LILCO LONG ISLAND LIGHTING

LONG ISLAND LIGHTING COMPANY

SHOREHAM NUCLEAR POWER STATION • P.O. BOX 628 • WADING RIVER, NEW YORK 11792

TEL. (516) 929-8300

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

NRC Bulletin 88-08
Thermal Stresses in Piping Connected to
Reactor Coolant Systems
Shoreham Nuclear Power Station - Unit 1
Docket No. 50-322

Gentlemen:

Long Island Lighting Company (LILCO) has reviewed NRC Bulletin 88-08, dated June 22, 1988, and its associated Supplements 1 and 2, dated June 24, 1988 and August 4, 1988, respectively, for its applicability to the Shoreham Nuclear Power Station (SNPS) and has determined that unisolable sections of piping connected to the SNPS Reactor Coolant System (RCS) will not be subjected to temperature transients or stratification that could contribute to thermal cycling fatigue induced by leaking valves. This determination is based on the following review and analyses.

Bulletin 88-08, and its supplements, describe incidents at. Farley-2 and Tihange-1, both pressurized water reactors (PWRs), where cracks were found in unisolable sections of Emergency Core Cooling System (ECCS) piping. These cracks were determined to have been caused by and resulted from high cycle thermal fatigue. Bulletin 88-08 specifies that the following actions be taken by licensees:

(1) Review systems connected to the Reactor Coolant System (RCS) to determine whether unisolable sections of piping connected to the RCS can be subjected to stresses from temperature stratification or temperature oscillations that could be induced by leaking valves and that were not evaluated in the design analysis of the piping. (If none are identified, then no action is required);

(2) For identified piping, perform non-destructive examination of the welds, heat-affected zones, and high stress locations, including geometric discontinuities, in that piping to provide assurance that there are no existing flaws; and

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(3) Plan and implement a program to provide continuing assurance that unisolable sections of all piping connected to the RCS will not be subjected to combined cyclic and static thermal and other stresses that could cause fatigue failure during the remaining life of the unit.

Bulletin 88-08 states that "thermal fatigue of unisolable piping connected to the RCS can occur when the connected piping is isolated by a leaking block valve, the pressure upstream from the block valve is higher than RCS pressure, and the temperature upstream is significantly cooler than RCS temperature." Piping must fall within these parameters if the Bulletin is to be considered applicable.

In preparing our response to Bulletin 88-08, LILCO contacted Mr. Roger W. Woodruff, NRR technical contact for the Bulletin, and requested additional information regarding the phenomenon of high cycle thermal fatigue. Mr. Woodruff offered the following information for our consideration. The fatigue, as identified in Bulletin 88-08, was probably caused by relatively cool water leaking through a closed block valve and entering the piping between the block valve and a downstream check valve. The check valve would remain closed until upstream leakage would provide a sufficient upstream pressure on the disc to overcome the pressure of the downstream side pressure, which is the same as Reactor Coolant System (RCS) pressure. When the disc did open, it permitted the cold water to enter the hotter piping. However, with an equalization of pressure across the disc, the check valve would reclose and await the process to start again. This repetitive cycle of injecting cold water into a hot pipe caused localized thermal fatigue of the piping directly downstream of the check valve. This thermal cycling occurred over a long period of time because the section of piping upstream of the block valve sees the pressure of a charging pump, which operates constantly during reactor operation. Therefore, with a leaking block valve, and a constantly running charging pump, the leakage was continuous. This continuous leakage caused the continuous thermal cycling, and the thermal fatigue which followed was in excess of that for which it was originally designed.

At the Shoreham Nuclear Power Station, the following systems were investigated and analyzed in regard to the Bulletin and the phenomenon as described above:

1. <u>Feedwater (FW)</u> - This system is normally in operation and continuously injects comparatively cold water into the RCS during normal operation. The RCS piping is designed for this and no abnormal temperature transients or stratification that could contribute to thermal cycling fatigue are anticipated to occur.

