NORTHEAST UTILITIES

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WESTERN MASSACHUSETTS ELECTRIC COMPANY
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October 30, 1989

Docket No. 50-245
A08591
Re: Generic Letter 89-16
ISAP Topic 1.113

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

Gentlemen:

Millstone Nuclear Power Station, Unit No. 1
Response to Generic Letter 89-16
Installation of a Hardened Wetwell Vent

Purpose and Introduction

The purpose of this letter is to outline the approach that Northeast Nuclear Energy Company (NNECO) intends to utilize in resolving the Mark I containment hardened vent path issue at Millstone Unit No. 1. This letter is in response to Generic Letter 89-16, "Installation of a Hardened Wetwell Vent," received on September 14, 1989.

The Staff identified a number of plant modifications at the conclusion of the Mark I Containment Improvement Program that could potentially enhance existing capability to prevent and mitigate the consequences of severe accidents. As part of the comprehensive plan for resolving severe accident issues, the Commission concluded that the recommended safety improvements with one exception, hardened wetwell vent capability, should be evaluated as part of the Individual Plant Examination (IPE) program. To address the hardened wetwell vent, Generic Letter 89-16 was issued. It requested that licensees of plants with Mark I containments provide the NRC Staff with plans for addressing the issue of hardened wetwell venting capability. Encouragement was also provided to voluntarily undertake plant modifications under the provisions of 10CFR50.59. Absent voluntarily incorporating design changes, it was requested that cost estimates for implementation of a hardened wetwell vent, described in SECY 89-017, be provided, including an incremental cost estimate for installation of an AC-independent design. These cost estimates, along with the Staff's plant-specific backfit analysis, will be used to evaluate the efficacy of requiring the installation of the hardened vents.

Integrated Safety Assessment Program

NNECO acknowledges that there may be a potential benefit from installation of a hardened vent path, but we do not see this as an issue that is best treated

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independent of our IPE program and addressed in isolation. This is especially true since our front-end evaluation is essentially completed and the back-end is scheduled for completion approximately one year from now.

Given the need to prioritize plant modifications, the Integrated Safety Assessment Program (ISAP) has become an integral part of project evaluation for Millstone Unit No. 1. Our experiences to date have demonstrated the program to be a resource-efficient and cost-effective process for enhancing the safety of Millstone Unit No. 1, while also being responsive to long-standing NRC support of systematic safety reviews of operating nuclear power plants. Moreover, NNECO's commitment to the "Living Probabilistic Risk Assessment (PRA)" concept contributes significantly to the overall safety improvement process.

"Living Probabilistic Risk Assessment"

Northeast Utilities maintains a corporate policy on nuclear safety goals. It is our intention to implement this policy through the "Living PRA" concept. As needed, the Millstone Unit No. 1 Probabilistic Safety Study (PSS), a Level 1 PRA, is updated to reflect design and operational changes. Since its initial submittal to the Staff on July 10, 1985,(1) two major updates(2)(3) have been submitted.

NNECO recognizes the importance of the Millstone Unit No. 1 PSS to understanding the characteristics of the plant and to the reduction of risk. In conjunction with ISAP, the PSS is an important tool for prioritizing the expenditure of resources in a way that will be most effective in reducing the overall risk to the public. As a direct result of the PSS analysis, the Millstone Unit No. 1 Core-Melt Frequency (CMF) has been reduced significantly, to 8.92×10^{-5}/year, through improvements, corrective actions, reanalyses, and procedural modifications.

For Millstone Unit No. 1, a Level 1 PRA for internally initiated events, as well as fire and internal flooding, is complete and actively exercised. As

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(1) J. F. Opeka letter to J. A. Zwolinksi, "Millstone Unit No. 1 Probabilistic Safety Study--Results and Summary Report," dated July 10, 1985.

(2) E. J. Mroczka letter to U.S. Nuclear Regulatory Commission, "Probabilistic Safety Study Update," dated February 11, 1987.

