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March 14 , 1990

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

Subject: Catawba Nuclear Station
Docket No. 50-413
LER 413/90-05, Rev. 1

Gentlemen:

Attached is Licensee Event Report 413/90-05, Revision 1, concerning TECHNICAL SPECIFICATION 3.0.3 ENTERED FOR INOPERABLE POWER RANGE NUCLEAR INSTRUMENTATION DURING UNIT SHUTDOWN DUE TO A MANAGEMENT DEFICIENCY.

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

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)
Catawba Nuclear Station, Unit 1	0 5 0 0 0 4 1 3	1 OF 0 9

TITLE (4) Technical Specification 3.0.3 Entered For Inoperable Power Range Nuclear Instrumentation During Unit Shutdown Due To A Management Deficiency

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 1	2 6	9 0	9 0	– 0 0 5 –	0 1	0 3	1 5	9 0	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)

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	AREA CODE	
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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)

[ ] 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)

On January 26, 1990, at 1830 hours, Catawba Unit 1 began to decrease power to start its end-of-cycle 4 refueling outage. At 2300 hours, Technical Specification 3.0.3 was entered due to more than one power range nuclear instrumentation (PRNI) channel exceeding 5% deviation (non-conservative) between rated thermal power (RTP) and indicated excore detector power. Standing Work Request 4099 SWR was in progress at the time to calibrate the PRNI. Technical Specification 3.0.3 was exited at 2327 hours, when calibration was completed on 3 of 4 channels. Deviations between RTP and PRNI indicated power are an expected occurrence during power changes; the operating procedure cautions Operators to initiate calibration as needed to prevent the deviation from exceeding 5%. This incident is attributed to a Management Deficiency in scheduling by not starting the calibration in time to avoid exceeding the limit. Corrective actions will be developed to better anticipate and carry out PRNI calibration so as to avoid exceeding the deviation limit.

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

BACKGROUND

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% Rated Thermal Power (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 5.0% in the non-conservative direction (calorimetric power greater than excore power). If the mismatch is between 2.0% and 5.0% 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 5.0% in the non-conservative direction, as specified by the Technical Specification Interpretation, dated August 25, 1989.

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

On January 26, 1990, Catawba Unit 1 was in Mode 1, Power Operation, and initiated a controlled shutdown to begin its end-of-cycle 4 refueling outage. Power decrease from 100% began at 1830 hours, at a rate of 10% per hour. Standing work request 4099 SWR was given to Instrumentation and Electrical (IAE) Crew Supervisor A during the Shift Manager's meeting at 2100 hours, to calibrate the Power Range Nuclear Instrumentation (PRNI) to Rated Thermal Power (RTP). This work activity was not on the IAE crew's schedule for the shift. At 2300 hours, with the calibration in progress, two or more PRNI channels deviated from RTP by more than 5% in the non-conservative direction, placing Unit 1 into Technical Specification 3.0.3. The calibration continued and at 2327 hours, 3 channels of PRNI had been calibrated to agree with RTP; Unit 1 exited Technical Specification 3.0.3 at that time.

Unit shutdown continued; IAE performed a second calibration before the 5% deviation limit was exceeded. Unit 1 entered Mode 2, Startup, at 0414 hours, and Mode 3, Hot Standby, at 0440 hours, on January 27, 1990.

CONCLUSION

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 (i.e. "rod shadowing"). Recent analysis and interpretation of Technical Specification limits has 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 analyses assume a 2% deviation as an initial condition.

Provisions are made for IAE to perform the calibration via a preplanned, standing work request (SWR) to be issued by Operations; the need for calibration is widely recognized. Operating procedure OP/1(2)/A/6100/03, Controlling Procedure for Unit Operation, contains a caution to initiate calibration as needed and states that Control Rod Bank D insertion will lead to PRNI-RTP deviation.

A significant amount of time is needed to prepare for this activity. Prior to beginning work, IAE Technician availability and qualification for the task must be verified, the work assigned, and the procedure reviewed. The calibration is begun by verifying a working copy of IP/1/A/3240/11, Calibration Procedure NIS Power Range Calibration At Power. Each channel is calibrated in turn using a separate enclosure to the procedure: the time required to complete the calibration can vary from one to two hours. In this event, the SWR was issued at 2100 hours, the working copy was signed off as verified at 2205 hours, Technical Specification 3.0.3 was entered at 2300 hours, and calibration was completed at 2335 hours (2 1/2 hours after initiation of the work activity).

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

A distinction can be drawn between planned power changes (i.e. shutdowns) and unplanned or rapid power changes (i.e. runbacks) with respect to the amount of time available to calibrate the PRNI prior to exceeding the 5% deviation limit. In the latter situation, a Unit may be decreasing power rapidly in order to avoid a more significant event, e.g. a Unit trip. In such circumstances PRNI-RTP deviations of greater than 5% could be unavoidable. But in the former case of planned power changes it should be possible to initiate and complete PRNI calibration without exceeding the limit.

This incident is attributed to a Management Deficiency, in that scheduling of this work activity did not ensure that the limit would not be exceeded. A contributing Management Deficiency is also identified because, although the need for PRNI calibration was identified, due to poor group interface action was not initiated in time to avoid exceeding the limit.

As previously planned (LER 413/89-025), an Operations procedure has been developed and is being evaluated on the simulator to give Control Room Operators the recourse of adjusting PRNI channels (using gain adjustment) during power changes.

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. Representatives from affected station groups, Design Engineering, and other Duke stations participated. Crew expertise, time constraints, work priority and safety significance were discussed, as were alternative measures that can be taken to avoid exceeding the deviation limit. As a result of these discussions, the following corrective actions will be 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 crews will receive training to emphasize the urgency of PRNI calibration and the need for prompt completion of this activity.

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

* Emphasis will be placed on including the 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.

Discussion with cognizant Design Engineering personnel indicates that no additional margin is available to relax the limitation further. Also, lower power accidents pose as significant a concern as higher power accidents and hence relaxation at lower power levels is not viable.

There have been three previous Technical Specification 3.0.3 events involving inoperable PRNI channels (LERs 413/89-025, 413/89-016, and 414/88-030). 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 before 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 PRNI 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 the current event. This is considered a recurring event. An "Abnormal Plant Event" meeting will be held to discuss these events and determine any additional corrective action needed to minimize recurrence.

CORRECTIVE ACTION

SUBSEQUENT

1) IAE calibrated all four PRNI channels within acceptable deviation.

PLANNED

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

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

3) IAE crews will receive training to emphasize the urgency of PRNI calibration and need for prompt completion of this activity.

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

5) To facilitate prior scheduling of PRNI calibration during planned shutdowns, Unit Trip and Forced Outage lists will be revised to include this work activity.

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.

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

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.

The Unit 1 D-3 S/Gs utilize a ramped operating level based on NIS indication input to the Feedwater control valve position. Hence, during this transient, it is likely that the control system was "searching" causing oscillations in feedwater flow and S/G level (the control valves would attempt to control based on NIS indicated power, while actual power is given by thermal best estimate). However, these oscillations were apparently minor, as S/G Low-Low Level Reactor Trip Signal and S/G High-High Level Reactor Trip Signal did not occur.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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

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.