TXU Power

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Ref: 10CFR50.90

CPSES-200602475
Log # TXX-06205
File # 00236

December 14, 2006

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

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION (CPSES) DOCKET NOS. 50-445 AND 50-446 RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION RELATED TO LICENSE AMENDMENT REQUEST (LAR) 05-08, REVISION TO TECHNICAL SPECIFICATIONS FOR NOMINAL TRIP SETPOINTS (NTS) AND ALLOWABLE VALUE (AV) SETPOINTS FOR SG WATER LEVEL LOW-LOW AND HIGH-HIGH, TAC NOS. MD0187 AND MD0188

REF:
1) TXU Power letter, logged TXX-06001, from Mike Blevins to the U. S. Nuclear Regulatory Commission, dated February 21, 2006.
2) TXU Power letter, logged TXX-06150, from Mike Blevins to the U. S. Nuclear Regulatory Commission, dated September 12, 2006.

Dear Sir or Madam:

In Reference 1, TXU Generating Company LP (TXU Power) submitted a proposed license amendment (LAR) which would revise the Nominal Trip Setpoints (NTS) and Allowable Values (AV) of setpoints for steam generator (SG) water level low-low and high-high. The changes will be applicable to the replacement SGs in Unit 1. In Reference 2, TXU Power provided responses to an NRC request for additional information related to the initial submittal.

Based on a question provided by Mr. Mohan Thadani of the NRC in an email dated October 12, 2006, TXU Power hereby provides additional information regarding LAR 05-08. The NRC question and TXU Power's response are provided in Attachment 1 to this letter.

A001

This communication contains no new or revised licensing basis commitments.

Should you have any questions, please contact Mr. Bob Kidwell at (254) 897-5310.

In accordance with 10CFR50.91(b), TXU Power is providing the State of Texas with a copy of this letter.

I state under penalty of perjury that the foregoing is true and correct.

Executed on December 14, 2006

Sincerely,

TXU Generation Company LP

By: TXU Generation Management Company LLC
Its General Partner

Mike Blevins

By: [signature]
Fred W. Madden
Director, Oversight and Regulatory Affairs

RJK

Attachment TXU Power Response to Request for Additional Information

c - B. S. Mallett, Region IV
M. C. Thadani, NRR
Resident Inspectors, CPSES

Ms. Alice Rogers
Environmental & Consumer Safety Section
Texas Department of State Health Services
1100 West 49th Street
Austin, Texas 78756-3189

ATTACHMENT to TXX-06205

TXU POWER RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION RELATED TO LICENSE AMENDMENT REQUEST 05-08

REVISION TO TECHNICAL SPECIFICATIONS FOR NOMINAL TRIP SETPOINTS AND AV SETPOINTS FOR SG WATER LEVEL LOW-LOW AND HIGH-HIGH TAC NOS. MD0187 AND MD0188

NRC Question:

In Table 1 of the September 12, 2006 letter, the licensee presented the uncertainty allowances considered for the Unit 1 steam generator water level trip functions. We would like clarification of the method used to determine the uncertainty allowances in Table 1 for the following parameters:

(1) Process measurement uncertainty allowances, including the process pressure variations, reference leg temperature variations, fluid velocity effects, downcomer subcooling effects, mid-deck and intermediate pressure drop effects, feed ring pressure drop effects, lower deck plate and deck supports pressure drop effects, and non-recoverable losses due to carryunder into the lower downcomer,

(2) The environment allowance for reference leg heat up effects, and

(3) Transient effects, including single loop loss of normal feedwater, small steam line breaks outside containment, and increase in feedwater flow.

TXU Power Response:

The steam generator water level indication is inferred from a differential pressure transmitter. In the ideal state, the pressure acting on each side of the transmitter is simply the static head of a column of water. On the reference leg side, the height of the water column is maintained constant through the use of a condensing pot. Only changes to the water density, caused by changes to the ambient temperature, affect the pressure acting on the transmitter. On the steam generator (or process) side, the height of the water column is the variable being measured, or inferred, based on the differential pressure between the upper and lower narrow range instrumentation taps. If the steam generator water level is at the same elevation as the upper narrow range instrument tap, and the process fluid is at the same temperature (density) as the fluid in the reference leg, the differential pressure acting on transmitter would be zero (in the ideal state). Consequently, if there are conditions in the steam generator which affect the pressure drop between the upper and lower narrow range instrument taps, an imprecise indication of the steam generator water level may result. Known differences, such as the expected steam generator operating pressure and nominal water level, are typically addressed in the scaling (calibration) of the different pressure transmitter.

