September 4, 2002

Mr. C. Lance Terry
Senior Vice President
& Principal Nuclear Officer
TXU Energy
ATTN: Regulatory Affairs
P. O. Box 1002
Glen Rose, TX 76043

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION (CPSES), UNITS 1 AND 2 - ISSUANCE OF AMENDMENTS RE: USE OF ZIRLO™ FUEL (TAC NOS. MB3101, MB3102, MB4740, AND MB4741)

Dear Mr. Terry:

The Commission has issued the enclosed Amendment No. 99 to Facility Operating License No. NPF-87 and Amendment No. 99 to Facility Operating License No. NPF-89 for CPSES, Units 1 and 2, respectively. The amendments consist of changes to the Technical Specifications (TSs) in response to your application dated April 1, 2002, as supplemented by letter dated June 6, 2002.

The amendments include topical report ERX-2001-005-P, "ZIRLO™ Cladding and Boron Coating Models for TXU Electric's Loss of Coolant Accident Analysis Methodologies," in the list of approved methodologies for use in generating the Core Operating Limits Report in TS 5.6.5, "Core Operating Limits Report (COLR)," based upon the NRC staff's review and approval of ERX-2001-005-P. In addition, the proposed changes include ZIRLO™ clad in the description of the fuel assemblies in TS 4.2.1, "Fuel Assemblies."

A copy of our related Safety Evaluation, which describes the review and approval of ERX-2001-005-P and associated TS changes, is enclosed. The Notice of Issuance will be included in the Commission's next biweekly *Federal Register* notice.

Sincerely,

/RA/

David H. Jaffe, Senior Project Manager, Section 1
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-445 and 50-446

Enclosures:
1. Amendment No. 99 to NPF-87
2. Amendment No. 99 to NPF-89
3. Safety Evaluation

cc w/encls: See next page

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The amendments include topical report ERX-2001-005-P, "ZIRLO™ Cladding and Boron Coating Models for TXU Electric's Loss of Coolant Accident Analysis Methodologies," in the list of approved methodologies for use in generating the Core Operating Limits Report in TS 5.6.5, "Core Operating Limits Report (COLR)," based upon the NRC staff's review and approval of ERX-2001-005-P." In addition, the proposed changes include ZIRLO™ clad in the description of the fuel assemblies in TS 4.2.1, "Fuel Assemblies."

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cc w/encls: See next page
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Accession No.: ML022180303 *See previous concurrence **No legal objection w/comments

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TXU GENERATION COMPANY LP

COMANCHE PEAK STEAM ELECTRIC STATION, UNIT NO. 1

DOCKET NO. 50-445

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 99
License No. NPF-87

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by TXU Generation Company LP dated April 1, 2002, as supplemented by letter dated June 6, 2002, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, as amended, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this license amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment and paragraph 2.C.(2) of Facility Operating License No. NPF-87 is hereby amended to read as follows:

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 99 , and the Environmental Protection Plan contained in Appendix B, are hereby incorporated into this license. TXU Generation Company LP shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. The license amendment is effective as of its date of issuance and shall be implemented within 60 days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Robert A. Gramm, Chief, Section 1
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: September 4, 2002

TXU GENERATION COMPANY LP

COMANCHE PEAK STEAM ELECTRIC STATION, UNIT NO. 2

DOCKET NO. 50-446

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 99
License No. NPF-89

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by TXU Generation Company LP dated April 1, 2002, as supplemented by letter dated June 6, 2002, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, as amended, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this license amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment and paragraph 2.C.(2) of Facility Operating License No. NPF-89 is hereby amended to read as follows:

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 99 , and the Environmental Protection Plan contained in Appendix B, are hereby incorporated into this license. TXU Generation Company LP shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of its date of issuance and shall be implemented within 60 days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Robert A. Gramm, Chief, Section 1
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: September 4, 2002

ATTACHMENT TO LICENSE AMENDMENT NO. 99

TO FACILITY OPERATING LICENSE NO. NPF-87

AND AMENDMENT NO. 99

TO FACILITY OPERATING LICENSE NO. NPF-89

DOCKET NOS. 50-445 AND 50-446

Replace the following pages of the Appendix A Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Remove	Insert
4.0-1	4.0-1
5.0-34	5.0-34

