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 MANDATORY 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 required number of digits/characters for each block)

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TITLE (4)
Main Steam Safety Valve Pilot Valves Exceed Lift Setpoints

| EVENT DATE (5) | | | LER NUMBER (6) | | | REPORT DATE (7) | | | OTHER FACILITIES INVOLVED (8) | |
|---|---|---|---|---|---|---|---|---|---|---|
| MONTH | DAY | YEAR | YEAR | SEQUENTIAL NUMBER | REVISION | MONTH | DAY | YEAR | FACILITY NAME | DOCKET NUMBER |
| | | | | | | | | | | 05000 |
| 06 | 16 | 94 | 94 | - 015 - | 02 | 09 | 05 | 97 | FACILITY NAME | DOCKET NUMBER 0500 |

| OPERATING MODE (9) | 1 | THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11) | | | |
|---|---|---|---|---|---|
| | | 20.2201(b) | 20.2203(a)(2)(v) | [X] 50.73.(a)(2)(i) | 50.73(a)(2)(viii) |
| POWER LEVEL (10) | 100 | 20.2203(a)(1) | 20.2203(a)(3)(i) | 50.73(a)(2)(ii) | 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) | 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) |
|---|---|
| M. Fiala | (860)267-2556 |

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 |
|---|---|---|---|---|---|---|---|---|---|---|
| B | SB | RV | A415 | Y | | | | | | |
| | | | | | | | | | | |

| SUPPLEMENTAL REPORT EXPECTED (14) | | EXPECTED SUBMISSION | MONTH | DAY | YEAR |
|---|---|---|---|---|---|
| [ ] YES (If yes, complete EXPECTED SUBMISSION DATE). | [X] NO | | | | |


**ABSTRACT** (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On June 16, 1994, at 1000 hours, with the plant in Mode 1 at 100 percent power, while performing setpoint verification testing on the pilot valves associated with four main steam safety valves, it was determined that four pilot valves were outside of their allowable setpoint tolerance. Both pilot valves for main steam safety valve MS-SV-24 lifted at a setpoint which was higher than permitted by Technical Specification 3.7.1.1 resulting in MS-SV-24 being declared inoperable. The cause of this event has been attributed to seat adhesion resulting from similar materials being used for both the pilot disc and nozzle. Immediate corrective action was to readjust the setpoints. Long term corrective action consisted of evaluating the replacement of the pilots with new pilots with discs constructed from alternate materials. This supplemental report is being submitted to retract originally proposed corrective actions that are no longer required due to the Haddam Neck Plant being in a permanently defueled state.

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

## BACKGROUND INFORMATION

In July 1993, during the Cycle 17 refueling outage, four of the spring loaded safety valve (EIIS Code: RV) were replaced with pilot operated safety valves (PORV) with remote operation capability. These valves were installed as a means of enhancing the plant's capability to cool down by dumping steam from intact steam generators following a steam generator tube rupture. These valves are each equipped with two pilots, one of which was originally intended to be an installed spare. Due to the ongoing seat adhesion problems, both pilots have been placed on line as a way of improving valve reliability and availability. The self actuation function of the steam generator (EIIS Code: SB) PORV will actuate in response to the lower of the two pilot set pressures.

During testing in February, 1994, it became apparent that the pilots were experiencing seat adhesion problems which resulted in the pilots' inability to maintain their set pressure. Seat adhesion manifests itself by the first lift after a pilot has been sitting idle for a period of time being high and outside of set pressure tolerance with subsequent lifts being lower, and most often, within set pressure tolerance. Seat adhesion is believed to be less of a problem once the pilot is exposed to steam conditions and is then periodically cycled. It is believed that the corrosion related film which bonds the pilot disc closed does not reform as quickly once it is initially broken. In order to maintain the pilots operable, the pilots have been periodically exercised for the purpose of breaking any corrosion related bonds and verifying setpoint. The pilots are currently being exercised at monthly intervals.

During testing on May 19, 1994, three of the eight pilots tested failed to reseat completely. Although operable, these pilots were replaced with spares and were successfully exercised after one week in service (May 26,1994) to break any bonds which were initially formed.

On June 16, 1994, all eight pilots were again exercised. During this evolution, four of the eight pilots lifted above their maximum allowable set pressure on the first lift. In each case, the second lift was at a considerably lower pressure then the first lift, thereby confirming seat adhesion. A vendor representative was present during this evolution and, in his opinion, the fact that the pilots which lifted high did not simmer prior to popping was further indication of seat adhesion. Three of the pilots which did not lift within tolerance were those which were replaced on May 19, 1994 and subsequently exercised after one week of service.

Refer to LER 94-006-00 for additional background information.

## EVENT DESCRIPTION

On June 16, 1994, at 1000 hours, with the plant in Mode 1 at 100 percent power, while performing setpoint verification testing on the pilot valves associated with four main steam safety valves, it was determined that four pilot valves were outside of their allowable setpoint tolerance. Both pilot valves for main steam safety valve MS-SV-24 lifted at a setpoint which was higher than permitted by Technical Specification 3.7.1.1 resulting in MS-SV-24 being declared inoperable.

As described above, three of the four pilots which exhibited signs of seat adhesion were replaced one month prior to the June 16, 1994 test and were exercised three weeks prior to the test in order to break any adhesion bonds which initially formed as a result of exposure to the steam environment. The fourth pilot had been in service since startup from the Service Water outage in late February, 1994.