(3) E. J. Mroczka letter to U.S. Nuclear Regulatory Commission, "Millstone Nuclear Power Station, Unit No. 1 Probabilistic Safety Study Update (Revision 2)," dated February 10, 1989.

discussed in our July 31, 1986[4] and August 4, 1987[5] submittals, NNECO has plans in place to expand the Level 1 PRA model to evaluate containment response. This ongoing back-end analysis effort was further discussed in a letter dated July 27, 1989,[6] in which we described our approach to meeting the IPE program guidance of Generic Letter 88-20. Upon completion of the back-end analysis, currently scheduled for late-1990, NNECO believes the safety benefits of implementing the Staff's recommendations on Mark I containments, including hardened venting capability, will best be ascertained.

Mark I Containment Principal Accident Sequences

Generic PRA studies for boiling water reactors (BWRs) indicate that accidents initiated by transients rather than loss-of-coolant accidents (LOCA) dominate the total CMF estimates. The principal accident sequences consist of station blackout (SBO), anticipated transient without scram (ATWS), and loss of long-term decay heat removal (TW). NNECO's progress towards resolving these issues is discussed below.

o Station Blackout

ISAP Topic 1.106 was assigned to track industry initiatives relating to SBO, as well as the in-house effort to assure that Millstone Unit No. 1 complies with the SBO rule. This topic will also incorporate specific open items that result from the NRC Safety Evaluation for the Millstone site visit of July 18-21, 1989.

Several emergency gas turbine generator (GTG) reliability improvement modifications were implemented during the 1989 refueling outage under other ISAP topic numbers. They are related to the topic of SBO, and were discussed fully in Attachment 1 to the recently transmitted SBO rule response letter dated April 17, 1989.[7] Should the GTG and diesel generator be unavailable, the 23-kV Flanders line can supply power to the

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(4) J. F. Opeka letter to C. I. Grimes, "Integrated Safety Assessment Program--Final Report for Millstone Unit No. 1," dated July 31, 1986.

(5) E. J. Mroczka letter to U.S. Nuclear Regulatory Commission," Integrated Safety Assessment Program (ISAP)," dated August 4, 1987.

(6) E. J. Mroczka letter to U.S. Nuclear Regulatory Commission, "Response to Generic Letter 88-20--Individual Plant Examinations for Severe Accident Vulnerabilities," dated July 27, 1989.

(7) E. J. Mroczka letter to Dr. T. E. Murley, "Response to Station Blackout Rule," dated April 17, 1989.

emergency station service transformer, which feeds emergency loads through Bus 14G.

The Staff has identified alternate AC (AAC) power as the preferred method for reducing risk of severe accidents resulting from SBO. A 4-kV cross-tie exists between Millstone Unit Nos. 1 and 2, which enables Millstone Unit No. 1 to be powered by either of two Millstone Unit No. 2 emergency diesel generators. It is available within 1 hour of the onset of the SBO event and has sufficient capacity and capability to operate systems necessary for coping with the event for the required SBO duration of 8 hours, to bring and maintain the plant in safe shutdown. The Millstone Unit No. 2 emergency AC power source can be credited as an AAC source since it satisfies the Appendix B criteria of NUMARC 87-00 and is available within 1 hour. The Staff has already approved a 4-hour duration in order to bring the AAC power source on line for Appendix R compliance.[8] If a decision is made to voluntarily install an AC-independent hardened vent at Millstone Unit No. 1, we do not intend at this time to design for a 24-hour SBO, but rather will design the vent to be consistent with our implementation of the requirements of the SBO rule. It should be noted that at this time, no analysis exists which shows that an AC-independent vent will be beneficial for Millstone Unit No. 1.

The NRC Staff states that one goal of the SBO rule is to maintain the frequency of core damage from SBO near or below 10^{-5}/year. In the supplementary information to the final rule, the NRC Staff states that the SBO rule must be met regardless of whether a plant-specific PRA currently meets this goal. The NRC Staff does not, on the other hand, preclude the licensee from identifying plant-specific PRA data to support a determination that SBO would have an acceptably small probability for causing core damage. Accordingly, NNECO reiterates its previous determination that the CMF of SBO at Millstone Unit No. 1, from internally initiated events at power, is approximately 10^{-6} per reactor year.

o <u>Anticipated Transient Without Scram</u>

The ATWS rule requires that BWRs install an Alternate Rod Injection (ARI) system, a Standby Liquid Control System (SLCS) with a flow capacity equivalent to 86 gallons per minute of 13 weight percent sodium pentaborate solution, and include features to automatically trip the reactor coolant recirculating pumps under conditions indicative of ATWS.

