

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMS NO. 3150-0194

EXPIRES 8/31/86

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| FACILITY NAME (1) | DOCKET NUMBER (2) | LER NUMBER (3) | | | PAGE (3) | | |
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Peach Bottom Atomic Power
Station - Unit 2

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

Description of the Events:

On August 12, 1985 at 1100 hours with Unit 2 at 100% power, the 'A' loop Residual Heat Removal (RHR) system outboard injection valve, MO-2-10-154A, was declared inoperable. The valve was found to have failed in the closed position during surveillance testing. This failure rendered the "A" loop of the Low Pressure Coolant Injection (LPCI) system unavailable through normal system flow paths.

At the time of this event, the E-3 diesel generator was out-of-service for its annual inspection. Technical Specification 3.5.F.1 allows continued reactor operation up to seven days with one diesel generator inoperable, provided that all of the low pressure core and containment cooling subsystems are operable. In accordance with Technical Specification 3.5.F.1, concurrent inoperability of a LPCI subsystem and a diesel generator requires Unit 2 to be in the cold shutdown condition within 24 hours. Therefore, after the discovery of the MO-2-10-154A valve inoperability, an orderly shutdown was commenced. Unit 2 attained cold shutdown at 0700 hours on August 13, 1984. After appropriate repairs were completed and the E-3 diesel generator was returned to service, Unit 2 returned to power operation at 1730 hours on August 14, 1985.

On August 19, 1985 at 1238 hours, with Unit 2 at 100% power, the MO-2-10-154A valve again failed to operate properly during a surveillance test. At the time of this event, the E-2 diesel generator was out-of-service for its annual inspection. In accordance with the Technical Specification, an orderly shutdown was commenced upon discovery of the MO-2-10-154A valve inoperability and Unit 2 attained cold shutdown at 0608 hours on August 20, 1985. After appropriate repairs were completed and the E-2 diesel generator was returned to service, Unit 2 returned to power operation at 1700 hours on August 25, 1985.

The EIIS code for the affected system is BO and for the affected component is INV.

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U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMS NO. 3150-0104

EXPIRES: 6/31/86

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Peach Bottom Atomic Power
Station - Unit 2

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TEXT (If more space is required, use additional NRC Form 366A (1))

Consequences of the Events:

As a result of each MO-2-10-154A valve failure, two subsystems of the LPCI system were unavailable for injection into the reactor vessel via the normal system flow paths. However, these two LPCI subsystems were available for injection into the reactor vessel via a cross-tie valve into the discharge of the remaining two operable LPCI subsystems. Therefore, adequate LPCI injection capacity was available and could have been maintained utilizing the cross-tie valve to mitigate the consequences of a loss-of-coolant accident. Additionally, both Core Spray systems were operable and available.

Cause of the Events:General:

It is believed at this time that the events of August 12, 1985 and August 19, 1985, although similar to the event of June 3, 1985 (LER 2-85-3), were caused by replacement parts which were not adequately compatible, whereas the June 3 event was the result of improper operation of the valve. Dimensional variations existed between the replacement yoke, nuts and locknuts, purchased from the valve manufacturer, and those on the valve prior to the June 3 failure. Arrangements have been made for an independent laboratory to measure these parts.

Background:Operator/Valve Interface Description

The MO-2-10-154A valve is a 24" pressure seal right angle globe valve manufactured by the Walworth Company. It is operated with a Limitorque motor operator (Model SMB-5T-350). An assembly consisting of a yoke nut, locknut, and two sets of roller bearings was designed by Walworth Company to be fitted to the valve yoke. The term yoke nut, in this case, is what is normally called a stem nut on Limitorque motor operators. The yoke nut is keyed to the Limitorque torque drive sleeve enabling conversion of the motor operator torque output to valve stem thrust. The valve is installed with the

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U.S. NUCLEAR REGULATORY COMMISSION

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Peach Bottom Atomic Power
Station - Unit 2

0 8 0 0 0 2 7 7 8 5 - 0 1 3 - 0 0 0 4 OF 0 9

TEXT (if more space is required, use additional NRC Form 365a (17))

valve stem threaded through the yoke nut in a vertical orientation (See Attachment 2).

The lower roller bearing operates between a shoulder in the underside of the valve yoke and a bearing support plate that rests on a protruding rim at the base of the yoke nut. These components of the thrust assembly are under load during valve closing.

