

APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report Nos. 50-445/91-61; 50-446/91-61

Operating License No. NPF-87

Construction permit No. CPPR-127

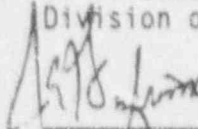
Licensee: TU Electric
400 North Olive Street, L.B. 81
Dallas, Texas 75201

Facility Name: Comanche Peak Steam Electric Station (CPSES)

Inspection At: CPSFS, Glen Rose, Texas

Inspection Conducted: November 18-22, 1991

Inspector: H. F. Bundy, Reactor Inspector, Test Programs Section
Division of Reactor Safety

Approved: 
J. E. Magliardo, Chief, Test Programs Section
Division of Reactor Safety

12/10/91
Date

Inspection Summary

Inspection Conducted November 18-22, 1991 (Report 50-445/91-61)

Area Inspected: Routine, announced inspection of the licensee's programmed enhancements in response to Generic Letter (GL) 88-17, "Loss of Decay Heat Removal."

Results: The licensee's actions were responsive to GL 88-17 programmed enhancement recommendations. The licensee's program exhibited the following strengths:

- o Reactor coolant system (RCS) status and residual heat removal (RHR) performance monitoring instrumentation was user friendly in that it was mostly clustered on one panel in the main control room.
- o The RCS level readings were noted by the inspector to be accurate while the RCS level was at mid-loop.
- o The RCS status and RHR performance monitoring instrumentation was diverse and redundant with appropriate alarms available in the main control room.

- Administrative procedures and controls were comprehensive and well organized.
- Sufficient equipment had been dedicated procedurally for emergency RCS makeup and core cooling.
- The analyses, which supported reduced inventory operating procedures and equipment configuration, were comprehensive and clear.
- The licensee's actions to minimize RCS perturbations during reduced inventory operations were comprehensive, particularly in the areas of training and outage management.

The following inspector observations were provided to the licensee for consideration for possible further improvement of the subject program:

- There was an apparent need for better administrative controls for the installation and maintenance of temporarily installed hoses based on a poorly routed Tygon vent hose identified during the plant walkdown.
- Consideration should be given to install trending capability for RHR pump motor current, RHR pump suction pressure, and RCS level as suggested by GI 88-17.
- The procedure for responding to RHR system malfunctions (ABN-104A) was complex and difficult to follow.

At the exit meeting, licensee representatives indicated that they would consider the above observations in completing their enhancement program. They had already taken some actions as discussed in paragraph 2.2. The inspector found the programmed enhancement actions completed by the licensee to be of high quality. No violations or deviations were identified. An unresolved item (445/9161-01) involving the licensee's redefinition of the RCS level for reduced inventory conditions is discussed in paragraph 2.2.2.

Inspection Conducted November 18-22, 1991 (Report 50-446/91-51)

Areas Inspected: No inspection of Unit 2 was performed.

Results: Not applicable.

DETAILS

1. PERSONS CONTACTED

TU ELECTRIC

- *J. Donahue, Manager, Operations
- *W. Guldemon, Manager, Site Licensing
- *B. Lancaster, Manager, Plant Support
- *J. LaMarca, Manager, Technical Programs
- *D. Davis, Manager, Plant Analysis
- *M. Palmer, Manager, Event Analysis
- *S. Palmer, Stipulation Manager
- *R. Cole, Manager, Reactor Engineering
- *W. Rosette, Station Nuclear Engineering Supervisor
- *J. Jank, Unit Supervisor
- M. Oliver, Professional Staff Training Supervisor
- R. Colde, Simulator Training Supervisor
- *N. Harris, Senior Licensing Specialist
- *J. Meyer, Principal Engineer, Plant Engineering
- *O. Bhatti, Site Licensing

CASE

- *O. Thero, Consultant

NRC

- *W. Johnson, Senior Resident Inspector

The inspector also interviewed other licensee employees during the inspection.

*Denotes those attending the exit meeting on November 22, 1991.

