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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
SUBMITTAL OF TOPICAL REPORT ERX-2001-004
IN SUPPORT OF A PLANNED LICENSE ACTIONS

Gentlemen:

Please find enclosed 1 (one) copy of the proprietary topical report, ERX-2001-004-P, and 1 (one) copy of the non-proprietary version of the same topical report, ERX-2001-004-NP, "Implementation of ZIRLO™ Cladding and Boron Coating in TXU Electric's Loss of Coolant Accident Analysis Methodology." TXU Electric will reference this topical report in support of an amendment to the Operating License and Technical Specification. This topical report is being provided to the NRC on the CPSES Dockets in order to facilitate NRR reviews of the topical report in support of the planned license actions.

Also enclosed are a Westinghouse authorization letter, CAW-01-1463 and accompanying Affidavit, Proprietary Information Notice, and Copyright Notice (Enclosure 3) and a Framatome ANP Affidavit for withholding proprietary information (Enclosure 4). As topical report ERX-2001-004-P contains proprietary information to Westinghouse, LLC and proprietary information to Framatome ANP, it is supported by an Affidavit signed by Westinghouse and an Affidavit signed by Framatome, the owner of their respective information. Each Affidavit sets forth the basis on which their respective information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of Section 2.790 of the Commission's regulations.

AP01

Accordingly, it is respectfully requested that the information which is proprietary to Westinghouse and the information which is proprietary to Framatome be withheld from public disclosure in accordance with 10CFR Section 2.790 of the Commission's regulations. Correspondence with respect to the copyright or proprietary aspects of the Westinghouse items listed above or the supporting Affidavit should reference CAW-01-1463 and should be addressed to Henry A. Sepp, Manager of Regulatory and Licensing Engineering, Westinghouse Electric Company, LLC, P. O. Box 355, Pittsburgh, Pennsylvania 15230-0355. Correspondence with respect to the proprietary aspects of the Framatome items listed above or the supporting Affidavit should be addressed to Jerald S. Holm, Manager, Product Licensing, Framatome ANP, 2101 Horn Rapids Road, Richland, Washington 99352.

This communication contains no new licensing basis commitments regarding CPSES Units 1 and 2.

TXU

Should you have any questions, please call Mr. J. D. Seawright at (254) 897-0140.

Sincerely,

C. L. Terry

By: Roger D. Walker
Roger D. Walker
Regulatory Affairs Manager

JDS/js

Enclosures:

1. ERX-2001-004-P, "Implementation of ZIRLO™ Cladding and Boron Coating in TXU Electric's Loss of Coolant Accident Analysis Methodology" (Proprietary)

2. ERX-2001-004-NP, "Implementation of ZIRLO™ Cladding and Boron Coating in TXU Electric's Loss of Coolant Accident Analysis Methodology" (Non-Proprietary)

3. Westinghouse Letter CAW-01-1463, "Application for Withholding Proprietary Information from Public Disclosure," with Affidavit, Proprietary Notice, and Copyright Notice

4. Framatome ANP Affidavit regarding withholding proprietary information in TXU Electric report ERX-2001-004-P

c - Mr. E. W. Merschoff, Region IV (Non-Proprietary)
Mr. J. A. Clark, Region IV (Non-Proprietary)
Mr. D. H. Jaffe, NRR (Proprietary)
Resident Inspectors, CPSES (Non-Proprietary)

Enclosure 2

ERX-2001-004-NP
Implementation of ZIRLO™ Cladding and Boron Coating in TXU Electric's Loss of Coolant Accident Analysis Methodology
(Non-Proprietary)

ERX-2001-004-NP

TXU

IMPLEMENTATION OF ZIRLO™ CLADDING AND BORON COATING IN TXU ELECTRIC'S LOSS OF COOLANT ACCIDENT ANALYSIS METHODOLOGIES

JUNE, 2001

P. Salim

H. C. da Silva, Jr.

REACTOR ENGINEERING

ERX-2001-004-NP

IMPLEMENTATION OF ZIRLO™ CLADDING AND BORON COATING IN TXU ELECTRIC'S LOSS OF COOLANT ACCIDENT ANALYSIS METHODOLOGIES

JUNE, 2001

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ABSTRACT

This report is presented to demonstrate the implementation of ZIRLO™ cladding and boron fuel coating models in TXU Electric's Large and Small Break Loss-of-Coolant Accident (LOCA) Emergency Core Cooling System (ECCS) Evaluation Models. The ZIRLO™ cladding and boron fuel coating models implemented into TXU Electric's Evaluation Models are similar to Westinghouse Electric Corporation's and Combustion Engineering's (CE) changes to their respective Evaluation Models to account for the same fuel features.

