UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST TO WITHDRAW AN ANTICIPATED TRANSIENT WITHOUT SCRAM

TEST COMMITMENT

NORTHEAST NUCLEAR ENERGY COMPANY

MILLSTONE NUCLEAR POWER STATION, UNIT NO. 2

DOCKET NO. 50-336

1.0 INTRODUCTION

By letter dated September 5, 1997, Northeast Nuclear Energy Company (NNECO, licensee) requested NRC staff approval to withdraw a commitment made on July 25, 1988, as part of its anticipated transient without scram (ATWS) modifications for the Millstone Nuclear Power Plant, Unit 2 (Millstone Unit 2). A request for additional Information (RAI) related to this topic was sent to the licensee on January 23, 1998, and a response to the RAI was provided on May 6, 1998. In addition, conference calls took place on June 22 and July 10, 1998, between the staff and NNECO to discuss the failure modes of the shared power sources between the Reactor Protection System (RPS) and the Diverse Scram System (DSS). Based on these conversations, NNECO submitted additional information on September 14, 1998.

2.0 BACKGROUND

The ATWS Rule (10 CFR 50.62) requires that the equipment/systems installed to prevent and/or mitigate the consequences of ATWS events be electrically independent of the existing RPS to minimize the potential for common mode failures (CMFs) that could affect both RPS and ATWS circuits. The Millstone Unit 2 DSS is part of the ATWS mitigation system. Electrical independence of the DSS from the existing RPS should be provided from the sensor outputs up to and including the final actuation device. The ATWS design at Millstone Unit 2 shares a common power supply between the RPS and DSS that deviates from the staff guidance provided in the supplemental information concerning electrical independence that was published with the ATWS Rule.

The staff has allowed exceptions to the electrical independence guidance for the DSS and RPS power supply circuits where these systems are designed, procured, installed, and maintained as fully redundant safety-related (Class 1E) circuits. NNECO was also required to demonstrate that CMFs of the shared power sources would not result in loss of both RPS and ATWS prevention/mitigation functions as discussed in Item 2.a.2 of the staff's RAI dated June 8, 1988. The staff asked NNECO to explain why a CMF affecting the RPS power distribution system, including degraded voltage and frequency conditions, that would compromise both the RPS and the ATWS prevention/mitigation functions, cannot go undetected. The staff further indicated that, if alarms were relied on to provide early detection of degraded voltage and/or frequency conditions, NNECO was requested to identify the specific alarms provided along with a discussion of the periodic surveillance testing performed to verify alarm operability.

Enclosure

NNECO responded by stating that vital aternating current (ac) power to the four-channel RPS and the four-channel DSS is supplied from four vital (Class 1E safety-related) inverters. These inverters are equipped with the following local and control room alarms and indications:

a. Input Breaker Trip
b. AC Voltage Output Low (Setpoint of 108 VAC)
c. AC Ground Fault
d. High Temperature (Setpoint of 175 deg. F)

The inverters are powered by a station 125 VDC system, which consists of two batteries, three battery chargers, and two battery busses. Each bus powers two inverters which, in turn, provide the four separate channels of vital 120-volt ac for the four-channel RPS and DSS. The battery bus and battery charger systems are monitored and alarmed for various conditions including:

a. Charger Trouble:
   1. High Voltage at 150 VDC
   2. Low Voltage at 120 VDC
b. DC Bus Undervoltage at 126 VDC
c. Ground Alarms
d. Indications are provided for battery current and voltage and direct current (dc) bus current and voltage.

NNECO also stated that the Millstone Unit 2 procedures call for testing of dc bus undervoltage alarms at every other outage. However, NNECO indicated that revised procedures, which would be implemented at the next planned refueling outage, include testing one set of ac voltage output low alarms, charger trouble alarms, and dc bus undervoltage alarms at alternate refueling outages. The revised procedures would ensure that one set of these alarms are tested during each outage. By letter dated September 5, 1997, the staff was informed that provisions to test the above alarms were not implemented and that NNECO was requesting withdrawal of the testing commitment it made on July 25, 1988, as part of its ATWS modifications.