2. Reactor Water Cleanup (RWCU) - This system is normally at a pressure equal to or less than the RCS and injects into the RCS via the feedwater system. When the RCS is operating, this system (RWCU) is injecting water at normal flow rates into the FW system which then injects into the RCS. The thermal cycling phenomenon noted in the Bulletin does not occur; therefore, this system will not experience thermal cycling fatigue.

3. Standby Liquid Control (SBLC) - This system has the capability to inject cold water into the RCS during testing but is normally isolated from the RCS by explosive actuated zero leakage valves. Therefore, SBLC is not subject to the problems noted in the Bulletin.

4. Control Rod Drive (CRD) - Like RWCU, this system is a normally operating system and therefore the cyclic cold water injection effects on piping are not applicable to this system. However, regarding the CRD system, General Electric issued Service Information Letter (SIL) #200, Rev. 1, in July 1979, after cracking was detected in the CRD hydraulic control system return line. It was determined that this cracking was due to thermal fatigue caused by thermal cycling of relatively cold water in the return line. SIL #200 contained recommendations for plant modifications to resolve this potential problem. The recommendations in this SIL were incorporated in the SNPS-1 original design and therefore no further action is required.

5. High Pressure Coolant Injection (HPCI) - This system is normally in a non-pressurized, standby mode. The pump is started only during emergencies and during testing. In both these instances, the HPCI system pressure is greater than RCS pressure. During emergency conditions all block valves are open and the piping experiences normal flow rates to the RCS. However, during testing, the block valves are closed and the possibility exists for leakage past the block valve which could set up a similar thermal cycling scenario, with the following exceptions:

   a) There is no downstream check valve to set up the cyclic effect.
   b) Testing occurs once a quarter for approximately a one half-hour period.
   c) The HPCI system is tied into an isolable section of the feedwater system.

   We have analyzed the effects of leakage through the block valve during HPCI testing. While we note that during the period of the test colder water from HPCI enters the hot feedwater line, our analysis has concluded that Shoreham will not experience fatigue failures of the piping.

6. <u>Reactor Core Isolation Cooling (RCIC)</u> - This system is similar to HPCI (as was noted above) with the exception that the RCIC block valve is designed to permit leakage to the feedwater system during testing. Its downstream disc contains a 3/16" diameter hole, which passes 10 gpm when the RCIC pump is operating. Again, we analyzed the effects of leakage through the block valve during RCIC testing, and the results were the same as those for HPCI.

In conclusion, based on our review and analyses, LILCO has determined that the Shoreham Nuclear Power Station does not have any unisolable sections of piping which can be exposed to the phenomenon of Bulletin 88-08, and therefore the concerns of Bulletin 88-08 are not applicable to Shoreham. This is consistent with the information provided by General Electric in its August 29, 1988 letter to the BWR Owners' Group Primary Representatives. In addition, even in those systems (HPCI and RCIC) where we analyzed the effects of leakage in isolable sections of piping, we found that the piping would not experience thermal cycling fatigue as noted in the foregoing summary.

Since we have determined that there are no unisolable sections of piping that can be subjected to the stresses identified in Bulletin 88-08, this correspondence fulfills LILCO's reporting requirements in accordance with Bulletin 88-08.

If you should require additional information or clarification regarding this matter, please do not hesitate to contact me.

Very truly yours,

John D. Leonard, Jr.
Vice President - Nuclear Operations

MAP:ck

cc: W. T. Russell
F. Crescenzo
S. Brown

AFFIDAVIT

STATE OF NEW YORK)
: ss:
COUNTY OF SUFFOLK)

I, JOHN D. LEONARD, JR., being duly sworn, depose and say that I am the Vice President - Nuclear Operations for the Long Island Lighting Company. I am authorized on the part of said Company to sign and file with the U.S. Nuclear Regulatory Commission the enclosed letter (SNRC-1503) for the Shoreham Nuclear Power Station. This response was prepared under my supervision and direction; and the statements contained therein are true and correct to the best of my knowledge, information and belief.

John D. Leonard, Jr.

John D. Leonard, Jr.

Sworn to before me this
26 day of September 1988

James A Little

JAMES A. LITTLE
NOTARY PUBLIC, State of New York
No. 4886267, Suffolk County
Term Expires May 18, 19[illegible]