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March 9, 1990

William J. Cahill, Jr.
Executive Vice President

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

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION
DOCKET NO. 50-445
REACTOR PROTECTION SYSTEM ACTUATION
LICENSEE EVENT REPORT 90-001-00

Gentlemen:

Enclosed is Licensee Event Report 90-001-00 for Comanche Peak Steam Electric Station Unit 1, "Reactor Protection System Actuation due to Spike on Source Range Channel."

Sincerely,

William J. Cahill, Jr.

JRW/daj

Enclosure

c - Mr. R. D. Martin, Region IV
Resident Inspectors, CPSES (3)

400 North Olive Street L.B. 81 Dallas, Texas 75201

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Enclosure to TXX-90093

NRC FORM 366 U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92
ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC. 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC. 20503.

LICENSEE EVENT REPORT (LER)

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Title (4)
REACTOR PROTECTION SYSTEM ACTUATION DUE TO SPIKE ON SOURCE RANGE CHANNEL

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 Numbers
0 2	0 9	9 0	9 0	- 0 0 1	- 0 0	0 3	0 9	9 0	N/A	0 5 0 0 0
									N/A	0 5 0 0 0

Operating Mode (9): N
Power Level (10): 0 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)	[X] 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)	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
D. NORMAN HOOD SUPERVISOR, COMPLIANCE	Area Code 8 1 7 — 8 9 7 - 5 8 8 9

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)

At approximately 0051 CST on February 9, 1990, two Instrumentation and Control (I&C) technicians were performing the Analog Channel Operational Test (ACOT) for Neutron Flux Source Range Channel N31 (SR N31) in accordance with an approved work document when a Reactor Protection System (RPS) Flux Doubling Signal was initiated. In response to the Flux Doubling Signal, the appropriate automatic safety system component actuations occurred as designed.

At approximately 0052 CST on February 9, 1990, following receipt of the Flux Doubling Alarm, control room personnel responded by blocking the Flux Doubling Signal and returning the actuated components to their original position.

After having investigated the apparent potential causes for this event, there has been no reproducible occurrence which can be identified as the cause of the event. The cause of the RPS Flux Doubling Signal is assumed to be a momentary spike on SR N31 which occurred when the SR N31 drawer was withdrawn from the Nuclear Instrumentation Cabinet.

Appropriate Source Range procedures have been identified and revised to require insertion of the Flux Doubling Signal "BLOCK" prior to drawer withdrawal.

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

I. DESCRIPTION OF WHAT OCCURRED:

A. PLANT OPERATING CONDITIONS BEFORE THE EVENT:

On February 9, 1990, Comanche Peak Steam Electric Station (CPSES) Unit 1 was preparing for initial Mode 6 entry. No fuel had been loaded in the reactor (EIIS:(RCT)(AB)). The Reactor Coolant System (RCS) (EIIS:(AB)) was at ambient pressure and temperature and was borated to a level of approximately 2042 ppm. Centrifugal Charging Pump -01 (CCP) (EIIS:(P)(CB)) was operating taking suction from the Volume Control Tank (VCT) (EIIS:(TK)(CB)).

B. REPORTABLE EVENT DESCRIPTION (INCLUDING DATES AND APPROXIMATE TIMES OF MAJOR OCCURRENCES):

Event Classification: An event or condition that resulted in an automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (RPS).

At approximately 0042 CST on February 9, 1990, two Instrumentation and Control (I&C) technicians (utility, non-licensed) began performance of the Analog Channel Operational Test (ACOT) for Neutron Flux Source Range Channel N31 (SR N31) (EIIS:(CHA)(JC)) in accordance with an approved work document. The ACOT was initiated to satisfy Technical Specification Surveillance Requirement 4.9.2b in preparation for initial fuel loading. The Technical Specification requires that the ACOT be performed on the Neutron Flux Source Range Channels (SR N31 and SR N32) within 8 hours prior to the start of initial core alterations. At approximately 0051 CST on February 9, 1990, the I&C technicians withdrew the SR N31 Drawer from the Nuclear Instrumentation Cabinet (EIIS:(CAB)(JC)) in accordance with the ACOT procedure. The Source Range Instrumentation Drawer assemblies are mounted on slide rails to provide easy withdrawal from the cabinet. Coincident with the withdrawal of the drawer, a momentary spike is assumed to have occurred which resulted in the initiation of an RPS Flux Doubling Signal consistent with the one-out-of-two channel logic.

