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Dominion®

February 25, 2016

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

Serial No	16-015
NLOS/WDC	R0
Docket Nos.	50-336/50-423
License Nos.	DPR-65/NPF-49

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

In a letter dated June 30, 2015, Dominion Nuclear Connecticut, Inc. (DNC) requested 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. In an email dated January 13, 2016, the NRC transmitted a request for additional information (RAI) related to the amendment request. DNC agreed to respond to the RAI by February 29, 2016.

The attachment to this letter provides DNC's response to the NRC's RAI.

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

Sincerely,

[signature]

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 25th day of February, 2016.

My Commission Expires: 12/31/16

[signature]
Notary Public

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

A001
NRR

Commitments made in this letter: None.

Attachment:

Response to Request for Additional Information Regarding License Amendment Request for Removal of Severe Line Outage Detection From the Offsite Power System

cc: U.S. Nuclear Regulatory Commission
Region I
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Suite 100
King of Prussia, PA 19406-2713

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Millstone Power Station

Director, Radiation Division
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ATTACHMENT

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING LICENSE AMENDMENT REQUEST FOR REMOVAL OF SEVERE LINE OUTAGE DETECTION FROM THE OFFSITE POWER SYSTEM

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RAI 1

On page 18 of 42 of Attachment 1 of the LAR, the licensee states:

> *"Within the approximate 9-mile ROW [right of way] 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."*

a). *Based on the above, if two lines are impacted by a single point vulnerability while another line is out of service, then the remaining line may trip due to its relays experience large swings in power and voltage as a result of instability which will result in loss of offsite power (LOOP) to MPS. Explain how the LOOP can be avoided to MPS in this scenario which is similar to the MPS LOOP experience on May 25, 2014? What automatic actions will be required to maintain the grid stability without SLOD special protection system (SPS)?*

b). *How is independence and reliability achieved if one 345 kV line (single circuit tower (SCT)) failure impacts another 345 kV line SCT? Please explain how GDC 17 is satisfied in this situation with respect to minimizing the probability of losing electric power from any of the remaining power supplies.*

c). *Please explain why the FSAR markup did not address the grid stability where failure of one SCT impacts another SCT while one SCT (simultaneous ground fault) is in outage with only one transmission line available?*

DNC Response

Response to 1.a

For the scenario described above (one line out of service and simultaneous failure of two lines leaving only one line available to carry the MPS output), a LOOP would not be avoided. However, the defined scenario represents an abnormal condition which the proposed TRM requirements would address. The proposed TRM requirements would limit the time that one line can be out of service before further action is required to reduce total plant output consistent with the ISO-New England Millstone Facility Out Guide. GDC-17 compliance is addressed in the acceptability of the normal configuration and the limiting conditions placed on plant output through the detailed, transmission-line-specific TRM requirements on output that have been proposed with completion times.

The postulated scenario of one line out of service and a tower failure impacting two other lines is beyond the required Northeast Power Coordinating Council's (NPCC) compliance requirements for maintaining grid stability. MPS connections to the transmission system were originally designed to comply with the NPCC's 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 Directory 1, "Design and Operation of the Bulk Power System," and ISO New England Planning Procedure No. 3, "Reliability Standards for the New England Area Bulk Power Supply System," 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 to service do not result from the contingencies contained in the Millstone Facility Out Guide/specified in the standards. In addition, the loss of MPS2, MPS3, or the loss of any other generating plant in the system has been analyzed by ISO-New England to ensure that such loss does not result in grid instability.

Furthermore, the scenario described above requires simultaneous loss of two transmission lines. However, the double circuit transmission (DCT) towers for the 345kV transmission lines have been replaced with single circuit towers (SCT), and therefore, the simultaneous loss of two transmission lines is no longer a normal contingency for planning purposes. For normal contingency events, only one additional transmission element failure is required to be considered.

For MPS, if two transmission lines are out of service, the total MPS output would be reduced via operator action in accordance with the ISO-New England Millstone Facility Out Guide to maintain system stability in the event of an additional transmission element failure.

To minimize the potential of a LOOP event, MPS has proposed TRM actions that are more conservative than the actions required by the Millstone Facility Out Guide.

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. The proposed TRM actions effectively minimize the risk of losing offsite power from the loss of any of the remaining power supplies and provide reasonable assurance of continued grid stability.

With two offsite lines nonfunctional, in accordance with the Millstone Facility Out Guide stability operating limits, MPS would be required to reduce total station output within the next 30 minutes. The required output reduction is dependent upon which two offsite elements are non-functional.