2. PROGRAMMED ENHANCEMENTS IN RESPONSE TO GENERIC LETTER 88-17 - LOSS OF DECAY HEAT REMOVAL (TI 2515/103)

2.1 Generic Letter 88-17 Recommendations and Inspection Scope

Generic Letter (GL) 88-17 provided recommended licensee actions to prevent and, if necessary, to respond to loss of decay heat removal (DHR) during operations with the reactor coolant system (RCS) partially drained.

Recommendations were made by GL 88-17 in two categories:

- o Expeditious actions, which were to be implemented prior to operating in reduced inventory conditions, and

- Programmed enhancements, which were to be developed in parallel with the expeditious actions and were to replace, supplement, or add to the expeditious actions.

The NRC's review of the licensee's expeditious actions was documented in NRC Inspection Report 50-445/89-90. The purpose of this inspection was to ascertain completion of programmed enhancements. For the purpose of future reference, the programmed enhancement recommendations are briefly paraphrased below (to avoid confusion, the numbers are identical to similar items contained in GL 88-17).

Programmed Enhancements

(1) Instrumentation

Provide reliable indications of parameters that describe the state of the RCS and the performance of systems normally used to cool the RCS for both normal and accident conditions. At a minimum, provide the following in the control room:

- Two independent RCS level indications;
- At least two independent temperature measurements representative of the core exit temperature whenever the reactor vessel (RV) head is located on top of the RV;
- The capability of continuously monitoring DHR system performance whenever a DHR system is being used for cooling the RCS; and
- Visible and audible indications of abnormal conditions in temperature, level, and DHR performance.

(2) Procedures

Develop and implement procedures that cover reduced inventory operation and that provide an adequate basis of entry into a reduced inventory condition. These include:

- Procedures that cover normal operation of the nuclear steam supply system (NSSS), the containment, and supporting systems under conditions for which cooling would normally be provided by DHR systems;
- Procedures that cover emergency, abnormal, off-normal, or the equivalent operations of the NSSS, the containment, and supporting systems if an off-normal condition occurs while operating under conditions for which cooling would normally be provided by DHR systems; and

- Administrative controls that support and supplement the procedures and all other actions identified in this communication, as appropriate.

(3) Equipment

- Provide equipment of high reliability for cooling the RCS and avoiding loss of RCS cooling;
- Maintain equipment available to mitigate loss of DHR or loss of RCS inventory should either occur, including at least one high-pressure injection pump and one other system, each sufficient to keep the core covered; and
- Provide adequate equipment for personnel communications involving activities related to the RCS or systems necessary to maintain the RCS in a stable and controlled condition.

(4) Analyses

Conduct analyses to supplement existing information and develop a basis for procedures, instrumentation installation and response, and equipment/NSSS interactions and response.

(5) Technical Specifications (TS)

TS that restrict or limit the safety benefit of the actions identified in this letter should be identified, and appropriate changes should be submitted.

(6) Reactor Coolant System (RCS) Perturbations

Reexamine item (5) of the expeditious actions and refine operations as necessary to minimize the likelihood of loss of DHR.

2.2 Licensee's Actions in Response to GL 88-17 Programmed Enhancement Recommendations (TI 2515/103)

The inspectors' comments on the licensee's actions are provided below.

The Attachment is a tabulation of related documents reviewed by the inspectors. The document numbers used in this section are those assigned to the document in the Attachment. In addition to reviewing the listed documents and interviewing appropriate personnel, the inspector walked down installed instrumentation and equipment. The terms DHR and residual heat removal (RHR) may be considered synonymous.

The inspector reviewed the licensee's responses to GL 88-17 and the NRC followup questions, which were reflected in Documents 1 to 9. The inspector found the licensee's actions to be responsive to the GL 88-17 program enhancement recommendations. The licensee's program exhibited strengths in the following areas:

