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April 5, 1990

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

Subject: Catawba Nuclear Station
Docket No. 50-414
LER 414/90-04

Gentlemen:

Attached is Licensee Event Report 414/90-04 concerning TECHNICAL SPECIFICATION 3.0.3 ENTERED AS A RESULT OF TWO CHANNELS OF POWER RANGE NUCLEAR INSTRUMENTATION BEING OUT OF ACCEPTABLE RANGE DUE TO A DEFECTIVE PROCEDURE.

This event was considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

Tony B. Owen
Station Manager

keb\LER-NRC.TBO

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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)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
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TITLE (4) Technical Specification 3.0.3 Entered As A Result Of Two Channels Of Power Range Nuclear Instrumentation Being Out Of Acceptable Range Due To Defective Procedure

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 2	0 2	9 0	9 0	- 0 0 4	- 0 0	0 4	0 5	9 0	N/A	0 5 0 0 0
										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)			
POWER LEVEL (10)	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)	X 50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
	20.405(a)(1)(iii)	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
R.M. Glover, Compliance Manager	AREA CODE 8 0 3 8 3 1 - 3 2 3 6

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	

SUPPLEMENTAL REPORT EXPECTED (14)

		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

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

On February 2, 1990, at 1150 hours, Unit 2 was in Mode 1, Power Operation. Four Main Steam Safety Valves (MSSVs) were declared inoperable per Technical Specifications (T/S), and Reactor power reduction was initiated. At 1255 hours, T/S 3.0.3 was entered due to two Power Range Nuclear Instrumentation (PRNI) channels being greater than 5% out of calibration in a non-conservative direction. Instrumentation and Electrical (IAE) personnel were notified and Standing Work Request (SWR) 5959 was issued for calibration of the PRNIs. The calibrations were completed at 1349 hours, and T/S 3.0.3 was exited. An entry was made in the Shift Manager's logbook stating the entry into T/S 3.0.3 and also that Compliance (CPL) was notified. The notification was not effective; a Problem Investigation Report (PIR) was not initiated. The Shift Manager could not recall who was contacted and the CPL Duty Engineer could not recollect the telephone conversation. Corrective actions will include emphasis on following proper notification procedures which include initiation of a PIR for reportable events. As a result of previous PRNI mismatches, needed corrective actions were identified in LER 413/90-005, which will better define the time in which PRNI recalibrations are needed and provide guidance for the Operator as to actions to take when the 5% limit is challenged.

BACKGROUND

The primary purpose of the Main Steam [EIIS:SB] (SM) System is to convey steam from the Steam Generators [EIIS:HX] (S/Gs) to the high pressure turbine [EIIS:TRB]. In addition, the SM System supplies high pressure steam as required, to various plant equipment. The Main Steam Bypass to Condenser [EIIS:SO] (SB) System and the Main Steam Vent to Atmosphere [EIIS:VL] (SV) System control S/G pressure and Nuclear Steam Supply System (NSSS) thermal loading by relieving main steam as required to the main condenser and to the atmosphere.

The S/Gs and associated SM piping are protected from overpressurization by five ASME code safety valves [EIIS:V] on each SM line. The valve tag numbers are SV2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 20, 21, 22, 23, and 24. Combined safety valve capacity is sufficient to prevent an unacceptable pressure rise during the postulated most severe loss of heat sink accident. Individual valve capacity, however, is not sufficient to cause excessive S/G blowdown should a valve inadvertently stick open. Valve set pressures are staggered to prevent chatter during operation.

Technical Specification 3.7.1.1 states that with four Reactor Coolant [EIIS:AB] (NC) loops and associated S/Gs in operation and with one or more of the Main Steam Safety Valves (MSSVs) inoperable, operation in MODES 1, 2, and 3 may proceed provided that, within 4 hours, either the inoperable valve is restored to OPERABLE status or the Power Range Neutron Flux High Trip Setpoint is reduced per Table 3.7-1. With 2 MSSVs inoperable on any Operating S/G, the maximum allowable Power Range Neutron Flux High Setpoint (Percent of Reactor Thermal Power (RTP)) is 65%.