Causal analysis of the May 25, 2014 event determined that relay mis-operation, which resulted in the third line tripping, was the result of human error. Specifically, adequate consideration was not given to the effects of mutual coupling when setting ground instantaneous overcurrent (IOC) element settings. The issue with the relays has been corrected. Corrective actions were completed by Eversource (formerly Northeast Utilities (NU)) to prevent recurrence of this event.

In summary, no automatic actions are required to maintain grid stability without SLOD. Removal of the DCT contingency, the operating restrictions contained in the ISO-New England Millstone Facility Out Guide, and the proposed TRM actions effectively minimizes the probability of losing offsite power from the remaining power supplies.

Response to 1.b

Current stability studies have not been performed for the simultaneous loss of two transmission lines because this scenario is not considered a NPCC Directory #1 planning design contingency.

Standard Review Plan (SRP) 8.1 Rev. 2, which provided the guidance to meet GDC-17, was in effect when MPS3 was licensed. MPS2 was not licensed using the SRP, but was still required to meet the requirements of GDC-17. SRP 8.1 Rev. 3, Table 8.2 provides the NRC staff interpretation of GDC-17. A section of Table 8.2 is provided below as an aid for this response to document how MPS meets the NRC staff interpretation of GDC-17 after the separation of the DCTs to SCTs and removal of SLOD:

GDC 17	Staff Interpretation	Millstone
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.	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 Northeast Power Coordinating Council's 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 Directory 1, "Design and Operation of the Bulk Power System" and ISO New England Planning Procedure No. 3, "Reliability Standards for the New England Area Bulk Power Supply System", respectively. Compliance with these criteria 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 to service do not result from these contingencies. In addition, the loss of either MPS2 or MPS3 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 offsite power to the units. The use of double circuit transmission (DCT) towers for the 345kV transmission lines leaving Millstone Station required ISO-New England planning to consider simultaneous permanent phase-to ground on different phases. For this condition, SLOD was required to maintain grid stability. With the elimination of the DCT towers, ISO-New England no longer considers simultaneous permanent phase-to ground on different phases a normal contingency and therefore, automatic action (SLOD) is no longer required to maintain grid stability. Within the Millstone Station Rights-of-Way (ROW) layout for the 345kV transmission lines, there are four locations within the approximately 9 miles ROW where lines from one transmission tower are in close enough proximity to affect lines in an adjacent tower if the line was to fall in combination with sufficient wind velocity and direction. In addition, at Hunts Brook Junction, the line 371/364 path is crossed over by lines 383 and 310. The failure of one 345kV line causing the failure of another 345kV line is not considered a normal contingency by ISO-New England but a failure of a higher

GDC 17	Staff Interpretation	Millstone
		elevation line could potentially impact a lower elevation line. The above scenarios are not considered normal contingencies by ISO-New England and single failure is not required to be applied to the transmission system.

With two lines out of service and both MPS units at full output, the Millstone Facility Out Guide requires a manual load output reduction such that a loss of a third line would not result in loss of station service. The Millstone Facility Out Guide implements the operating restrictions necessary to comply with the mandatory NERC reliability standards to maintain reliable offsite power to MPS during design contingencies established by NERC.

Therefore, based on the above, MPS continues to meet the NRC staff interpretation of GDC-17.

Response to 1.c

The proposed MPS2 and MPS3 FSAR markups do not address grid stability for the condition where failure of one SCT impacts another SCT (simultaneous ground fault) and one line is out of service with only one transmission line available because this condition is not considered a NPCC Directory #1 planning design contingency. The FSAR does not provide failure analysis for conditions beyond normal plant configurations.

RAI-2

a.) *On page 19 of 42 of Attachment 1 of the LAR, the licensee states that "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."*

Please provide a summary of the "ISO-New England Millstone Facility Out Guide-Text Document" Revision 1, dated February 26, 2015, including all assumptions used that shows the offsite system will remain stable. Also, provide details of applicable North American Electric Reliability Corporation (NERC) Standards that ISO-New England used to satisfy the grid stability including MPS voltage and frequency requirements.

b). *On page 23 of 42 of Attachment 1 of the LAR, the licensee states that "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."*

Please provide a summary of the MPS output limitations specified in this document including all contingencies postulated (Table 1). Explain how the MPS output will be automatically controlled to prevent a LOOP or system instability without a SLOD SPS.

