NRC Form 366 (4-95)

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 04/30/98

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

(See reverse for number of digits/characters for each block)

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TITLE (4)
Service Water System Single Failure Vulnerability

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									N/A	05000
07	01	97	97	011	02	12	30	97	FACILITY NAME: N/A	DOCKET NUMBER: 05000

OPERATING MODE (9)	N
POWER LEVEL (10)	100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR: (Check one or more) (11)

20.2201 (b)	20.2203(a)(2)(v)	50.73(a)(2)(i)	50.73(a)(2)(viii)
20.2203(a)(1)	20.2203(a)(3)(i)	x 50.73(a)(2)(ii)(B)	50.73(a)(2)(x)
20.2203(a)(2)(i)	20.2203(a)(3)(ii)	50.73(a)(2)(iii)	73.71
20.2203(a)(2)(ii)	20.2203(a)(4)	50.73(a)(2)(iv)	OTHER
20.2203(a)(2)(iii)	50.36(c)(1)	50.73(a)(2)(v) (D)	Specify in Abstract below or in NRC Form 366A
20.2203(a)(2)(iv)	50.36(c)(2)	50.73(a)(2)(vii)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Jeffrey W. Keene - Regulatory Affairs Department Manager	508-830-7876

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED SUBMISSION DATE(15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	x	NO				

The Pilgrim Station design basis includes a requirement for redundant and independent salt service water (SSW) system trains such that no single active failure can prevent the SSW system from fulfilling its safety objective (i.e., to provide cooling water to the reactor building closed cooling water (RBCCW) system). The design basis of the SSW system also includes the requirement for the normally cross-connected SSW trains to be automatically isolated upon loss of the preferred AC power source. During a Service Water Operational Performance Inspection (SWOPI) follow-up NRC inspection, a single failure vulnerability was identified which placed the unit in a condition thought to be outside the design basis. Specifically, a single failure of a 125 vdc battery, under certain conditions, would compromise the redundancy and independence of the SSW system and potentially lead to a SSW pump cavitation condition.

It was determined that a single failure of a 125 vdc battery might defeat the SSW loop independence and redundancy if the SSW swing pump was selected for dedication to the opposite safety train and a loss of off-site power occurred. Such a DC failure would disable the associated diesel generator and one of the SSW discharge header division valves. As a result, the SSW loops would remain cross-connected, and one SSW pump would supply both loops of SSW for a short time, potentially in a cavitating condition.

A temporary modification was implemented that required closing one of the division valves in the common SSW discharge header to effect redundant and independent cooling water loops and to preclude the potential pump cavitation condition. The condition posed no threat to public health and safety.

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TEXT (If more space is required, use additional copies of NRC Form 366A) **(17)**

REASON FOR THE SUPPLEMENT

This report is submitted in accordance with our commitment to supplement revision number 01 of the report.

DESCRIPTION OF THE EVENT

On June 6, 1997, during a Service Water Operational Performance Inspection (SWOPI) follow-up NRC inspection, a single failure was identified which was believed to have placed the plant in a condition outside the design basis. Specifically, a single failure of a 125 vdc battery, under certain conditions, would compromise the redundancy and independence of the SSW system and potentially lead to a SSW pump cavitation condition. Problem Reports 97.2040, 9408 and 9413 were written in response to the problem. The initial problem report (PR 97.2040) was written on June 6, 1997. The initial operability assessment was made on June 6, 1997. A formal operability evaluation was issued on June 27, 1997. The operability evaluation concluded that the affected systems, salt service water (SSW) and reactor building closed cooling water (RBCCW), were operable. Based on the operability evaluation, the reportability evaluation (completed on July 3, 1997) concluded that the problem addressed in PR 97.2040 was not reportable.

The potential single failure was evaluated in problem reports 97.9408 (July 1, 1997) and 97.9413 (July 3, 1997). The reportability evaluations for problem reports 97.9408 and 97.9413 were completed on July 18, 1997, and it was concluded that the problems were reportable under 10 CFR 50.72 and 50.73 because the condition was outside the design basis of the plant. The NRC Operations Center was notified in accordance with 10 CFR 50.72 on July 18, 1997 (Reportable Event # 32649).

