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

April 27, 1993

Docket No. 50-423
B14458
Re: 10CFR50.90

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

Gentlemen:

Millstone Nuclear Power Station, Unit No. 3
Proposed Revision to Technical Specifications
One-Time Extension to Various 18-Month Surveillance
Requirements - Additional Information (TAC No. M86148)

In a letter dated March 30, 1993,[1] Northeast Nuclear Energy Company (NNECO) submitted to the NRC a license amendment request related to several 18-month surveillance requirements for the surveillances listed in Table 1 of the submittal to be performed during the fourth refueling outage presently scheduled to begin on July 31, 1993. This submittal provides information related to the risk impact of a one-time extension to certain surveillances listed in Table 1 of the March 30, 1993, submittal.

On April 14 and 21, 1993, the NRC Staff requested further information regarding a probabilistic risk assessment completed for a one-time extension to certain surveillances listed in Table 1 of the March 30, 1993, submittal. The purpose of this submittal is to respond to the Staff's request. Attachment 1 of this letter contains the requested information.

300042

---

(1) J. F. Opeka letter to the U.S. Nuclear Regulatory Commission, "Proposed Revisions to Technical Specifications, One-Time Extension to Various 18-Month Surveillance Requirements," dated March 30, 1993.

A001 1/1

We believe the attached information, coupled with the information provided in our submittals dated March 30, 1993, and April 20, 1993,[2] provides a complete basis for approval of the requested amendment. Of course, should the Staff have any additional questions, NNECO remains available to respond promptly to them.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

J. F. Opeka
Executive Vice President

cc: T. T. Martin, Region I Administrator
V. L. Rooney, NRC Project Manager, Millstone Unit No. 3
P. D. Swetland, Senior Resident Inspector, Millstone Unit Nos. 1, 2, and 3

Mr. Kevin McCarthy
Director, Radiation Control Unit
Department of Environmental Protection
Hartford, Connecticut 06116

(2) J. F. Opeka letter to the U.S. Nuclear Regulatory Commission, "Proposed Revisions to Technical Specifications, One-Time Extension to Various 18-Month Surveillance Requirements," dated April 20, 1993.

Docket No. 50-423
B14458

Attachment 1

Millstone Nuclear Power Station, Unit No. 3

Probabilistic Risk Assessment (PRA) Calculations:
Supporting Information

April 1993

PROBABILISTIC RISK ASSESSMENT (PRA) CALCULATIONS SUPPORTING INFORMATION

Objective: The objective of the PRA calculations was to assure ourselves that reasonably conservative estimates of change in core melt frequencies (CMF) due to the surveillance test interval (STI) extension are in the order of 10^{-7}/yr or lower.

I. Table 4.3-1, Functional Unit 17d, Reactor Trip System Interlock P-9

Functional Unit 17d is associated with the interlock P-9. In the absence of P-9, the reactor will not trip subsequent to a turbine trip (TT), thus resulting in an anticipated transient without scram (ATWS) event.

ATWS Contribution to CMF = 3.38×10^{-6}/yr.
[Source: Millstone Unit No. 3 Individual Plant Examination (MP3 IPE)]

Based on a comparison of TT frequency to the total frequency of all events contributing to ATWS events, the TT initiator associated ATWS contribution to CMF ≈ 1.5×10^{-6}/yr.

Consider the following:

i. Failure of P-9 interlock is one of many failures contributing to an ATWS
ii. 1.3 month extension as a fraction of 18-month STI is < 0.1
iii. redundancy (2/4 channels needed for success)

Based on the above three factors, it is reasonable to assume that the TT ATWS associated CMF increases by less than 1%. Therefore,

$$\Delta\ CMF < \frac{1}{100} \times 1.55 \times 10^{-6}/yr$$
$$< 1.55 \times 10^{-8}/yr$$

II. Table 4.3-1, Functional Unit 17c, Reactor Trip System Interlock P-8

Functional Unit 17c is associated with the interlock P-8. In the absence of P-8, a reactor trip on "low flux reactor coolant flow in a single loop" is blocked. Therefore, the increase in risk due to STI extension will be reflected by a small increase in ATWS potential.

However, note that "failure of an RCS loop" event is of lower frequency compared to a TT event. For Millstone Unit No. 3, frequency of TT is 2.25/yr and loss of reactor coolant system (RCS) flow is 0.47/year (Source: MP3 IPE). Therefore, given that the change in CMF due to turbine trip related ATWS events for the STI extension is less than 1.55 x 10^{-8} per year, the CMF increase due to loss of RCS loop related ATWS events for the STI extension must be less than 1.55 x 10^{-8} per year.

III. Table 4.3-2, Functional Unit 9c, Engineered Safety Features Actuation System (ESFAS) Interlock

Functional Unit 9c is associated with the interlock P-4 of reactor trip function. Per the Millstone Unit No. 3 Final Safety Analysis Report, this interlock:

- actuates turbine trip
- closes main and bypass feedwater valves
- prevents opening feedwater (FW) valves
- allows manual block of safety injection (SI) signal
- transfers steam dump control from the load rejection controller to the plant trip controller

The impact of failure of P-4 is to increase the potential for accident conditions where TT or FW isolation (FWI) does not follow a reactor trip. Such failures create RCS overcooling. The plant response under such conditions can be approximated by a steamline break outside containment (SLBOC) event tree model. Based on the MP3 IPE, the frequency of a SLBOC event is 3.78 x 10^{-2} per year. The CMF contribution due to SLBOC is 8.12 x 10^{-6} per year. Using these two numbers, one can approximate the conditional core-melt probability (CMP) given an SLBOC event at 2 x 10^{-4} ($\approx$ 8.12 x 10^{-6}/3.78 x 10^{-2}).