The changes and/or acceptance of the applicability of existing models, implemented by TXU Electric, are fundamentally the same as those implemented by Westinghouse and CE. Since those positions have been accepted by the USNRC, it follows that TXU Electric's implementation should also be acceptable. The purpose of this report is therefore to document that the changes and/or acceptance of the applicability of existing models, in TXU Electric's large and small break LOCA methodologies are indeed similar to those approved by the USNRC, and that they are properly implemented.

The additional TXU Electric Evaluation Model features to simulate ZIRLO™ cladding and boron fuel coating are minor, for two reasons: First, their effect on peak cladding temperature for Comanche Peak Steam Electric Station (CPSES) is not significant, i.e., it is (much) less than 50^0F in all sample cases examined. Second, for ZIRLO™ , these changes are simply the implementation of material properties and/or the acceptance of the applicability of Zircaloy-4 properties, all of which are essentially input to the analyses whose values have already been

demonstrated; and because for the boron fuel coating, the change amounts to correcting the initial pre-LOCA fuel rod gas moles to account for coating burn off. This is merely a change in initial conditions that only impacts (in a minor way) end of life results, which have never been limiting for CPSES.

In order to demonstrate the implementation of the changes, several LOCA analyses, are presented to illustrate various comparisons: (a) The results of implementing the ZIRLO™ cladding models are compared to an identical case except with the Zircaloy-4 models used. No correction for the boron coating is made in either case. Two cases are performed, one at end of life and another at beginning of life. These cases show that the ZIRLO™ cladding models are properly implemented into the TXU Electric LBLOCA methodology. (b) The results of implementing the boron coating correction are compared to an identical case except that the boron coating is not accounted for. Both cases use the ZIRLO™ cladding models. This case shows the effect of the correction, within the framework of the TXU Electric methodology. (c) The results of implementing both the ZIRLO™ cladding models and the boron correction are compared to an identical case except that the Zircaloy-4 models are used and the boron coating is not accounted for. This case shows that the combined effect of implementing both the ZIRLO™ cladding models and the boron correction is less than the effect of implementing each separately. Since Comanche Peak Steam Electric Station (CPSES) Units 1 and 2 cores are likely to have both features if they have either, these cases show that their combined effect on LBLOCA results will be small. (d) A small break LOCA case showing the combined effect of both features is presented as well, leading to a similar conclusion.

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CHAPTER 1

INTRODUCTION

The main objective of this work is to obtain USNRC approval of a few changes to TXU Electric's Emergency Core Cooling Systems (ECCS) Evaluation Models (References 1 and 5) so that they may be used to analyze fuel with ZIRLO™ cladding and/or when the fuel pellets are coated with boron . These features of Westinghouse Electric Corporation fuel products may be present in future fuel assemblies for Comanche Peak Steam Electric Station (CPSES) Unit 1 and Unit 2, and therefore need to be incorporated into the large and small break Loss-of-Coolant Accident (LOCA) ECCS Evaluation Models.

TXU Electric's ECCS Evaluation Models are based on Framatome ANP Richland, Inc.'s (Framatome, formerly Siemens Power Corporation) methodologies (References 2 and 6). The methodologies are used to perform the large and small break LOCA ECCS licensing analyses that comply with USNRC regulations contained in 10 CFR 50.46 and 10 CFR 50 Appendix K.

This report demonstrates the implementation of ZIRLO™ cladding and boron fuel coating models in TXU Electric's Evaluations Models. The ZIRLO™ cladding and boron fuel coating models implemented into TXU Electric's Evaluation Model are similar to Westinghouse

Electric Corporation's (Reference 3) and Combustion Engineering's (CE) (Reference 4) changes to their respective Evaluation Models to account for the same fuel features.