- o Instrumentation - The RCS status and RHR performance monitoring instrumentation was user friendly in that it was mostly clustered on one panel in the main control room. The instruments for measuring the significant parameters were diverse and redundant with appropriate alarms available in the main control room. The inspector noted that the RCS level indications were accurate when the RCS level was at mid-loop.
- o Procedures - The procedures and administrative controls were comprehensive and well organized. The prerequisites and limitations in the procedure for reduced inventory operations (Document 15) were extensive and appropriate.
- o Equipment - Sufficient equipment had been dedicated for emergency RCS makeup and core cooling. The flow paths had been adequately evaluated. The inspector noted that the centrifugal charging pumps (CCPs), safety injection pumps (SIPs), safety injection (SI) accumulators, and the refueling water storage tank (RWST) were procedurally required to be available for emergency RCS makeup during reduced inventory operations.
- o Analyses - The supporting analyses for operating procedures and equipment configuration were comprehensive and clear. They adequately supported all postulated operating configurations.
- o Minimizing RCS Perturbations - The reduced inventory operating procedure appeared to be effective in minimizing RCS perturbations. As a part of outage planning, the licensee had established a risk assessment task force. They had made an assessment of the preliminary outage schedule and identified some unacceptable risks. The final schedule had been modified to remove these risks. A risk assessment team also reviewed the outage schedule and activities on a daily basis to identify unacceptable risks. The inspector noted that all personnel who might be involved in activities with the potential to perturb the RCS had received classroom training in mid-loop operations.

The inspector provided the following observations to licensee management for consideration for possible further improvement of the enhancement program:

- o Installation and surveillance procedures for temporary vent hoses - During a walkdown, the inspector noted that the Tygon vent hose for the pressurizer had pinch points and a loop seal in which there was condensate. The licensee was notified and immediate action was taken to correct the routing. The licensee also issued

a condition report (Document 10) to generate appropriate corrective action to prevent recurrence. There appeared to be no effect on the RCS level reading, because the pressurizer manway was removed at the time. At the exit meeting, a licensee representative stated that more stringent installation and surveillance procedures were being developed for temporary vent hoses.

- Trending of Mid-Loop Operating Parameters - The licensee could trend most mid-loop operating parameters with the process computer. However, it was unable to trend readings from recently installed instruments such as RHR pump motor current, RHR pump suction pressure, and RCS level. Trends of these parameters were considered as valuable information in GL 88-17. The operations manager stated at the exit meeting that trending of these parameters was being studied.
- Enhancement of Abnormal Operating Procedures - Although the inspector considered the procedure for responding to RHR system malfunctions (Document 17) adequate, it was complex and difficult to follow. The operator would have to make a partial assessment of the event before he would know which section of the procedure to enter. A licensee representative stated that enhancement of this procedure had been planned.

A more detailed discussion of the six areas of programmed enhancements is given in the following subparagraphs.

2.2.1 Instrumentation

2.2.1.1 Level Instrumentation

There were wide- and narrow-range digital instruments for RCS level on a panel in the main control room. In addition, RCS level could be determined from a Tygon hose sight gauge in containment. During a walkdown with the RCS at mid-loop level, the inspector observed that the level instrumentation was accurate. The control board instruments had identical readings. The Tygon hose sight gauge was reading approximately 1.5 inches lower. This was within the expected accuracy range. There were mimics, both in the procedure and on the control panel, to advise the operator of desired operating levels. The levels were referenced to both plant elevation and height above mid-loop of the hot leg. In addition, a heated junction thermocouple level indicating system gave discreet point level readings at heights of 11 inches above the upper core plate to 49 inches above the RV flange. The diversity and redundancy of these systems met the intent of GL 88-17 for RCS level indication.

The inspector found the installation of RCS level instruments was generally of high quality. However, he noted that a Tygon vent hose for the pressurizer had pinch points and a loop partially filled with condensate. Upon

notification, the licensee's operations staff took immediate action to reroute the hose and initiated a condition report (Document 10) to generate actions to prevent recurrence. The inspector observed that the RCS level readings were not affected because the pressurizer manway had been removed to provide a hot-leg vent path as required by the steam generator nozzle dam installation procedure. At the exit meeting, a licensee representative stated that improved installation and surveillance procedures for temporary vent hoses were being developed.

2.2.1.2 Core Exit Temperature (CET) Monitoring

The licensee's reduced inventory operating procedure required at least 2 CET monitors with the head on the RV. The readings were displayed on a CRT and had alarm setpoints. The licensee had made provisions for temporary hookups, if necessary. The procedure did not allow going to reduced inventory with the RV head removed. The inspector observed that the licensee should consider alternate temperature monitoring if it should decide to allow future reduced inventory operation with the head removed.

