TU ELECTRIC

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Group Vice President

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

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION (CPSES)-UNIT 2
DOCKET NO. 50-446
OPERATION ABOVE THE LICENSED MAXIMUM THERMAL POWER LEVEL

The attached report discusses violation of Section 2.C.(1) of the Comanche Peak Steam Electric Station Operating License for Unit 2, "Maximum Power Level." This report is submitted pursuant to the requirements of Section 2.E of the License.

Should you require additional information regarding this event, please do not hesitate to contact Obaid Bhatty at (817) 897-5839 to coordinate this effort.

Sincerely,

C. L. Terry

By: M.R. Blevins
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OB:ob
Attachment

cc: Mr. L. J. Callan, Region IV
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Resident Inspectors, CPSES

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FEBRUARY 14, 1996 OVERPOWER EVENT

PURPOSE

This report discusses violation of Section 2.C.(1) of the Comanche Peak Steam Electric Station Operating License for Unit 2, "Maximum Power Level." The report is submitted pursuant to the requirements of Section 2.E of CPSES Unit 2 License No. NPF-89.

ABSTRACT

On February 14, 1996, at approximately 8:31 a.m., and 10:03 a.m., two separate turbine runback events occurred. Both events were initiated by the inadvertent opening of condensate low pressure feedwater heater bypass valve 2-PV-2286. These transients resulted in a loss of efficiency and subsequent decrease in the temperature of the feedwater feeding the Steam Generators. This temperature reduction in combination with the negative moderator temperature coefficient of the reactor resulted in reactor power increasing to approximately 102 percent power based on indication from the excore Nuclear Instrumentation System (NIS). For both events the power increase was terminated by an automatic turbine runback when the Overpower N-16 runback setpoint was reached. Following the second runback, calorimetric data retrieved from the plant computer showed thermal power indicated approximately 101.77 percent or less for approximately 45 minutes. Nuclear Instrumentation indicated approximately 100 percent and N-16 power indicated approximately 106 percent during the same period.

TU Electric has concluded that the first (8:31 a.m.) event was caused due to less than adequate procedure and design documents used to calibrate loop 2-P-2240. The second event (10:03 a.m.) was caused by the opening of 2-PV-2286 due to low Feedwater Pump (FWP) suction pressure. The corrective actions were to review and correct Instrumentation and Control calibration procedures, form a task team to examine feedwater and heater drain design improvements, and enhance Licensed Operator training regarding end of core life transients.

DESCRIPTION OF THE EVENT

On February 14, 1996, at approximately 8:29 a.m., Comanche Peak Steam Electric Station (CPSES) Unit 2 was in coast down in preparation for its second refueling outage (2RF02). The plant was operating at approximately 95 percent power.

On February 14, 1996, at approximately 8:31 a.m., a transient on the secondary plant occurred when the low pressure feedwater heater bypass valve 2-PV-2286 opened. The inadvertent opening of the low pressure heater bypass valve caused a reduction in feedwater temperature due to feedwater bypassing the low pressure feedwater heat exchangers. The resultant cooler water effected level in the high pressure heaters causing extraction steam to these heaters to isolate. This loss of extraction steam further reduced feedwater system (EIIS:(SJ)) temperature. Since the Turbine load was not affected, the reactor's (EIIS:(RCT)) response was to increase thermal power to 102.2 percent NIS power as a result of the reactivity feedback from the combination of colder RCS cold leg temperature, and the negative moderator temperature coefficient. This power increase was terminated by an automatic turbine runback when the Overpower N-16 setpoint was reached. Indicated N-16 power peaked at approximately 109 percent prior to the turbine runback. The N-16 power monitor indirectly measures the thermal power of the NSSS by detecting the N-16 level (an isotope of nitrogen generated by neutron activation of oxygen contained in water) present in the coolant system. The N-16 monitor is rate compensated to provide anticipatory response to transients. The rate compensated output also provides N-16 power indication.