The changes and/or acceptance of the applicability of existing models, implemented by TXU Electric, are fundamentally the same as those implemented by Westinghouse and CE. Since those positions have been accepted by the USNRC, it follows that TXU Electric's implementation should also be acceptable. Thus, the changes and/or acceptance of the applicability of existing models, implemented by TXU Electric, are both necessary and sufficient, to properly model features to simulate ZIRLO™ cladding, and boron fuel coating, for large and small break LOCA analysis, because they have already been deemed so by the USNRC for other applications (Reference 3). The purpose of this report is therefore to document that the changes and/or acceptance of the applicability of existing models, in TXU Electric's large and small break LOCA methodologies are indeed similar to those approved by the USNRC, and that they are properly implemented.

The additional TXU Electric Evaluation Model features to simulate ZIRLO™ cladding and boron fuel coating are minor, for two reasons: First, their effect on Peak Cladding Temperature (PCT) for CPSES is not significant, i.e., it is (much) less than 50^0F in all sample cases examined. Second, for ZIRLO™ , these changes are simply the implementation of material properties and/or the acceptance of the applicability of Zircaloy-4 properties, all of which are essentially input to the analyses whose values have already been demonstrated; and because for the boron fuel coating, the change amounts to correcting the initial pre-LOCA fuel rod gas moles to account for coating burn off. This is merely a change in initial conditions that only impacts (in a minor way) end of life results, which have never been limiting for CPSES (e.g. Reference 1 and 5).

The ZIRLO™ implementation is presented in Chapter 2. All the relevant cladding-related properties and correlations in the TXU Electric LOCA Evaluation Models are discussed one by one to determine if a new model is required or whether the corresponding Zircaloy-4 model is applicable. Whenever a new model is required, its implementation in each of the relevant LOCA codes is described.

The boron coating implementation in the TXU LOCA models is presented in Chapter 3. The thin boron [ ]^{a,c} coating on the fuel pellet surface is a burnable poison. This product is known as Integral Burnable Fuel Absorber (IFBA). The only impact of the thin boron coating on LOCA analysis is that it affects the initial (pre-LOCA) gas content of the fuel rod, due to the helium generated as the coating becomes depleted with burnup. Therefore, only the RODEX2 code, which calculates the initial fuel rod conditions, for both the SBLOCA and the LBLOCA, is potentially impacted. The change involves adjusting code results for this effect after the run, rather than changing the code itself. This is possible because RODEX2 results are used as input in later steps of the LOCA analyses. The correction is calculated using Westinghouse formulae (Reference 9) which are part of their Evaluation Model (Reference 9) and therefore have already been deemed acceptable the USNRC.

In order to demonstrate the implementation of the changes, several LOCA analyses, are presented to illustrate various comparisons: (a) The results of implementing the ZIRLO™ cladding models are compared to an identical case except with the Zircaloy-4 models used. No correction for the boron coating is made in either case. Two cases are performed, one at end of life and another at beginning of life. These cases show that the ZIRLO™ cladding models are properly implemented into the TXU Electric LBLOCA methodology. (b) The results of implementing the boron coating correction are compared to an identical case except that the boron coating is not accounted for. Both cases use the ZIRLO™ cladding models. This case shows the effect of the correction, within the framework of the TXU Electric methodology. (c) The results of implementing both the ZIRLO™ cladding models and the boron correction are compared to an identical case except that the Zircaloy-4 models are used and the boron coating is not accounted for. This case shows that the combined effect of implementing both the ZIRLO™ cladding models and the boron correction is less than the effect of implementing each separately. Since Comanche Peak Steam Electric Station (CPSES) Units 1 and 2 cores are likely to have both features if they have either, these cases show that their combined effect on LBLOCA results will be small (actually negligible, about 1^0F in the sample problems of Table 4.1).

Two additional LBLOCA analyses are presented to show that correcting for the boron coating after running the fuel code gives essentially the same result as running the fuel code with the boron coating options activated, so that post-run correction, rather than a code modification, is an adequate way to account for the coating.

Finally, two SBLOCA analyses are presented to demonstrate the effect of the relevant model changes in that methodology. These cases also show that the combined effect of both features is small, leading to a conclusion similar to that reached for the large break cases.

