NORTHEAST UTILITIES

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April 4, 1990

Docket No. 50-423
B13425

Re: GL 88-17

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

Gentlemen:

Millstone Nuclear Power Station, Unit No. 3
Generic Letter 88-17, Revised Response to Expeditious Action Item 4
(Program Enhancement Item 1) (TAC No. 69755)

Background

On October 17, 1988, the NRC issued Generic Letter (GL) 88-17(1) to request information from Licensees regarding the actions taken to implement the identified expeditious actions and plans and schedules to implement the identified programmed enhancements concerning operation of the Nuclear Steam Supply System (NSSS) during shutdown cooling or during conditions where such cooling would normally be provided. By letter dated December 23, 1988(2) Northeast Nuclear Energy Company (NNECO) described the expeditious actions which have been taken or will be taken as an interim measure to achieve an immediate reduction in risk associated with reduced inventory operation.

In response to expeditious action item 4, NNECO stated that, prior to entry into reduced inventory conditions, NNECO will provide at least two of the following reactor coolant system (RCS) level indications:

1. A single channel of the existing reactor vessel level monitoring system (RVLMS) shall be operable providing the operator with a continuous display of reactor vessel level at eight discrete points above the core.

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(1) D. M. Crutchfield letter to All Holders of Operating Licenses or Construction Permits for Pressurized Water Reactors (PWRs), Loss of Decay Heat Removal (Generic Letter No. 88-17), 10CFR50.54(f), dated October 17, 1988.

(2) E. J. Mroczka letter to the U. S. Nuclear Regulatory Commission, Loss of Decay Heat Removal, GL 88-17, dated December 23, 1988.

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2. A transmitter will be located off either the residual heat removal (RHR) or charging letdown line which will monitor a level from the bottom of the hot leg to a level adequate to cover reduced inventory conditions.

3. A temporary level indication system consisting of a firmly mounted gauge-glass on the bottom of the RCS hot leg will be continuously monitored by a closed circuit TV located outside the control room.

These modifications were also intended to satisfy programmed enhancement Item 1 of GL 88-17[(3)] related to the RCS level. It is noted that all the RCS level indication modifications were implemented during the last refueling outage except a firmly mounted gauge-glass (described as Item 3 above). Instead, NNECO proposes to use the tygon tube/video camera system. It is noted that the Staff's observations/comments[(4)] on NNECO's response to GL 88-17 have been utilized in the implementation of the RCS level modifications.

<u>Level Indication System</u>

The purpose of this letter is to describe the Millstone Unit No. 3 level indication system that will be used to monitor the RCS level during a reduced inventory condition. As discussed in our response to expeditious actions,[(5)] Millstone Unit No. 3 will define "Reduced Inventory" as being lower than 5 feet below the reactor vessel flange (i.e., 19 foot, 6 inch level). For Millstone Unit No. 3, the RCS level (when RCS is in a reduced inventory condition) indication system consists of one channel of the existing RVLMS, three level transmitters and a tygon tube/video camera system.

I. <u>Level Transmitters</u>

Three independent level transmitters are utilized for level indication, level trending and level alarming. These transmitters are installed to continuously monitor RCS level from the reactor vessel flange to the bottom of the hot leg. One transmitter is located in the letdown piping off the RCS cold leg, another is located off the RHR-A pipe leg and the third is located off the RHR-B pipe leg. All three transmitters have their reference leg vented to containment atmosphere.

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(3) E. J. Mroczka letter to the U.S. Nuclear Regulatory Commission, Loss of Decay Heat Removal, GL 88-17, dated January 31, 1989.

(4) D. H. Jaffee letter to E. J. Mroczka, Comments on NNECO Response to GL 88-17 With Respect to Expeditious Actions for Loss of Decay Heat Removal, dated May 23, 1989.

(5) E. J. Mroczka letter to the U.S. Nuclear Regulatory Commission, Loss of Decay Heat Removal, GL 88-17, dated December 23, 1988.

In the presence of an RCS vacuum or an RCS pressurization we recognize that failure to vent the level transmitters to an RCS air void could lead to measurement errors. For the RCS vacuum case, the level instruments will read a value which is lower than the true level; in effect, the error will occur in the conservative direction and will be self corrected by alarming and operator action. RCS pressurization effects, on the other hand, can occur following the loss of RHR cooling in which the RCS water temperature quickly rises and the resulting increase in vapor pressure cannot be released by RCS venting. For this case, the operator is fully cognizant of loss of RHR and is required by procedure to refill the RCS and to use the single channel of the RVLMS to monitor the RCS level.

As stated above, one level transmitter is located in the letdown leg. This location provides an ideal location for level measurement because the letdown leg is a standing water column during the mid-loop operational mode. Further, experimental measurements performed during the last refueling outage indicate that there is no detectable level gradient between this location and the RHR suction pipe location.

RHR level transmitters are subject to process measurement effects due to fluid flow within the RHR pipes. The analytical calculations on flow induced errors and our experimental testing after installation have shown that the fluid flow error in both transmitters is approximately 2" of water at the RHR pipe flow rates of 1000 gpm. This fluid flow offset is constant for constant flow. For constant flow, the RHR level transmitters provide constant level indications; for a flow disturbance such as caused by vortex formation, the RHR level will show a rapid change in flow offset and thus provide early and direct indication of a flow anomaly.

II. RVLMS

At least one channel of the reactor vessel level monitoring system will be operable providing the operator with a continuous display of the reactor vessel level at eight discrete points above the core. The RVLMS, mentioned above, provides two fundamental purposes in the mid-loop measurement system. During RCS pressurization conditions, the RVLMS will provide level indication; during normal mid-loop operation, the RVLMS probes will provide a cross-check against the level transmitter and tygon tube level indication.