The purpose of the Excore Nuclear Instrumentation [EIIS:JG] (ENB) System is to monitor Reactor [EIIS:VSL] Core leakage neutron flux and generate appropriate trips and alarms for various phases of Reactor operations. The three separate overlapping ranges of Source Range, Intermediate Range, and Power Range also provide control functions and indicate Reactor status during Mode 2, Startup and Mode 1, Power Operation. Technical Specification 4.3.1.1 requires that channel calibration be performed daily on the Power Range Neutron Flux High Setpoint. This is to be performed by comparison of calorimetric (reactor thermal power best estimate, based on actual plant temperatures) to excore power (based upon nuclear power levels from excore instrumentation) when the Unit is above 15% RTP. Excore channel gains are to be adjusted to make indicated excore power consistent with indicated calorimetric power whenever this comparison reveals an absolute difference of more than 2% between the two.

Technical Specification 3.3.1, Table 3.3-1, requires that three out of four channels of Power Range Nuclear Instrumentation (PRNI) must be operable during Modes 1 and 2.

During Mode 1, a power range channel must be considered INOPERABLE whenever a mismatch exists between calorimetric power and excore power indication that is greater than 5% in the non-conservative direction (calorimetric power greater than excore power). If the mismatch is between 2% and 5% in the non-conservative direction, the channel is OPERABLE as long as the calibration process has been initiated. When the Unit is engaged in a power maneuver which results in a mismatch between calorimetric and excore power in excess of 2%, excore adjustment may be delayed until the Unit reaches a steady-state power level, provided the mismatch does not exceed 5% in the non-conservative direction, as specified by the Technical Specification Interpretation, dated August 25, 1989.

Procedure OP/1(2)/A/6100/03, Controlling Procedure for Unit Operation, contains Enclosure 4.2, Power Decrease, which delineates steps to be taken for Unit Power decrease. Step 2.3 states the following:

> "As required during power decrease, issue Work Request (WR) 5969 SWR (for Unit 2) to I&E prior to mismatch between OAC thermal output measurement (P1385 - Reactor Thermal Power, Best Estimate) and any excore power channel exceeding 2%."

Technical Specification 3.0.3 is required to be entered when the Unit is operating in a condition prohibited by Technical Specifications. This condition exists when a Limiting Condition for Operation is not met except as provided in the associated Action Requirements. It requires that within one hour action shall be initiated to place the Unit in a Mode in which the specification does not apply by placing it, as applicable, in:

a. At least HOT STANDBY within the next 6 hours,
b. At least HOT SHUTDOWN within the following 6 hours, and
c. At least COLD SHUTDOWN within the subsequent 24 hours.

EVENT DESCRIPTION

During a discussion between a Mechanical Engineering Services (MES) Engineer and a representative of Dresser Industries, on January 26, 1990, a new equipment constant was mentioned which had been developed in August 1989 for adjustment of MSSVs. At 1100 hours, a MES representative initiated PIR 0-C90-0026 to investigate. At 1330 hours, Compliance (CPL) personnel requested an operability evaluation from Design Engineering (DE). On February 1, 1990, at 1400 hours, a DE Engineer contacted CPL personnel and stated that the evaluation would show several valves which would not meet the +/- 1% tolerance for valve lift settings given in Technical Specification 3.7.1 (2SV 3,8,12, and 14). At 1500 hours, Station Management, DE personnel, and NRC representatives discussed the situation. The decision was made at 1600 hours, that DE would confirm information and issue a formal Operability Statement on February 2, 1990.

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

On February 2, 1990, at 1100 hours, DE issued the Operability Statement which concluded that the 4 valves, 2SV3, 8, 12, and 14 were inoperable. Operations (OPS) Control Room Operators (CROs) entered the action statement for Technical Specification 3.7.1 at 1150 hours, and began to decrease RTP to 53%. This action was taken due to two of the four valves that were declared inoperable being in Steam Generator loop 'C'. At 1255 hours, Technical Specification 3.0.3 was entered due to two of the PRNI channels (N-42 and N-43) being greater than 5% out of calibration in a non-conservative direction. Instrumentation and Electrical (IAE) personnel were notified and 5969 SWR (Standing Work Request) was issued to recalibrate the PRNIs. The PRNI channel calibrations were completed at 1349 hours, and Technical Specification 3.0.3 was exited. By 1441 hours, Unit 2 had obtained 54% Reactor power. At 1300 hours, following a teleconference with Station Management, Nuclear Production Department, General Office personnel, NRC residents, and NRC NRR personnel, a verbal waiver of compliance was granted. The four safety valves were declared operable at 1400 hours.