The SSW system draws cooling water from Cape Cod Bay, which is the ultimate heat sink for Pilgrim Station. Pilgrim has five (5) SSW pumps. The pumps discharge to a common header from which independent piping supplies two cooling loops. Two normally open, 125 vdc powered division valves are included in the common header to effect loop separation when needed. When the loops are isolated, two pumps are aligned to the 'A' loop and two are aligned to the 'B' loop. The fifth SSW pump (swing pump) can be aligned to either loop depending on the alignment of the two division valves. The control room operator pre-selects, via a control switch, the loop to which this pump is automatically aligned if a loss of preferred AC power occurs.

Upon loss of the preferred AC power source, automatic closure of one division valve separates the common header into two loops. The two salt service water pumps on loop A are powered by diesel generator A, and the two pumps on loop B are powered by diesel generator B. The fifth pump is powered by a common emergency service bus which can be powered from either diesel generator. Following a LOCA and loss-of-offsite power, one and only one SSW pump will automatically start in each loop.

Based on a review of the design of the SSW and 125 vdc power system, completed on July 18, 1997, it was initially determined that the Pilgrim Station design was vulnerable to a single failure of a 125 vdc battery that had the potential to defeat the SSW system independence and redundancy. Coincident with a loss of offsite power, such a failure would disable the associated diesel generator and the respective SSW pumps and discharge header division valve. If the SSW swing pump was selected to the other safety train, both SSW discharge header division valves would remain open. In this situation, one SSW pump would supply both loops, potentially in a runout condition, until operator action was taken to isolate the loops.

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Based on subsequent research and review of the PNPS design basis, the following conclusion was made: the design basis of the SSW system per UFSAR section 10.7.2 requires that no single active failure can prevent the SSW system from achieving its safety objective (i.e., "to provide a heat sink for the RBCCW system under transient and accident conditions"). However, the battery failure alluded to above meets the UFSAR definition of a passive failure and is, therefore, outside the bounds of the SSW system design basis as it pertains to single failure analysis requirements.

Although the battery failure scenario described is beyond the design basis of the SSW system, single active failures do exist that could leave the SSW system in a configuration with one pump serving both SSW trains. In LER 97-011-01, the question being evaluated at the time of it's submittal was whether this configuration was an acceptable result (i.e., within the design basis) of single failures evaluated.

Extensive review of the results of the single failure analysis performed for the SSW system shows that certain single active failures can cause the loss of the automatic closing feature of SSW motor-operated header isolation valves MO-3808 and MO-3813 and the loss of SSW pumps in one train which can result in a configuration with one SSW pump supplying both SSW trains through the open cross connect header isolation valves. The design basis is not clear as to whether this is an analyzed and reviewed configuration. Therefore, this condition is being reported conservatively as outside the design basis and considered an unreviewed safety question.

Another related concern was identified while working on this subject. The August 25, 1971, safety evaluation report states in section 7.4 (SSW system) that the SSW "loops are automatically isolated by redundant valves" on loss of AC power. This is inconsistent with the physical layout description of the SSW system provided in the UFSAR which matches the actual plant configuration. The UFSAR describes that on loss of offsite power, only one cross-connect valve closes; the other valve remains open to allow the swing pump to be aligned to a pre-determined loop. It also states two independent, full capacity loops are provided. This discrepancy is only mentioned as a related point of information and is the subject of separate correspondence with the NRC.

The plant was operating at 100 percent reactor power when the problem was identified. The reactor mode selector switch was in the RUN position. The reactor vessel pressure was approximately 1035 psig with the reactor water at the saturation temperature for that pressure.

CAUSE

After researching this subject, it has been concluded that the specific battery failure concern is beyond the PNPS design basis. However, active single failures do exist that would create the same configuration as the battery failure scenario. It is not clear that this configuration is within the design basis. This condition is an example of the PNPS UFSAR being ambiguous which was the cause of recent LERs reporting operation outside the design basis.