The changes to TXU Electric LOCA methodology presented herein — including all codes, results, input decks, inferences and conclusions presented within this report — will be incorporated into TXU Electric's LOCA methodologies used to perform large and small break LOCA analyses and evaluations in compliance with 10 CFR 50.46 criteria and 10 CFR 50, Appendix K requirements, for fuel cycle analyses and to address pertinent licensing issues for Comanche Peak Steam Electric Station Unit 1 and Unit 2.

CHAPTER 2

ZIRLO™ CLADDING IMPLEMENTATION

2.1 INTRODUCTION

This section describes the implementation of ZIRLO™ cladding in the TXU Electric Large Break Loss-of-Coolant Accident (LBLOCA) and Small Break Loss-of-Coolant Accident (SBLOCA) Emergency Core Cooling Systems (ECCS) performance evaluation models. Section 2.2 describes the cladding-related models for Zircaloy-4 used in both LBLOCA and SBLOCA methodologies. Section 2.3 describes the modifications that have been made to those models to represent ZIRLO™ cladding. It includes a description of the cladding model for ZIRLO™ for each parameter that requires a different model than Zircaloy-4. It also identifies those parameters for which the Zircaloy-4 model is applicable and provides a basis for the applicability. The results of both a LBLOCA and a SBLOCA performance analysis comparison between Zircaloy-4 and ZIRLO™ cladding are presented in Chapter 4.

The implementation of ZIRLO™ cladding in the TXU Electric evaluation models is based on the NRC- accepted implementation in the Westinghouse Appendix K evaluation models and on Combustion Engineering's submittal. As described in Reference 3, Westinghouse determined that many of the physical and mechanical properties of ZIRLO™ are similar to those of Zircaloy-4 when the two are in the same metallurgical phase. Consequently, many of the material property models for Zircaloy-4 are applicable to ZIRLO™. However, the change from the alpha to the beta phase occurs over a different temperature range in the two materials. This requires that a few material property models applicable to Zircaloy-4 be modified to represent ZIRLO™. Specifically, the models for specific heat, cladding creep, cladding rupture temperature and strain, and assembly blockage following rupture were modified to represent ZIRLO™ in the Westinghouse Appendix K evaluation models. The Westinghouse ZIRLO™ models are implemented in the TXU Electric LBLOCA and SBLOCA models as described in this section.

[

]a,c

Lastly, it is noted that 10 CFR 50.46, which identifies the ECCS acceptance criteria, has been revised to extend the applicability of the criteria to fuel that is clad with ZIRLO™ cladding. Consequently, no exemptions to 10 CFR 50.46 or Appendix K thereto are needed to apply the criteria to the new analyses.

2.2 CLADDING-RELATED MODELS IN THE TXU ELECTRIC LOCA METHODOLOGIES

The current NRC-approved TXU Electric ECCS performance evaluation models are TXU's version of Framatome ANP Richland, Inc.'s (Framatome) SEM/PWR-98 (References 1 and 2) for LBLOCA and TXU's version of Framatome's EXEM PWR Small Break Model (References 5 and 6) for SBLOCA.

The LBLOCA methodology is shown schematically in Figure 2.1 and includes the following computer codes: RODEX2 computes initial fuel conditions such as dimensions for gap, crack and plenum volumes, gas inventory and initial stored energy. RELAP4 performs the thermal-hydraulic analysis of the blowdown. RFPAC, performs the thermal-hydraulic analysis of the reflood and refill. Finally TOODEE2 computes the hot rod heat up peak clad temperature and cladding oxidation.

The SBLOCA methodology is shown schematically in Figure 2.2 and also includes RODEX2 and TOODEE2. The thermal-hydraulic system analysis is performed by ANF-RELAP.

The following sections will show that only a few TOODEE2 and RODEX2 models required changes to conservatively represent ZIRLO™ cladding in LBLOCA and SBLOCA analyses with respect to the acceptance criteria of 10 CFR 50.46.

The list of models potentially affected by the use of ZIRLO™ cladding in LBLOCA and SBLOCA analyses is:

1. Thermal-physical properties:

   specific heat,

   density,

   thermal conductivity.

