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March 31, 1993

Docket No. 50-423
B14410

Re: 10CFR50.59

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

Gentlemen:

Millstone Nuclear Power Station, Unit No. 3
Emergency Diesel Generator Fuel Oil Storage Capacity

Northeast Nuclear Energy Company (NNECO) recently completed an evaluation regarding the Millstone Unit No. 3 emergency diesel generators (EDG) and the associated fuel oil system. This evaluation included a review of various discrepancies between the actual capabilities and previously stated capabilities of the diesel generator fuel oil supply system. NNECO has concluded that the diesel generators and the associated fuel oil system have been determined to be operable and the discrepancies do not result in the plant operating outside its licensing/design basis. However, NNECO has recognized that the Millstone Unit No. 3 Final Safety Analysis Report (FSAR) should be revised to reflect more accurately the actual EDG run times with the available fuel oil storage capacity.

Historical Background

The licensing basis and design features of the EDG fuel oil system are described in the Millstone Unit No. 3 FSAR. This information was reviewed and documented by the NRC Staff in their Safety Evaluation Report(1) (SER), dated August 1984. The following are excerpts from the SER.

> "Each diesel engine fuel oil storage and transfer system consists of a 550-gal day tank sufficient to power the diesel engine at continuous rated load for approximately 1.5 hours, a 35,000-gal diesel fuel oil storage tank sufficient to power the diesel engine on the basis of the continuous rated load for 3.5 days, ... Except for the sharing noted in Section 9.5.4.1 between the systems to meet the 7-day fuel oil storage requirements, each diesel engine fuel oil storage and transfer system is independent and physically separated from the other system supplying the redundant diesel generator. Thus, a single failure within any one of the

(1) Millstone Unit No. 3 Safety Evaluation Report, dated August 1, 1984 (NUREG 1031).

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> systems will affect only the associated diesel generator. However, because each fuel oil storage tank is sized only for 3.5 days of oil capacity at continuous load and to provide a 7-day fuel oil supply for one diesel generator, the applicant had designed his fuel oil storage and transfer system so that fuel oil can be transferred from either storage tank to both diesel generators. ... Also, the applicant stated that one diesel generator must be shut down to meet the 7-day fuel oil requirements for the other diesel generator."

Prior to the publication of the SER, the Staff had questions regarding the independence criterion of General Design Criterion (GDC) 17 for redundant systems and found, at least initially, that the design did not meet the requirements of GDC 17 and the recommendations of Regulatory Guide 1.137, "Fuel Oil Systems for Standby Diesel Generators," Position C.1; ANSI N195, "Fuel Oil Systems for Standby Diesel Generators," Section 5.2; and SRP Section 9.5.4, Paragraphs I.1.d and III.6.b, which require 7 days of fuel oil storage for each diesel generator. The Staff requested that NNECO justify the design or provide a full 7 days of fuel oil storage for each diesel.

NNECO responded to the Staff's above concern in a letter dated May 17, 1984. This letter explained that the tanks could be replenished within 24 hours after notice for fuel had been given. This action would ensure that 7 days of fuel would be available to an operating diesel generator. This submittal also described the historic grid reliability of Millstone's off-site electrical sources and that past experiences were that the necessity of diesel generator continuous operation beyond 24 hours was highly unlikely.

Additionally, this response described a load-shedding analysis which demonstrated that with reduction of loads, the EDGs (EITHER ONE or BOTH) will have the capability to be operated continuously for a minimum period of 5 and one-half days with margin that allows approximately 6 days.

Again, the Staff requested NNECO submit a listing of the loads to be shed or placed onto the bus and when they are to be placed onto the bus. The original SER indicated that pending the submittal and acceptance of this information, the Staff found that the design of the system was acceptable and met the above requirements.

NNECO responded to this request in letters dated July 12,[2] and November 19,[3] 1985, by providing a revised load shedding analysis. The Staff reviewed this analysis and issued an addendum to the original SER as Supplement No. 4, dated November 1985. In this supplement, the Staff

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(2) J. F. Opeka letter to Director of Nuclear Reactor Regulation, "Response to Safety Evaluation Report Confirmation Item 58," dated July 12, 1985.

(3) J. F. Opeka letter to Director of Nuclear Reactor Regulation, "Revised Response to SER Confirmation Item 58," dated November 19, 1985.

re-reviewed the issues in question and found the design of the fuel oil storage system acceptable.

The NRC Staff reviewed and accepted the Millstone Unit No. 3 EDG fuel oil storage and transfer system after consideration of various factors including:

1. A combined approach to meeting longer-term diesel generator operation; i.e., two 35,000 gallon storage tanks that are cross-connected to supply an operating diesel generator and still meet diversity and redundancy requirements.