III. tygon tube

The tygon tube/video camera system also provides level indication during a reduced inventory condition. The tygon tube technique uses hard piping from a pipe penetration at the 17'-6" level (mid level on the RCS) on the RCS hot leg. The hard pipe is terminated at an isolation valve. From the isolation valve, a tygon tube is run horizontally about 5 feet and

vertically about 3 feet to form a gently sloping arc which terminates at the pressurizer vessel wall. Along the pressurizer vessel wall the tube is run from approximately the 16' level to the 25' level in a straight vertical path. At 25' the tygon tube is routed around pipes and finally vents to containment atmosphere at approximately the 45' level.

The level of interest using the tygon tube is the 17'-6" level to the 19'-6" level. Nineteen feet six inches corresponds to the start of the reduced inventory condition at Millstone Unit No. 3. A camera with tilt control is mounted at the 17'-6" level (hot leg mid-loop). It views the tygon tube mounted against a permanently mounted metal template. This template clearly depicts level in 1/4" increments about mid-loop, and 1" increments from the reduced inventory to mid-loop. Key reference points such as reduced inventory level, top of hot leg and mid-loop are clearly shown.

The video camera sends a video signal to a control room monitor. A video control box in the control room allows the operator to tilt the camera which allows the operators to track the tygon tube level during draindown from the 19'-6" foot level to the 17'-6" level.

tygon tube Concerns

Level measurement using the tygon tube techniques has been criticized by the NRC and INPO as a potential source of inaccurate indication of the RCS level during reduced inventory condition. The following paragraphs reiterate the four principal concerns with the tygon tube method and provide the Millstone Unit No. 3 response.

(1) Air voids: Because tygon tube is a flexible hose it can be installed by inexperienced personnel in such a way that air voids can occur in the installation. Air voids could occur when the tygon is not run in a continuously sloped manner.

Response

As discussed previously, the Millstone Unit No. 3 tygon tube installation is hard-piped to an isolation valve. The tygon tube is installed at the isolation valve and run horizontally 5 feet and vertically 3 feet in a gently curving arc and attached to the pressurizer cubicle wall. If the tygon tube were coiled or purposely jumbled in the small section from the isolation valve to the pressurizer cubicle wall, then an air pocket could form in the tygon tube. However, our installation and inspection procedure specifically mandate that the tygon tube will be installed in a gently curving upward arc from the isolation valve to the cubicle wall. From this point up to approximately the 45' level, the tygon tubing is routed in a continuous upward slope. In the unlikely event that condensation forms in the air leg portion of the tube, it would fall

back into the wet leg portion. Further, as an additional check, the level as indicated by the tygon tube is periodically cross-checked with the level instrumentation to verify all level instrumentation correlates. Therefore, NNECO believes that for the Millstone Unit No. 3 installation, air voids forming within the tygon tubing is highly unlikely due to installation and inspection practice, the tube extremely short run of tubing and periodic cross checking tygon level with diverse level instrumentation.

(2) Tygon Collapse: Terminating a tygon tube to a reactor head vent can cause the tygon to collapse. If, during the draindown evolution, the head vent begins to draw vacuum, the vacuum within the tygon tube could cause the tube to collapse leading to a false level reading.

Response

Tygon will collapse if the air end of the tube is attached to a location that can draw a vacuum. The Millstone Unit No. 3 tygon tube is vented to containment and not to the reactor vessel head vent, therefore, the air end of the tube can never draw vacuum and the possibility of tygon tube collapse is remote.

From a measurement point of view, however, the tygon tube level and level instrument level will not indicate true level in the event of head vacuum effect or head pressurization effects. For the RCS vacuum case, the level instruments will read a value which is lower than the true level. Consequently, the lower level will alarm and alert the operator to perform corrective action. Also, as is the case for the level transmitters, the RVLMS will provide level indication for pressurization effects.

Based on the above, we conclude that the tygon tube, as installed at Millstone Unit No. 3 and vented to the containment atmosphere, is immune to tygon tube collapse effects. Further, we conclude that head vacuum effect will cause a level error in the conservative direction and that the RVLMS probes will provide adequate level indication for head pressurizer effects.

(3) Alarming: A tygon tube installation provides indication only. If the level within the tube drops dramatically in a short period of time the control room operator would not realize the alarm condition unless he was continuously viewing the tygon tube level.

Response

Although the tygon tube measurement itself does not have level alarming, the three level transmitters associated with the mid-loop measurement will provide this function.

(4) Control Room Viewing: A typical tygon tube installation would involve the tubing run, a shift person stationed near the tube to read the level and voice communications facility to relay level readings to the control room operators. A breakdown in communications, or a misreading by the person stationed at the tygon tube could easily lead to misleading level information and in appropriate control action.

Response

As discussed previously, the tygon tube level is displayed directly on a T.V. monitor within the control room. Also, the operators have camera tilt control in the control room to tilt the camera. Camera tilting allows close tracking of the tygon tube level throughout the draindown evolution and subsequent refill.

Therefore, the tygon tube/video camera system, as part of the RCS level indication system, provides an accurate and diverse method for the control room operators to monitor and control the RCS level during a reduced inventory condition at Millstone Unit No. 3.

In summary, a reduced inventory condition, the combination of the above instrumentation (level transmitters, single channel of the RVLMs and the tygon tube/video camera) will be used to continuously monitor the RCS level to satisfy programmed enhancement item 1 of Generic Letter 88-17.

If you have any questions regarding this matter, please contact our licensing staff directly.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

FOR: E. J. Mroczka
Senior Vice President

BY: C. F. Sears
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cc: T. T. Martin, Region I Administrator
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