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RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 91-009-00:on 910816,overtemperature delta temp channels discovered inoperable.Caused by summator module lag constants.Unit shutdown initiated w/reactor being made subcritical.W/910916 ltr.

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H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261
LICENSE NO. DPR-23
LICENSEE EVENT REPORT 91-009

Gentlemen:

The enclosed Licensee Event Report (LER) is submitted in accordance with 10 CFR 50.73 and NUREG-1022 including Supplements No. 1 and 2.

Very truly yours,

Ray H. Chambers

R. H. Chambers
Plant General Manager
H. B. Robinson S. E. Plant

CTB:rks

Enclosure

cc: Mr. S. D. Ebneter
Mr. L. W. Garner
INPO

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NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

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TITLE (4)

OVERTEMPERATURE DELTA TEMPERATURE CHANNELS INOPERABLE DUE TO SUMMATOR MODULE LAG CONSTANTS

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 NAMES	DOCKET NUMBER(S)
										0 5 0 0 0
0 8	1 6	9 1	9 1	— 0 0 9	— 0 0	0 9	1 6	9 1		0 5 0 0 0

OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
N		20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
POWER LEVEL (10)		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
1 0 0		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	X 50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	X 50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
	AREA CODE
C. T. Baucom - Senior Specialist	8 0 3 — 3 8 3 - 1 2 5 3

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

CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS	

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
X YES (If yes, complete EXPECTED SUBMISSION DATE)	NO		1 1	3 0	9 1

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

In August of 1991, an on-going analysis and review was in progress regarding delay times and lag constants associated with Overtemperature Delta Temperature (OTΔT) instrumentation and circuitry. The overall response time of reactor coolant system hot and cold leg temperature instrumentation and circuitry was revised by a 1988 modification. However, certain summator modules within this circuitry contained capacitors (lag circuits) that were not consistent with the values assumed within the accident analyses. The three OTΔT channels were declared inoperable at 1200 hours on August 16, 1991 and Technical Specification 3.0 was entered. Since repairs could not be completed within eight hours as required by the Technical Specifications, a unit shutdown was initiated at 1345 hours, with the reactor being made subcritical at 1845 hours. The capacitors were removed and the OTΔT channels were declared operable at 0630 hours on August 18, with the unit being placed on line at 1432 hours. An investigation is in progress to determine the causal factors that resulted in the failure to identify the impact of these lag circuits during development and review of the 1988 modification. This review will also establish appropriate corrective actions to address identified causal factors. Pending completion of this investigative effort, a Supplement to this Licensee Event Report will be submitted.

NRC Form 366A (9-83)

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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

I. Description of Event

In August of 1991, H. B. Robinson Unit No. 2 (HBR2) was operating at steady-state conditions with reactor power at 100%.[1] An on-going analysis and review was in progress regarding delay times and lag constants associated with Overtemperature Delta Temperature (OTΔT) instrumentation and circuitry. During the course of this review, it was determined that certain summator modules within reactor coolant system (RCS) hot leg temperature instrumentation circuitry contained lag times that were not considered in the assumed channel response time, and were not consistent with values assumed within the accident analyses.

The overall system and channel response time was revised by a 1988 Refueling Outage modification that removed the RCS Resistance Temperature Detector (RTD) bypass manifold piping. This modification, MOD-959, "RCS Bypass RTDs", replaced direct-immersion RTDs with thermowell-mounted RTDs, and modified instrumentation and circuitry associated with the measurement and processing of RCS hot and cold leg temperatures. The modified system had a different response time from the previously installed system, which necessitated reanalysis of OTΔT trip events. This reanalysis only considered the following delay times and lag constants:

1. Thermal lag representing both thermal transport through the thermowell and RTD response time. 4.0 seconds

2. Electronics delay representing electronic signal processing, trip breaker operation, and control rod drive gripper release. 0.75 seconds

RCS delta temperature (ΔT) and average temperature (TAVG) summator modules within the existing OTΔT circuitry were not directly affected by MOD-959. These summator modules contained capacitors that were used as noise filters, which introduced a lag constant of up to 2 seconds into the channel response time. The presence of these capacitors was not recognized as an impact to MOD-959 or to the channel response time assumed within the OTΔT trip event reanalysis.

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[1] H. B. Robinson Steam Electric Plant Unit No. 2 is a Westinghouse pressurized water reactor in commercial operation since March 1971.

*U.S. GPO 1988-0-624-538/455

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

Actual ramp test data, taken during Refueling Outage 13 and listed as follows, provides the measured lag times associated with each summator module:

RCS Loop A	TM-412J(ΔT)	1.05 seconds
	TM-412K(TAVG)	1.5 seconds
RCS Loop B	TM-422J(ΔT)	1.7 seconds
	TM-422K(TAVG)	1.59 seconds
RCS Loop C	TM-432J(ΔT)	1.8 seconds
	TM-432K(TAVG)	1.5 seconds

These summator module lag times were not included in the assumed "electronic signal processing" time, and in all cases exceeded the total assumed "electronics delay" time of 0.75 seconds. Therefore, it could not be assured that the OTΔT channels would operate as assumed within the accident analyses.

On this basis, all OTΔT protection channels were declared inoperable at 1200 hours on August 16, 1991. Technical Specification 3.0 was entered due to the inability to comply with the Minimum Channels Operable (MCO) requirements provided by Technical Specification Table 3.5-2, Item 5. This condition was reported to NRC via the Emergency Notification System (ENS) at 1235 hours as an unanalyzed condition pursuant to 10CFR50.72(b)(1)(ii)(A). Due to the inability to complete repairs to the OTΔT circuitry within the required time, a unit shutdown was initiated at 1345 hours. The initiation of the unit shutdown as required by the Technical Specifications was reported to NRC via the ENS at 1405 hours pursuant to 10CFR50.72(b)(1)(i)(A). At 1845 hours, the reactor was made subcritical and Technical Specification 3.0 was exited based on the unit being in Hot Shutdown as required by Technical Specification Table 3.5-2, Item 5.

