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Boston Edison

Pilgrim Nuclear Power Station
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BECo Ltr. #95-118

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

Docket No. 50-293
License No. DPR-35

Response to NRC Bulletin 95-02

By letter dated October 17, 1995, the NRC transmitted Bulletin 95-02 to Boiling Water Reactor licensees. This Bulletin deals with unexpected clogging of pump strainers when pumps are drawing water from the suppression pool.

The Bulletin requested an evaluation verifying pump operability for pumps drawing suction from the suppression pool when performing their safety functions. The requested evaluation was to be based on pool and strainer conditions during the last inspection or cleaning and an assessment of the potential for the introduction of debris or other materials that could clog the strainers.

Our review concludes that Pilgrim's Emergency Core Cooling Systems (ECCS), when drawing water from the suppression pool to perform their safety functions, are operable and are not compromised by sludge or fibrous material in the suppression pool or on the ECCS suction strainers.

A summary of the considerations supporting this conclusion is attached to this letter.

Bulletin 95-02 also requested other actions. Pilgrim provides the following in response to those actions:

- Pilgrim will perform testing to confirm our operability evaluation within 120 days of the Bulletin and report the results to the NRC by February 13, 1996.
- Pilgrim will visually inspect the suction strainers at the next Refueling Outage (RFO #11), currently planned for February, 1997.
- Pilgrim planned to clean the suppression pool during RFO #11, and will continue with that plan.

- Pilgrim will participate in the Boiling Water Reactors Owners Group (BWROG) effort to develop and implement a process for determining the frequency of future suppression pool cleanings.

- Pilgrim will implement a suppression pool cleaning plan prior to RFO #11 in support of the scheduled cleaning.

- Identified enhancements to the Foreign Material Exclusion process will be completed by February 13, 1996.

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PMK/nas/Rap95/9502Resp

Attachment

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Bulletin 95-02 provides five requests to licensees. Boston Edison Company's (BECo) response to each is described below:

1) Verify the operability of all pumps which draw a suction from the suppression pool (torus) when performing their safety functions (e.g., ECCS containment spray, etc.) based on an evaluation of suppression pool (torus) and suction strainer cleanliness conditions. This evaluation should be based on the pool and strainer conditions during the last inspection or cleaning and an assessment of the potential for the introduction of debris or other materials that could clog the strainers since the pool was last cleaned.

Our review indicates that Pilgrim's ECCS systems are operable and are not compromised by suppression pool (torus) or ECCS suction strainer cleanliness.

We reviewed suppression pool (torus) cleaning and inspection records. Suppression pool (torus) cleaning was last performed in 1991 during RFO #8 when the entire suppression pool (torus) was vacuum cleaned by divers. At that time, internal suppression pool (torus) coating inspection and repairs were completed in approximately one half of the suppression pool (torus). Inspection of the suppression pool (torus) in accordance with PNPS Procedure 1.3.108 was performed by the system engineer during RFO #10 (1995) who documented a high-level of water clarity with no visible foreign material on the ECCS suction strainers. Chemistry data for suppression pool (torus) water show consistently high water clarity throughout the period since the last suppression pool (torus) cleaning.

Pilgrim Station has a Mark I suppression pool (torus). Unlike open suppression pool (torus)s, the Mark I suppression pool (torus) is closed except for vent pipes connecting the suppression pool (torus) to the drywell that are also closed. During power operation, the suppression pool (torus) is not accessible to personnel; access requires the removal of shield plugs and a large bolted cover. Procedural controls are in place to provide inventory control when the suppression pool (torus) is open. This design in conjunction with the procedural controls minimizes the entry of dust, dirt, and other foreign material into the suppression chamber.

The Mark I containment has ring girders between bays that restrict the transport of sludge and other materials between the suppression pool (torus) bays. These features tend to trap loose debris and result in less suspended solids in the suppression pool (torus) water. The RFO #10 closeout inspection found no appreciable debris in these areas.

Foreign material exclusion (FME) programs are in place to prevent the introduction of foreign materials into the suppression pool (torus) that could impact ECCS operation. Containment inspections in response to NRC Bulletin 93-02 found no temporary air filters or other fibrous materials stored in containment. On May 27, 1993, as part of the RFO #9 inspection, the BECo Operations Section Manager, accompanied by the NRC Resident Inspector, performed a drywell closeout inspection. Temporary air filters were verified to have been removed, no loose material or equipment was observed, and good overall cleanliness was noted. PNPS Procedure 3.M.1-38, "Primary

Containment Closeout", requires removal of all temporary fibrous materials prior to drywell closeout. The RFO #10 closeout inspection also showed the containment was free of foreign materials. RFO closeout inspections are conducted by Pilgrim management prior to closing the containment.