DNC Response

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 Millstone Facility Out Guide provides real-time guidance to posture MPS generation to maintain generator stability during a facility-out condition. The guide describes the limitations on 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.

Studies were performed in accordance with ISO-New England Operating Procedure No. 19-Transmission Operations and are used to identify and develop mitigation measures associated with thermal, voltage, and stability violations. The limitations developed for the Millstone Facility Out Guide represent the appropriate station output that would mitigate the next contingency from causing system or generator instability issues. No thermal or voltage violations were identified that would require additional limitations. For the normal contingency studies performed to support creation of the Millstone Facility Out Guide operating limits, the following results were observed for the various facility-out conditions.

The studies performed found the following conditions to be stable:

- When all elements are in service, response to normal system contingency (as defined by *ISO-New England Operating Procedure No. 19 – Transmission Operations - Appendix J*) is stable.
- When one major element is out of service, as defined in Table 1 – Millstone Facility Out Stability Operating Limits, response to any normal system contingency (as defined by *ISO-New England Operating Procedure No. 19 – Transmission Operations – Appendix J*) is stable.
- When two major elements are out of service, as defined in Table 1 – Millstone Facility Out Stability Operating Limits, and only one MPS unit is on-line, response to any normal system contingency (as defined by *ISO-New England Operating Procedure No. 19 – Transmission Operations – Appendix J*) is stable.

In addition to the results above, the following conditions were found to be unstable. Under these conditions, station output must be limited pursuant to the Millstone Facility Out Guide:

- When two major elements are out of service, and more than one MPS unit is on-line, response to a normal system contingency (as defined by *ISO-New England Operating Procedure No. 19 – Transmission Operations – Appendix J*) is unstable.

- When two major elements are out of service and both MPS generators would be lost in the event of a normal system contingency.

These unstable conditions are mitigated by limiting the MPS generators to a station output level that supports both system and generator stability. This mitigative action reduces the potential for a system blackout and loss of offsite power to the station under normal conditions.

ISO-New England continuously monitors the transmission system during real-time operations through the Energy Management System (EMS) and more specifically the Real-Time Contingency Analysis (RTCA) tool. This tool routinely evaluates all identified contingencies for the New England grid. If a MPS unit is out of service, and a second element is removed from service (forced or emergency), the system operator is required to refer to the Millstone Facility Out Guide and determine the appropriate output limit for the station. This results in the system operator issuing a generation dispatch instruction to MPS to reduce station output to the appropriate level. As described in NPCC Directory #1, the system adjustment shall be completed as quickly as possible following any contingency, but within 30 minutes. The MPS emergency downpower ramp rates are 25 minutes for all conditions.

The ISO-New England studies conclude that with the MPS generation limits required by the Millstone Facility Out Guide, the transmission grid remains reliable and stable which is also consistent with GDC-17. The MPS FSARs credit these administrative controls to ensure the local transmission network is aligned to meet the assumptions of the stability analysis. In addition, to ensure MPS's compliance with the GDC-17 voltage analysis, ISO-New England and CONVEX model and plan the New England transmission system such that the MPS 345kV switchyard voltage bus is at or above 345kV.

As stated in the response to RAI question 1a, no automatic actions are required to maintain grid stability without SLOD. Removal of the DCT contingency, the operating restrictions contained in the ISO-New England Millstone Facility Out Guide, and the new proposed TRM actions effectively minimize the risk of losing offsite power from the loss of any of the remaining power supplies and provide reasonable assurance of continued grid stability.

Because of ISO-New England information policy restrictions, further details associated with the ISO-New England Millstone Facility Out Guide must be requested directly from ISO-New England. Contact information for ISO-New England was provided to the NRC Project Manager for MPS in an email dated January 12, 2016.

RAI-3

a). *On page 9 of 42 of Attachment 1 of the LAR, the licensee states that "although SLOD was designed as a NPCC Type 1 special protection system, over the time the transmission system had evolved with new contingencies that SLOD would not detect."*

Please identify the contingencies that SLOD would not have detected and also the relays that are in place now to address all NPCC and ISO-New England stability and reliability criteria.

b). *On page 11 of 42 of Attachment 1 of the LAR, the licensee states that "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 that could inadvertently trip MPS3. Therefore, SLOD was removed to eliminate a special protection scheme, thereby improving station service grid reliability and operational safety."*

What are the potential risks of SLOD misoperation and transmission operator burdens that resulted in making a decision to remove the SLOD for improving grid reliability and operational safety? Also, discuss any operating experience during the period SLOD was in operation that caused grid instability, Millstone multi-unit trips, and LOOP events.