The upper roller bearing operates between a shoulder in the topside of the valve yoke and locknut which is threaded onto the yoke nut. The locknut is provided with two setscrews, located 90 degrees apart in the locknut, which are tightened against the yoke nut external threads to prevent its rotation on the yoke nut. These components of the thrust assembly are under load during valve opening.

O-rings installed in the lower bearing support plate and locknut are in continuous contact with these components' respective bores in the valve yoke. The O-rings provide a dynamic seal preventing the entry of dirt to, and the exit of grease from the thrust assembly.

The yoke nut has an internal triple-lead, left-hand acme thread which mates to the threading on the valve stem. The external yoke nut threading which mates with the locknut is right-hand with twelve threads per inch. When the yoke nut is rotated counter-clockwise (top view) the valve stem rises, opening the valve.

Details of Failures:August 12, 1985 Event

When the Limitorque operator was removed from the valve yoke on August 13, 1985, the locknut was observed to be disengaged from the external yoke nut thread. The yoke nut was found to have rotated down the valve stem until the yoke nut drive key had jammed between the top of its slot in the yoke nut and the top surface of the locknut. This prevented further rotation of the yoke nut and the valve from being opened.

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U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMS NO. 3150-8104
EXPIRES: 8/31/86

FACILITY NAME (1)

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Peach Bottom Atomic Power
Station - Unit 2

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YEAR SEQUENTIAL
8 5 - 0 1 3 - 0 0

0 5 OF 0 9

TEXT (If more space is required, use additional NRC Form 266a (17))

It was observed that the locknut had been deformed such that the bottom shoulder of the O-ring recess had been bent upward along approximately 45 degrees of the locknut outer circumference. This was the result of non-uniform load distribution between the locknut and the upper surface of the upper bearing inner race. Locknut deformation caused by the yoke nut key extended over the inner circumference of the upper face over a 90 degree section. The greatest depth of key-caused damage was at the innermost diameter and on the same side of the locknut as the O-ring shoulder damage. The pinching effect caused the locknut to become dished upward over approximately 120 degrees of its perimeter. There was no observed damage to the locknut threads other than the distortion caused by the yoke nut key. It has been concluded from the described damages that the locknut had become cocked in the yoke bore after disengaging from the yoke nut external threading.

Upon further disassembly, the upper bearing cone was found to be fractured. A crack through the inner race was terminated at one end with a small 'V'-shaped chip (approximately 1/16" wide and 1/16" deep) at the upper surface outer circumference of the race. At the other end of the crack, a large chip (approximately 1" wide and 1/2" deep) was removed from the lower inside diameter of the race. It is believed that this damage was caused by high localized forces attributed to the locknut becoming cocked. The upper bearing cup and lower roller bearing assembly were undamaged.

Damage to the yoke nut key was minimal and it was determined that the key could be reused after removal of the burrs.

No damage to the yoke nut was detected.

August 19, 1985 Event:

Details of this event are similar to those details given for the August 12, 1985 event. The major differences are reported below.

Both yoke nut and locknut threads were rolled over at the thread crests. This is indicative of minor thread stripping as a result of an incomplete thread mesh between the yoke nut and locknut.

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U.S. NUCLEAR REGULATORY COMMISSION
APPROVED ONS NO. 3186-0184
EXPIRES 8/31/85

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| Peach Bottom Atomic Power Station - Unit 2 | 0 5 0 0 0 2 7 7 | 8 5 | 0 1 3 | 0 0 | 0 6 | OF 0 9 |

TEXT (If more space is required, use additional NRC Form 266a (17))

The yoke nut external threading had two areas where the threads were completely removed by the locknut setscrews. These areas were in the shape of an inverted 'T' with its bottom approximately 4"-5" in length and parallel with the yoke nut external threading. The vertical portion of the inverted 'T' was perpendicular to the yoke nut external threading. These markings, made by the setscrews, indicate that the locknut had rotated back and forth before it was stripped up and off of the yoke nut threading.

The yoke nut key and key slot exhibited considerable deformation as a result of the key having been jammed between the top of its slot and the locknut.

The upper roller bearing cone was cracked in a fashion similar to that of the August 12 event, except that the chip on the lower inside diameter of the race was larger (approximately 3 5/8" wide and 1" deep).