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 99 TO

FACILITY OPERATING LICENSE NO. NPF-87

AND AMENDMENT NO. 99 TO

FACILITY OPERATING LICENSE NO. NPF-89

TXU GENERATION COMPANY LP

COMANCHE PEAK STEAM ELECTRIC STATION, UNITS 1 AND 2

DOCKET NOS. 50-445 AND 50-446

1.0 INTRODUCTION

By application dated April 1, 2002, as supplemented by letter dated June 6, 2002, TXU Generation Company LP (TXU Electric, TXU Energy, or the licensee) requested changes to the Technical Specifications (TSs) for the Comanche Peak Steam Electric Station (CPSES), Units 1 and 2. The proposed changes would include topical report ERX-2001-005-P, "ZIRLO™ Cladding and Boron Coating Models for TXU Electric's Loss of Coolant Accident Analysis Methodologies," in the list of approved methodologies for use in generating TS 5.6.5, "Core Operating Limits Report (COLR)." In addition, the proposed change would include ZIRLO™ clad in the description of the fuel assemblies in TS 4.2.1, "Fuel Assemblies."

The June 6, 2002, supplemental letter provided clarifying information that did not change the the scope of the original Federal Register notice (67 FR 34493, published May 14, 2002) or the original no significant hazards consideration determination.

2.0 BACKGROUND

By letter dated October 8, 2001, the licensee submitted topical report ERX-2001-005-P, "ZIRLO™ Cladding and Boron Coating Models for TXU Electric's Loss of Coolant Accident Analysis Methodologies," for approval. The licensee plans to use its approved loss-of-coolant accident (LOCA) analysis and transient analysis methodologies, incorporating these ZIRLO™ models, to evaluate operation of CPSES, Units 1 and 2, with cores containing ZIRLO™ fuel. The licensee presented clarifying information in a meeting on May 14, 2002, and provided supplemental information in a letter dated June 6, 2002. This safety evaluation (SE) provides the results of the U.S. Nuclear Regulatory Commission (NRC) evaluation of ERX-2001-005-P. In addition, the licensee's April 1, 2002, application provides information which addresses the use of ZIRLO™ fuel at CPSES, Units 1 and 2. The NRC staff's approval of ERX-2001-005-P, and the changes to the TS proposed in the April 1, 2002, application, allows use of ZIRLO™ fuel at CPSES, Units 1 and 2.

3.0 EVALUATION

The staff evaluated ERX-2001-005-P to determine the applicability of the licensee's large beak LOCA (LBLOCA) and small break LOCA (SBLOCA) methodologies to CPSES, Units 1 and 2, with cores containing ZIRLO™ fuel. Although ERX-2001-005-P does not directly address non-LOCA transient and accident analyses, the staff also considered the applicability of the licensee's non-LOCA transient and accident analysis methodologies to CPSES, Units 1 and 2, with cores containing ZIRLO™ fuel. The NRC staff also evaluated the licensee's proposed changes to the TS as addressed in the April 1, 2002, application.

3.1 Normal Steady State Operation

3.1.1 Operational Considerations

The maximum permitted burnup for ZIRLO™ fuel is 62,000 Megawatt-Days/Metric-Ton-Uranium (MwD/MTU). For other fuels in the CPSES, Units 1 and 2 cores, the licensee considers the burnup limit to be that for which the individual fuel type is approved or certified (60,000 MwD/MTU).

WCAP-12610-P-A[1] and CENPD-404-P-A[2] discuss several issues (e.g. causes of operational fuel system damage and operational fuel rod damage) which could affect fuel condition and/or performance during normal operation. These reports conclude that fuel with ZIRLO™ cladding (and certain structures) performs acceptably, similar to fuel with Zircaloy (Zr_4) cladding (and certain structures), and sometimes better. Operation within vendor fuel design guidance increases the likelihood of achieving operational performance objectives, such as higher burnup. Because the CPSES plants are of Westinghouse design, WCAP-12610-P-A is directly applicable to the CPSES plants, their operation with ZIRLO™ fuel, and most of their analytical considerations. CENPD-404-P-A provides applicable information regarding adapting the licensee's analytical methods, which are different than those Westinghouse used in WCAP-12610-P-A, to the CPSES plants fueled with ZIRLO™.

Licensing basis event analyses which identify the bounding conditions provided in TSs and vendor design guidance also assure safe and optimal operation of the fuel.