DNC Response

a) SLOD would not have detected the contingency related to the initial condition of Line 364 out of service. One of the four critical transmission paths was Line 371 from Millstone to Montville connected to Line 364 from Montville to Haddam Neck via the closed Montville circuit breaker 4J-1T-2. The SLOD design used power relays at MPS to determine whether a path was in service or not. Since the load at Montville alone often exceeded the Line 371 power relay setting, the SLOD system considered the 371/364 path in service even when Line 364 was out of service. Therefore, SLOD could not adequately supervise the status of each path under all conditions.

ISO-New England Operations also identified that SLOD may not have operated when required if the Beseck terminal on the Beseck to Haddam section of Line 348 was open.

The protective relays that are now in place at MPS to address NPCC and ISO-New England stability and reliability criteria are:

Eversource Relays:

- Line 310: 21P/L3 primary line protection, 21B/L3 backup line protection
- Line 348: 21P/L4 primary line protection, 21B/L4 backup line protection
- Line 371: 21P/L2 primary line protection, 21B/L2 backup line protection
- Line 383: 21P/L1 primary line protection, 21B/L1 backup line protection
- 345kV "A" Bus: 50FDP/ST-2 fault detector, 21Z1/ST-2A directional distance, 67N/ST-2A ground overcurrent, 50FDB/ST-2 fault detector, 21Z1/ST-2B directional distance, 67N/ST-2B ground overcurrent
- 345kV "B" Bus: 50FDP/ST-3 fault detector, 21Z1/ST-3A directional distance, 67N/ST-3A ground overcurrent, 50FDB/ST-3 fault detector, 21Z1/ST-3B directional distance, 67N/ST-3B ground overcurrent

Dominion Relays:

CATEGORY	UNIT	Relay	Description
Main Generator 15G-3U	3	50GS-SPUB18 (35000/5 Gen Neut. - RLY)	Main Generator Standstill Protection
Main Generator 15G-3U	3	50/62BF-3SPUB01	Generator Breaker Failure
Main Generator 15G-3U	3	59NH-3SPUB10	Gen Neutral
Main Generator 15G-3U	3	21-3SPUB06	Distance Relay
Main Generator 15G-3U	3	46-3SPUB06	Negative Sequence
Main Generator 15G-3U	3	32-3SPUB06	Reverse Power
Main Generator 15G-3U	3	50-3SPUB06	Generator Distance Inst Overcurrent
Main Generator 15G-3U	3	62-3SPUB15	Timing
Main Generator 15G-3U	3	59NB-3SPUB17	Generator Leads Ground
Main Generator 15G-3U	3	60E	Blocks 59B & Alarms
Main Generator 15G-3U	3	60R	Blocks 21, 40-1 & 40-2 Loss of Relay Pot and Alarms
Main Generator 15G-3U	3	40-1-3SPUB06	Loss of Excitation
Main Generator 15G-3U	3	40-2-3SPUB06	Loss of Excitation

CATEGORY	UNIT	Relay	Description
Main Generator 15G-3U	3	59-3-3SPUB07	Volts/Hz
Main Generator 15G-3U	3	62A-3SPUB12	Timing
Main Generator 15G-3U	3	87-G1-A-3SPUA01	Generator Differential
Main Generator 15G-3U	3	87-G1-B-3SPUA01	Generator Differential
Main Generator 15G-3U	3	87-G1-C-3SPUA01	Generator Differential
Main Generator 15G-3U	3	32BS-3SPUB06	Generator Reverse Power
Main Generator 15G-3U	3	50L1	TIE LINE
Main Generator 15G-3U	3	87L1	TIE LINE
Main Generator 15G-3U	3	85L1	TIE LINE
Main Generator 15G-3U	3	87GL-A-3SPUA03	Generator Leads Differential
Main Generator 15G-3U	3	87GL-B-3SPUA03	Generator Leads Differential
Main Generator 15G-3U	3	87GL-C-3SPUA03	Generator Leads Differential
Main Generator 15G-3U	3	87G2-A-3PUN04	Generator Overall Differential (87L & 87H)
Main Generator 15G-3U	3	87G2-B-3PUN04	Generator Overall Differential (87L & 87H)
Main Generator 15G-3U	3	87G2-C-3PUN04	Generator Overall Differential (87L & 87H)
Main Generator 15G-3U	3	87E-A-3SPUA14	Excitation Differential
Main Generator 15G-3U	3	87E-B-3SPUA14	Excitation Differential
Main Generator 15G-3U	3	87E-C-3SPUA14	Excitation Differential
Main Generator 15G-3U	3	32PS-3PSUA01	Generator Reverse Power
Main Generator 15G-3U	3	36PWY	TIE LINE

