation	Basis for Meeting GDC-17
Criterion 17-Electric Power Systems. An onsite electric power system and an offsite electric power system shall be provided to permit functioning of structures, systems, and components important to safety. The safety function for each system (assuming the other system is not functioning) shall be to provide sufficient capacity and capability to assure that (1) specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded as a result of anticipated operational occurrences and (2) the core is cooled and containment integrity and other vital functions are maintained in the event of postulated accidents.	a. Both an offsite and onsite power system shall be provided, each independent of the other and capable of providing power for all safety functions. (The offsite and onsite power systems considered together must meet the single failure criterion on a system basis without losing the capability to provide power for <u>all</u> safety functions. In addition, in view of the requirement (b) below, the two systems considered together must be capable of sustaining a complete loss of offsite power and a single failure in onsite system, without losing the capability to provide power for the <u>minimum required</u> safety functions.)	The offsite and onsite power systems continue to be independent of each other and capable of providing power for required safety functions. Modification of the DCTs to SCTs and removal of SLOD have no impact on the onsite power system. The current onsite systems, designed to detect a LOOP, start the EDGs and provide power to complete the required safety functions, remain unchanged and unaffected. There is no change to the independence between the onsite and offsite power systems. Both systems, considered together, continue to be able to provide power for the required safety functions assuming a complete loss of the offsite system and a single failure on the onsite system. Therefore, MPS continues to meet the Staff interpretation of this portion of GDC-17.

Table 1 Evaluation of Compliance with GDC-17 for Millstone Power Station		
GDC-17	**Staff Interpretation**	**Basis for Meeting GDC-17**
The onsite electric power supplies, including the batteries, and the onsite electric distribution system, shall have sufficient independence, redundancy, and testability to perform their safety functions assuming a single failure.	b. The complete onsite electric power system (Class 1E) must be capable of sustaining a single failure without loss of capability to provide power for the <u>minimum required</u> safety function.	Modification of the DCTs to SCTs and the removal of SLOD have no impact on the onsite power system (e.g., no onsite control system changes, no onsite loading changes). The onsite electrical power system, including the batteries, will continue to have sufficient independence, redundancy, and testability to perform their safety functions assuming a single failure without loss of capability to provide power for the minimum required safety function. Therefore, MPS continues to meet the Staff interpretation of this portion of GDC-17.
Electric power from the transmission network to the onsite electric distribution system shall be supplied by two physically independent circuits (not necessarily on separate rights of way) designed and located so as to minimize to the extent practical the likelihood of their simultaneous failure under operating and postulated accident and environmental conditions. A switchyard common to both circuits is acceptable.	c. The offsite system shall be comprised of two physically independent circuits connecting the transmission network (grid) to the onsite distribution system (safety buses). (Separate transmission line towers are required but common switchyard structures are acceptable. No requirement for meeting the single failure criterion and, in the absolute sense, this criterion cannot be met because there is only one power source, the grid.)	<u>MPS2</u> The MPS2 design provides two offsite circuits between the switchyard and the 4 kV Class 1E buses. The immediately available offsite supply is the MPS2 RSST and the alternate supply is the MPS3 bus 34A or 34B. The normal supply to MPS2 with the plant online is the NSST. If this source is lost due to a plant trip, a fast bus transfer scheme connects the plant electrical system (6.9 kV and 4 kV) to the RSST. A second or alternate source of offsite power is available by manual control of MPS3 bus 34A or 34B for 4 kV power to feed MPS2 bus 24E. Physical separation of the offsite power sources remain unchanged by the modification of the DCTs to SCTs and elimination of SLOD.

Table 1 Evaluation of Compliance with GDC-17 for Millstone Power Station		
GDC-17	Staff Interpretation	Basis for Meeting GDC-17
		<u>MPS3</u> The MPS3 design provides two immediate access offsite circuits between the switchyard and the 4 kV Class 1E buses. Within the switchyard, the tie-line terminations are separated electrically by two circuit breakers so that a fault on one offsite supply circuit along with a breaker failure does not cause the second offsite supply to be lost. The tie-lines are supported on separate structures with one circuit terminating at the GSU transformer dead-end tower and the second tie-line circuit terminating on the RSST dead end tower. The NSST and RSST are located on opposite sides of the unit. The connections from the NSST and RSST to the 4 kV Class 1E buses are via physically separate and electrically independent underground duct lines. The offsite source normally available immediately after a unit trip is from the GSU transformer and NSST. This source is not lost on a unit trip because the generator breaker effects the disconnection of the main generator from the grid, leaving the GSU transformer and NSST backfed from the switchyard. The second source of offsite power is available through an automatic transfer to the RSST. Therefore, MPS continues to meet the Staff interpretation of this portion of GDC-17.

Table 1
Evaluation of Compliance with GDC-17 for Millstone Power Station

GDC-17	Staff Interpretation	Basis for Meeting GDC-17
Each of these circuits shall be designed to be available in sufficient time following a loss of all onsite alternating current power supplies and the other offsite electric power circuit, to assure that specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded.	d. Each of the two required offsite power circuits shall be designed to be available in sufficient time to effect safe shutdown in the event of a loss of all onsite power and the loss of the other offsite circuit. (The staff has designated the second circuit as the "delayed access circuit." The offsite power system (i.e., the two circuits considered together) must meet the single failure criterion, but only with respect to the delayed access circuit function.)	Modification of the DCTs to SCTs and the removal of SLOD did not change the access design of either of the two offsite power circuit connections to the onsite power system for either unit. <u>MPS2</u> The design continues to provide two offsite circuits between the switchyard and the 4 kV Class 1E buses. The immediately available offsite supply is the MPS2 RSST and the alternate supply is the MPS3 bus 34A or 34B. There is no single failure that could impact access to both offsite circuits simultaneously. <u>MPS3</u> The design continues to provide two, physically separate, immediately accessible offsite circuits to the switchyard via the NSST and RSST. There is no single failure that could impact access to both offsite circuits simultaneously. Therefore, MPS continues to meet the Staff interpretation of this portion of GDC-17.
One of these circuits shall be designed to be available within a few seconds following a loss-of coolant accident to assure that core cooling, containment integrity, and other vital safety functions are maintained.	e. One of these circuits shall be designed to be available within a few seconds following a loss-of-coolant accident. (The staff has designated this circuit as the "immediate access circuit." Because only one such circuit is required, the offsite power system need not meet the single failure criterion with respect to its immediate access	Modification of the DCTs to SCTs and the removal of SLOD did not impact the immediate access of one offsite circuit. <u>MPS2</u> With the plant on line, the normal supply is the NSST. If this source is lost due to a plant trip, a fast bus transfer scheme connects the plant electrical system (6.9 kV and 4 kV) to the RSST. The second or alternate source of offsite power is available by manual control of

Table 1 Evaluation of Compliance with GDC-17 for Millstone Power Station		
GDC-17	**Staff Interpretation**	**Basis for Meeting GDC-17**
	function.)	MPS3 bus 34A or 34B for 4 kV power. <u>MPS3</u> Upon loss of power from the generator, the generator breaker is opened to ensure continuous power service to the safety-related buses (immediate access offsite power source). Upon loss of power from the NSST, an automatic transfer to the respective RSST is provided to ensure continuous power service to the 6.9 kV equipment and the 4 kV electrical systems (second access offsite power source). Therefore, MPS continues to meet the Staff interpretation of this portion of GDC-17.
Provisions shall be included to minimize the probability of losing electric power from any of the remaining supplies as a result of, or coincident with, the loss of power generated by the nuclear power unit, the loss of power from the transmission network, or the loss of power from the onsite electric power supplies.	f. Analyses (performed by the utility) must verify that the grid remains stable in the event of a loss of the nuclear unit generator, the largest other unit on the grid, or the most critical transmission line. (There is no specific requirement for meeting the single failure criterion. However, overlapping requirement (a) above requires the offsite/onsite power systems to meet this criterion on a system basis.)	The connections to the system were originally designed to comply with the NPCC "Basic Criteria for the Design and Operation of Interconnected Power Systems" and the "Reliability Standards for the New England Interconnected Power Pool" adopted by that Pool. These standards have been superseded by NPCC Regional Reliability Reference Directory #1 (Reference 7.4) and ISO-New England Planning Procedure No. 3 (Reference 7.9), respectively. Compliance with these standards ensures that the supply of offsite power is not lost following severe faults in the interconnected transmission system. Transient stability studies have been performed to verify that widespread or cascading interruptions of service do not

Table 1 Evaluation of Compliance with GDC-17 for Millstone Power Station		
GDC-17	**Staff Interpretation**	**Basis for Meeting GDC-17**
		result from these contingencies. In addition, the loss of MPS2, MPS3, or any other generating plant in the system does not result in cascading system outages and thus does not cause a LOOP to the units. Use of DCTs for the 345kV transmission lines leaving MPS, required ISO-New England planning to consider double circuit faults. While two circuits were installed on the DCTs, SLOD was installed to resolve concerns with grid stability. After elimination of the DCT tower configuration, ISO-New England no longer considered double circuit faults a normal contingency and therefore concluded that the automatic action performed by SLOD was no longer necessary to ensure grid stability. Within the approximate 9-mile ROW for the 345 kV transmission lines leaving the MPS switchyard, there are several points where a single transmission tower is in close enough proximity to affect adjacent towers in the event a tower was to fall. In addition, at Hunts Brook Junction, the Line 371/364 path is crossed over by Lines 383 and 310. The failure of one 345 kV line causing the failure of another 345 kV line is not considered a normal contingency by ISO-New England, but the lines are in close enough proximity such that the failure of one line could impact another line. The above scenarios are not normal contingencies for ISO-New England and single failure is not required to be applied to the transmission system.

Table 1 Evaluation of Compliance with GDC-17 for Millstone Power Station		
GDC-17	Staff Interpretation	Basis for Meeting GDC-17
		Therefore, MPS continues to meet the Staff interpretation of this portion of GDC-17.

Based on the evaluation provided above, DNC meets GDC-17 requirements with the modification of DCTs to SCTs and removal of SLOD. The basis is summarized below.

- The modification of the DCTs to SCTs and removal of SLOD does not affect the onsite power system or the two physically separate connections from the onsite power system to the offsite power system.
- The capability of the onsite and offsite power systems to provide the required power to perform their required safety functions remain unchanged from that previously evaluated.
- Even with one 345 kV line out of service and a single failure affecting one additional transmission element (line, breaker, generator, etc.), the ISO-New England Millstone Facility Out Guide shows the offsite system will remain stable.

In addition, since initial licensing of MPS3, there have been many upgrades to the offsite transmission system to make the grid more reliable (e.g., switchyard breaker replacements, disconnect switch replacements, substation transformer replacements).

Compliance with GDC-5, Sharing of Structures, Systems and Components

GDC-5 requires that SSCs important to safety shall not be shared among nuclear power units unless it can be shown that such sharing will not significantly impair their ability to perform their safety functions, including, in the event of an accident in one unit, an orderly shutdown and cooldown of the remaining units.

The offsite power system switchyard is common to both MPS2 and MPS3. This configuration was evaluated during the initial licensing of MPS3 and determined to be acceptable to the NRC.

In order for MPS2 to meet its GDC-17 requirements for an alternate offsite source, the following MPS3 equipment may be utilized: GSU transformer, NSST, and RSST. The modification of the DCTs to SCTs, and removal of SLOD, does not impact the above MPS3 component's ability to provide an alternate offsite power source to MPS2.

In addition, the radioactive gaseous waste system discharge stack is shared between MPS1, MPS2, and MPS3. The modification of the DCTs to SCTs and removal of SLOD has no impact on the radioactive gaseous waste system discharge stack ability to perform its function.

Removal of SLOD from 345 kV Breaker Failure Scenarios

As stated in the MPS2 and MPS3 FSARs, breaker failure relays are provided for each of the 345 kV circuit breakers. These relays are designed to trip adjacent breakers in the event that the primary breaker fails to trip. The direct current (DC) power for breaker failure operation is supplied from the backup battery system.

A breaker failure timing relay is initiated every time a main breaker is ordered to trip by either the primary or backup relays. If the breaker has not tripped before the time period has expired, tripping of the adjacent breakers takes place.

The MPS 345 kV circuit breakers have mechanically independent poles and two separate methods of tripping. These installations include two sets of relays and trip coils. There are two sets of current and potential transformers, the wiring for the relay packages are installed in separate duct banks, the relay packages are physically separated in the control house and two separate DC supplies are provided.

Sufficient redundancy is provided in the 345 kV breakers to ensure they reliably isolate a transmission line in the event of a fault. At least three 345 kV breakers would be required to fail-to-trip before three transmission lines would be lost. Failure of a single 345 kV breaker to trip, when required, is considered highly unusual, therefore, having three 345 kV breakers failing to trip simultaneously, is unlikely. As a result, DNC considers that eliminating SLOD as a defense-in-depth measure for maintaining grid stability has a minimal impact on overall grid reliability.

4.2 New Technical Requirement for Offsite Line Power Sources

DNC proposes to add a new technical requirement, "Offsite Line Power Sources," to the MPS2 and MPS3 TRMs. The proposed new TRM requirements for MPS2 and MPS3 are provided in Attachments 4 and 5, respectively. The TRMs would be revised to improve operational safety margin and minimize risk to the plants. The TRMs would require that the four offsite transmission lines be functional when MPS output exceeds 1650 MW_e net. With one offsite line nonfunctional, the TRM requirements would allow 72 hours to restore the nonfunctional line with a provision to allow up to 14 days if specific TRM action requirements are met.

The DCT configuration led to installation of the SLOD special protection system during the original plant licensing for MPS3. The SLOD system was designed to automatically trip MPS3 if three transmission lines were lost and thus, maintain stability of the offsite power supply to MPS. Although SLOD was installed during initial licensing of MPS3 to

address overall grid stability, this special protection system also created the potential for an inadvertent reactor trip of MPS3, if it spuriously actuated. Therefore, SLOD was disabled by Northeast Utilities in 2012 following modification of the DCT design to SCTs. With the four 345 kV transmission lines each on a separate tower and SLOD disabled, DNC considered the likelihood of a double line-to-ground fault causing a loss of offsite power or the potential inadvertent tripping of MPS3, was reduced.

The proposed TRM Action a.1 would allow 72 hours with one offsite line removed from service (i.e., nonfunctional). This 72-hour AOT is conservatively based on the loss of one offsite line being equal to the risk of losing one onsite connection to the offsite power system (i.e., TS 3.8.1.1).

The proposed TRM Action a.2 would contain a provision to allow up to 14 days if specific action requirements are met. The 14-day AOT, along with the proposed action requirements, will reduce the likelihood of a LOOP event by minimizing the time that a double circuit failure scenario can result in grid instability and therefore, improve operational safety margin. The 14-day AOT will reduce the risk of a plant perturbation as a result of having to downpower the unit for short duration line outages.

The proposed new TRM requirements for MPS2 and MPS3 are based on a deterministic/qualitative analysis and will rely on both defense-in-depth and configuration management measures. Three elements provide the basis for the new TRM requirements and provide a high degree of assurance of the capability to provide power to the safety related electrical buses when one of four 345 kV transmission lines is out of service. The elements are (1) a traditional engineering analysis, (2) avoidance of plant configurations that could degrade defense-in-depth using appropriate action requirements, and (3) continued implementation of the Configuration Risk Management Program (CRMP) to aid in identification of configurations that could degrade defense-in-depth while the line is out of service.

Element 1 - Traditional Engineering Analysis

The New England Bulk Power System is comprised of various interconnected member utilities with several connections to neighboring power systems. Power generation and transmission within the six-state power system is overseen by ISO-New England. The system includes MPS and the four 345 kV transmission lines which terminate at the MPS switchyard.

The MPS offsite transmission lines are designed and operated in accordance with the ISO-New England Planning Procedure No. 3, "Reliability Standards for the New England Area Bulk Power Supply System" (Reference 7.9) and NPCC's Regional Reliability Reference Directory #1, "Design and Operation of the Bulk Power System" (Reference 7.4). The purpose of these New England reliability standards is to ensure the reliability and efficiency of the New England bulk power system.

North American Electric Reliability Corporation (NERC) Reliability Standard NUC-001-2.1, "Nuclear Plant Interface Coordination" (Reference 7.10) requires each nuclear plant

generator operator and its associated transmission entities to establish nuclear interface agreements that document the applicable Nuclear Plant Interface Requirements (NPIRs) for the purpose of ensuring nuclear plant safe operation and shutdown. These NPIRs include the following requirements:

- Maintain real-time voltage at the MPS switchyard at or above 345 kV and below 362 kV in order to ensure safe shutdown capability for MPS.
- Coordinate and plan in real-time the outage of any transmission line serving as an offsite power source for MPS.

ISO-New England has performed grid stability studies based on a number of different contingencies. These stability studies show that with three 345 kV lines available and the loss of either MPS2, MPS3, the largest other unit on the grid, or the most critical transmission line, the grid will remain stable and offsite power will be available to MPS.

During the initial licensing of MPS3, the cross-over of lines at Hunts Brook Junction and the DCTs installed within the common ROW north of the MPS switchyard were identified as concerns. The DCTs have been replaced with SCTs, however, the concern regarding the cross-over of lines at Hunts Brook Junction remain. The approximate 9-mile ROW between MPS and Hunts Brook Junction was recently walked down to identify any circuit towers/lines in close enough proximity to allow potential interaction (Reference 7.11). This walkdown identified the following areas of concern:

- <u>Proximity of Two Lines</u> - At four ROW locations, the spacing separation of two of the independent lines are close enough to enable certain types of limiting line-drop type single failures to impact an adjacent line.

  Within the approximately 9-mile ROW going north of the MPS switchyard, there are four AC circuit conductor locations where two lines are supported from different towers in close proximity (horizontal clearance less than about 40 feet) with one line supported at a higher vertical location (vertical clearance more than 40 feet). This combination of horizontal proximity and support at different vertical heights could potentially allow a dropped or broken conductor from one line to contact a conductor on an adjacent line assuming conditions with sufficient wind velocity and direction (Reference 7.12).

- <u>Line Cross-Overs</u> - At three specific ROW locations, transmission lines cross-overs exist which enable a limiting line-drop type single failure to also impact an adjacent line.

  There are three locations of AC circuit conductor crossovers at Hunts Brook Junction. There are two failure modes for conductors and shield wires that could allow them to fall onto a lower line. If an insulator or cross arm on the support tower on either side of the crossing span were to fail, the conductor or shield wire could drop onto the second line. If a conductor or shield wire were to break within

the crossing span, the broken conductor or shield wire could drop onto the second line.

- Tower Failures - There are a number of locations where circuit towers are in close proximity such that the failure of one tower could impact another tower.

  There are various locations within the ROW where one tower is in close enough proximity to affect another tower in the event of total failure. The transmission towers which support the four 345 kV transmission lines are designed to the National Electric Safety Code, Part C2 and consist of a combination of steel and wooden mono-pole structures, and steel and wooden H-frame structures.

NERC reliability standards do not consider a SCT or line failure affecting another tower or line (regardless of proximity) as a normal contingency. Therefore, ISO-New England stability/transient studies do not assume simultaneous phase-to-ground faults impacting two 345 kV transmission lines when each line is on its own separate tower.

Since DCTs no longer support any of the four 345 kV transmission lines leaving MPS, ISO-New England only considers normal contingencies in the stability/transient studies. The stability/transient studies conclude that with one 345 kV transmission line out of service, the loss of either MPS2, MPS3, the largest other unit on the grid, or the most critical transmission line, the grid will remain stable and offsite power will be available to MPS. Therefore, ISO-New England does not require MPS to reduce power output in order to maintain offsite power stability when only one of the four 345 kV transmission lines is out of service.

DNC takes a more conservative approach in addressing these limiting areas of concern that could potentially cause the loss of two 345 kV lines due to a single failure. DNC conservatively considers that when less than four 345 kV transmission lines are in service, a degradation of safety margin and defense-in-depth has occurred. Therefore, DNC is proposing to establish appropriate requirements in the TRMs that are applicable whenever MPS output exceeds 1650 MW_e net and any one of the four 345 kV transmission lines is out-of-service (i.e., nonfunctional).

Basis for Applicability when Station Output Exceeds 1650 MWe Net

ISO-New England has performed stability studies which conclude that when two 345 kV lines are in service, the transmission system will remain stable assuming the additional loss of a third 345 kV line (leaving only one 345 kV line connected to the Millstone switchyard) as long as Millstone Station electrical output is less than the value provided in Millstone Facility Out Guide-Text Document.

Table 1 in the Millstone Facility Out Guide indicates MPS electrical output, with any two transmission lines out-of-service, must be maintained below the specified limit. There would be no required power reduction request from ISO-New England if MPS output is less than 1650 MW_e net for any combination of two transmission lines out-of-service.

Basis for 14-Day Allowed Outage Time

The 14-day AOT was selected based on the following:

- The AOT is consistent with the 14-day AOT in Technical Specification 3.8.1.1 for one inoperable EDG for MPS2 and MPS3.
- A 14-day AOT is prescribed for offsite power sources in Branch Technical Position 8-8 (Reference 7.15).
- Given expected frequency and consequences of system challenges, limiting the offsite line AOT to 14 days, along with the proposed TRM action requirements, reduces the likelihood of a LOOP event by minimizing the time that a double circuit failure scenario can result in grid instability and therefore, improves operational safety margin.
- Transmission line outage data shows that establishing a 14-day AOT minimizes the likelihood of having to maneuver the units due to planned and unplanned line outages.

Therefore, establishing TRM requirements that allow up to 14 days of full power operation when any one of the four 345 kV transmission lines is out of service is considered reasonable. The defense-in-depth analysis and historical transmission line data review is provided below.

Defense-in-Depth Analysis

1. System redundancy, independence, and diversity are maintained commensurate with expected frequency and consequences of system challenges.

   The ISO-New England Millstone Facility Out Guide concludes that with one 345 kV transmission line out of service and one additional transmission system element failure (line, breaker, generator, etc.), the offsite power system will remain stable. Based on failure history, limiting the offsite line AOT to 14 days, along with the proposed TRM action requirements, reduces the likelihood of a LOOP event by minimizing the time that a double circuit failure scenario can result in grid instability and therefore, improves operational safety margin.

2. Defenses against potential Common Cause Failures (CCF) are maintained and potential for introduction of new CCFs mechanisms are assessed.

   Removal of one 345 kV transmission line minimally increases the potential for a LOOP event; however, this is not a new CCF. The proposed TRM requires an initial weather assessment when using the 14 day AOT and then once per shift

thereafter. This requirement reduces the likelihood of a single failure causing the concurrent loss of two additional 345 kV transmission lines.

3. Independence of physical barriers is not degraded.

   There are four connections (two per unit) between the onsite and offsite power systems. The physical barriers separating these four connections remain unchanged when one 345 kV transmission line is removed from service.

4. Defenses against human errors are maintained.

   By establishing an AOT of 14 days, historical data indicates that the number of plant maneuvers due to planned and unplanned transmission line outages will be minimized, thereby minimizing the potential for human error.

5. The intent of plant design criteria is maintained.

   The ISO-New England Millstone Facility Out Guide concludes that with one 345 kV transmission line out of service, the loss of either MPS2, MPS3, the largest other unit on the grid, or the most critical transmission line, the grid will remain stable and offsite power will be available to MPS.

Historical Transmission Line Data Review

DNC reviewed Eversource data for the four 345 kV transmission lines leaving MPS. This data includes: transmission line disturbances from 2005 through May 1, 2015, forced transmission line outages from 2005 through August 2014, and planned transmission line outages from 2009 through May 3, 2015 (Reference 7.13).

A review of the disturbance data for the four 345 kV transmission lines leaving MPS showed that most line failures were due to bird fouling, and caused only a momentary loss of the transmission line. There was one conductor failure; however, it did not occur in an area of concern and did not affect two lines. There were three insulator failures, two of which caused significant line outage durations. However, none occurred in an area of concern where two lines could be affected.

There were only two events which caused multiple 345 kV transmission line failures. One event was Hurricane Sandy during which three momentary losses occurred (two momentary losses of Line 383 at slightly different times and one momentary loss of Line 310). None of these interruptions occurred concurrently. An action requirement, intended to minimize the potential for this failure mechanism, has been included in the proposed TRM requirements which are described below. Specifically, TRM Action a.2.b would require MPS2 and MPS3 to perform an initial weather assessment for the scheduled transmission line outage duration and then once per shift thereafter. If an assessment predicts adverse or inclement weather will exist while the offsite line is nonfunctional (i.e., out of service for planned maintenance), total

station output would be reduced to the limiting value associated with the loss of one additional line in accordance with the Millstone Facility Out Guide stability operating limits, prior to arrival of the adverse or inclement weather.

The second event was the May 25, 2014 dual unit trip and LOOP event. The cause of this event was not due to transmission line failures. Rather, the cause was related to a human performance error associated with a protective relay setting at an offsite location. The cause was corrected as part of the corrective actions to prevent recurrence for the May 25, 2014 dual unit trip and LOOP event (Reference 7.14). These corrective actions are summarized below:

- Conducted a comprehensive study of the Northeast Utilities 345KV transmission protection systems to determine if other relay setting vulnerabilities exist due to incomplete consideration of the mutual coupling effect.

- Implemented a Northeast Utilities Transmission Lessons Learned document to emphasize the importance of considering the effects of mutual coupling when setting ground instantaneous over current (IOC) elements.

- Performed a comprehensive review of relay settings associated with the 345 kV transmission lines connected to Millstone 15G and issued, implemented and tested revised settings which specifically include: 1) Permanently disabling the ground IOC elements for the line terminals at Millstone 15G and remote terminals of Lines 310, 371, and 383. 2) Permanently disabling the ground IOC elements for both line terminals of the 364 line. 3) Re-enabling the ground IOC elements at the 348 line remote terminals only upon a line relay loss of potential condition.

The data showed there were no tower failures during this time period (from 2005 through May 1, 2015).

Between 2005 and May 1, 2015, there were a total of 36 transmission line disturbances, 13 of which occurred when MPS output was less than 1650 MW_e net (i.e., one Millstone unit was in an outage). Of the remaining 23 disturbances, only one was greater than 3 days in duration (i.e., during the May 25, 2014 LOOP event).

Between 2005 and August 2014, there were seven forced transmission line outages, two of which occurred when MPS output was less than 1650 MW_e net (i.e., one Millstone unit was in an outage). None of the forced outages were greater than three days in duration.

Between 2009 and May 3, 2015, there were a total of 67 planned transmission line outages, 22 of which occurred when MPS output was less than 1650 MW_e net (i.e. one Millstone unit was in an outage). Of the remaining 45 planned outages, 12 were greater than three days in duration (this does not include the transmission line outage from the May 25, 2014 LOOP event).

Based on these durations and a 72-hour AOT, plant operators would have been required to maneuver the reactor (or plant equipment) a total of 12 additional times between 2009 and May 2015 (Note: During this time period there was only one line outage greater than 14 days.). Implementation of the proposed TRM requirements, which would allow a single line to be out of service for up to 14 days, minimizes the likelihood of having to maneuver the units due to planned and unplanned line outages.

Element 2 - Avoidance of Plant Configurations that Could Degrade Defense-in-Depth Using Appropriate Mitigating Measures

The following TRM action requirements are proposed to ensure defense-in-depth is maintained during the 14-day AOT when one 345 kV offsite transmission line is out of service. These action requirements are intended to minimize the likelihood of a LOOP event by ensuring that 1) the remaining 345 kV lines will remain functional during the period of planned maintenance, 2) appropriate actions will be taken to minimize the potential for a adverse or inclement weather conditions event to impact grid reliability, and 3) AC power will be available to support safety-related equipment in the unlikely event of a LOOP when a 345 kV line is out of service. Specifically, the proposed action requirements are:

- Once per shift, verify the remaining offsite lines to the Millstone Switchyard are FUNCTIONAL.
- Perform an initial weather assessment for the expected line outage duration and then once per shift thereafter.
- Within one hour prior to or after entering this condition, verify that the EDGs are OPERABLE and the Millstone Unit 3 SBO diesel generator is available and at least once per 24 hours thereafter.

The basis for each TRM action requirement is discussed below.

TRM Action Requirement a.2.a

"Once per shift, verify the remaining offsite lines to the Millstone Switchyard are FUNCTIONAL.

Basis:

This action requires that Millstone contact Eversource once per shift to verify there are no known issues that could threaten the reliability of the remaining 345 kV transmission lines. This requirement increases confidence that the remaining 345 kV lines will remain functional during the planned outage of the affected 345 kV line.

TRM Action Requirement a.2.b

"Perform an initial weather assessment for the scheduled line outage duration and then once per shift thereafter. If the assessment predicts adverse or inclement weather conditions will exist while the offsite line is nonfunctional (i.e., out-of-service), reduce total station output to the limiting value associated with the loss of one additional line in accordance with the Millstone Facility Out Guide stability operating limits, prior to arrival of the adverse or inclement weather."

Basis:

The transmission towers which support the four 345 kV lines are designed to the National Electric Safety Code, Part C2 and consist of a combination of steel and wooden mono-pole structures, and steel and wooden H-frame structures.

Accordingly, a review of the transmission tower design requirements and anticipated weather patterns at MPS provide reasonable assurance that the towers will withstand typical weather conditions, except severe conditions such as hurricanes and tornadoes.

A review of Eversource data for unplanned MPS 345 kV transmission line outages from 2005 to May 1, 2015 (Reference 7.13) confirms there have been few weather-related offsite line outages. There were five weather-related events; two due to lightning and three due to Hurricane Sandy. The impact of the five events was minimal in that the line outage durations were negligible (breaker opening and closing). Therefore, thunderstorms with lightning forecasted are not considered adverse or inclement weather conditions. Hurricanes and tornadoes are considered adverse or inclement weather conditions.

The action requirement to perform weather assessments ensures appropriate actions are taken to minimize the potential for a severe event to impact grid reliability with one line nonfunctional (i.e., out-of-service). If an adverse or inclement weather condition is predicted, the nonfunctional 345 kV line must be restored to functional status or station output must be reduced to the limiting value associated with the loss of one additional line in accordance with the Millstone Facility Out Guide stability operating limits, prior to arrival of the adverse or inclement weather. This action requirement to perform weather assessments is consistent with the requirements contained in the MPS2 and MPS3 TS 3.8.1.1 Bases when using the 14-day TS 3.8.1.1 AOT for extended EDG maintenance.

TRM Action Requirement a.2.c

"Within one hour prior to or after entering this condition and at least once per 24 hours thereafter, verify that both the Millstone Unit 2 EDGs and the Millstone Unit 3 EDGs are OPERABLE and the Millstone Unit 3 SBO diesel generator is available. Restore any inoperable Millstone Unit 2 EDG or Millstone Unit 3 EDG to OPERABLE status and/or the Millstone Unit 3 SBO to available status within 72 hours or reduce total station output to the limiting value associated with the loss of one additional line in accordance with the Millstone Facility Out Guide stability operating limits within the next 6 hours."

Basis:

Maintaining the EDGs operable and the MPS3 SBO diesel generator available provides a high degree of assurance that AC power will be available to support required safety equipment in the unlikely event of a LOOP when a 345 kV line is nonfunctional.

For the condition where the 14-day AOT is in use for one offsite line nonfunctional (i.e., out-of-service) and an EDG is inoperable or the MPS3 SBO diesel generator is unavailable, 72 hours is allowed to restore the inoperable EDG or unavailable SBO diesel generator or total station output must be reduced to the limiting value associated with the loss of one additional line in accordance with the Millstone Facility Out Guide stability operating limits within the next 6 hours.

Two Offsite Lines Nonfunctional

For an unplanned failure of one additional 345 kV transmission line during the 14-day AOT, TRM Action b would require DNC to downpower in accordance with the ISO-New England Millstone Facility Out Guide stability operating limits within the next 30 minutes, as required by the NPCC Regional Reliability Reference Directory #1 (Reference 7.4), to prevent any additional 345 kV line failures from causing offsite power stability issues.

Element 3 - Continued Implementation of Configuration Risk Management Program (CRMP) to Aid in Identification of Configurations that Could Degrade Defense-In-Depth During the 14 Day AOT

The following describes the elements of the configuration risk management program which ensure reliability of AC power to support required safety equipment:

- Planned transmission line outages are coordinated between ISO-New England and MPS.
- DNC will request transmission operating guides to contain the 14-day AOT TRM limit.
- The MPS2 and MPS3 EDGs will be operable and the MPS3 SBO diesel generator will be available with a TRM provision to allow 72 hours to restore an inoperable EDG or unavailable SBO diesel generator.
- Core damage risk associated with performing switchyard work (including transmission line outages and physical work) will continue to be managed under Section (a)(4) of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants."

Conclusion

DNC is proposing to add new requirements to the MPS2 and MPS3 TRMs that would require all four offsite 345 kV transmission lines to be functional when MPS electrical output exceeds 1650 MW_e net. The proposed TRM also contains required actions that must be performed when one offsite 345 kV transmission line is non-functional. The TRM actions would allow a 345 kV transmission line to be nonfunctional for up to 14 days provided the applicable TRM Actions are performed. The proposed new TRM requirements provide flexibility to preclude plant downpowers due to planned and unplanned offsite transmission line outages. The TRM requirements provide this flexibility while also maintaining adequate defense in depth to ensure grid reliability and stability are preserved and the ability of the plants to respond to design basis accidents is not adversely affected. The 14-day AOT provides flexibility for conducting maintenance and improves operational safety margin by the following:

- Minimizes the number of plant downpowers for short duration 345 kV transmission line outages.
- Reduces the likelihood of a LOOP event by establishing an AOT with additional defense-in-depth measures to minimize the potential for a double circuit failure scenario which can result in grid instability.

5.0 Regulatory Evaluation

5.1 Applicable Regulatory Requirements/Criteria

On February 20, 1971, the Atomic Energy Commission published in the Federal Register the General Design Criteria [GDC] for Nuclear Power Plants. The GDC, which are contained in Appendix A of 10 CFR 50, establish minimum requirements for the principal design criteria for water-cooled nuclear power plants. Although MPS2 was designed and licensed to the GDC, as issued on July, 11, 1967, DNC has attempted to comply with the intent of the newer GDC to the extent possible, recognizing previous design commitments.

The following GDC, regulatory documents, and industry standards establish specific design requirements applicable to the MPS offsite power systems:

- GDC-17, Electric Power Systems
- GDC-5, Sharing of Structures, Systems, and Components

These design requirements were used for evaluating the adequacy of the MPS offsite power system design.

GDC-17, Electric Power Systems

GDC-17 defines requirements for the onsite electric power system and the offsite electric power system. The offsite power system is referred to as the "preferred power supply" – see Section 8.2 of the NRC's Standard Review Plan (Reference 7.8). However, the preferred power supply is not a Class 1E system.

GDC-17 is part of the design and licensing bases for MPS2 and MPS3. GDC-17 requires the onsite and offsite power system to have sufficient capacity to assure:

a. Specified fuel design limits and design conditions of reactor coolant pressure boundary are not exceeded as a result of anticipated operational occurrences, and;
b. The core is cooled and containment integrity and other vital functions are maintained in event of postulated accidents.

GDC-5, Sharing of structures, systems, and components

GDC-5 requires that structures, systems, and components important to safety shall not be shared among nuclear power units unless it can be shown that such sharing will not significantly impair their ability to perform their safety functions, including, in the event of an accident in one unit, an orderly shutdown and cooldown of the remaining units.

Technical Specifications

The MPS2 and MPS3 TS require, "Two physically independent circuits between the offsite transmission network and the onsite Class 1E distribution system" to be operable in Modes 1, 2, 3, and 4 (TS 3.8.1.1). With one offsite circuit inoperable, Surveillance Requirement 4.8.1.1.1 must be performed for the remaining offsite circuit within 1 hour prior to or after entering the inoperable condition, and at least once per 8 hours thereafter, until operability is restored. Surveillance Requirement 4.8.1.1.1 involves verifying correct breaker alignments and power available from the offsite circuit. The action statement associated with TS 3.8.1.1 for one offsite circuit inoperable also requires restoration of the inoperable offsite circuit to operable status within 72 hours or the plant must be in hot standby within the next 6 hours and cold shutdown within the following 30 hours.

For Modes 5 and 6, only "One circuit between the offsite transmission network and the onsite Class 1E distribution system" is required to be operable (TS 3.8.1.2).

5.2 Evaluation of 10 CFR 50.36 Criteria

DNC is proposing to add new requirements to the MPS2 and MPS3 TRM for offsite line power sources. The TRMs would require that the four 345 kV offsite transmission lines be functional when MPS output exceeds 1650 MW_e net. With one offsite line nonfunctional, the TRM requirements would allow 72 hours to restore the nonfunctional line with a provision to allow up to 14 days if specific TRM actions are met.