2. A combined approach to meeting short-term diesel generator operation; i.e., two 550 gallon day tanks that can be filled from either of the two 35,000 gallon storage tanks and still meet diversity and redundancy requirements.

3. The capability of ordering and delivering sufficient replenishments of fuel oil from geographically diverse off-site fuel suppliers within 24 hours after notice for fuel has been given. This capability extends fuel supply to and beyond 7 days.

4. A historical perspective of the reliability and stability of the grid supplying the Millstone site. Historically, off-site power has been restored 95 percent of the time within 24 hours of first being lost at Millstone Unit No. 1 and Millstone Unit No. 2. This experience indicated that diesel generator operation in excess of 24 hours is highly unlikely.

5. A load shedding analysis which demonstrated that with reduction of loads, the EDGs (either one or both) will have the capability to be operated continuously for a minimum period of five and one-half days, with margin that allows approximately 6 days.

Results of Self-Assessment Activities

As a part of self-assessment activities, in the fall of 1991, NNECO undertook a significant effort in the performance of a mini-electrical distribution system functional inspection at Millstone Unit No. 3. This self-assessment was performed to demonstrate that the electrical distribution system function was designed in accordance with the GDC, applicable NRC requirements, and the current industry standards. Details of this self-assessment were provided to the NRC under separate cover.(4)

This self-assessment identified minor inconsistencies between the Millstone Unit No. 3 FSAR description and calculations related to the fuel oil storage

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(4) J. F. Opeka letter to the U.S. Nuclear Regulatory Commission, "Millstone Nuclear Power Station, Unit No. 3, Electrical Distribution System Self-Assessment," dated March 25, 1992.

capacity for the EDGs. As a result of the above inconsistencies, an operability/reportability evaluation (REF) was initiated. A calculation (91-019-152M3) was initiated to verify fuel oil storage capacity of the EDG fuel oil storage tanks and the EDG fuel oil day tanks. A calculated increase in the post-accident electrical loads due to corrections in the calculation and improvements in the calculation methodology, which occurred since the original design calculation (1985), postulated operation of the EDG above the originally assumed continuous load of 4986 kW; i.e., within the 2000 hour - 5335 kW rating. The calculated increase in the electrical loads results in an increased fuel consumption. No physical change in the volume of the tank occurred and no new loads have been added. In addition, the fuel consumption calculation took into account worst case instrument errors and an effect of variations in the fuel oil specific gravity on the tank level indicator readings and fuel consumption previously not considered in the original calculation. In the calculation of the usable storage capacity and EDG run time based on fuel volume available in the day tanks, a margin for vortexing was also considered. The calculation concluded that the EDG run times specified in the Millstone Unit No. 3 FSAR Sections 8.3 and 9.5 are not correct.

The evaluation of the REF concluded that the EDGs and the associated fuel oil system are operable and the discrepancies do not result in the plant operating outside its licensing/design basis. However, NNECO has determined that the following changes are required based on the present analysis.

- Revise 3.5 day single EDG run time fuel storage capacity to approximately 3 days (actual calculated under a worst case scenario it could be 3.15 days).

- Revise 7 day single EDG run time based on two tank storage capacity to approximately 6 days (actual calculated under a worst case scenario it could be 6.3 days).

- Revise day tank storage capacity from 1½ hours to 1¼ hours based on usable volume, to 1 hour with fuel level at the leading transfer pump starting level and ¾ of an hour if vortexing and instrument inaccuracies are considered.

In addition, the requirement related to ordering of fuel oil within 4 hours of a loss of off-site power (LOP) or an LOP coincident with a designed-basis event (DBE) presently included in plant operating procedure, OP-3846A, will be placed in the appropriate emergency plan implementing procedure. This will free the control room operators to manage the activities related to mitigation of an LOP or an LOP coincident with a DBE.

With regard to the load shedding analysis, it was recognized that the variety of load shedding schemes cannot be procedurallized effectively, and it was NNECO's understanding that the information related to the load shedding analysis submitted to the Staff[5][6] was for demonstration purposes only. Therefore, no formal guidance was incorporated into procedures. However, based on a recent review of this matter, NNECO has decided to incorporate guidance in regard to load shedding into the Emergency Response Procedures. The main objective is to establish a trigger to initiate a load shedding consideration in a timely manner in response to a specific design basis event. The specific loads to be shed will be determined by the Emergency Response Group, based on plant condition following the event.

