**Boston Edison**

Pilgrim Nuclear Power Station
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Docket 50-293
License DPR- 35

10 CFR Part 21--30 Day Report
-Degraded SSPV Diaphragms at Pilgrim Nuclear Power Station-

Enclosed with this letter is a 30 day report to the NRC required by 10 CFR 21.21(c)(3)(ii) regarding degraded diaphragms found in ASCO scram solenoid pilot valves (SSPV) in the hydraulic control units at Pilgrim Nuclear Power Station (PNPS). This report supplements the initial report from Boston Edison Company to the NRC Operations Center on June 20,1994 for the same subject.

During scram time testing, some control rod scram times were slower than expected, and one control rod scram time was slower than required by the PNPS Technical Specifications. Inspections of Buna-N diaphragms in scram solenoid pilot valves (SSPVs) indicated the diaphragms had become embrittled. SSPV diaphragms of control rods with acceptable scram times were also inspected. Some of these diaphragms were also embrittled. This indicates functional failure of SSPVs could be sudden and unpredictable.

The scram function is essential for mitigating the effects of over-pressure transients of which the Feedwater Controller Failure (maximum demand) is the most severe at PNPS. Assuming all SSPVs failed to function, the worse coincident single failure would be common mode failure of the backup scram valves. Given these circumstances, improbable as they are, the Alternate Rod Insertion subsystem would insert rods before clad temperatures exceeded 1353°F, the limiting result of a sustained ATWS at PNPS.

Although fuel integrity is assured and no radioactive release would occur, the Minimum Critical Power Ratio (MCPR) safety limit would be exceeded during the above postulated transient. This in itself constitutes a substantial safety hazard, and the condition must be reported as a 10 CFR Part 21 defect.



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Questions regarding this notice should be directed to Mr. Gerald G. Whitney, Licensing Engineer, Regulatory Affairs and Emergency Preparedness Department, (508)-830-7872.

E. T. Boulette, PhD

Enclosure: 10 CFR Part 21--30 Day Report

ETB/GGW/nas/Rap94/21-30day

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10 CFR Part 21--30 Day Report
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The format of the report follows the requirements found in 10 CFR Part 21.21(c)(4), paragraphs (i) through(viii). The Part 21 requirement is quoted in **BOLD** print followed by the BECo response.

**"10 CFR Part 21.21(c)(4):"**

**"The written report required by this paragraph shall include, but need not be limited to, the following information, to the extent known:"**

**"(i) Name and address of the individual or individuals informing the Commission. "**

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**"(ii) Identification of the facility, the activity, or the basic component supplied for such facility or such activity within the United States which fails to comply or contains a defect."**

The facility is Pilgrim Nuclear Power Station (PNPS),(Docket No. 50-293, Facility Operating License No. DPR-35). The basic component which contains a defect is the ASCO scram solenoid pilot valves (SSPV).

**"(iii) Identification of the firm constructing the facility or supplying the basic component which fails to comply or contains a defect."**

The ASCO SSPVs and replacement diaphragms were supplied to PNPS by General Electric Nuclear Energy (GE).

**"(iv) Nature of the defect or failure to comply and the safety hazard which is created or could be created by such defect or failure to comply."**

Premature degradation of the SSPV diaphragms creates a common mode failure in the Control Rod Drive System. The BUNA-N diaphragm material in the Control Rod Drive System has degraded prematurely. This degradation was observed during scram time testing when some control rod scram times were slower than expected and one control rod scram time was slower than required by the PNPS Technical Specifications. It has been determined at PNPS that control rod drive timing cannot be used to reliably detect degraded diaphrams. Thus, premature degradation can occur without warning resulting in failure to actuate upon demand.

Background:

At PNPS, 580 diaphragms are installed in 145 hydraulic control units (HCU) (2 diaphragms per SSPV, 2 SPVs per HCU). During RFO-8 at PNPS (Spring of 1991), all 580 SSPV diaphragms were replaced. General Electric Service Information Letter (SIL), No. 128, Rev. 2, provides GE Part Number 317A6168P002 and Drawing Number 23X558-013 as the correct spare parts kit for replacing the diaphragms associated with ASCO Model Number HVA-90-405-2A in use at PNPS. The shelf life of the replacement kits was verified to be current prior to installation.