The TRM is a licensee-controlled document that contains requirements for plant operation that do not meet the threshold for inclusion into TSs. Changes to the TRM are controlled under the requirements of 10 CFR 50.59, "Changes, Tests and Experiments."

The Commission's regulatory requirements related to the content of TSs are set forth in 10 CFR 50.36. This regulation requires that the TSs include items in five specific categories. These categories include; 1) safety limits, limiting safety system settings and limiting control settings; 2) limiting conditions for operation (LCOs); 3) surveillance requirements; 4) design features; and 5) administrative controls. However, the regulation does not specify the particular TSs to be included in a plant's license.

Additionally, 10 CFR 50.36(c)(2)(ii) sets forth four criteria to be used in determining whether an LCO is required to be included in the TSs. Specifically, 10 CFR 50.36 (c)(2)(ii) requires a TS LCO must be established for each item meeting the one or more of the following criteria:

1. Installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary.

2. A process variable, design feature, or operating restriction that is an initial condition of a design basis accident or transient analysis that assumes either the failure of, or presents a challenge to, the integrity of a fission product barrier.

3. A structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a design-basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.

4. A structure, system or component which operating experience or probabilistic risk assessment has shown to be significant to public health and safety.

Existing LCOs and related surveillances which satisfy any of the criteria stated above must be retained in TSs. Those requirements which do not satisfy these criteria may be located in other licensee-controlled documents. Since requirements related to the offsite power system beyond the scope of TS 3.8.1.1 have never been included in the MPS2 or MPS3 TSs, DNC is proposing to include the proposed new requirements in the MPS2 and MPS3 TRM.

The NRC published its Final Policy Statement on TS improvements on July 22, 1993 (58FR39132). The Final Policy Statement provided the four specific criteria above for determining which design features and information should be located in TSs as LCOs. The four criteria provided in the Final Policy Statement were subsequently codified in 10 CFR 50.36. The Final Policy Statement contains a discussion of each of the four criteria. Each of the four criteria is listed below, along with the Final Policy Statement discussion related to each criterion, and the DNC evaluation of the proposed requirements for the offsite power system.

1. Installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary.

   Discussion of Criterion 1

   A basic concept in the adequate protection of the public health and safety is the prevention of accidents. Instrumentation is installed to detect significant abnormal degradation of the reactor coolant pressure boundary so as to allow operator actions to either correct the condition or to shut down the plant safely, thus reducing the likelihood of a loss-of-coolant accident.

   This criterion is intended to ensure that TSs control those instruments specifically installed to detect excessive reactor coolant system leakage. This criterion should not, however, be interpreted to include instrumentation to detect precursors to reactor coolant pressure boundary leakage or instrumentation to identify the source of actual leakage (e.g., loose parts monitor, seismic instrumentation, valve position indicators).

   Evaluation of Criterion 1

   The offsite power system does not include instrumentation that detects, or indicates in the control room, degradation of the reactor coolant pressure boundary. Therefore, the proposed TRM requirements for offsite line power sources do not meet Criterion 1 for inclusion into technical specifications.

2. A process variable, design feature, or operating restriction that is an initial condition of a design basis accident or transient analysis that assumes either the failure of, or presents a challenge to, the integrity of a fission product barrier.

   Discussion of Criterion 2

   Another basic concept in the adequate protection of the public health and safety is that the plant shall be operated within the bounds of the initial conditions assumed in the existing design basis accident and transient analyses and that the plant will be operated to preclude unanalyzed transients and accidents. These analyses consist of postulated events analyzed in the FSAR for which a structure, system, or component must meet specified functional goals. These analyses are contained in

Chapter 14 (or equivalent chapters) and are identified as Condition II, III, or IV events (ANSI N18.2) (or equivalent) that either assume the failure of, or present a challenge to, the integrity of a fission product barrier.

As used in Criterion 2, process variables are only those parameters for which specific values or ranges of values have been chosen as reference bounds in the design basis accident or transient analyses and which are monitored and controlled during power operation such that process values remain within the analysis bounds. Process variables captured by Criterion 2 are not, however, limited to only those directly monitored and controlled from the control room.

These could also include other features or characteristics that are specifically assumed in design basis accident and transient analyses even if they cannot be directly observed in the control room (e.g., moderator temperature coefficient and hot channel factors).

The purpose of this criterion is to capture those process variables that have initial values assumed in the design basis accident and transient analyses, and which are monitored and controlled during power operation. As long as these variables are maintained within the established values, risk to the public safety is presumed to be acceptably low. This criterion also includes active design features (e.g., high pressure/low pressure system valves and interlocks) and operating restrictions (pressure/temperature limits) needed to preclude unanalyzed accidents and transients.

<u>Evaluation of Criterion 2</u>

The offsite power systems are assumed to be available during several FSAR Chapter 14 (MPS2) and Chapter 15 (MPS3) events. Existing TS 3.8.1.1 currently requires connections to the offsite transmission network. The proposed new TRM change to allow 72 hours to restore a nonfunctional line with a provision to allow up to 14 days if specific TRM action requirements are met, does not impact offsite power availability. With one 345 kV line nonfunctional, offsite power remains available and the existing analyses remain bounding.

Therefore, the proposed TRM requirements for offsite line power sources do not meet Criterion 2 for inclusion into technical specifications.

3. A structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.

Discussion of Criterion 3

A third concept in the adequate protection of the public health and safety is that in the event that a postulated design basis accident or transient should occur, structures, systems, and components are available to function or to actuate in order to mitigate the consequences of the design basis accident or transient. Safety sequence analyses or their equivalent have been performed in recent years and provide a method of presenting the plant response to an accident. These can be used to define the primary success paths.

A safety sequence analysis is a systematic examination of the actions required to mitigate the consequences of events considered in the plant's design basis accident and transient analyses, as presented in Chapters 14 (or equivalent chapters) of the plant's FSAR. Such a safety sequence analysis considers all applicable events, whether explicitly or implicitly presented.

The primary success path of a safety sequence analysis consists of the combination and sequences of equipment needed to operate (including consideration of the single failure criteria), so that the plant response to design basis accidents and transients limits the consequences of these events to within the appropriate acceptance criteria.

It is the intent of this criterion to capture into TSs only those structures, systems, and components that are part of the primary success path of a safety sequence analysis. Also captured by this criterion are those support and actuation systems that are necessary for items in the primary success path to successfully function. The primary success path for a particular mode of operation does not include backup and diverse equipment (e.g., rod withdrawal block which is a backup to the average power range monitor high flux trip in the startup mode, safety valves which are backup to low temperature overpressure relief valves during cold shutdown).

Evaluation of Criterion 3

The offsite power systems are assumed to be available during several FSAR Chapter 14 (MPS2) and Chapter 15 (MPS3) events. For these events, connection to the offsite power system is part of the primary success path for which TS LCOs already exist (i.e., TS 3.8.1.1).

The proposed TRM change to allow 72 hours to restore a nonfunctional line, with a provision to allow up to 14 days if specific TRM action requirements are met, does not impact offsite power availability and does not adversely impact the primary success path associated with offsite power availability. With one offsite line nonfunctional, offsite power remains available and the existing analyses remain bounding.

Therefore, the proposed TRM requirements for offsite line power sources do not meet Criterion 3 for inclusion into technical specifications.

4. A structure, system or component which operating experience or probabilistic risk assessment has shown to be significant to public health and safety.

Discussion of Criterion 4

It is the Commission policy that licensees retain in their TSs LCOs, action statements and surveillance requirements for the following systems (as applicable), which operating experience and PRA have generally shown to be significant to public health and safety and any other structures, systems, or components that meet this criterion:

- Residual Heat Removal, and
- Recirculation Pump Trip.

The Commission recognizes that other structures, systems, or components may meet this criterion. Plant and design-specific PRA have yielded valuable insight to unique plant vulnerabilities not fully recognized in design basis accident or transient analyses. It is the intent of this criterion that those requirements for which PRA or operating experience exposes as significant to public health and safety (consistent with the Commission's Safety Goal and Severe Accident Policies), be retained or included in TSs.

The Commission expects that licensees, in preparing TS-related submittals, will utilize any plant-specific PRA or risk survey, as well as any available literature on risk insights from PRA. This material should be employed to strengthen the technical bases for those requirements that remain in TSs, when applicable, and to verify that none of the requirements to be relocated contain constraints of prime importance in limiting the likelihood or severity of the accident sequences that are commonly found to dominate risk.

Similarly, the NRC staff will also employ risk insights and PRA in evaluating TS-related submittals. Further, as a part of the Commission's ongoing program of improving TSs, it will continue to consider methods to make better use of risk and reliability information for defining future generic TS requirements.

Evaluation of Criterion 4

Offsite power systems are not included in NUREG-1431, "Standard Technical Specifications – Westinghouse Plants" (Reference 7.17) or NUREG-1432, "Standard Technical Specifications – Combustion Engineering Plants" (Reference 7.18). Therefore, not including requirements associated with the offsite power system in the TSs is consistent with both past and current industry practice and precedent.

The MPS2 and MPS3 PRAs do not specifically model the four offsite power transmission lines. Instead, LOOP frequency and consequential LOOP probability values are applied in the PRA models. The values are calculated based on industry LOOP events occurring within a certain time period. For MPS, the May 25, 2014 event represents the only site LOOP event (i.e., a LOOP to all operating units on site) or event initiated following loss of three transmission lines occurring in the station's history. The only other transmission line-related event occurred in 2007 when MPS3 experienced a LOOP (while MPS2 remained in operation) during Refueling Outage 11 due to a switchyard breaker being inadvertently opened by the transmission system operator.

Based on transmission line maintenance data, one transmission line is removed from service approximately 10 times per year (Reference 7.13), with the May 25, 2014 event being the only instance during which a loss of three transmission lines occurred. In this event, one line was out for maintenance and a fault occurred on a second transmission line with the third line failing as the result of a latent human error associated with transmission line protective relaying at an offsite location. One of the corrective actions taken by Eversource after this event was to eliminate the protective relaying element that caused the trip. As a result, corrective actions to prevent recurrence have been taken. With only one event occurring over a relatively extended period (i.e., decades) and the cause of that event eliminated, the 2014 event is not considered representative of the risk impact associated with the removal of one transmission line from service. Consequently, the individual offsite transmission lines, including the specific configuration involving one transmission line out-of-service for maintenance, are not considered significant to public health and safety.

Therefore, the proposed TRM requirements for offsite line power sources do not meet Criterion 4 for inclusion into technical specifications.

Based on the above, DNC has concluded that the proposed new TRM requirements for offsite line power sources do not meet the criteria in 10 CFR 50.36(c)(2)(ii) for establishing a TS LCO. DNC is proposing to locate these requirements in the TRM for MPS2 and MPS3. The TRM is a licensee-controlled document that contains requirements for plant operation that do not meet the 10 CFR 50.36(c)(2)(ii) criteria for inclusion in the plant TSs. Changes to the TRM are controlled under the requirements of 10 CFR 50.59. The above conclusions are consistent with the NRC Final Policy Statement on TS improvements dated July 22, 1993 (58FR39132).

5.3 <u>No Significant Hazards Consideration</u>

Pursuant to 10 CFR 50.90, Dominion Nuclear Connecticut, Inc. (DNC) is requesting an amendment to Operating License DPR-65 for Millstone Power Station Unit 2 (MPS2) and Operating License NPF-49 for Millstone Power Station Unit 3 (MPS3).

The proposed amendments will revise the MPS2 and MPS3 Final Safety Analysis Reports (FSAR) to reflect changes made to the offsite transmission system to improve the reliability of offsite power. Specifically, the previous configuration of the four 345 kV offsite transmission lines had four lines sharing two sets of double circuit towers (steel monopole and wooden) in the approximate 9-mile length of right-of-way (ROW) between MPS and Hunts Brook Junction. This tower design was later modified to a single circuit tower design such that each of the four 345 kV offsite transmission lines are now supported on their own separate tower. The new configuration reduces the probability for simultaneous failure of two lines on a common tower. In conjunction with the changes to the support towers, the severe line outage detection (SLOD) protection equipment was disabled.

Additionally, the proposed license amendments would add a new Technical Requirements Manual (TRM) requirement for MPS2 and MPS3 to maintain four offsite lines functional when MPS output exceeds 1650 MW_e net. In addition, the proposed new TRM requirement provides required actions when one offsite line is nonfunctional. Specifically, the proposed TRM requirement would allow 72 hours with one offsite line nonfunctional and up to 14 days with one line nonfunctional provided specific actions are performed.

According to 10 CFR 50.92(c), a proposed amendment to an operating license involves no significant hazards consideration if operation of the facility in accordance with the proposed amendment would not:

1. *Involve a significant increase in the probability or consequences of an accident* previously evaluated; or
2. Create the possibility of a new or different kind of accident from any accident previously evaluated; or
3. Involve a significant reduction in a margin of safety.

In support of this determination, an evaluation of each of the three criteria set forth in 10 CFR 50.92(c) is provided below regarding the proposed license amendment.

Criterion 1

Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No

The post-modification configuration of the offsite 345 kV transmission system (four lines separately supported and SLOD disabled) improves overall grid reliability and continues to meet the requirements for two independent sources of offsite power (GDC-17). Therefore, the post-modification configuration does not significantly increase the probability or consequences of a loss of offsite power event. Likewise, the associated

proposed changes to the MPS2 and MPS3 FSARs to document the revised 345 kV transmission line tower design and disabling of SLOD, do not increase the probability or consequences of an accident previously evaluated in the FSARs.

The grid (offsite power) is by design, the preferred power source for the affected units. The grid provides a reliable source of power to MPS2 and MPS3 while the units are at power, in the event of unit trips, and when the units are shut down for maintenance. New TRM requirements are proposed that will maintain adequate defense in depth to ensure grid reliability and stability are preserved.

A loss of offsite power event is an anticipated operational occurrence. The proposed changes do not significantly increase the probability of this event. Additionally, as described in Chapter 14 (MPS2) and Chapter 15 (MPS3), several events are assumed to occur coincident with a loss of offsite power. Sufficient onsite power sources are available to mitigate these events and ensure the consequences of the existing analyses for these events remain bounding.

The proposed new TRM requirements for offsite line power sources will not change the plant design or design requirements. The design criteria for the offsite power system remain unchanged. Therefore, the safety analyses as documented in the MPS2 and MPS3 FSARs remain unchanged. Temporary reductions in the number of offsite lines from four to three, in accordance with the proposed TRM action requirements, will not adversely affect offsite power system availability in the event of a loss of either MPS2, MPS3, the largest other unit on the grid, or the most critical transmission line. Use of the proposed TRM requirements will not cause an accident to occur and will not change how accident mitigation equipment is operated. Allowing one offsite line to be nonfunctional for up to 14 days does not increase the probability of any previously evaluated accidents.

Therefore, the proposed changes to the offsite 345 kV transmission system (four lines separately supported and SLOD disabled) and proposed new TRM requirements does not significantly increase the probability or consequences of an accident previously evaluated.

Criterion 2

Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No

The proposed amendments do not change the design function or operation of the offsite power system and do not affect the offsite power systems ability to perform its design function. The proposed amendments do not conflict with the design criteria, codes, or standards committed to in the licensing basis. The existing codes and standards, as they apply to the onsite emergency power systems, remain unchanged. The design

criteria for the offsite power system remain unchanged. Therefore, the safety analyses as documented in the MPS2 and MPS3 FSARs remain unchanged.

No credible new failure mechanisms, malfunctions, or accident initiators not considered in the design and licensing basis are created by the proposed amendment. The offsite power system is assumed to be available during several FSAR Chapter 14 (MPS2) and Chapter 15 (MPS3) events. The new TRM requirements would allow 72 hours to restore a nonfunctional line, and up to 14 days to restore a nonfunctional line if specific TRM action requirements are met. Use of these TRM requirements does not impact offsite power availability and does not create the possibility for a new or different kind of accident from any previously evaluated. Temporary reductions in the number of offsite lines from four to three, in accordance with the proposed TRM requirements, will continue to ensure offsite power system availability in the event of a loss of either MPS2, MPS3, the largest other unit on the grid, or the most critical transmission line.

The proposed amendments have no adverse effect on plant operation or accident mitigation equipment. The response of the plants and the operators following a design basis accident will not be different. In addition, the proposed amendments do not create the possibility of a new failure mode associated with any equipment or personnel failures.

Therefore, the proposed amendments will not create the possibility of a new or different kind of accident from any accident previously evaluated.

Criterion 3

Does the proposed amendment involve a significant reduction in a margin of safety?

Response: No

The post-modification configuration of the offsite 345 kV transmission system (four lines separately supported and SLOD disabled) improves overall grid reliability and continues to meet the requirements for two independent sources of offsite power (GDC-17). Likewise, the addition of TRM requirements that limit the unavailability of offsite lines provides acceptable assurance that line outages will not result in a significant reduction to grid stability and hence also to the margin of safety.

The offsite power systems are assumed to be available during several FSAR Chapter 14 (MPS2) and Chapter 15 (MPS3) events. The loss of the offsite power system is an anticipated operational occurrence. Additionally, as described in Chapter 14 (MPS2) and Chapter 15 (MPS3), several events are assumed to occur coincident with a loss of offsite power. Sufficient onsite power sources are available to mitigate these events and ensure the consequences of the existing analyses for these events remain bounding. The proposed amendments do not affect the assumptions in the safety analyses or the ability to safely shutdown the reactors and mitigate accident conditions. Station structures, systems, and components will continue to be able to mitigate the design basis

accidents as assumed in the safety analyses and ensure proper operation of accident mitigation equipment. In addition, the proposed amendment will not affect equipment design or operation of station structures, systems, and components and there are no changes being made to the safety limits or safety system settings required by technical specifications.

Therefore, the proposed amendments will not result in a significant reduction in a margin of safety.

Conclusion

Based upon evaluation of these criteria, DNC concludes that the proposed amendment presents no significant hazards under the standards set forth in 10 CFR 50.92(c) and, accordingly, a finding of "no significant hazards consideration" is justified.

6.0 Environmental Consideration

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

7.0 References

7.1 10 CFR 50, Appendix A, "General Design Criteria for Nuclear Power Plants," Criterion 17, "Electric Power Systems."

7.2 10 CFR 50.63, "Loss of All Alternating Current Power."

7.3 Nuclear Management and Resources Council (NUMARC) 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors."

7.4 Northeast Power Coordinating Council (NPCC) Regional Reliability Reference Directory #1, "Design and Operation of the Bulk Power System," Version 1, dated December 1, 2009.

7.5 DNC Letter 15-073, Millstone Power Station Units 2 and 3, "Response to a Notice of Violation," EA-14-126, dated March 31, 2015.

7.6 NRC Letter EA-14-126 (J. A. Trapp) to Dominion Resources (D. Heacock) dated August 28, 2014, "Millstone Power Station Units 2 and 3 – NRC Special Inspection Report 05000336/2014011 and 05000423/2014011" (ADAMS Accession No. ML14288A481).

7.7 NUREG-0800, Standard Review Plan 8.1, "Electrical Power- Introduction," Revision 4, dated February 2012.

7.8 NUREG-0800, Standard Review Plan 8.2, "Offsite Power System," Revision 5, May 2010.

7.9 ISO-New England Planning Procedure No. 3, "Reliability Standards for the New England Area Bulk Power Supply System," dated March 1, 2013.

7.10 North American Electric Reliability Corporation (NERC) Reliability Standard NUC-001-2.1, "Nuclear Plant Interface Coordination," April 2010.

7.11 MPR-4189, "Millstone Station GDC-17 License Amendment Support," Revision 0, dated April 10, 2015.

7.12 MPR Calculation No. 0282-1410-001, "Wind Speed Criterion to Prevent Contact Between a Dropped or Broken Transmission Line Conductor and an Adjacent Line," Rev. 2, dated April 9, 2015

7.13 Eversource Historical Data of Millstone 345 KV Lines 348, 310, 383, and 371-364 - Outage Duration and Reason, dated September 29, 2014 and May 7, 2015.

7.14 Northeast Utilities Event Analysis Report, "Loss of Off-Site Power to Millstone Nuclear Power Station May 25, 2014," dated August 5, 2014.

7.15 NUREG-0800, Standard Review Plan Branch Technical Position (BTP) 8-8, "Onsite (Emergency Diesel Generators) and Offsite Power Sources Allowed Outage Time Extensions," Revision 0, dated February 2012.

7.16 10 CFR 50, Appendix A, "General Design Criteria for Nuclear Power Plants," Criterion 5, "Sharing of structures, systems, and components."

7.17 NUREG-1431, Revision 4.0, "Standard Technical Specifications, Westinghouse Plants," Volume 1, Specifications.

7.18 NUREG-1432, Revision 4.0, "Standard Technical Specifications, Combustion Engineering Plants," Volume 1, Specifications.

7.19 Dominion Engineering Technical Evaluation, ETE-MP-2015-1039, Millstone Station GDC-17 License Amendment Request (LAR) Support Documentation.

7.20 ISO-New England "Millstone Facility Out Guide-Text Document", Revision 1, effective date February 26, 2015.

ATTACHMENT 2

MARK-UP OF PROPOSED FSAR CHANGES

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 2

1.A AEC GENERAL DESIGN CRITERIA FOR NUCLEAR POWER PLANTS

10 CFR PART 50 APPENDIX A

On February 20, 1971, the Atomic Energy Commission published in the Federal Register the General Design Criteria for Nuclear Power Plants. Prior to this date, proposed General Design Criteria for Nuclear Power Plants as issued on July 11, 1967, in the Federal Register were in effect. Before issuance of the construction permit for Millstone Unit 2, discussions reflecting the design intent in consideration of the 1967 proposed criteria were submitted in the PSAR. Design and construction was thus initiated and has been completed based upon the 1967 proposed criteria.

Since February 20, 1971, the applicants have attempted to comply with the intent of the newer General Design Criteria to the extent possible, recognizing previous design commitments. The extent to which this has been possible is reflected in the discussions of the 1971 General Design Criteria which follow.

CRITERION 1 - QUALITY STANDARDS AND RECORDS

> Structures, systems, and components important to safety are designed, fabricated, erected and tested to quality standards commensurate with the importance of the safety functions performed. Where generally recognized codes and standards are used, they are identified and evaluated to determine their applicability, adequacy, and sufficiency and are supplemented or modified as necessary to assure a quality product in keeping with the required safety function. A quality assurance program has been established and implemented in order to provide adequate assurance that these structures, systems, and components will satisfactorily perform their safety functions. Appropriate records of the design, fabrication, erection and testing of structures, systems, and components important to safety are maintained by or under the control of the nuclear power unit licensee throughout the life of the unit.

Discussion of the quality standards for those structures and components which are essential to the prevention of incidents which would affect the public health and safety or to mitigation of their consequences are presented in appropriate sections of the FSAR. The quality assurance program in effect to assure that these structures, systems, and components will satisfactorily perform their safety functions is discussed in Section 12.8.

For example, components of the safety injection and containment cooling systems are designed and fabricated in accordance with established codes and/or standards as required to assure that their quality is in keeping with the safety function of the component. It is not intended, however, to limit quality standards requirements to this list.

High Pressure Injection, Low Pressure Injection, and Containment Spray Pumps

a. Surfaces of pressure retaining materials for the high and low pressure safety injection pumps were examined by liquid penetrant techniques in accordance with

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CRITERION 15 - REACTOR COOLANT SYSTEM DESIGN

> The reactor coolant system and associated auxiliary, control, and protection system is designed with sufficient margin to assure that the design conditions of the reactor coolant pressure boundary are not exceeded during any condition of normal operation, including anticipated operational occurrences.

The design criteria and bases for the reactor coolant pressure boundary are described in the response to Criterion 14.

The operating conditions established for the normal operation of the plant are discussed in the FSAR and the control systems are designed to maintain the controlled plant variables within these operating limits, thereby ensuring that a satisfactory margin is maintained between the plant operating conditions and the design limits.

The reactor protective system functions to minimize the deviation from normal operating limits in the event of certain anticipated operational occurrences. The results of analyses show that the design limits of the reactor coolant pressure boundary are not exceeded in the event of such occurrences.

CRITERION 16 - CONTAINMENT DESIGN

> Reactor containment and associated systems are provided to establish an essentially leak-tight barrier against the uncontrolled release of radioactivity to the environment and to assure that the containment design conditions important to safety are not exceeded for as long as postulated accident conditions require.

The reactor containment structure, described in Section 5.2, consists of a prestressed concrete cylinder and dome with a reinforced concrete base. A one-quarter inch thick welded steel liner plate is attached to the inside face of the concrete to provide a high degree of leak tightness. Designed as a pressure vessel, the containment structure is capable of withstanding all design postulated accident conditions including a loss-of-coolant accident (LOCA). All containment penetrations are sealed as described in Subsection 5.2.7. Isolation valves are provided for all piping systems which penetrate the containment, as described in Subsection 5.2.8.

As an extra measure of safety, an enclosure building completely surrounds the containment. In the event of an accident, the enclosure building filtration region (EBFR), described in Section 6.7.2, is maintained at a slightly negative pressure to preclude leakage to the environment. Potential leakage from the containment is channeled into the enclosure building filtration system as described in Section 6.7. Throughline leakage that can bypass the EBFR is discussed in Section 5.3.4.

CRITERION 17 - ELECTRIC POWER SYSTEMS

> An on site electric power system and an off site electric power system are provided to permit functioning of structures, systems, and components important to safety. The safety

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function for each system (assuming the other system is not functioning) is to provide sufficient capacity and capability to assure that (1) specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary (RCPB) are not exceeded as a result of anticipated operational occurrences; and (2) the core is cooled and containment integrity and other vital functions are maintained in the event of postulated accidents.

The on site electric power supplies, including the batteries, and the on site electric distribution system, have sufficient independence, redundancy, and testability to perform their safety functions assuming a single failure.

Electric power from the transmission network to the on site electric distribution system is supplied by two physically independent circuits (not necessarily on separate rights-of-way), designed and located so as to minimize to the extent practical, the likelihood of their simultaneous failure under operating and postulated accident and environmental conditions. A switchyard common to both circuits is acceptable. Each of these circuits is designed to be available in sufficient time following a loss of all on site AC power supplies and the other off site electric power circuit, to assure that specified acceptable fuel design limits and design conditions of the RCPB are not exceeded. One of these circuits is designed so it is available within a few seconds after a loss-of-coolant accident (LOCA) to assure that core cooling, containment integrity, and other vital safety functions are maintained.

Provisions are included to minimize the probability of losing electric power from any of the remaining supplies as a result of, or coincident with, the loss of power generated by the nuclear power unit, the transmission network, or from the on site electric power supplies.

The off site power supplies system is described in Sections 8.1 and 8.2. The preferred source of auxiliary power for unit shutdown is from or through the reserve station service transformers. System interconnection is provided by four 345 kV circuits. These transmission lines are on a single right-of-way~~, two circuits share common structures with the third and fourth circuits~~ [with each line] installed on an independent set of structures. ~~Spacing between~~ [A description of] the structure~~s~~ [routing configuration] is described in Subsection 8.1.2.1.

The combination breaker-and-a-half and double breaker-double bus switching arrangement in the 345 kV substation includes two full capacity main buses. Primary and backup relaying are provided for each circuit along with circuit breaker failure backup protection. These provisions permit the following: | 15-16

a. Any circuit can be switched under normal or fault conditions without affecting another circuit.

b. Any single circuit breaker can be isolated for maintenance without interrupting the power or protection to any circuit.

c. Short circuits on any section of bus are isolated without interrupting service to any element other than those connected to the faulty bus section.

d. The failure of any circuit breaker to trip within a set time initiates the automatic tripping of the adjacent breakers and thus may result in the loss of a line or generator for this contingency condition; however, power can be restored to the good element in less than eight hours by manually isolating the fault with appropriate disconnect switches. | 15-16

Overhead lines from the switchyard to the reserve station service transformers are separated at the switchyard structure and are carried on separate towers. These transformers are located near each Unit, and are physically isolated from the normal station service transformers and from the main transformers.

In the event of loss of power from the normal station service transformer, there is an immediate automatic transfer of auxiliary loads to the Unit 2 reserve station service transformer. In the unlikely event that power is not available from this source, and from the On site Emergency Diesel mentioned below, the operator can manually connect emergency bus A-5 (24E) to Unit 3 bus 34A or 34B. By means of interlocked circuit breakers, the Unit 2 post accident loads can be fed from this source.

The on site power supply system is described in Sections 8.3 and 8.5. Two full capacity, separate and redundant batteries are provided for all DC loads and for 120 volt AC vital instrument loads.

In the event that off site power is not available when needed, a "start" signal is given to both emergency diesel generators (DG). These generators and their auxiliaries are entirely separate and redundant, and each generator feeds one 4,160 volt emergency bus. A generator is automatically connected to its bus only if there is no bus voltage and only if the dead bus did not result from protective relay action.

The electric power distribution system is described in Section 8.7. The redundancy of the power sources is enhanced by separate and redundant auxiliary power and control distribution systems. A single failure and any possible related failures in that channel cannot adversely affect equipment and components on the other redundant channel.

Due to the redundancy and separation of power supplies, distribution and control required for vital functions, all components can be readily inspected and tested. Similarly, most subsystems can be tested in their entirety.

CRITERION 18 - INSPECTION AND TESTING OF ELECTRIC POWER SYSTEMS

Electric power systems important to safety are designed to permit appropriate periodic inspection and testing of important areas and features, such as wiring, insulation, connections, and switchboards, to assess the continuity of the systems and the condition of their components. The systems shall be designed with a capability to test periodically (1) the operability and functional performance of the components of the systems, such as on

NOTE: REFER TO THE CONTROLLED PLANT DRAWING FOR THE LATEST REVISION.

CHAPTER 8 - ELECTRICAL SYSTEMS

List of Figures

8.1 ELECTRIC POWER

8.1.1 INTRODUCTION

This chapter describes the utility grid and its interconnections to other grids and to the Millstone Nuclear Power Station 345 kV switchyard. The on site electric system is also described. Definitions used in this chapter are given below. | 15-12

Transmission System

The transmission system includes all transmission lines coming to the Millstone Nuclear Power Station complex up to, but not including, the point of connection to the 345 kV switchyard.

Off Site System

The off-site system includes the transmission system and the 345 kV switchyard and extends up to, but does not include, the main transformer bank. Included in the off site system are the reserve station service transformers, Millstone Units 2 and 3.

On Site System

The on-site system includes the Millstone Unit 2 electric power systems out to, and including, the main transformer bank (Figure 8.2-1); this includes the normal station service transformer.

Normal Operation

Normal operation is when the main generator is transmitting electrical power through the main transformer bank and when plant auxiliaries are being supplied from the normal station service transformer.

Normal Power System

The normal power system includes that equipment required to support the main turbine generator, plant systems, and equipment associated with the reactor.

Emergency Power System

The emergency power system includes that electrical distribution equipment required to support the safe shutdown and post-accident operations of Millstone Unit 2. Included in the emergency power system are the emergency 4160 V switchgear and all extensions except those going to the normal switchgear and the reserve station service transformer and Unit 3(Figure 8.2-1). The emergency power system and equipment is Class 1E and safety related. | 15-15

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Standby Power System

The standby power system includes the Class 1E emergency diesel generators, which are referred to as the on-site emergency power supply.

Preferred Power System

The preferred off site power supply is from the 345 kV switchyard and the reserve station service transformer.

Alternate Off Site Source

The alternate off site source is the 4160-V tie to Millstone Unit 3 via bus 34A or 34B.

8.1.1.1 Design Criteria

The 345 kV switchyard and the associated transmission lines provide the off site sources that are the preferred power supplies, as outlined in Section 5.2.3 of IEEE Standard 308-1971 and Criterion 17 of Appendix A of 10 CFR Part 50. The conventional and accepted design of these facilities has been shown to be conservative and reliable.

Transmission facilities connecting the Millstone generating units to the main transmission grid are designed in accordance with the "Design and Operation of the Bulk Power System," developed by the Northeast Power Coordinating Council (NPCC). 15-15

8.1.1.2 Utility Grid

The utility electrical system consists of interconnected diverse energy sources including fossil fueled, hydro-electric and nuclear fueled plants supplying electric energy over a 345/115 kV transmission system (Figure 8.1-1C). 15-12

ISO-New England is the regional transmission organization which has authority over the operation of the transmission system in Connecticut. The main transmission system fed by Millstone Power Station is part of the New England power system. The Connecticut Valley Electric Exchange (CONVEX) is one of the local control centers in New England and assists ISO-New England in running the power system in Connecticut. 15-12

The electrical output of Millstone Unit 2 is delivered to the 345 kV switchyard (Figure 8.1-1D). Four 345 kV transmission lines feed power to the 345 kV system. Two of these lines feed the eastern part of Connecticut by connecting respectively to the Card and Montville substations. The remaining two lines feed the central part of Connecticut by connecting to the Beseck, Haddam, and Manchester substations. 15-12

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8.1.1.3 Interconnections

Millstone Power Station is connected to the Eversource Energy, Inc. transmission system which is closely integrated with transmission systems of several other utilities and operating companies. The New England power system is part of the larger northeast interconnection power grid and is tied through various connections points throughout New England. These interconnections include 345kV, 230kV, 138kV, 115kV, 69kV, and DC lines. The New England power system is also tied to neighboring grids such as New York, Hydro Quebec and New Brunswick, which are under the control of other reliability coordinators within the NPCC region. 15-15

8.1.1.4 345-kV Switchyard System at Site

The 345 kV switchyard is designed in an arrangement as shown on Figure 8.1-1D. The switchyard consists of ten 345 kV breakers, four 345 kV transmission Units 2 and 3 lines, two 345 kV tie lines to the generator step-up transformers, and two 345 kV tie lines to the reserve station service transformers. The Millstone 1 generator step-up transformer and reserve station service transformer are no longer in service.

The breakers and motor-operated disconnect switches are controlled primarily from CONVEX via the Supervisory Control and Data Acquisition System (SCADA) and from the Millstone Unit 1 Control Room. Millstone 2 Operations is responsible for the switching and tagging of equipment located in the Millstone 1 Control Room. Via the Millstone Unit 1 Control Room Millstone 2 Operations has primary control of breakers 8T, and 9T, as well as indication only of the remaining breakers and motor-operated disconnect switches. The Millstone Units 2 and 3 Control Rooms are equipped with remote panels that show the status only of the breakers and motor-operated disconnect switches in the switchyard. Through the operation of control switches, all breakers can be operated at the switchyard, if necessary.

Each element of the Millstone bus and associated line terminations are protected by redundant sets of primary and backup relays. The primary and backup relays are supplied from separate DC sources, separate current transformers, separate coupling capacitor voltage transformers, and communication channels.

The DC power is supplied by two independent batteries, one primary and one backup. Each battery is equipped with its own charger and distribution panel. A manual transfer scheme is provided to allow one battery and charger to carry the DC load upon the failure of the other battery and charger.

~~A severe line outage detector (SLOD) special protection scheme (SPS) has been installed in the 345 kV switchyard, recognizing that it is possible to lose two 345 kV circuits simultaneously on either of the two tower lines when only one circuit is in service on the other tower line.~~

~~Without SLOD this condition could result in instability in the transmission system. It is recognized that in anticipation of a double circuit fault, following the outage of a single circuit, generation reduction at Millstone Station is required to reduce the potential for instability.~~

~~The SLOD scheme continuously monitors the individual status of four critical transmission elements together with the power output of Millstone Station. Generation is curtailed automatically if a system condition arises where any of the critical situations exist and generation is above a predetermined level.~~

8.1.2 OFF SITE POWER SYSTEM

8.1.2.1 Description

The off site power system is designed to provide reliable sources of power to the on site AC power distribution system adequate for the safe shutdown of the unit. Details of the ~~off site power system~~ [345 kV switchyard] are shown on ~~the following figures:~~ [Figure 8.1-1D]

~~a. Transmission Right of Way Cross Section (Figure 8.1-1A)~~

~~b. 345 kV Switchyard (Figure 8.1-1D)~~

The switchyard, which is configured in a combination breaker-and-a-half and double breaker-double bus arrangement, buses together four 345 kV transmission line circuits, two generator circuits and two station service circuits ~~(Figure 8.1-1D)~~. The Millstone 1 generator and station service circuits are no longer in service. 15-16

The four transmission line circuits terminated at the switchyard are:

a. Millstone to Beseck (Line Number 348)

b. Millstone to Card (Line Number~~,~~ 383)

c. Millstone to Montville (Line Number~~,~~ 371) (this line includes Line 364)

d. Millstone to Manchester (Line Number~~,~~ 310)

These circuits connect the station to the 345 kV system transmission grid and follow a common right-of-way from Millstone to Hunts Brook Junction (9.0 miles). ~~For the first 1.7 miles of this right-of-way (to Daniels Avenue), the four lines travel upon two double-circuit steel-pole transmission lines separated by 330 feet. The double circuit steel pole lines consist of two independent single-circuit structures at locations where the right-of-way changes direction (angle structure) and of a single common structure at all other locations. For the next 2.4 miles, the construction consists of one double-circuit steel-pole transmission line (Line Nos. 348 and 310) and two single-circuit wood-pole H-frame transmission lines (Line Numbers 371 and 383). For the remaining 4.9 miles, single-circuit wood-pole H-frame construction is used for all four circuits.~~

~~Figure 8.1-1A shows the right-of-way cross sections in the foregoing three zones, indicating maximum tower heights in each of the zones and the ground clearance between towers.~~ These

The transmission towers, which support the four lines, consist of a combination of steel and wooden mono-pole structures, and steel and wooden H-frame structures. The towers are designed to the National Electric Safety Code Part C2, and Eversource Overhead Transmission Line Standards, which have both strength and overload design factors to provide for conservative designs. The towers for all four transmission lines are periodically inspected for proper physical condition.

four circuits are individually mounted on separate structures which are installed across a 415-500 foot wide Right of Way

~~cross sections indicate the significant clearances which exist~~ to provide adequate physical independence of the transmission lines.

service, the offsite power source complies with GDC-17 with no reasonable failure that can

feeding

With ~~The~~ four lines ~~emanating from~~ the Millstone Switching Station ~~are~~ in ~~compliance with the staff position that no other transmission lines cross over these four lines and that the four lines be physically separate and independent so that no single event such as a tower falling or line breaking will be able to simultaneously~~ affect all circuits in such a way that none of the four circuits can be returned to service in time to prevent fuel design limits or design conditions of the reactor coolant pressure boundary from being exceeded.

