NRC FORM 366
(7-77)

U.S. NUCLEAR REGULATORY COMMISSION

UPDATE REPORT - SEPT. 16, 1981

LICENSEE EVENT REPORT

CONTROL BLOCK: ☐☐☐☐☐☐ ① (PLEASE PRINT OR TYPE ALL REQUIRED INFORMATION)

0 1 LICENSEE CODE: M A P P S 1 ② LICENSE NUMBER: 0 0 - 0 0 0 0 0 - 0 0 ③ LICENSE TYPE: 4 1 1 1 1 ④ CAT ⑤

CON'T 0 1 REPORT SOURCE: L ⑥ DOCKET NUMBER: 0 5 0 - 0 2 9 3 ⑦ EVENT DATE: 1 0 0 6 8 1 ⑧ REPORT DATE: 1 0 0 8 8 1 ⑨

EVENT DESCRIPTION AND PROBABLE CONSEQUENCES ⑩

0 2 On August 28, 1981, it was discovered that a bypass condition existed in the "B"
0 3 RBCCW Heat Exchanger. This condition was attributed to water erosion due to mussel
0 4 blockage induced high delta P. Subsequent analysis now shows that a deficiency
0 5 exists in the original design of the heat exchangers which may be a cause of lasting
0 6 deformation. This design deficiency may have safety implications for similar
0 7 facilities.
0 8

0 9 SYSTEM CODE: S B ⑪ CAUSE CODE: B ⑫ CAUSE SUBCODE: A ⑬ COMPONENT CODE: H T E X C H ⑭ COMP. SUBCODE: C ⑮ VALVE SUBCODE: Z ⑯

⑰ LER/RO REPORT NUMBER: EVENT YEAR: 8 1 — SEQUENTIAL REPORT NO.: 0 4 9 / OCCURRENCE CODE: 0 1 REPORT TYPE: T — REVISION NO.: 1

ACTION TAKEN: B ⑱ FUTURE ACTION: A ⑲ EFFECT ON PLANT: Z ⑳ SHUTDOWN METHOD: Z ㉑ HOURS ㉒: 0 0 0 0 ATTACHMENT SUBMITTED: Y ㉓ NPRD-4 FORM SUB.: Y ㉔ PRIME COMP. SUPPLIER: A ㉕ COMPONENT MANUFACTURER: A 2 7 0 ㉖

CAUSE DESCRIPTION AND CORRECTIVE ACTIONS ㉗

1 0 The identified design deficiency involves the pass partition plates, which were not
1 1 designed adequately for specified operating conditions leading to plate deformation
1 2 and excessive bypass. A long term corrective design change is currently being
1 3 implemented in the 1981 Refueling Outage. (See Attachment)
1 4

1 5 FACILITY STATUS: H ㉘ % POWER: 0 0 0 ㉙ OTHER STATUS ㉚: N.A. METHOD OF DISCOVERY: D ㉛ DISCOVERY DESCRIPTION ㉜: IE Information Notice 81-21

1 6 ACTIVITY RELEASED: Z ㉝ CONTENT OF RELEASE: Z ㉞ AMOUNT OF ACTIVITY ㉟: N.A. LOCATION OF RELEASE ㊱: N.A.

PERSONNEL EXPOSURES
1 7 NUMBER: 0 0 0 ㊲ TYPE: Z ㊳ DESCRIPTION ㊴: N.A.

PERSONNEL INJURIES
1 8 NUMBER: 0 0 0 ㊵ DESCRIPTION ㊶: N.A.

LOSS OF OR DAMAGE TO FACILITY ㊸
1 9 TYPE: Z ㊷ DESCRIPTION: N.A.

PUBLICITY
2 0 ISSUED: N ㊹ DESCRIPTION ㊺: N.A.

NRC USE ONLY

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PDR ADOCK 05000293
S PDR

NAME OF PREPARER: S. J. Harwood PHONE: 617-424-2723

GPO 917-926

BOSTON EDISON COMPANY
PILGRIM NUCLEAR POWER STATION
DOCKET NO. 50-293

Attachment A to LER 81-049/01T-1

Event Description

On August 28, 1981 while conducting an inspection of the "B" RBCCW heat exchanger (E209B), it was discovered that a water bypass condition existed which rendered the loop ineffective. "B" loop was declared inoperable, the conditions listed in T.S. 4.5.B.2 were initiated and a M.R. issued to correct the problem. Repairs were made, inspection and testing successfully completed and the loop declared operable on Sept. 3, 1981. The NRC was notified via ENS.