2.2.1.3 Residual Heat Removal (RHR) System Monitoring

Most RHR performance monitoring indications were available at one instrument panel in the main control room. Among the parameters monitored were flow, RHR pump suction and discharge pressure, RHR heat exchanger inlet and outlet temperature, hot-leg temperature, RHR pump motor current, and RHR valve misalignments. The inspector observed that these instruments should provide a good reflection of RHR system performance.

2.2.1.4 Visible and Audible Indications of Abnormal Conditions

There were visual and audible alarms clustered at the main control board for all important RCS status and RHR performance monitoring parameters. Among these alarms were RCS low level, RHR pump low-suction pressure, and RHR pump motor current fluctuation. The licensee could trend most other parameters, but did not have instrumented trending capability for these three parameters. The inspector pointed out that trends of these parameters is considered valuable information in GL 88-17. A licensee representative noted at the exit meeting that the trending of these parameters on the process computer was being studied.

2.2.2 Procedures

The administrative procedures and controls were comprehensive and well organized. The prerequisites and limitations in the procedure for reduced inventory operations (Document 15) were extensive and appropriate. It required refresher training for operations, maintenance, planning, work control, and test department personnel who would be involved in reduced inventory operations. Adequate communication equipment was required to be

operational. The shift relief review checklist required recording the time to reach saturation following a loss of RHR. Containment integrity was adequately monitored. Completion of a prerequisite checklist was required every 12 hours when the plant was at reduced inventory.

During review of the procedure for reduced inventory operations, the inspector noted that the RCS level defining reduced inventory conditions was approximately 5 feet below the RV flange. The RCS level specified in GL 88-17 for reduced inventory conditions is 3 feet below the RV flange. The licensee had redefined reduced inventory level because of a concern with potential wetting of the reactor vessel head "O" rings during installation of the head. This would allow head installation at a reduced level without instituting reduced inventory controls. The licensee had supported the lower RCS level by completion of a 10 CFR Part 50.59 evaluation (Document 12), which concluded that it would not impact nuclear safety. Several letters (Documents 6 to 9) had been exchanged between the licensee and the NRC on this issue. The final NRC letter (Document 9) acknowledged that the licensee would make this change to a previous commitment based on a 10 CFR Part 50.59 evaluation. Document 9 concluded that further review of this issue would be considered during this inspection.

Based on the available information, the inspector could not confirm the licensee's conclusion that the lower RCS level for entering reduced inventory controls had no impact on margin of safety or probability of malfunction of equipment important to safety. It appeared that the new level for reduced inventory controls had been instituted with NRC knowledge at one other facility. The acceptability of redefining the reduced inventory level is unresolved pending further review by the NRC. Also, the process for notifying the NRC when commitments are changed using the 10 CFR Part 50.59 program will be reviewed. These issues remain unresolved pending further review and inspection. (Unresolved Item 445/9161-01).

Although the inspector considered the procedure for responding to RHR system malfunctions (Document 17) adequate, it was complex and difficult to follow. The operator would have to make a partial assessment of the event before he would know which section of the procedure to enter. A licensee representative stated that enhancement of this procedure had been planned.

2.2.3 Equipment

Sufficient equipment had been dedicated for emergency RCS makeup and core cooling. The flow paths had been adequately evaluated. The inspector noted that the CCP, SIPs, SI accumulators, and the RWST were procedurally required to be available for emergency RCS makeup during reduced inventory operations. The inspector noted that a considerable portion of the RWST inventory was unavailable for gravity feed because of the relatively low elevation of the RWST with respect to the RCS. The reduced inventory procedure required maintenance of an adequate liquid level in the RWST to provide gravity flow capability.

2.2.4 Analysis

The supporting analyses for operating procedures and equipment configuration were comprehensive and clear. They adequately supported all postulated operating configurations. The inspector noted that several recent analyses were actually prepared in response to NUREG 1410 (Vogtle event). However, they were responsive to GL 88-17 issues. To assess the adequacy of the licensee's calculations, the inspector reviewed portions of Documents 12 through 14, and 18 through 33.