RHR and Core Spray pump performance data from prior to the time of the last suppression pool (torus) cleaning (1991) until the last quarterly surveillances have been reviewed. These pump tests are performed in accordance with Pilgrim's ASME Code Section XI In-Service Test (IST) Program and demonstrate compliance with Technical Specification limits for pump performance. The measurements include idle and running pump suction pressures that are used together with pump discharge pressure to determine pump total head. The pump suction pressure data has been reviewed and calculations performed to evaluate the potential of strainer fouling. No adverse trends indicative of ECCS strainer plugging were found. Comparison of the measured data to calculated suction line pressure drop show the strainers to be clean.

As part of the evaluation, the expected suction line pressure drops for the four RHR and two Core Spray Pumps were calculated. The expected line losses include those from the clean strainer, pipe friction, and head loss from all elbows, valves, and other fittings. The suction line pressure drop for the IST pump test conditions was calculated for comparison with the actual plant measurements. The suction pressure is measured at the pump using a calibrated pressure gage. Suction pressure is first read with no flow which gives the static head from the suppression pool (torus) water level. With the pump operating at the controlled test flow rate, the suction pressure is read again. This method inherently accounts for elevation head effects and allows a direct measurement of suction line pressure drop for comparison to the calculated values.

The plant data for the period from 1990 to the present was reviewed in detail since this included the complete cleaning of the suppression pool (torus) during the 1991 (RFO #8). Although there is some data scatter in the readings, there is clearly no adverse trend. The measured values correlate closely with the calculated values. We, therefore, conclude the strainers are nominally clean and that there is no evidence of fouling. Pilgrim intends to improve the accuracy and precision of future readings which will provide a reliable indication of strainer cleanliness. Measurement of suction pressure drop in this manner during the IST pump tests is considered to be the best method for monitoring strainer cleanliness.

In addition to the calculation of expected pump suction pressure drop, "Alert" and "Required Action" limits were developed to be applied to the IST pump suction measurements. The limits are based on the NPSH requirements of the RHR and Core Spray Pumps under the predicted post-accident conditions for wetwell temperature, pressure, pump required flow rates, and predicted maximum strainer debris fouling. The limits, when applied at the pump testing conditions for flow rate and temperature, ensure that the RHR and Core Spray Pumps will have adequate NPSH under predicted accident conditions. The Alert limit is based on conservative bounding values for the above parameters. The Required Action limit is based on the predicted values for the accident parameters. For example, the limiting RHR Pump has an expected suction pressure drop of 1.31 psi at test conditions; the proposed "Alert Limit" will be set at 2.0 psi, and the "Required Action Limit" will be 4.0 psi for the same test conditions. Actual IST readings are generally in the range of 1.0 to 1.5 psi. Plant data for the period

1990 to the present were reviewed since this period included the complete cleaning of the suppression pool (torus) during the RFO #8 (1991). At no time during this period did the readings exceed the proposed alert limits for any of the RHR or Core Spray pumps.

Once per month, RHR is run in the suppression pool (torus) cooling mode for six to eight hours prior to taking suppression pool (torus) water samples. In addition, the 'A' loop of suppression pool (torus) cooling was initiated 18 times during August 1995, resulting in over 100 hours of operation. The longest continuous run was for 17 hours and 35 minutes. Although the suction pressure is not measured during these runs, the pump flow rate and motor currents are monitored. These parameters are gross indicators of pump performance. No evidence of RHR pump performance degradation was noted during these periods of extended operation.

The High Pressure Core Injection (HPCI) system and the Reactor Core Isolation Cooling (RCIC) system are normally aligned to the Condensate Storage Tank (CST) and do not use strainers when so configured. However, both systems can draw water from the suppression pool (torus) through strainers. Although the RCIC and HPCI strainers are located in separate bays from each other and from the Core Spray and RHR strainers, RHR pump suction measurements will be used to infer the cleanliness of the RCIC and HPCI strainers. If the RHR strainers are demonstrated clean, HPCI and RCIC strainers can be assumed to be clean.

Recent industry incidents demonstrated that any fibers in the suppression pool (torus) would collect on the suction strainers during a prolonged pump run. The fibers and pool debris collection are a chronic condition that manifests itself through reduced suction pressure as the pumps run with the rate of pressure drop being a function of fiber concentrations and debris in the pool. Pilgrim drained and recoated its suppression pool (torus) in 1984 ensuring that all construction and early operational debris was removed. Pilgrim's suppression pool (torus) was vacuumed again in 1991, it is still clean and has excellent water clarity which permitted the system engineer to easily see the bottom of the pool during his inspection in 1995. In addition to verifying that there was no debris or fibrous material on the strainers, the engineer confirmed there were no "piles of debris" around or under the strainers which would indicate the material had collected on the strainers during operation and had fallen off after the pumps stopped. In the four years since the last pool cleaning, there is no indication of suction pressures decreasing during the quarterly surveillances. During the prolonged suppression pool (torus) cooling runs of last summer, there were no signs fiber or debris was collecting on the strainers causing reduced flow, reduced suction pressures or increased pump motor current. For these reasons, we believe Pilgrim's FME practices continue to be effective. Pilgrim's ECCS are not and will not be compromised by suction strainer cleanliness concerns.