2. Thermal-mechanical properties. These are properties used in the calculation of gap conductance and of cladding diameter. These properties are:

   thermal expansion,

   modulus of elasticity,

   Poisson's ratio,

   thermal emissivity.

3. Cladding rupture, swelling and blockage models, including pre-rupture plastic strain.

4. Metal-water reaction model.

5. Cladding creep model.

2.3 IMPLEMENTATION OF ZIRLO™ PROPERTIES AND CORRELATIONS IN THE TXU ELECTRIC LOCA METHODOLOGIES

ZIRLO™ represents a modification of Zircaloy-4 reducing tin and iron content, eliminating chromium, eliminating iron and chromium precipitates and adding 1% niobium. ZIRLO™ undergoes alpha to beta phase changes at lower temperatures than Zircaloy-4. (Appendix A of Reference 3)

Thus per Appendix A of Reference 3, ZIRLO™ starts alpha to beta phase change at ~750^{0}C and ends at ~940^{0}C, and Zircaloy-4 starts alpha to beta phase change at ~815^{0}C and ends at ~970^{0}C.

Since both ZIRLO™ and Zircaloy-4 are 98% Zirconium, properties are not significantly different except to the extent that they are affected by the phase change temperatures as indicated above (Appendix A of Reference 3). A study of Section 5.2 of Section G, of Appendix A of Reference 3 and, of Sections 6.3.2, 6.3.3 and 6.3.5 of Reference 4, leads to the following ZIRLO™ properties/models relevant to LOCA analysis:

2.3.1 DENSITY, THERMAL CONDUCTIVITY AND THERMAL EXPANSION

There is no significant difference in any of these properties and Zircaloy-4 values can be used for ZIRLO™.

2.3.2 SPECIFIC HEAT

The specific heat of ZIRLO™ and Zircaloy-4 are virtually identical up to 750°C (Figure A-3 of Appendix A of Reference 3). Westinghouse developed their ZIRLO™ heat capacity curve by distributing the heat of transformation from alpha to beta phase represented by the area under the curve, see Figure 2.3, between the Zircaloy-4 transition temperatures of 1093 K to 1248 K (820°C to 975°C) over the ZIRLO™ transformation range of 1023 K to 1213 K (750°C to 940°C).

Thus, the Zircaloy-4 heat capacity derived backwards from the ZIRLO™ data would rise in the alpha to beta phase change range of 820°C to 975°C (instead of 750°C to 940°C) and would go to [ ][a,b,c] (see page 59 of Appendix A of Reference 3 and Figure 2.3).

2.3.2.1 Implementation in the TOODEE2 Code

TXU does not use a step function (based on Framatome's approach), but rather a ramp function (as does CE, e.g. Figure 6.3.1-1 of Reference 4) in the alpha to beta phase change range, which is also slightly different from the Westinghouse Zircaloy-4 range. Still, the same approach can be applied to derive a ZIRLO™ heat capacity for use in TOODEE2 that is analogous to the existing Zircaloy-4 data in shape and format and yet adjusted to ZIRLO™ using Westinghouse's approach of distributing the heat of transformation from alpha to beta phase.

Based on the above then, and referring to the Framatome data table of page 11-4 of Reference 8, only 3 changes need to be made to obtain a TXU TOODEE2 ZIRLO™ curve.

The first change is to switch the alpha to beta phase change range from [

]a,b,c and the end transition temperature from [

.]a,b,c

The second step is to adjust the peak value 85.176 BTU/ft^3 ^{0}F such that the area under the curve remains the same, as described on page 59 of Appendix A of Reference 3. The adjustment here is made based on the Westinghouse transition temperature interval ratio from alpha to beta phase, [

.]a,b,c

[

.]a,b,c

The ZIRLO™ heat capacity curve to be inserted into TOODEE2 is thus given in Table 2.1.

2.3.2.2 <u>RELAP4, RFPAC and ANF-RELAP Codes</u>

These codes provide the thermal-hydraulic boundary conditions for the fuel rod heat-up calculations performed by TOODEE2: RELAP4, RFPAC for LBLOCA and ANF-RELAP for

SBLOCA. Small variations in the heat capacity of the cladding have virtually no impact in core themal-hydraulic boundary conditions. Still, the cladding heat capacity of the cladding can be provided as input so that no code modifications are needed. The values to be used as input are those of Table 2.1.