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

NNECO's implementation of ATWS is complete. The Technical Specification changes associated with the SLCS were approved by the Staff in a letter dated July 30, 1987.(9) The Safety Evaluation for the ARI system and automatic recirculating pump trip was provided in a letter dated October 6, 1988.(10) This completed the Staff's review of Millstone Unit No. 1's implementation of the ATWS rule and concluded that Millstone Unit No. 1 is in compliance with the rule.

o Long-Term Decay Heat Removal

ISAP Topic 2.28 was initiated to study the long-term cooling capability at Millstone Unit No. 1. The study was completed in August 1987 and the results have been factored into the Millstone Unit No. 1 PSS. The revised PSS indicates that failure of long-term decay heat removal is no longer the major contributor to total CMF it once was considered to be.

At Millstone Unit No. 1, the TW sequence requires a combination of loss of the main condenser, loss of the isolation condenser (IC), loss of shutdown cooling, and loss of alternate shutdown cooling including loss of torus cooling. The availability of these systems is affected by the accident scenario as well as the availability of support systems such as AC power and emergency service water. The redundancy in decay heat removal systems make the frequency of TW sequences at Millstone Unit No. 1 low, approximately 10^{-5}/year.

Our review of SECY 89-017 indicates that the primary benefit of the hardened vent is the further reduction of risk associated with the TW sequence. NNECO believes this goal may be accomplished by the IC already installed at Millstone Unit No. 1. The IC system removes heat from the core via a natural circulation cooling process. As the steam is condensed within the IC, heat is rejected to the shell of the IC. The condensate flows back to the reactor vessel by gravity, thereby conserving the reactor coolant inventory. There is sufficient inventory of water on the shell side of the IC to remove decay heat for approximately 45 minutes. The IC is station AC-independent. The only valve which needs to change state for successful IC initiation is DC-powered.

Long-term makeup to the IC is provided by the Fire Protection System which consists of three redundant pumps, one of which is diesel-powered and a second which is AC-powered from Millstone Unit No. 2. The IC

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(9) C. O. Thomas letter to E. J. Mroczka, "Standby Liquid Control System--License Amendment No. 5," dated July 30, 1987.

(10) M. L. Boyle letter to E. J. Mroczka, "Safety Evaluation on ATWS Rule 10CFR50.62 (TAC No. 68494)," dated October 6, 1988.

makeup system also consists of a DC-powered motor-operated valve (MOV), along with check valves and locked-open manual isolation valves. An alternate means of IC makeup is provided by the Condensate Transfer System. In addition, ISAP Topic 1.02, Tornado-Missile Protection, addressed the need to provide a missile protected source of makeup water to the IC. NNECO concluded that the best alternative is to provide the IC makeup from the city water supply. Modifications are scheduled for implementation in 1990.

The IC and its makeup system significantly reduce the contribution of TW type sequences to CMF. One of the dominant contributors to the loss of IC during an SBO is the loss of the diesel-driven fire pump. Since the hardened vent is of little benefit without the fire pump for makeup to the reactor vessel, a hardened vent will not likely have a significant effect on CMF reduction for SBO sequences at Millstone Unit No. 1.

Emergency Operating Procedures

NNECO implemented Revision 4 of the BWR Owners Group (BWROG) Emergency Procedure Guidelines (EPGs) through a revision to the Millstone Unit No. 1 Emergency Operating Procedures (EOPs) on September 1, 1989. The generic BWROG guidance concerning when to vent containment was followed. This approach allows venting before containment pressure reaches the primary containment pressure limit (PCPL) of 71 psig at torus bottom or hydrogen and oxygen concentrations exceed 6 and 5 percent, respectively. The intent is to take action to reduce the challenge to containment before an uncontrolled containment boundary failure occurs.