3.1.2 Effect of ZIRLO™ Fuel on the Acceptability of the Computer Codes Used in the Licensee's Normal Operational Analysis Methodologies

The discussions in WCAP-12610-P-A and CENPD-404-P-A apply to the licensee's use of its normal steady-state operational analysis methodologies to perform licensing basis analyses. In general, the staff reviews of those two reports found that, based on the similarity between

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[1] Westinghouse Electric Company (Westinghouse), "Vantage+ Fuel Assembly Reference Core Report," WCAP-12610-P-A, April 1995.

[2] Combustion Engineering (CE) Nuclear Power, "Implementation of ZIRLO™ Cladding Material in CE Nuclear Power Fuel Assembly Designs," CENPD-404-P-A, January 2001, as approved.

ZIRLO™ and Zr_4 cladding material properties, that it is appropriately conservative to apply the same analysis criteria to cladding made with either material type. In its SE for WCAP-12610-P-A, dated July 1, 1991, the staff stated that, for mixed cores (ZIRLO™ and Zr_4), "because of the close similarity between ZIRLO™ and Zr_4 fuel assemblies a mixed core penalty need not be applied to any combination of ZIRLO™ and Zr_4 fuel assemblies, if both types of fuel have the same design features" (e.g., geometry, such as mixing vanes, etc.; and surface texture). The SE also found that the choice of cladding material (ZIRLO™ or Zr_4) does not change the identification of the limiting case (other than limiting material: while neither material needed to have a mixed core penalty applied, each material must have its own specific evaluation). Subsequent plant reviews verified that methodologies approved to perform normal operational analyses (e.g., critical heat flux) for plants fueled with Zr_4-clad fuel could also be applied to the same plants fueled with ZIRLO™ fuel.

In a letter dated February 18, 2002, the licensee stated that the ZIRLO™ fuel assembly design that it will include in the CPSES Core is essentially the same as the Westinghouse Optimized Fuel Assembly (OFA) design now resident in the CPSES core, except for the fuel cladding material. The approved normal operational methodologies, including mixing factor determinations to account for differences between the OFA fuel and other resident fuel designs, will be used to perform licensing basis analyses for ZIRLO™.

Based on conclusions the staff has drawn in similar reviews of WCAP-12610-P-A, CENPD-404-P-A, and several other Westinghouse-designed plants using ZIRLO™ fuel, the staff concludes that the use of ZIRLO™ fuel, if code input properly represents it (see Section 3.3.1, below), will not compromise the capability of the licensee's approved normal operational methodologies to perform licensing basis analyses for the CPSES plants with cores containing ZIRLO™ fuel.

3.1.3 Westinghouse Integral Burnable Fuel Absorber (IBFA)

The new ZIRLO™ fuel, which the licensee will use in the CPSES plants, is also equipped with the Westinghouse IBFA feature to help control core power shape. From an operational standpoint, the performance of IBFA is monitored through the resultant core power profiles. The TSs (COLR) provide limits of acceptability for core power profiles. The licensee has operational means to correct core power profiles or avoid unacceptable power shapes per the TSs.

The licensee's data input to its approved normal operational, LOCA, and non-LOCA methodologies reflects the presence of IBFA. The data is converted from Westinghouse-supplied information.

This is acceptable because it enables the licensee's methodologies to properly reflect the influence of IBFA in CPSES normal operational, LOCA, and non-LOCA analyses without compromising the validity of the methodologies.

3.2 Transients and Accidents

3.2.1 Effect of ZIRLO™ Fuel on the Acceptability of the Computer Codes Used in the Licensee's LOCA and non-LOCA Analysis Methodologies

The discussion in Section 3.1.2 of this SE states that the same analysis criteria apply to cladding made with either Zr_4 or ZIRLO™. This discussion also applies to the acceptability of the computer codes used in the licensee's LOCA and non-LOCA analysis methodologies.

Consistent with the findings in WCAP-12610-P-A, because the ZIRLO™ fuel is like the Zr_4-clad OFA fuel it replaces, the licensee may apply the same approved analysis codes and criteria to ZIRLO™ fuel as to the OFA fuel, including mixed core penalties associated with the likeness of the two fuels, e.g., geometry. Since the licensee employs methods to assess a mixed-core penalty for OFA fuel, it must determine a mixed-core penalty for the ZIRLO™ fuel, and it may do so using the same methods.