2.3.2.3 RODEX2 Code

This code computes the initial conditions in the fuel rod prior to the LOCA. Therefore, although conservatism is included, these are all normal operating conditions prior to the accident. As a result, cladding temperatures are less than 750^0C or 1382^0F so that both cladding materials are always in the alpha phase. Thus, as discussed in Section 2.3, the heat capacities of Zircaloy-4 and ZIRLO™ are virtually identical and no changes to the code or the input models are required.

2.3.3 MODULUS OF ELASTICITY, POISSON'S RATIO AND THERMAL EMISSIVITY

The modulus of elasticity, Poisson's ratio and thermal emissivity of Zircaloy-4 are used for ZIRLO™ in the Westinghouse Appendix K Evaluation Models (Reference 3). The same is done by CE (Reference 4). Consistent with both of these approaches, the Zircaloy-4 values for all these properties are used for ZIRLO™ in the TXU Electric LBLOCA and SBLOCA methodologies as well.

2.3.4 CLADDING BURST STRAIN, RUPTURE TEMPERATURE AND ASSEMBLY BLOCKAGE

NUREG-0630 (Reference 7) describes the cladding rupture temperature, rupture strain, and assembly blockage models that were developed by the NRC for use in Appendix K evaluation models. The NUREG-0630 rupture temperature, rupture strain, and assembly blockage models are used in the Westinghouse and in the TXU Electric Appendix K Evaluation Models. However, because of the change in the temperature range over which the alpha to beta phase change occurs for ZIRLO™ versus Zircaloy-4, the models are not applicable to ZIRLO™ cladding. Consequently, Westinghouse conducted a rod burst test program for ZIRLO™ cladding and following the methodology of NUREG-0630 developed rupture and blockage models for ZIRLO™ cladding that are used in the Westinghouse Appendix K Evaluation Models.

2.3.4.1 Implementation in the TOODEE2 Code

The Westinghouse burst temperature correlation is shown in Figure 5-2 of Reference 3 along with the Zircaloy-4 correlation it replaced. It should be noted that, in the Westinghouse tests, ZIRLO™ showed [ ]a,b,c

Figure 2.4 is a copy of Figure 5-2 of Reference 3 showing where the Framatome model of Equation 16 of Reference 8 and the data of the table on page 3-6 of Reference 8 fall with respect to the Westinghouse models for Zircaloy-4 (solid lines) and ZIRLO™ (dashed line). The

ZIRLO™ model for burst temperature inserted into TOODEE2 is shown in Figure 2.4 and is as follows:

[

.][a,b,c]

[

.][a,b,c]

(3) The new tabular data to replace that of page 3-6 of Reference 8 is given below. The new entry point at [

][a,b,c] from then on follows that former data set.

The above data set was then plotted and additional points developed from the smoothed curve of Figure 2.5. The "new" tabular data set for ZIRLO™ is given in Table 2.2.

The burst strain table on page 3-7 of Reference 8 is also modified for ZIRLO™ according to the Westinghouse data in Figure D-8 of Reference 3 and Figure 5-3 of Reference 3. Note that the NUREG-0630 burst strains shown in Figure D-8 (Reference 3) for Zircaloy-4 correspond to those of Framatome's table on page 3-7 of Reference 8. As discussed above, Westinghouse test data showed that [ ]a,b,c The data shown below and implemented in TOODEE2 corresponds to the Westinghouse ZIRLO™ strain LOCA model shown in Figure 5-3 of Reference 3.

The assembly blockage model in the Framatome TOODEE2 model is derived directly from burst strains. Therefore no changes in this model are required as ZIRLO™ properties are already reflected in the revised burst strains.

2.3.4.2 RELAP4, RFPAC and ANF-RELAP Codes

These codes provide the thermal-hydraulic boundary conditions for the fuel rod heat-up calculations performed by TOODEE2: RELAP4, RFPAC for LBLOCA and ANF-RELAP for SBLOCA. Therefore, rupture models in these codes would only be relevant for LOCA analysis if they were to affect the thermal-hydraulic boundary conditions for the hot rod. For this to occur it would be necessary that a potential for all the hot assembly rods or all the average core rods to rupture. This is never the case. Therefore, there is no need to modify rupture models in these codes. However, the rupture tables in these codes are input parameters and therefore, for the sake of completeness, although code changes are not needed, these input values will be changed in these codes so as to match the rupture data presented in this chapter.