In particular, a sequence of cascading events from a particular tower falling in a specific manner, at one of only a few specific locations, or a line falling at Hunts Brook Junction, the worst case would be the loss of two circuits.

~~In the event of a structure failure between Millstone and Hunts Brook Junction, the worst probable longer-than-momentary outage would be a loss of two circuits; i.e., the two circuits on a common steel pole, or an H-frame structure falling into an adjacent line.~~

All four of the 345 kV lines leaving Millstone cross over two 115 kV circuits which supply the Waterford Substation, and constitute the off site source for Millstone Unit ~~One~~ 1. However, the mechanical failure of a single 345 kV line, and the consequential failure of the 115 kV circuits will not affect the preferred source of off site power to Millstone units 2 and 3.

At Hunts Brook Junction, the four transmission line circuits diverge along three separate rights-of-way (Figure 8.1-1B). ~~Line 348 runs westerly for approximately 34 miles to the Beseck substation. The 310 and 383 lines proceed along a northerly direction for 38 miles and 20 miles to the Manchester and Card substations respectively. Line 371 crosses under line 383 and continues in an easterly direction for approximately 3.6 miles to the Montville substation. Even though one~~ At this junction, aerial crossover of lines exist (line 383 and line 310 cross over line 371/364); however, at worst, only two of the four circuits from the Millstone Switching Station would be removed from service should a structure collapse or a conductor drop.

The main transformer bank and reserve station service transformer circuits, connecting the generating station to the 345 kV switchyard, are 0.35 mile long and each circuit is installed on separate structures. These circuits are supplied from different bus positions in the switchyard, so placed that no single equipment or component failure would remove both circuits from service at one time.

The inspection and testing of the 345 kV circuit breakers and the transmission line protective relaying are done on a routine basis, without removing the transmission lines from service. The insulating oil for the transformers (main step up, normal station service transformer (NSST), reserve station service transformer (RSST)) is sampled and tested on a routine basis. During these routine inspections and tests, the operability and functional performance of the electric systems are verified.

The 348 line turns west to the Beseck Substation, the 383 and 310 lines continue north to the Card Street and Manchester Substations, respectively, and the 371 line turns east to Montville Substation.

8.1.2.2 Analysis

The possibility of power failure due to contingencies in the connections to the system and the associated switchyard is minimized by the following arrangements: | 15-15

a. The connections to the system have been designed to comply with the NPCC
"Design and Operation of the Bulk Power System" and the ISO New England 15-15
"Reliability Standards for the New England Area Bulk Power Supply System."
Compliance with these criteria ensure that the supply of off-site power will not be
lost following contingencies in the interconnected transmission system. Transient 15-15
stability studies have been performed to verify that widespread or cascading
interruptions to service will not result from these contingencies. In addition, the
loss of Millstone Unit 2 or the loss of any other unit in the system will not result in
cascading system outages and thus will not cause loss of off-site power to units 2
and 3.

The 345 kV circuit breakers are SF6 puffer type and are pneumatically operated.
Electrical controls are provided for both local and remote Millstone 1 control room
or CONVEX operation. Each power circuit breaker has a separate pneumatic
supply unit capable of operating the breaker for a minimum of three close-open 15-16
operations after the loss of its pneumatic supply unit. The essential AC station
service for the power circuit breaker pneumatic supply units and the other
switchyard requirements is supplied by an off site 23 kV line which has transfer
capability to a source from Millstone Unit 3. The circuit breakers are equipped
with a closing solenoid and two independent trip solenoids. A standard anti-pump
and trip-free control scheme is used.

Two 125 VDC batteries are located in the switchyard control and relay enclosure for switchyard relaying and control. Each battery has its own charger and DC distribution panel. The redundant batteries and protective relaying systems are physically and electrically separate.

b. The 345 kV system is protected from lightning and switching surges by overhead
electrostatic shield wires, earth grounding at most structures, surge arrestors on the
switchyard main buses, surge arrestors at the transformer high voltage bushings,
and rod gaps on the line terminals. 15-15

c. Each 345 kV transmission line is protected from phase to phase and phase to
ground faults by two sets of diverse protective relays, one primary and one back- 15-16
up, both of which are high speed schemes.

The primary line protection consists of a distance relaying package in a directional 15-16
comparison blocking scheme communicating with the remote terminal over a
carrier current channel.

The backup line protection consists of step-distance relays operating 15-16
independently from the remote terminal. This equipment is used with a transfer
trip channel to provide a high speed permissive over-reaching scheme. A second
transfer trip scheme provides tripping of the breakers at the remote terminal in the
event of a stuck breaker at Millstone as well as tripping Millstone breakers
following the reception of a trip signal from the remote end.

Pilot wire relaying is used for primary protection of the 345 kV tie lines between the switchyard and the main step-up transformers. Backup protection consists of directional distance, single zone and directional ground overcurrent relays located in the switchyard and for transfer tripping to the plant dual channel audio-tone equipment is used.

Tripping of the switchyard breakers following the operation of the generator or main step-up transformer bank primary and backup relays is accomplished by the means of the transfer trip via pilot wire and audio-tone.

The Millstone 2 RSST 345 kV tie line is protected by two sets of protective relays, one primary and one backup. The directional distance relays detect phase-faults, and the directional ground overcurrent relays detect ground-faults. Operation of these relays will trip the appropriate 345 kV circuit breakers on the A switchyard bus, and send a transfer trip signal via digital teleprotection system with fiber optics communications medium to trip the transformer's low side circuit breaker at the plant. The operation of any of the RSST transformer protective relays at the plant will trip the low side breaker, and send a transfer trip signal via digital teleprotection system with fiber optics communications medium to trip the appropriate switchyard breakers.

Breaker failure relays are provided for each of the 345 kV circuit breakers to trip adjacent breakers in the event that the primary breaker fails to trip. The DC power for breaker failure operation is supplied from the backup battery system.

A breaker failure timing relay is initiated every time a main breaker is signaled to trip by primary or backup relays. If the breaker has not tripped before the time period has expired, tripping of the adjacent breaker will take place.

Phase angle sensitive impedance relays are also included in the backup protection of the main step-up transformer bank tie lines to protect the generator.

Automatic reclosing of 345 kV breakers is allowed following the protective relay tripping of the 345 kV transmission lines. The reclosing is designed for time delay reclosure from the remote ends only. At the switchyard, the breakers will close via synch-check relays.

A synch-check relay is also provided for each circuit breaker to supervise both manual closing and automatic reclosing of the breaker.

d. Primary and backup relaying is provided for each circuit breaker along with breaker failure backup protection. These provisions permit the following:

1. Any circuit can be switched under normal or fault conditions without affecting another circuit.

2. Any single circuit breaker can be isolated for maintenance without interrupting power or protection of any circuit.

3. Short circuits on any section of a bus are isolated without interrupting service to any element other than those connected to the faulty bus section.

4. The failure of any circuit breaker to trip within a set time initiates the automatic tripping of the adjacent breakers and thus may result in the loss of a line or generator for this contingency condition; however, power can be restored to the good element in less than eight hours by manually isolating the fault with appropriate disconnect switches. 15-16

Complete battery failure is considered highly unlikely since two independent 125 VDC battery systems are provided. Failure of a single battery system results only in a momentary loss of one set of protective relays until the DC is manually transferred to the other battery. Therefore, no single failure could negate the effectiveness of the relaying to clear a fault.

The Millstone design provides two off site circuits between the switchyard and the 4.16 kV Class 1E buses. The immediately available off site supply is the Millstone Unit 2 RSST while the alternate supply is the Millstone Unit 3 bus 34A or 34B.

The normal supply to the plant with the plant on line is the NSST. If this source is lost due to a plant trip, a fast bus transfer scheme connects the plant electrical system (6.9 kV and 4.16 kV) to the RSST. The second or alternate source of off site power is available by manual controls to Millstone Unit 3 bus 34A or 34B for 4.16 kV power.

Physical separation of the off site power sources, switchyard protection, redundancy, and the transmission system design based on load flow and stability analyses minimize the possibility of simultaneous failure of all power sources (reserve station service supply, standby AC emergency generators, and Millstone Unit 3 bus 34A or 34B.

The 345 kV transmission system supplying off site power to Millstone is normally operated at 357 kV at Millstone. This system voltage is controlled by varying the reactive power generation on the Millstone Power Station units. The Millstone Units 2 and 3 operators control the unit excitation as specified by CONVEX Operation Instruction Number 6913. The unit operators are required to balance the reactive power output of the units.

The CONVEX system operator supervises the system reactive power dispatch. The CONVEX operator directs the loading of all the reactive power sources in CONVEX to balance the reactive supply. The CONVEX operator keeps the Millstone Power Station reactive power generation in balance with the Eastern Area requirements so that the effect on the system of voltage variations is minimized when a unit is lost.

One objective of the reactive power dispatch is to prevent the voltage at the Millstone Power Station from going below the minimum required to support actuation of the Engineered Safety Features equipment. A switchyard voltage of 345 kV will assure successful actuation and

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operation of all necessary safeguards loads in the unlikely event Millstone Unit 2 experiences a Loss-of-Coolant Accident and trips off the transmission system. CONVEX operates the system to assure that this minimum voltage requirement will be met, following the loss of the unit. When in Reactor Modes 5 or 6, with the auxiliary electrical system lightly loaded, Millstone Unit 2 can assure successful actuation and operation of all necessary safeguards loads with a switchyard voltage of 335 kV. The maximum allowable voltage at Millstone Station is 362 kV based on equipment ratings.

If abnormal system conditions result in voltages approaching minimum levels, system operating instructions and procedures direct the CONVEX operator to take specific corrective actions to restore voltage. 15-12

Actual experience and system simulations show that the CONVEX operator is able to control the system voltages within the desired limits.

The Millstone plant is connected to the transmission system by four 345 kV circuits (described in Section 8.1.2.1). ~~For a short distance, these lines are on double-circuit steel poles.~~ Transmission operating procedures are in place to ensure that no more than the minimal number of circuits would ever intentionally be taken out of service, except in an emergency, when both Millstone generating units are on-line.

If both Millstone units 2 and 3 are on line at full output, certain contingencies on the transmission system as determined by CONVEX result in procedural restrictions on the station's net output, in order to assure that system synchronous and voltage stability will be maintained. ~~In addition, procedural restrictions on the station's output are necessary if the SLOD SPS is out-of-service. This SPS will automatically curtail generation at Millstone Unit 3, depending upon certain transmission system contingencies and the net output of the Millstone Station~~.

By careful design of the switchyard and protective relays, the possibility of the simultaneous loss of both units 2 and 3 at Millstone has been significantly reduced. The system has been computer modeled for both light load and heavy load conditions. The stability analysis indicates that the rest of the system remains in synchronism after the loss of any one Millstone unit~~, since Millstone 3 is subject to automatic generation rejection.~~ The probability of losing both on-line units simultaneously is extremely small because of the preventive measures discussed in the following paragraphs. Accordingly, the Licensee believes it is reasonable to count upon on site power sources to supply the necessary station service power requirements in the very remote event that both Millstone units 2 and 3 should be lost at once accompanied by the total loss of the transmission supply to the station.

A primary objective in designing the connection of the Millstone Nuclear Power Station to the 345 kV transmission network in Connecticut has been to prevent the loss of the entire station output. The reliability criteria of NPCC and ISO New England are a fundamental part of this design process. ~~SPS or generation restrictions at the Millstone Station are used to avoid unit instability for some transmission contingencies at or near the station. The following are~~ the most severe outage~~s~~ which the system has been designed to survive in order to minimize the possibility of a total plant outage~~.~~ 15-15

Is as follows:

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a. With any one of the four Millstone 345 kV transmission circuits out of service the plant remains stable for any three-phase fault normally cleared (four cycles) or any one-phase fault with the delayed clearing (eight cycles).

b. In order to meet the licensing requirement that no single mechanical failure, such as a tower falling or a line dropping, is able to simultaneously affect all circuits in such a way that off site power would be lost, simultaneous 3-phase faults have been tested for each of the two circuits which are mounted upon common towers. With all lines in service the system remains stable for this two circuit disturbance. It should be recognized that the four circuits leaving the Millstone switchyard are paired on two widely spaced rows of double circuit structures for only a short distance, and, hence the exposure to this double-circuit outage is small.

Without Millstone Unit 1 on line, the net Millstone output does not threaten system stability, even in the event of this double-circuit fault. Double-circuit faults on the Millstone Beseck and Millstone Manchester lines do not require generation rejection in order to maintain system stability.

c. The simultaneous loss of two Millstone circuits on common structures following a previous (non simultaneous) outage of either of the other Millstone circuits (or any other critical element) must not result in instability. All of the critical outages of this type effectively result in the loss of three of the four Millstone circuits and leave the Millstone station weakly tied to the transmission grid. To prevent instability for these extremely severe (and highly improbable) disturbances, it is necessary for the SLOD SPS to be in-service when the loss of the two circuits on common structures takes place.

The Millstone units are connected to the large interconnected transmission system in the eastern half of the United States. The interconnected system frequency is maintained at 60 ± 0.03 Hz in accordance with NPCC standards for the bulk power system. The system is designed and operated such that the loss of the largest single supply to the grid does not result in the complete loss of preferred power. The system design considers the loss, through a single event, of the largest capacity being supplied to the grid, removal of the largest load from the grid, or loss of the most critical transmission line. This could be the total output of a single Millstone reactor unit, the largest generating unit on the grid, or possibly multiple generators as a result of the loss of a common transmission tower, transformer, or a breaker in a switchyard or substation. 15-15

In order to ensure that the interconnected system will remain stable following certain postulated faults, an SPS, or generation rejection scheme, has been installed at the Millstone Station switchyard. The SLOD, continuously monitors the individual state of four transmission line circuits terminated at Millstone 15G switchyard. together with the generation output at the Millstone complex. The four line circuits are:

1. Millstone Manchester Line (Number 310);

2. Millstone Beseck (Number 348);

3. Millstone - Card Street Line (Number 383);

4. Millstone - Montville Line (Number 371)

Should the system condition arise where any one of the four critical line circuits is unavailable, the generation at Millstone is above a predetermined MW level, and two specific transmission circuits are forced out, then generation will automatically be curtailed at Millstone. Stability studies indicate that during maximum output conditions (2001 MW), Millstone Unit 3 can be successfully tripped and system stability maintained leaving Millstone Unit 2 in synchronism with the transmission network.

Studies indicate that a large loss of generation in New England could lead to voltage problems in New York and Pennsylvania, when heavy west to east power transfers are taking place on their systems. ISO New England monitors the loading on the New York and Pennsylvania systems to determine the maximum allowable amount of generation loss which the interconnected system can safely tolerate. Whenever any one of the four (4) critical line circuits involved in the generation rejection scheme is out of service, the output of Millstone 3 is reduced to the maximum allowable amount of generation loss.

The operation of the SLOD Millstone generation rejection scheme is based on the outage of combinations of certain transmission circuit elements. This system continuously monitors the individual status of the four critical transmission elements together with the generation output of the Millstone complex. Generation is curtailed automatically if a system condition arises when station power has been greater than 1750 MW (Gross) 1650 MW (Net) for more than 60 seconds, and there is a loss of 3 of the 4 critical transmission circuits.

The combinations of unavailable components which must be monitored are:

Necessary to meet NPCC and NEPOOL criteria:

Millstone - Manchester, Millstone - Card and Millstone - Montville
Millstone - Beseck, Millstone - Card and Millstone - Montville
Millstone - Montville, Millstone - Manchester and Millstone - Beseck
Millstone - Card, Millstone - Manchester and Millstone - Beseck

Since the operation of the SLOD generation rejection scheme should take place in less than 18 cycles to maintain stability, all transmission line faults must be cleared at high speed.

With the SLOD generation rejection scheme in service, it is permissible to operate with a net Millstone Station output of 2500 MW, when any one of four critical line circuits is out of service. Depending upon conditions in other areas, it may also be necessary to limit the output of Millstone Unit 3 to the Maximum Allowable Millstone Generation Contingency (MAMGC). The MAMGC limit is determined based on NYPP and Pennsylvania-Jersey-Maryland system conditions. As a member of ISO New England and the NPCC, the Licensee is required to comply with either of the following operability requirements with one element out of the service:

1. have SLOD fully operational, limit the net station output to ≤2500 MW and limit the output of Unit 3 to the MAMGC limit, if applicable, or

2. reduce load to a total station output of ≤1750 MW (Gross) 1650 MW (Net) within 30 minutes after the element is removed from service.

With all lines in-service, the net station output is limited to 2520 MW. This will ensure transient stability is maintained in the event of a double-circuit contingency.

These instructions are documented as part of the CONVEX operating instructions for the Millstone switchyard and are regulated by CONVEX. To facilitate regulation, CONVEX is aware of the condition of all lines and the status of the SLOD scheme via an annunciator located at CONVEX.

The operability requirements specified above ensures that, upon loss of a double circuit line with a third line out of service and generation in excess of 1750 MW (Gross) 1650 MW (Net), off site power is available for safe shutdown; maintaining system stability minimizes the probability of coincident loss of both off site supplies. This is consistent with the requirements of General Design Criterion (GDC) 17.

GDC 17 also requires that the probability of losing an off site supply coincident with loss of the nuclear power unit be minimized. Because of the necessity for SLOD to complete its function within 18 cycles, SLOD trips Millstone 3 by tripping the switchyard breakers instead of the generator breaker (this eliminates the extra time required for relay and communication channel operation in a transfer trip scheme). Under these conditions, station auxiliary loads high speed transfer to the reserve station service transformers, and the normal station service transformer (which is tripped when SLOD trips Unit 3) can be reenergized by CONVEX closing a switchyard breaker. Therefore, both off site supplies are available to ensure safe shutdown of the unit in accordance with GDC 17.

8.1.2.3 Extreme Contingency Events

The design of the switchyard protective relay schemes and circuit breaker installations is such that at most only one pole or phase of a three-phase circuit breaker will fail to clear a fault. Breakers which are designed to meet this criteria are classified as having independent pole tripping. Independent pole tripping is ensured by installing breakers with mechanically independent poles and two separate methods of tripping the circuit breaker. These installations include two sets of relays, trip coils, and two sets of current and potential transformers. The wiring for the relay packages are installed in separate duct banks, the relay packages are physically separated in the control house and two separate DC supplies are provided.

15-11

The 345 kV switchyard at Millstone is designed so that the loss of more than one transmission circuit due to a failure of a breaker to trip requires at least two circuit breakers to simultaneously fail to operate. The failure of even one circuit breaker is very unusual. At least three circuit

breakers would have to fail before three transmission lines would be lost due to malfunctions in the switchyard. ~~At that point, the SLOD generation rejection scheme would operate to keep one unit in service. In order to lose the entire station, at least four circuit breakers must fail.~~

8.1.3 STATION BLACKOUT (SBO)

On July 21, 1988, the Code of Federal Regulations 10 CFR Part 50, was amended to include Section 50.63 entitled "Loss of All Alternating Current Power," (Station Blackout [SBO]). The SBO rule requires that each light-water-cooled nuclear power plant be able to withstand and recover from a SBO event of specified duration, requires licensees to submit information as defined in 10 CFR Part 50.63, and requires licensees to provide a plan and schedule for conformance to the SBO rule. The SBO rule further requires that the baseline assumptions, analyses and related information be available for NRC review. Guidance for conformance to the rule is provided by (1) Regulatory Guide (RG) 1.155, Station Blackout; (2) NUMARC 87-00, Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors; and (3) NUMARC 87-00 Supplemental Questions/Answers and Major Assumptions dated December 27, 1989 (issued to the industry by Nuclear Management and Resources Council, Inc. [NUMARC], dated January 4, 1990).

8.1.3.1 Station Blackout Duration

Millstone Unit 2 has the ability to cope with a loss of preferred and emergency on-site AC power sources for up to eight hours. Unit 2 must provide decay heat removal during the event. It is assumed that there will be no AC power available during the first hour of the SBO except for battery backed power supplies (i.e., vital 120V AC). Within the first hour, Millstone Unit 2 will have an alternate AC power source available from Millstone Unit 3 Alternate AC (SBO) diesel generator.

Millstone Units 2 and 3 each have two emergency diesel generators in addition to the Unit 3 Alternate AC (SBO) diesel generator. In accordance with the SBO Rule and NUMARC 87-00, one of the four emergency diesel generators would be available and a Station Blackout is postulated to occur at one unit only at any one time. In the event of a Unit 2 station blackout, the Unit 3 AAC diesel will be made available within one hour by Unit 3 operator action and connected to Unit 2 Bus 24E by Unit 2 operator action.

8.1.3.2 Ability to Cope with a Station Blackout

Eight-hour coping assessments were performed for the 1) condensate inventory available for decay heat removal, 2) Class 1E battery capacity, 3) compressed air capability, 4) effects of loss of ventilation, 5) containment isolation, 6) emergency lighting, 7) communications, and 8) heat tracing. The results of these assessments are summarized below.

Condensate Inventory Available for Decay Heat Removal

A calculation was performed to determine the available volume in the Condensate Storage Tank (CST) for decay heat removal during SBO. The necessary condensate inventory required for

FIGURE 8.1-1A - DELETED

MNPS-2 FSAR

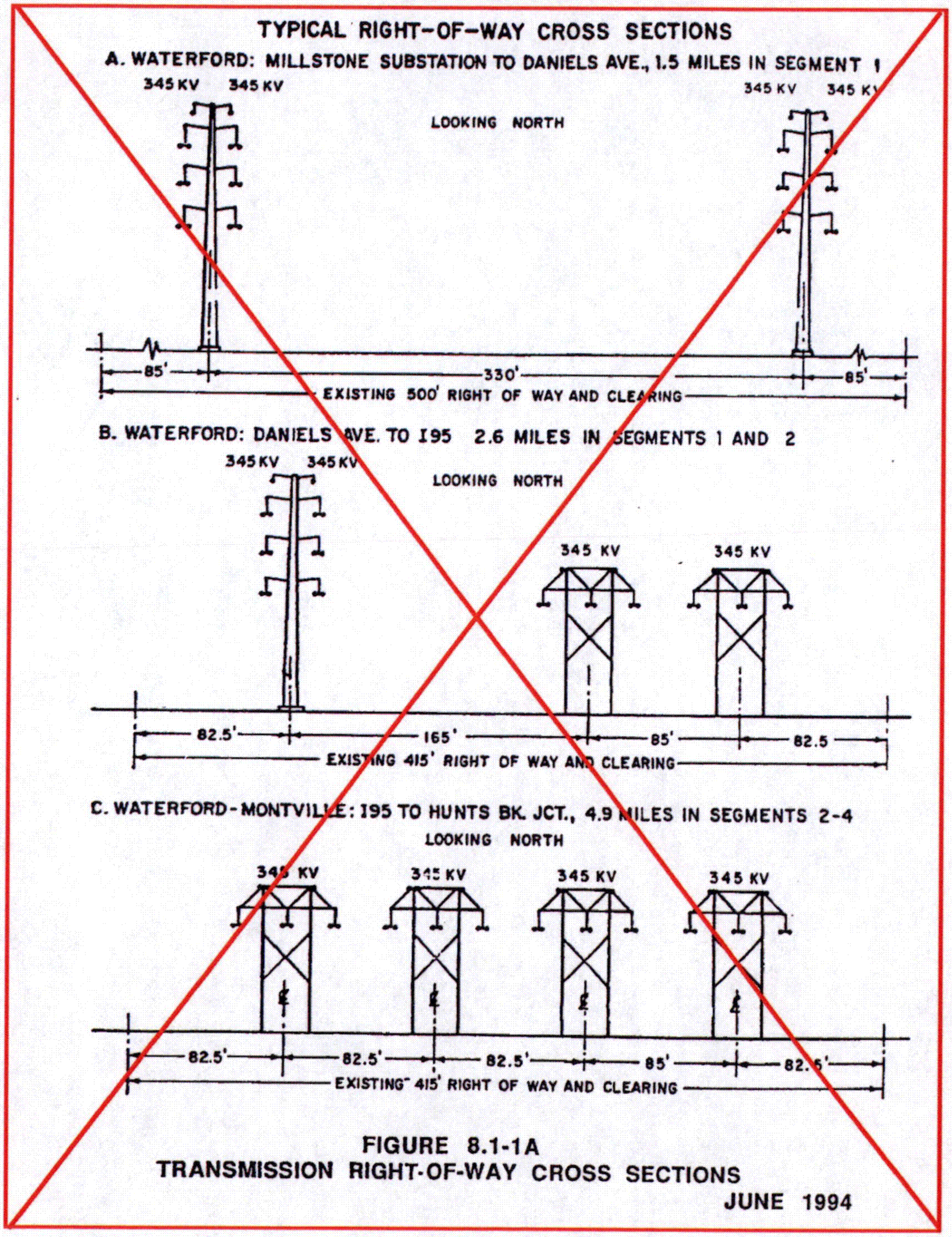
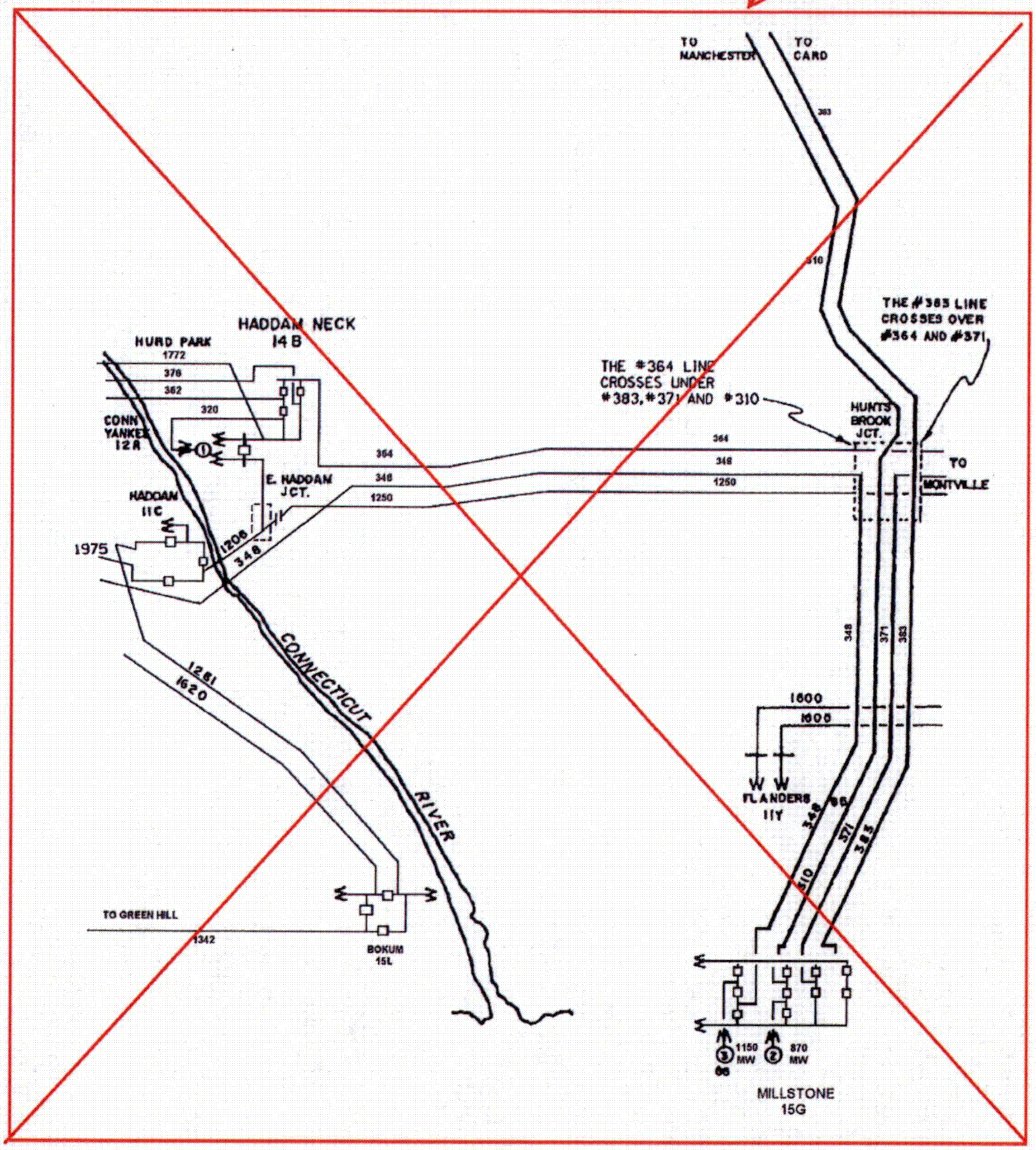


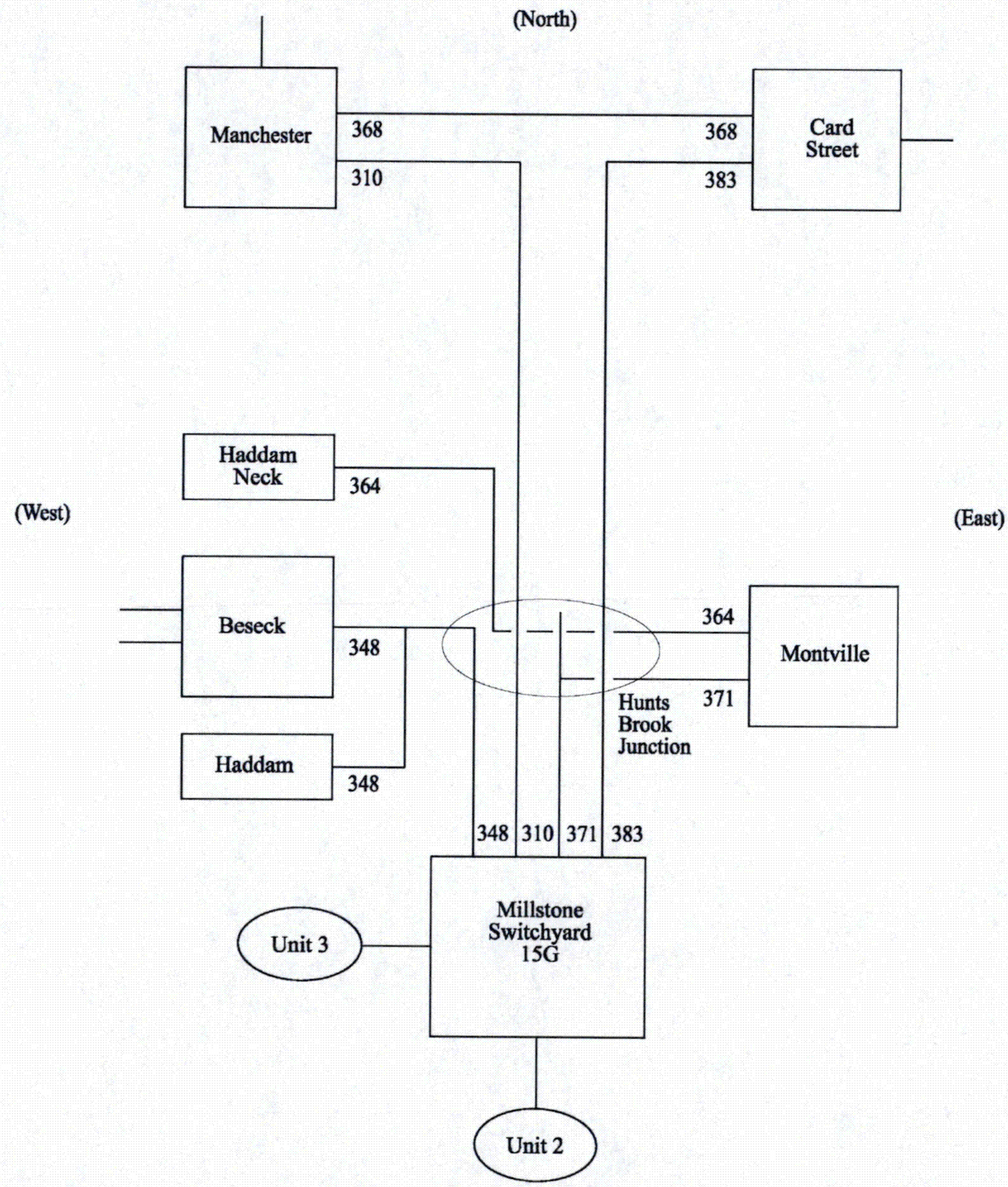
FIGURE 8.1-1A
TRANSMISSION RIGHT-OF-WAY CROSS SECTIONS
JUNE 1994

FIGURE 8.1-1B HUNTS BROOK JUNCTION

Replace with INSERT A



Insert A



Hunts Brook Junction

Note: This figure replaces existing MP2 FSAR Figure 8.1-1B and MP3 FSAR Figure 8.2-2

MNPS-2 FSAR

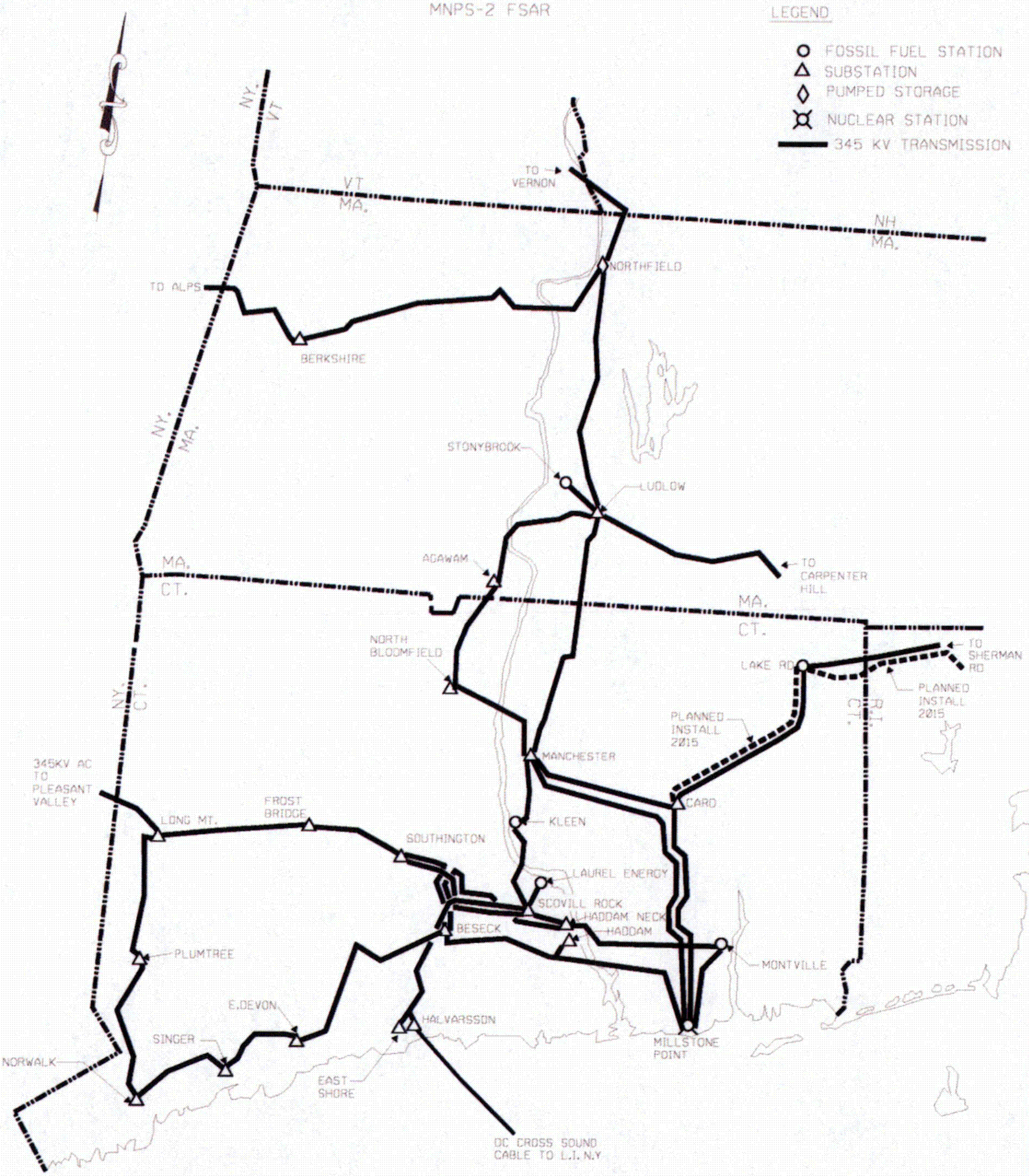


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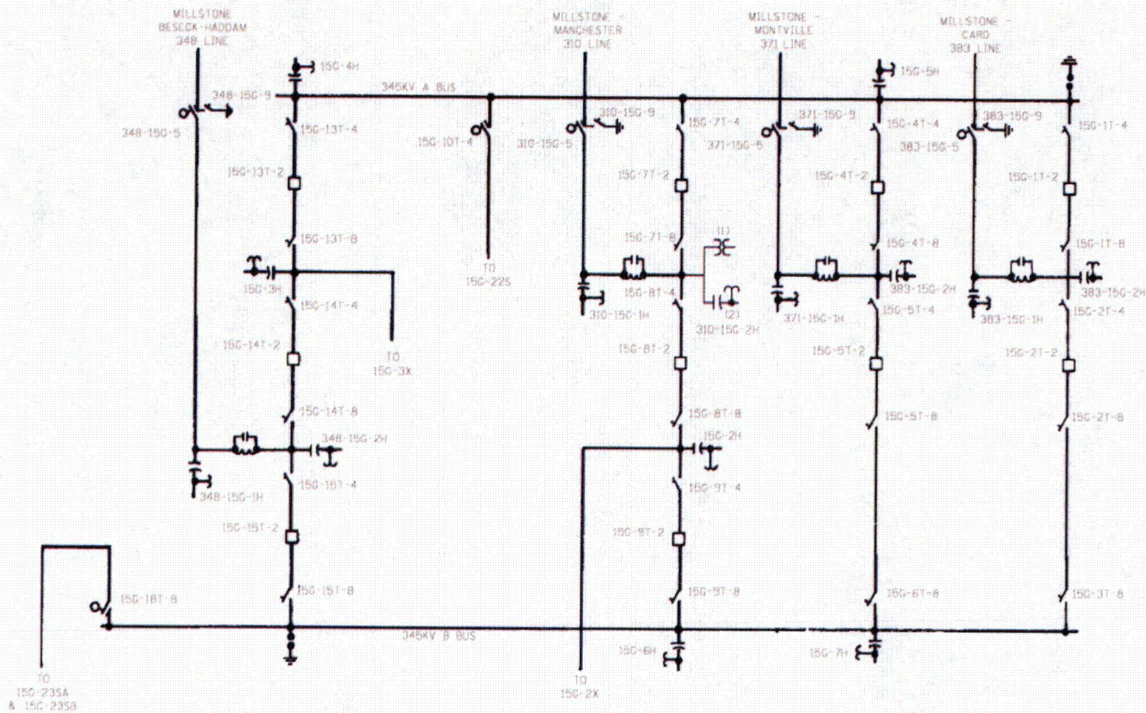
FIGURE 8.1-1C
345KV TRANSMISSION MAP OF CONNECTICUT AND WESTERN MASSACHUSETTS

MPS-2 FSAR

FIGURE 8.1-1D 345KV SWITCHYARD



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Serial No: 15-297
Docket Nos. 50-423

ATTACHMENT 3

MARK-UP OF PROPOSED FSAR CHANGES

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 3

MPS-3 FSAR

NOTE: REFER TO THE CONTROLLED PLANT DRAWING FOR THE LATEST REVISION.