The Shift Manager for the day shift placed an entry into the Shift Manager's Log at 1904 hours that noted the Technical Specification 3.0.3 event. There was also a comment that Compliance had been notified of the event. According to Compliance personnel on duty at the time, no communications were made concerning initiation of a Problem Investigation Report (PIR).

On February 3, 1990, at 0016 hours, work list items for 2B Condenser Feedwater Pump Turbine (CFPT) control power supply and 1HTA, Motor Control Center, had been completed and Unit 2 commenced RTP increase to 88%. By 1355 hours, the Unit had reached RTP of 97%.

On March 7, 1990, Unit 2 was in Mode 1, Power Operation. A Compliance Support Technician was reviewing entries in the Control Room Logbook. During this review the Technical Specification 3.0.3 event on February 2 was noted. PIR 2-C90-0078 was initiated on March 7, 1990 at 1600 hours, by the Compliance Manager.

CONCLUSION

This event is attributed to a defective procedure, containing ambiguous information. The OP/2/A/6100/03 Enclosure 4.2 statement containing "As required during power decrease..." is considered to be too subjective.

Deviations between PRNI indicated power and RTP are an expected phenomenon during power changes. Control rod [EIIS:ROD] insertion causes the PRNI excore detectors [EIIS:XT] to experience a greater decrease in neutron flux relative to the corresponding decrease in thermal power. Recent analysis and interpretation of Technical Specification limits have determined that PRNI channels must be

declared inoperable if they deviate (non-conservatively) from RTP by more than 5%. Deviations between 2% and 5% are permitted provided that the calibration process has been initiated. The relevant safety analysis assumes a 2% deviation as an initial condition.

A distinction can be made between planned power changes and unplanned or rapid power changes with respect to the amount of time available to calibrate the PRNIs prior to exceeding the 5% deviation limit. LER 413/90-005 was written as a result of Technical Specification 3.0.3 being entered for inoperable PRNIs during Unit 1 shutdown due to a Management Deficiency in scheduling by not starting the calibrations in time to avoid exceeding the 5% limit.

The planning, scheduling, and conduct of PRNI calibration during power changes were discussed by Station Management at an "Abnormal Plant Event" meeting on February 28, 1990. In addition to alternative measures that can be taken to avoid exceeding the deviation limit, time constraints, crew expertise and safety significance were discussed. The following corrective actions are being taken:

* Operations procedure OP/1(2)/A/6100/03 and its enclosure will be revised to issue the SWR to IAE for PRNI calibration when a planned power decrease begins (if a decrease of more than approximately 20% power is planned).

* IAE Section Management will communicate with the IAE crews, to emphasize the urgency of PRNI calibration and the need for prompt completion of this activity.

* Evaluate ways to streamline the preparation for PRNI calibration, including faster confirmation to Shift Managers and/or Shift Supervisors of the validity of current thermal power calculations.

* Emphasis will be placed on including PRNI calibration activity in work schedules for planned power decreases. To facilitate this, PRNI calibration SWRs will be added to the Unit trip and forced outage lists.

Discussions with Design Engineering personnel indicate that no additional margin is available to relax the limitation further. Lower power accidents pose as significant a concern as higher power accidents. The relaxation at lower power levels is therefore not viable.

There have been four previous Technical Specification 3.0.3 events involving inoperable PRNI channels (LERs 413/90-005, 413/89-025, 413/89-016, and 414/88-030). LER 413/90-005 was written as a result of Technical Specification 3.0.3 being entered for inoperable PRNIs during Unit 1 shutdown due to a Management Deficiency in scheduling the calibrations in time to avoid exceeding the 5% limit. LER 413/89-025 involved a rapid manual power reduction to prevent a Turbine [EIIS:TRB] and Reactor trip, which did not allow enough time for PRNI calibration prior to exceeding the 5% deviation limit. LER 413/89-016 involved

a Turbine runback which did not allow enough time for PRNI calibration. LER 414/88-030 involved a planned power reduction where prompt action was not taken to calibrate the PRNIs and was attributed to a procedure deficiency. The procedure changes prompted by this event, to caution the Operators to anticipate the need for PRNI calibration during power reduction, had been incorporated at the time of this current event. This is considered to be a recurring event.