The CPSES Source Range Nuclear Instrumentation provides indication of the neutron flux level of the reactor core during reactor shutdown and startup. SR N31 and SR N32 utilize BF3 proportional detectors, a remote pre-amplifier and processing circuitry in a cabinet mounted drawer. The detector generates pulses proportional to the neutron flux which are amplified by the pre-amplifier. The source range drawer then amplifies, shapes, integrates and again amplifies the pulses to develop the signal. The signal is then used for neutron flux indication and inputs to various bistables, recorders and the flux doubling circuitry. When the source range neutron flux level doubles within 10 minutes or less, a Flux Doubling Signal is generated. The Flux Doubling Signal is an input to the Solid State Protection System (SSPS) (EIIS:(JG)) which initiates the shift of the CCP suction from the VCT to the Refueling Water Storage Tank (RWST)(EIIS:(TK)(BE)).

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As a result of the Flux Doubling Signal, valves 1-LCV-112D & -112E (isolation valves (EIIS:(ISV)(CB)) from the RWST) automatically opened and valves 1-LCV-112B & -112C (isolation valves from the VCT) automatically closed to cause the CCP suction to shift from the VCT to the RWST. Both pairs of isolation valves are considered part of the Chemical Volume and Control System (CVCS) (EIIS:(CB)). At 0052 CST, following receipt of the Flux Doubling Alarm (EIIS:(ALM)(IB)), control room personnel (utility, licensed) responded to the event by verifying that the expected actuations had occurred and that the indication was appropriate for existing plant conditions. The Shift Supervisor then directed that the Flux Doubling Signal "BLOCK" be inserted and the CCP suction lineup to the VCT be restored. Subsequently, he requested that the I&C technicians (who were working in the vicinity) to insert and withdraw the SR N31 drawer again. Upon completion of this action, the Flux Doubling Alarm (which had previously been cleared) returned and the withdrawal of the drawer was confirmed as the source of the Flux Doubling Signal. The CCP suction shift to the RWST was confirmed during the post event review of the trend recorder which indicated a rise in the VCT level.

Following the initiation of the Flux Doubling Signal, and subsequent control room personnel actions, the I&C technicians discussed the situation with the Shift Supervisor and it was agreed that the Flux Doubling Signal "BLOCK" should be inserted and would remain in place until the surveillance testing was completed. Subsequently, the ACOT procedures for SR N31 and SR N32 were revised and steps rearranged to require that control room personnel place the "SR FLUX DBLG" switches to the "BLOCK" position prior to opening the Source Range Nuclear Instrumentation Cabinet Drawer.

Following approval of the procedure revisions, the ACOT for SR N31 was successfully completed at approximately 0213 CST. The ACOT for SR N32 was started immediately following the SR N31 ACOT completion and was successfully completed at approximately 0306 CST on February 9, 1990. No additional Flux Doubling Alarms were received during the surveillance testing.

An event or condition that results in an automatic actuation of any ESF, including the RPS is reportable within 4 hours under 10CFR50.72(b)(2)(ii). At approximately 0141 CST on February 9, 1990, the Nuclear Regulatory Commission Operations Center was notified via the Emergency Notification System of the event as required.

C. STATUS OF STRUCTURES, SYSTEMS, OR COMPONENTS THAT WERE INOPERABLE AT THE START OF THE EVENT AND THAT CONTRIBUTED TO THE EVENT:

Not applicable - no structures, systems, or components were inoperable at the start of the event that have been determined to have contributed to the event.