CHAPTER 8 - ELECTRIC POWER

List of Figures

CHAPTER 8 - ELECTRIC POWER

8.1 INTRODUCTION

The descriptions of the utility grid, its interconnections to other grids and to the Millstone Nuclear Power Station 345 kV switchyard, and the on site electric system include the terms defined below.

Transmission System

The transmission system includes all transmission lines coming to the Millstone Nuclear Power Station complex from around the countryside up to, but not including, the point of connection to the 345 kV switchyard.

Off site System

The off site system includes the transmission system, the 345 kV switchyard and extends up to, but not including, the main transformers as shown on Figure 8.1-1. Included in the off site system are the Millstone 3 reserve station service transformers and Millstone 2 in its entirety.

On site System

The on site system includes the Millstone 3 electric power systems out to, and including, the main transformers (Figure 8.1-1); this includes the normal station service transformers.

Normal Operation

Normal operation is considered to be when the main generator is transmitting electrical power through the main transformers and plant auxiliaries are being supplied from the normal station service transformers.

Normal System

The normal system includes that equipment required to support the main turbine generator and nonsafety equipment associated with the reactor. The normal systems and equipment are also referred to as non-Class IE, nonsafety related, nonvital, nonessential, and are color coded black.

Emergency System

The emergency system includes that equipment required to support the safe shutdown of the unit and post accident operations. Included in the emergency system are the emergency 4,160 V switchgear and all extensions except those going to the normal switchgear and the reserve station service transformer (Figure 8.1-1). The emergency systems and equipment are also referred to as Class IE, safety related, vital, essential, engineered safety features, and are color coded purple or orange for trains and red, white, blue, or yellow for channels.

Alternate AC Power Source

The alternate AC power source (AAC) includes the station blackout (SBO) diesel generator and its support equipment required to provide electrical power to equipment necessary to maintain the plant in a safe condition in the event of a loss of both off site power and the standby power system (defined as a Station Blackout Event).

Standby Power System

The standby power system includes the emergency generators, which are also referred to as the on site emergency power supply.

Load Group

The load group is an arrangement of busses, switching equipment, and loads with a common power source. The emergency systems are divided into two redundant and independent load groups.

Preferred Power System

The preferred power system includes the normal off site source and the alternate off site source.

Normal Off site Source

The normal off site source is from the 345 kV switchyard through the main and normal station service transformers with the generator breaker open.

Alternate Off site Source

The alternate off site source is from the 345 kV switchyard through the reserve station service transformers.

8.1.1 UTILITY GRID

The utility electrical system consists of interconnected diverse energy sources including fossil-fueled, hydro-electric and nuclear-fueled plants supplying electric energy over a 345/115 kV transmission system (Figure 8.1-2). 15-12

ISO-New England is the regional transmission organization which has authority over the operation of the transmission system in Connecticut. The main transmission system fed by Millstone Power Station is part of the New England power system. The Connecticut Valley Electric Exchange (CONVEX) is one of the local control centers in New England and assists ISO-New England in running the power system in Connecticut. 15-12

Millstone 3 is rated 1,354.7 MVA, 0.925 pF, 0.50 SCR, 24.0 kV, 1,800 rpm, 3-phase, 60 Hz.

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The output of Millstone 3 is delivered to a 345 kV switchyard (Figure 8.1-3). Four transmission lines at 345 kV feed power to the 345 kV system. Two of these lines feed the Eastern part of Connecticut by connecting respectively to the Card and Montville Substations. The remaining two lines feed the central part of Connecticut by connecting to the Beseck, Haddam, and Manchester Substations. 15-12

8.1.2 INTERCONNECTIONS

Millstone Power Station is connected to the Eversource Energy, Inc. transmission system which is closely integrated with transmission systems of several other utilities and operating companies. The New England power system is part of the larger northeast interconnection power grid and is tied through various connections points throughout New England. These interconnections include 345kV 230kV, 138kV, 115kV, 69kV, and DC lines. The New England power system is also tied to neighboring grids such as New York, Hydro Quebec and New Brunswick, which are under the control of other reliability coordinators within the NPCC region. 15-16

8.1.3 345 KV SWITCHYARD SYSTEM AT SITE

The 345 kV switchyard is designed in an arrangement as shown on Figure 8.1-3.

The switchyard consists of ten 345 kV breakers, four 345 kV transmission lines, two 345 kV tie lines to the generator step-up transformers, and two 345 kV tie lines to the reserve station service transformers. The Millstone 1 generator step up transformer and reserve station service transformer are no longer in service.

The control and relay equipment is housed in a masonry building with complete separation of primary and backup relaying, cables, etc.

The breakers and motor-operated (M.O.) disconnect switches are controlled locally from the switchyard control panels, from the Connecticut Valley Electric Exchange (CONVEX) via Supervisory Control And Data Acquisition (SCADA) or from the Millstone 1 Control Room. Millstone 2 Operations is responsible for the switching and tagging of equipment located in the Millstone 1 Control Room.

With the installation of SCADA in the Millstone 1 Control Room, Millstone 2 Operations has control of generator breakers 8T and 9T, as well as indication only of the remaining breakers and M.O. disconnect switches via the existing RFL industries supervisory equipment. Millstone 2 and 3 control rooms are equipped with remote panels showing the status only of the breakers and M.O. disconnect switches in the switchyard.

The control side of the switchyard panels also contains the annunciator, control switches, indicating metering, breaker synchronizing check relays, reclosing relays and potential indicating lights.

The relay side contains transmission and generator tie line backup relays, out-of-step tripping relays, breaker failure relays, synchronizing relays, and pilot wire relays.

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An immediate read-out transient recovery system (oscillograph) is provided for recording the magnitude and duration of abnormal conditions.

The primary and backup relays, transfer trip, and carrier equipment are all located on their own individual cabinets.

The DC power is supplied by two independent batteries, one primary and one backup. Each battery is equipped with its own charger and distribution panel. A manual transfer scheme is provided to allow one battery and charger to carry the dc load upon the failure of the other battery and charger.

The 345 kV circuit breakers are pneumatically operated, consisting of three individual pole units.

Each phase consists of a pneumatic operating mechanism with associated linkage to operate the interrupters.

One air compressor is supplied for each breaker, in the case of the loss of one of the compressors another compressor can be used. The breakers are air operated, spring closed. The air opens the breaker and at the same time charges the closing spring for the next operation. The breakers have the capability of interrupting at maximum rating within two cycles after a trip signal has been received. Air capacity allows a minimum of three close-open operations to be available after the 15-17
loss of the compressor.

The low voltage breakers for the closing coil DC supplies to the 345 kV breakers are equipped with shunt trip coils to remove the DC supplies and initiate an alarm in case of breaker failure relay operation.

In accordance with the concept of separating primary and backup relaying, all 345 kV circuit breakers are equipped with two trip coils. The primary and backup relays are supplied from separate DC sources, separate current transformers, separate coupling capacitor potential devices, and communication channels.

Each 345 kV transmission line is protected from phase-faults and ground-faults by two sets of diverse protective relays, one primary and one back-up. The primary relays consists of distance 15-17
relays operating in a directional comparison blocking scheme and communicating with the remote channel over a carrier current channel.

The backup protection consists of step distance relays operating in conjunction with transfer trip 15-17
system over a communication channel. This system provides tripping at the remote channel following the operation of the line backup relays or circuit breaker failure relays, as well as tripping of the switchyard breakers following the reception of the transfer trip signal from the remote end.

A permissive over reaching scheme, utilizing audio-tone channel (via a combination of leased and 15-16
dedicated fiber communication lines) is used as additional backup protection.

Pilot wire relaying is used for primary protection of the tie lines up to the main step- up transformer. 15-16

Backup protection consists of directional distance, single zone and directional ground over current relays. For transfer tripping to the plant end, dual channel audio-tone equipment is used.

Tripping of the switchyard breakers following the operation of the generator or main step-up transformer primary and backup relays is accomplished by the means of the transfer trip via pilot wire and audio tone channels.

The Millstone 3 reserve station service transformers' (RSST) 345 kV tie line is protected by two sets of protective relays, one primary and one backup. The directional distance relays detect phase-faults, and the directional ground overcurrent relays detect ground-faults. Operation of these relays will trip the appropriate 345 kV circuit breakers on the B switchyard bus, and send a transfer trip signal via audio tone to trip the transformers' low side circuit breakers at the plant. The operation of any of the RSST transformer protective relays at the plant will trip the low side breakers, and send a transfer trip signal via audio tone to trip the appropriate switchyard breakers.

Breaker failure relays are provided for each of the circuit breakers to trip adjacent breakers in the event that the primary breaker fails to trip. The DC power for breaker failure operation is supplied from the backup battery system.

A breaker failure timing relay is initiated every time a main breaker is ordered to trip by either the primary or backup relays. If the breaker has not tripped before the time period has expired, tripping of the adjacent breakers takes place.

Phase angle sensitive impedance relays are also added to the backup protection of the main step-up transformer tie lines to protect the generator against out-of-step conditions. These relays trip the generator breakers only.

Reclosing of 345 kV breakers is provided following the protective relaying tripping of the 345 kV transmission lines. The reclosing is designed for time delay reclosure from the remote ends only. At the switchyard, the breakers close via synchronism check relays.

A synch-check relay is provided for each breaker to supervise both time delay and manual reclosures.

~~A severe line outage detector (SLOD) protection scheme has been installed, recognizing that it is possible to lose two circuits simultaneously on either of the two-line towers with only one circuit in service on the other two-line tower.~~

~~This condition can result in instability of Millstone generation. It is recognized that in anticipation of a double circuit outage, following the outage of a single circuit, generation reduction at Millstone 15G could be effective in preventing instability.~~

~~The SLOD scheme continuously monitors the individual status of four critical transmission system elements together with the power output of the Millstone generation. Generation is curtailed automatically if a system condition arises where any of the critical situations exist and generation at Millstone is above a predetermined megawatt level. For a more detailed explanation of SLOD see Section 8.2.~~

~~The total operating time of the SLOD generation reduction scheme is no more than 18 cycles.~~

8.1.4 ONSITE ELECTRIC SYSTEM

The on site electric system consists of the normal and emergency systems (Section 8.3 and Figure 8.1-1).

During normal operation, AC power (Section 8.3.1) is provided to the normal and emergency systems through the normal station service transformers, which are connected to the main generator by isolated phase bus ducts. The normal station service transformers have adequate capacity to supply all normal auxiliaries and those emergency auxiliaries (both load groups) required during normal operation, up to the full output of the main generator plus the capacity to supply Millstone Unit 2 GDC 17 requirements as an alternate off site source for minimum post-accident loads. Upon loss of power from the generator, the generator breaker is opened to ensure continuous power service to the auxiliary buses. Upon loss of power from a normal station service transformer, an automatic high speed transfer to the respective reserve station service transformer is provided to ensure continuous power service to the 6.9 kV equipment and the 4.16 kV electrical system.

During startup or shutdown, each of the preferred power sources (normal and alternate off site) has adequate capacity to supply all normal auxiliaries required for an orderly shutdown together with emergency auxiliaries (both load groups) required for a safe shutdown.

When the Unit 3 RSST is out of service, the Unit 3 NSST connection must be credited as the Unit 2 alternate off site source. A single failure of breaker 13T in the 345 kV switchyard would cause simultaneous loss of both Unit 2 off site sources, and therefore breaker 13T and associated disconnect switches must be maintained "open" when this Unit 3 situation exists. With breaker 13T "open," and the Unit 3 RSST out of service, a fault on the Millstone-Beseck 345 kV line would cause a Unit 3 loss of off site power.

The reserve station service transformers also have adequate capacity to supply normal auxiliaries and those emergency auxiliaries (both load groups) if required during normal operation up to the full output from the main generator plus the capacity to supply Millstone Unit 2 GDC 17 requirements as an alternate off site source for minimum post-accident loads.

The standby power sources provide AC power to the emergency systems for safe shutdown when the off site power sources are unavailable. The standby power sources consist of two independent and redundant ac power emergency generators driven by separate diesel engines. Each standby emergency generator has adequate capacity to supply emergency auxiliaries required (one load group only) for a safe shutdown.

8.2 OFF SITE POWER SYSTEM

8.2.1 DESCRIPTION

The off site power system is designed to provide reliable sources of power to the on site AC power distribution system adequate for the safe shutdown of the unit in compliance with General Design Criterion 17 (GDC-17). Details of the off site power system are shown on the following figures:

1. Site Layout (Figure 2.1-3)
2. Site Plan (Figure 2.1-4)
3. Plot Plan (Figure 1.2-2)
4. Transmission Map (Figure 8.1-2)
5. 345 kV Switchyard (Figure 8.1-3)

The switchyard, which is configured in an arrangement as shown on FSAR Figure 8.1-3, buses together four 345 kV transmission line circuits, two generator circuits, and two station service circuits. The Millstone 1 generator and station service circuits are no longer in service.

The four transmission line circuits terminated at the switchyard are:

1. Millstone to Card (Line Number 383)
2. Millstone to Montville (Line Number 371) (this line includes Line 364)
3. Millstone to Beseck (Line Number 348)
4. Millstone to Manchester (Line Number 310)

These circuits connect the station to the system transmission grid and follow a common right-of-way from Millstone to Hunts Brook Junction (9.0 miles). ~~For the first 1.7 miles of this right-of-way, the construction consists of two double-circuit steel-pole transmission lines. The double-circuit steel-pole lines consist of two independent single-circuit structures at locations where the right-of-way changes direction (angle structure) and of a single common structure at all other locations. For the next 2.4 miles, the construction consists of one double-circuit steel-pole transmission line (Line Numbers 348 and 310) and two single-circuit wood-pole H-frame transmission lines (Line Numbers 371 and 383). For the remaining 4.9 miles, single circuit wood-pole H-frame construction is used for all four circuits.~~

~~At Hunts Brook Junction, the four transmission line circuits diverge along three separate rights-of-way. The 371 line consisting predominantly of wood-pole H-frame construction, follows an easterly right-of-way for approximately 3.6 miles to the Montville Substation. The 348 line~~

These four circuits are individually mounted on separate structures which are installed across a 415-500 foot wide Right of Way to provide adequate physical independence of the transmission lines. The transmission towers which support the four lines consist of a combination of steel and wooden mono-pole structures, and steel and wooden H-frame structures. The towers are designed to the National Electric Safety Code Part C2, and Eversource Overhead Transmission Line Standards, which have both strength and overload design factors to provide for conservative designs. The towers for all four transmission lines are periodically inspected for proper physical condition.

~~consisting almost entirely of wood-pole H-frame construction with only a few exceptions where steel structures are utilized, follows a westerly right-of-way for approximately 34 miles to the Beseck substation. The 310 and 383 lines utilizing primarily single circuit wood-pole H-frame construction proceed along a northerly right-of-way for 38 miles and 20 miles to the Manchester and Card substations, respectively.~~

With

feeding

service, the offsite power source complies with GDC-17 with no reasonable failure that can

~~The~~ four lines ~~emanating from~~ the Millstone Switching Station ~~are~~ in ~~compliance with the staff position that no other transmission lines cross over these four lines and that the four lines be physically separate and independent so that no single event, such as a tower falling or line breaking, is able to simultaneously~~ affect all circuits in such a way that none of the four circuits can be returned to service in time to prevent fuel design limits or design conditions of the reactor coolant pressure boundary from being exceeded. ~~Figure 8.2-1, taken from the Connecticut Siting Council Docket No. 25, Application for the Millstone to Manchester 345 kV line, shows the right-of-way cross sections between Millstone and Hunts Brook Junction. The double circuit steel-pole structures between Millstone and I-95 are approximately 120 feet above ground while the wood pole H-frame structures between Daniels Avenue and Hunts Brook Junction are approximately 85 feet above ground.~~

In particular, a sequence of cascading events from a particular tower falling in a specific manner, at one of only a few specific locations, or a line falling at Hunts Brook Junction, the worst case would be the loss of two circuits.

~~In the event of a structure failure between Millstone and Hunts Brook Junction, the worst probable longer-than-momentary outage would be a loss of two circuits; i.e., the two circuits on a common steel pole or an H-frame structure falling into an adjacent line.~~

All four of the 345 kV lines leaving Millstone cross over two 115 kV circuits which supply the Waterford Substation, and constitute the off site source for Millstone Unit One. However, the mechanical failure of a single 345 kV line, and the consequential failure of the 115 kV circuits will not affect the preferred source of off site power to Millstone units 2 and 3.

transmission

diverge along three separate rights-of-way

At Hunts Brook Junction, the four lines ~~split~~ (refer to Figure 8.2-2). The 348 line turns west to the Beseck Substation, the 383 and 310 lines continue north to the Card Street and Manchester Substations, respectively, and the 371 line turns east to Montville Substation. ~~One aerial crossover of a line from Millstone exists at this junction (383 crosses 371). In addition, the 310, 371, and 383 lines all cross over the 364 line (Montville to Haddam Neck). But,~~ at worst, only two of the four circuits from the Millstone Switching Station would be removed from service should a structure collapse or a conductor drop.

At this junction, aerial crossover of lines exist (line 383 and line 310 cross over line 371/364), however,

Separate and independent structures are provided for each of the four 345 kV transmission lines connecting generators 2 and 3 and reserve station service transformers 2 and 3 to the switchyard. The Millstone 1 generator and station service circuits are no longer in service.

The Millstone 3 design, which provides two immediate access off site circuits from the 345 kV switchyard to the 4.16 kV Class 1E buses, is via separate transformers (main/normal station service and reserve station service). Figure 8.1-1 shows the tie lines, transformer, and bus arrangement connections.

The tie lines to the main/normal station service transformers and to the reserve station service transformer are physically separate and electrically independent. The main/normal station service

transformers and the reserve station service transformers are located at opposite ends of the plant. The connections from the normal station service transformers and from the reserve station service transformers to the 4.16 kV Class 1E buses are via physically separate and electrically independent underground duct lines. Figure 2.1-4 shows the tie line routes from the switchyard to the main/normal and to the reserve station service transformers. Figure 1.2-2 shows the physical separation between the normal station service and the reserve station service transformers. Figure 8.3-7, Sheets 1 and 2, shows the embedded conduit duct lines as they enter the redundant switchgear rooms in the control building.

The breakers in the Class 1E buses (34C and D) are independently protected with separate relaying. The control power for these buses is from different DC panels and batteries.

These circuits are completely redundant and separated so that no single failure can disable both off site power supplies to the Class 1E buses; therefore, the design is in compliance with General Design Criterion 17, Electrical Power Systems.

The inspection and testing of the 345 kV circuit breakers and the transmission line protective relaying are done on a routine basis, without removing the generators, transformers or transmission lines from service. The insulating oil for the transformers is sampled and tested on a routine basis. During these routine inspections and tests, the operability and functional performance of the electric systems are in compliance with General Design Criterion 18, Inspection and Testing of Electric Power Systems.

8.2.2 ANALYSIS

The possibility of power failure due to contingencies in the connections to the system and the associated switchyard is minimized by the following arrangements. 15-16

1. The connections to the system have been designed to comply with the Northeast Power Coordinating Council's Design and Operation of the Bulk Power System and the Reliability Standards for the New England Area Bulk Power System. Compliance with these criteria ensure that the supply of off site power is not lost following contingencies in the interconnected transmission system. Transient stability studies have been performed to verify that widespread or cascading interruptions to service do not result from these contingencies. In addition, the loss of Millstone 3 or the loss of any other generating plant in the system does not result in cascading system outages and thus does not cause loss of off site power to the units. Electrical facilities shared between Millstone 3 and Millstone Units 1 & 2 are discussed in Section 3.1.2.5, compliance with General Design Criterion 5, Sharing of Structures, Systems, and Components, is ensured. The Millstone 1 generator and station service circuits are no longer in service. 15-16

   345 kV switchyard is designed in a combination breaker-and-a-half and double breaker-double bus switching arrangement as shown on Figure 8.1-3. 15-17

MPS-3 FSAR

The 345 kV circuit breakers are SF6 gas puffer types and are pneumatically operated. Electrical controls are provided for both local and remote Millstone 1 control room or CONVEX operation. Each power circuit breaker has a separate pneumatic supply unit capable of operating the breaker for a minimum of three close-open operations after the loss of the compressor. Each pneumatic compressor is supplied from a separate feeder at the switchyard essential AC panel. The circuit breakers are equipped with a closing solenoid and two trip solenoids. A standard anti-pump and trip-free control scheme is used. | 15-17

Primary and backup relaying are both high speed protective schemes. Primary and backup protective relays are used, along with breaker failure relaying, to provide redundant protective relaying for the switchyard.

Two 125 VDC batteries are located in the switchyard control and relay enclosure for switchyard relaying and control. Each battery has its own charger and DC distribution panel. The redundant batteries and protective relaying systems are physically and electrically separate. The essential AC station service for the power circuit breaker pneumatic supply units and the other switchyard requirements is supplied from one of two separate sources.

2. The 345 kV system is protected from lightning and switching surges by overhead electrostatic shield wires, earth grounding at most structures surge arrestors on the Switchyard main buses, surge arrestors at the transformer high voltage bushings, and rod gaps on the line terminals. | 15-16

3. Primary and backup relaying is provided for each circuit along with circuit breaker failure backup protection. These provisions permit the following.

   a. Any circuit can be switched under normal or fault conditions without affecting another circuit.

   b. Any single circuit breaker can be isolated for maintenance without interrupting power or protection of any circuit.

   c. Short circuits on any section of a bus are isolated without interrupting service to any element other than those connected to the faulty bus section.

   d. The failure of any circuit breaker to trip initiates the automatic tripping of the adjacent breaker or breakers and thus may result in the loss of a line or generator for this contingency condition; however, power can be restored to the good element in less than eight hours by manually isolating the fault with appropriate disconnect switches. | 15-17

Complete battery failure is considered highly unlikely since two independent 125 VDC battery systems are provided. Failure of a single battery system results only in a temporary loss of one set

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of protective relays until the DC is manually transferred to the other battery. Therefore, no single failure could negate the effectiveness of the relaying to clear a fault.

The Millstone 3 design provides two immediate access off site circuits between the switchyard and the 4.16 kV Class 1E buses. Within the switchyard, the tie line terminations are separated electrically by two circuit breakers so that a fault on one off site supply circuit along with a breaker failure does not cause the second off site supply to be lost. The tie lines are supported on separate structures with one circuit terminating at the main transformer dead end tower, and the second tie line circuit terminating on the reserve station service transformer dead end tower. The normal station service transformers and the reserve station service transformers are located on opposite sides of the unit. The connections from the normal station service transformers and from the reserve station service transformers to the 4.16 kV Class 1E buses are via physically separate and electrically independent under ground duct lines. Figure 2.1-4 shows the tie line routes from the switchyard to the main/normal and to the reserve station service transformers. Figure 1.2-2 shows the physical separation between the normal and the reserve station service transformers. Figure 8.3-7, Sheets 1 and 2, show the embedded conduit duct lines as they enter the redundant switchgear rooms in the control building.

The breakers in the Class 1E buses (34C and 34D) are independently protected with separate relaying. The control power for these buses is from different DC panels and batteries.

Physical separation of the off site power sources, switchyard protection, redundancy, and transmission system design based on load flow and stability analyses minimize the possibility of simultaneous failure of power sources (normal station service supply, reserve station service supply, and standby AC emergency generators) in compliance with General Design Criterion No. 17, Electric Power Systems.

The off site source that is normally available immediately on a unit trip is from the main and normal station service transformers. This source is not lost on a unit trip because the generator breaker effects the disconnection of the unit from the grid leaving the main and normal station service transformers backfed from the switchyard. The second source of off site power is available through an automatic transfer to the reserve station service transformers. Testing the normal immediate access circuit during plant operation would be inappropriate as this would disconnect the unit from the grid. The automatic transfer feature of the alternate immediate access off site circuit is not tested during plant power operation since it risks unnecessary plant trips. Immediate access is not required of a second off site source. For the Millstone 3 design, if the automatic transfer is not successful, the reserve station service transformers can be connected to the emergency buses by manual control switch operation in an acceptable time.

The automatic transfer of emergency 4.16 kV buses 34C (Train A) and 34D (Train B) from either the normal to the reserve station service transformer or the normal or reserve station transformer to the emergency generators were tested prior to initial startup and will be tested during refueling shutdowns of the unit to prove the operability of the system. Therefore, appropriate testing and testability of the transfer of power upon loss of normal power satisfies the requirements of General Design Criterion 18, Inspection and Testing of Electric Power Systems.

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The 345 kV transmission system supplying off site power to Millstone is normally operated at 357 kV at Millstone. This system voltage is controlled by varying the reactive power generation on the Millstone units. The Millstone 2 and 3 operators control the unit excitation as specified by CONVEX Operation Instruction Number 6913. The unit operators are required to balance the reactive power output of the units.

The CONVEX system operator supervises the system reactive power dispatch. He directs the loading of all of the reactive power sources in CONVEX to balance the reactive supply. He keeps the Millstone reactive power generation in balance with the Eastern Area requirements so that the effect on the system of voltage variations is minimized when a unit is lost.

One objective of the reactive power dispatch is to prevent the voltage at Millstone from going below the minimum required to support the actuation of the Engineered Safety Features equipment. A switchyard voltage of 345 kV will assure successful actuation and operation of all necessary safeguards loads in the unlikely event Millstone Unit 3 experiences a Loss-of-Coolant Accident and trips off the transmission system. CONVEX operates the system to assure that this minimum voltage requirement will be met, following the loss of the unit. When in Reactor Modes 5 or 6, with the auxiliary electrical system lightly loaded, Millstone Unit 3 can assure successful actuation and operation of all necessary safeguards loads with a switchyard voltage of 335 kV. The maximum allowable voltage at Millstone is 362 kV based on equipment ratings.

If abnormal system conditions result in voltages approaching minimum levels, the system operating instructions and procedures direct the CONVEX operator to take specific corrective actions to restore voltage. 15-12

Actual experience and system simulations show that the CONVEX operator is able to control the system voltages within the desired limits.

The Millstone plant is connected to the transmission system by four 345 kV circuits (described in Section 8.2.1). ~~For a short distance, these lines are on double-circuit steel poles.~~ Transmission operating procedures are in-place to ensure that no more than the minimum number of circuits would ever intentionally be taken out-of-service, except in an emergency, when both Millstone generating units are on-line.

If both Millstone units 2 and 3 are on-line at full output, certain contingencies on the transmission system as determined by CONVEX result in procedural restrictions on the station's net output, in order to assure that system synchronous and voltage stability will be maintained. ~~In addition, procedural restrictions on the station's output are necessary if the Severe Line Outage Detector (SLOD) Special Protection Systems is out-of-service. This Special Protection System will automatically curtail generation at Millstone Unit 3, depending upon certain transmission system contingencies and the net output of the Millstone Station.~~

By careful design of the switchyard and protective relays, the possibility of the simultaneous loss of both units 2 and 3 at Millstone has been significantly reduced. The system has been computer modeled for both light load and heavy load conditions. The stability analysis indicates that the rest of the system remains in synchronism after the loss of any one Millstone unit~~, since Millstone 3 is~~

subject to automatic generation rejection. The probability of losing both on-line units simultaneously is extremely small because of the preventive measures discussed in the following paragraphs. Accordingly, the Licensee believes it is reasonable to count upon on site power sources to supply the necessary station service power requirements in the very remote event that both Millstone units 2 and 3 should be lost at once accompanied by the total loss of the transmission supply to the station.

A primary objective in designing the connection of the Millstone Nuclear Power Station to the 345 kV transmission network in Connecticut has been to prevent the loss of the entire station output. The reliability criteria of the Northeast Power Coordinating Council (NPCC) and the ISO New England are a fundamental part of this design process. Special Protection Systems (SPS) or generation restrictions at the Millstone Station are used to avoid unit instability for some transmission contingencies at or near the station. The following are the most severe outages which the system has been designed to survive in order to minimize the possibility of a total plant outage. is as follows:

a. With any one of the four Millstone 345 kV transmission circuits out of service, the plant remains stable for any three-phase fault normally cleared (four cycles) or any one-phase fault with delayed clearing (eight cycles).

b. In order to meet the licensing requirement that no single mechanical failure, such as a tower falling or a line dropping, is able to simultaneously affect all circuits in such a way that off site power would be lost, simultaneous 3-phase faults have been tested for each of the two circuits which are mounted upon common towers. With all lines in-service the system remains stable for this two circuit disturbance. It should be recognized that the four circuits leaving the Millstone switchyard are paired on two widely spaced rows of double circuit structures for only a short distance, and, hence the exposure to this double-circuit outage is small.

Without Millstone Unit 1 on-line, the net Millstone output does not threaten system stability, even in the event of this double-circuit fault. Double-circuit faults on the Millstone-Beseck and Millstone-Manchester lines do not require generation rejection in order to maintain system stability.

c. The simultaneous loss of two Millstone circuits on common structures following a previous (non-simultaneous) outage of either of the other Millstone circuits (or any other critical element) must not result in instability. All of the critical outages of this type effectively result in the loss of three of the four Millstone circuits and leave the Millstone station weakly tied to the transmission grid. To prevent instability for these extremely severe (and highly improbable) disturbances, it is necessary for the Severe Line Outage Detection (SLOD) SPS to be in-service when the loss of the two circuits on common structures takes place.

The Millstone units are connected to the large interconnected transmission system in the eastern half of the United States. The interconnected system frequency is maintained at 60+/-0.03 Hz in accordance with NPCC standards for the bulk power system. Loss of large amounts of generation 15-16

or the isolation of an area can cause a deficiency or surplus of generation respectively. Either case causes frequency deviations. High frequency deviations causes generation to be tripped, and low frequency causes automatic load shedding. Either action applied appropriately helps the frequency to recover to 60 Hz within a few minutes.