Corrective Actions:

The thrust assembly was rebuilt with new parts from the storeroom after the August 12, 1985 event. The yoke nut and key were the only components reused. Following repairs, the valve was tested satisfactorily on August 16, 1985. Testing included checking outgoing interlocks, valve stroke times and a local leak rate test.

After the August 19, 1985 event, the thrust assembly was rebuilt in accordance with written work instructions. However, neither a yoke nut key nor a properly fitting locknut were available from the storeroom. During a mock fit-up of the remaining yoke nut and locknut from the storeroom, the locknut slipped loosely over the yoke nut threads rendering the locknut unusable. In addition, a critical dimension of the yoke nut (the distance between the rim on which the lower bearing support plate is supported and the yoke nut external threading) was measured. The measured distance was larger than the same measurement for the previously failed yoke nuts and was larger than the dimension indicated on the manufacturer's yoke nut machine drawing. The yoke nut key slot was also observed to be shorter in length with a different end configuration than shown on the yoke nut drawing. Measurements of the valve yoke upper and lower shoulder depths resulted in dimensional variations from those obtained from the valve manufacturer representative.

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U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES 8/31/95

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| Peach Bottom Atomic Power Station - Unit 2 | 0 8 0 0 0 2 7 7 8 5 | - 0 | 1 3 | - 0 0 | 0 7 | OF | 0 9 |

TEXT (if more space is required, use additional NRC Form 366A (17))

To use the remaining spare yoke nut and compensate for the critical dimensional variations, a representative from Alloyco, Inc. (the current N-stamp holder for Walworth Co.) recommended manufacturing a locknut of increased thickness to provide the necessary constant contact between the load bearing surfaces of the thrust assembly while maintaining the full 1.5" of thread engagement with the yoke nut.

Because the material specified by the valve manufacturer (AISI-1015) was not available, an alternate (ASME SA-515, Gr. 70) was suggested to Alloyco, Inc. It was available in the necessary thickness at PECO Stores and was purchased under the Nuclear Quality Assurance Program. Alloyco, Inc. considered ASME SA-515, Gr. 70 acceptable, assuming the yield strength was a minimum of 45 KSI, for use in machining both the new locknut and yoke nut key. The Certified Material Test Report for the 2" x 48" x 96" plate of ASME SA-515, Gr. 70 from which the locknut and key were machined listed a yield strength of 49.5 KSI and tensile strength of 82.3 KSI.

The on-site Alloyco, Inc. representative provided a sketch for machining the new yoke nut key. This sketch compensated for the differences in key slot length and slot end configuration of the new yoke nut. The sketch was reviewed by a PECO Maintenance Division engineer and a Mechanical Engineering Division engineer on-site. A sketch for machining the new locknut was provided by the on-site PECO Mechanical Engineering Division engineer. This sketch was based on the original Walworth Co. design for the locknut with the changes required to account for dimensional variations of the yoke nut. A fit-up measurement was made in order to determine the necessary thickness of the new locknut to maintain the required 1.5" of thread engagement with the yoke nut external threading. The measurement was performed with all available new thrust assembly components installed in the valve yoke. The necessary increase in thickness (the distance between the upper roller bearing backface and the bottom of the yoke nut threads) was measured to be 13/32". A counterbore was provided in the underside of the locknut to assure clearance over the yoke nut section immediately below the threads.

To provide an accurate thread fit between the locknut and yoke nut, the machinist measured the yoke nut thread major diameter using a micrometer. The pre-threading bore diameter of the locknut was then machined to obtain a Class 2A fit which should assure a 90% thread engagement with the yoke nut external threading.

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U.S. NUCLEAR REGULATORY COMMISSION

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| FACILITY NAME (1) Peach Bottom Atomic Power Station - Unit 2 | DOCKET NUMBER (2) 0 8 0 0 0 2 1 7 7 | LER NUMBER (6) | | | PAGE (3) | | |
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TEXT (if more space is required, use additional NRC Form 304A (17))

After application of the proper pre-load on the thrust assembly as recommended by Timken Co., self-locking setscrews were inserted through the locknut after application of "Lok tite" and properly tightened.

After complete reassembly in accordance with written work instructions, the valve was successfully tested and returned to service on August 25, 1985.

Representatives of the Mechanical Engineering Division of Philadelphia Electric Company participated in the most recent investigation of the problem and recommended and/or concurred with all corrective steps taken. They are satisfied that valve MO-2-10-154A will now perform its design function without further malfunction.