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D. CAUSE OF EACH COMPONENT OR SYSTEM FAILURE, IF KNOWN:

Not applicable - no component or system failures have been identified.

E. FAILURE MODE, MECHANISM, AND EFFECT OF EACH FAILED COMPONENT:

Not applicable - no failed components have been identified.

F. FOR FAILURES OF COMPONENTS WITH MULTIPLE FUNCTIONS LIST OF SYSTEMS OR SECONDARY FUNCTIONS THAT WERE ALSO AFFECTED:

Not applicable - no component failures have been identified.

G. FOR FAILURES THAT RENDERED A TRAIN OF A SAFETY SYSTEM INOPERABLE, AN ESTIMATE OF THE ELAPSED TIME FROM THE DISCOVERY OF INOPERABILITY UNTIL THE TRAIN WAS RETURNED TO SERVICE:

Not applicable - no failures have been identified.

H. THE METHOD OF DISCOVERY OF EACH COMPONENT OR SYSTEM FAILURE OR PROCEDURAL ERROR:

Not applicable - no component or system failures or procedural errors have been identified.

I. CAUSE OF THE EVENT:

Root Cause:

The cause of the RPS Flux Doubling Signal is assumed to be a momentary spike on SR N31 which occurred when the SR N31 drawer was withdrawn from the Nuclear Instrumentation Cabinet while performing routine surveillance testing.

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After having investigated the apparent potential causes for this event, there has been no single reproducible occurrence which can be identified that caused the spike when the SR N31 drawer was withdrawn. The following actions were taken as part of the investigation to determine the root cause of the spike.

1. The System Engineer (utility, non-licensed) conducted discussions with the appropriate Westinghouse representative (contractor, non-licensed) and the CPSES engineer (contractor, non-licensed) with previous Unit 1 startup experience on this system to determine the potential causes of the spike. Loose connectors and a change in the grounding path via the drawer slides were identified as potential causes for a spike. Based on these discussions, a determination was made that this event had not occurred previously at CPSES, but had occurred within the industry.

2. A visual inspection of the opened drawer was conducted to determine if any loose connectors could be identified, including the ground wire. No loose connector problems were found.

3. A second inspection was conducted under an approved work document with the Flux Doubling Signal "BLOCK" inserted to determine whether or not moving the connectors/wires associated with the drawer, or moving the drawer, could initiate a Flux Doubling Signal. The results were similar to the first inspection and no specific cause for the spike was identified.

4. On several occasions since the event occurred, (during routine surveillance testing), with the Flux Doubling Signal "BLOCK" inserted, the SR N31 monitor was observed to see if any spikes resulted from withdrawing/inserting the drawer. The surveillance activities did not initiate a Flux Doubling Signal.

Contributory Factors:

1. The background neutron flux level was < 1 count per second due to no fuel in the reactor vessel. The flux doubling circuit is sensitive enough that any small signal detector change or signal spike would meet the doubling requirements and initiate a Flux Doubling Signal.

2. The Flux Doubling Signal was not blocked prior to sliding the Source Range Drawer out. The I&C ACOT procedure specified that the drawer be withdrawn prior to inserting the "BLOCK" of the Flux Doubling Signal.

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J. SAFETY SYSTEM RESPONSES THAT OCCURRED:

The following safety system actuated automatically as a result of the event. The appropriate components within this system operated as designed upon receipt of the Flux Doubling Signal from the SSPS.

Chemical Volume and Control System Train 'A' and 'B'.

K. FAILED COMPONENT INFORMATION:

Not applicable - no failed components were involved.