The system is designed and operated such that the loss of the largest single supply to the grid does not result in the complete loss of preferred power. The system design considers the loss, through a single event, of the largest capacity being supplied to the grid, removal of the largest load from the grid, or loss of the most critical transmission line. This could be the total output of a single Millstone reactor unit, the largest generating unit on the grid, or possibly multiple generators as a result of the loss of a common transmission tower, transformer, or a breaker in a switchyard or substation. 15-16

~~In order to ensure that the interconnected system will remain stable following certain postulated faults, Special Protection Systems, or generation rejection schemes, have been installed at the Millstone Station switchyard. The Severe Line Outage Detector or SLOD continuously monitors the individual state of four transmission line circuits terminated at Millstone 15G switchyard together with the generation output at the Millstone complex. The four line circuits are:~~

1. ~~Millstone - Manchester Line (Number 310);~~
2. ~~Millstone - Beseck Line (Number 348);~~
3. ~~Millstone - Card Street Line (Number 383);~~
4. ~~Millstone - Montville Line (Number 371)~~

~~Should the system condition arise where any one of the four critical line circuits is unavailable, the generation at Millstone is above a predetermined MW level, and two specific transmission circuits are forced out, then generation will automatically be curtailed at Millstone. Stability studies indicate that during maximum output conditions (2001 MW), Millstone Unit 3 can be successfully tripped and system stability maintained leaving Millstone Unit 2 in synchronism with the transmission network. The tripping of this unit results in a generation reduction of up to approximately 1143 MW with 858 MW remaining synchronized.~~

~~Studies indicate that a large loss of generation in New England could lead to voltage problems in New York and Pennsylvania, when heavy west to east power transfers are taking place on their systems. ISO New England monitors the loading on the New York and Pennsylvania systems to determine the maximum allowable amount of generation loss which the interconnected system can safely tolerate. Whenever any one of the four (4) critical line circuits involved in the generation rejection scheme is out of service, the output of Millstone 3 is reduced to the maximum allowable amount of generation loss.~~

~~The operation of the SLOD Millstone generation rejection scheme is based on the outage of combinations of certain transmission circuit elements. This system continuously monitors the individual status of the four critical transmission elements together with the generation output of~~

~~the Millstone complex. Generation is curtailed automatically if a system condition arises when station power has been greater than 1750 MW (gross) 1650 MW (net) for more than 60 seconds, and there is a loss of 3 of the 4 critical transmission circuits.~~

~~The combinations of unavailable components which must be monitored are:~~

~~Necessary to meet NPCC and NEPOOL criteria:~~

~~Millstone - Manchester, Millstone - Card and Millstone - Montville~~

~~Millstone - Beseck, Millstone - Card and Millstone - Montville~~

~~Millstone - Montville, Millstone - Manchester and Millstone - Beseck~~

~~Millstone - Card, Millstone - Manchester and Millstone - Beseck~~

~~Since the operation of the SLOD generation rejection scheme should take place in less than 18 cycles to maintain stability, all transmission line faults must be cleared at high speed.~~

~~With the SLOD generation rejection scheme in service, it is permissible to operate with a net Millstone Station output of 2500 MW, when any one of four critical transmission circuits is out of service. Depending upon conditions in other areas, it may also be necessary to limit the output of Millstone Unit 3 to the Maximum Allowable Millstone Generation Contingency (MAMGC). The MAMGC limit is determined based on New York Power Pool (NYPP) and Pennsylvania-Jersey-Maryland (PJM) system conditions. As a member of ISO New England and the NPCC, the Licensee is required to comply with either of the following operability requirements with one element out of service:~~

1. ~~have SLOD fully operational, limit the net station output to ≤ 2500 MW and limit the output of Unit 3 to the MAMGC limit, if applicable, or~~

2. ~~reduce load to a total station output of ≤ 1750 MW (gross) 1650 MW (net) within 30 minutes after the element is removed from service.~~

~~With all lines in-service, the net station output is limited to 2520 MW. This will ensure transient stability is maintained in the event of a double circuit contingency.~~

~~These instructions are documented as part of the Connecticut Valley Electric Exchange (CONVEX) operating instructions for the Millstone switchyard and are regulated by CONVEX. To facilitate regulation, CONVEX is aware of the condition of all lines and the status of the SLOD scheme via an annunciator located at CONVEX (CONVEX is an operating division of ISO New England.~~

~~The operability requirements specified above ensures that, upon loss of a double circuit line with a third line out of service and generation in excess of 1750 MW (gross) 1650 MW (net), off site power is available for safe shutdown; maintaining system stability minimizes the probability of~~

~~coincident loss of both off site supplies. This is consistent with the requirements of General Design Criterion (GDC) 17.~~

~~GDC 17 also requires that the probability of losing an off site supply coincident with loss of the nuclear power unit be minimized. Because of the necessity for SLOD to complete its function within 18 cycles, SLOD trips Millstone 3 by tripping the switchyard breakers instead of the generator breaker (this eliminates the extra time required for relay and communication channel operation in a transfer trip scheme). Under these conditions, station auxiliary loads high speed transfer to the reserve station service transformers, and the normal station service transformer (which is tripped when SLOD trips Unit 3) can be reenergized by CONVEX closing a switchyard breaker. Therefore, both off site supplies are available to ensure safe shutdown of the unit in accordance with GDC 17.~~

The design of the switchyard protective relay schemes and circuit breaker installations is such that at most only one pole or phase of a three-phase circuit breaker will fail to clear a fault. Breakers which are designed to meet this criteria are classified as having independent pole tripping. Independent pole tripping is ensured by installing breakers with mechanically independent poles and two separate methods of tripping the circuit breaker. These installations include two sets of relays, trip coils, and two sets of current and potential transformers. The wiring for the relay packages are installed in separate duct banks, the relay packages are physically separated in the control house and two separate dc supplies are provided.

| 15-11

The 345 kV switchyard at Millstone is designed so that the loss of more than one transmission circuit due to a failure of a breaker to trip requires at least two circuit breakers to simultaneously fail to operate. The failure of even one circuit breaker is very unusual. At least three circuit breakers would have to fail before three transmission lines would be lost due to malfunctions in the switchyard. ~~At that point, the SLOD generation rejection scheme would operate to keep one unit in service. In order to lose the entire station, at least four circuit breakers must fail.~~

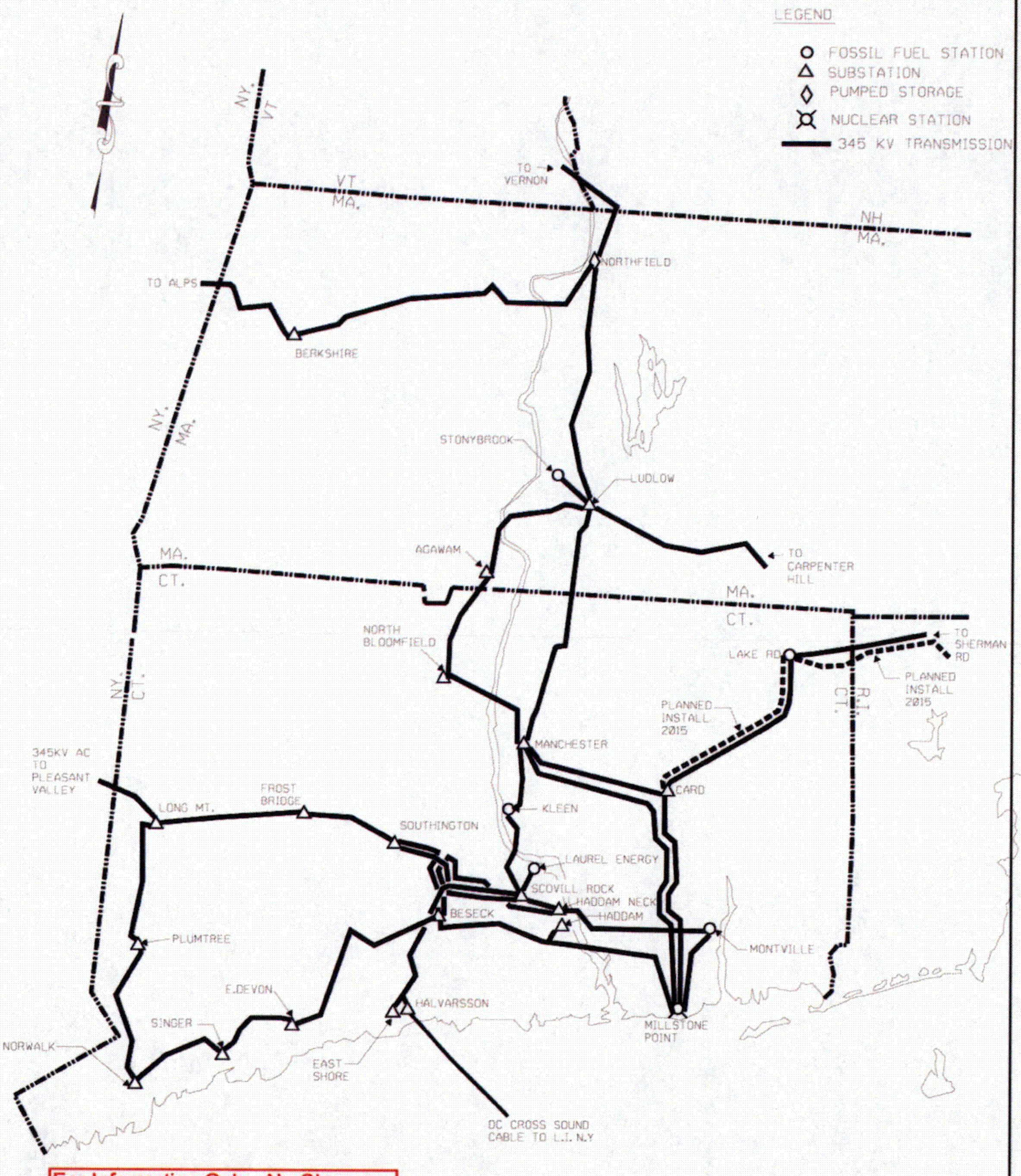

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FIGURE 8.1-2
345KV TRANSMISSION MAP OF CONNECTICUT AND WESTERN MASSACHUSETTS

MPS-3 FSAR

FIGURE 8.1-3 345KV SWITCHYARD

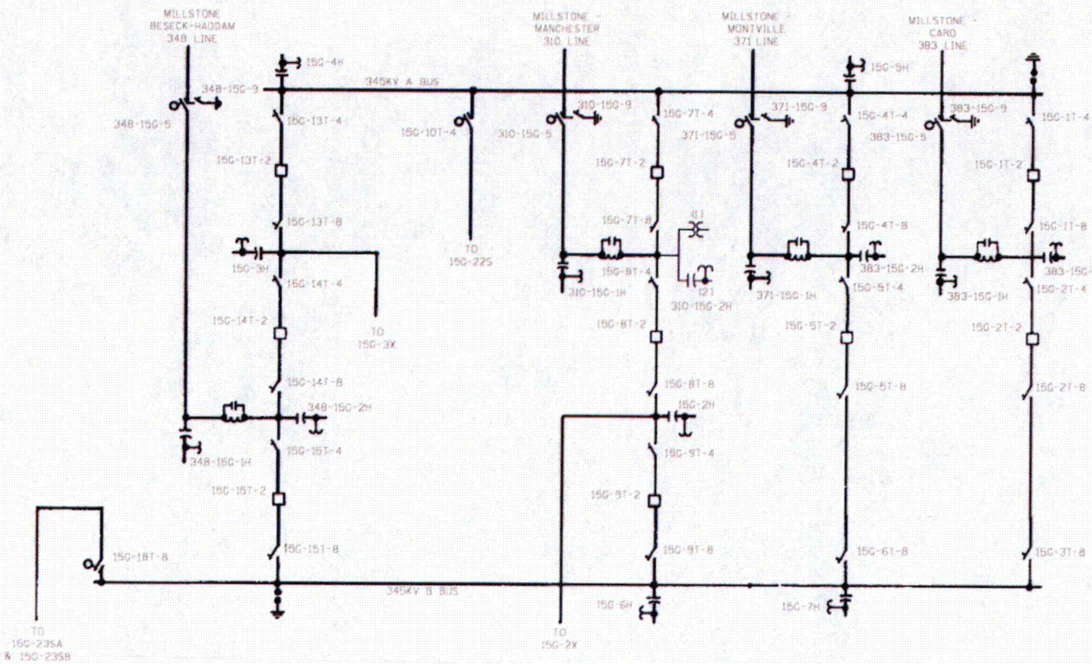

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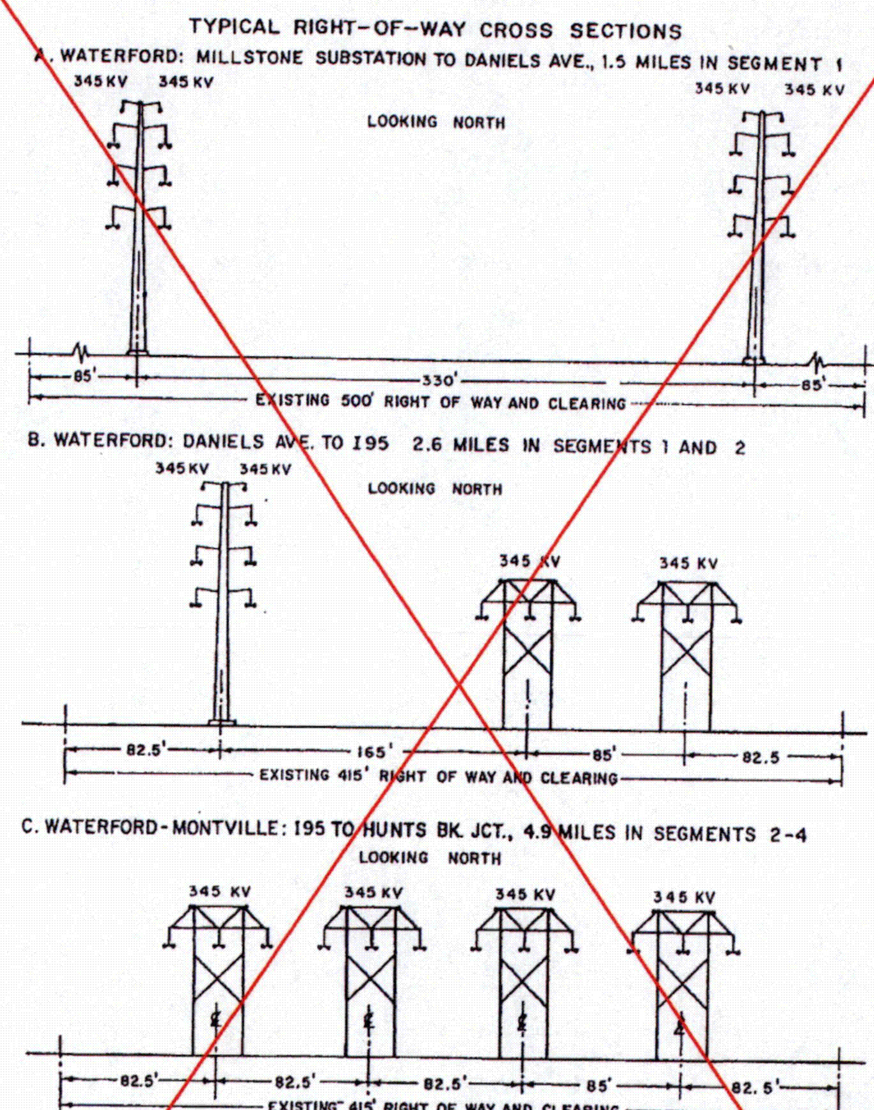
FIGURE 8.2-1 - DELETED

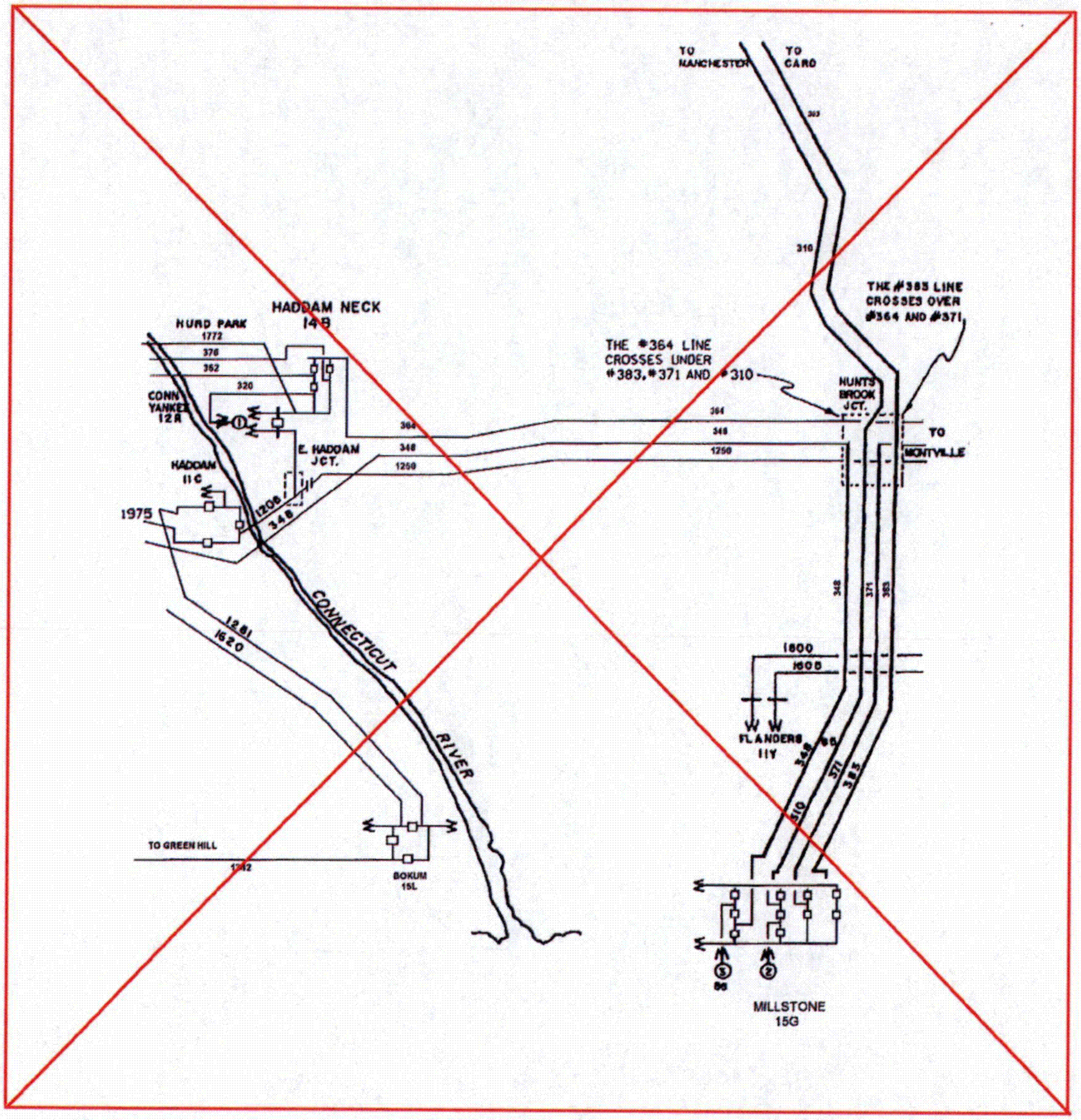
FIGURE 8.2-1 MILLSTONE - MANCHESTER 345KV LINE



MPS-3 FSAR

FIGURE 8.2–2 HUNTS BROOK JUNCTION

Replace with INSERT A



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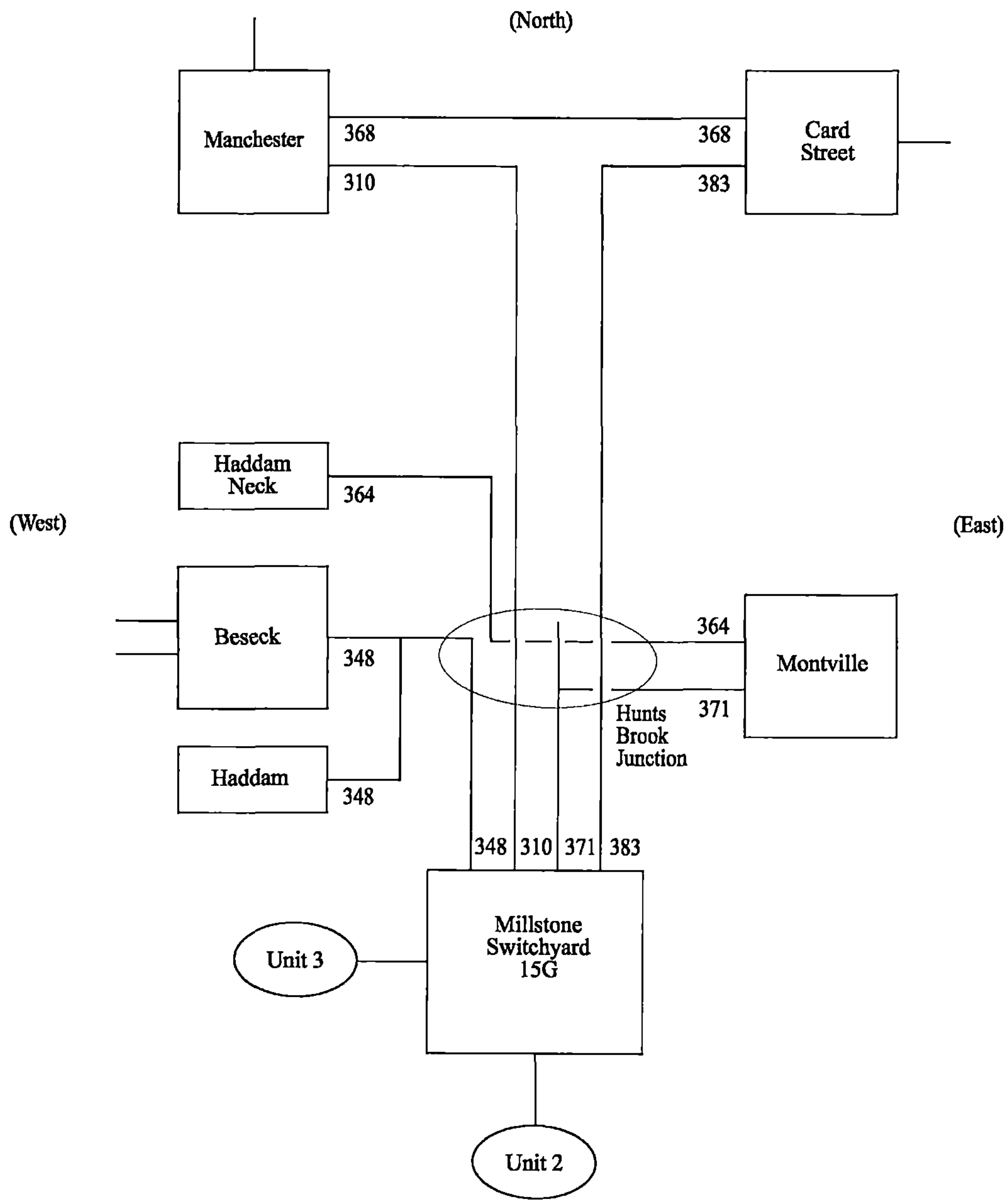

Hunts Brook Junction

Note: This figure replaces existing MP2 FSAR Figure 8.1-1B and MP3 FSAR Figure 8.2-2

ATTACHMENT 4

NEW TECHNICAL REQUIREMENT FOR OFFSITE LINE POWER SOURCES

(FOR INFORMATION ONLY)

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 2

3/4.8 ELECTRICAL POWER SYSTEMS

3/4.8.1 A.C. SOURCES

OFFSITE LINE POWER SOURCES

TECHNICAL REQUIREMENT

===

3.8.1.2 The offsite lines to the Millstone Switchyard: 310, 348, 371 (includes 364 line), and 383, shall be FUNCTIONAL.

APPLICABILITY:

When Millstone Power Station (MPS) electrical output exceeds 1650 MW_e net.

ACTION:

a. With one offsite line nonfunctional, perform the following or reduce total station output to the limiting value associated with the loss of one additional line in accordance with the Millstone Facility Out Guide stability operating limits within the next 6 hours:

   1. Restore FUNCTIONALITY of the affected offsite line within 72 hours, or

   2. Establish the following ACTION requirements AND restore FUNCTIONALITY within 14 days.

      a. Once per shift, verify the remaining offsite lines to the MPS switchyard are FUNCTIONAL.

      b. Perform an initial weather assessment for the scheduled line outage duration and then once per shift thereafter.

         1. If the assessment predicts adverse or inclement weather will exist while the offsite line is nonfunctional (i.e., out of service), reduce total station output to the limiting value associated with the loss of one additional line in accordance with the Millstone Facility Out Guide stability operating limits, prior to arrival of the adverse or inclement weather.

      c. Within one hour prior to or after entering this condition and at least once per 24 hours thereafter, verify that both the Millstone Unit 2 EDGs and the Millstone Unit 3 EDGs are OPERABLE and the Millstone Unit 3 SBO diesel generator is available. Restore any inoperable Millstone Unit 2 EDG or Millstone Unit 3 EDG to OPERABLE status and/or the Millstone Unit 3 SBO to available status within 72 hours or reduce total station output to the limiting value associated with the loss of one additional line in accordance with the Millstone Facility Out Guide stability operating limits within the next 6 hours.

b. With two offsite lines nonfunctional, reduce total station output in accordance with the Millstone Facility Out Guide stability operating limits within the next 30 minutes.

TECHNICAL SURVEILLANCE REQUIREMENTS

==

4.8.1.2 The four offsite lines to the Millstone Switchyard shall be determined to be FUNCTIONAL at least once per 7 days when station output exceeds 1650 MW_e net.

BASES:

TR 3.8.1.2 requires that all four offsite 345 kV transmission lines are FUNCTIONAL when MPS electrical output exceeds 1650 MW_e net. TR 3.8.1 contains ACTIONS that must be performed when one offsite 345 kV transmission line is nonfunctional.

TR 3.8.1.2 provides flexibility to preclude plant downpowers due to planned and unplanned offsite transmission line outages. The TRM requirements provide this flexibility while also maintaining adequate defense-in-depth to ensure grid reliability and stability are preserved and the ability of the plants to respond to design basis accidents is not adversely affected.

With one offsite line nonfunctional, ACTION a.1 allows 72 hours to restore FUNCTIONALITY. This 72-hour allowed outage time (AOT) is conservatively based on the loss of one offsite line being equal to the risk of losing one onsite connection to the offsite power system (i.e., TS 3.8.1.1).

With one offsite line nonfunctional, ACTION a.2 contains the provision to allow up to 14 days to restore FUNCTIONALITY if ACTIONS a.2.a, a.2.b, and a.2.c are met. The 14-day AOT reduces the risk of a plant perturbation as a result of having to downpower the unit for short duration line outages. The 14-day AOT provides flexibility for conducting maintenance and improves operational safety margin by the following:

- Minimizes the number of plant downpowers for short duration 345 kV transmission line outages.
- Reduces the likelihood of a loss of offsite power event by establishing an AOT with additional defense-in-depth measures to minimize the potential for a double circuit failure scenario which can result in grid instability.

During the 14-day AOT, ACTION a.2.a ensures there are no known issues that could threaten the reliability of the remaining 345 kV transmission lines. Verifying the remaining 345 kV offsite transmission lines to the MPS switchyard are FUNCTIONAL, increases confidence that the remaining 345 kV lines will remain FUNCTIONAL during the planned outage of the affected 345 kV line.

During the 14-day AOT, the action to perform weather assessments as required by ACTION a.2.b ensures appropriate actions are taken to minimize the potential for adverse or inclement weather event to impact grid reliability with one line nonfunctional. If adverse or inclement weather is predicted, the nonfunctional 345 kV line would be restored to FUNCTIONAL status or station output would be reduced to the limiting value associated with the loss of one additional line in accordance with the Millstone Facility Out Guide stability operating limits prior to the arrival of the adverse or inclement weather.

During the 14-day AOT, ACTION a.2.c (i.e., both the Millstone Unit 2 and Millstone Unit 3 EDGs are operable and the Millstone Unit 3 SBO is available) provides assurance that AC power will be available to support required safety-related equipment in the unlikely event of a complete loss of offsite power during the time one of the 345 kV lines is nonfunctional. This ACTION ensures that electrical power will be available in a timely manner to perform the required functions to maintain cooling to the reactor core in the unlikely event a loss of offsite power was to occur during this 14-day AOT.

For the condition where the 14-day AOT is in use for one nonfunctional transmission line and one or more of the following components is out-of-service:

- a Millstone Unit 2 EDG
- a Millstone Unit 3 EDG
- the Millstone Unit 3 SBO diesel generator

72 hours is allowed for restoration of the out-of-service component. If any one of these components is not restored within 72 hours, reduce total station output to the limiting value associated with the loss of one additional line in accordance with the Millstone Facility Out Guide stability operating limits within the next 6 hours.

REFERENCE:
License Amendment XXX

ATTACHMENT 5

NEW TECHNICAL REQUIREMENT FOR OFFSITE LINE POWER SOURCES

(FOR INFORMATION ONLY)

**DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 3**

3/4.8 ELECTRICAL POWER SYSTEMS

3/4.8.1 A.C. SOURCES

OFFSITE LINE POWER SOURCES

TECHNICAL REQUIREMENT

3.8.1 The offsite lines to the Millstone Switchyard: 310, 348, 371 (includes 364 line), and 383, shall be FUNCTIONAL.

APPLICABILITY:

When Millstone Power Station (MPS) electrical output exceeds 1650 MW_e net.

ACTION:

a. With one offsite line nonfunctional, perform the following or reduce total station output to the limiting value associated with the loss of one additional line in accordance with the Millstone Facility Out Guide stability operating limits within the next 6 hours:

   1. Restore FUNCTIONALITY of the affected offsite line within 72 hours, or

   2. Establish the following ACTION requirements AND restore FUNCTIONALITY within 14 days.

      a. Once per shift, verify the remaining offsite lines to the MPS switchyard are FUNCTIONAL.

      b. Perform an initial weather assessment for the scheduled line outage duration and then once per shift thereafter.

         1. If the assessment predicts adverse or inclement weather will exist while the offsite line is nonfunctional (i.e., out of service), reduce total station output to the limiting value associated with the loss of one additional line in accordance with the Millstone Facility Out Guide stability operating limits, prior to arrival of the adverse or inclement weather.

      c. Within one hour prior to or after entering this condition and at least once per 24 hours thereafter, verify that both the Millstone Unit 2 EDGs and the Millstone Unit 3 EDGs are OPERABLE and the Millstone Unit 3 SBO diesel generator is available. Restore any inoperable Millstone Unit 2 EDG or Millstone Unit 3 EDG to OPERABLE status and/or the Millstone Unit 3 SBO to available status within 72 hours or reduce total station output to the limiting value associated with the loss of one additional line in accordance with the Millstone Facility Out Guide stability operating limits within the next 6 hours.

b. With two offsite lines nonfunctional, reduce total station output in accordance with the Millstone Facility Out Guide stability operating limits within the next 30 minutes.

TECHNICAL SURVEILLANCE REQUIREMENTS

==

4.8.1 The four offsite lines to the Millstone Switchyard shall be determined to be FUNCTIONAL at least once per 7 days when station output exceeds 1650 MW_e net.

BASES:

TR 3.8.1 requires that all four offsite 345 kV transmission lines are FUNCTIONAL when MPS electrical output exceeds 1650 MW_e net. TR 3.8.1 contains ACTIONS that must be performed when one offsite 345 kV transmission line is nonfunctional.

TR 3.8.1 provides flexibility to preclude plant downpowers due to planned and unplanned offsite transmission line outages. The TRM requirements provide this flexibility while also maintaining adequate defense-in-depth to ensure grid reliability and stability are preserved and the ability of the plants to respond to design basis accidents is not adversely affected.

With one offsite line nonfunctional, ACTION a.1 allows 72 hours to restore FUNCTIONALITY. This 72-hour allowed outage time (AOT) is conservatively based on the loss of one offsite line being equal to the risk of losing one onsite connection to the offsite power system (i.e., TS 3.8.1.1).

With one offsite line nonfunctional, ACTION a.2 contains the provision to allow up to 14 days to restore FUNCTIONALITY if ACTIONS a.2.a, a.2.b, and a.2.c are met. The 14-day AOT reduces the risk of a plant perturbation as a result of having to downpower the unit for short duration line outages. The 14-day AOT provides flexibility for conducting maintenance and improves operational safety margin by the following:

- Minimizes the number of plant downpowers for short duration 345 kV transmission line outages.
- Reduces the likelihood of a loss of offsite power event by establishing an AOT with additional defense-in-depth measures to minimize the potential for a double circuit failure scenario which can result in grid instability.

During the 14-day AOT, ACTION a.2.a ensures there are no known issues that could threaten the reliability of the remaining 345 kV transmission lines. Verifying the remaining 345 kV offsite transmission lines to the MPS switchyard are FUNCTIONAL, increases confidence that the remaining 345 kV lines will remain FUNCTIONAL during the planned outage of the affected 345 kV line.

During the 14-day AOT, the action to perform weather assessments as required by ACTION a.2.b ensures appropriate actions are taken to minimize the potential for adverse or inclement weather event to impact grid reliability with one line nonfunctional. If adverse or inclement weather is predicted, the nonfunctional 345 kV line would be restored to FUNCTIONAL status or station output would be reduced to the limiting value associated with the loss of one additional line in accordance with the Millstone Facility Out Guide stability operating limits prior to the arrival of the adverse or inclement weather.

During the 14-day AOT, ACTION a.2.c (i.e., both the Millstone Unit 2 and Millstone Unit 3 EDGs are operable and the Millstone Unit 3 SBO is available) provides assurance that AC power will be available to support required safety-related equipment in the unlikely event of a complete loss of offsite power during the time one of the 345 kV lines is nonfunctional. This ACTION ensures that electrical power will be available in a timely manner to perform the required functions to maintain cooling to the reactor core in the unlikely event a loss of offsite power was to occur during this 14-day AOT.

For the condition where the 14-day AOT is in use for one nonfunctional transmission line and one or more of the following components is out-of-service:

- a Millstone Unit 2 EDG
- a Millstone Unit 3 EDG
- the Millstone Unit 3 SBO diesel generator

72 hours is allowed for restoration of the out-of-service component. If any one of these components is not restored within 72 hours, reduce total station output to the limiting value associated with the loss of one additional line in accordance with the Millstone Facility Out Guide stability operating limits within the next 6 hours.

REFERENCE:
License Amendment XXX

ATTACHMENT 6

ISO-NEW ENGLAND MILLSTONE FACILITY OUT GUIDE LETTER

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNITS 2 AND 3

ISO new england

June 17, 2015

Deborah MacDonald
Manager Nuclear Design Engineering
Millstone Generation Power Station, Route 156, Rope Ferry Road
Waterford, CT, 06385

Dear Mrs. MacDonald:

This letter is in response to your request for a statement from ISO New England regarding the Millstone Facility Out Guide. This is to support Dominion's Millstone Station filing to the NRC (Docket Numbers 50-336 and 50-423).

The ISO New England Millstone Facility Out Guide represents the results of dynamic studies completed in accordance with NERC Reliability Standards, NPCC Directories and ISO New England Procedures. The Guide provides real-time guidance to posture Millstone generation to maintain generator stability during a facility out condition. The Guide describes the limitations to Millstone Station generation (Millstone 2+3) if there are two major elements (Line + Line, Line + Breaker or Breaker + Breaker) out of service in the Millstone switchyard.

If the NRC would like to review the Millstone Facility Out Guide they will have to make a request directly to ISO New England. Due to ISO New England Information Policy restrictions, the request cannot be made through Millstone Station.

Sincerely,

Kevin Clark
Principal Nuclear & System Reliability Coordinator

ISO New England Inc.
One Sullivan Road, Holyoke, MA 01040-2841
www.iso-ne.com T 413 535 4000

ATTACHMENT 7

HISTORICAL REGULATORY CORRESPONDENCE PERTAINING TO MPS3 OFFSITE POWER SOURCES

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 3

Excerpts from

NRC Letter Dated May 3, 1983

Request for Additional Information for Millstone Nuclear Power Station, Unit 3

ASCII Text

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

MAY 3 1983

Docket No. 50-423

Mr. W. G. Counsil
Senior Vice President
Nuclear Engineering and Operations
Northeast Nuclear Energy Company
Post Office Box 270
Hartford, Connecticut 06101

RECEIVED
MAY 4 1983
SENIOR VICE PRESIDENT
Nuclear Engineering & Operations

Dear Mr. Counsil:

Subject: Request for Additional Information for Millstone Nuclear Power Station, Unit 3

Enclosed are requests for additional information which the staff requires to complete its evaluation of your application for an operating license for Millstone 3. These requests for additional information are the result of the staff's review of the information in your FSAR. You should amend your FSAR to include the information requested in Enclosure 1.

Review of certain portions of your application has been delayed and questions concerning these portions are not included in this package. You will be advised of the schedule for transmittal of any questions resulting from this remaining review. Due to the expected number and nature of these questions, the staff expects that you will be able to provide your responses to these questions when you respond to the questions in Enclosure 1; however, if necessary, you will be given ninety days from the date of transmittal to provide your responses.

As you were advised in the letter from Darrell G. Eisenhut to you dated January 31, 1983 concerning acceptance of your application for docketing, only a single set of questions concerning your FSAR are being transmitted to you for responses. After the staff has reviewed your responses to these questions, a draft SER will be prepared to provide a basis for a series of meetings designed to close out open items.

You should provide your response to the enclosed request for additional information in the form of an amendment to the FSAR no later than August 1, 1983.

For further information or clarification, please contact the Licensing Project Manager, Elizabeth L. Doolittle (301/492-7134).

Sincerely,

B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing

RECEIVED
MAY 10 1983
R. T. LAUDENAT

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Enclosure:
As Stated

cc w/encls.: See next page

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REQUEST FOR ADDITIONAL INFORMATION
MILLSTONE NUCLEAR POWER STATION UNIT 3
DOCKET NO. 50-423

430.0 POWER SYSTEMS BRANCH, ELECTRICAL

430.3 (SRP 8.1) Criterion 50 of Appendix A to 10 CFR 50, IEEE Standard 485, Regulatory Guide 1.63 and branch technical positions ICSB 4, PSB-1 and PSB-2 have not been identified in Table 8.1-2 of the FSAR; thus, a positive statement as to compliance with these criteria and staff guidelines has not been provided in the FSAR. Provide a statement of compliance and justify areas of noncompliance.

430.4 (SRP 8.2) There are four transmission lines between Millstone and Hunts Brook Junction that follow a common right-of-way. It is the staff position that no other transmission lines cross over these four lines and that the four lines be physically separate and independent so that no single event such as a tower falling or line breaking will be able to simultaneously affect all circuits in such a way that none of the four circuits can be returned to service in time to prevent fuel design limits or design conditions of the reactor coolant pressure boundary from being exceeded. Line cross overs and physical separation of these four transmission lines has not been described in the FSAR. Provide the description and justify areas of noncompliance with the above staff position.

430.5 (SRP 8.2) The Millstone design provides two immediate access offsite circuits between the switchyard and the 4.16 kv Class 1E busses. It is the staff position that these two circuits be physically separate and independent such that no single event can simultaneously affect both circuits in such a way that neither can be returned to service in time to prevent fuel design limits or design conditions of the reactor coolant pressure boundary from being exceeded. The physical separation and independence of these two circuits has not been described or analyzed in the FSAR. Provide the description and analysis and justify areas of noncompliance with the above staff position. The analysis should include separation and independence of control and protective relaying circuits as well as the power circuits.