The motor brake was replaced following each event. After the first event, it was noted that the stationary metal discs of the brake were damaged by excessive heat. It is believed that binding of the valve yoke assembly occurred first and caused the motor to operate at excessively high currents. This overload condition would have reduced the voltage at the brake coils. Insufficient voltage to the coils would have allowed the brake to engage while stroking the valve. It is believed that this caused the overheating of the discs.

After the second event, it was noted that insulation had worn off of one of the three coil leads. There was no sign, however, that the bare lead had come in contact with any metallic parts and shorted to ground. The insulation had apparently worn off from coming in contact with moving parts within the brake assembly. In both events, however, the brake did not contribute to the failure of the valve to open.

Maintenance procedures for repairing Walworth valves will be reviewed. A precautionary step will be included requiring that Maintenance Engineering verify by inspection the dimensional compatibility of replacement parts purchased from the manufacturer, and existing parts to be reused. We expect these revisions to be complete by April 30, 1986.

At the time of these failures, an approved specific procedure for repairing this model valve did not exist. Such procedures did exist for repairing Limitorque operators. Preparation of detailed procedures for repairing this model valve is in progress. This procedure will include a dimensional verification step as described above. We expect these procedures to be approved by the Plant Operations Review Committee (PORC) by December 1, 1985. However, in the

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TEXT (if more space is required, use additional NRC Form 360A (17))

event of a failure of this valve model before these procedures are approved, emergency maintenance procedures could be approved by the PORC concurrently with repair work in accordance with Administrative Procedure A-19.

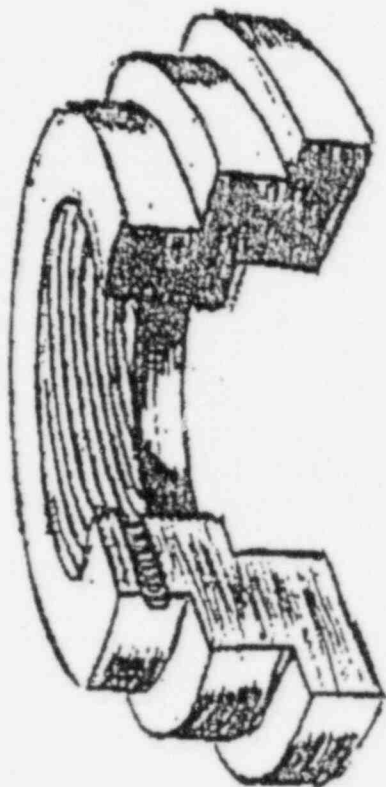
An investigation will be performed on the parts supplier for this model valve to determine what controls are necessary to ensure the procurement of proper replacement parts.

Previous Similar Occurrences

Similar failures were reported in LERs 2-85-03 and 3-78-22/3L-0 for Peach Bottom Atomic Power Station.

