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December 26, 1989
CPY-353-89

US Nuclear Regulatory Commission
Document Control Desk
Washington, D. C. 20555

Gentlemen:

Licensee Event Report No. 88-39, Revision 1, is attached. This report updates an event in which a calibration of the reactor coolant system resistance temperature detectors was not performed.

Sincerely,

Richard E. Susee for

C. P. Yundt
General Manager
Trojan Nuclear Plant

c: Mr. John B. Martin
Regional Administrator
US Nuclear Regulatory Commission

Mr. David Stewart-Smith
State of Oregon
Department of Energy

Mr. R. C. Barr
USNRC Resident Inspector
Trojan Nuclear Plant

IE22
1/1

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): Incomplete Calibration of RTDs Due to Assumed Drift Value of Zero

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)
1 0	1 4	8 8	8 8	— 0 3 9 —	0 1	1 2	2 6	8 9	N/A	0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9): 1

POWER LEVEL (10): 1 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

[ ] 20.402(b)	[ ] 20.405(c)	[ ] 50.73(a)(2)(iv)	[ ] 73.71(b)
[ ] 20.405(a)(1)(i)	[ ] 50.36(c)(1)	[ ] 50.73(a)(2)(v)	[ ] 73.71(c)
[ ] 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)	[ ] 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)
John Guberski, Compliance Engineer	5 0 3 5 5 6 - 0 8 4 0

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
N/A									

SUPPLEMENTAL REPORT EXPECTED (14)

[ ] YES (If yes, complete EXPECTED SUBMISSION DATE) [X] NO

EXPECTED SUBMISSION DATE (15): MONTH | DAY | YEAR

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

During the period of July 25, 1988 through October 14, 1988, an extensive review of Reactor Coolant System (RCS) narrow range resistance temperature detector (RTD) calibration was performed. This review culminated with the completion of an internal event report (88-131) which concluded that the narrow range RTDs were not being calibrated, as required. On February 21, 1989 a second internal event report was generated to address wide range RTD calibration. Trojan Technical Specifications (TTS) require that the RTDs be calibrated once every 18 months. In the past, the RTDs were judged to be sufficiently stable over time to assume a drift value of zero. However, recent technical information has been developed that suggests that a small amount of RTD drift may occur over time.

The cause of this event was a failure to implement a TTS surveillance based on an assumption that RTDs do not drift. The immediate corrective action was to perform a comparative check of spare and active narrow range RTDs in each RCS loop which confirmed agreement between measured temperatures among the narrow range RTDs in each loop. Data for a cross channel calibration check was taken for RCS narrow range and wide range RTDs during the 1989 refueling outage. Means for calibrating the strap-on wide range RTDs for Reactor Vessel Level Indicating System reference leg compensation are being evaluated. The setpoint calculations associated with the RTDs will be revised and/or the TTS definition for RTD calibration will be clarified. This event had no effect on public health and safety.

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

Description of Event

On October 14, 1988, the plant was in Mode 1 (power operations). During the period of July 25, 1988 through October 14, 1988, an extensive review of Reactor Coolant System (RCS) narrow range resistance temperature detector (RTD) calibration was performed. This review culminated with the issuance of internal event report 88-131 on October 14, 1988 which concluded that the narrow range RTDs were not being calibrated. The narrow range RTDs provide delta temperature and average temperature inputs to the reactor protection system for overtemperature delta temperature (OT Delta T) and overpower delta temperature (OP Delta T) and the Engineered Safety Features Actuation System (ESFAS) for high steam flow in any two steam lines coincident with low-low RCS average temperature (Tavg). Trojan Technical Specification (TTS) 3/4.3.1, "Reactor Trip System Instrumentation", requires that each reactor trip system instrumentation channel be demonstrated operable by the performance of a channel calibration. This TTS requires that the OT Delta T and OP Delta T channels be calibrated once every 18 months. In addition, TTS 3/4.2.3, "ESFAS Instrumentation", requires that each ESFAS instrumentation channel be demonstrated operable by the performance of a channel calibration. This TTS requires that the high steam flow in any two steam lines coincident with low-low Tavg channels also be calibrated once every 18 months. The narrow range RTDs are also used for satisfying TTS 3.2.5, "Departure from Nucleate Boiling (DNB) Parameters". TTS 1.9 states that a channel calibration shall include the sensor.

On February 21, 1989, after the Plant Review Board (PRB) review of the original event report on narrow range RTDs, the PRB directed that a second internal event report be generated to address RCS wide range RTDs. The wide range RTDs provide input to the (accident monitoring) Reactor Vessel Level Indicating System (RVLIS) and the RCS Subcooling Margin Monitors (SMMs). TTS 3/4.3.3.9, "Accident Monitoring Instrumentation", requires that each accident monitoring channel be demonstrated operable once every 18 months by performance of a channel calibration.