3.0 EVALUATION

As previously noted, an RAI was issued on January 23, 1998, requesting clarification on the testing of the power supply circuit alarms. NNECO was asked if it had the capability to detect degraded conditions on the power distribution system without reliance on or credit for the alarms in question (ac voltage output low alarms, charger trouble alarms, and dc bus undervoltage alarms). By response dated May 5, 1998, as clarified on September 14, 1998, NNECO indicated that, during normal plant operation, the power distribution system is subject to constant monitoring of instruments located on the main control board in the control room. Routine rounds are also conducted by the operators to verify main control board indications and to confirm local indications and satisfactory operation of equipment in the field. The periodicity of these routine rounds is commensurate with the surveillance requirements of the technical specifications for the electrical distribution system. The combination of the observation of control board indications and routine rounds provides detection of abnormal or degraded conditions. Any indications of a deviation from normal conditions would be identified in the observation of control board indications and the performance of the routine rounds. With the exception of the charger trouble alarms, one train of the dc bus undervoltage alarms is tested each refueling cycle on an alternating basis. All the ac voltage output alarms are tested once per refueling cycle.

Failure of Common Power Supply

The staff also requested confirmation that a failure of a power supply (degraded conditions on a 125 VDC or 120 vital ac inverter No. 2 -Vital Bus VA20) and, Channel 'A' High Pressurizer Pressure of the RPS in bypass, will not prevent the ATWS mitigating system (which includes the DSS) and the RPS from performing their intended functions. It should be noted that NNECO has submitted a proposed license amendment to the Millstone Unit 2 Technical Specifications to limit the RPS bypass, including high pressurizer pressure, to 48 hours from the current requirement that allows indefinite bypass. This change will decrease the time that Channel 'A' High Pressurizer Pressure of the RPS can be in bypass.

For this postulated situation, the following conditions apply:

1. With Channel 'A' High Pressurizer Pressure of the RPS in bypass, ATWS Channel 'A' is also bypassed as a precautionary measure to preclude a reduction in availability of the ATWS trip logic to one-out-of-three.

2. When both RPS and ATWS Channel 'A' are bypassed, Channel 'A' is precluded from providing a trip input. The combinations affected are 'AB,' 'AC,' and 'AD' logic matrices.

3. A degraded Vital Bus VA20 will affect the Channel 'B' sensors, which are used for both the ATWS mitigating system and the RPS. The combinations affected are 'AB,' 'BC,' and 'BD' logic matrices.

4. A degraded Vital Bus VA20 may also affect RPS logic matrix 'CD,' because the power supply design for this RPS logic matrix includes both Vital Bus VA20 and Vital Bus VA40. The concern would be the possibility of a single failure within the common bus system propagating through the logic matrix power supplies into the matrix circuitry.

ATWS Evaluation

For the ATWS mitigating system, based on the preceeding common power supplies, DSS logic matrices 'AB,' 'AC,' 'AD,' 'BC,' and 'BD' could be lost by a single failure. However, DSS logic matrix 'CD' would not be affected and would remain available to process the ATWS trip. This is because the ATWS circuitry employs an auctioneered power supply design that supplies both the six combinational trip logic matrices and the associated actuation relays. One power supply is fed from Vital Bus VA10 and the other is fed from Vital Bus VA20. Therefore, although the matrix power supply fed from Vital Bus VA20 may be affected, the auctioneered power supply fed from Vital Bus VA10 would be available and the ATWS mitigating system (which includes the DSS) will not be prevented from performing its intended function.

RPS Evaluation

The RPS logic matrices could be vulnerable to a degraded Vital Bus VA20. This vulnerability results from a modification to the original RPS design to prevent spurious trips. In analyzing a potential logic matrix circuitry failure, due to a vital bus single failure, NNECO determined that only a failure that resulted in the welding closed of the logic matrix relay contacts would prevent performance of the required protective function. Since the contacts are normally closed (low resistance), insignificant self heating of the contacts could occur. In event heat levels in the relay

coils would rise, however, one or both relay coils could fail. Such relay coil failures are not of concern since failure of one or both of these coils will deenergize the respective trip circuit breaker control relay resulting in a half-trip condition. Thus, no RPS power supply single failure resulting in loss of RPS function is credible.

NNECO also found no failures that would cause a high-voltage condition at the output terminals of a power supply. NNECO's evaluation documented the following conditions with no effect on the RPS logic matrices.

a. single phase to ground faults and surges applied to a vital ac source,
b. continuous phase-to-phase short-circuit of the vital ac input to one matrix power supply, and
c. transverse mode surges or a continuous high voltage were applied to a matrix power supply.

