11/25 13:17   7203010 #03

PREVIOUS REPORT - November 21, 1983

NRC FORM 366 (12-81) 10 CFR 50

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT

APPROVED BY OMB 3150-0011

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

0 1 | A L B R F 3 (2) | 0 0 - 0 0 0 0 0 - 0 0 (3) | 4 1 1 1 1 (4) | (5)

LICENSEE CODE | LICENSE NUMBER | LICENSE TYPE | CAT

CON'T 0 1 | REPORT SOURCE L (6) | 0 5 0 0 0 2 9 6 (7) | 0 4 1 1 8 3 (8) | 1 1 2 5 8 3 (9)

DOCKET NUMBER | EVENT DATE | REPORT DATE

EVENT DESCRIPTION AND PROBABLE CONSEQUENCES (10)

0 2 During normal operation on unit 3, while attempting to establish the EECW
0 3 flow rate to the 3 ED Emergency Diesel Generator Coolers following a modi-
0 4 fication, a head on the heat exchanger was found to be cracked. The
0 5 generator was rendered inoperable and unit 3 placed in an LCO (T.S. 3.9.B.2).
0 6 Redundant systems were proven operable. There was no danger to the health
0 7 and safety of the public.
0 8

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

(17) LER/RO REPORT NUMBER	EVENT YEAR		SEQUENTIAL REPORT NO.		OCCURRENCE CODE	REPORT TYPE		REVISION NO.
	8 3	—	0 2 6	/	0 3	X	—	4

ACTION TAKEN	FUTURE ACTION	EFFECT ON PLANT	SHUTDOWN METHOD	HOURS (22)	ATTACHMENT SUBMITTED	NPRD-4 FORM SUB.	PRIME COMP. SUPPLIER	COMPONENT MANUFACTURER (26)
B (18)	A (19)	Z (20)	Z (21)	0 0 0 0	Y (23)	Y (24)	L (25)	Y 0 2 1

CAUSE DESCRIPTION AND CORRECTIVE ACTIONS (27)

1 0 A Young Radiator Company heat exchanger head was found to have an apparent
1 1 manufacturing defect which became apparent due to in-service stresses. The
1 2 cast iron head was replaced on May 25, 1983 with a newly fabricated head,
1 3 tested, and the diesel generator was returned to service. This was a random
1 4 occurrence and no further action is required.

1 5 FACILITY STATUS E (28) | % POWER 0 9 9 (29) | OTHER STATUS (30) NA | METHOD OF DISCOVERY A (31) | DISCOVERY DESCRIPTION (32) Operator Observation

1 6 ACTIVITY RELEASED Z (33) | CONTENT OF RELEASE Z (34) | AMOUNT OF ACTIVITY (35) NA | LOCATION OF RELEASE (36) NA

1 7 PERSONNEL EXPOSURES NUMBER 0 0 0 (37) | TYPE Z (38) | DESCRIPTION (39) NA

1 8 PERSONNEL INJURIES NUMBER 0 0 0 (40) | DESCRIPTION (41) NA

8312080111 831125
PDR ADOCK 05000296
S PDR

1 9 LOSS OF OR DAMAGE TO FACILITY TYPE Z (42) | DESCRIPTION (43) NA

IE22

2 0 PUBLICITY ISSUED N (44) | DESCRIPTION (45) NA

NRC USE ONLY

205/729-0885

Tennessee Valley Authority
Browns Ferry Nuclear Plant

Form BF 17
BF 15.2
2/19/82

LER SUPPLEMENTAL INFORMATION

BFRO-50- 296 / 83026R4 Technical Specification Involved 3.9.B.2

Reported Under Technical Specification 6.7.2.b(2) * Date Due NRC

Event Narrative:
Units 1, 2, and 3 were operating at 81-percent power, 85-percent power and 99-percent power respectively. Only unit 3 was affected by this event. After performing modification work on the 3 ED Emergency Diesel-Generator Cooler, one of the heat exchanger heads was found to be cracked, apparently due to a manufacturing defect, when the flow rate to the EECW cooler was established. The generator was declared inoperable and unit 3 was placed in an LCO (Technical Specification 3.9.B.2).

The cast iron head was replaced on May 25, 1983 with a newly fabricated head, tested, and the diesel-generator returned to service. This was a random occurrence and no further action is required.