Because the licensee's approved LOCA and non-LOCA analysis codes are acceptable for performing calculations of codes with OFA fuel; and because the reviews of WCAP-12610-P-A and CENPD-404-P-A found that the use of LOCA and non-LOCA analysis codes for licensing analyses of cores containing a mixture of fuels, including ZIRLO™, of similar type to the proposed fuels for the CPSES cores, is acceptable; the staff finds that the licensee's LOCA and non-LOCA analysis codes are, likewise, applicable to the core loadings with ZIRLO™ fuel as the licensee has proposed, if the licensee properly represents ZIRLO™ by code input (see Section 3.2.2, below).

3.2.2 Issues Related to Modeling of ZIRLO™ in the Licensee's Approved LOCA and non-LOCA Methodologies

While the review discussed in Section 3.2.1 of this SE found that the licensee's LOCA and non-LOCA analysis computer codes are capable of acceptably accounting for the phenomena that might occur in licensing analyses of CPSES, Units 1 and 2, with cores containing various combinations of the fuel types involved, the values of parameters input to the computer codes constituent to the licensee's LOCA and non-LOCA analysis methodologies affect the validity of the analyses results. The only differences in inputs needed to perform valid analyses for CPSES, Units 1 and 2, with cores containing ZIRLO™ fuel versus previous analyses are those which reflect the presence of the ZIRLO™ cladding and IBFA. (Steam generator, other fuels, reactor coolant pump, etc., descriptions need not change.) The following subsections discuss the ZIRLO™ and IBFA descriptive inputs used by the licensee in the CPSES analyses.

3.2.2.1 Specific Heat (Volumetric Heat Capacity)

The licensee's model for specific heat of Zircaloy, the Westinghouse model, and the CE model are all based on data from MATPRO-11[3] with the licensee's model more closely resembling the MATPRO data plot. TXU Energy, Westinghouse, and CE models project the Zircaloy data

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[3] NRC, "MATPRO-Version 11 (Revision 2) A Handbook of Materials Properties for Use in The Analysis of Light Reactor Fuel Rod Behavior," NUREG/CR-0497, August 1981.

profile into their respective ZIRLO™ models. MATPRO and the CE and TXU Energy models show a phase change temperature shift between Zr_4 and ZIRLO™ on the specific heat versus temperature relationship; however, the models give virtually the same values for both materials at other points in the plots.

ERX-2001-005-P provides a qualitative discussion to justify that the differences between the various models for heat capacity have an insignificant impact on LOCA analyses. ERX-2001-005-P also provides the results of comparative LOCA analyses using the Westinghouse ZIRLO™ model and the TXU Energy model, with a resulting calculated peak cladding temperature (PCT) of less than 2 °F difference between the calculations. This is consistent with the information provided in WCAP-12610-P-A and CENPD-404-P-A.

For non-LOCA events in which the PCT is below the phase change temperature, since for all models the heat capacity of ZIRLO™ and Zr_4 are virtually the same in that range, the results are insensitive to the differences between ZIRLO™ and Zr_4 and between the models used to represent their properties.

Non-LOCA events in which the PCT rises to or above the phase-change temperature are rapid events, such as locked rotor or rod ejection events, in which the PCT rises and falls quickly enough to limit the effect of the transient differences in cladding type on an integrated amount of energy deposited in the fuel or the cladding, or transferred to the RCS coolant. The results are relatively insensitive to the differences in the models in the phase-change regime because so little transient time is spent in that regime.

The staff concludes that TXU Energy's specific heat model for ZIRLO™ in its LOCA and non-LOCA analysis methodologies is acceptable because it closely simulates the MATPRO data plot, and because results of LOCA and non-LOCA analyses are relatively insensitive to differences between the way TXU Energy methodologies and previously approved methodologies represent specific heat for ZIRLO™.

3.2.2.2 Density

The licensee only uses cladding density to convert MATPRO-specific heat data to volumetric heat capacity for use in its analysis methodologies. The staff concludes that the discussion in Section 3.2.2.1 of this SE also applies to cladding density, and, therefore, the licensee's treatment of ZIRLO™ density is acceptable because it is effectual in producing an acceptable volumetric heat capacity model.