At CPSES the N-16 power monitor is used to produce Overtemperature and Overpower Reactor Protection System (RPS) actuations in contrast to Overtemperature delta T and Overpower delta T RPS functions used at other Westinghouse Pressurized Water Reactors. The Overpower N-16 runback activation is not a Reactor Protection System (RPS) or an Engineered Safeguards Feature Actuation. The runback initiation results from a control signal set with a setpoint conservatively below the RPS trip setpoint to preclude a reactor trip. The turbine runback is terminated when the overpower condition clears. The Overpower N-16 turbine runback (power reduction) experienced during this event was estimated to be from approximately 1105 MWe to approximately 990 MWe. After the initial runback of approximately 10 percent, the N-16 power indication was reduced from approximately 109 percent to approximately 105 percent and the actuation signal was cleared. The Plant Operators (utility, licensed) stabilized power at approximately 97 percent excore NIS and continued restoration of the affected Balance of Plant systems. Turbine power was restored to approximately 92 percent based on the efficiency gained by placing the low pressure feedwater heaters back in service. The plant operators were in the process of establishing extraction steam to the high pressure feedwater heaters which would restore plant efficiency and feedwater temperature to the values prior to the first transient.

On February 14, 1996, at approximately 10:01 a.m., 2-PV-2286 reopened. During restoration of extraction steam to high pressure Feedwater heaters 2A/2B, a differential pressure occurred between the two Heater Drain Tanks causing a corresponding level difference (i.e., a manometer effect) which resulted in a loss of Heater Drain forward flow. A loss of Heater Drain Pump forward flow caused a Feedwater Pump (FWP) (EIIS:(P)(SJ)) low suction pressure. The low FWP suction pressure caused 2-PV-2286 to open. Since the Turbine load was not affected, the natural, load-following response of the reactor (EIIS:(RCT)) was to increase to approximately 102 percent excore NIS power as a result of the colder feedwater temperature and the negative moderator temperature coefficient. At approximately 10:03 a.m., a second Overpower N-16 turbine runback occurred. Turbine Power reduction was estimated to be from approximately 1071 MWe to approximately 990 MWE. The N-16 monitor again peaked at approximately 109 percent before being reduced by the runback to approximately 106 percent indicated N16 power. The Plant Operators (utility, licensed) maintained reactor power at approximately 100 percent based on NIS while restoring the affected Balance of Plant systems. At approximately 10:28 a.m., after determining that the plant computer calorimetric and N-16 power indicated greater than 100 percent, the plant operators began reducing turbine load and inserting control rods to bring indicated calorimetric power down to 100 percent. Calorimetric data, used to calibrate NIS and N-16 monitors, is normally available for indication via the plant computer; however, the calorimetric instrumentation was out of service for instrument calibration prior to the first (8:31 a.m.) event. The calorimetric instrumentation was restored at approximately 9:30 a.m.. Data retrieved from the plant computer during the post event investigation showed reactor thermal power based on the 15 minute running average calorimetric power was in excess of 100 percent for approximately 45 minutes and at approximately 101.77 percent for approximately 35 minutes.

CAUSE OF THE EVENT

On February 14, 1996, two Overpower N-16 turbine runbacks were experienced. The 8:31 a.m. event and the 10:03 event were experienced due to 2-PV-2286 opening, however, causes of both events were deemed to be different.

The first event occurred when an Instrument and Control (I&C) Technician was performing a calibration on loop 2-P-2240 (Condensate pumps discharge header pressure, Channel 2240). When the I&C Technician pulled an NMA printed circuit card out of the rack for a scheduled calibration the turbine runback event occurred. A further review of the initial runback event concluded that the NMA card scheduled for calibration (Channel 2240) also shared a circuit with control loop 2-F-2243 (Condensate flow control, Channel 2243). When the channel 2240 NMA

card was removed for calibration, it resulted in the closure of 2-FCV-2243 (gland steam condenser condensate bypass valve). This created a differential pressure greater than 20 psid across the condenser sending an open signal to 2-PV-2286. 2-PV-2286 opening resulted in a transient in the feedwater system. Reactor power increased to approximately 102.2 percent NIS power to compensate for the colder feedwater. TU Electric believes that the 8:31 a.m. event was caused due to less than adequate design documentation and procedure used to calibrate loop 2-P-2240. The loop circuit drawing did not show the dual functionality of this circuit and the calibration procedure did not consider the dual function of the NMA card.