II. Cause of Event

An investigative effort is underway to determine and document the causal factors that contributed to this occurrence. Although this effort is not fully completed, certain issues have been identified as contributing factors. Should this investigative effort yield further insight into the contributing factors discussed below, or identify other significant contributing factors, this information will be provided within a Supplement to this Licensee Event Report.

The primary responsibility for development and design of MOD-959 was assigned to the Nuclear Steam Supply System (NSSS) vendor under contract to Carolina Power and Light Company (CP&L). During the course of their activities, it is apparent that the vendor never clearly identified and/or communicated the need to remove the capacitors from the summator modules. As such, specific instructions for removal of these capacitors were never incorporated into the modification.

Reviews were performed by CP&L personnel during the development and implementation of MOD-959. These reviews ranged from specific discipline reviews to general reviews of the modification and its implementing procedures. Preliminary investigative efforts have raised some questions regarding the overall review process, in that the summator module lag constants were not identified as an impact to the system response time. The investigation of this occurrence will further examine these questions, and will establish whether or not this was in fact a contributing factor.

III. Analysis of Event

As stated above, actual OTΔT channel response time may have exceeded the value assumed within the accident analyses by as much as 2 seconds. This condition had existed since unit startup from the 1988 Refueling Outage until the removal of the summator module capacitors in August of 1991. To address the safety significance of this condition, the response times and parameters associated with actual unit operation during this time were evaluated against the values assumed within the accident analyses.

The Updated Final Safety Analysis Report (UFSAR) Chapter 15 includes three event analyses which take credit for the OTΔT trip function:

1. Loss of External Load.

2. Uncontrolled Control Rod Assembly Withdrawal at Full Power.

3. Full Length Rod Control Cluster Assembly (RCCA) Drop.

The key criteria associated with the analyses of these events is maintaining the Departure from Nucleate Boiling Ratio (DNBR) greater than the required safety limit.

NRC Form 366A (9-83)

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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The nuclear fuel vendor for HBR2 was asked to perform a review of the actual plant configuration over the specified time interval against the values assumed within the analyses of the OTΔT trip events listed above. The preliminary results of this review indicate that there was sufficient DNBR margin to support a 2.0 second delay in the system response time. This margin was achieved by using actual RCS flow rate values for Cycles 13 and 14, and the Technical Specification value or actual value of the Moderator Temperature Coefficient (MTC) for Cycles 13 and 14. No additional analyses are required. In summary, preliminary indications are that sufficient margin was available to compensate for the additional channel response time, such that the OTΔT trip function would have performed as required to maintain DNBR greater than the safety limit.

This condition was reported to NRC via the ENS at 1235 hours on August 16, 1991, as an unanalyzed condition pursuant to 10CFR50.72(b)(1)(ii)(A). Due to the inability to complete repairs to the OTΔT circuitry within the required time, a unit shutdown was initiated at 1345 hours. The unit shutdown as required by the Technical Specifications was reported to NRC via the ENS at 1405 hours pursuant to 10CFR50.72(b)(1)(i)(A). This Licensee Event Report is submitted pursuant to the requirements of 10CFR50.73(a)(2)(ii)(A) as an unanalyzed condition and 10CFR50.73(a)(2)(i)(A) due to the completion of a plant shutdown required by the plant's Technical Specifications.

IV. Corrective Actions

On August 16, 1991 at 1345 hours, a unit shutdown was initiated with the reactor being made subcritical at 1845 hours. While the unit was shutdown, a change to MOD-959 was prepared, approved, and implemented to remove the lag circuits (capacitors) from the affected summator modules. The modification to the temperature summators was implemented, and all three OTΔT loops were declared operable at 0630 hours on August 18, 1991. Following completion of the modification to the summator modules, the reactor was made critical at 1152 hours on August 18, with the unit being placed on-line at 1432 hours. These actions constitute the immediate corrective actions taken in response to the identification of this condition.

As stated within the "Cause of Event" above, an investigative effort is underway to determine and document the causal factors that contributed to this occurrence. The preliminary results of this effort have identified concerns regarding the development and review of MOD-959. These concerns include the involvement of the NSSS vendor in the design and development of the modification, and the review and implementation of the modification by CP&L personnel.

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However, since this investigative effort is not fully complete and the contributing factors identified are preliminary, appropriate long term corrective actions to address these issues have not yet been established. The completion of the investigation is expected to include specific recommendations regarding corrective actions, which will be reviewed and incorporated, as appropriate, with the finalized corrective actions being included within a Supplement to this Licensee Event Report. It is anticipated that recommended corrective actions will be established by October 31, 1991, with submittal of the Supplemental Licensee Event Report to follow by November 30, 1991.

V. Additional Information

A. Failed Component Identification

None.

B. Previous Similar Events

The following Licensee Event Reports have been generally identified as previous similar events based on their relationship to either the OTΔT instrumentation and circuitry, or to MOD-959. For each occurrence, however, causal/contributing factors and corrective actions may be significantly different.

1. Licensee Event Reports 88-002 and 88-002-01, dated February 19, 1988 and June 6, 1988, respectively, described the potential for unanalyzed reactor operation due to a nonconservative Overtemperature Delta Temperature trip setpoint.

2. Licensee Event Report 89-007, dated May 17, 1989, described inconsistencies in the reactor coolant system core differential temperature process parameters used as inputs to reactor protection circuitry. These inconsistencies introduced a degree of nonconservatism into the Overtemperature and Overpower Delta Temperature setpoints.