CATEGORY	UNIT	Relay	Description
Main Transformer 15G-3X	3	87T-3SPUB01	Overall Unit Differential
Main Transformer 15G-3X	3	87NT-3SPUB08	Main Transformer 3 Gnd. Differential
Main Transformer 15G-3X	3	87TA-3SPUA09	Main Transformer Differential
NSST "A" 15G-3SA	3	50/51-A-3SPSB01	Normal Station Service Transformer "A" Overcurrent
NSST "A" 15G-3SA	3	50/51-B-3SPSB01	Normal Station Service Transformer "A" Overcurrent
NSST "A" 15G-3SA	3	50/51-C-3SPSB01	Normal Station Service Transformer "A" Overcurrent
NSST "A" 15G-3SA	3	51NXN2-3SPSB03	NSST "A" Ground Overcurrent
NSST "A" 15G-3SA	3	51NYN2-3SPSB05	NSST "A" Ground Overcurrent
NSST "A" 15G-3SA	3	51NXN1-3SPSB02	Normal Station Service Transformer "A" Ground Overcurrent
NSST "A" 15G-3SA	3	51NYN1-3SPSB04	Normal Station Service Transformer "A" Ground Overcurrent
NSST "A" 15G-3SA	3	87TA-A-3SPSA01	Normal Station Service Transformer "A" Differential
NSST "A" 15G-3SA	3	87TA-B-3SPSA01	Normal Station Service Transformer "A" Differential
NSST "A" 15G-3SA	3	87TA-C-3SPSA01	Normal Station Service Transformer "A" Differential
NSST "A" 15G-3SA	3	87NX-3SPSA04	Normal Station Service Transformer "A" Ground Differential
NSST "A" 15G-3SA	3	87NY-3SPSA05	Normal Station Service Transformer "A" Ground Differential
NSST "B" 15G-3SB	3	50/51-A-3SPSB06	Normal Station Service Transformer Overcurrent
NSST "B" 15G-3SB	3	50/51-B-3SPSB06	Normal Station Service Transformer Overcurrent
NSST "B" 15G-3SB	3	50/51-C-3SPSB06	Normal Station Service Transformer Overcurrent
NSST "B" 15G-3SB	3	51NXN2-3SPSB07	NSST "B" Ground Overcurrent
NSST "B" 15G-3SB	3	51NYN2-3SPSB09	NSST "B" Ground Overcurrent
NSST "B" 15G-3SB	3	51NXN1-3SPSB08	Normal Station Service Transformer "B" Ground Overcurrent
NSST "B" 15G-3SB	3	51NYN1-3SPSB10	Normal Station Service Transformer "B" Ground Overcurrent
NSST "B" 15G-3SB	3	87TB-A-3SPSA06	Normal Station Service Transformer "B" Differential
NSST "B" 15G-3SB	3	87TB-B-3SPSA06	Normal Station Service Transformer "B" Differential
NSST "B" 15G-3SB	3	87TB-C-3SPSA06	Normal Station Service Transformer "B" Differential
NSST "B" 15G-3SB	3	87NX-3SPSA11	Normal Station Service Transformer "B" Ground Diff.
NSST "B" 15G-3SB	3	87NY-3SPSA12	Normal Station Service Transformer "B" Ground Diff.
SWITCHYARD RELAYS	3	50PWY	Tie Line fault Detector