The RVLIS wide range RCS hot leg (Th) RTDs are used for density calculations and strap-on RTDs are used to correct the RVLIS indication for environmental effects on sensing lines. The wide range RTDs for both Th and cold leg (Tc) temperature are used to calculate temperature and pressure margins for the SMMs.

In the past, the RTDs were judged to be sufficiently stable over time to assume a drift value of zero. This is consistent with the RTD drift values assumed in the Westinghouse setpoint study performed for Trojan. More recent information contained in NUREG/CR-4928, "Degradation of Nuclear Plant Temperature Sensors", raised the concern that some RTD drift could occur.

The RTD sensor consists of a platinum wire with a known resistance versus temperature curve. The RTDs were purchased calibrated with a given response curve to relate temperature to the RTD electrical resistance. RTD resistance

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is converted to a temperature signal in a millivolt to current (mV/I) converter. The mV/I converter is calibrated on an annual basis to conform to the original manufacturer's resistance versus temperature curve. The platinum wire RTDs cannot be adjusted. Given the inherent high stability of the device, adjustment was deemed unnecessary.

Acceptable means of calibrating the RTD and mV/I converter pair include: (1) placing the RTD in a known temperature bath, (2) comparing the RTD against a known standard, and (3) performing a cross-channel comparison. All of these have been used in the nuclear industry, however, the radiation dose to personnel for the first two methods is excessively high. The cross-channel comparison method involves the implicit assumption that the drift of RTDs is not biased, and therefore the average reading of a large group of RTDs is the true temperature. The group average temperature can be used to judge whether a particular RTD is out of the acceptable range.

During the initial Trojan startup testing program, spare and active narrow range RTD readings were taken at several temperature plateaus. At the start of Cycles 2 through 4 both spare and active narrow range RTDs were read at hot, no-load temperature to calibrate the incore thermocouples. Because of a favorable comparison between the spare and active narrow range RTDs, only the spare narrow range RTDs were read at hot, no-load temperature for subsequent cycles. The data from the start of Cycle 11 (the current operating cycle) shows a maximum deviation of 1.6 degrees F.

On October 18, 1988, temperature measurements were performed to compare the spare and active narrow range RTDs for both the RCS hot legs and cold legs. The spare and active narrow range RTDs are adjacent to each other. Loop-to-loop comparisons cannot be made at power because of differences in thermal conditions of the loops. Thus, the comparison of adjacent narrow range RTDs is viewed as a means to verify agreement among comparable instruments. The assumed instrumentation loop uncertainty for measuring Th and Tc is +/- 1.7 degrees F per RTD. The measurements performed confirmed agreement between measured temperatures among the narrow range RTDs in each loop.

Cause of Occurrence

This event was caused by a failure to implement a TTS surveillance based on an assumption that RTDs do not drift. In the past, it was assumed that RTDs did not drift and the entire channel calibration was satisfied by inputting the original RTD resistances to the mV/I converter. With the development of new technical information on RTDs, the assumption of zero RTD drift was questioned and subjected to further review as discussed above.

Corrective Action

The immediate corrective action was to perform the aforementioned testing of October 18, 1988 which consisted of a comparative check of narrow range RTDs while at power.

Long term corrective action includes a cross channel calibration check for spare and inservice narrow range and wide range RTDs. Strap-on wide range RTDs for density compensation on the RVLIS reference leg are not properly configured for such a check and corrective action is still under evaluation.

Data for a cross channel calibration check was performed during heatup after the 1989 refueling outage. RCS isothermal conditions were developed and temperature measurements were taken at approximately 250, 340, 450, and 510 degrees F. Temperature readings were taken for spare and inservice Th and Tc narrow range RTDs (4 per loop, 16 total) and Th and Tc wide range RTDs (2 per loop, 8 total).

One result of the above calibration check was the generation of a new calibration data sheet for RCS loop 3 Th spare narrow range RTD, TE-430A.

The data for the wide range RTDs is still under evaluation. The impact of changing the indicated accuracy requirements is being evaluated for the SMMs and the RVLIS (CTL 30284 and 30285). This evaluation will be completed by February 28, 1990. The accuracy calculations for the SMMs and the RVLIS will be revised and/or the means for RTD calibration in the TTS will be clarified.

The Main Feedwater System RTDs (used in the Plant calorimetric) are also being evaluated for inclusion into the calibration program (CTL 30287).

Significance of Occurrence

This event had no effect on public health and safety. The affected areas of plant safety due to postulated increased narrow range RTD error are:

1. Overtemperature delta T reactor trip.

2. Overpower delta T reactor trip.

3. Departure from Nucleate Boiling Ratio (DNBR) parameters.

4. High steam flow coincident with low-low Tavg safety injection signal.

The impact of considering narrow range RTD drift on these safety functions is described below. Evaluation of wide range RTD drift on the RVLIS and the SMMs follow that discussion.