430.6 (SRP 8.2) The Millstone design arrangement provides two immediate access offsite circuits. One of these circuits utilizes a generator circuit breaker to isolate the turbine generator from the main and normal station service transformers. Other facilities that utilize generator circuit breakers have been required to perform verification testing. Provide a verification test program with results to demonstrate the breaker's ability to perform its intended function during steady-state operation, power system transients, and major faults. (See additional guidelines for this question in Attachment 1.)

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REQUEST FOR ADDITIONAL INFORMATION
MILLSTONE NUCLEAR POWER STATION UNIT 3
DOCKET NO. 50-423

430.0 POWER SYSTEMS BRANCH, ELECTRICAL (CONT'D)

430.7 (SRP 8.2)

a. It is the staff position that the Millstone grid stability analysis must show that loss of the largest single supply to the grid does not result in the complete loss of preferred power. The analysis should consider the loss, through a single event, of the largest capacity being supplied to the grid, removal of the largest load from the grid, or loss of the most critical transmission line. The combined capacity of Millstone Units 1, 2, and 3 is to be supplied to the grid through the common Millstone switchyard. The combined capacity of the three units appears to be the largest capacity being supplied to the grid and should be considered in the Millstone grid stability analysis. Provide the results of the grid stability analysis when simultaneous loss of the combined capacity of Units 1, 2, and 3 is considered and justify areas of noncompliance with the above staff position.

b. There are four transmission circuits that connect the Millstone switchyard to the grid system. The four circuits are routed on two tower lines - two circuits per tower line. Section 8.1.3 of the FSAR indicates that a simultaneous failure of either of the two tower lines with only one circuit in service on the other tower line, may result in instability of Millstone generation. The applicant, in order to prevent instability, has installed a protection scheme to automatically reduce generator output at Millstone Unit 3. Describe the protection scheme.

430.8 (SRP 8.2 & 8.3.1) Each of the 4.16 kV Class 1E busses at Millstone is supplied power from preferred offsite and standby onsite circuits. It is the staff position that these circuits should not have common failure modes. Physical separation and independence of these circuits has not been described or analysed in the FSAR. Provide a description and analysis in accordance with Section 5.2.1(5) of IEEE Standard 308-1974.

430.9 (SRP 8.3.1, Appendix 8A) Section 8.3.1.1.4 of the FSAR indicates that a degraded voltage scheme with two-out-of-four logic is provided on each of the 4.16 kV Class 1E buses. Provide reference to electric schematic drawings that describe the degraded voltage scheme and provide a description, with voltage and time setpoints, to indicate how the Millstone design complies with the guidelines of position 1 of branch technical position PSB-1 (NUREG-0800 Appendix 8A) and provide justification for any deviations.

430.10 (SRP 8.3.1, Appendix 8A) As stated in Section 8.3.1.1.3 of the FSAR, the emergency generator load sequences (EGLS) has the capability to automatically reset during a sustained low voltage condition on the essential bus. It is the staff concern that this capability may unnecessarily

Excerpts from

Northeast Utilities Letter Dated August 1, 1983

Millstone Nuclear Power Station, Unit No. 3

Response to Select Requests for Additional Information

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NORTHEAST UTILITIES

THE CONNECTICUT LIGHT AND POWER COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

General Offices • Selden Street, Berlin, Connecticut

P.O. BOX 270
HARTFORD, CONNECTICUT 06141-0270
(203) 666-6911

August 1, 1983
Docket No. 50-423
B10850

Director of Nuclear Reactor Regulation
Mr. B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

References:

(1) B. J. Youngblood to W. G. Counsil, Request for Additional Information for Millstone Nuclear Power Station, Unit No. 3, dated May 3, 1983.

(2) W. G. Counsil to B. J. Youngblood, Millstone Nuclear Power Station, Unit No. 3: Response to Select Requests for Additional Information, dated July 22, 1983.

(3) B. J. Youngblood to W. G. Counsil, Request for Additional Information for Millstone Nuclear Power Station, Unit No. 3, dated May 31, 1983.

Dear Mr. Youngblood:

Millstone Nuclear Power Station, Unit No. 3:
Response to Select Requests for Additional Information

Attached are the remaining responses to those questions contained in Reference (1) that were not forwarded by Reference (2). Attachment 1 lists and contains these responses. Additionally, responses to a portion of the questions forwarded by Reference (3) are now being forwarded in advance of the August 29, 1983 due date. Attachment 2 lists and contains these responses. Attachment 3 contains FSAR changes made as a result of responses to questions.

Similar to the transmittal of Reference (2), because our response to Reference (3) is being forwarded via two (2) transmittals, some of the revised FSAR pages associated with responses contained herein are common to those to be forwarded on or before August 29, 1983. Such revisions should not be construed as final until they are forwarded on or before August 29, 1983.

As agreed in discussions between your Mr. J. Sprawl and our Mr. D. O. Nordquist during a July 7, 1983 meeting, the attached 260 series question responses concerning the Millstone Unit No. 3 Quality Assurance Program have been prepared to address the operational phase. In other words, responses to 260 series questions were prepared considering that these questions were asked as a

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result of the NRC's review of the Northeast Utilities Quality Assurance Program against NUREG-0800, Standard Review Plan Section 17.2, Quality Assurance During the Operational Phase. The 260 series responses attached are self-contained. They do not revise FSAR Section 17.2 or NU-QA-1, the Northeast Utilities Quality Assurance Program Topical Report. However, as agreed with Mr. Sprawl a decision will be made in the near future to revise one of these documents to include the applicable responses to the 260 series questions.

The responses to Reference (1) contained in both this transmittal and in Reference (2) have been or are being provided as they will appear in Amendment 3 to the FSAR. On or before September 1, 1983, the required 60 copies of Amendment 3 will be forwarded to you for insertion into your FSAR sets. Similarly, the responses provided now to Reference (3) and those remaining to be provided August 29, 1983 have been or will be provided as they will appear in Amendment 3 or Amendment 4 to the FSAR which will be forwarded on or before October 1, 1983.

If you have any concerns related to commitments contained herein or any questions related to our responses, please contact our Licensing representative directly.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY, ET AL
By NORTHEAST NUCLEAR ENERGY COMPANY, Their Age

W. G. Counsil
Senior Vice President

STATE OF CONNECTICUT)
) ss. Berlin
COUNTY OF HARTFORD)

Then personally appeared before me W. G. Counsil, who being duly sworn, did state that he is Senior Vice President of Northeast Nuclear Energy Company, a Licensee herein, that he is authorized to execute and file the foregoing information in the name and on behalf of the Licensees herein and that the statements contained in said information are true and correct to the best of his knowledge and belief.

Notary Public

My Commission Expires March 31, 1988

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ATTACHMENT 1

Remaining Responses to Those Questions Contained in Reference 1 That Were Not Forwarded by Reference 2

ROUND 1 QUESTIONS

220.9	241.17	260.32	410.7
220.11	241.18	260.33	410.8
220.12	241.19	260.34	410.9
220.13	241.20	260.35	410.10
220.14	250.2	260.36	410.11
220.15	250.3	260.37	410.12
220.17	250.4	260.38	410.13
220.21	250.5	260.39	410.15
220.22	250.6	260.40	410.16
220.23	250.7	260.41	410.17
220.24	260.1	260.42	410.21
220.27	260.2	260.43	410.22
220.28	260.3	260.44	410.24
220.29	260.4	260.45	410.26
220.30	260.5	260.46	410.27
220.34	260.6	260.47	410.28
220.35	260.7	260.48	410.31
220.36	260.8	260.49	430.4
220.37	260.9	260.50	430.7
230.3	260.10	260.51	430.9
230.4	260.11	260.52	430.10
230.5	260.12	260.53	430.11
231.1	260.13	260.54	430.12
231.2	260.14	260.55	430.15
231.3	260.15	260.56	430.16
240.1	260.16	260.57	430.17
240.4	260.17	280.8	430.18
240.5	260.18	280.15	430.19
240.6	260.19	280.19	430.21
240.7	260.20	280.21	430.22
240.8	260.21	280.23	430.23
241.1	260.22	280.25	430.24
241.3	260.23	280.27	430.26
241.4	260.24	281.3	430.29
241.5	260.25	281.4	430.32
241.7	260.26	281.5	430.35
241.8	260.27	281.7	430.36
241.9	260.28	281.8	430.39
241.10	260.29	281.9	430.40
241.13	260.30	281.10	430.41
241.15	260.31	281.13	

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ATTACHMENT 1 (Cont)

430.42
430.43
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730.1

NRC Letter: May 3, 1983

Question No. Q430.4 (SRP Section 8.2)

There are four transmission lines between Millstone and Hunts Brook Junction that follow a common right-of-way. It is the staff position that no other transmission lines cross over these four lines and that the four lines be physically separate and independent so that no single event such as a tower falling or line breaking will be able to simultaneously affect all circuits in such a way that none of the four circuits can be returned to service in time to prevent fuel design limits or design conditions of the reactor coolant pressure boundary from being exceeded. Line crossovers and physical separation of these four transmission lines has not been described in the FSAR. Provide the description and justify areas of noncompliance with the above staff position.

Response:

The four lines emanating from the Millstone Switching Station will be in compliance with the staff position. Attached Figure Q430.4-1, taken from the Connecticut Siting Council Docket No. 25, Application for the Millstone to Manchester 345-kV line, shows the right-of-way cross sections between Millstone and Hunts Brook Junction. The double circuit steel-pole structures between Millstone and I-95 average 120 feet above ground while the wood pole H-frame structures between Daniels Avenue and Hunts Brook Junction average 85 feet above ground.

In the event of a structure failure between Millstone and Hunts Brook Junction, the worst probable longer-than-momentary outage would be a loss of two circuits; i.e., the two circuits on a common steel pole, or an H-frame structure falling into an adjacent line.

At Hunts Brook Junction, the four lines split (see attached Figure Q430.4-2). The 348 line turns west to Southington Substation, the 383 and new 310 lines continue north to Card Street and Manchester Substation respectively, and the 371 line turns east to Montville Substation. One aerial crossover of a line from Millstone exists at this junction (383 crosses 371). But, at worst, only two of the four circuits from the Millstone Switching Station would be removed from service should a structure collapse.

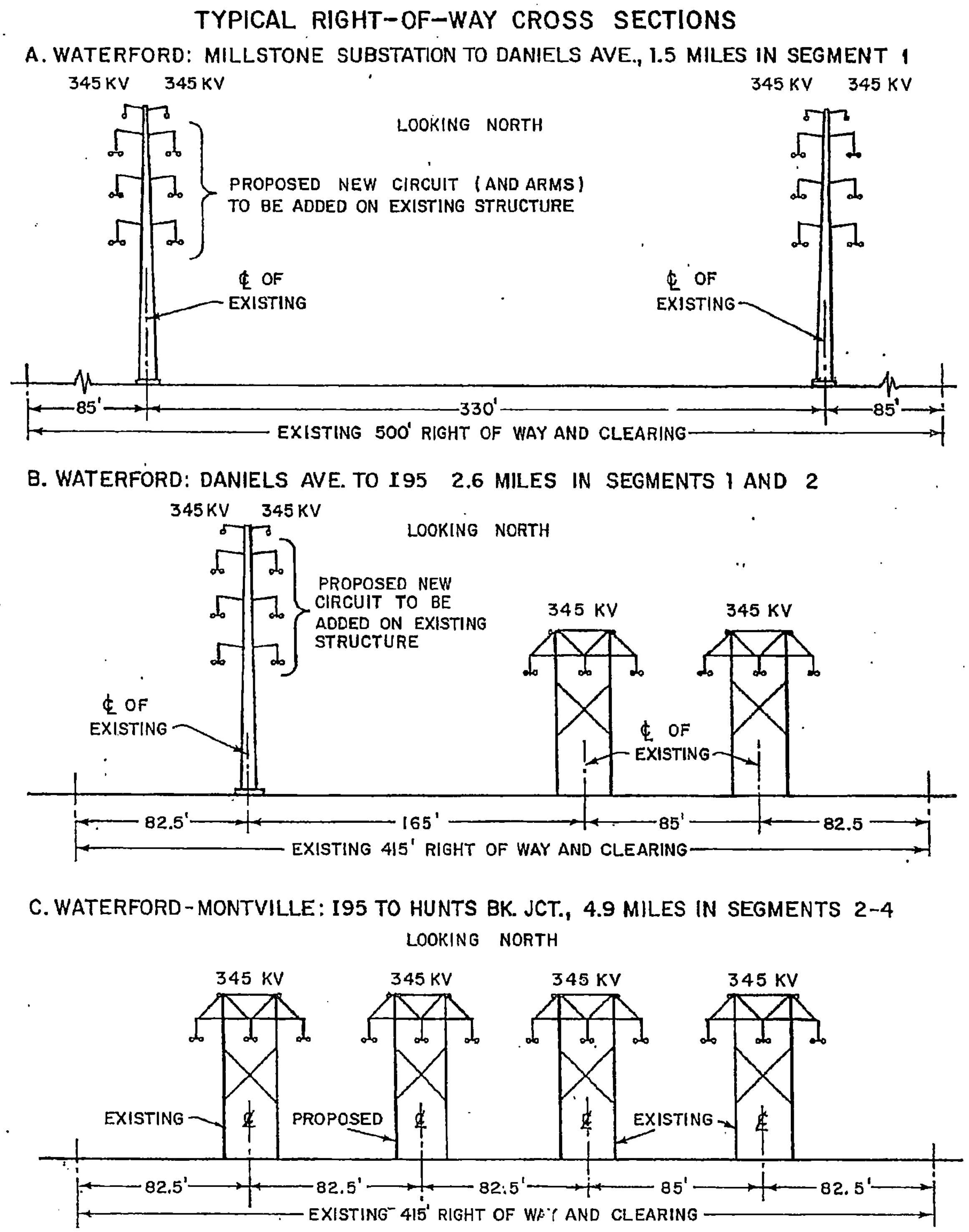

FIGURE Q 430.4-1
MILLSTONE-MANCHESTER 345KV LINE
MILLSTONE NUCLEAR POWER STATION
UNIT 3
FINAL SAFETY ANALYSIS REPORT

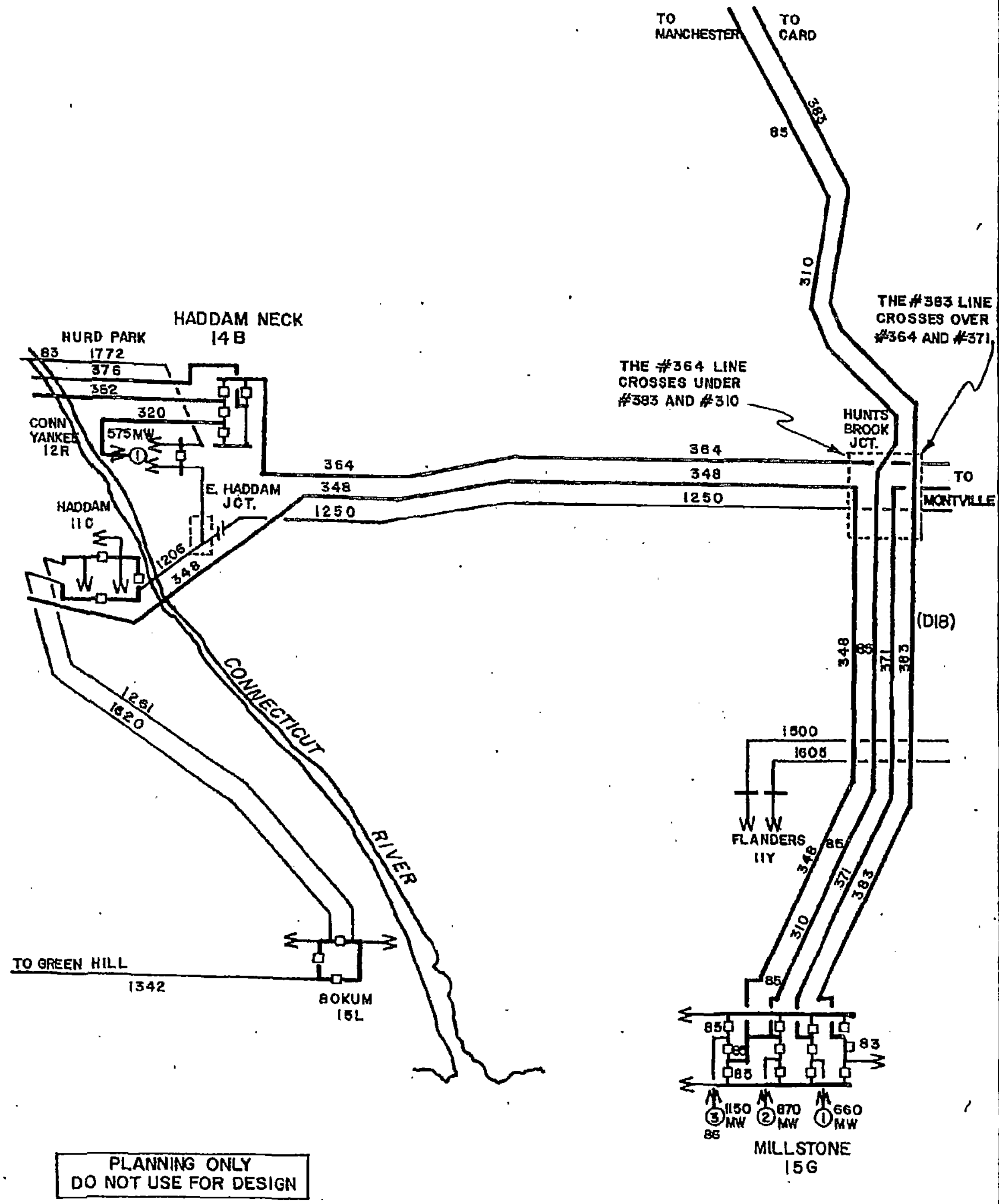

FIGURE Q430.4-2
HUNTS BROOK JUNCTION
MILLSTONE NUCLEAR POWER STATION
UNIT 3
FINAL SAFETY ANALYSIS REPORT

NRC Letter: May 3, 1983

Question No. Q430.7 (SRP Section 8.2)

a. It is the staff position that the Millstone grid stability analysis must show that loss of the largest single supply to the grid does not result in the complete loss of preferred power. The analysis should consider the loss, through a single event, of the largest capacity being supplied to the grid, removal of the largest load from the grid, or loss of the most critical transmission line. The combined capacity of Millstone Units 1, 2, and 3 is to be supplied to the grid through the common Millstone switchyard. The combined capacity of the three units appears to be the largest capacity being supplied to the grid and should be considered in the Millstone grid stability analysis. Provide the results of the grid stability analysis when simultaneous loss of the combined capacity of Units 1, 2, and 3 is considered and justify areas of noncompliance with the above staff position.

b. There are four transmission circuits that connect the Millstone switchyard to the grid system. The four circuits are routed on two tower lines - two circuits per tower line. Section 8.1.3 of the FSAR indicates that a simultaneous failure of either of the two tower lines with only one circuit in service on the other tower line, may result in instability of Millstone generation. The Applicant, in order to prevent instability, has installed a protection scheme to automatically reduce generator output at Millstone Unit 3. Describe the protection scheme.

Response:

Answer to Part A

By careful design of the switchyard and protective relays, NU has practically eliminated the possibility of the simultaneous loss of three units at Millstone. Nevertheless, the loss of the Millstone plant and all four transmission circuits has been simulated in design studies. The transmission circuits were outaged along with the station in order to simulate worst case conditions, and this outage was simulated both with and without a fault.

The stability analysis indicates that the rest of the system will remain in synchronism after the loss of the entire output of the Millstone station. The system was modelled for one set of operating conditions; hence, it is possible that a similar test under heavy transfer conditions within the interconnected system might result in instability. However, we are certain that the probability of losing all three units simultaneously is extremely small bacuase of the preventive measures discussed below in this response. Accordingly, NU believes it is reasonable to count upon onsite power sources to supply the necessary station service power requirements in the very remote event that all three Millstone units should be lost at once

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accompanied by the total loss of the transmission supply to the station.

A primary objective in designing the connection of the Millstone Nuclear Power Station to the 345 kV transmission network in Connecticut has been to prevent the loss of the entire station output. The reliability criteria of The Northeast Power Coordinating Council (NPCC) and the New England Power Pool (NEPOOL) are a fundamental part of this design process. The following are the most severe outages which the system has been designed to survive in order to minimize the possiblity of a total plant outage:

a. With any one of the four Millstone 345 kV transmission circuits out of service, the plant remains stable for any three-phase fault normally cleared (four cycles) or any one-phase fault normally cleared (four cycles) or any one-phase fault with delayed clearing (nine cycles). These tests are done with maximum generation at Millstone to simulate worst case conditions.

b. The reliability criteria further require testing to determine if the loss of two circuits on a common structure can be tolerated. The event which is used to test the loss of the two circuits is a simultaneous line to ground fault on different phases of the two circuits. With all lines in service, the system remains stable for this two circuit disturbance. It should be recognized that the four circuits leaving the millstone switchyard are paired on two rows of double circuit structures for only a short distance, and, hence the exposure to this outage is small.

c. Also, the simultaneous loss of two Millstone circuits on common structures following a previous (nonsimultaneous) outage of either of the other Millstone circuits (or any other critical element) must not result in instability. All of the critical outages of this type effectively result in the loss of three of the four Millstone circuits and leave the Millstone station weakly tied to the transmission grid. To prevent instability for these extremely severe (and highly improbable) disturbances, it is necessary to reduce output after the initial line outage and before the loss of the two circuits on common structures takes place and/or install an automatic generation rejection scheme.

Because of the significant economic penalties involved, the reduction of generation after the initial line outage is considered a highly undesirable solution to the potential stability problems identified in item (c) above and should be avoided to the extent possible. Therefore, a post disturbance generation curtailment scheme has been provided. This system continuously monitors the individual state of six critical system components together with the generation output at the Millstone complex. Should the system condition arise where 1) any one of the six critical lines or elements is unavailable, 2) the generation at Millstone is above a predetermined MW level, and 3) two specific transmission circuits are forced out, then generation will automatically be curtailed at Millstone. Stability studies

indicate that during maximum output conditions (2640) MW), Millstone Units 1 and 3 can be successfully tripped and system stability maintained leaving Millstone Unit 2 in synchronism with the transmission network. The tripping of these units results in a generation reduction of up to approximately 1810 MW with 870 MW remaining synchronized. This generation reduction scheme is described in the answer to Part B of this question. The scheme is called a Severe Line Outage Detection (SLOD).

Additional testing was carried out for Possible but Improbable (PBI) events which are specified in the NPCC and NEPOOL reliability criteria. The one PBI event which could have a serious effect at Millstone is a three-phase fault followed by delayed clearing due to a three-phase stuck circuit breaker. This results in the Millstone units losing synchronism. This stability problem has been eliminated by designing the protective relay schemes and circuit breaker installations so that at most, one pole will fail to clear. The breakers which are designed to meet this criteria are classified as having independent pole tripping.

NU insures independent pole tripping by installing breakers with mechanically independent poles and two separate methods of tripping the circuit breaker. These installations include two sets of relays and trip coils. There are two sets of current and potential transformers, the wiring for the relay packages are installed in separate duct banks, the relay packages are physically separated in the control house and two separate dc supplies are provided.

The 345 kV switchyard at Millstone is designed so that the loss of more than one transmission circuit due to a failure of a breaker to trip requires at least two circuit breakers to simultaneously fail to operate. The failure of even one circuit breaker is very unusual. At least three circuit breakers would have to fail before three transmission lines would be lost due to malfunctions in the switchyard. At that point, the generation rejection scheme would operate to keep one unit in service. In order to lose the entire station, at least four circuit breakers must fail.

To summarize: The Company is taking extensive precautions to prevent the sudden loss of the three generating units at Millstone Station and the simultaneous loss of offsite power. We believe these measures make the probability of such an occurrence extremely small.

Answer to Part B

The operation of the Millstone generation rejection scheme is based on the outage of combinations of certain transmission circuit elements. The scheme has been name Severe Line Outage Detector (SLOD). See reference to SLOD in the answer to Part A of this question.

This system will continuously monitor the individual status of six critical transmission elements in the area of the Millstone Station together with the generation output of the Millstone complex.

Generation will be curtailed automatically if a system condition arises where any of ten combinations of the six elements are outaged, and generation at Millstone is above 1200 MW.

To monitor the status of the 345 kV system, SLOD equipment has been required at the Millstone and at Montville switchyards. In addition, it will be necessary to install high speed backup relay protection with a permissive overreaching audio tone scheme on both ends of the Millstone to Manchester and the Millstone to Southington lines.

At Millstone, three logic packages will be provided. The operation of any two logic units will provide a tripping output. The current detecting devices of each logic package will sense the available state of each of the four transmission circuits emanating from the Millstone switchyard. Signals indicating the availability state of two remote components (the Montville 345 kV tie breaker, and the Montville - Haddam Neck Line) will be transmitted to Millstone. The megawatt output from each of the Millstone units will be measured and summed to provide an indication of the toal megawatt output of the Millstone units. Should the comparative logic in the SLOD package indicate that any one of the combinations of transmission outages listed below exist, and the generation level at the Millstone Station is above 1200 MW, then Millstone Units 1 and 3 will be curtailed immediately.

The combinations of unavailable components which must be monitored are:

1. Necessary to meet NPCC and NEPOOL criteria:

   Millstone - Manchester, Millstone -Card and Millstone - Montville

   Millstone - Southington, Millstone - Card and Millstone - Montville

   Millstone - Montville, Millstone - Manchester and Millstone - Southington

   Millstone - Card, Millstone - Manchester and Millstone - Southington

   Montville - Haddam Neck, Millstone - Manchester and Millstone - Southington

   Montville 345 kV tie breaker, Millstone - Manchester and Millstone - Southington

2. Also included to simplify the SLOD package logic but not required to meet NPCC and NEPOOL criteria are:

   Millstone - Southington, Millstone - Card and Montville - Haddam Neck

Millstone - Manchester, Millstone - Card and Montville - Haddam Neck

Millstone - Southington, Millstone - Card and Montville 345 kV tie breaker

Millstone - Manchester, Millstone - Card and Montville 345 kV tie breaker

As mentioned above, signals indicating the availability status of the two remote components at Montville are required at Millstone. To monitor the status of the 345 kV circuit breaker at Montville, and the availability of the Montville-Haddam Neck line, three logic units will be required at Montville. The three independent logic packages will supply information to the Millstone logic packages via an independent transfer trip tone transmitter.

Since the operation of the generation rejection scheme should take place in less than 12 cycles to maintain stability, all transmission line faults must be cleared at high speed. This will require the addition of high speed backup protection using permissive overreaching audio tone equipment on the Millstone-Manchester line and the Millstone-Southington line at both terminals.

With the Generation Rejection scheme in service, it will be permissible to operate with high Millstone Station output when any one of six critical transmission elements is out of service.

Excerpts from

NRC Letter Dated February 24, 1984

Draft SER for Millstone Nuclear Power Station, Unit 3

ASCII Text

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

FEB 24 1984

RECEIVED

MAR 2 1984

SENIOR VICE PRESIDENT
Nuclear Engineering & Operations

Docket No.: 50-423

Mr. William G. Counsil
Senior Vice President
Nuclear Engineering and Operations
Northeast Nuclear Energy Company
P. O. Box 270
Hartford, Connecticut 06141-0270

Dear Mr. Counsil:

Subject: Draft SER for Millstone Nuclear Power Station, Unit 3

Reference: (1) B. J. Youngblood to W. G. Counsil, Draft SER for Millstone Nuclear Power Station, Unit 3 dated December 30, 1983

Enclosed is a copy of sections of the DSER not transmitted to you in Reference 1. A list of these sections is shown in the attachment.

Please review this information and issue a written response to the open items prior to May 16, 1984 in order to accomodate the schedule for issuance of the final SER on July 16, 1984. The open items are described in sufficient detail in the text of the DSER sections.

A copy of this information has been placed in the Commissions Public Document Room and in the local public document room in Waterford, Connecticut.

For further information or clarification, please contact the Licensing Project Manager, Elizabeth L. Doolittle (301-492-4911).

Sincerely,

B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing

Attachment:
As stated

cc: See next page

Raster Image

8.2.2 Compliance With General Design Criterion (GDC) 17

The applicant has met (except as noted) the requirements of GDC 17, "Electric Power Systems," with respect to the offsite power system's (a) capacity and capability to permit functioning of structures, systems, and components important to safety, (b) provisions to minimize the probability of losing electric power from any of the remaining supplies as a result of, or coincident with the loss of power generated by the nuclear power unit or loss of power from the onsite electric power supplies, (c) physical independence of circuits, and (d) availability of circuits.

The following items address the problem areas revealed during the staff review and resolutions or status concerning them.

8.2.2.1 Physical Separation of Offsite Circuits Within a Common Right-of-Way

As described in Section 8.2.1 of the FSAR, there are four transmission lines between Millstone and Hunts Brook Junction that follow a common right-of-way. It is the staff position that no other transmission lines cross over these four lines and that the four lines be physically separate and independent so that no single event such as a tower falling or line breaking will be able to simultaneously affect all circuits in such a way that none of the four circuits can be returned to service in such time to prevent fuel design limits or design conditions of the reactor coolant pressure boundary from being exceeded. Line cross overs and physical separation of these four transmission lines were not described in the FSAR.

The applicant, by amendment 3 to the FSAR, documented that their design is in compliance with the above staff position and provided a description of their design. Based on their description, the staff concludes that the transmission lines are physically separate and independent in accordance with the above stated staff position, meet the requirements of GDC 17, and is, therefore, acceptable.

8.2.2.2 Physical Separation of Offsite Circuits Between Switchyard and Class 1E System

As implied by Section 8.1.2 of the FSAR, the Millstone design provides two immediate access offsite circuits between the switchyard and the 4.16 kv Class 1E busses. It is the staff position that these two circuits be physically separate and independent such that no single event can simultaneously affect both circuits in such a way that neither can be returned to service in time to prevent fuel design limits or design conditions of the reactor coolant pressure boundary from being exceeded. The physical separation and independence of these two circuits has not been described or analyzed in the FSAR.

The applicant by amendment 3 to the FSAR presented additional information in regard to these circuits. However, based on the additional information the staff was unable to conclude that the design meets GDC 17. This item will continue to be pursued with the applicant and the results of the staff review will be reported in a supplement to this report.

as a result of or coincident with loss of power generated by the nuclear power unit, meets the requirements of GDC 17, and is, therefore, acceptable.

8.2.2.5 Generation Rejection Scheme

There are four transmission circuits that connect the Millstone switchyard to the grid system. The four circuits are routed on two tower lines - two circuits per tower line. Section 8.1.3 of the FSAR indicates that a simultaneous failure of either of the two tower lines with only one circuit in service on the other tower line, may result in instability of Millstone generation. The applicant, in order to prevent instability, has installed a protection scheme to automatically reduce generator output at Millstone Unit 3.

The applicant by amendment 3 to the FSAR, provided a description of the protection scheme. However, in order to conclude that the design meets GDC 17 and 18 for the proposed mode of operation (one of four offsite transmission lines out of service), the staff requires additional description of surveillance, operability requirements, and analysis demonstrating compliance with the requirements of GDC 17 and 18 be documented in the FSAR. This item will be pursued with the applicant the results of the staff review will be reported in a supplement to this report.

Excerpts from

Northeast Utilities Letter Dated June 12, 1984

Millstone Nuclear Power Station, Unit No. 3

Summary/Submittal of Responses to PSB Electrical Draft SER Items

ASCII Text

NORTHEAST UTILITIES

THE CONNECTICUT LIGHT AND POWER COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

General Offices • Selden Street, Berlin, Connecticut

P.O. BOX 270
HARTFORD, CONNECTICUT 06141-0270
(203) 666-6911

June 12, 1984

Docket No. 50-423
B11223

Director of Nuclear Reactor Regulation
Attn: Mr. B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

References: (1) B. J. Youngblood to W. G. Counsil, Additional Draft SER Sections for Millstone Nuclear Power Station, Unit No. 3, dated February 24, 1984.

Gentlemen:

Millstone Nuclear Power Station, Unit No. 3
Summary/Submittal of Responses to PSB Electrical Draft SER Items

Reference (1) included the PSB Electrical Draft SER write-up which identified several open items with regard to information provided within our OL application. We have subsequently held two meetings, May 14, 1984 and May 31, 1984, to discuss and resolve these open items. Attachment 1 provides a summary status of all items originally open. The responses, Attachment 2, reflects those discussed during the meetings except where the summary status indicates a response was subsequently revised.

If you have any questions, please contact our Licensing representative directly.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY
et. al.

BY NORTHEAST NUCLEAR ENERGY COMPANY
Their Agent

W. G. Counsil
Senior Vice President

By: C. F. Sears
Vice President
Nuclear and Environmental Engineering

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STATE OF CONNECTICUT)
) ss. Berlin
COUNTY OF HARTFORD)

Then personally appeared before me C. F. Sears, who being duly sworn, did state that he is Vice President of Northeast Nuclear Energy Company, an Applicant herein, that he is authorized to execute and file the foregoing information in the name and on behalf of the Applicants herein and that the statements contained in said information are true and correct to the best of his knowledge and belief.

Lorraine J. D'Amico
Notary Public

My Commission Expires March 31, 1988

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Attachment 1

Status of PSB Electrical SER Items

Section/Question	Status	Remarks/Required Action
8.2.1.1	Closed	Attached.
8.2.2.1/430.4	Confirmatory	Response to Q430.4 will be incorporated into a future FSAR Amendment per NRC reviewer's request. Once done this item will be considered closed. Because this item was originally considered closed and the response to Q430.4 previously submitted, no further documentation is attached.
8.2.2.2/430.5	Closed	Attached.
8.2.2.3/430.6	Closed	Attached.
8.2.2.5/430.7b	Confirmatory	Attached. Response to Q430.7b will be incorporated into a future FSAR Amendment per NRC reviewer's request. Once done this item will be considered closed.
8.2.2.6	Closed	Attached.
8.2.3.1	Closed	Attached.
8.3.1.2/430.3	Closed	Attached.
8.3.1.3/430.9	Confirmatory	Attached. Response to Q430.9 will be incorporated into a future FSAR Amendment per NRC reviewer's request. Once done this item will be considered closed.
8.3.1.4/430.10	Closed	Attached.
8.3.1.5/430.11	Confirmatory	Attached. Once results of station electric system voltage testing is complete or the predicting analysis, this item will be considered closed.
8.3.1.6/430.12	Closed	Attached.
8.3.1.7/430.13	Closed	Attached.
8.3.1.8/430.14	Closed	Attached.

Millstone Nuclear Power Station, Unit No. 3

Open Items

Power Systems Branch (Electrical)

PSB06 (196) 430.7 GENERATION REJECTION SCHEME (8.2.2.5)

There are four transmission circuits that connect the Millstone switchyard to the grid system. The four circuits are routed on two tower lines - two circuits per tower line. Section 8.1.3 of the FSAR indicates that a simultaneous failure of either of the two tower lines with only one circuit in service on the other tower line, may result in instability of Millstone generation. The applicant, in order to prevent instability, has installed a rejection scheme to automatically reduce generator output at Millstone Unit 3.

The applicant, by amendment 3 to the FSAR, provided a description of the rejection scheme. However, in order to conclude that the design meets GDC 17 and 18 for the proposed mode of operation (one of four offsite transmission lines out of service), the staff requires additional description of surveillance, operability requirements, and analysis demonstrating compliance with the requirements of GDC 17 and 18 be documented in the FSAR. This item will be pursued with the applicant the results of the staff review will be reported in a supplement to this report.

Response:

Refer to the revised response to question no. 430.7.

NRC Letter: May 3, 1983

Question No. Q430.7 (SRP Section 8.2)

a. It is the staff position that the Millstone grid stability analysis must show that loss of the largest single supply to the grid does not result in the complete loss of preferred power. The analysis should consider the loss, through a single event, of the largest capacity being supplied to the grid, removal of the largest load from the grid, or loss of the most critical transmission line. The combined capacity of Millstone Units 1, 2, and 3 is to be supplied to the grid through the common Millstone switchyard. The combined capacity of the three units appears to be the largest capacity being supplied to the grid and should be considered in the Millstone grid stability analysis. Provide the results of the grid stability analysis when simultaneous loss of the combined capacity of Units 1, 2, and 3 is considered and justify areas of noncompliance with the above staff position.

b. There are four transmission circuits that connect the Millstone switchyard to the grid system. The four circuits are routed on two tower lines - two circuits per tower line. Section 8.1.3 of the FSAR indicates that a simultaneous failure of either of the two tower lines with only one circuit in service on the other tower line, may result in instability of Millstone generation. The Applicant, in order to prevent instability, has installed a protection scheme to automatically reduce generator output at Millstone Unit 3. Describe the protection scheme.