CATEGORY	UNIT	Relay	Description
SWITCHYARD RELAYS	3	87PWY	Pilot Wire
SWITCHYARD RELAYS	3	50FD/TB-3	Tie Line fault Detector
SWITCHYARD RELAYS	3	21/TB-3	MHO Distance Relay
SWITCHYARD RELAYS	3	67N/TB-3	Directional Overcurrent
SWITCHYARD RELAYS	3	21ST/TB-3	Out of Step
SWITCHYARD RELAYS	3	21M/TB-3	Out of Step
Main Transformer 15G-2X	2	87T/2X	Main Generator Transformer Differential Relay
Main Generator 15G-2U	2	87U/2U	Unit Differential Relay
Main Generator 15G-2U	2	32G-2/2U	Reverse Power
NSST 15G-2S	2	87T/2S	Transformer Differential Relay
Main Generator 15G-2U	2	59NB/2U	Main Generator Transformer Ground Fault Protection
Main Generator 15G-2U	2	46/2U	Negative Phase Sequence Time O/C
Main Generator 15G-2U	2	40/2U	Loss of Excitation Relay
Main Generator 15G-2U	2	21G-A-B/2U	Generator Distance Relay
Main Generator 15G-2U	2	21G-B-C/2U	Generator Distance Relay
Main Generator 15G-2U	2	21G-C-A/2U	Generator Distance Relay
Main Transformer 15G-2X	2	59T/2X	Volts/Hertz Relay
Main Generator 15G-2U	2	59NG/2U	Generator Ground Fault Relay
Main Generator 15G-2U	2	32G/2U	Reverse Power Relay
Main Generator 15G-2U	2	21GX/2U	SAM timing relay
SWITCHYARD RELAYS	2	50PWP/2U	Main Generator Tie Line Instantaneous Overcurrent Relay
SWITCHYARD RELAYS	2	87PWP/2U	Main Generator Tie Pilot Wire Differential Relay
SWITCHYARD RELAYS	2	36PWP/2U	Main Generator Tie Line Pilot Wire Monitoring Relay

CATEGORY	UNIT	Relay	Description
NSST 15G-2S	2	50/51T-A/2S	Inv. Time / Inst. O/C
NSST 15G-2S	2	50/51T-B/2S	Inv. Time / Inst. O/C
NSST 15G-2S	2	50/51T-C/2S	Inv. Time / Inst. O/C
NSST 15G-2S	2	51N-1/2S2	Norm. Station Service Transformer Very Inverse Time O/C Gnd. Fault Relay
NSST 15G-2S	2	50/51T-A/2S3	NSS Zig Zag Transformer Inverse Time Phase O/C Relay
NSST 15G-2S	2	50/51T-B/2S3	NSS Zig Zag Transformer Inverse Time Phase O/C Relay
NSST 15G-2S	2	50/51T-C/2S3	NSS Zig Zag Transformer Inverse Time Phase O/C Relay
NSST 15G-2S	2	51N-2/2S3	NSS Zig Zag Transformer Very Inverse Time Ground Fault Relay
Main Generator 15G-2U	2	87G-A/2U	Generator High Speed Differential Relay
Main Generator 15G-2U	2	87G-B/2U	Generator High Speed Differential Relay
Main Generator 15G-2U	2	87G-C/2U	Generator High Speed Differential Relay
Main Generator 15G-2U	2	60/2U	Voltage Balance Relay
Main Generator 15G-2U	2	46-2/2U	Negative Phase Sequence Time O/C
Main Generator 15G-2U	2	51NG-2U	Neutral Transformer Very Inverse Time Ground Fault Relay
Main Generator 15G-2U	2	59G-1/2U	Volts per Hertz
Main Generator 15G-2U	2	59G-2/2U	Volts per Hertz
Main Generator 15G-2U	2	J1K/2U	Max Excitation Alterrex cabinet
SWITCHYARD RELAYS	2	50PWY 2U	Fault detector
SWITCHYARD RELAYS	2	87PWY 2U	Pilot Wire
SWITCHYARD RELAYS	2	36PWY 2U	Pilot Wire Monitoring and Transfer trip Relays
SWITCHYARD RELAYS	2	50FD/TB-2 2U	Fault detector
SWITCHYARD RELAYS	2	21/TB-2 2U	MHO Distance Relay
SWITCHYARD RELAYS	2	67N/TB-2 2U	Directional Overcurrent
SWITCHYARD RELAYS	2	21ST/TB-2	Out of Step
SWITCHYARD RELAYS	2	21M/TB-2	Out of Step MHO