2.2.5 Technical Specifications (TS) Changes

The only TS change made in response to GL 88-17 was transmitted from NRR by Document 34. It involved deletion of the automatic closure interlock (ACI) for the RHR system isolation valves. Consideration of this change was recommended in GL 88-17. It was supported by a generic Westinghouse technical evaluation.

2.2.6 Reactor Coolant System (RCS) Perturbations

The reduced inventory operating procedure appeared to be effective in minimizing RCS perturbations. As a part of outage planning, the licensee had established a risk assessment task force. They had made an assessment of the preliminary outage schedule and identified some unacceptable risks. The final schedule had been modified to remove these risks. A risk assessment team also reviewed the outage schedule and activities on a daily basis to identify unacceptable risks. The inspector noted that all personnel who might be involved in activities with the potential to perturb the RCS had received classroom training in mid-loop operations.

The inspector was aware that an apparent lapse in work controls occurred on November 8, 1991. As a result of removing a bonnet on a feedwater valve with the steam generator secondary manways removed, a containment breach occurred during core alterations. It was immediately closed. The inspector reviewed the condition report on this event (Document 11). The condition report should assure that appropriate corrective action is taken.

In reviewing the lesson plans and training records, the inspector observed that the operators had received simulator training on mid-loop operations. A scenario involving loss of offsite power while at mid-loop conditions should have been particularly instructive.

3. EXIT MEETING

The inspector met with licensee representatives denoted in paragraph 1 on November 22, 1991, and summarized the scope and findings of this inspection. The licensee did not identify, as proprietary, any of the material provided to, or reviewed by, the inspector during this inspection. Mr. D. D. Chamberlain (NRC) discussed Unresolved Item 445/9161-01 (paragraph 2.2.2) with Mr. R. D. Walker (TU Electric) on December 12, 1991, during a site visit.

ATTACHMENT

Documents Reviewed

1. Letter TXX-89041, TU Electric to NRC, "CPSES Response to GL 88-17 - Loss of DHR," dated February 10, 1989
2. Letter TXX-89282, TU Electric to NRC, "CPSES Updated Response to GL 88-17," dated June 1, 1989
3. Letter, NRC to TU Electric, "Comments on TU Electric Company Response to GL 88-17 with Respect to Expeditious Actions for Loss of DHR for CPSES," dated June 27, 1989
4. Letter TXX-89084, TU Electric to NRC, "CPSES Updated Response to GL 88-17," dated November 20, 1989
5. Letter TXX-90169, TU Electric to NRC, "Revised Response to GL 88-17, Loss of DHR," dated May 2, 1990
6. Letter TXX-91127, TU Electric to NRC, "Revision to RCS Water Level for Reduced Inventory Conditions," dated April 5, 1991
7. Letter, NRC to TU Electric, "Comanche Peak Revision to RCS Water level for Reduced Inventory Conditions," dated June 11, 1991
8. Letter TXX-91253, TU Electric to NRC, "Revision to RCS Water Level for Reduced Inventory Conditions Letter Withdrawal," dated July 29, 1991
9. Letter, NRC to TU Electric, "CPSES Revision to RCS Water Level for Reduced Inventory Conditions," dated September 30, 1991
10. ONE Form FX91-1535, "Vent Hose From Valve 1-RC-8098 Improperly Routed," dated November 20, 1991
11. ONE Form FX91-1440, "Breach of Containment During Core Alterations Caused by Repair Work on Valve 1FW-0090," dated November 8, 1991
12. Evaluation SE-91-86 (10CFR50.59), "Redefinition of RCS Reduced Inventory From Three Feet to Five Feet Below RV Flange," dated September 11, 1991
13. Westinghouse Technical Bulletin NSD-TB-87-02, Revision 2, "Head "O" Ring Leakage," dated July 13, 1990
14. Procedure IPO-TP-89A-1, Revision 0, "RCS Mid-Loop Operations/Vortex Testing," completed May 19, 1989
15. Procedure IPO-01CA, Revision 4, PCN 3, "RCS Reduced Inventory Operations," effective November 13, 1991