3.2.2.3 Thermal Conductivity

ERX-2001-005-P indicates that the licensee will represent the thermal conductivity of ZIRLO™ in LOCA analyses with values for Zr_4, as determined by the thermal conductivity correlation in its RODEX-2 code. While the NRC encourages use of actual fuel cladding-specific values for parameters in LOCA analyses, thermal conductivity data is lacking for ZIRLO™ above 1300 °F. ERX-2001-005-P provides comparisons of the RODEX-2-calculated thermal conductivity values with the existing data and with values from other vendor and MATPRO calculations. The RODEX-2-calculated values are within the scatter of values and tend to be conservative, compared to the values determined by the other calculations and the ZIRLO™ data. However, above 1300 °F, a comparison of an extention of the RODEX-2-calculated values to an

extrapolation of the ZIRLO™ data could be interpreted to diverge. ERX-2001-005-P addresses this postulated divergence for LOCA analyses. In LOCA analyses, the fuel thermal conductance and/or the fuel-cladding gap conductance versus the heat transfer to the coolant is the determining comparison to decide whether the cladding heats up or cools down. Cladding thermal conductance is not the limiting consideration. In addition, in its supplemental letter dated June 6, 2002, the licensee stated that, even if the divergence were assumed, the RODEX-2-calculated values would be more conservative than the extrapolated ZIRLO™ thermal conductivity values for LOCA analysis. The staff has considered both of these arguments and finds both are acceptable.

In the June 6, 2002, supplemental letter, the licensee also addressed the use of RODEX-2-calculated ZIRLO™ thermal conductivity values in its non-LOCA analysis methodologies. Few non-LOCA event scenarios lead to temperatures above 1300 °F, at which the postulated divergence between RODEX-2-calculated values and the ZIRLO™ data might occur. In the June 6, 2002, supplemental letter, the licensee described sensitivity studies it had performed to assess the effect of the difference in cladding thermal conductivity values on calculated results for locked rotor and turbine trip events, the most affected events. The licensee performed the analyses consistent with their report RXE-91-001-A[4], which provides transient guidance, including time-in-life, reactivity feedback, etc. The effects on parameters of concern (e.g., reactor coolant system pressure, PCT, etc.) of the difference in thermal conductivity values were negligible.

The NRC staff concludes that the licensee's modeling of ZIRLO™ thermal conductivity in its LOCA and non-LOCA analysis methodologies is acceptable because RXE-91-001-A provides information that demonstrates good comparison with ZIRLO™ data and other ZIRLO™ thermal conductivity models below 1300 °F, and good comparison with previously approved models above 1300 °F. The licensee has provided sound, qualitative justification for the acceptability of the modeling, and has shown by sensitivity studies that its modeling of ZIRLO™ thermal conductivity has a negligible impact on its LOCA and non-LOCA analyses.

3.2.2.4 Thermal Expansion, Modulus of Elasticity, and Poisson's Ratio

The licensee bases models for thermal expansion, modulus of elasticity, and Poisson's ratio directly on their corresponding MATPRO formulations for Zr_4 in the approved non-LOCA methodologies and on refined MATPRO formulations for Zr_4 in the approved LOCA methodologies. ERX-2001-005-P compares the the licensee's LOCA correlations for these parameters against ZIRLO™ data for thermal expansion and against the Zircaloy correlations for all three parameters in the previously approved ZIRLO™ methodologies. All the data and correlation comparisons showed reasonable-to-good comparison, within or very close to the uncertainty band for the corresponding MATPO correlations, despite some noticeable differences between the various plots. The licensee performed sensitivity studies which demonstrated that the analysis results for LOCA and non-LOCA analyses are not sensitive to the selection of ZIRLO™ versus Zircaloy material in the correlations of the methodologies to support its qualitative arguments.

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[4] TXU Energy Topical Report RXE-91-001-A, "Transient Analysis Methods for Comanche Peak Steam Electric Station Licensing Applications."

The licensee has demonstrated that results of analyses performed with its LOCA and non-LOCA analysis methodologies are not too sensitive to the use of Zr_4 correlations to represent ZIRLO™, which is the same basis as used for the previously approved methodologies. Therefore, the staff concludes that the licensee's Zr_4 representations of thermal expansion, modulus of elasticity, and Poisson's ratio in its LOCA and non-LOCA analysis methodologies are acceptable for modeling ZIRLO™ in those methodologies.