Based on the preceeding discussion, for the postulated scenario, the RPS will not be prevented from performing its intended function.

4.0 CONCLUSION

Based on the preceeding evaluation, the staff has concluded that NNECO's alternate proposal (one train of the dc bus undervoltage alarms is tested each refueling cycle on an alternating basis, and all the ac voltage output alarms tested once per refueling cycle) is acceptable for ensuring power availability to the RPS and ATWS systems. The staff has further concluded that NNECO has provided adequate justification that the ATWS mitigating system and the RPS will continue to perform their intended functions when subject to a failure of a common power supply and the bypass of Channel 'A' high pressurizer pressure.

Principal Contributor: J. Joyce

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Millstone Nuclear Power Station
Unit 2

cc:
Lillian M. Cuoco, Esquire
Senior Nuclear Counsel
Northeast Utilities Service Company
P. O. Box 270
Hartford, CT 06141-0270

Mr. John Buckingham
Department of Public Utility Control
Electric Unit
10 Liberty Square
New Britain, CT 06051

Edward L. Wilds, Jr., Ph.D.
Director, Division of Radiation
Department of Environmental Protection
79 Elm Street
Hartford, CT 06106-5127

Regional Administrator, Region I
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

First Selectmen
Town of Waterford
15 Rope Ferry Road
Waterford, CT 06385

Mr. Wayne D. Lanning, Director
Millstone Inspections
Office of the Regional Administrator
475 Allendale Road
King of Prussia, PA 19406-1415

Charles Brinkman, Manager
Washington Nuclear Operations
ABB Combustion Engineering
12300 Twinbrook Pkwy, Suite 330
Rockville, MD 20852

Senior Resident Inspector
Millstone Nuclear Power Station
c/o U.S. Nuclear Regulatory Commission
P.O. Box 513
Niantic, CT 06357

Mr. F. C. Rothen
Vice President - Work Services
Northeast Utilities Service Company
P. O. Box 128
Waterford, CT 06385

Ernest C. Hadley, Esquire
1040 B Main Street
P.O. Box 549
West Wareham, MA 02576

Mr. John F. Streeter
Recovery Officer - Nuclear Oversight
Northeast Utilities Service Company
P. O. Box 128
Waterford, CT 06385

Mr. John Carlin
Vice President - Human Services
Northeast Utilities Service Company
P. O. Box 128
Waterford, CT 06385

Mr. Allan Johanson, Assistant Director
Office of Policy and Management
Policy Development and Planning
Division
450 Capitol Avenue - MS# 52ERN
P. O. Box 341441
Hartford, CT 06134-1441

Mr. M. H. Brothers
Vice President - Operations
Northeast Nuclear Energy Company
P.O. Box 128
Waterford, CT 06385

Mr. J. A. Price
Director - Unit 2
Northeast Nuclear Energy Company
P.O. Box 128
Waterford, CT 06385

Millstone Nuclear Power Station
Unit 2

cc:
Mr. Leon J. Olivier
Chief Nucler Officer - Millstone
Northeast Nuclear Energy Company
P.O. Box 128
Waterford, CT 06385

Citizens Regulatory Commission
ATTN: Ms. Susan Perry Luxton
180 Great Neck Road
Waterford, CT 06385

Deborah Katz, President
Citizens Awareness Network
P. O. Box 83
Shelburne Falls, MA 03170

The Honorable Terry Concannon
Co-Chair
Nuclear Energy Advisory Council
Room 4035
Legislative Office Building
Capitol Avenue
Hartford, CT 06106

Mr. Evan W. Woollacott
Co-Chair
Nuclear Energy Advisory Council
128 Terry's Plain Road
Simsbury, CT 06070

Little Harbor Consultants, Inc.
Millstone - ITPOP Project Office
P. O. Box 0630
Niantic, CT 06357-0630

Mr. Daniel L. Curry
Project Director
Parsons Power Group Inc.
2675 Morgantown Road
Reading, PA 19607

Attorney Nicholas J. Scobbo, Jr.
Ferriter, Scobbo, Caruso, Rodophele, PC
1 Beacon Street, 11th Floor
Boston, MA 02108

Mr. J. P. McElwain
Recovery Officer - Millstone Unit 2
Northeast Nuclear Energy Company
P. O. Box 128
Waterford, Connecticut 06385