Based on past Millstone Unit No. 3 experience, the frequency of reactor trip events for Millstone Unit No. 3 is assumed to be 5 per year. An SLBOC-type event can occur if TT and FWI fail subsequent to a reactor trip. If the probability of failure to trip turbine and isolate feedwater using auto (P-4 interlock) or manually (Operator) is assumed to be less than 10^{-3}, then the frequency of SLBOC events due to loss of TT and FWI will be less than 5 x 10^{-3} per year. Note that it is reasonable to assume that failure probability of FWI and TT is less than 10^{-3} since both the operator and the redundant auto signals must fail.

Considering the CMP for SLBOC at approximately 2 x 10^{-4} and TT and FWI failure probability at less than 5 x 10^{-3}, the current value of CMF attributed to TT and FWI failure will be less than 10^{-6} (2 x 10^{-4} x 5 x 10^{-3}) per year. Therefore, even if one assumes STI extension causes a 10% increase in the probability of failure to trip the turbine and isolate feedwater (again very conservative considering STI is extended

approximately 10%), the change in the core-melt frequency will be less than 10^{-7} (10^{-6} x 0.1) per year.

IV. Table 4.3-1, Functional Unit 1, Manual Reactor Trip

The risk associated with the STI extension of the channels associated with this functional unit were determined to be insignificant due to the following redundancy/diversity considerations.

As shown on Table 3.3-1 of the Millstone Unit 3 Technical Specifications (see functional unit #1) success of only 1 of 2 channels is needed for the successful manual reactor trip. Therefore, there is redundancy. However, note that the primary reason for risk insignificance of this STI extension is diversity. As shown by Table 3.3-1, there are a large number of functional units that would automatically trip the reactor in the event of an abnormal event. For example, during a LOCA, 3 of 4 channels of pressurizer pressure channels and 2 of 2 SI signal channels must fail in order to demand the manual trip function. Manual reactor trip function is always the backup rather than the primary mitigating function for reactivity control during all design basis accidents.

A third (however not a dominant) reason for low risk significance is the low marginal increase in failure probabilities. In general, the failure probability of a channel is calculated using the formula

$$\frac{\lambda T}{2}$$

where "T" is the STI and "λ" is the failure rate. This formula implicitly assumes that the failure probability is linearly dependent on the STI. However, since instrument drift is not a concern for these channels, this assumed linear dependency may be overly conservative. That is, a 10% increase in STI will not necessarily increase the failure probability of a channel by 10%, although the above formula suggests so.

V. Table 4.3-2, Functional Unit 5c, Turbine Trip and Feedwater Isolation

The bases for concluding that the STI extension of functional unit 5c is insignificant are:

- redundancy
- diversity
- low marginal increase in failure probability

As shown in Technical Specification Table 3.3-3, ESFAS unit 5c consists of 2 channels and only one of them is needed for success. Therefore, there is redundancy. Moreover, an event that causes a safety injection (SI) and thereby trips the turbine (TT) and isolates feedwater (FWI)

creates other signals (high-high water level during a steam generator tube rupture (SGTR), reactor trip signal during a LOCA) that would cause TT and FWI. Therefore, there is diversity.

In comparison to functional unit 1 reactor trip system (RTS) discussed in "IV" above, functional unit 5c has lower diversity. However, on the other hand, TT and FWI is of a lower risk significance compared to the reactor trip function. Failure to TT and FWI will create an overcooling transient whose conditional core melt probability is approximately at 2 x 10^{-4} per Millstone 3 IPE (See III above). This is in comparison to a ATWS event that has a relatively higher conditional core-melt probability.

In addition to the redundancy and diversity, low marginal increase in failure probability, especially in the absence of instrument drift concerns, (see discussion related to $\lambda T/2$ formula above) reinforces the low risk significance associated with this STI extension.

VI. Table 4.3-2, Functional Unit 7a & 7b Control Building Isolation (CBI)

Redundancy, diversity, low marginal increase in failure probability, and low functional risk significance were the bases that led to the "insignificant risk increase due to STI extension" conclusion.

Both ESFAS units 7a and 7b have redundant channels (1 of 2 needed for success. See Table 3.3-3). Again, as shown in Table 3.3-3, a CBI can occur due to any one of the item (a), (b), (d), or (e) of Table 3.3-3.

In the case of CBI, a major reason for insignificance in the risk increase is its indirect rather than the direct impact on core melt frequency. That is, failure of CBI creates a problem in control room habitability for which other actions can be taken rather than impacting any RCS physical parameter which impacts either the RCS or the containment integrity.

For all IV, V, and VI above, additional quantifications or analysis were deemed unnecessary since the STI extension is a one-time extension rather than an extension for every refueling cycle.