(1) The Process Measurement Uncertainty Allowance terms are used to reflect the differences between actual dynamic operating conditions and the static ideal state.

- The differential pressure transmitter is calibrated based on expected operating conditions of the steam generator; i.e., saturated steam corresponding to a power level between 0% and 100% power. The Process Pressure variation uncertainty term is used to calculate the error resulting from pressures different from the assumed calibration pressure. This term is the difference in the fluid density between the assumed calibration condition and the expected steam generator operating conditions (steam pressure and water level near the trip setpoint), expressed as a percent of the narrow range span. This expected steam generator operating pressure is a function of power level. Since the differential pressure transmitter is calibrated at an assumed intermediate power level, the impact of this uncertainty term will vary, depending on the actual steam generator pressure relative to the assumed calibration pressure.

- The reference leg temperature variation allowance is provided to address the possibility that the ambient containment temperature during power operations may be different that the temperature during the calibration process. Two ranges of containment temperatures are considered: normal operations and adverse conditions. The normal operations uncertainty allowance considers the maximum expected containment temperatures, consistent with Technical Specification limits. This allowance is simply the difference of the reference leg densities at the calibration conditions and the maximum normal operations condition, expressed as a percentage of narrow range span. This allowance is applied to the entire range of normal operating conditions. The adverse containment conditions are only considered for those transients, such as a main feedwater line break, wherein the steam generator water level trip function is required after an accident has been initiated that exposes the reference leg to high temperatures. The elevated temperature chosen for this calculation is based on the maximum predicted containment temperature following a steam line break, which bounds the expected temperature following a feedwater line break.

- The fluid velocity effect is an allowance for the local effect of fluid flow in the transition cone / lower downcomer region of the steam generator, perpendicular to the lower narrow range pressure tap. In this region, the fluid velocity is highest, and the perpendicular flow tends to reduce the local pressure at the lower tap, resulting in a higher differential pressure across the transmitter, which leads to a lower-than-actual water level indication. The magnitude of the fluid velocity effect is an easily calculated parameter, and is a function of the flow velocity and fluid density down the downcomer annulus, and is typically highest at full power conditions.

- In the calibration of the differential pressure transmitter, it was assumed that the steam generator fluid above the lower narrow range instrument tap was saturated. With the introduction of subcooled main feedwater into the upper downcomer region of the steam generator through the feed ring, this assumption is not strictly valid. Because this downcomer subcooling effect increases the pressure differential between the upper and lower narrow range instrument taps, the indicated water level will be higher than actual. The magnitude of the effect is conservatively estimated based on the calculated circulation ratio in the steam generator; i.e., an effective density is calculated by weighting the densities of the saturated recirculating fluid and the subcooled main feedwater by the relative flows. The magnitude is then the difference in the fluid density between the assumed calibration condition and the expected steam generator operating conditions (steam pressure and water level near the trip setpoint), expressed as a percent of the narrow range span.

- The mid-deck pressure drop effect accounts for the pressure drop of steam carryunder from the primary separators, separating from the liquid in the upper downcomer, and venting through the mid-deck plate. The amount of steam carryunder is a function of the power level. The Comanche Peak Δ76 steam generator designer, Westinghouse, has performed extensive testing and modeling of the efficiency of the primary separators, such that the amount of steam carryunder is well understood. In addition, Westinghouse has designed the mid-deck plate for the Comanche Peak Δ76 steam generators, and has accurate drawings of the available vent paths. With these two pieces of information, the calculation of the mid-deck plate pressure drops is a straight-forward process. Because the mid-deck plant pressure drop increases the pressure differential between the upper and lower narrow range instrument taps, the indicated water level will be higher than the actual level. The mid-deck pressure drop effect is not significant when the actual level is above the elevation of the mid-deck plate.

  Similar to the mid-deck plate pressure drop effects, there are two other pressure drop effects in the upper downcomer region that may affect the differential pressure between the upper and lower instrument taps. The intermediate deck plate pressure drop effect and the feed ring pressure drop effect are attributed to circulating fluid flowing around these structures. As for the mid-deck plate, the steam generator vendor has the design drawings and circulating fluid flow rates; the calculation of the pressure drop is a straight-forward process. These effects increase the pressure differential between the upper and lower narrow range instrument taps; thus, the indicated water level will be higher than the actual level.