16. Form ODA-308-26, Revision 0, "Standard LOCAR Containment Integrity"
17. Procedure ABN-104A, Revision 4, PCN 3, "RHR System Malfunction," effective October 4, 1991
18. Calculation ME-CA-0250-2149, Revision 0, "Time to Core Uncovery Upon a Loss of DHR Capability During Mid-Loop Operations - Input to Procedure IPO-010A," prepared February 7, 1990
19. Memorandum CPSES-9119765, L. A. Wojcik to Dean Palmer, "NUREG 1410," dated August 12, 1991
20. Memorandum CPSES-9009301, D. Hiltbrand to File, "GL 88-17, Loss of DHR," dated April 9, 1990
21. Calculation ME-CA-0000-3111, Revision 0, "Containment Thermal Environment Due to a Loss of RHR During Mid-Loop Operations," approved August 27, 1991
22. Calculation ME-CA-0250-2155, Revision 0, "Radiological Consequences of a Loss of RHR, GL 88-17," approved April 6, 1990
23. Memorandum CPSES-9129798, J. W. Meyer to J. T. Jank, "Hot Leg Vent Path," November 8, 1991
24. Letter WPT-14019, Westinghouse Electric Corporation to TU Electric, "Loss of RHR Cooling in Reduced Inventory," dated October 17, 1991
25. Calculation ME-CA-0270-2139, "Requirements for Use of Hot Leg Vent Paths During Mid-Loop Operations With a Cold Leg Opening," approved March 13, 1990
26. Calculation 600, "Calculation of Loop and Density Errors During Mid-Loop Operation for the RV Level Measurement," reviewed August 3, 1989
27. Memorandum CPSES-9009504, R. C. Hagar to J. Donahue, "Calculations for Mid-Loop Operations," dated April 11, 1990
28. Calculation ME-CA-0250-2191, Revision 0, "SIP and CCP Flows Following a Loss of RHR Cooling During Mid-Loop Operations," approved April 9, 1990
29. Calculation ME-CA-0260-3079, Revision 0, "RWST Gravity Drain to RCS During Mid-Loop Operations," approved May 15, 1991
30. Letter WPT-11930, Westinghouse Electric Corporation to TU Electric, "CPSES Mid-Loop Calculations," dated August 25, 1989

31. Memorandum CPSES-9009308, R. C. Hagar to J. Donahue, "Calculations for Mid-Loop Operations," dated April 6, 1990
32. Memorandum CPSES-9028965, B. W. Wieland to D. Palmer, "Emergency Closure of Equipment Hatch," dated December 13, 1990
33. Technical Evaluation TE-MM-90-2671, "Technical Evaluation of Equipment Hatch Emergency Closure with Reduced Number of Bolts Installed," approved November 28, 1990
34. Letter, NRC to TU electric, "CPSES, Unit 1 - Amendment No. 4 to Facility Operating License No. NPF-87," dated October 8, 1991
35. Lesson Plan (LP) EM38.D91.IR3, "Mid-Loop Operations (IPO-10A)," approved August 20, 1991, and presentation records for September 25 to October 3, 1991
36. LP MM38.D91.IR1, "Continuing Training Third Quarter 91/Mid-Loop Operations," approved June 12, 1991, and presentation records for June 24 to July 29, 1991
37. LP GF11.RHR.X01, "Reduced Inventory operations Refresher," approved March 18, 1991, and presentation records for April 11 to September 19, 1991
38. LP L021.SM4.X01.LP001, "Mid-Loop Operations - Simulator Classroom," approved February 19, 1990, and presentation records for November 9, 1990, to November 8, 1991
39. LP L024.SM4MUB, "Mid-Loop Operations - Simulator Training," approved October 27, 1991, and presentation records for October 3 to November 8, 1991
40. LP L041A92.OP1, "Mid-Loop Operations," approved August 1, 1991, and presentation records for August 9 to September 13, 1991
41. LP L044A92AE2, "Mid-Loop Operations - Simulator Training," approved July 26, 1991, and presentation records for August 5 to September 9, 1991
42. LP ET28MLOR1, "Mid-Loop Operations," approved August 1, 1991, and presentation records for August 13 to September 27, 1991

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