2) The operability evaluation requested in action 1 above should be confirmed through appropriate test(s) and strainer inspection(s) within 120 days of the date of this bulletin.

We will run each RHR pump for at least 8 hours (4-5 turnovers of suppression pool (torus) water/run) in the suppression pool (torus) cooling mode within 120 days of the date of this bulletin. Each pump loop will be run separately. This will provide data to

determine changes in pressure drop across the RHR suction strainer for the pump in use. Analysis of these data will determine the need to perform additional tests or inspection. We will visually examine the ECCS suction strainers at the next scheduled refueling outage (April 1997) because, as described above, the suppression pool (torus) inspection requires a plant shutdown.

Since the Core Spray and RHR systems use the same size strainers in similar locations, if RHR strainers are clean, Core Spray strainers can be assumed clean. The future IST Performance Tests on all ECCS pumps will be performed with improved accuracy and trending of suction pressure drop and with the application of new more stringent acceptance criteria for this measurement.

HPCI and RCIC strainers can also be assumed clean if the RHR strainers are clean.

We believe testing will confirm our conclusion that all ECCS strainers are presently clean, have been clean throughout the plant's operation, and can be monitored for cleanliness during future operations.

3) Schedule a suppression pool (torus) cleaning. The schedule for cleaning the pool should be consistent with the operability evaluation requested in action 1 above. In addition, a program for periodic cleaning of the suppression pool (torus) should be established, including procedures for cleaning the pool, criteria for determining appropriate cleaning frequency, and criteria for the adequacy of the pool cleanliness.

A suppression pool (torus) cleaning is scheduled for the next refueling outage, currently planned for February 1997. We determined the next suppression pool (torus) cleaning date based on a review of data described in action 1 above, sludge generation rate calculations, and the time elapsed since the last suppression pool (torus) cleaning. Based on the results of the next cleaning, sludge generation rate calculations will be verified. On-going BWROG investigations on ECCS strainer plugging issues along with the plant specific sludge generation rate will be used to determine the frequency of future suppression pool (torus) cleaning. We will institute procedures for suppression pool (torus) cleaning, including cleanliness criteria, prior to the next suppression pool (torus) cleaning.

4) Review FME procedures and their implementation to determine whether adequate control of materials in the drywell, suppression pool (torus), and systems that interface with the suppression pool (torus) exists. This review should determine if comprehensive FME controls have been established to prevent materials that could potentially impact ECCS operation from being introduced into the suppression pool (torus), and whether workers are sufficiently aware of their responsibilities regarding FME. Any identified weaknesses should be corrected. In addition, the effectiveness of the FME controls since the last time the suppression pool (torus) was cleaned and the ECCS strainers inspected, and the impact that any weaknesses noted may have upon the operability of the ECCS should be assessed.

Comprehensive FME controls are in place at Pilgrim Station for the drywell, suppression pool (torus), and for systems that interface with the suppression pool (torus).

We have reviewed our FME process and procedures in response to previous correspondence on this topic including IN 93-34, IN 94-57, and INPO SOER 95-1. The effort included reviews of procedures, implementation, and training on FME. Our FME process was inspected by the NRC (Inspection 94-22, conducted September 13 through October 24, 1994) for conformity to the guidance of NRC Temporary Instruction 2515/125, "Foreign Material Exclusion Controls." The inspection found that the programmatic and procedural provisions in place at Pilgrim to preclude FME were effective. Identified weaknesses have been or shall be corrected. None of the identified weaknesses impact ECCS operability.

General Employee Training (GET) includes modules addressing FME. In addition, all plant personnel had FME issues reinforced via an "FYI" message distributed November 1, 1995. Pre-outage training on FME for contract and in-house craft and management personnel is performed to assure heightened awareness and compliance with FME processes.

5) Consider additional measures such as suppression pool (torus) water sampling and trending of pump suction pressure to detect clogging of ECCS suction strainers.

Pilgrim has instituted an additional chemistry program for suppression pool (torus) water that measures total suspended solids with a focus on fibrous material. These data will be trended.

Idle and running suction pressures for RHR and Core Spray pumps are recorded quarterly during operation of the pumps for routine surveillance. Pilgrim currently trends these data.

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