  The other circulation flow effect is due to the flow of circulating fluid around the lower deck plate and the lower deck supports. Because these structures are in the transition to the downcomer annulus and are in the immediate vicinity of the lower instrument tap, the pressure drop effects tend to reduce the local pressure on the narrow range tap. Similar to the velocity head effects, this effect reduces the local pressure at the lower tap, resulting in a higher differential pressure across the transmitter, which leads to a lower-than-actual water level indication. The steam generator vendor has the design drawings and circulating fluid flow rates; the calculation of the local pressure effects is a straight-forward process.

- The final effect considered during normal operations is an allowance for non-recoverable losses due to carryunder into the lower downcomer. Due to the relatively large and smooth transition between the upper downcomer plenum and lower downcomer annulus, this effect was calculated to be negligible for the Comanche Peak Δ76 steam generator design.

Other considerations that affect the Process Measurement Uncertainty Allowances described above are attributed not to normal operating conditions, but to transient effects. The described effect is the same as for normal operations; however, the transient could result in a range of conditions that is outside the range considered for normal operations.

(2) For example, as previously described for the reference leg temperature variation, a steam line or feedwater line break could increase the ambient temperature near the reference leg. The effect of this "adverse containment" condition on the reference leg is calculated in the same manner as previously described; only the magnitude of the temperature is different. For the Comanche Peak calculation, a maximum temperature was selected based on plant-specific analyses of maximum containment temperatures following a steam line break (which bounds the maximum containment temperatures following a feedwater line break).

(3) The other effects that must be considered are attributed to those transients in which a steam generator water level trip function is credited, and which affects one or more of the parameters previously described.

Note that in the proposed Comanche Peak trip setpoint, the adverse environment uncertainty (i.e., the reference leg heatup effects, calculated to be approximately 13% narrow range span) calculated for the post-feedline break accident is embedded in the low-low steam generator water level trip setpoint at all times, regardless of whether an actual adverse environment is present or not. Therefore, the general approach to addressing the transient effects is to show that the transient-specific uncertainties are bounded by the adverse environment uncertainty, which although included, is not required for that specific transient. In other words, the adverse environment uncertainty allowance conservatively bounds the transient-specific uncertainty.

The single loop loss of normal feedwater transient is a potential concern because the steam flow in the affected loop could increase significantly, resulting in a potentially large increase in the mid-deck plant pressure drop. The steam generator vendor, as part of a Westinghouse Owners Group project, performed a series of analyses for a wide spectrum of plant and steam generator designs. Although a Comanche Peak-specific analysis of the single loop loss of normal feedwater transient was not performed, the spectrum of analyses performed allows one to estimate a reasonable transient-induced uncertainty for Comanche Peak Unit 1 with the Δ76 steam generator design. For a typical large four-loop plant, the increase in steam flow within the steam generator corresponds to approximately 115% of nominal. For a plant with the similar Δ75 steam generator design, the steam flow was calculated to be 121% of nominal, which resulted in a 0.144 psi mid-deck plant pressure drop. This mid-deck plate pressure drop corresponds to approximately 2.3% of the Comanche Peak Unit 1 narrow range span. Note that adverse containment allowances of greater than 13% span for the reference leg heatup effects alone, although included, are not required for the response to this event and more than offset the effects of the mid-deck plate pressure drop. No additional consideration is required.

A specific analysis was previously performed for Comanche Peak to develop the mass and energy releases for a small steamline break outside containment. There are two items of interest:

- the increase in steam flow, which can spike as high as 141% of nominal for CPSES, and
- the reduction in steam pressure at the assumed time of the steam generator water level - low-low trip (at approximately 860 psia).

Evaluations of the larger process measurement uncertainties - the mid-deck pressure drop effects due to the increased steam flow and the process pressure uncertainty due to the reduced pressure, have concluded that these effects are more than offset by the adverse containment allowances (of greater than 13% span for the reference leg heatup effects alone) which are not required for this transient. Therefore, no further considerations are required for this scenario.

The steam generator water level – high-high trip function is credited for the mitigation of the increase in feedwater flow transient. With the exception of the downcomer subcooling effect, the transient conditions induced by the increase in feedwater flow are not different from those considered for the development of the "steady-state" uncertainties. Note that the downcomer subcooling effect leads to a higher than actual indicted water level, and thus, is in the conservative direction for the steam generator water level – high-high trip function. However, Westinghouse has generically recommended that a conservative bounding bias of -2.2% span be applied to address any other cumulative transient effects.