Safety Evaluation

In accordance with 10CFR50.59, NNECO has reviewed the change related to the EDG fuel oil capacity described above and concluded that the changes are safe and do not constitute an unreviewed safety question (USQ). The basis for this conclusion is that the three criteria of 10CFR50.59.a(2) are not compromised. The proposed changes do not involve a USQ because the changes would not:

1. Increase the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the safety analysis report.

   The proposed change, a calculated decrease in volume of the fuel oil available in the storage tank, will shorten the length of the single EDG operation without new fuel delivery from 3.5 days to approximately 3 days. A calculated decrease in the usable volume of the fuel in the day tank will shorten the EDG run time from 1½ hours to 1¼ hours based on usable volume to 1 hour with fuel level at the leading transfer pump starting level and to ¾ of an hour if vortexing and instrument inaccuracy are considered. The shorter run time of the EDG based on the usable volume available at the site has no effect on the probability of occurrence of previously evaluated accidents. Also this change has no effect on the diesel engine operation and reliability and, therefore, there is no effect on the probability of occurrence of previously evaluated malfunction of equipment important to safety. In addition, the proposed change has no adverse impact on the consequences of the previously evaluated accidents.

2. Create a possibility for an accident or malfunction of a different type than any evaluated previously in the safety analysis report.

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(5) J. F. Opeka letter to Director of Nuclear Reactor Regulation, "Response to Safety Evaluation Report Confirmatory Item 58," dated July 12, 1985.

(6) J. F. Opeka letter to Director of Nuclear Reactor Regulation, "Revised Response to SER Confirmatory Item 58," dated November 19, 1985.

The EDG is required to operate in response to an LOP. The proposed change does not introduce any alteration to plant equipment or procedures which would introduce any new failure modes. Since there are no changes in the way the plant is operated, the possibility of an accident or malfunction of a different type is not created.

3. Reduce the margin of safety as defined in the basis of any technical specification.

The proposed change, a decrease in a volume of the fuel oil available in the storage tank will shorten the length of the single EDG operation without new fuel delivery from 3.5 days to approximately 3 days (under a worst case scenario, it could be as low as 3.15 days). The shorter operating time based on fuel oil stored at the site still provides a significant margin of time for new fuel delivery. The ability of the plant to replenish fuel oil is described in detail in the SAR Section 9.5.4.2. This ability remains unchanged and is not adversely affected by the decrease of available fuel capacity from 3.5 to 3.15 days (a difference of approximately 8 hours). This conclusion is based on the following:

a. Emergency fuel oil suppliers can deliver fuel on site within 24 hours after being contacted. Suppliers are notified within 4 hours after an LOP or a design-basis accident.

b. There are four regular and four emergency fuel suppliers located at various locations to assure redundancy in delivery routes.

c. High grid reliability combined with a high probability of restoring off-site power within 24 hours based on historic data.

d. The tanks are cross-connected to supply a single operating diesel with a combined volume of both tanks if necessary.

In addition, under extreme conditions there is a possibility to extend the EDG operation beyond the calculated worst case scenario of 3.15 days through load shedding. An example of such a scheme was analyzed previously using the 1985 based electric loads and concluded that operation of the EDG could be extended significantly (from 3.5 days to 5.5-6 days). Section 8.3, Figure 8.3-1, pages 5 and 6 of the FSAR contains results of this calculation in a form of an electrical load shedding chart. In the proposed scheme, operation of the EDG during the first 8 hours after an LOP was at full rated power. Later the loads could be reduced by eliminating redundant equipment and maintaining all loads essential to safe shutdown, leaving both EDGs partially loaded. In the event of the equipment failure, its backup on the other train could be started as power would remain on both emergency buses. It is reasonable to assume that the same scheme could be used with the higher loads and would extend a single diesel operation to approximately 5 days.

(This is an estimate only, as the previous calculation has not been formally revised to account for the electrical load changes.)

A calculated decrease in the usable volume of the fuel in the day tank will shorten the EDG run time from 1½ hours to 1¼ hours based on usable volume to 1 hour with fuel level at the leading transfer pump starting level and to ¾ of an hour if vortexing and instrument inaccuracy is considered. The running time under a worst case scenario of ¾ of an hour is acceptable as it provides at least 30 minutes for an operator's intervention. The fuel oil system is designed with two transfer pumps to be single-failure proof. At the follow-up pump start level, the tank provides for 30 minutes of the engine operation. Prior to the follow-up pump start, a low-level alarm is activated with remaining running time of 35 minutes.

Based on the above discussion, it is concluded that there is no impact on the margin of safety as a result of the proposed change.

Therefore, the proposed changes are safe and do not constitute a USQ. In accordance with 10CFR50.59a(i), NNECO has initiated a change to the Millstone Unit No. 3 FSAR to reflect actual capability of the EDG fuel oil system. The change is scheduled for NRC submittal in June 1993.

Summary

NNECO concludes that the diesel generators and the associated fuel oil system are operable and the discrepancies do not result in the plant operating outside its licensing/design basis.

If you have any questions regarding the information contained in this letter, please contact us.

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