Response:

Answer to Part A

By careful design of the switchyard and protective relays, NU has practically eliminated the possibility of the simultaneous loss of three units at Millstone. Nevertheless, the loss of the Millstone plant and all four transmission circuits has been simulated in design studies. The transmission circuits were outaged along with the station in order to simulate worst case conditions, and this outage was simulated both with and without a fault.

The stability analysis indicates that the rest of the system will remain in synchronism after the loss of the entire output of the Millstone station. The system was modelled for one set of operating conditions; hence, it is possible that a similar test under heavy transfer conditions within the interconnected system might result in instability. However, we are certain that the probability of losing all three units simultaneously is extremely small becuase of the preventive measures discussed below in this response. Accordingly, NU believes it is reasonable to count upon onsite power sources to supply the necessary station service power requirements in the very remote event that all three Millstone units should be lost at once

accompanied by the total loss of the transmission supply to the 1.48
station.

A primary objective in designing the connection of the Millstone 1.49
Nuclear Power Station to the 345 kV transmission network in 1.50
Connecticut has been to prevent the loss of the entire station
output. The reliability criteria of The Northeast Power Coordinating 1.51
Council (NPCC) and the New England Power Pool (NEPOOL) are a 1.52
fundamental part of this design process. The following are the most 1.53
severe outages which the system has been designed to survive in order
to minimize the possiblity of a total plant outage: 1.54

a. With any one of the four Millstone 345 kV transmission circuits 1.56
out of service, the plant remains stable for any three-phase 1.57
fault normally cleared (four cycles) or any one-phase fault
normally cleared (four cycles) or any one-phase fault with 1.58
delayed clearing (nine cycles). These tests are done with 1.59
maximum generation at Millstone to simulate worst case
conditions.

b. The reliability criteria further require testing to determine if 1.60
the loss of two circuits on a common structure can be tolerated. 2.1
The event which is used to test the loss of the two circuits is a 2.2
simultaneous line to ground fault on different phases of the two 2.3
circuits. With all lines in service, the system remains stable 2.4
for this two circuit disturbance. It should be recognized that 2.5
the four circuits leaving the millstone switchyard are paired on
two rows of double circuit structures for only a short distance, 2.6
and, hence the exposure to this outage is small.

c. Also, the simultaneous loss of two Millstone circuits on common 2.7
structures following a previous (nonsimultaneous) outage of 2.8
either of the other Millstone circuits (or any other critical
element) must not result in instability. All of the critical 2.9
outages of this type effectively result in the loss of three of
the four Millstone circuits and leave the Millstone station 2.10
weakly tied to the transmission grid. To prevent instability for 2.11
these extremely severe (and highly improbable) disturbances, it
is necessary to reduce output after the initial line outage and 2.12
before the loss of the two circuits on common structures takes
place and/or install an automatic generation rejection scheme. 2.13

Because of the significant economic penalties involved, the reduction 2.15
of generation after the initial line outage is considered a highly 2.16
undesirable solution to the potential stability problems identified
in item (c) above and should be avoided to the extent possible. 2.17
Therefore, a post disturbance generation curtailment scheme has been 2.18
provided. This system continuously monitors the individual state of 2.19
six critical system components together with the generation output at 2.20
the Millstone complex. Should the system condition arise where 2.21
1) any one of the six critical lines or elements is unavailable,
2) the generation at Millstone is above a predetermined MW level, and 2.22
3) two specific transmission circuits are forced out, then generation 2.23
will automatically be curtailed at Millstone. Stability studies 2.24

indicate that during maximum output conditions (2640) MW), Millstone
Units 1 and 3 can be successfully tripped and system stability 2.25
maintained leaving Millstone Unit 2 in synchronism with the
transmission network. The tripping of these units results in a 2.27
generation reduction of up to approximately 1810 MW with 870 MW
remaining synchronized. This generation reduction scheme is 2.29
described in the answer to Part B of this question. The scheme is 2.30
called a Severe Line Outage Detection (SLOD).

Additional testing was carried out for Possible but Improbable (PBI) 2.31
events which are specified in the NPCC and NEPOOL reliability 2.32
criteria. The one PBI event which could have a serious effect at 2.33
Millstone is a three-phase fault followed by delayed clearing due to 2.34
a three-phase stuck circuit breaker. This results in the Millstone 2.35
units losing synchronism. This stability problem has been eliminated 2.36
by designing the protective relay schemes and circuit breaker
installations so that at most, one pole will fail to clear. The 2.38
breakers which are designed to meet this criteria are classified as
having independent pole tripping.

NU insures independent pole tripping by installing breakers with 2.39
mechanically independent poles and two separate methods of tripping 2.40
the circuit breaker. These installations include two sets of relays 2.41
and trip coils. There are two sets of current and potential 2.42
transformers, the wiring for the relay packages are installed in
separate duct banks, the relay packages are physically separated in 2.43
the control house and two separate dc supplies are provided.

The 345 kV switchyard at Millstone is designed so that the loss of 2.44
more than one transmission circuit due to a failure of a breaker to 2.45
trip requires at least two circuit breakers to simultaneously fail to
operate. The failure of even one circuit breaker is very unusual. 2.46
At least three circuit breakers would have to fail before three 2.47
transmission lines would be lost due to malfunctions in the 2.48
switchyard. At that point, the generation rejection scheme would 2.49
operate to keep one unit in service. In order to lose the entire 2.50
station, at least four circuit breakers must fail.

To summarize: The Company is taking extensive precautions to prevent 2.51
the sudden loss of the three generating units at Millstone Station 2.52
and the simultaneous loss of offsite power. We believe these 2.53
measures make the probability of such an occurrence extremely small.

<u>Answer to Part B</u> 2.55

The operation of the Millstone generation rejection scheme is based 2.56
on the outage of combinations of certain transmission circuit 2.58
elements. The scheme has been name Severe Line Outage Detector 2.59
(SLOD). See reference to SLOD in the answer to Part A of this 2.60
question.

This system will continuously monitor the individual status of six 3.1
critical transmission elements in the area of the Millstone Station 3.2
together with the generation output of the Millstone complex.

Generation will be curtailed automatically if a system condition arises where any of ten combinations of the six elements are outaged, and generation at Millstone is above 1200 MW.

To monitor the status of the 345 KV system, SLOD equipment has been required at the Millstone and at Montville switchyards. In addition, it will be necessary to install high speed backup relay protection with a permissive overreaching audio tone scheme on both ends of the Millstone to Manchester and the Millstone to Southington lines.

At Millstone, three logic packages will be provided. The operation of any two logic units will provide a tripping output. The current detecting devices of each logic package will sense the available state of each of the four transmission circuits emanating from the Millstone switchyard. Signals indicating the availability state of two remote components (the Montville 345 kV tie breaker, and the Montville - Haddam Neck Line) will be transmitted to Millstone. The megawatt output from each of the Millstone units will be measured and summed to provide an indication of the toal megawatt output of the Millstone units. Should the comparative logic in the SLOD package indicate that any one of the combinations of transmission outages listed below exist, and the generation level at the Millstone Station is above 1200 MW, then Millstone Units 1 and 3 will be curtailed immediately.

The combinations of unavailable components which must be monitored are:

1. Necessary to meet NPCC and NEPOOL criteria:

   Millstone - Manchester, Millstone -Card and Millstone - Montville

   Millstone - Southington, Millstone - Card and Millstone - Montville

   Millstone - Montville, Millstone - Manchester and Millstone - Southington

   Millstone - Card, Millstone - Manchester and Millstone - Southington

   Montville - Haddam Neck, Millstone - Manchester and Millstone - Southington

   Montville 345 kV tie breaker, Millstone - Manchester and Millstone - Southington

2. Also included to simplify the SLOD package logic but not required to meet NPCC and NEPOOL criteria are:

   Millstone - Southington, Millstone - Card and Montville - Haddam Neck

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Millstone - Manchester, Millstone - Card and Montville - Haddam Neck

Millstone - Southington, Millstone - Card and Montville 345 KV tie breaker

Millstone - Manchester, Millstone - Card and Montville 345 KV tie breaker

As mentioned above, signals indicating the availability status of the two remote components at Montville are required at Millstone. To monitor the status of the 345 KV circuit breaker at Montville, and the availability of the Montville-Haddam Neck line, three logic units will be required at Montville. The three independent logic packages will supply information to the Millstone logic packages via an independent transfer tone transmitter.

Since the operation of the generation rejection scheme should take place in less than 12 cycles to maintain stability, all transmission line faults must be cleared at high speed. This will require the addition of high speed backup protection using permissive overreaching audio tone equipment on the Millstone-Manchester line and the Millstone-Southington line at both terminals.

With the Generation Rejection scheme in service, it will be permissible to operate with high Millstone Station output when any one of six critical transmission elements is out of service. As a member of NEPOOL and the NPCC, the Applicant will be required to comply with either of the following operability requirements with one line out of service:

1) Have SLOD fully operational, or
2) Reduce load to a total station output of 1200 MW within 4 hours.

These instructions will be documented as part of the Connecticut Valley Electric Exchange (CONVEX) operating instructions for the Millstone switchyard and will be regulated by CONVEX. To facilitate regulation, CONVEX is aware of the condition of all lines and the status of the SLOD scheme via an annunciator located at CONVEX (CONVEX is an operating division of NEPOOL).

The operability requirements specified above assures that, upon loss of a double circuit line with a third line out of service and generation in excess of 1200 MW, offsite power will be available for safe shutdown; maintaining system stability minimizes the probability of coincident loss of both offsite supplies. This is consistent with the requirements of GDC 17.

GDC 17 also requires that the probability of losing an offsite supply coincident with loss of the nuclear power unit be minimized. Because of the necessity for SLOD to complete its function within 12 cycles, SLOD trips Millstone Unit 3 by tripping the switchyard breakers instead of the generator breaker (this eliminates the extra time required for relay and communication channel operation in a transfer trip scheme). Under these conditions, station auxiliary loads high speed transfer to the reserve station service transformers, and the normal station service transformer (which is tripped when SLOD trips Unit 3) can be re-energized by closing a switchyard breaker. Therefore, both offsite supplies will be available to assure safe shutdown of the unit in accordance with GDC 17.

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The SLOD scheme was manufactured to be a reliable unit. Each line is monitored by a logic package which utilizes redundant channels (2-out-of-3 logic) in case of a failure of one channel. Each logic package alarms in the event of a channel failure and triggers a SLOD trouble alarm in the Millstone Unit 1 control room and at CONVEX. Also, a failed channel causes arming of the logic, indicating the monitored system component to be out of service. Additionally, every eight (8) hours, the SLOD scheme automatically tests ~~the entire scheme including the logic package combinations that would result in a trip (functional test)~~ one ~~eight~~ channel, yielding a complete scheme verification once every twenty-four (24) hours. In the event of failure, a SLOD trouble alarm is actuated in the Millstone Unit 1 control room and at CONVEX. Upon receiving the SLOD trouble alarm, the operator will dispatch a person to the Millstone switchyard control house to evaluate the condition of the system. In the event that one line is out of service and the SLOD system is not operating in one hour, CONVEX will reduce station output to 1200 MW or below during the next three (3) hours. The continual channel surveillance and periodic (8-hours) functional tests that are run automatically, ensure conformance to the General Design Criteria 18.

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Millstone Nuclear Power Station, Unit No. 3

Open Items

Power Systems Branch (Electrical)

PSB07 (197) DESCRIPTION AND ANALYSIS DEMONSTRATING COMPLIANCE WITH GDC 17 (8.2.2.6)

A system description and analysis sufficient to demonstrate compliance with GDC 17 has not been presented to Section 8.2 of the FSAR in accordance with the guidelines of Regulatory Guide 1.70. This item will be pursued with the applicant and the results will be reported in a supplement to this report.

Response:

Refer to revised FSAR section 8.2.2.

along with breaker failure relaying to provide redundant
protective relaying for the switchyard. 2.23

Two 125V dc batteries are located in the switchyard control 2.24
and relay enclosure for switchyard relaying and control.
Each battery has its own charger and dc distribution panel. 2.25
The redundant batteries and protective relaying systems are 2.26
physically and electrically separate. The essential ac 2.27
station service for the power circuit breaker pneumatic
supply units and the other switchyard requirements is 2.28
supplied from one of two separate sources.

2. The 345-kV system is protected from lightning and switching 2.31
surges by overhead electrostatic shield wires, surge
arrestors on main buses, and rod gaps on the disconnect 2.32
switches.

3. Primary and backup relaying is provided for each circuit 2.33
along with circuit breaker failure backup protection. These 2.34
provisions permit the following:

   a. Any circuit can be switched under normal or fault 2.36
   conditions without affecting another circuit.

   b. Any single circuit breaker can be isolated for 2.37
   maintenance without interrupting power or protection of
   any circuit.

   c. Short circuits on any section of a bus are isolated 2.38
   without interrupting service to any element other than
   those connected to the faulty bus section. 2.39

   d. The failure of any circuit breaker to trip initiates 2.40
   the automatic tripping of the adjacent breaker or
   breakers and thus may result in the loss of a line or 2.41
   generator for this contingency condition; however,
   power can be restored to the good element in less than 2.42
   1 hour by manually isolating the fault with appropriate
   disconnect switches. 2.43

Complete battery failure is considered highly unlikely since two 2.45
independent 125V dc battery systems are provided. Failure of a 2.46
single battery system results only in a momentary loss of one set of
protective relays until the DC is manually transferred to the other 2.47
battery. Therefore, no single failure could negate the effectiveness 2.48
of the relaying to clear a fault.

The Millstone design provides two immediate access offsite circuits 2.49
between the switchyard and the 4.16 KV Class IE buses. Within the 2.51 8.2.3.6
switchyard, the tie line terminations are separated electrically by PEE-7
two circuit breakers so that a fault on one offsite supply circuit 2.52
along with a breaker failure will not cause the second offsite supply
to be lost. The tie lines are supported on dead end tower and the 2.53
second tie line circuit terminating on the reserve station service 2.54
separate structures with one circuit terminating at the main transformer

transformer dead end tower. The normal ~~reserve~~ station service 2.55
transformers and the reserve station service transformers are located
on opposite sides of the unit. The connection from the normal 2.57
station service transformers and from the reserve station service
transformers to the 4.16 KV Class IE buses is via physically separate 2.58
and electrically independent under ground duct lines. The 2.59
Figure 1.2-1 shows the tie line routes from the switchyard to the
main/normal and to the reserve station service transformers. The 3.1
Figure 1.2-2 shows the physical separation between the normal and the
reserve station service transformers. Figure 8.3-7 Sheets 1 and 2 3.2
show the embedded conduit duct lines as they enter the redundant
~~switchyard~~ Switchgear rooms in the control building. 3.3

The control power for these buses is from different dc panels and 3.4
batteries. The breakers in the Class IE buses (34C and 34D) are 3.5
independently protected with separate relaying.

The offsite source that will normally be available immediately on a 3.6
unit trip is from the main and normal station service transformers. 3.7
This source is not lost on a unit trip because the generator breaker 3.8
effects the disconnection of the unit from the grid leaving the main 3.9
and normal station service transformers backfed from the switchyard.
The second source of offsite power is available through a fast 3.10
transfer to the reserve station service transformers. Testing the 3.11
normal immediate access circuit during plant operation would be
inappropriate as this would disconnect the unit from the grid. The 3.13
fast transfer feature of the alternate immediate access offsite
circuits will not be tested during plant power operation since it 3.14
risks unnecessary plant trips. Immediate access is not required of a 3.15
second offsite source, and for the Millstone 3 design, if the fast
transfer is not successful the reserve station service transformers 3.16
can be connected to the emergency buses by manual control switch 3.17
operation in an acceptable time.

The automatic transfer of emergency 4.16 KV buses 34C (Train A) and 3.18
34D (Train B) from either the normal to the reserve station service 3.19
transformer or the normal or reserve station transformer to the
emergency generators will be tested prior to initial startup and 3.20
during refueling shutdowns of the unit to prove the operability of 3.21
the system. Therefore, appropriate testing and testability of the 3.22
transfer of power upon loss of normal power satisfies the
requirements of General Design Criterion 18, Inspection and Testing 3.23
of Electric Power Systems.

Physical separation of the offsite power sources, switchyard 3.24
protection, redundancy, and transmission system design based on load 3.25
flow and stability analyses minimize the possibility of simultaneous
failure of power sources (normal station service supply, reserve 3.26
station service supply and standby ac emergency generators) in
compliance with General Design Criterion No. 17 "Electric Power 3.27
Systems."

The 345 kV transmission system supplying offsite power to Millstone 3.28
is normally operated at 357 kV at Millstone. This system voltage is 3.29

ASCII Text

Millstone Nuclear Power Station, Unit No. 3

Open Items

Power Systems Branch (Electrical)

PSB08 (198) DESCRIPTION AND ANALYSIS DEMONSTRATING COMPLIANCE WITH GDC 18 (8.2.3.1)

A system description and analysis sufficient to demonstrate compliance with GDC 18 has not been presented in Section 8.2 of the FSAR in accordance with the guidelines of Regulatory Guide 1.70. This item will be pursued with the applicant and the results will be reported in a supplement to this report.

Response:

Refer to revised FSAR section 8.2.2.

transformer dead end tower. The normal reserve station service 2.55
transformers and the reserve station service transformers are located
on opposite sides of the unit. The connection from the normal 2.57
station service transformers and from the reserve station service
transformers to the 4.16 KV Class IE buses is via physically separate 2.58
and electrically independent under ground duct lines. The 2.59
Figure 1.2-1 shows the tie line routes from the switchyard to the
main/normal and to the reserve station service transformers. The 3.1
Figure 1.2-2 shows the physical separation between the normal and the
reserve station service transformers. Figure 8.3-7 Sheets 1 and 2 3.2
show the embedded conduit duct lines as they enter the redundant
~~switchyard~~ SWITCHGEAR rooms in the control building. 3.3

The control power for these buses is from different dc panels and 3.4
batteries. The breakers in the Class IE buses (34C and 34D) are 3.5
independently protected with separate relaying.

The offsite source that will normally be available immediately on a 3.6
unit trip is from the main and normal station service transformers. 3.7
This source is not lost on a unit trip because the generator breaker 3.8
effects the disconnection of the unit from the grid leaving the main 3.9
and normal station service transformers backfed from the switchyard.
The second source of offsite power is available through a fast 3.10
transfer to the reserve station service transformers. Testing the 3.11
normal immediate access circuit during plant operation would be
inappropriate as this would disconnect the unit from the grid. The 3.13
fast transfer feature of the alternate immediate access offsite
circuits will not be tested during plant power operation since it 3.14
risks unnecessary plant trips. Immediate access is not required of a 3.15
second offsite source, and for the Millstone 3 design, if the fast
transfer is not successful the reserve station service transformers 3.16
can be connected to the emergency buses by manual control switch 3.17
operation in an acceptable time.

The automatic transfer of emergency 4.16 KV buses 34C (Train A) and 3.18
34D (Train B) from either the normal to the reserve station service 3.19
transformer or the normal or reserve station transformer to the
emergency generators will be tested prior to initial startup and 3.20
during refueling shutdowns of the unit to prove the operability of 3.21
the system. Therefore, appropriate testing and testability of the 3.22
transfer of power upon loss of normal power satisfies the
requirements of General Design Criterion 18, Inspection and Testing 3.23
of Electric Power Systems.

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protection, redundancy, and transmission system design based on load 3.25
flow and stability analyses minimize the possibility of simultaneous
failure of power sources (normal station service supply, reserve 3.26
station service supply and standby ac emergency generators) in
compliance with General Design Criterion No. 17 "Electric Power 3.27
Systems."

The 345 kV transmission system supplying offsite power to Millstone 3.28
is normally operated at 357 kV at Millstone. This system voltage is 3.29

Northeast Utilities Letter Dated April 1, 1985

Millstone Nuclear Power Station, Unit No. 3

Power Systems Branch Electrical (PSBE)

SER Confirmatory Items 44, 45, 46 and 50

NORTHEAST UTILITIES

THE CONNECTICUT LIGHT AND POWER COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

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April 1, 1985

Docket No. 50-423
B11497

Director of Nuclear Reactor Regulation
Mr. B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Reference: (1) U. S. Nuclear Regulatory Commission, "Safety Evaluation Report Related to the Operation of Millstone Nuclear Power Station, Unit No. 3, Docket No. 50-423 (NUREG-1031)," July, 1984.

Dear Mr. Youngblood:

Millstone Nuclear Power Station, Unit No. 3
Power Systems Branch Electrical (PSBE)
SER Confirmatory Items 44, 45, 46 and 50

Attached are three (3) copies of revisions to Sections 8.2 and 8.3 of the Millstone Unit No. 3, FSAR. These revisions close SER Confirmatory Items 44, 45, 46, and 50 (Reference 1). All information contained in the FSAR revisions has been discussed with your Mr. John Knox, Power Systems Branch Electrical, and was provided in our responses to NRC questions 430.4, 430.5, 430.7, and 430.9, corresponding to SER Confirmatory Items 44, 45, 46 and 50, respectively. The attached revisions respond to Mr. Knox's request for the information to be incorporated in the FSAR text. Revisions are provided as they will appear in Amendment 13 of the FSAR.

If you have any concerns related to the information contained herein, please contact our licensing representative directly.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY
et. al.
BY NORTHEAST NUCLEAR ENERGY COMPANY
Their Agent

W. G. Counsil
Senior Vice President

CF920001

STATE OF CONNECTICUT)
) ss. Berlin
COUNTY OF HARTFORD)

Then personally appeared before me W. G. Counsil, who being duly sworn, did state that he is Senior Vice President of Northeast Nuclear Energy Company, an Applicant herein, that he is authorized to execute and file the foregoing information in the name and on behalf of the Applicants herein and that the statements contained in said information are true and correct to the best of his knowledge and belief.

Notary Public

My Commission Expires March 31, 1988

ASCII Text

8.2 OFFSITE POWER SYSTEM

8.2.1 Description

The offsite power system is designed to provide reliable sources of power to the onsite ac power distribution system adequate for the safe shutdown of the unit in compliance with General Design Criterion 17 (GDC-17). Details of the offsite power system are shown on the following figures:

1. Exclusion Area (Figure 1.2-1)
2. Plot Plan (Figure 1.2-2)
3. Transmission Map (Figure 8.1-2)
4. 345 kV Switchyard (Figure 8.1-3)

The switchyard, which is configured in a breaker and a half arrangement, busses together four 345 kV transmission line circuits, three generator circuits and three station service circuits

The four transmission line circuits to be terminated at the switchyard are:

1. Millstone to Card (Line No. 383)
2. Millstone to Montville (Line No. 371)
3. Millstone to Southington (Line No. 348)
4. Millstone to Manchester (Line No. 310) - inservice in 1985

These circuits connect the station to the system transmission grid and follow a common right-of-way from Millstone to Hunts Brook Junction (9.0 miles). For the first 1.7 miles of this right-of-way, the construction consists of two double circuit steel-pole transmission lines. For the next 2.4 miles, the construction consists of one double circuit steel-pole transmission line (Line Nos. 348 and 310) and two single circuit wood-pole H-frame transmission lines (Line Nos. 371 and 383). For the remaining 4.9 miles, single circuit wood-pole H-frame construction is used for all four circuits.

At Hunts Brook junction, the four transmission line circuits diverge along three separate rights-of-way. The 371 line consisting predominantly of wood-pole H-frame construction, follows an easterly right-of-way for approximately 3.6 miles to the Montville substation. The 348 line consisting almost entirely of wood-pole H-frame construction with only a few exceptions where steel structures are utilized, follows a westerly right-of-way for 44 miles to the Southington substation. The 310 and 383 lines utilizing primarily single circuit wood-pole H-frame construction proceed along a

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northerly right-of-way for 38 miles and 20 miles to the Manchester and Card substations respectively.

insert A Q430.4

Separate and independent structures are provided for each of the six 345 kV transmission lines connecting generators 1, 2 and 3 and reserve station service transformers 1, 2 and 3 to the switchyard.

insert B Q430.5

The inspection and testing of the 345-kV circuit breakers and the transmission line protective relaying are done on a routine basis, without removing the generators, transformers, and transmission lines from service. The insulating oil for the transformers is sampled and tested on a routine basis. During these routine inspections and tests, the operability and functional performance of the electric systems are in compliance with General Design Criterion 18, "Inspection and Testing of Electric Power Systems."

8.2.2 Analysis

The possibility of power failure due to faults in the connections to the system and the associated switchyard is minimized by the following arrangements:

1. The connections to the system have been designed to comply with the Northeast Power Coordinating Council "Basic Criteria for the Design and Operation of Interconnected Power Systems" and the "Reliability Standards for the New England Interconnected Power Pool" adopted by that pool. Compliance with these criteria ensure that the supply of offsite power will not be lost following severe faults in the interconnected transmission system. Transient stability studies have been performed to verify that widespread or cascading interruptions to service will not result from these contingencies. In addition, the loss of Millstone 3 or the loss of any other generating plant in the system will not result in cascading system outages and thus will not cause loss of offsite power to the units.

   The 345 kV circuit breakers are air blast type and are pneumatically operated. Electrical controls are provided for both local and remote (Millstone 1 control room) operation. Each power circuit breaker has a separate pneumatic supply unit capable of operating the breaker for five close-open operations after the loss of the compressor. Each pneumatic compressor is supplied from a separate feeder at the switchyard essential ac panel. The circuit breakers are equipped with a closing solenoid and two trip solenoids. A standard anti-pump and trip-free control scheme is used.

   Primary and backup relaying are both high speed protective schemes. Primary and backup protective relays are used, along with breaker failure relaying to provide redundant protective relaying for the switchyard.

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Two 125V dc batteries are located in the switchyard control and relay enclosure for switchyard relaying and control. Each battery has its own charger and dc distribution panel. The redundant batteries and protective relaying systems are physically and electrically separate. The essential ac station service for the power circuit breaker pneumatic supply units and the other switchyard requirements is supplied from one of two separate sources.

2. The 345-kV system is protected from lightning and switching surges by overhead electrostatic shield wires, surge arrestors on main buses, and rod gaps on the disconnect switches.

3. Primary and backup relaying is provided for each circuit along with circuit breaker failure backup protection. These provisions permit the following:

   a. Any circuit can be switched under normal or fault conditions without affecting another circuit.

   b. Any single circuit breaker can be isolated for maintenance without interrupting power or protection of any circuit.

   c. Short circuits on any section of a bus are isolated without interrupting service to any element other than those connected to the faulty bus section.

   d. The failure of any circuit breaker to trip initiates the automatic tripping of the adjacent breaker or breakers and thus may result in the loss of a line or generator for this contingency condition; however, power can be restored to the good element in less than 1 hour by manually isolating the fault with appropriate disconnect switches.

Complete battery failure is considered highly unlikely since two independent 125V dc battery systems are provided. Failure of a single battery system results only in a momentary loss of one set of protective relays until the DC is manually transferred to the other battery. Therefore, no single failure could negate the effectiveness of the relaying to clear a fault.

Physical separation of the offsite power sources, switchyard protection, redundancy, and transmission system design based on load flow and stability analyses minimize the possibility of simultaneous failure of power sources (normal station service supply, reserve station service supply and standby ac emergency generators) in compliance with General Design Criterion No. 17 "Electric Power Systems."

The 345 kV transmission system supplying offsite power to Millstone is normally operated at 357 kV at Millstone. This system voltage is

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controlled by varying the reactive power generation on the Millstone units. The Millstone 1 and 2 operators control the unit excitation as specified by CONVEX Operation Instruction No. 6913. When Millstone 3 is placed in service, it will be included in the voltage regulation scheme. The unit operators are required to balance the reactive power output of the units.

The CONVEX system operator supervises the system reactive power dispatch. He directs the loading of all of the reactive power sources in CONVEX to balance the reactive supply. He keeps the Millstone reactive power generation in balance with the Eastern Area requirements so that the effect on the system of voltage variations is minimized when a unit is lost.

One objective of the reactive power dispatch is to prevent the voltage at Millstone from going below the minimum required by Millstone 3 reserve station service transformer. The maximum allowable voltage at Millstone is 362 kV based on equipment ratings.

If abnormal system conditions result in voltages approaching minimum levels, the "Guidelines for Dispatch of Reactive Power on the Northeast Utilities System" directs the CONVEX operator to take specific corrective actions to restore voltage. Many of these actions will also be taken when the Millstone reactive power output reaches 400 MVAR (with two units in service).

Actual experience and system simulations show that the CONVEX operator is able to control the system voltages within the desired limits.

The Millstone plant is connected to the transmission system by four 345-kV circuits (described in Section 8.2.1). For a short distance, these lines are on double circuit steel poles. Stability studies show that the plant remains in synchronism with the rest of the system, even if two 345-kV circuits are lost simultaneously as a result of a 3-phase fault.

The loss of any single 345 kV circuit will have a negligible effect on the Millstone units. Hence, no single circuit is critical to the operation of the units, the switchyard, the transmission system and Q430.1 the supply of offsite power. Furthermore, the loss of a second 2 345 kV circuit has been analyzed (i.e., after one has already been switched out of service) and results show that the loss will not result in instability of the Millstone units and will not cause facilities remaining in service to be loaded beyond acceptable limits.

The loss of a Millstone unit will not affect system stability. ⟸ insert Q430.7

The Millstone units are connected to the large interconnected transmission system in the eastern half of the United States. The interconnected system frequency is a 60± 0.03 Hz. Loss of large amounts of generation result in frequencies of as low as 59.94 Hz which recover to 60 Hz within a few minutes.

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In order to have large frequency deviations at Millstone, it is necessary to isolate the plant with a large excess of load. The only possible system separation which would accomplish this would be to isolate the State of Connecticut. This requires the overlapping loss of three 345 kV, one 138 kV, and one 115 kV circuit at a time when Connecticut is importing power.

If the 138 kV and 115 kV ties are neglected and assume that the outage of the three 345 kV ties are statistically independent events, one occurrence every 1.4 million years could be expected. Since the three 345 kV transmission circuits are more than 20 miles apart, statistical independence is a reasonable assumption. However, even if we assume that only two of the three events are statistcially independent, we would expect the occurrence to be only one in 1,148 years could be expected.

The occurrence of a large Connecticut import at the same time has not been included in the statistical calculations. Including the probability of a large import at the time the three 345 kV circuits were lost would increase the time between events.

insert D Q430.7
p.2-16.

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The four lines emanating from the Millstone Switching Station will be in compliance with the staff position that no other transmission lines cross over these four lines and that the four lines be physically separate and independent so that no single event such as a tower falling or line breaking will be able to simultaneously affect all circuits in such a way that none of the four circuits can be returned to service in time to prevent fuel design limits or design conditions of the reactor coolant pressure boundary from being exceeded. Figure 8.2-1, taken from the Connecticut Siting Council Docket No. 25, Application for the Millstone to Manchester 345 kV line, shows the right-of-way cross sections between Millstone and Hunts Brook Junction. The double circuit steel pole structures between Millstone and I-95 average 120 feet above ground while the wood pole H-frame structures between Daniels Avenue and Hunts Brook Junction average 85 feet above ground.

In the event of a structure failure between Millstone and Hunts Brook Junction, the worst probable longer-than-momentary outage would be a loss of two circuits; i.e., the two circuits on a common steel pole or an H-frame structure falling into an adjacent line.

At Hunts Brook Junction, the four lines split (see Figure 8.2-2). The 348 line turns west to Southington Substation, the 383 and new 310 lines continue north to Card Street and Manchester Substation respectively, and the 371 line turns east to Montville Substation. One aerial crossover of a line from Millstone exists at this junction (383 crosses 371). But, at worst, only two of the four circuits from the Millstone Switching Station would be removed from service should a structure collapse.

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The Millstone design provides two immediate access off-site circuits between the switchyard and the 4.16 kV Class IE buses. The design of two off-site circuits from the 345 kV switchyard to the 4.16 kV Class IE buses is via separate transformers (main/normal station service and reserve station service). FSAR Figure 8.1-1 shows the tie lines, transformer and bus arrangement connections.

The tie lines to the main/normal station service transformers and to the reserve station service transformer are physically separate and electrically independent. The main/normal station service transformers and the reserve station service transformers are located at opposite ends of the plant. The connection from the normal station service transformers and from the reserve station service transformers to the 4.16 kV Class 1E buses is via physically separate and electrically independent underground duct lines. FSAR Figure 1.2-1 shows the tie line routes from the switchyard to the main/normal and to the reserve station service transformers. FSAR Figure 1.2-2 shows the physical separation between the normal station service and the reserve station service transformers. FSAR Figure 8.3-7, Sheets 1 and 2, shows the embedded conduit duct lines as they enter the redundant switchgear rooms in the control building.

The control power for these buses is from different dc panels and batteries. The breakers in the Class IE buses (34C and D) are independently protected with separate relaying.

These circuits are completely redundant and separated so that no single failure can disable both off-site power supplies to the Class 1E buses; therefore, the design is in compliance with General Design Criterion 17, Electrical Power Systems.

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By careful design of the switchyard and protective relays, NU has practically eliminated the possibility of the simultaneous loss of three units at Millstone. Nevertheless, the loss of the Millstone plant and all four transmission circuits has been simulated in design studies. The transmission circuits were outaged along with the station in order to simulate worst case conditions, and this outage was simulated both with and without a fault.

The stability analysis indicates that the rest of the system will remain in synchronism after the loss of the entire output of the Millstone station. The system was modelled for one set of operating conditions; hence, it is possible that a similar test under heavy transfer conditions within the interconnected system might result in instability. However, we are certain that the probability of losing all three units simultaneously is extremely small because of the preventive measures discussed in the following paragraphs. Accordingly, NU believes it is reasonable to count upon onsite power sources to supply the necessary station service power requirements in the very remote event that all three Millstone units should be lost at once accompanied by the total loss of the transmission supply to the station.

A primary objective in designing the connection of the Millstone Nuclear Power Station to the 345 kV transmission network in Connecticut has been to prevent the loss of the entire station output. The reliability criteria of the Northeast Power Coordinating Council (NPCC) and the New England Power Pool (NEPOOL) are a fundamental part of this design process. The following are the most severe outages which the system has been designed to survive in order to minimize the possibility of a total plant outage:

a. With any one of the four Millstone 345 kV transmission circuits out of service, the plant remains stable for any three-phase fault normally cleared (four cycles) or any one-phase fault normally cleared (four cycles) or any one-phase fault with delayed clearing (nine cycles). These tests are done with maximum generation at Millstone to simulate worst case conditions.

b. The reliability criteria further requires testing to determine if the loss of two circuits on a common structure can be tolerated. The event which is used to test the loss of the two circuits is a simultaneous line to ground fault on different phases of the two circuits. With all lines in service, the system remains stable for this two circuit disturbance. It should be recognized that the four circuits leaving the Millstone switchyard are paired on two rows of double circuit structures for only a short distance, and, hence the exposure to this outage is small.

c. Also, the simultaneous loss of two Millstone circuits on common structures following a previous (nonsimultaneous) outage of either of the other Millstone circuits (or any other critical element) must not result in instability. All of the critical outages of this type effectively result in the loss of three of the four Millstone circuits and leave the Millstone station weakly tied to the transmission grid. To prevent instability for these extremely severe (and highly improbable) disturbances, it is necessary to reduce output after the initial line outage and before the loss of the two circuits on common structures takes place and/or install an automatic generation rejection scheme.

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Because of the significant economic penalties involved, the reduction of generation after the initial line outage is considered a highly undesirable solution to the potential stability problems identified in Item (c) above and should be avoided to the extent possible. Therefore, a post disturbance generation curtailment scheme has been provided. This system continuously monitors the individual state of six critical system components together with the generation output at the Millstone complex. Should the system condition arise where 1) any one of the six critical lines or elements is unavailable, 2) the generation at Millstone is above a predetermined MW level and 3) two specific transmission circuits are forced out, then generation will automatically be curtailed at Millstone. Stability studies indicate that during maximum output conditions (2640 MW), Millstone Units 1 and 3 can be successfully tripped and system stability maintained leaving Millstone Unit 2 in synchronism with the transmission network. The tripping of these units results in a generation reduction of up to approximately 1,810 MW with 870 MW remaining synchronized. This generation reduction scheme is called a Severe Line Outage Detection (SLOD).

The operation of the Millstone generation rejection scheme is based on the outage of combinations of certain transmission circuit elements. The scheme has been named Severe Line Outage Detection (SLOD).

This system will continuously monitor the individual status of six critical transmission elements in the area of the Millstone Station together with the generation output of the Millstone complex.

Generation will be curtailed automatically if a system condition arises where any of ten combinations of the six elements are outaged, and generation at Millstone is above 1,200 MW.

To monitor the status of the 345 kV system, SLOD equipment has been required at the Millstone and at Montville switchyards. In addition, it will be necessary to install high speed back-up relay protection with a permissive overreaching audio-tone scheme on both ends of the Millstone to Manchester and the Millstone to Southington lines.