Following discussions with both the Shift Manager and Compliance personnel that were on duty on February 2, 1990, there was no clear communication performed that would have resulted in the initiation of a PIR. The importance of the procedural requirement for both Compliance notification and the initiation of a PIR as stated for Technical Specification 3.0.3 events, will be emphasized. The need for additional procedural guidance for initiating PIRs to ensure proper reporting of plant events will be evaluated by station management at an Abnormal Plant Event Meeting.

CORRECTIVE ACTION

SUBSEQUENT

1) IAE personnel completed calibration of all four PRNI channels to within acceptable limits.

PLANNED

1) A procedure has been developed and will be tested on the simulator to evaluate the feasibility of allowing the Operations Control Room personnel to adjust the PRNI readings (to agree with Rated Thermal Power), at the discretion of the Shift Supervisor.

2) Revise OP/1(2)/A/6100/03 and Enclosure 4.2 to issue SWR to IAE for PRNI calibration when power decrease begins (if a decrease of more than 20% is anticipated).

3) Unit trip and forced outage lists will be revised to include prior scheduling of PRNI calibration.

4) Emphasize the importance of proper notification and initiation of PIRs, for a T/S 3.0.3 event, to the Shift Manager (per RP/0/3/5000/13), by way of memorandum and through a Shift Managers' meeting.

5) The need for additional procedural guidance for initiating PIRs to ensure proper reporting of plant events will be evaluated by station management at an Abnormal Plant Event Meeting.

SAFETY ANALYSIS

The excore power range neutron detectors are arranged and located such that one detector measures core leakage neutron flux for one quadrant. Each detector and its associated circuitry comprise one channel, for a total of four PRNI channels. The Power Range High Neutron Flux Trip (High Setpoint) function utilizes a 2-out-of-4 logic.

Catawba Technical Specification 4.3.1.1 requires that channel calibration be performed daily on the Power Range Neutron Flux High Setpoint. This is to be performed by comparison of calorimetric (thermal best estimate) to excore power indication when the Unit is above 15% RTP. Excore channel gains are to be adjusted to make indicated excore power consistent with indicated calorimetric power whenever this comparison reveals an absolute difference of more than 2% between the two.

Based upon a Technical Specification Interpretation, during power maneuvers the operability requirements for the Nuclear Instrumentation System (NIS) channels are met provided that the process of calibration has been initiated, and the total thermal best estimate and NIS mismatch does not exceed 5% in the non-conservative direction (i.e., thermal best estimate > NIS). The justification for the increased allowable mismatch is based upon the existing margins in the Steam Generator [EIIS:HX] (S/G) low-low level and power range high flux (high and low) setpoint calculations, power range response during specific transient analyses, and the conservatisms inherent in the Catawba FSAR analyses.

Bank D Rod Cluster Control Assemblies (RCCAs) are located in the core such that one RCCA is inserted in the middle of the core along the vertical axis, with one RCCA inserted in each of the four quadrants (for a total of 5 RCCAs in Control Bank D). The RCCAs in Control Bank D are positioned more closely to the excore neutron detectors than other Control Bank RCCAs, and therefore affect the leakage neutron flux seen by these detectors to a greater degree than the other control banks. This phenomenon commonly occurs during power reductions in which Control Bank D is partially inserted.

The following is a list of Catawba FSAR Chapter 15 transients in which credit is assumed for the Power Range High Neutron Flux Trip (High Setpoint):

1) Startup of an Inactive Reactor Coolant Pump [EIIS:P] at an Incorrect Temperature (discussed in Section 15.4.4).

2) Feedwater System Malfunctions that Result in a Reduction in Feedwater Temperature (discussed in Section 15.1.1).

3) Excessive Increase in Secondary Steam Flow (discussed in Section 15.1.3).

4) Inadvertent Opening of a Steam Generator Relief or Safety Valve [EIIS:V] (discussed in Section 15.1.4).