The second event occurred while restoring the secondary side to normal operation. During the restoration of extraction steam to high pressure Feedwater Heaters 2A/2B, the heater drain forward flow was lost causing low FWP suction pressure which reopened bypass valve 2-PV-2286. 2-PV-2286 opening resulted in a transient in the feedwater system. Reactor power increased to approximately 102 percent NIS power to compensate for the efficiency loss. TU Electric has concluded that the 10:03 a.m., event was caused due to differential pressure between the A and B heater drain tanks during the restoration of extraction steam to the high pressure feedwater heaters. This differential pressure caused the level in one of the heater drain tanks to decrease, and the low level signal caused the heater drain pump discharge valve to close resulting in loss of heater drain pump forward flow.

During the review of the subject event, it was noted that the N-16 and plant calorimetric printouts indicated that the power level may have been greater than 100 percent Rated Thermal Power (RTP) for approximately 45 minutes. TU Electric believes that the operators maintained reactor power based on Power Range NIS, which were indicating approximately 100 percent power, whereas the N-16 indications which are deemed to be more true reactor power indications than NIS (when considering the shadowing effects of the colder temperatures) were greater than 100 percent, and were not considered. When plant operators determined N-16 power indicated greater than 100 percent the plant calorimetric was referenced and action was taken to reduce all power indication to less than 100 percent.

ANALYSIS OF THE EVENT

The actual events were similar to the analysis of the "Decrease in Feedwater Temperature" event presented in CPSES Final Safety Analysis Report (FSAR) Section 15.1.1. However, in that analysis, calculations have shown that the inadvertent opening of the low pressure heater bypass valve, coupled with the trip of the heater drain pumps, would result in a decrease in the feedwater temperature of 35 degrees F. In the actual events, even though initiated by the inadvertent opening of the low pressure feedwater heater bypass valve, other system failures such as a

loss of extraction steam resulted in a total decrease in the feedwater temperature of approximately 200 degrees F. The effect of a 200 degrees F decrease in feedwater temperature is to increase the heat removed from the Reactor Coolant System by approximately 30 percent, which is significantly greater than the effects explicitly analyzed in the "non-steamline break" increase in heat removal by the secondary events presented in FSAR Chapter 15.1.

The actual events would be classified as ANS Condition II Events, events which have an expected frequency of occurrence not more than once per reactor year. The relevant event acceptance criteria for ANS Condition II events are the violations of specified acceptable design limits and the prevention of Departure from Nucleate Boiling (DNB). These criteria are also the bases for the safety limits presented in CPSES Technical Specification (TS) 2.1.1. The safety limits will not be exceeded if the Reactor Trip System is functioning as designed. The Overpower N-16 reactor trip function precludes exceeding the violations of specified acceptable design limits and the Overtemperature N-16 reactor trip function precludes exceeding the DNB event acceptance criterion. Because both of these trip functions were OPERABLE at the time of the events and during the subsequent recovery periods when the reactor power was greater than 100 percent RTP, and because the trip setpoints for these functions were not exceeded, the safety limits of TS 2.1.1 were maintained and the event acceptance criteria was met. Thus, it is concluded that the health and safety of the public was unaffected by these events.

CORRECTIVE ACTIONS

The I&C Procedure was revised to clarify the dual function of the printed circuit card. All of the procedures used for calibrating shared NMA cards were reviewed, and affected procedures were revised to preclude recurrence.

TU Electric had previously established a task team to evaluate design changes which would eliminate the manometer effect in the heater drain tanks, and additional items that cause a MFP low suction pressure. The goal of this team is to greatly reduce the likelihood of secondary induced runbacks. Additionally, a design modification has been issued to remove the control logic which opens 2-PV-2286 when 2-FV-2243 experiences a high differential pressure.

Operations training is being enhanced to include details regarding end of life runbacks and the effects on nuclear instrumentation and N-16 due to changes in cold leg temperature, and subsequent decrease in feedwater temperature. Moreover, a lessons learned will be issued which will describe the subject events, and will

reemphasize managements expectation with respect to utilization of all available indications during plant transients.

PREVIOUS SIMILAR EVENTS

There have been no previous reportable events at CPSES, where the causes of the events were similar to the February 14, 1996 event.