Redundant and backup systems were proven operable. There was no danger to the health and safety of the public.

TVA has performed a design analysis on the diesel generator cooler heat exchanger shell flanges, tube sheet, and tubes. The calculations indicate that the rated pressures of these are 180, 190, and 1200 psig respectively. All of these pressures are above the normal system operating pressure range of 80 - 120 psig and the maximum actual pressure obtained during an accident (135 psig; 2 EECW pumps starting on each header).

Section XI hydrostatic tests have been performed on the EECW side of these coolers, which includes the bonnet and bonnet flanges. Unit 1 and 2 diesel coolers were tested in February 1980 and unit 3 diesel coolers were tested in November 1978. Test pressures ranged from 142 - 168 psig. This is 118 - 140% above the maximum normal system operating pressure (120 psig) and 105 - 124% of the EECW accident pressure (135 psig). Modification to all 16 of the diesel-generator engine coolers will be complete by August 1984 to assure operation pressure of the diesel-generator engine coolers is below 75 psig.

Based on these design calculations and hydrostatic test data, there is no immediate operating concern. A detailed report and analysis is attached.

* Previous Similar Events:

None

Retention: Period - Lifetime; Responsibility - Document Control Supervisor

*Revision: JRP

(LER ALBRF 50-296/83026)

DETAILED REPORT AND ANALYSIS

The diesel generator engine cooler heat exchangers have been manufactured by Young Radiator Company to company standards for 75 psig design pressure. However, the Tennessee Valley Authority's Division of Engineering Design has performed calculations on the tubes, tube sheet, and shell flanges using calculation procedures established by ASME Section VIII or Tubular Exchange Manufacturer Association (TEMA) and a comparison of bonnet and bonnet flange assembly (head) to AWWA fittings. These calculations and comparisons are attached. The dimensions and material of all parts subject to cooling water pressure have been compared to ANSI and TEMA standards for similar components in water service. In addition, the heat exchanger bonnets (heads) are cast iron. Cast iron does not exhibit fatigue failure which is the type of failure that would occur with repeated overpressurization.

The diesel generator engine cooler heat exchangers have been in service for 10-years. During these 10-years, the heat exchangers have operated at EECW pressures of 80-120 psig (normally in the upper part of the range, 100-120 psig). These pressures are obtained with one pump on each main EECW header. During tests with two pumps on each header, the maximum pressure was found to be 135 psig. The four pump pressure, two pumps per header, is the maximum operating pressure the EECW system will see since there are only four EECW pumps that would start from an accident signal to the diesel generators. The EECW flow to each EECW system component is set by manual throttle valves which are locked in after being set for the required flow.

Both the unit 1 and 2 (south header performed 1980) and unit 3 (both headers performed 1978) diesel generator engine cooler heat exchangers were hydrostatically pressure tested by procedures written to requirements of Section XI of the ASME Boiler and Pressure Vessel Code. In accordance with these procedures, the EECW system is divided into six sections (two sections per unit) and each of these section is individually hydrostatically tested. The two sections on unit 1 and the two sections on unit 3 contain the diesel generator engine coolers. To test each of these sections, the section under test is isolated from the rest of the EECW system by closing the appropriate EECW main header sectionalizing valve and isolating each EECW component using its outlet isolation valve. Included in each of the unit 1 and unit 3 section's components are two diesel generator engine coolers. After isolation, both EECW pumps assigned to that header, plus one pump assigned to the other header, are started if they are not already running. The EECW pressures established during the unit 1 and unit 3 hydrostatic tests were 142-168 psig.

There has been only one failure associated with the diesel generator engine coolers. The bonnet (head) on one heat exchanger failed during reassembly due to bolt-up stress and a possible manufacturing defect. It was detected immediately after the heat exchanger was placed back in service after modifications to the connecting EECW piping. There have been no failures on any of the 16 heat exchangers due to overpressurization.

From the calculations, comparisons to industry standards, and operating experience, it is evident that the diesel generator engine cooler heat exchangers can operate at the normal and accident pressure without degradation. However, to ensure the satisfactory long-term operation of the heat exchangers, throttle valves will be installed in the inlet piping of each set of heat exchangers (two heat exchangers arranged in series in each diesel generator engine cooler). These throttle valves will be used to set the EECW pressure to each heat exchanger at levels that are calculated to be below the manufacturers design pressure of 75 psig. The schedule for completion of this modification is to have all eight diesel generator engine coolers complete by August 1984. The diesel generators are and will continue to be visually checked each day as documented in operating instructions until the modification is complete.