2.3.4.3 RODEX2 Code

This code has no rupture model.

2.3.5 METAL-WATER REACTION

Westinghouse also demonstrated that the use of the Baker-Just model for the calculation of the metal-water reaction rate, which is a required feature of Appendix K Evaluation Models, is [

]^{a,b,c} Although Westinghouse developed a new model in order to take advantage of improved behavior for ZIRLO™, the TXU Electric Evaluation Models [

]^{a,c}

2.3.6 CLADDING CREEP

2.3.6.1 Implementation in the RODEX2 Code

Cladding creep is only an issue for the fuel performance code RODEX2. None of the other codes in either the small or large break LOCA methodologies model creep. The TXU Electric approach to modeling creep for ZIRLO™ is to make changes in RODEX2 that correspond to the input changes Westinghouse makes to their fuel performance code PAD 3.4 (Reference 10) when modeling ZIRLO™ versus Zircaloy-4.

When modeling ZIRLO™ versus Zircaloy-4 with PAD 3.4 only three inputs are varied (Reference 9):

a,c

	Zircaloy-4	ZIRLO™

[ ]a,c This variable has no impact in LOCA analysis. Although it affects the initial [

]a,c Therefore no change is made in RODEX2, or in any other LOCA code in the TXU methodologies to match this change in PAD.

[

]a,c

This factor was used in PAD 3.4 to obtain quantitative PAD 3.4 predictions of other ZIRLO™ creepdown data. These quantitative comparisons verify that a ZIRLO™ total in reactor creep ratio of [

]a,c A predicted to measured plot is shown as Figure B-2 of Reference 3.

[

]a,c

The RODEX2 Zircaloy-4 creep rate equation is given in Reference 2 (Section 3-5.1):

$\epsilon_g = \epsilon_{g\ th\ cr} + \epsilon_{g\ irr\ cr}$

where,

{ }

and,

{ }

Both k_{th} and k_{irr} are constants. Based on Westinghouse's ZIRLO™ to Zircaloy-4 creep and irradiation growth ratios implemented in the PAD 3.4 model as discussed above, [

]a,c, it is simply necessary to adjust the creep rates in the RODEX2 model above as follows:

$k_{th,Zirlo} = (0.8)^{1/2} \cdot k_{th,Zircaloy}$ and,

[

]^{a,c}

The RODEX2 Zircaloy-4 creep rate equation is given in Reference 2 (Section 3-5.1):

{ }

where,

{ }

and,

{ }

Both k_{th} and k_{irr} are constants. Based on Westinghouse's ZIRLO™ to Zircaloy-4 creep and irradiation growth ratios implemented in the PAD 3.4 model as discussed above, [

]^{a,c}, it is simply necessary to adjust the creep rates in the RODEX2 model above as follows:

$k_{th,Zirlo} = (0.8)^{1/2} \cdot k_{th,Zircaloy}$ and,

$k_{irr,Zirlo} = 0.8 \cdot 0.625 \cdot k_{irr,Zircaloy}$

Note that [ ]^{a,c} applies to the irradiation component too (Reference 9).

From Table 3.9 of Reference 2, the following constants then need to be changed in RODEX2 to represent ZIRLO™ creep rates:

$AHM(1) = \ln(A_\theta K_{th})$

$ALM(1) = \ln(A_\theta \; B_\theta^{1.23} K_{irr})$

Based on the relations developed above for the ratios $k_{th,Zirlo}/k_{th,Zircaloy}$ and $k_{irr,Zirlo}/k_{irr,Zircaloy}$:

[ ]^{a,c} and,

[ ]^{a,c}

2.3.6.2 <u>RELAP4, RFPAC, TOODEE2 and ANF-RELAP</u>

Cladding creep is only an issue for the fuel performance code RODEX2.. None of the other codes in either the small or large break LOCA methodologies models creep.