The EPGs, however, do not provide guidance on how to vent. Our preferred method is to vent from the wetwell, if possible. If venting from the wetwell is not possible, due to failure of the torus vent valves, for example, the drywell will be vented. Based on our evaluation of several options, we have developed a method for venting based upon radiation levels in the drywell. If drywell radiation levels are less than 40,000 R/hr, primary containment will be vented directly to the stack via the Main Reactor Building (MRB) exhaust. The capacity of the MRB exhaust fans exceed the maximum expected vent flow rate, so an overpressurization within the sheet metal ductwork is not expected. These fans can also be lined up to take power from emergency power supplies in the event of a loss of normal power. If the radiation levels exceed 40,000 R/hr, the vent flow will be diverted to the Reactor Building and filtered through the Standby Gas Treatment system. This method allows particulate plate-out in the Reactor Building and, in conjunction with filtering, reduces the potential release to the stack and subsequently to the environment.

In a design basis accident the PCPL will not be exceeded. The PCPL can only be exceeded in an accident which has progressed beyond the design basis. Initiation of venting to maintain the containment pressure below the PCPL assures operability of the vent valves, safety/relief valves, and structural integrity of the containment.

Positive effects of venting may include reducing core-melt likelihood, reducing the consequences of severe accidents, and avoiding containment failure. However, the benefits of a hardened vent are limited to enhancing current capabilities regarding vent paths, which were described above, not providing a previously nonexistent capability.

During the Cycle 12 refueling outage, environmentally qualified, AC-powered valve operators were installed on the containment spray MOVs. The benefit of qualifying these valves was the ability to expand the use of drywell spray under the revised EOPs. Although not a benefit to the TW sequence, drywell spray can have a significant impact on the plant response to a LOCA. Use of spray can be very effective in reducing containment pressure and temperature and in scrubbing the containment atmosphere.

NNECO's Approach to Hardened Vent Path Issue

NNECO believes the risk of the TW sequence is low. Initially, we also believed that a hardened vent would further reduce the risk of this sequence and provide a small improvement in overall plant safety at Millstone Unit No. 1. However, uncertainty over the purpose of and design criteria for the hardened vent, plus consideration of previously unidentified technical issues related to interaction of the vent with existing plant systems, have shown that additional analysis is required. It is not unreasonable to postulate that the systems interaction effects could have a potential negative safety impact if not designed properly. This additional analysis will focus on determining whether the installation of a hardened vent will reduce the CMF at Millstone Unit No. 1 for the TW sequence. At this time, it is not readily apparent that a hardened vent will appreciably reduce the CMF, especially given the existence of the IC at Millstone Unit No. 1.

NNECO intends to utilize the IPE as the framework for the analysis. We have committed to expanding the Millstone Unit No. 1 PRA model to meet the provisions of Generic Letter 88-20. Following the actual IPE, we intend to evaluate any potential design changes through ISAP Topic 1.113, consistent with accepted past practice and the pending license amendment. Our decision regarding installation of a hardened wetwell vent will be based on these results. We are prepared to commit to the installation of a hardened vent, provided a functional and cost-effective design is developed for the reduction of the CMF for the TW sequence. Although our decision to install a hardened vent will be based on its ability to reduce the CMF for the TW sequence, once that decision is made, we intend to maximize the benefit of a hardened vent to further reduce the CMF from other accident sequences and to protect containment integrity. We believe this approach to be consistent with the philosophy behind accident management.

Notwithstanding the above, NNECO will be working with the BWR Owners' Group to develop general design criteria and will tailor these to the Millstone Unit

No. 1 design specifics. It is anticipated that such design criteria will be available for NRC review by April 30, 1990. Presuming we decide to voluntarily commit to the installation of the hardened vent, plant-specific design details will be developed as we complete the appropriate portions of the IPE and study the possibility of systems interaction effects between the vent and the existing plant design. Consideration will also be given to the conditions under which the vent is able to operate and reclose, as well as potential failure modes of the vent; e.g., random, seal degradation, and steam.

If the design criteria and related issues can be successfully resolved, and we conclude the hardened vent could be beneficial to the operators, we will schedule installation in accordance with ISAP. Our intent would be to complete installation during the second refueling outage from the date of this letter. This is consistent with the Commission's goal of having this issue resolved within approximately three years. NNECO is determined to satisfactorily address this issue and will inform the Staff of our decision not later than December 15, 1990. We therefore recommend that the Staff not undertake a backfit analysis for Millstone Unit No. 1 at this time.