5) Steam System Piping [EIIS:PSP] Failure (discussed in Section 15.1.5).

6) Uncontrolled Rod Cluster Control Assembly Bank Withdrawal From a Subcritical or Low Power Startup Condition (discussed in Section 15.4.1).

7) Uncontrolled Rod Cluster Control Assembly Bank Withdrawal at Power (discussed in Section 15.4.2).

8) Spectrum of Rod Cluster Control Assembly Ejection Accidents (discussed in Section 15.4.8).

The following discussion outlines the protective features which existed for the above scenarios other than the Power Range High Neutron Flux Trip Function (High Setpoint):

1) The "Startup of an Inactive Reactor Coolant Pump at an Incorrect Temperature" scenario is not applicable and the Abnormal Procedures do not permit the Operators to start an inactive Reactor Coolant Pump above 25% RTP.

2) The Unit would be protected against a "Feedwater System Malfunctions that Result in a Reduction in Feedwater Temperatures " scenario by the Overtemperature and Overpower Delta-T trip functions.

3) The Unit would be protected against the "Excessive Increase in Secondary Steam Flow" scenario by the Overtemperature and Overpower Delta-T trip functions.

4) The Unit would be protected against the "Inadvertent Opening of a Steam Generator Relief or Safety Valve" scenario by initiation of a Safety Injection signal (due to steamline pressure) which initiates a Reactor Trip signal. The Overtemperature and Overpower Delta-T trip functions also provide Reactor protection in this scenario.

5) The Unit would be protected against a "Steam System Piping Failure" scenario by initiation of a Safety Injection signal (due to steamline pressure) which initiates a Reactor Trip signal. The Overtemperature and Overpower Delta-T trip functions also provide Reactor protection in this scenario.

6) The "Uncontrolled Rod Cluster Control Assembly Bank Withdrawal From a Subcritical or Low Power Startup Condition" scenario is not applicable as this incident involved a power reduction.

7) The "Uncontrolled Rod Cluster Control Assembly Withdrawal at Power" scenario is assumed to be terminated by the following trip functions in addition to the Power Range High Neutron Flux Trip Function (High Setpoint): Overtemperature and Overpower Delta-T, pressurizer pressure, and pressurizer level. In addition to these trip functions, there are the following RCCA withdrawal blocks:

a) high neutron flux, b) Overtemperature Delta-T, and c) Overpower Delta-T. For slow RCCA withdrawal accidents, thermal time constraints on the heatup do not become a factor; the plant is tripped and DNBR is maintained above the limit value.

8) The "Spectrum of Rod Cluster Control Assembly Ejection Accidents" scenario assumes credit for the High Neutron Flux Rate Trip Function.

Therefore, in addition to the NIS being functionally able to provide input to the SSPS, protection was provided against exceeding Reactor-related and other NSSS Safety Limits by the above stated operable limiting safety system settings.

Furthermore, in any postulated rod withdrawal accidents, the out-of-calibration condition would correct itself during the transient due to the absence of the cause, i.e., insertion of Control Bank D. Also, the conservative effects of moderator and doppler feedback would tend to omit any postulated power excursions.

The calibration problem was one of gain setting, or overall absolute value power indication. The ability of the PRNI to detect axial flux difference (AFD) and high flux rate was unaffected. The Overtemperature Delta-T Trip Function receives AFD as an input to the setpoint equation, and the Overpower Delta-T Trip Function is unaffected by neutron flux. Therefore, the high flux rate, Overtemperature Delta-T, and Overpower Delta-T Trip Functions remained intact and functional throughout the incident. The Overtemperature Delta-T Trip function protects against DNB conditions, and the Overpower Delta-T Trip Function ensures that allowable heat generation rate (kw/ft) is not exceeded.

Additionally, Power Mismatch Signal, based on the difference between Turbine impulse pressure (correlative thermal power level) and NIS indication, is a control input to the Rod Control System program. However, this program does not utilize absolute power mismatch, but rather rate of change of power mismatch (i.e., it is an anticipatory function). Therefore, the out-of-calibration condition of the NIS did not affect automatic rod control.

The health and safety of the public were unaffected by this incident.