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May 13, 1991

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 (CPSES)
DOCKET NO. 50-445
MANUAL OR AUTOMATIC ACTUATION OF ANY ENGINEERED SAFETY FEATURE
LICENSEE EVENT REPORT 91-014-00


Gentlemen:

Enclosed is Licensee Event Report 91-014-00 for Comanche Peak Steam Electric Station Unit 1, "Two Inadvertent Auxiliary Feedwater System Actuations Due to Inadequate Procedures and Mode Selector Switch Design."

Sincerely,

William J. Cahill, Jr.

By:


W. G. Gulderson
Manager, Site Licensing

JAA/bm

c - Mr. R. D. Martin, Region IV
Resident Inspectors, CPSES (2)

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S PDR

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

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NRC FORM 366				U.S. NUCLEAR REGULATORY COMMISSION				APPROVED OMB NO. 3150-0104 EXPIRES: 4/30/92			
LICENSEE EVENT REPORT (LER)								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.			
Facility Name (1) COMANCHE PEAK - UNIT 1								Docket Number (2) 015101010141415		Page (3) 1 OF 110	
Title (4) TWO INADVERTENT AUXILIARY FEEDWATER SYSTEM ACTUATIONS DUE TO INADEQUATE PROCEDURES AND MODE SELECTOR SWITCH DESIGN											
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
04	13	91	91	0114	0	04	05	11	N/A		015101010111
									N/A		015101010111
Operating Mode (9) 5 This report is submitted pursuant to the requirements of 10 CFR 50. (Check one or more of the following) (11)											
Power Level (10)		20.402(b)		20.405(a)(1)(i)		50.73(a)(2)(iv)		73.71(b)			
01010		20.405(a)(1)(ii)		50.36(c)(1)		50.73(a)(2)(v)		73.71(c)			
		20.405(a)(1)(iii)		50.36(c)(2)		50.73(a)(2)(vi)		Other (Specify in Abstract below and in Text, NRC Form 366A)			
		20.405(a)(1)(iv)		50.73(a)(2)(i)		50.73(a)(2)(vii)(A)					
		20.405(a)(1)(v)		50.73(a)(2)(ii)		50.73(a)(2)(vii)(B)					
				50.73(a)(2)(iii)		50.73(a)(2)(v)					
Licensee Contact For This LER (12)											
Name T. A. HOPE								Area Code 81117		Telephone Number 819171-16131710	
COMPLIANCE SUPERVISOR											
Complete One Line For Each Component Failure Described in This Report (13)											
Cause	System	Component	Manufacturer	Reportable To NPSDS		Cause	System	Component	Manufacturer	Reportable To NPSDS	
Supplemental Report Expected (14)										Expected Submission Date (15)	
<input type="checkbox"/> Yes (If yes, complete Expected Submission Date)										<input checked="" type="checkbox"/> No	
Abstract (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)											
<p>On April 13, 1991, a "Safety Injection Without Loss of Power Train B" test was in progress. Upon taking the Solid State Protection System (SSPS) to Normal, an Auxiliary Feedwater (AFW) actuation occurred. The cause was an earlier procedural step that did not completely block an Auxiliary Feedwater actuation from occurring.</p> <p>On April 15, 1991, a "Safety Injection in Conjunction With Loss of Offsite Power Train B" test had just been completed and restoration was in progress. An AFW actuation occurred when fuses were being installed in the Train B Aux Relay Rack. The cause of the actuation was that the slave relays did not reset as expected due to the presence of a 15 Volt DC test voltage that exists when the SSPS is in the Mode 5/6 lineup. This voltage is not enough to cause the relays to actuate, but is enough to hold the relays once actuated.</p> <p>The root causes were inadequate test procedures and MODE SELECTOR switch design. Procedure revisions have been made to correct the deficiencies and to be more compatible with the switch design to preclude recurrence of these events.</p>											

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

I. DESCRIPTION OF THE REPORTABLE EVENT

A. REPORTABLE EVENT CLASSIFICATION

Any event or condition that resulted in manual or automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (EIS:(JC)).

B. PLANT OPERATING CONDITIONS PRIOR TO THE EVENT

April 13, 1991

On April 13, 1991, Comanche Peak Steam Electric Station (CPSES) Unit 1 was in Mode 5, Cold Shutdown, with reactor coolant temperature at 100 degrees Fahrenheit. ESF Surveillance Test, "Safety Injection Without Loss of Power Train B", was in progress. Train B Solid State Protection System (SSPS) (EIS:(JE)) was in the Mode 5/6 lineup to prevent selected ESF actuations. Three of four Steam Generators (SG) (EIS:(SG)(SB)) were drained for maintenance activities.

April 15, 1991

On April 15, 1991, CPSES Unit 1 was in Mode 5, Cold Shutdown, with reactor coolant temperature at 98 degrees Fahrenheit. ESF Surveillance Test, "Safety Injection in Conjunction With Loss of Offsite Power Train B", had just been completed and restoration was in progress. Train B SSPS was in Normal in accordance with the System Operating Procedure for the SSPS. Two of four SGs were drained for maintenance activities. Auxiliary Feedwater (AFW) actuation circuitry (EIS:(34)(BA)), blocked by removal of the BOP Aux Relay Rack fuses (EIS:(FU)(JE)), was being restored.