The replacements were purchased from GE. Most were received at PNPS during 1990 and 1991. Since all SSPV diaphragms were replaced in 1991, the service life of these diaphragms actually was less than three years, significantly shorter than the four and one half years recommended by General Electric in their SIL, No. 575, dated October, 1993. Operating history at PNPS and industry experience indicates the useful service life of the subject diaphragms should normally be expected to be more than five years.

Degraded diaphragms similar to those found at PNPS were also found two weeks earlier at WNP-2, the Washington Public Power Supply System nuclear power plant. Coincidentally, the WNP-2 diaphragms were supplied during the same 1990 to 1991 time frame as the PNPS diaphragms.

On April 17, 1994, control rod scram time testing was performed. The first seventeen control rods tested indicated increased 10% scram insertion times. One of these rods, 10-31, also did not meet the Technical Specification 100% scram insertion time of 7.0 seconds. A second population of control rods was then selected for scram time testing. The first twelve rods tested also showed increased 10% scram insertion times. An investigation was then initiated to resolve the scram insertion time problems.

Control rod 10-31, which failed the TS required insertion time, was disassembled. This revealed one completely failed exhaust diaphragm and one embrittled and cracked pressure diaphragm. Subsequently, 22 more SSPVs, considered slow, were disassembled, inspected and rebuilt. These inspections revealed diaphragms in various degrees of degradation from like-new to embrittled and cracked.

To determine if scram time testing was a reliable indicator of SSPV degradation, five more control rod SSPVs were selected for disassembly and inspection. These rods were selected based on acceptable scram times and no visible scram time degradation from the previous test. Upon disassembly, two of these rods had diaphragms with significant degradation indicating imminent failure was possible.

Therefore, scram time testing cannot be used as a reliable indicator of SSPV diaphragm degradation. Also, shelf life of the replacement kits cannot be used to determine service life expectancy of the BUNA-N diaphragms in the kits.

Given coincident failure of all SSPV diaphragms upon demand during a Feed Water Controller Failure event and the single failure of the Backup Scram Valves, the Alternate Rod Insertion (ARI) dump valves would perform the scram function. Although fuel damage would not occur (clad temperatures would not exceed 1353°F), the MCPR safety limit would be exceeded.

Though these events are unlikely and conservative, the consequence of exceeding a safety limit satisfies the definition of a defect.

**"(v) The date on which the information of such defect or failure to comply was obtained."**

The determination of a substantial safety hazard regarding the ASCO BUNA-N diaphragms was made on June 17, 1994.

**"(vi) In the case of a basic component which contains a defect or fails to comply, the number and location of all such components in use at, supplied for, or being supplied for one or more facilities or activities subject to the regulations in this part."**

The extent of use of these diaphragms beyond PNPS is not known by Boston Edison. It can be assumed that most BWRs of the PNPS vintage use the affected diaphragms.

**"(vii) The corrective action which has been, is being, or will be taken; the name of the individual or organization responsible for the action; and the length of time that has been or will be taken to complete the action."**

Following discovery of degraded diaphragms in the two SSPVs with acceptable scram times, the decision to shutdown PNPS was made. During this shutdown, PNPS replaced all 580 SSPV diaphragms to restore confidence in functional operability. The replaced diaphragms were inspected and catalogued.

To determine root cause of the degradation, BECo sent three types of samples to an independent testing lab, Massachusetts Materials Research. The samples are categorized as follows:

1. Two severely degraded diaphragms (brittle and fractured)
2. Two reasonably degraded diaphragms (some hardening but no severe cracking)
3. Two new diaphragms received from another BWR facility.

Test results indicate major differences exist in the formulation and curing of the sampled diaphragms. Although the precise failure mechanism causing the degradation cannot be determined by the testing conducted on these samples, the substantive changes in material formulation seen are known to have a profound effect on the useful service life of these BUNA-N components.

**"(viii) Any advice related to the defect or failure to comply about the facility, activity, or basic compo ient that has been, is being, or will be given to purchasers or licensees."**

BECo intends to replace all SSPV related diaphragms every refuel outage. PNPS has a 24 month refuel cycle. However, if new diaphragm material, such as Viton, becomes available we will evaluate using the new material if it proves to have a longer service life.