Cause and Corrective Action

The inspection, which was conducted in conjunction with IE Information Notice 81-21, revealed a possible generic problem caused by water erosion to the heat exchanger supplied in 1969 by Engineers and Fabricators Inc. This erosion appears to be a result of a high Delta P condition due to the mussel incursion described in circumstance 2 (Flow blockage by mussels) of IN 81-21 and a possible design deficiency of the 90/10 copper nickel baffle plates used in these heat exchangers. The inspection report for "B" Heat Exchanger listed the following conditions:

1. Upper and lower baffle plates deformed.
2. Existing "Liquid metal" on the baffle seating deteriorated to allow bypass flow.
3. End plate showed extensive erosion

NOTE: "A" Heat Exchanger also showed some plate deformation but minimal erosion.

Because of this erosion problem, the ORC directed this event to be reported as a potential generic problem under T.S. Section 6.9.B.1.i.

Repairs to the heat exchanger consisted of removing as much of the existing cold welding compound as necessary to ensure effective adhesion of the repair material, new metal set applied and baffle grooves machined.

While heat exchanger was being cleaned and before repairs made, a safety evaluation of the proposed repairs was conducted. This safety evaluation required acceptability tests at normal flow and at least one at design accident flow with subsequent visual inspection before "B" RBCCW heat exchanger could be declared operable. The corrective action also includes frequent backwashing and periodic inspection of the internal components. In addition, a design change is being prepared to be implemented during the scheduled 1981 Refueling Outage, in conjunction with a long term program to minimize the mussel fouling.

BOSTON EDISON COMPANY
PILGRIM NUCLEAR POWER STATION
DOCKET NO. 50-293

Attachment B to LER 81-049/01T-1

INTRODUCTION

Previous issuance of this Licensee Event Report identified that deterioration of the 'B' RBCCW heat exchanger as a potential generic problem. Subsequent investigation has revealed that a design deficiency may exist in the original configuration of the RBCCW heat exchangers which would contribute to the condition experienced and described in revision zero of this Licensee Event Report (Attachment A).

BACKGROUND

On 8/28/81, while conducting an inspection of RBCCW heat exchanger E209B, a water bypass condition was discovered that rendered the heat exchanger ineffective. Subsequently, the "B" loop was declared inoperable, and the referenced Licensee Event Report was issued. As described in the Licensee Event Report, the water bypass condition was attributed to heat exchanger water erosion and deformation, apparently caused by a "high Delta P condition due to mussel incursion". The heat exchanger has since been repaired, with corrective measures taken to ensure operability, as described in the referenced Licensee Event Report.

However, further analysis has shown that the heat exchanger design, in itself, may have been deficient from the point of manufacturing in other words, mussel-blockage induced erosion of the heat exchanger may not be the sole cause of the existing deformation.

DESCRIPTION OF DESIGN DEFICIENCY

The original Bechtel Technical Specification (#6498-M-11) for the RBCCW heat exchangers (E209A and B) specifies that the pass partition plates shall be designed in accordance with the Standards of Tubular Exchanger Manufacturers Association, Class "C" requirements. Specifically, TEMA Section C-8, 132 requires that "special consideration be given to thickness requirements for internal partitions subjected to pulsating fluids or to large differential pressures under specified operating conditions..." The Technical Specification further defines the operating conditions to which the partition plates would be subject, while the manufacturer's manual acknowledges the resulting pressure differentials under the given operating conditions and the corresponding design adequacy of the heat exchangers.

However, recent calculations have shown that the original heat exchanger design (supplied in 1969 by Engineers and Fabricators, Inc., of Houston, Texas) did not give adequate attention to the TEMA Section C-8, 132 requirements. Specifically, at the design operating pressure differential of 25 psi (12.5 psi per partition during emergency and fast shutdown modes), the partition plates would be overstressed in excess of material yield, with resulting permanent deformation. Also, at design operating pressures, excessive plate deformation would occur and could cause significant tube bypass, thereby preventing the heat exchangers from maintaining design conditions.

As discussed in the referenced Licensee Event Report, inspections have shown that permanent deformation and flow bypass have occurred; long-term corrective actions are currently in progress.

SAFETY IMPLICATIONS

The RBCCW heat exchanger design deficiency, already having contributed, in part, to the existing deformation, is believed to have the potential for causing major degradation of safety-related equipment. Furthermore, this condition has implications of potential major safety concern for other facilities employing similarly designed equipment under comparable operating conditions. Thus, Boston Edison believes that the identified design deficiency has the potential for creating a substantial safety hazard.

RECOMMENDATION

The identified design deficiency may not cause immediate danger to all licensees in this same situation. Boston Edison's experience indicates that the deformation develops over a number of years, and that such deformation becomes of potential concern only after several inspections. Thus, any deformation, including that possibly resulting from an original design deficiency, is most likely due to a combination of factors, including operating conditions, years of operation, maintenance, etc. In any event, the manufacturer of the RBCCW heat exchangers (E&F, Inc.) has been notified of our analysis demonstrating the design deficiency.

(Note that the above information also satisfies, to the extent known, the information required in submitting a 10CFR 21 evaluation.)