II. ASSESSMENT OF THE SAFETY CONSEQUENCES AND IMPLICATIONS OF THIS EVENT:

Source Range Nuclear Instrumentation provides the following functions:

1. Protects against excessive power excursions caused by unexpected reactivity additions and high startup rates while in the source range;

2. Terminates inadvertent boron dilution transients and initiates boration to minimize the approach to criticality while in the source range (i.e., Flux Doubling Signal); and

3. Provides low power indication (i.e., Audible/Visual flux count rate indication of 1 through 1E+06 counts per second).

This event consisted of a Flux Doubling Signal being generated from the Source Range Nuclear Instrumentation. However, based on the following factors, the event did not adversely affect the safe operation of CPSES Unit 1 or the health and safety of the public.

1. The Flux Doubling signal was inadvertent and not required to mitigate an actual boron dilution transient. Since no fuel had been placed in the reactor vessel an inadvertent criticality could not be achieved even if an actual dilution transient had occurred.

2. The appropriate safety system actuated automatically upon the initiation of the Flux Doubling Signal and would have performed its design function if an actual boron dilution transient had occurred. The possible dilution accident situations have been analyzed in FSAR Chapter 15 and it has been concluded that the successful automatic actuation of the CVCS isolation valves will terminate the dilution transient, initiate boration, and the reactor will be left in a stable condition while regaining the required shutdown margin.

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III. CORRECTIVE ACTIONS:

A. IMMEDIATE:

Operations Shift personnel responded appropriately to the Flux Doubling Alarm which was received on the main control board (EIIS:(MCBD)(IB)). The Reactor Operator blocked the Flux Doubling Signal and restored the actuated components to their original positions.

B. ACTIONS TO PREVENT RECURRENCE:

Root Cause:

Following the completion of troubleshooting and investigation, no root cause could be determined for the spike.

Corrective Action:

Although no specific root cause can be identified, corrective action for Contributory Factor - 1 will provide the barrier to prevent recurrence of this event.

Contributory Factor -1:

The Flux Doubling Signal was not blocked prior to withdrawing the drawer. The I&C ACOT procedure specified that the drawer to be withdrawn prior to inserting the "BLOCK" of the Flux Doubling Signal.

Corrective Action - 1:

I&C has revised both procedures for conducting the ACOT's for SR N31 and SR N32 by rearranging the steps to require that the "BLOCK" be inserted prior to withdrawing the drawer rather than after. This action will prevent initiation of a Flux Doubling Signal during future ACOT surveillance testing activities.

Contributory Factor - 2:

The background neutron flux level was < 1 count per second due to no fuel in the reactor vessel. The Flux Doubling circuit is sensitive enough that any small signal detector change or spike would meet the doubling requirements and initiate a Flux Doubling Signal.

Corrective Action - 2:

This condition was unique to initial fuel load. Since CPSES Unit 1 has subsequently completed initial fuel loading, a neutron flux greater than during this event will be present during future plant operations with the possible exception of complete core off load conditions. Based on the corrective actions taken to prevent recurrence, no corrective action is necessary to resolve this contributing factor.

C. ACTION TAKEN ON GENERIC CONCERNS IDENTIFIED AS A DIRECT RESULT OF THE EVENT:

Generic Implication:

Additional procedures may exist that require the withdrawal of a drawer from the Nuclear Instrumentation Cabinets prior to inserting the signal "BLOCK". Also, I&C procedures for reactor protection functions may not specify placing the trip bistables to "TEST" or "BLOCK" mode before calibration activities are performed.

Corrective Action:

I&C has conducted a review to identify those procedures which include removal of a drawer from Nuclear Instrumentation Cabinets. In addition to the two procedures which have been previously identified, four associated Source Range procedures have also been revised to rearrange the steps to place the Source Range Doubling Block Switch in the "BLOCK" position prior to withdrawal of the drawers.

Procedures for the Intermediate and Power Range drawers have been reviewed and determined to have steps placing the channel in "BLOCK" or "TEST" mode prior to drawer withdrawal.

Also, I&C procedures with reactor protection functions will be reviewed to verify that the trip bistables are placed in either "TEST" or "BLOCK" modes in the proper sequence.

IV. PREVIOUS SIMILAR EVENTS:

There have been no previous similar events reported pursuant to 10CFR50.73.