CATEGORY	UNIT	Relay	Description
Main Generator voltage regulator	3	TripLOE1	Loss of Excitation
Main Generator voltage regulator	3	TripLOE2	Loss of Excitation
Main Generator voltage regulator	3	TripVHz1	Volts/Hz
Main Generator voltage regulator	3	TripVHz2	Volts/Hz
Main Generator voltage regulator	3	TripVHi	Overvoltage
Main Generator voltage regulator	3	TripOEL	Field Current Overexcitation
Main Generator voltage regulator	3	ExOEL	Exciter Field Overcurrent
Main Generator voltage regulator	3	DC_FOC_Trip	Exciter Field Instantaneous Overcurrent

b) Generically, from the grid operator's perspective, special protection schemes are used to address weaknesses in the grid design and should be minimized due to their complexity and reliability concerns. SLOD was installed as a special protection scheme to address potential grid instability concerns, including specifically the DCT design. SLOD was installed to assist in minimizing the probability of coincident loss of both offsite supplies and loss of a nuclear power unit. Specifically, SLOD would have removed the power generated by MPS3 by opening the 13T and 14T 345kV breakers in the MPS switchyard. A mis-operation of SLOD could have a negative effect on the grid by causing the loss of the entire MPS3 output and could have a negative impact on the plant by causing turbine/reactor protection systems to generate an automatic turbine and reactor trip in response to the loss of load.

It was subsequently noted by the grid operator that SLOD did not address all instability concerns. Specifically, SLOD did not adequately monitor Line 364, as described in the response to question 3a. An ISO-New England transmission operating guide was developed to drive compensatory actions when Line 364 was out of service. An additional problem existed with Line 383. Under certain 345kV system conditions, Line 383 carries little or no load from MPS. This caused the primary and backup SLOD relays for this line to consider the line out of service when, in fact, it was still in service. With power flows close to the relay setting, nuisance alarms were generated which caused various data base problems and caused distractions for the grid operators. As a result, a time delay was added to minimize the number of alarms in an effort to mitigate the Sequence of Events buffer overwriting other data.

During the period SLOD was in operation, no operating experience resulted in grid instability, Millstone multi-unit trips or LOOP events. However, in early 2011, SLOD armed when not intended but did not generate a false trip signal.

RAI-4

Since manual actions cannot prevent system instability or LOOP, in the absence of SLOD SPS, please explain the automatic actions that will take place to curtail generation to less than 1650 megawatts within 60 seconds if station generation exceeds this limit such as MPS2 and MPS3 operating at full power when contingencies exist as listed in Northeast Utilities letter dated August 1, 1983, shown in Attachment 7? Also, please clarify how the status of the availability of two remote components – the Montville 345 kV tie-breaker and the Montville-Haddam Neck line – without SLOD will be transmitted to Millstone?

DNC Response

Currently, there are no automatic actions that will curtail station output to less than 1650 Mw within 60 seconds.

The present MPS2 and MPS3 FSARs state that SLOD was required to operate within 18 cycles to complete its function when required to operate to maintain system stability (for one line out and simultaneous failure of two lines on the same tower, whenever plant output was greater than 1650 MWe (net) for at least 60 sec).

The Millstone Facility Out Guide provides the station output limits for any combination of two elements out of service. Limiting station output to these limits ensures system stability in the event of a loss of another transmission element (normal contingency). With two lines out of service, MPS would enter the proposed TRM 3/4.8.1, A.C SOURCES, action statement b, which would require operator action to reduce station output to the limits provided in the Millstone Facility Out Guide within 30 minutes.

The status of the availability of two remote components, the Montville 345 kV tie-breaker and the Montville-Haddam Neck line, is continuously monitored by ISO-New England and CONVEX, one of the local control centers in New England. ISO-New England procedurally requires MPS to be notified (by ISO-NE or CONVEX) of any change in status of the critical transmission elements which include the Montville 345 kV tie-breaker and the Montville-Haddam Neck line.

RAI-5

On page 22 and 23 of 42 of Attachment 1 of the LAR, the licensee states:

> *"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."*

From the above statements, it is not clear to the staff whether DNC's conservative approach includes additional transmission line out of service (loss of two 345 kV lines due to a single failure) and how it is addressed in the transient/stability studies. Please provide a brief summary with applicable excerpts, and conclusions including all assumptions used in the studies.

DNC Response

As a result of eliminating exposure to the DCT contingency, NERC guidelines allow a single transmission line to be out of service indefinitely. With MPS total station output above 1650 MWe, DNC conservatively proposes to limit the time that a single transmission line can be removed from service. Additionally, if one line is out of service and MPS has entered the proposed 14 day TRM Action requirement and adverse weather is predicted, MPS conservatively proposed to reduce power to the level that would be allowed by Millstone Facility Out Guide if a second transmission line was out of service. ISO-New England stability studies, that are the basis of the Millstone Facility Out Guide, have shown that the established power level associated with two lines out of service will ensure the grid remains stable even if a third line is lost. Proactively reducing MPS total station output for this condition (one line out of service during adverse weather) provides reasonable assurance that grid stability is maintained. For additional information, see the response to RAI-2.