3.2.2.5 Thermal Emissivity

The licensee's LOCA methodologies model rod-to-rod and assembly-to-assembly radiative heat transfer. Cladding emissivity is a significant factor in the modeling of those radiative processes applicable to either Zr_4 or ZIRLO™ cladding. The approved licensee LOCA methodologies include an emissivity value, which is not consistent with common industry usage and technical literature. In its June 6, 2002, supplemental letter, the licensee committed: "Following NRC approval to include ZIRLO™ Cladding and Boron Coating models in TXU Energy's Loss of Coolant Accident Analysis methodologies, TXU Energy will use a value of thermal emissivity of 0.7 in all licensing-basis LOCA calculations regardless of whether the cladding material is Zircaloy or ZIRLO." The new value is acceptable because it is consistent with technical literature and common industry practice. Section 3.5, herein, addresses the licensees commitments.

3.2.2.6 Cladding Strain and Rupture, and Flow Blockage

The licensee derived the cladding strain and rupture, and flow blockage LOCA models for ZIRLO™ in its methodologies in a manner patterned after the approved Westinghouse approach and based on the Westinghouse data, with certain adaptations to accommodate the differences between the respective fuel models. Westinghouse developed its model consistent with NUREG-0630, "Cladding Swelling and Rupture Models for LOCA Analysis," NRC, April 1980. Because the licensee developed its ZIRLO™ LOCA cladding strain and rupture, and flow blockage model based on an approved model consistent with NUREG-0630, and used ZIRLO™-specific data in developing the model, the staff concludes that the licensee's model is acceptable.

3.2.2.7 Metal-Water Reaction Rate (Post-LOCA)

The licensee proposes to model the post-LOCA metal-water reaction rate for ZIRLO™ cladding using the Baker-Just correlation specified in 10 CFR 50.46. The licensee demonstrated that the Baker-Just correlation (for Zr_4 cladding) is conservative for modeling ZIRLO™ by referring to information contained in WCAP-12610-P-A and CENPD-404-P-A. Appendix K to 10 CFR Part 50 requires the use of the Baker-Just correlation to model post-LOCA metal-water reaction rate in LOCA analyses. Appendix K assumes Zircaloy oxidation rates. Because the licensee has by reference shown that the Baker-Just equation conservatively models the post-LOCA metal-water reaction rate for ZIRLO™ cladding, the staff concludes that the licensee's proposal to use that correlation to model ZIRLO™ in its LOCA methodologies demonstrates conformance with the Appendix K requirement and is acceptable.

3.2.2.8 Cladding Creep and Axial Growth

Cladding creep and axial growth play a part in the licensee's LOCA and non-LOCA accident analysis methodologies by providing initial condition input values. The licensee determines the cladding creep and axial growth models in its RODEX models in a manner similar to what Westinghouse did to model ZIRLO™ in the Westinghouse PAD 3.4 code as described in WCAP-12610-P-A. The licensee demonstrated that these items have little affect on LOCA and non-LOCA accident analysis outcome in sensitivity analyses. Because CPSES, Units 1 and 2, are of Westinghouse design, WCAP-12610-P-A applies to the CPSES plants. The staff concludes that the licensee treatment is acceptable because it is sufficiently similar to the treatment used in a previously approved applicable methodology and because the licensee demonstrated that ZIRLO™ cladding creep and axial growth (versus Zr_4) have little affect on accident analyses using the licensee's methodologies.

3.2.2.9 ZIRLO™ Data and Substituted Properties

The licensee proposes to represent ZIRLO™ fuel, assuming some ZIRLO™-specific properties and some properties specific to Zr_4 in the LOCA analyses. The list of substituted properties varies from SBLOCA to LBLOCA, between various stages of the LOCA and non-LOCA events, and between the various models constituent to the LOCA and non-LOCA methodologies. The licensee stated that the substitution of Zr_4 properties for ZIRLO™ was justified because either the specific calculational model does not use the specific property, the properties of the two materials were close enough to be interchangeable, or the impact of the substitution on calculated PCT was negligible. The licensee provided information to support the substitutions using its LOCA and non-LOCA methodologies and constituent models as they are presently configured and codified.

In its supplemental letter dated June 6, 2002, the licensee recognized that the data base containing the measurements of the physical properties is not as extensive and comprehensive as is available for other zirconium-based alloys used as fuel cladding. The licensee further committed (Commitment Number 27265) that: "...As more data becomes available to TXU Energy, the models used in the LOCA evaluation models will be assessed, and any identified model changes will be proposed, as appropriate." While not unqualified, this commitment does represent an acknowledgment by the licensee of the staff concern about the substitution of Zr_4 properties for ZIRLO™ properties in licensing analyses, and a willingness to upgrade the modeling of ZIRLO™ in its LOCA and non-LOCA methodologies if and when additional data becomes available.