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

There were no inoperable structures, systems or components that contributed to the event.

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<p>D. NARRATIVE SUMMARY OF THE EVENT, INCLUDING DATES AND APPROXIMATE TIMES</p> <p>April 13, 1991</p> <p>At 0600, April 13, 1991, while performing "Safety Injection Without Loss of Power Train B", the Test Director (utility, non-licensed) was directed by the test procedure to lift and isolate a conductor to defeat the SG LO-LO Level AFW interlock (EIIIS:(IEL)(JE)). At 0609, in accordance with the test procedure, the Reactor Operator (RO) (utility, licensed) was placing SSPS in the normal lineup. Upon taking SSPS to Normal, an AFW actuation occurred. The lifting of the conductor did prevent the starting of Motor Driven Auxiliary Feedwater (MDAFW) Pump 02 (EIIIS:(P)(BA)), but it did not prevent the following from occurring:</p> <ul style="list-style-type: none"> • Condensate Storage Tank Outlet Isolation valve (EIIIS:(ISV)(KA)) closed, • MDAFW Pump 02 Discharge Throttle valve (EIIIS:(FCV)(BA)) tripped to auto and opened, • SG Sampling valves (EIIIS:(SMV)(KN)) closed. <p>The test procedure failed to completely block an automatic AFW actuation due to a SG LO-LO Level signal. The signal was received when SSPS was placed in the Normal lineup and received valid SG LO-LO Level signals from the three SGs that were drained for maintenance activities.</p> <p>The Nuclear Regulatory Commission was notified of the event via the Emergency Notification System at 0803, April 13, 1991.</p> <p>April 15, 1991</p> <p>At 1435, April 15, 1991, the Test Director informed the Unit Supervisor (utility, licensed) that the test, "Safety Injection in Conjunction With Loss of Offsite Power Train B", was completed and requested that Train B SSPS be restored to the Mode 5/6 lineup in accordance with the System Operating Procedure. At 1445, the Test Director received notification from the RO that Train B SSPS had been restored to the Mode 5/6 lineup and received permission from the Unit Supervisor to restore the 2/4 SG LO-LO Level AFW Actuation circuit by replacing the fuses in the BOP Aux Relay Racks. At 1450, the RO installed a fuse in the Aux Relay Rack 2 in accordance</p>									

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with the test procedure and immediately heard several relays energize. The RO quickly returned to the Main Control Board (EIS:(MCBD)(ID)) and observed that the:

- Condensate Storage Tank Outlet Isolation valve closed,
- MDAFW Pump 02 Discharge Throttle valve tripped to auto and opened.

The RO and Test Director went to the Train B SSPS Output Relay Cabinets (EIS:(CAB)(JE)) and observed that the slave relays, K640 and K641 (EIS:(83)(JE)), were energized. The RO reset the relays and the Unit Supervisor directed the repositioning of the actuated valves.

Reference Figure 1 on page 10 for the following explanation:

All non-latching slave relays in the SSPS, including K640 and K641, were expected to deenergize when switching from the Normal lineup to the Mode 5/6 lineup when the MODE SELECTOR switch (EIS:(HS)(JD)) was taken from OPERATE to TEST. When SSPS is in the Normal lineup with the MODE SELECTOR switch in the OPERATE position the "A" contacts are closed which provide 118 Volts AC (VAC) to the slave relay coils for normal operation upon master relay contact closure. When placing the SSPS in a Mode 5/6 lineup the MODE SELECTOR switch is taken to the TEST position, closing the "B" contacts and opening the "A" contacts. Due to a "make-before-break" MODE SELECTOR switch design (i.e., contacts "A" closed at the same time contacts "B" are closed), the slave relay has a potential of being "sealed-in" by the 15 Volt DC (VDC) test source. The 15 VDC supply is intended for test (continuity verification) purposes only and will not supply enough current to energize the relay, but 15 VDC will provide enough current to hold the relay if already energized via the 118 VAC source, which is what occurred in this event. The master relay was energized because two SGs were drained for maintenance activities so valid SG LO-LO Level signals were present.

The Nuclear Regulatory Commission was notified of the event via the Emergency Notification System at 1556, April 15, 1991.

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

April 13, 1991

Main Control Board annunciators (EHS:(ALM)(IB)) and indications were received in the Control Room when the RO placed SSPS in the Normal lineup.

April 15, 1991

When the RO installed a fuse in the Aux Relay Rack 2 he immediately heard several relays energize. Main Control Board annunciators and indications were received in the Control Room.

II. COMPONENT OR SYSTEM FAILURES

A. FAILURE MODE, MECHANISM, AND EFFECT OF EACH FAILED COMPONENT

No failed components contributed to this event.