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Narrow Range RTD Drift

The OT Delta T trip setpoint provides protection for transients such as the loss of load event. Calculations show that the excess design margin for this trip function is approximately 0.68 degrees F. The individual loop delta T protection trips are based on a percent of channel full power delta T and are adjusted separately. This method preserves the accuracy of the trip setpoint since full power delta T varies from loop to loop and from year to year. Taking into consideration data from NUREG CR-4928, an assumed 1 degree F drift in the Trojan RTDs can be accommodated and still allow an excess design margin of approximately 0.47 degrees F. The overall effect is that the safety limit, as defined by Figure 15.0-1 of the Final Safety Analysis Report (FSAR), is not exceeded.

The OP Delta T trip, as described in TTS Bases Section 2.2.1, provides a backup to the high neutron flux trip. No credit was taken for the operation of this trip in the accident analysis; therefore, the inclusion of drift will not adversely affect plant safety. The drift does not adversely affect the reliability of the OP Delta T trip as a backup to other trips.

The DNB parameters described in TTS Table 3.2-1, "DNB Parameters", require a 12-hour check that Tavg is less than or equal to 589 degrees F. The nominal full-power Tavg is 585 degrees F, and FSAR Section 15.0.3.2 allows an indication error margin of 4 degrees F. Including a 1 degree F drift in the RTD instrument uncertainty calculation increases the uncertainty value to 3.91 degrees F for each loop. This is within the allowable limits.

The ESFAS signal for high steam flow with low-low Tavg is described in TS 3/4.3.2 and TS Tables 3.3-3 and 3.3-4. The allowable value is 551 degrees F and the trip setpoint is 553 degrees F for Tavg determined by two of four loops. As described in the Westinghouse setpoint study performed for Trojan, there is no associated safety analysis limit. Based on this, it is concluded that a small amount of drift will not affect the Plant response to an accident as the protection provided by the low-low Tavg/high-steam flow signal is bounded by other analyses.

Wide Range RTD Drift

Neither the RVLIS system nor the SMMs are used to initiate safety systems, and they are not credited in the FSAR accident analyses.

RVLIS is used in some Emergency Operating Procedures. Event Specific emergency instruction ES-0.3, "Natural Circulation Cooldown with Steam Void in Vessel (with RVLIS)", maintains pressurizer level in the indicating range and the RVLIS upper range indication greater than 75 percent. The background document for ES-0.3 states that the purpose of the RVLIS indication is to keep a steam bubble in the head from entering the hot legs and disrupting natural circulation. The technical manual for the RVLIS states that the upper range covers vessel level from the RCS hot legs to the top of the vessel. Thus the

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ES-0.3 procedure has approximately 75 percent margin to maintain the limits of the background document. The anticipated effect of reference leg RTD drift will not significantly reduce the existing margin of ES-0.3.

The Functional Restoration Instructions (FRIs) use the RVLIS as input to determine adequate core cooling and reactor inventory. In the FRIs, the RVLIS is used to determine whether the core is covered and the size of a steam bubble in the head. These determinations are also based on input from the core exit thermocouples, pressurizer level response, number of Reactor Coolant Pumps in operation, etc. Thus, the use of the RVLIS to determine the response to accident conditions is backed up by other information.

The additional uncertainty associated with the RVLIS reference leg RTD drift is not, by itself going to adversely affect the response to an accident. Thus, it is concluded that the procedural use of the RVLIS has sufficient margin to accommodate the small increase in uncertainty due to drift.

The SMMs are installed in the control room to provide the operator with an online indication of the saturation condition of the core and the reactor coolant loops. Signal inputs to the SMMs are obtained from the core exit thermocouples, wide range pressure sensors on the Residual Heat Removal suction leg, and Th and Tc RTDs. The SMMs are widely referred to in the Emergency Instructions and the FRIs.

There are two train separated SMMs. Each channel of the SMM module receives input from 8 core exit thermocouples, 2 wide range Th RTDs, 1 wide range Tc RTD, 1 cold junction temperature RTD, 1 wide range RCS pressure and 1 spare input connection. The highest of all the active input temperature values is used in the calculation of temperature margin. This highest temperature is compared to the saturation temperature calculated from the measured pressure value. This result gives the worst case temperature margin. A negative temperature margin indicates potential superheat conditions.

Should any RTD fail, its input signal can be disabled and the SMMs will still be fully operable. The RTD inputs are not required as inputs (used as backup) by the design, while inputs from core exit thermocouples are required.

RTDs in the Main Feedwater System are not addressed by the Technical Specifications but are under evaluation for inclusion in the calibration program.