CORRECTIVE ACTION

Temporary modification TM #97-44 (reference Safety Evaluation 3110) was implemented on July 18, 1997. The temporary modification provided for the closure of one of the division valves in the SSW common discharge header, thus, establishing isolated cooling water loops. It was conservatively decided to place the system in this configuration pending resolution of the single failure evaluation and the discrepancy in the August 25, 1971, safety evaluation report.

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CORRECTIVE ACTION (CONT'D)

Following extensive evaluation and analysis, it was determined that the SSW and RBCCW systems remain operable even if the SSW pump cavitates during the first 10 minutes of a DBA LOCA. Although this condition represents an unreviewed safety question, PNPS engineers concluded that TM# 97-44 could be canceled and the division valve reopened since GL 91-18, Rev. 1 allows operation with an unreviewed safety question as long as the plant remains in a safe condition. An evaluation of plant conditions with the valve open and shut concluded that the minimal safety consequences of operating with the division valves open were far outweighed by the negative plant impact caused by operating with the SSW system in a split loop configuration. Minimal heat loads, cold seawater temperature, and the interim requirement to operate with the SSW trains split created the need to throttle SSW system flow to the point that it was accelerating wear on the system piping and pumps. Following a telecon between BECo and NRC personnel, the division valve was reopened.

Although the results of the above described calculations show that the SSW system will perform its prescribed function, the single failures evaluated could place the SSW system in a configuration not previously analyzed resulting in an unreviewed safety question. The request to operate with this single failure consequence will be submitted to the NRC for review as a license amendment to the UFSAR by February 15, 1998.

Resolution of the discrepancy in the 1971 SER is currently pending with NRR.

SAFETY CONSEQUENCES

The condition posed no threat to public health and safety.

The following two concerns presented themselves under this situation.

- The ability of the SSW system to operate without damage with one pump supplying both trains of SSW system is addressed by PNPS Calculation M500, "Range of Salt Service Water System Header Pressure and Pump Flows," which concluded that continuous operation of a single SSW pump with an open header and minimum system resistance is acceptable. The expected pump flow rate is within the tested performance of the pump, and the NPSH requirements are met at the low astronomical tide. Additionally with the aid of the current pump OEM, it has been determined that the SSW pumps can withstand operation under the full range of conditions and times required with no significant adverse effects. This includes conditions under which only one pump would be operating with some cavitation until operator action is taken.

- The ability of the SSW system to supply adequate cooling to the RBCCW system until the operators take manual action to start additional SSW pumps and/or close one of the cross connect valves is shown by PNPS Calculation M771, "RBCCW Heatup Following a DBA LOCA." This calculation shows that even with no cooling to the RBCCW system from SSW during the first 10 minutes of the worst cause DBA LOCA, temperature within the RBCCW system remains within acceptable limits.

Based on these analyses, the adequacy of the SSW system to supply the required cooling to the RBCCW system during the first 10 minutes of the worst case design basis event is demonstrated, and its ability to perform its containment heat removal safety function after the first 10 minutes is retained. Therefore, the SSW system was considered operable and capable of performing it's safety function even if SSW loop isolation was not achieved during the first ten minutes of the limiting design basis event.

SIMILARITY TO PREVIOUS EVENTS

A review was conducted of LERs or 10 CFR Part 21 reports submitted since January 1984. The focus of the review was a problem(s) involving a single failure of a system(s) including the SSW system. The review identified a Part 21 report (RHR minimum flow single failure) that was submitted on May 23, 1986, and LER 86-021-01 (standby gas treatment system single failure) that was submitted on November 25, 1986. Neither of the LERs described single failure conditions reported as the result of UFSAR ambiguity.

ENERGY INDUSTRY IDENTIFICATION SYSTEM (EIIS) CODES

The EIIS codes for this report are:

COMPONENTS	CODES
Battery	BTRY
Pump	P
Valve	V
SYSTEMS	
Salt Service Water	BI
DC Power System - Class 1E	EJ