T A B L E

DIESEL GENERATOR	4-28-83 1 Pump per Header psig North Header	4-28-83 1 Pump per Header psig South Header	4-1-83 2 Pumps per Header psig North Header	4-1-83 2 Pumps per Header psig South Header	4-1-83 1 Pump per Header psig North Hader	4-1-83 1 Pump per Header psig South Header	Unit 1-1980 Unit 3-1978 Hydrostatic Test psig
1A	97	97	124	125	93	93	Scheduled for later date
1B	100	100	126	125	94	93	142
1C	101	100	125	124	92	92	Scheduled for later date
1D	98	98	123	124	92	89	142
3A	100	100	128	129	98	91	145
3B	101	102	129	130	100	100	168
3C	100	100	128	131	101	100	145
3D	100	100	128	129	100	98	168
NORTH HEADER							
Unit 1	99		129		93		N/A
Unit 3	98		127		94		145
SOUTH HEADER							
Unit 1	105		134		98		142
Unit 3	106		135		101		168

ATTACHMENT

Purpose - To evaluate the fitness for service of the coolers. Their nameplate pressure rating was 75 psig. The raw cooling water system pressure on the tube side was greater than 75 psig.

Method - The actual dimensions and materials in the cooler were compared to dimensions of standard pressure parts where applicable or calculations were performed where necessary to evaluate the cooler's pressure retaining capability against the raw cooling water pressure.

Details - Browns Ferry Nuclear Plant personnel provided the information requested on the attached sketch of a cooler. The outline drawing and data sheet for the coolers provided overall dimensions, piping connection sizes and tubing information.

On the tube side of the coolers, the tubes, tubesheet, flanges, and bonnets were evaluated.

a. Flanges

(1) Shell flanges were compared to ANSI steel flanges, 12-inch NPS, Class 150, low strength carbon steel.

ANSI Flange Pressure Rating - 215 psi

ANSI Flange Thickness - 1-1/4 inch

Cooler Flange thickness - 1-1/16 inch

$$\frac{t_{(ANSI)}}{t_{(Cooler)}} = \frac{P_{(ANSI)}}{P_{(Cooler)}}$$

P (Cooler) - approximately equal to 180 psi

The cooler flange had 24 bolts, 5/8-inch diameter, the ANSI flange requires 12 bolts, 7/8-inch diameter - The 24 smaller bolts were judged sufficient.

b. Bonnet Flanges to Shell and Bonnet (Head Assembly)

(1) Bonnet Flanges to Shell

Bonnet flanges were 1-inch thick. ASME and American Water Works Association (AWWA) flanges with 165 or 150 psi ratings require 1-1/4-inch flanges with 12 or 8 bolts. These flanges had 24 bolts and full face gaskets. 4/5 of 165 approximately equal to 130 psi.

(2) Bonnets

All pressure boundary dimensions of both bonnets were at least as thick as required for AWWA, 12 inch, 150 psi rated piping. The radius area of the inlet/outlet bonnet was thickened and present no concern.

c. Tubesheet - The tubesheet was assumed to be an unstayed flat head with ligament efficiency of 0.5. No staying effect of tubes was included.

$$t = d\sqrt{CP/SE}$$

$t = 7/8$ $\quad E = 0.5$

$d = 13$ $\quad S = 12{,}500 \times 1.5$

$$P = t^2 SE/d^2C$$

$$P = 140 \text{ psi}$$

Later calculations in accordance with TEMA showed a maximum design pressure of 190 psi.