Based on review of the information provided, the staff concludes that, while the properties of Zr_4 are not strictly the properties of ZIRLO™, the proposed substitution is acceptable using the licensee's present methodologies as it asserts and justifies. However, this finding only applies to the licensee's present LOCA and non-LOCA methodologies and constituent models as they are presently configured and codified. Changes to the LOCA and non-LOCA methodologies and models could affect the relative PCT impact between the substituted properties and the ZIRLO™-specific properties. If the licensee changes its LOCA and/or non-LOCA methodologies and/or constituent models in the future, it must include, in documentation supporting the change(s), justification of the continued applicability of the methodology or model to ZIRLO™.

3.3 Applicability of TXU Energy LOCA Methodologies to the CPSES Plants

The NRC has previously approved TXU Energy's LOCA analysis methodologies described in the topical reports ERX-2000-002-P-A, "Revised Large Break Loss-of-Coolant Accident Analysis Methodology," (LBLOCA) and RXE-95-001-P-A, "Small Break Loss-of-Coolant Accident Methodology," (SBLOCA), dated March 2002 and September 1996, respectively, for application to the CPSES, Units 1 and 2, in an SE dated October 6, 2000. The discussions in the preceding sections show that the introduction of ZIRLO™ fuel cladding to the CPSES cores will not affect that approval. However, since the approval of those topical reports, two generic issues related to the applicability of LOCA methodologies have arisen. TXU Energy has addressed these, as discussed in the following subsections.

3.3.1 Procedure for Treating Program Input (10 CFR 50.46(c)(2))

In the late 1990s, through the NRC inspection program, the staff became aware that many utilities did not have appropriate processes to assure that LOCA input values were truly representative of their plants as-operated, and the resulting analyses were not truly applicable to those plants.

In a letter dated September 6, 2000, the licensee confirmed that its methodologies continued to apply to CPSES, Units 1 and 2, by stating that CPSES (TXU Energy) and its vendors have ongoing processes which assure that LOCA analysis input values for PCT-sensitive parameters bound the as-operated plant values for those parameters. This statement was found to acceptably assure that the TXU Energy LOCA methodologies apply to the CPSES plants in the SE dated October 6, 2000. Since the presence of ZIRLO™-clad fuel in the CPSES plant cores does not affect the applicability of the TXU Energy methodologies to the CPSES plants, the TXU Energy methodologies, and the NRC SE dated October 6, 2000, continue to apply.

This statement is acceptable because it assures that TXU Energy has such processes as required by 10 CFR 50.46(c)(2) and Appendix A of 10 CFR Part 50 to assure appropriate input information for LOCA analyses.

3.3.2 Downcomer Boiling

Recently, the NRC has become aware of the issue of downcomer boiling during a LOCA. This issue is generic to all PWR 10 CFR Part 50, Appendix K, LOCA methodologies. The issue of concern is the effect of downcomer boiling on the LOCA transient during the core reflood period. Appendix K methodologies typically overpredict the reflood rate during this period and experience numerical instability. Subsequent to the termination of transient calculations, another core temperature peak would likely occur. Because this peak would occur after the calculation has terminated, there is a question of whether the analysis has indeed identified the worst consequences. The regulation at 10 CFR Part 50, Appendix K, II.2, requires code convergence (stability). The downcomer boiling issue also appears to involve violation of this LOCA code requirement.

TXU Energy addressed this concern by estimating the potential effects of downcomer boiling on the results for the limiting CPSES licensing LBLOCA event. TXU Energy estimated that the effect on PCT would be very small because of the CPSES design, which is a large 4-loop plant with a large dry containment. The licensee assessed the small, estimated, temporary effect

against its present licensing basis LBLOCA analysis. TXU Energy further committed (Commitment Number 27266) that: "TXU Energy will continue to investigate the downcomer boiling issue in conjunction with fuel vendors, and the temporary PCT penalty will be revised, if necessary, as new information is developed. While this issue is under investigation, the temporary penalty of 20 °F will be applied to the calculated PCTs." TXU Energy expects to have resolved the issue for its LOCA methodologies by the end of November 2002.

The staff concludes that licensee's actions in response to the downcomer boiling issue are acceptable because they are consistent with the guidance given in 10 CFR 50.46(a)(3)(ii).