At Millstone, three logic packages will be provided. The operation of any two logic units will provide a tripping output. The current detecting devices of each logic package will sense the available state of each of the four transmission circuits emanating from the Millstone switchyard. Signals indicating the availability state of two remote components (the Montville 345 kV tie breaker and the Montville - Haddam Neck line) will be transmitted to Millstone. The megawatt output from each of the Millstone units will be measured and summed to provide an indication of the total megawatt output of the Millstone units. Should the comparative logic in the SLOD package indicate that any one of the combinations of transmission outages listed below exist, and the generation level at the Millstone Station is above 1,200 MW, then Millstone Units 1 and 3 will be curtailed immediately.

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The combinations of unavailable components which must be monitored are:

1. Necessary to meet NPCC and NEPOOL criteria:

   Millstone - Manchester, Millstone - Card and Millstone - Montville

   Millstone - Southington, Millstone - Card and Millstone - Montville

   Millstone - Montville, Millstone - Manchester and Millstone - Southington

   Millstone - Card, Millstone - Manchester and Millstone - Southington

   Montville - Haddam Neck, Millstone - Manchester and Millstone - Southington

   Montville 345 kV tie breaker, Millstone - Manchester and Millstone - Southington

2. Also included to simplify the SLOD package logic but not required to meet NPCC and NEPOOL criteria are:

   Millstone - Southington, Millstone - Card and Montville - Haddam Neck

   Millstone - Manchester, Millstone - Card and Montville - Haddam Neck

   Millstone - Southington, Millstone - Card and Montville 345 kV tie breaker

   Millstone - Manchester, Millstone - Card and Montville 345 kV tie breaker

As mentioned above, signals indicating the availability status of the two remote components at Montville are required at Millstone. To monitor the status of the 345 kV circuit breaker at Montville, and the availability of the Montville-Haddam Neck line, three logic units will be required at Montville. The three independent logic packages will supply information to the Millstone logic packages via an independent transfer trip tone transmitter.

Since the operation of the generation rejection scheme should take place in less than 12 cycles to maintain stability, all transmission line faults must be cleared at high speed. This will require the addition of high speed back-up protection using permissive overreaching audio-tone equipment on the Millstone-Manchester line and the Millstone-Southington line at both terminals.

With the generation rejection scheme in service, it will be permissible to operate with high Millstone Station output when any one of six critical transmission elements is out of service. As a member of NEPOOL and the NPCC, the Applicant will be required to comply with either of the following operability requirements with one line out of service:

1. have SLOD fully operational, or

2. reduce load to a total station output of 1,200 MW within 4 hours.

These instructions will be documented as part of the Connecticut Valley Electric Exchange (CONVEX) operating instructions for the Millstone switchyard and will be regulated by CONVEX. To facilitate regulation, CONVEX is aware of the condition of all lines and the status of the SLOD scheme via an annunciator located at CONVEX (CONVEX is an operating division of NEPOOL).

The operability requirements specified above ensure that, upon loss of a double circuit line with a third line out of service and generation in excess of 1,200 MW, offsite power will be available for safe shutdown; maintaining system stability minimizes the probability of coincident loss of both offsite supplies. This is consistent with the requirements of General Design Criterion (GDC) 17.

GDC 17 also requires that the probability of losing an offsite supply coincident with loss of the nuclear power unit be minimized. Because of the necessity for SLOD to complete its function within 12 cycles, SLOD trips Millstone 3 by tripping the switchyard breakers instead of the generator breaker (this eliminates the extra time required for relay and communication channel operation in a transfer trip scheme). Under these conditions, station auxiliary loads high speed transfer to the reserve station service transformers, and the normal station service transformer (which is tripped when SLOD trips Unit 3) can be reenergized by closing a switchyard breaker. Therefore, both offsite supplies will be available to ensure safe shutdown of the unit in accordance with GDC 17.

The SLOD scheme was manufactured to be a reliable unit. Each line is monitored by a logic package which utilizes redundant channels (two-out-of-three logic) in case of a failure of one channel. Each logic package alarms in the event of a channel failure and triggers a SLOD trouble alarm in the Millstone Unit 1 control room and at CONVEX. Also, a failed channel causes arming of the logic, indicating the monitored system component to be out of service. Additionally, every 8 hours, the SLOD scheme automatically tests one channel, yielding a complete scheme verification once every 24 hours. In the event of failure, a SLOD trouble alarm is actuated in the Millstone Unit 1 control room and at CONVEX. Upon receiving the SLOD trouble alarm, the operator will dispatch a person to the Millstone switchyard control house to evaluate the condition of the system. In the event that one line is out of service and the SLOD system is not operating in one hour, CONVEX will reduce station output to 1,200 MW or below during the next 3 hours. The continual channel surveillance and periodic (8 hours) functional tests that are run automatically ensure conformance to GDC 18.

Additional testing was carried out for possible but improbable (PBI) events which are specified in the NPCC and NEPOOL reliability criteria. The one PBI event which could have a serious effect at Millstone is a three-phase fault followed by delayed clearing due to a three-phase stuck circuit breaker. This results in the Millstone units losing synchronism. This stability problem has been eliminated by designing the protective relay schemes and circuit breaker installations so that at most, one pole will fail to clear. The breakers which are designed to meet this criteria are classified as having independent pole tripping.

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NU insures independent pole tripping by installing breakers with mechanically independent poles and two separate methods of tripping the circuit breaker. These installations include two sets of relays and trip coils. There are two sets of current and potential transformers, the wiring for the relay packages are installed in separate duct banks, the relay packages are physically separated in the control house and two separate dc supplies are provided.

The 345 kV switchyard at Millstone is designed so that the loss of more than one transmission circuit due to a failure of a breaker to trip requires at least two circuit breakers to simulataneously fail to operate. The failure of even one circuit breaker is very unusual. At least three circuit breakers would have to fail before three transmission lines would be lost due to malfunctions in the switchyard. At that point, the generation rejection scheme would operate to keep one unit in service. In order to lose the entire station, at least four circuit breakers must fail.

To summarize: The Company is taking extensive precautions to prevent the sudden loss of the three generating units at Millstone Station and the simultaneous loss of off-site power. We believe these measures make the probability of such an occurrence extremely small.

ASCII Text

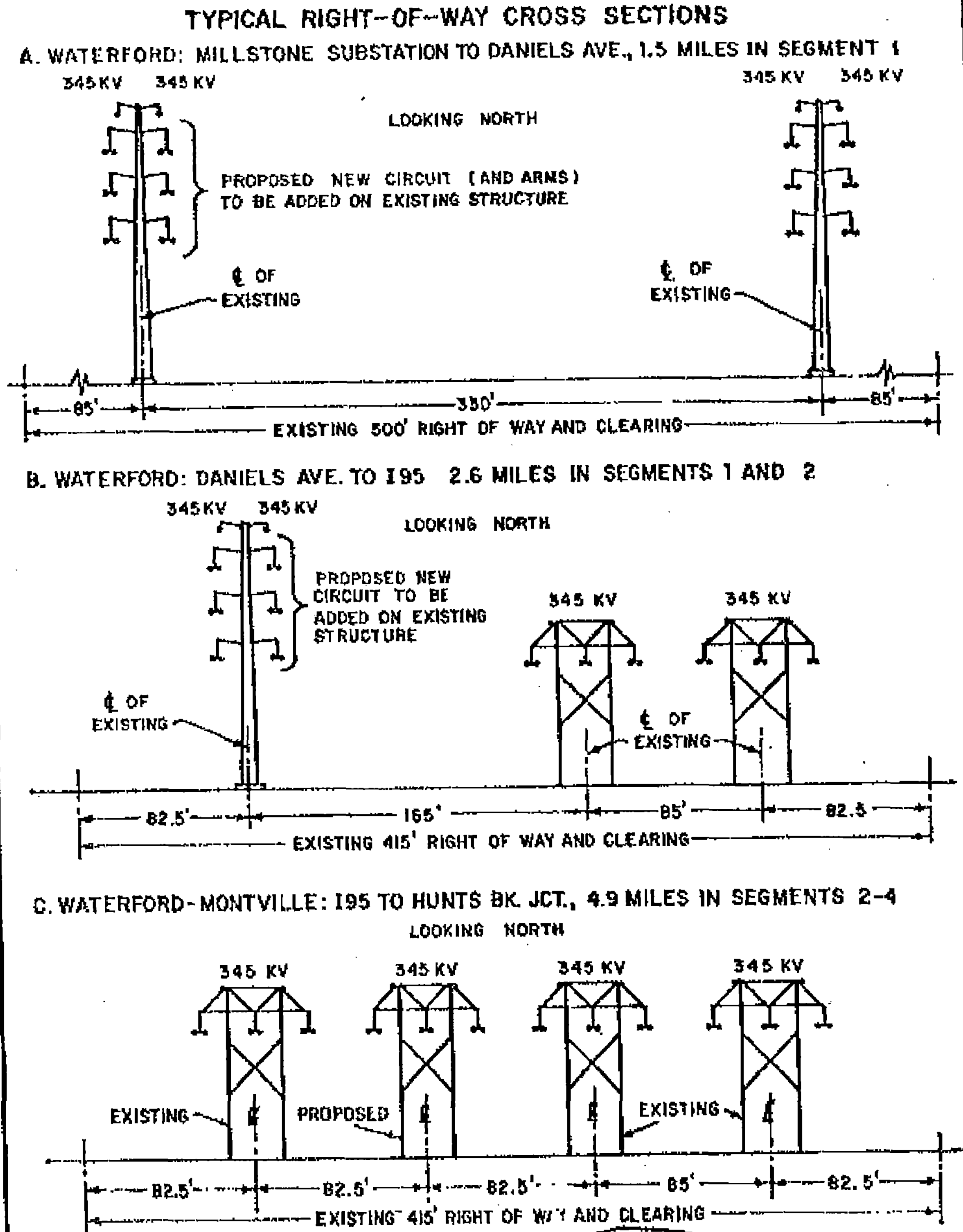

FIGURE Q 430.4-1 8.2-1
MILLSTONE-MANCHESTER 345KV LINE
MILLSTONE NUCLEAR POWER STATION
UNIT 3
FINAL SAFETY ANALYSIS REPORT

ASCII Text

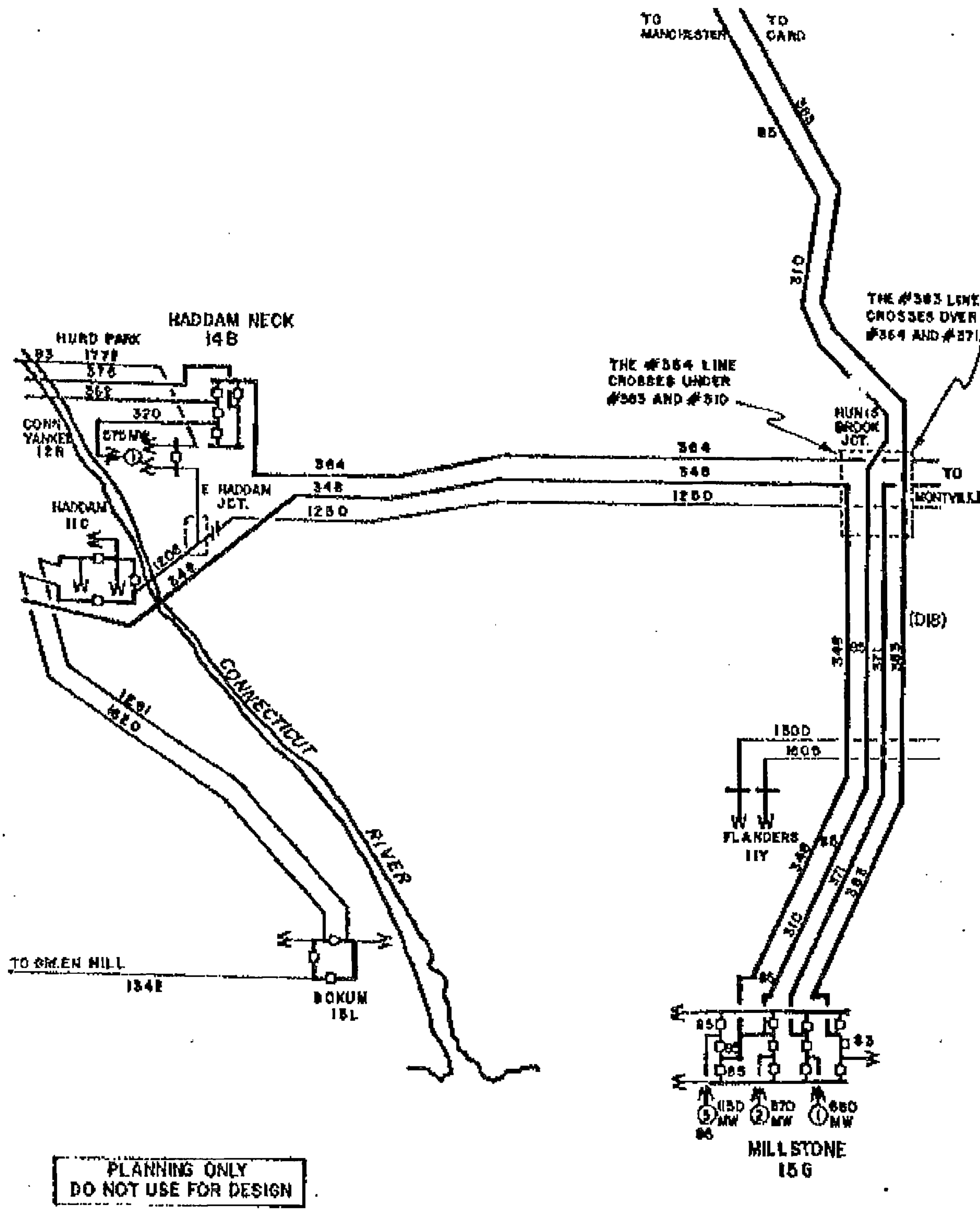

FIGURE 0430.4-2 B.2-2
HUNTS BROOK JUNCTION
MILLSTONE NUCLEAR POWER STATION
UNIT 3
FINAL SAFETY ANALYSIS REPORT

ASCII Text

FSAR Section 8.3.1.1.4

Time-overcurrent relays are provided for the reserve station service supply (i.e. alternate source) breakers. These relays provide protection against overload, low energy multiphase, and phase-to-ground faults. Additionally, instantaneous directional phase overcurrent and ground overcurrent relays are provided for these supply breakers. These relays provide protection against (i.e. by isolating the emergency bus) multiphase and ground faults external to the emergency bus by isolating the emergency bus.

b. Differential Bus Protection, Emergency Switchgear - Each emergency 4.16 kV bus is protected against multiphase-to-phase and phase-to-ground faults by high impedance differential relays. Under accident condition when emergency bus is being fed by the emergency generator, sequential tripping is introduced for ground faults. The generator neutral breaker is tripped first which will clear ground faults by ungrounding the system.

c. Undervoltage Bus Protection, Emergency Switchgear - Each emergency 4.16 kV bus is furnished with two undervoltage detection schemes.

Loss of voltage scheme with two-out-of-four logic is provided to detect voltage drop below acceptable level. After sufficient time delay to coordinate with overcurrent fault protection, this scheme will start the diesel generator, trip motors through the sequencer, and load the emergency generator as required.

Degraded voltage scheme with two-out-of-four logic is provided to detect prolonged voltage drop to the level which could be detrimental to operation of the emergency equipment if allowed to continue. Under accident conditions when the emergency generator is ready to accept load, this scheme will trip motors through the sequencer and load the emergency generator as required. Under normal conditions this scheme will start the emergency generator and, when it is ready to accept load, will trip motors through the sequencer and load the emergency generator as required.

← insert Q430.

d. Emergency Generator, Emergency Switchgear - The design of the electrical protective trip circuits of the emergency generator is consistent with minimizing the likelihood of false emergency generator trips during emergency conditions, as described in Section 8.3.1.1.3.

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The degraded voltage scheme with two-out-of-four logic provided for each 4.16 kV Class 1E bus is described in the following drawings, and logic and elementary diagrams (refer to FSAR Section 1.7):

One Line Drawings

12179-EE-1K
12179-EE-1M

Logic Diagrams

12179-LSK-24-3C, D, H, J, K
12179-LSK-24-4A, B

Elementary Diagrams

12179-ESK-5BD, BE, BF, BG
12179-ESK-7J, L

The Millstone 3 design complies with the guidelines of Position 1 of Branch Technical Position PSB-1 of NUREG-0800 in the following manner:

The second level of protection is in addition to the undervoltage scheme which also employs a two-out-of-four coincidence logic to prevent spurious trips of the offsite power source. Two separate time delays are incorporated in the degraded voltage scheme. The first time delay establishes the existence of a sustained degraded voltage on the bus. Following the delay, an alarm in the control room alerts the operator to the degraded condition. The subsequent occurrence of an accident signal (SIS or CDA) will immediately separate the Class 1E distribution system from the offsite power system. The second time delay is of a limited duration such that the permanent connected Class 1E loads will not be damaged. Following the delay, if the operator has failed to restore adequate voltages, the Class 1E distribution system is automatically separated from the offsite power system. No bypasses are incorporated in the scheme.

The Class 1E voltage sensors are physically located and electrically connected to the Class 1E switchgear. Test and calibration of the voltage sensors during power operation can be performed on an individual relay basis.

The Technical Specification will include limiting condition for operation, surveillance requirements, trip setpoints, and allowable values for the second-level voltage protection sensors and associated time delay devices.

Excerpts from

NRC Letter Dated September 10, 1985

Request for Additional Information for Millstone Nuclear Power Station, Unit No. 3

ASCII Text

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

RECEIVED

SEP 18 1985

SENIOR VICE PRESIDENT
Nuclear Engineering & Operations

Docket No.: 50-423

SEP 10 1985

Mr. John F. Opeka
Senior Vice President
Nuclear Engineering and Operations
Northeast Nuclear Energy Company
P. O. Box 270
Hartford, Connecticut 06141-0270

Dear Mr. Opeka:

Subject: Request for Additional Information for Millstone Nuclear Power Station, Unit No. 3

Enclosure 1 contains requests for additional information which the staff requires to complete its evaluation of your application for an operating license for Millstone 3.

Enclosure 2 contains meeting summaries also detailing information which the staff requires to complete its evaluation of your application for an operating license for Millstone 3.

Please submit your responses no later than 30 days of the date of this letter.

Enclosure 3 contains the staffs response to your requests for approval of use of 3 Code Cases at Millstone 3.

Enclosure 4 contains information related to the staffs review of the Millstone Nuclear Power Station Emergency Plan, Draft 2 to Revision 0.

For further information or clarification, please contact the Licensing Project Manager, Elizabeth L. Doolittle at (301) 492-4911.

Sincerely,

for

B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing

cc: See next page

Raster Image

A summary of the discussion for each of the above items is presented below:

OI #2 (SER Section 8.3.1.11)

Additional analysis or test data was not available to demonstrate the diesel generator's design capability (in accordance with the requirements of GDC 17) to accept design load after operation at no load. This item remains open.

OI #13 (SER Section 8.3.3.)

The applicant indicated that the design for the PORV and Block valve power supplies is being changed such that it will be in conformance with the staff position stated in the SER. This item remains open pending staff review of the proposed change.

CI #43 (SER Section 8.2.1.1)

This item has been closed by SSER #1.

CI #44 (SER Section 8.2.2.1)

Design description, documented by letters dated May 3, 1983 and August 29, 1983 (response to NRC question number 430.4), has not been incorporated into Section 8.2 of the FSAR. This item remains confirmatory.

CI #45 (SER Section 8.2.2.2)

The offsite power cables between the normal station service transformer and the Class 1E buses and between the Reserve station service transformer and the Class 1E buses were traced as part of the confirmatory site visit. Based on the cable tracing, the staff concludes that the cables are routed in accordance with Millstone separation criteria defined in the FSAR with the following exception. The A division cables from the normal station service transformer are not routed in embedded conduit when they pass through the B division cable tunnel shown on figure 8.3-7 of the FSAR. This item will become open.

CI #46 (SER Section 8.2.2.5)

Description of surveillance, operability requirements, and analysis presented by letter dated June 12, 1984 has not been documented in response to question 430.7 or in Section 8.2 of the FSAR. The applicant indicated that the analysis presented for the protection scheme is being changed. When the proposed change is received, this item will become open.

Excerpts from

Northeast Utilities Letter Dated September 19, 1985

Millstone Nuclear Power Station, Unit No. 3

Technical Specifications – Proof and Review

ASCII Text

NORTHEAST UTILITIES

THE CONNECTICUT LIGHT AND POWER COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

General Offices • Selden Street, Berlin, Connecticut

P.O. BOX 270
HARTFORD, CONNECTICUT 06141-0270
(203) 665-5000

September 19, 1985

Docket No. 50-423
B11731

Director of Nuclear Reactor Regulation
Mr. B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Gentlemen:

Millstone Nuclear Power Station, Unit No. 3
Technical Specifications - Proof and Review

Representatives from Northeast Nuclear Energy Company (NNECO) met with the Staff on September 6, 1985 to discuss the Technical Specifications for Millstone Unit No. 3. NNECO was requested to submit additional information concerning certain draft technical specifications by September 20, 1985. Enclosed please find NNECO's response to the questions raised.

We trust the attached will resolve the Staff's concerns. If there are additional questions, please contact our licensing representative directly.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY
et. al.

BY NORTHEAST NUCLEAR ENERGY COMPANY
Their Agent

J. F. Opeka

J. F. Opeka
Senior Vice President

By: E. J. Mroczka
Vice President

ASCII Text

SER Item

Item 6: 3/4.8.1 A. C. Sources

SER Section 8.2.2.5, page 8-4 would require the Severe Line Outage Detector (SLOD) Scheme surveillance and operability requirements for the protective scheme be in technical specifications.

NNECO's Response:

Section 8.1.3 of the Millstone Unit No. 3 (MP-3) FSAR describes a Severe Line Outage Detector (SLOD) Scheme. The SLOD scheme provides protection against potential system instability in the event of a loss of the two 345KV circuits on either of the two double circuit towers at a time when one of the remaining two circuits is out of service and Millstone site generation is heavy.

Question 430.7, part b, requesting additional details relative to SLOD resulted in NNECO subsequently providing this information. It was our understanding that the NRC reviewer, upon detailed review of that supplement, found the scheme to be acceptable.

The Millstone 3 Safety Evaluation Report (SER) was issued in July of 1984. Section 8.2.2.5 of the SER, entitled Generation Rejection Scheme documents your determination that the design meets GDC 17 and 18 criterion and is acceptable. Further stated however, is that "Surveillance and operability requirements for the protection scheme will be included in the Technical Specifications". NNECO strongly disagrees with this position, for the following reasons.

The transmission system (grid) within the State of Connecticut is operated by the Connecticut valley Electric Exchange (CONVEX). The Millstone switchyard is an important element of the Connecticut and New England grids, and is operated by CONVEX in close coordination with NNECO. Each of the Millstone generating units has two dedicated connections to the Millstone switchyard over which the respective unit has administrative control, and addressed by the unit Technical Specifications.

All the protective features contained within the switchyard (Millstone and all other switchyards) fall under the jurisdiction of the Northeast Utilities Transmission Organization with CONVEX serving as the operator. The SLOD scheme at Millstone is not Millstone Unit No. 3 specific, but the scheme required by the transmission system, wherein protection against the occurrence of system instability is deemed prudent. In this respect, it is only one of many system features which in total give rise to a highly reliable transmission network.

We have complete confidence in the ability of CONVEX to satisfactorily control the transmission system. They have demonstrated that ability as evidenced by the high reliability of the Connecticut Power System and by their sensitivity to the special needs of the nuclear units. CONVEX has in place operating procedures, and their equivalent of limiting conditions for operation (complete with compensatory interim measures), to provide for any transmission system off normal condition.

ASCII Text

Item No. 6 continued

General Design Criterion (GDC) 17 states that "Electric power from the transmission network to the onsite electric distribution system shall be supplied by two physically independent circuits designed and located so as to minimize to the extent practical the likelihood of their simultaneous failure...".

The statement "minimize to the extent practical" fully recognizes the non Class 1E and non-seismically qualified nature of the transmission system. The installation of the SLOD scheme is one element in the design of the transmission system to minimize the probability of loss of offsite power. The Technical Specifications the NRC desires to impose upon a small portion of that system (SLOD) are inconsistent with normal CONVEX controls. Although system reliability is largely affected by the quality and reliability of the hardware; it is also true that software elements are important to reliability. Such decisions as to how VARS will be dispatched (a continuously changing target/plan) and how much spinning reserve and of what type in what location, are all part of CONVEX's day to day activity.

Regarding SLOD specifically, the scheme was engineered for transmission system stability purposes, and it will be operated and maintained to support a high degree of reliability. No offsite Millstone switchyard transmission lines will be removed from service when all three Millstone Units are operating except under forced outage circumstances.

If, however unlikely, SLOD is not in service at that time, CONVEX will act to reduce Millstone site generation, within a matter of minutes. Similarly, if a line were forced out of service whenever SLOD is in service, (the expected case) CONVEX will act to optimize load flows and spinning reserve to prepare for the unlikely probability that SLOD could operate, and disconnect significant amount of nuclear generation.

We believe that this response appraises you of the complexities associated with controlling the transmission system, and clarifies the purpose of the SLOD scheme in relation to the transmission/generation system. Imposing plant specific technical specifications to address SLOD unavailability is inappropriate to effectively ensure the availability of offsite power.

Excerpts from

NRC Letter Dated September 25, 1985

Preliminary Safety Evaluation to be Included in SER Supplement 3

for Millstone Nuclear Power Station, Unit 3

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SEP 25 1985

Docket No.: 50-423

Mr. John F. Opeka
Senior Vice President
Nuclear Engineering and Operations
Northeast Nuclear Energy Company
P. O. Box 270
Hartford, Connecticut 06141-0270

Dear Mr. Opeka:

Subject: Preliminary Safety Evaluation to be Included in SER Supplement 3 for Millstone Nuclear Power Station, Unit 3

Enclosure 1 contains safety evaluations which are proposed for inclusion in SER Supplement 3 for Millstone 3. These evaluations are being transmitted to you for your information.

Enclosure 2 lists 21 SER open items on which the staff has been unable to continue its review due to NNECo's failure to provide requested additional information in a timely manner. In some instances more than a month has passed since the original NNECo submittal date. It is imperative that all of the requested information be provided to the staff promptly so that we can continue our review.

It is our understanding that all of the requested information necessary to resume our review will be docketed by September 30, 1985. Because resumption of our review requires receipt of the requested information, the completion of our review and subsequent issuance of your operating license could be delayed if NNECo does not submit the information by September 30, 1985.

Any comments or concerns should be directed to the Licensing Project Manager, Elizabeth L. Doolittle at (301) 492-4911.

Sincerely,

Paul W O'Connor

for B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing

Enclosures: As stated

cc w/o enclosures:
See next page

ENCLOSURE 2

SUPPLEMENTAL SAFETY EVALUATION REPORT
POWER SYSTEMS BRANCH
MILLSTONE NUCLEAR POWER STATION
UNIT 3
DOCKET NUMBER 50-423

8.0 ELECTRIC POWER SYSTEMS

8.2 Offsite Electric Power Systems

8.2.2.1 Physical Separation of Offsite Circuits Within a Common Right-of-Way

In a letter dated April 1, 1985, the applicant provided FSAR revisions as they will appear in Amendment 13 of the FSAR. In this letter, the applicant stated that his revision incorporates the response to NRC question number 430.4. This resolves confirmatory item 44 dealing with the inclusion of the information in the FSAR.

8.2.2.2 Physical Separation of Offsite Circuits Between Switchyard and Class 1E System

In a letter dated April 1, 1985, the applicant provided FSAR revisions as they will appear in Amendment 13 of the FSAR. In this letter the applicant stated that this revision incorporates the response to NRC question number 430.5. This resolves confirmatory item 45 dealing with the inclusion of this information in the FSAR. During a site visit held on April 10 and 11, 1985, the staff observed that the A division cables from the normal station service transformer are routed in cable trays when they pass through the B division cable tunnel. This contradicts sheet 2 of the FSAR Figure 8.3-7 which shows this cable in

Raster Image

embedded conduit. The applicant has indicated this figure will be corrected to resolve this discrepancy. This is acceptable.

8.2.2.5 Generator Rejection Scheme

The staff will pursue with the applicant concerns regarding stability of the offsite power system at Millstone

8.3.1.3 Description of Compliance with Position 1 of BTP PSB-1

In a letter dated April 1, 1985, the applicant provided FSAR revisions as they will appear in Amendment 13 of the FSAR. One of these revisions include the response to NRC question number 430.9 which the staff has previously reviewed and found acceptable. This resolves confirmatory item 50. As part of its review of the Millstone 3 Technical Specifications, the staff will ensure that the second level undervoltage protection setpoints are acceptable and the description of the logic matches that in the FSAR revision.

8.3.1.5 Adequacy of Station Electric Distribution System Voltage

As part of the site visit on April 10 and 11, 1985, the staff reviewed the results of the Millstone Unit 3 voltage drop analysis and found the results to be acceptable but noted that the grid voltage limits necessary to maintain adequate plant voltages may not be outside of the normal grid voltage extremes. This could result in the grid being incapable of supplying adequate voltages to safety loads during periods when the grid is operating at its normal voltage extremes. The staff will pursue this item with the applicant and report its resolution in a future supplement.

The NRC regional office will verify the test results which substantiate the Millstone Unit 3 voltage analysis. This item remains confirmatory pending completion of the Region verification.

Excerpts from

NRC Letter Dated November 14, 1985

Issuance of Supplement No. 3 to NUREG-1031

Millstone Nuclear Power Station, Unit No. 3

ASCII Text

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

NOV 14 1985

Docket No.: 50-423

RECEIVED

NOV 20 1985

SENIOR VICE PRESIDENT
Nuclear Engineering & Operations

Mr. John F. Opeka
Senior Vice President
Nuclear Engineering and Operations
Northeast Nuclear Energy Company
P. O. Box 270
Hartford, Connecticut 06141-0270

Dear Mr. Opeka:

Subject: Issuance of Supplement No. 3 to NUREG-1031 - Millstone Nuclear Power Station, Unit No. 3

The U. S. Nuclear Regulatory Commission has issued Supplement No. 3 to the Millstone Nuclear Power Station, Unit No. 3 Safety Evaluation Report related to operation of the facility.

Two copies of this report (NUREG-1031 Supplement No. 3) are enclosed for your use. Twenty additional copies will be forwarded when they have returned from our printer-contractor.

Sincerely,

B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing

Enclosure:
NUREG-1031 Supplement
No. 3 (2 copies)

cc w/o enclosure:
See next page

ASCII Text

Table 1.2 (Continued)

Item	Status	Section*
(35) Confirmatory test related to IE Bulletin 80-06	Closed (SSER 2)	
(36) Control building isolation reset	Closed (SSER 2)	
(37) Power lockout feature for motor-operated valves	Closed (SSER 1)	
(38) Failure mode and effects analyses of engineered safety features actuation system	Closed (SSER 1)	
(39) Non-Class 1E control signals to Class 1E control circuits	Closed (SSER 2)	
(40) Sequencer deficiency report	Closed (SSER 2)	
(41) Balance-of-plant instrumentation and control system testing capability	Closed (SSER 2)	
(42) Instrument accuracy related to Positions [Attachments] 4, 5, and 6, NUREG-0737, Item II.F.1	Closed (SSER 2)	
(43) Description and analysis demonstrating compliance with GDC 5	Closed (SSER 1)	
(44) Physical separation of offsite circuits within a common right of way	Closed (SSER 3)	8.2.2.1
(45) Physical separation of offsite circuits between switchyard and Class 1E system	Closed (SSER 3)	8.2.2.2
(46) Generation rejection scheme	Closed (SSER 3)	8.2.2.5
(47) Description and analysis demonstrating compliance with GDC 17	Closed (SSER 1)	
(48) Description and analysis demonstrating compliance with GDC 18	Closed (SSER 1)	

*Section of this supplement where item is discussed.

8 ELECTRIC POWER SYSTEMS

8.2 Offsite Electric Power System

8.2.2 Compliance With GDC 17

8.2.2.1 Physical Separation of Offsite Circuits Within a Common Right-of-Way

In a letter dated April 1, 1985, the applicant provided FSAR revisions as they will appear in FSAR Amendment 13. In this letter, the applicant stated that these revisions incorporate the response to NRC question Q430.4. This resolves confirmatory item (44) dealing with the inclusion of the information in the FSAR.

8.2.2.2 Physical Separation of Offsite Circuits Between Switchyard and Class 1E System

In a letter dated April 1, 1985, the applicant provided FSAR revisions as they will appear in FSAR Amendment 13. In this letter, the applicant stated that these revisions incorporate the response to NRC question Q430.5. This resolves confirmatory item (45) dealing with the inclusion of this information in the FSAR. During a site visit held on April 10 and 11, 1985, the staff observed that the A division cables from the normal station service transformer are routed in cable trays when they pass through the B division cable tunnel. This contradicts sheet 2 of FSAR Figure 8.3-7 which shows this cable in embedded conduit. The applicant has indicated this figure will be corrected to resolve the discrepancy. This is acceptable.

8.2.2.5 Generator Rejection Scheme

In the Millstone 3 SER, the staff stated that the surveillance and operability requirements for the generator rejection scheme (also termed the severe line outage detector, SLOD, scheme by the applicant) would be included in the technical specifications. Subsequently, in a letter dated September 19, 1985, the applicant stated that the SLOD scheme is only one of many system features which in total give rise to a highly reliable transmission network. The applicant stated that although system reliability is largely affected by the quality and reliability of the hardware, it is also true that software elements are important to reliability, such as how VARs (volt amperes reactive) will be dispatched and how much spinning reserve and of what type in what location are available. This is handled by the Connecticut Valley Electric Exchange (CONVEX) which operates the transmission system (grid) within the State of Connecticut.

The applicant stated that CONVEX has operating procedures in place, as well as its equivalent of limiting conditions for operation (complete with compensatory interim measures), to provide for any transmission system off-normal condition. The applicant stated that no offsite Millstone switchyard transmission lines will be removed from service when all three Millstone units are operating, except under forced outage conditions. If SLOD is not in service at that time, CONVEX will act to reduce Millstone site generation, within a matter of minutes,

to preclude the possibility of an unstable condition arising. Similarly, if a line were forced out of service whenever SLOD is in service, CONVEX will act to optimize load flow and spinning reserve to prepare for the event that SLOD could operate and disconnect significant amounts of nuclear generation.

The staff finds that these provisions minimize, to the extent practical, the likelihood of the simultaneous failure of both offsite power sources and therefore eliminate the need for Technical Specification limitations on the SLOD scheme. This closes confirmatory item (46).

8.3 Onsite Power Systems

8.3.1 Onsite AC Power System's Compliance With GDC 17

8.3.1.3 Description of Compliance With Position 1 of BTP PSB-1

In a letter dated April 1, 1985, the applicant provided FSAR revisions as they will appear in FSAR Amendment 13. One of these revisions includes the response to NRC question Q430.9 which the staff has previously reviewed and found acceptable. This resolves confirmatory item (50). As part of its review of the Millstone 3 Technical Specifications, the staff will ensure that the second level undervoltage protection setpoints are acceptable and the description of the logic matches that in the FSAR revision.

8.3.1.5 Adequacy of Station Electric Distribution System Voltage

As part of the site visit on April 10 and 11, 1985, the staff reviewed the results of the Millstone 3 voltage drop analysis and found the results to be acceptable; however, the staff noted that the grid voltage limits necessary to maintain adequate plant voltages may not be outside of the normal grid voltage extremes. This could result in the grid being incapable of supplying adequate voltages to safety loads during periods when the grid is operating at its normal voltage extremes. The staff will pursue this item with the applicant and report its resolution in a future SER supplement.

NRC will verify the test results that substantiate the Millstone 3 voltage analysis. This item remains confirmatory pending completion of verification by the staff.

8.3.1.7 Diesel Generator Protective Relaying

This item was identified as confirmatory in SER Section 8.3.1.7, but was not assigned a confirmatory item number in SER Table 1.4. The staff reviewed, with the applicant, Stone & Webster Engineering Corporation (SWEC) drawings 12179-ESK-8KK (Rev. 2), 12179-ESK-8KF (Rev. 6), 12179-ESK-5DS (Rev. 11), and 12179-ESK-8KG (Rev. 6). The staff confirmed that the design for bypassing diesel generator protective relaying under accident conditions meets the staff position. This item is, therefore, considered complete.

8.3.1.11 Diesel Generator Load Acceptance Test After Operation at No Load

In SER Section 8.3.1.11, it was stated that the method by which the diesel generator's no-load capability is considered in the load acceptance tests would be