In case the above approach is not acceptable to the Staff, we are including our initial cost estimates in Attachment 1, as requested in Generic Letter 89-16. These values are not considered bounding as the estimates are based solely on concepts, rather than firm design criteria. As the Staff is aware, costs can increase significantly as the design progresses from the conceptual phase to the plant-specific final design. NNECO strongly prefers to make any appropriate modifications only once, so the risk/benefit of alternative designs will be fully considered before any implementation plans are made.

Summary and Conclusion

Our continuing objective is to expend our resources where the overall safety return at the four units operated by Northeast Utilities is greatest. We are not yet convinced, however, that installation of a hardened vent at Millstone Unit No. 1 would be in furtherance of that objective, nor do we believe that installation of a hardened vent is needed to achieve "adequate protection," especially given the existence of an IC at Millstone Unit No. 1. As a multi-unit utility, our objective is to thoroughly evaluate the safety issues at each plant prior to expending our limited resources. Towards that end, improving the calculated CMF at the Haddam Neck Plant, estimated to be above 10^{-4}/year, is a current high priority corporate objective.

At Millstone Unit No. 1, NNECO has utilized the ISAP process and PRA analysis to maximize returns, in terms of plant safety and performance. Our belief is that the overall safety status of the various factors minimizing the importance of hardened vent capability is very positive. Several factors contributing to this positive status are:

- o Low Calculated CMF
- o Low SBO Contribution to CMF
- o Implementation of Revision 4 of EPGs
- o Existing Venting Capability
- o Isolation Condenser
- o Drywell Spray Capability
- o Significant AC-Power Options
  - -- Cross-Tie to two Millstone Unit No. 2 Diesel Generators
  - -- 23-kV Flanders Line Feeding Emergency Station Services Transformer

NNECO's positive experiences with ISAP have demonstrated the program to be a resource-efficient and cost-effective process for implementing plant improvements, while the Millstone Unit No. 1 PSS has been shown to be an effective yardstick for helping to determine the priority of each action. Expansion of the PRA model, in conjunction with the IPE, is expected to provide quantitative results on which a more rigorous evaluation of recommended Mark I improvements, including hardened wetwell vent, can be based. Following the actual IPE, NNECO will evaluate any potential design changes through ISAP.

We believe that the continued use of the proven ISAP program will allow Millstone Unit No. 1 to maintain its record of operating safely, in accordance with the Northeast Utilities' philosophy of spending its finite resources where the greatest benefits can be achieved.

If you should have any questions, please contact my staff.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

E. J. Mroczka
Senior Vice President

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

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

Then personally appeared before me, E. J. Mroczka, 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 Licensee 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, 1993

Docket No. 50-245
A08591

Attachment 1

Millstone Nuclear Power Station, Unit No. 1

Response to Generic Letter 89-16
Installation of a Hardened Wetwell Vent

Cost Estimates

October 1989

Millstone Nuclear Power Station, Unit No. 1
Response to Generic Letter 89-16
Installation of a Hardened Wetwell Vent
Cost Estimates

A. Cost Estimate for Hardened Vent Path

The initial cost estimate for installation of a hardened vent path, similar to the design utilized by Boston Edison, is $1.1 million. The conceptual design uses existing AC-powered containment isolation valves to the maximum extent possible.

As mentioned in the cover letter, additional engineering is needed to establish appropriate design criteria to ensure that the hardened vent system fully meets its intended function. The cost estimates to install a properly engineered hardened vent at Millstone Unit No. 1 may increase dramatically based on the specific design requirements for flow, pressure, single failure, environmental qualification for temperature and radiation, and seismic support. Also, the cost estimates do not consider potential backflow damper work, nor the implications to Millstone Unit Nos. 2 and 3, located at the same site.

B. Incremental Cost Estimate for AC-Independent Design

The incremental cost estimate for an AC-independent design is an additional $0.6 million, for a total of $1.7 million. The conceptual design includes installation of several DC-powered motor-operated valves, but does not consider the issue of 24-hour post-SBO availability. SECY 89-017 states that licensees implementing the SBO rule by use of an AAC source need not provide additional power supplies, provided the capacity of the AAC is sufficient for the requirements of both the SBO rule and the vent design. Although no analysis has yet been performed, it is expected that the above criterion would be met.