3.4 Conclusions Regarding Applicability of TXU Energy Methodologies to the CPSES Plants With ZIRLO™

Based on the conclusions stated in Sections 3.1, Normal Steady State Operation; 3.2, Transients and Accidents; 3.3, Applicability of TXU Energy LOCA Methodologies to the CPSES Plants; and supporting commitments by the licensee, the staff finds that its methodologies are applicable to analyses of the CPSES plants with cores containing fuel with ZIRLO™ cladding and certain structural components. Boron coating data and information supplied by Westinghouse is the basis for boron coating treatments in the licensee's analytical models which consider its affects. The presence of boron coating as described in ERX-2001-005-P, does not effect the validity or acceptability of the TXU Energy models.

Therefore, the staff concludes that ERX-2001-005-P, as supplemented by the licensee's letter dated October 6, 2002 (which should be included in approved versions of ERX-2001-005-P), is acceptable and applicable for reference by the CPSES, Units 1 and 2.

3.5 Commitments

1. "Following NRC approval to include ZIRLO™ Cladding and Boron Coating models in TXU Energy's Loss of Coolant Accident Analysis methodologies, TXU Energy will use a value of thermal emissivity of 0.7 in all licensing-basis LOCA calculations regardless of whether the cladding material is Zircaloy or ZIRLO." (Commitment Number 27264)

2. "TXU Energy recognizes that the data base containing measurements of the physical properties of ZIRLO is not as extensive and comprehensive as is available for other zirconium-based alloys used as fuel cladding. As more data becomes available to TXU Energy, the models used in the LOCA evaluation models will be assessed, and any identified model changes will be proposed, as appropriate." (Commitment Number 27265)

3. "TXU Energy will continue to investigate the downcomer boiling issue in conjunction with fuel vendors, and the temporary PCT penalty will be revised, if necessary, as new information is developed. While this issue is under investigation, the temporary penalty of 20 °F will be applied to the calculated PCTs." (Commitment Number 27266)

The NRC staff finds that reasonable controls for the implementation for subsequent evaluation of proposed changes pertaining to the above regulatory commitments are best provided by the licensee's administrative processes, including its commitment management program. The above regulatory commitments do not warrant the creation of regulatory requirements.

3.6 Changes to the TS

The licensee has proposed the following change to the CPSES TS:

- In TS 4.2.1, "Fuel Assemblies," add the words “or ZIRLO™” to the TS “...matrix of Zircaloy or ZIRLO™ clad fuel...."

The licensee proposes to change the wording of CPSES TS 4.2.1 in order to reflect the use of ZIRLO™ cladding, consistent with the proposed make-up of the CPSES cores. The wording retains the sentence reflecting the presence of a limited number of ZIRLO™ lead test assemblies (LTAs).

The staff finds the change to TS 4.2.1, as the licensee proposes, acceptable because it accurately describes the proposed make-up of the CPSES core, and because analyses using the applicable methodologies, as discussed in Section 3.2, above, and plant controls assuring safe operation of the plant are applicable to the CPSES units operating with cores containing ZIRLO™ fuel, as described in the TS.

The staff also concludes that the retention of the reference to the ZIRLO™ LTAs acceptable because it is inconsequential to the findings of this report.

The licensee has also proposed the following change to the CPSES TS:

- In TS 5.6.5, "Core Operating Limits Report (COLR)," add Reference “21) ERX-2001-005-P, 'ZIRLO™ Cladding and Boron Coating Models for TXU Electric’s Loss of Coolant Accident Analysis Methodologies,' October 2001.”

The staff review of this proposal considered the capability and applicability of the licensee’s analytical methodologies to properly reflect the presence of fuel with ZIRLO™ cladding (and certain structures) in the CPSES licensing-basis analyses. The NRC staff found that those approved methodologies properly reflect the presence of fuel with ZIRLO™ cladding (and certain structures) while retaining applicability to the CPSES plants without significant change in analysis results.

The licensee proposes to refer to ERX-2001-005-P among the methodologies used in the CPSES COLR. Based on the staffs finding that ERX-2001-005-P is acceptable and applicable for reference by the CPSES, Units 1 and 2, inclusion of ERX-2001-005-P among the methodologies used in the CPSES COLR is appropriate and acceptable because it describes methodologies which properly consider ZIRLO™-clad fuel performing safety analyses for the operation of the CPSES plants.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Texas State official was notified of the proposed issuance of the amendments. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendments change a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (67 FR 34493, published May 14, 2002). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

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Comanche Peak Steam Electric Station

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