B. CAUSE OF EACH COMPONENT OR SYSTEM FAILURE

No failed components contributed to this event.

C. SYSTEMS OR SECONDARY FUNCTIONS THAT WERE AFFECTED BY FAILURE OF COMPONENTS WITH MULTIPLE FUNCTIONS

No failed components contributed to this event.

D. FAILED COMPONENT INFORMATION

No failed components contributed to this event.

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IV. CAUSE OF THE EVENTS

ROOT CAUSE

1. The test procedure, "Safety Injection Without Loss of Power Train B", was incorrect. The SG LO-LO Level AFW Interlock was not fully defeated, as intended, by lifting the specified lead. This step only prevented the starting of MDAFW Pump 02 on an AFW actuation signal and did not address the necessary steps to prevent SC Blowdown and Sampling valves, MDAFW Pump 02 Discharge Throttle valves or the Condensate Storage Tank Outlet Isolation valve from stroking.
2. The test procedure, "Safety Injection in Conjunction With Loss of Offsite Power Train B", and the SSPS System Operating Procedure were not compatible with the MODE SELECTOR SWITCH design. The MODE SELECTOR switch does not drop non-latching slave relays in the SSPS when making the transition from the Normal lineup to the Mode 5/6 lineup by taking the MODE SELECTOR switch from OPERATE to TEST. When in TEST, the 15 VDC potential is sufficient to hold actuated relays.

V. CORRECTIVE ACTIONS

A. CORRECTIVE ACTIONS TO PREVENT RECURRENCE

ROOT CAUSE

1. The test procedure, "Safety Injection Without Loss of Power Train B", was incorrect.

CORRECTIVE ACTION

A procedure change was issued to remove the fuses in the BOP Aux Relay Racks which supply control power to relays actuated on a 2/4 SG LO-LO Level. A procedure change was also made to test procedure, "Safety Injection in Conjunction With Loss of Offsite Power Train B", to add the same steps.

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<p>2.. The test procedure, "Safety Injection in Conjunction With Loss of Offsite Power Train B", and the SSPS System Operating Procedure were not compatible with the MODE SELECTOR SWITCH design.</p> <p>CORRECTIVE ACTION</p> <p>A change was made to the system operating procedure to add steps to assure that all slave relays are reset and unlatched during the transition from a Normal lineup to a Mode 5/6 lineup in order to prevent unexpected ESF Actuations. Since all SSPS test procedures utilize the system operating procedure to change SSPS modes, this procedure change will also correct any generic concerns with any other SSPS test regardless of train.</p> <p>A change was made to the test procedure to add a caution step prior to fuse replacement in the BOP Aux Relay Rack to ensure slave relays associated with AFW actuation signal are reset. A procedure change was also made to test procedure, "Safety Injection Without Loss of Power Train B", to add the same caution.</p> <p>B. ACTION TAKEN ON GENERIC CONCERNS IDENTIFIED AS A DIRECT RESULT OF THE EVENT</p> <p>These and similar events involving SSPS testing could also occur in Train A if a similar sequence of events took place involving these components.</p> <p>CORRECTIVE ACTION</p> <p>A change was made to the system operating procedure to add steps to assure that all slave relays are reset and unlatched during the transition from a Normal lineup to a Mode 5/6 lineup in order to prevent unexpected ESF Actuations. Since all SSPS test procedures utilize the system operating procedure to change SSPS modes, this procedure change will correct any generic concerns with any other SSPS test regardless of train.</p>									

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<p>VI. PREVIOUS SIMILAR EVENTS</p> <p>LER 90-013, "Reactor Trip Due to Loss of Feedwater Pump Speed Controllers During Maintenance", root causes were determined to be an inadequate procedure review and approval process by allowing procedures to be used for modes they were not intended by marking "N/A" in the prerequisite, and the Operations and I&C plant impact review of the work order was less than adequate. The corrective actions for LER 90-013 would not have prevented either event. The test procedure was used during the correct mode and the work order review was adequate and would not have caught the procedure inadequacy.</p> <p>LER 90-018, "Inadvertent Automatic Start of Auxiliary Feedwater Pump Due to Personnel Error", root cause was determined to be less than adequate personnel performance. A contributing factor was less than adequate procedural guidance. The procedure inadequacies were corrected and in place for the two April events. The corrections to the system operating procedure would not have prevented this event.</p> <p>VII. ADDITIONAL INFORMATION</p> <p>The times listed in the report are approximate and Central Daylight Time.</p>									

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The diagram illustrates a control circuit. At the top, a 118 VAC source (labeled A) and a 15 VDC source (labeled B) are connected to a MODE SELECTOR SWITCH. The switch has two positions: 'Operate' and 'Test'. The 'Operate' position is selected. The circuit then splits into two parallel branches. The left branch contains a Slave Relay Coil (K640 typical) in series with a Master Relay Coil (labeled M). The right branch contains Slave Relay Contacts (labeled B). Both branches rejoin and connect to a common return line. A note indicates the circuit is shown with the Master Relay energized.

Figure 1