LOCK NUT

LER 2-85-13
Attachment 1



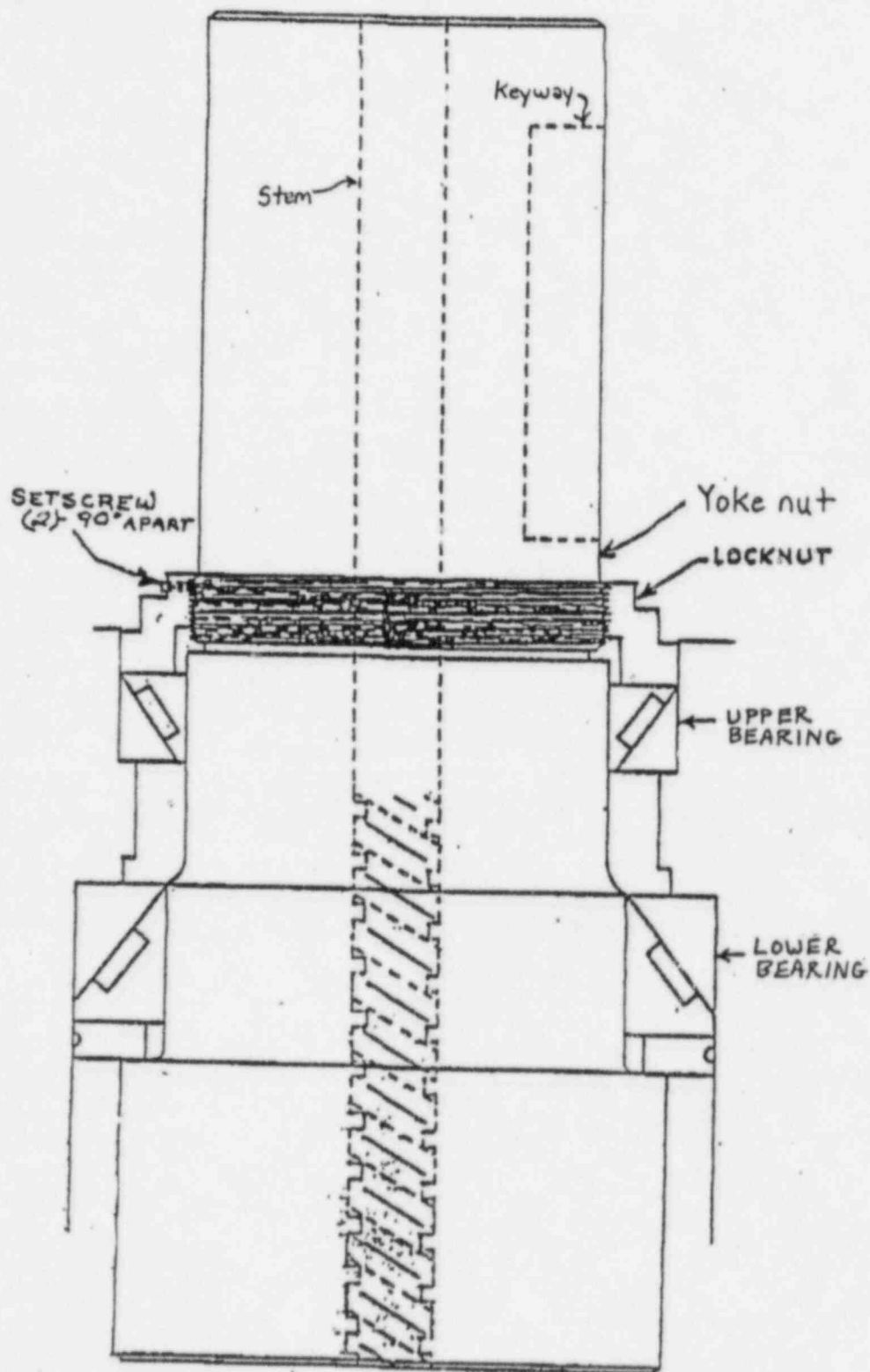
LOCK NUT



Not to scale

YOKE NUT AND THRUST ASSEMBLY

LER 2-85-13
Attachment 2



Not to scale

PHILADELPHIA ELECTRIC COMPANY

2301 MARKET STREET

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PHILADELPHIA, PA. 19101

(215) 841-4000

October 7, 1985

Docket No. 50-277

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Washington, DC 20555

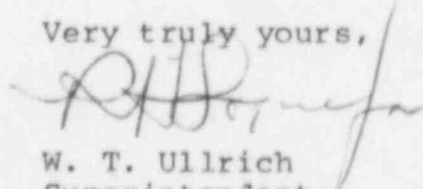
SUBJECT: Licensee Event Report
Peach Bottom Atomic Power Station - Unit 2

This LER concerns two separate events involving the failure of the 'A' loop residual heat removal system outboard injection valve MO-2-10-154A.

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|------------------|---------------------------------------------------------------------|
| Reference: | Docket No. 50-277 |
| Report Number: | 2-85-13 |
| Revision Number: | 00 |
| Event Dates: | August 12, 1985; August 19, 1985 |
| Report Date: | October 7, 1985 |
| Facility: | Peach Bottom Atomic Power Station RD 1, Box 208, Delta, PA 17314 |

This LER is being submitted pursuant to the requirements of 10 CFR 50.73(a)(2)(i) and 10 CFR 50.73(a)(2)(vii). The delay in the submittal of this LER is a result of the extensive compilation of information necessary to make this LER complete and accurate. We regret any inconvenience that this delay may have caused.

Very truly yours,



W. T. Ullrich
Superintendent
Nuclear Generation Division

cc: Dr. Thomas E. Murley, Administrator, Region I, USNRC
T. P. Johnson, NRC Resident Inspector

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