d. Tube

Admirality - 3/8 inch X 23 BWG

Allowable stress = 10,000 psi

$t = .0226$

$$P = 2 SET_m/Do$$

$$P = 1200 \text{ psi}$$

Conclusions

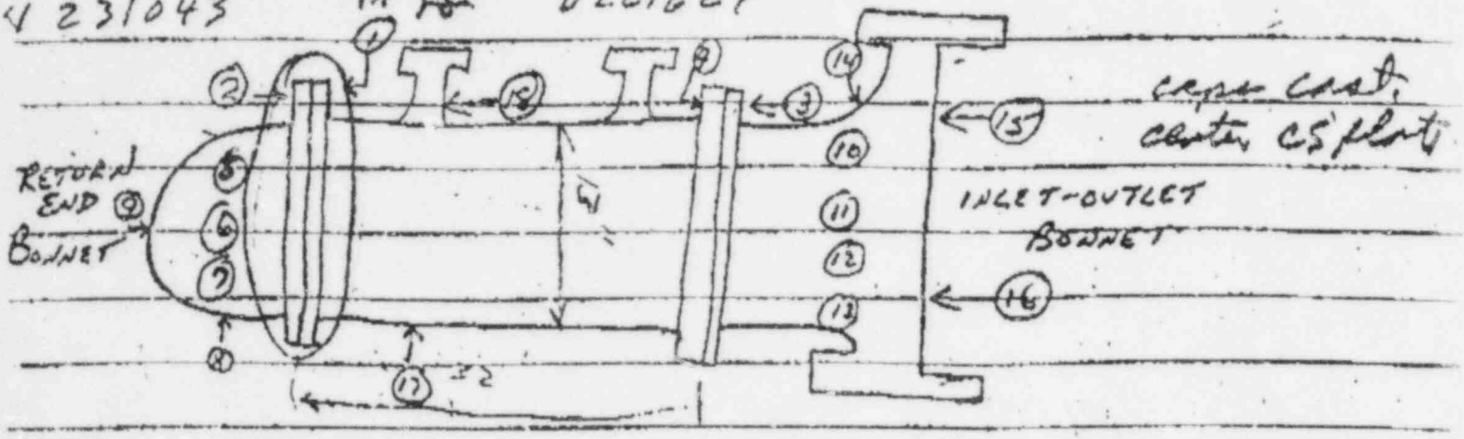
Component	Calculated Pressures	Max. Press. Seen During Section XI Hydro
1. Shell Flanges	180	168" psig
2. Head Assembly		168" psig
a. Bonnet Flanges	130	
b. Bonnets	150	
3. Tubesheet	190	168" psig
4. Tubes	1200	168" psig

DIESEL GENERATOR COOLING WATER COOLERS

COPY INFORMATION OFF NAMEPLATE shell/tube 75-PSI

model no. XF-1303-TR-2R 350°F.

4 231043 1st no. D227627



COPY ANY INFORMATION STAMED OR CAST IN

a) RETURN END BONNET

YOUNG. EXP. CO. RHEINE W. D242.100
D70824

b) INLET-OUTLET END BONNET

Y. R. CO. D70825

) THICKNESS (DIAMETER OK) (EXACT LOCATION NOT CRITICAL FLANGE THICKNESS SHOULD BE ON FLA

(1)	1.125	(5)	.55	(13)	.520
(2)	1.00"	(8)	.59	14	.725
(3)	1.00"	(9)	.58	15	.48
(4)	1.065	(10)	.610	16	.47
(6)	.605	(11)	.520	17	.125
(6)	.59	(12)	.445	(18)	.275

Bolt- upper 8 bolts 3/4" cap sq. (18)

"D" ends 24 bolts/end 7/8" dia

Bonnet Hg. 8 bolts 5/8 dia

WALT JOEST

615-694-0764

TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE 37401
1750 Chestnut Street Tower II

83 NOV 30 A7:22

November 25, 1983

Mr. James P. O'Reilly, Director
U.S. Nuclear Regulatory Commission
Suite 2900
101 Marietta Street, NW.
Atlanta, Georgia 30303

Dear Mr. O'Reilly:

TENNESSEE VALLEY AUTHORITY - BROWNS FERRY NUCLEAR PLANT UNIT 3 - DOCKET NO. 50-296 - FACILITY OPERATING LICENSE DPR-68 - REPORTABLE OCCURRENCE REPORT BFRO-50-296/83026 - REVISION 4

The enclosed report is a supplement to my letters to you dated May 9, 1983; June 16, 1983; November 18, 1983; and November 21, 1983, concerning a defective heat exchanger head on the 3 ED emergency diesel-generator coolers. This report is submitted in accordance with Browns Ferry unit 3 Technical Specification 6.7.2.b(2).

Very truly yours,

TENNESSEE VALLEY AUTHORITY

Helbert Abercrombie

H. J. Green
Director of Nuclear Power

Enclosure
cc (Enclosure):
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Washington, D.C. 20555

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