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A summary of the test data for the four pilots which did not meet their acceptance criteria for set pressure on the first lift (1034 psig ± 3%) is provided below:

| Pilot ID | Previous Test As-left Press. (psig) | Recent Test As-found Press. (6/16/94) | Second Lift |
|---|---|---|---|
| MS-V-1613-2A* | 1040 | 1100 | 1030 |
| MS-V-1613-3A* | 1040 | 1080 | 1065 |
| MS-V-1613-4A* | 1045 | 1175 | 1025 |
| MS-V-1613-2B# | 1025 | 1085 | 1005 |

*These valves were replaced on May 19,1994 and retested on May 26, 1994.

#This valve has been on line since the Service Water outage and was tested (sat.) on May 19, 1994.

CAUSE OF EVENT

The cause of the pilots sticking has been attributed to seat adhesion. The test data shows that the first lift, after an idle period, was high while the second lift was substantially lower. A vendor representative who was present for the test, confirmed the presence of adhesion since the pilots which lifted high did not simmer prior to opening.

In addition, three of the four pilots which lifted out of tolerance had been recently installed and exercised after one week of service time. The one week of service time prior to exercising these three pilots may have been insufficient for the formation of a significant corrosion film. Exercising of these pilots after a week may have been less than totally effective in reducing their potential for adhesion. The cause of adhesion in the fourth pilot after being in service for a number of months is believed to be continued interaction between the similar material of the nozzle and disc

SAFETY ASSESSMENT

This event is reportable under 10CFR50.73(a)(2)(i)(B) as a condition prohibited by the plant's Technical Specifications.

The limiting postulated scenario for secondary system overpressurization is a loss of load from 100 percent power with the main condenser unavailable. In this event, the self-actuated operation of the steam generator PORVs (MS-SV-14, 24, 34, and 44) (one per steam generator) is not required unless one of the 3 spring loaded main steam safety valves (3 per generator) fails to open. Technical Specification 3.7.7.1 requires that the 3 spring loaded safety valves have a lift setpoint pressure of 985, 1015, and 1025 psig, respectively, whereas, the PORVs have the highest lift setpoint pressure of 1034 psig. Therefore, from a system overprotection standpoint, the safety significance of this event is small.

The steam generator PORVs are used in the emergency operating procedure for steam generator tube rupture to rapidly cool down the reactor coolant system. In this accident scenario the PORV would be remotely actuated. The failure mechanism of the pilot valves does not affect the remote actuation, therefore, there is no safety significance in the steam generator tube rupture accident scenario.

Based on the above the overall safety significance to this event is minimal.

CORRECTIVE ACTION

Immediate corrective action consisted of readjusting the setpoints for pilot valves MS-V-1613-2B and MS-SV-1613-3A. The setpoints for MS-SV-1613-2A and 4A were satisfactory after the second lift and required no adjustment.

In order to provide recommendations on the on-line testing frequency of the pilot valves and seating area material changes, extensive testing of both the original material disk/nozzle combination and new disk/nozzle combinations has proceeded.

Through on-line testing, the original 17-4PH SS disk and nozzle combination has been concluded to be unsatisfactory due to a continued adhesion problem between the similar materials. Regular exercising of the pilot valves was not successful in preventing adhesion of the disc and nozzle.

Testing of alternate disc materials with the 17-4PH SS nozzle commenced on May 24,1994 on an in-house test stand. Eight new pilots were obtained from the vendor. Four of these pilots had discs which were fabricated from Inconel 718 while the other four had discs which were constructed from MP-35N, a cobalt based alloy. All eight of these valves were placed on a test stand in the Turbine Building. The test stand was connected to a high pressure steam source from non safety related main steam piping. The purpose of the test stand was to simulate, as closely as possible, the environment which the pilots would be exposed to when installed on the main steam PORVs. The two new disc materials (Inconel 718 and Cobalt MP-35N) both showed satisfactory results during test stand testing. No signs of seat adhesion were evidenced for a six week test interval.

With these encouraging results, the eight pilot valves with the new discs were placed in service (one pilot of each new material on each of the four Main Steam Safety Valves). Subsequent testing at the six week interval proved satisfactory and the test interval was expanded to quarterly. This is the current test interval.

Due to successful testing with the Inconel disk and its ease of machining, a decision was made to proceed with total disk changeout to Inconel 718. Upon downpowering for the next refueling, each of the four pilot valves were returned to the vendor for complete disassembly and inspection, pilot replacement, and setpoint verification on steam. A final decision on the testing frequency of the pilot valves was made after the last test prior to shutdown for refueling. A quarterly testing frequency was invoked upon start-up of the plant.

Information obtained through vendor testing revealed that with both pilot valves in the active position, pilot valve setpoints are unaffected. However, blowdown of the lifted pilot increased from 5-7 percent to approximately 27 percent. Since the Anderson-Greenwood safety valve would not be the first valve to lift during an overpressure transient, the safety significance of the increased blowdown was minimal. Due to this information, each safety valve was provided with only one active pilot valve through isolation via the Switchover Device. This is the original design configuration of the main valve.

Seating materials were matched (combinations of the Inconel 718 and Cobalt MP-35N) to allow continued test stand testing of the pilot valves. Material overlay on the disc was explored by the vendor. Testing will commence at the plant when these pilot valves are made available by the vendor. The power operated safety relief valves are Model Number 72712Q68/51 manufactured by Anderson Greenwood.

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## ADDITIONAL INFORMATION

Continued material improvement was pursued by Haddam Neck and the vendor. However as a result of the Haddam Neck Plant decommissioning and permanently defueled state the testing program was terminated.

## PREVIOUS SIMILAR EVENTS

LER 94-006-00 Main Steam Safety Valves Exceeded Lift Setpoint Criteria