RAI-6

The licensee states in Attachment 1 of the LAR that it is proposing to establish appropriate requirements in the Technical Requirements Manual (TRM) that are applicable whenever MPS output exceeds 1650 megawatts electrical net and any *one of the four 345 kV transmission lines is out-of-service (i.e., nonfunctional). 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. It further states that the licensee meets the staff positions described in Branch Technical Position 8-8, "Onsite (Emergency Diesel Generators) and Offsite Power Sources Allowed Outage Time Extensions," Revision 0, dated February 2012.*

Please clarify whether a supplemental power source is provided as a backup to the inoperable offsite power source, to maintain the defense-in-depth design philosophy of the electrical system to meet its intended safety function.

DNC Response

No supplemental power source is being provided as a backup to the inoperable offsite power source.

Overall station risk is managed in accordance with station maintenance rule program per 10CFR50.65(a)(4), including coordinating outages of redundant power supplies, safety systems, and high risk evolutions along with appropriate contingencies and compensatory actions.

RAI-7

Under "Element 1 - Traditional Engineering Analysis," of Attachment 1 of the LAR (page 21 of 42), it states that:

> *"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."*

Please identify all critical transmission elements in the area of the Millstone Station together with the generation output of the Millstone complex and any nearby generation greater than the Millstone Station. Explain clearly the contingencies required to be postulated in system studies in accordance with NERC reliability standards including N-1 contingencies.

DNC Response

The critical transmission elements in the area of MPS include Line 383 from Millstone to Card, Line 348 from Millstone to Beseck and Haddam, Line 310 to Manchester, Line 371 from Millstone to Montville, Line 364 line from Montville to Haddam Neck and the 4J-1T-2 circuit breaker that connects Line 371 to Line 364 in Montville. These transmission elements operate at 345kV. The total station output of MPS is the largest in the area with MPS3 being the single largest generator. Seabrook Nuclear Power Plant, also part of the ISO-New England system, is located approximately 160 miles from MPS, and has slightly larger generation output than MPS3.

In accordance with NERC reliability standards, the contingencies required to be postulated in system studies near MPS are described in NERC reliability standard TPL-001-4, NPCC Directory #1, ISO-New England Planning Procedure 3 and ISO-New England Operating Procedure OP-19. The latest revision of these standards and procedures are available on the websites listed below:

http://www.nerc.com/pa/stand/Pages/ReliabilityStandardsUnitedStates.aspx?jurisdiction=United%20States
https://www.npcc.org/Standards/Directories/Forms/Public%20List.aspx
http://www.iso-ne.com/participate/rules-procedures/operating-procedures
http://www.iso-ne.com/participate/rules-procedures/planning-procedures

ISO-New England Planning Procedure 3 states:

The system will remain stable and damped following the most severe of the normal contingencies stated below:

a. *A permanent three-phase fault on any generator, transmission circuit, transformer, or bus section with normal fault clearing.*

b. *Simultaneous permanent phase-to-ground faults on different phases of each of two adjacent transmission circuits on a multiple circuit transmission tower, with normal fault clearing. If multiple circuit towers are used only for station entrance and exit purposes, and if they do not exceed five towers at each station, then this condition and other similar situations can be excluded on the basis of acceptable risk, provided that the ISO specifically approves each request for exclusion. Similar approval must be granted by the NPCC Reliability Coordinating Committee.*

c. *A permanent phase-to-ground fault on any transmission circuit, transformer or bus section with delayed fault clearing. This delayed fault clearing could be due to circuit breaker, relay system or signal channel malfunction.*

d. *Loss of any element without a fault.*

e. *A permanent phase-to-ground fault in a circuit breaker, with normal fault clearing (Normal fault clearing time for this condition may not be high speed.)*

f. Simultaneous permanent loss of both poles of a direct current bipolar facility without an ac fault.

g. The failure of any SPS which is not functionally redundant to operate properly when required following the contingencies listed in "a" through "f" above.

h. The failure of a circuit breaker to operate when initiated by an SPS following: loss of any element without a fault; or a permanent phase to ground fault, with normal fault clearing, on any transmission circuit, transformer, or bus section.

Additionally, these requirements will also apply after any critical generator, transmission circuit, transformer, phase angle regulating transformer, HVDC pole, series or shunt compensating device has already been lost, assuming that the area resources and power flows are adjusted between outages.