Table 2.1 - ZIRLO™ Heat Capacity versus Temperature

a,b,c

Table 2.2- ZIRLO™ Rupture Temperatures versus Hoop Stress

a,b,c

Table 2.3 - ZIRLO™ Rupture Temperatures versus Burst Strain

a,b,c

Figure 2.1

Schematic Representation of TXU Electric's LBLOCA Methodology

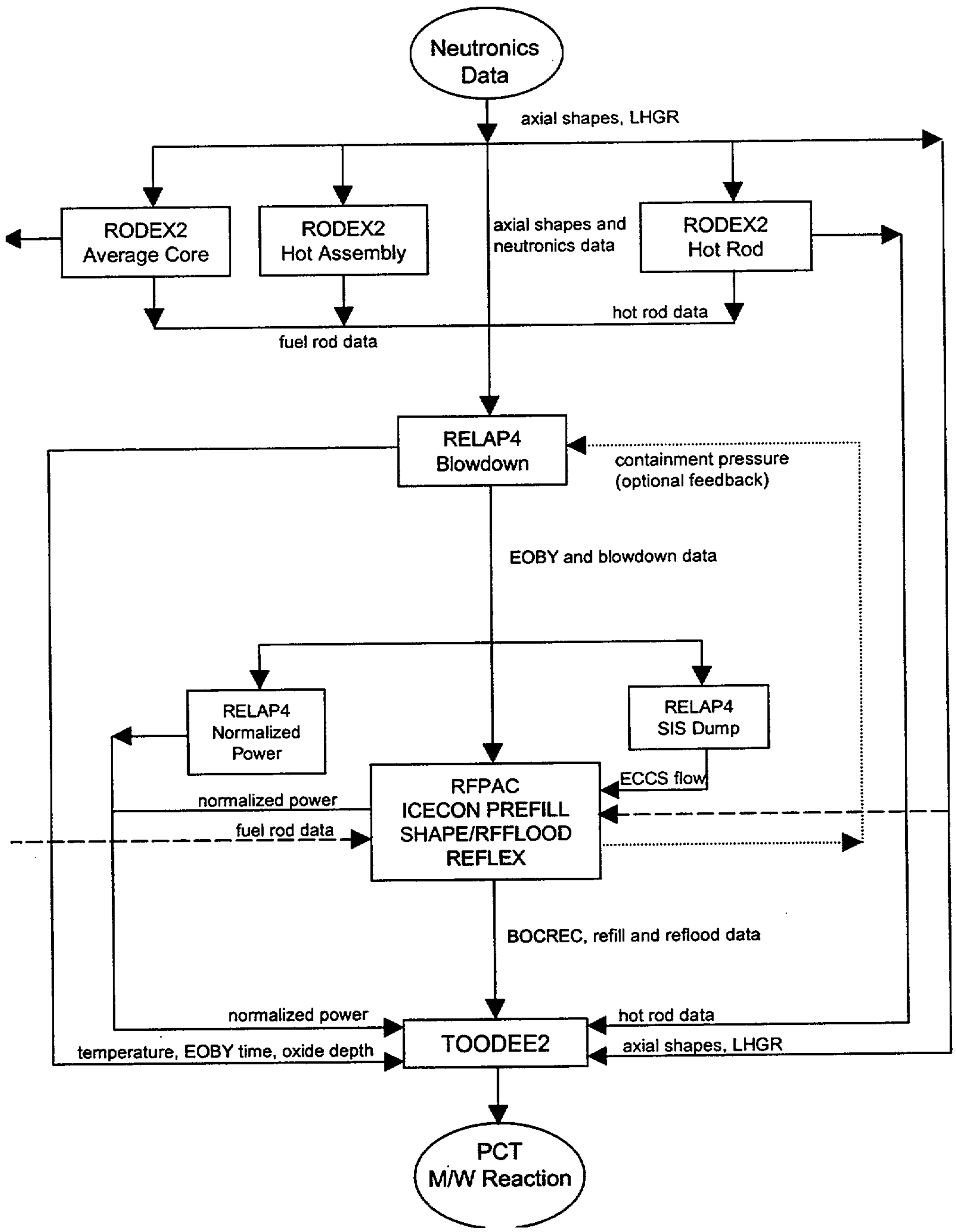

Figure 2.2

Schematic Representation of TXU Electric's SBLOCA Methodology

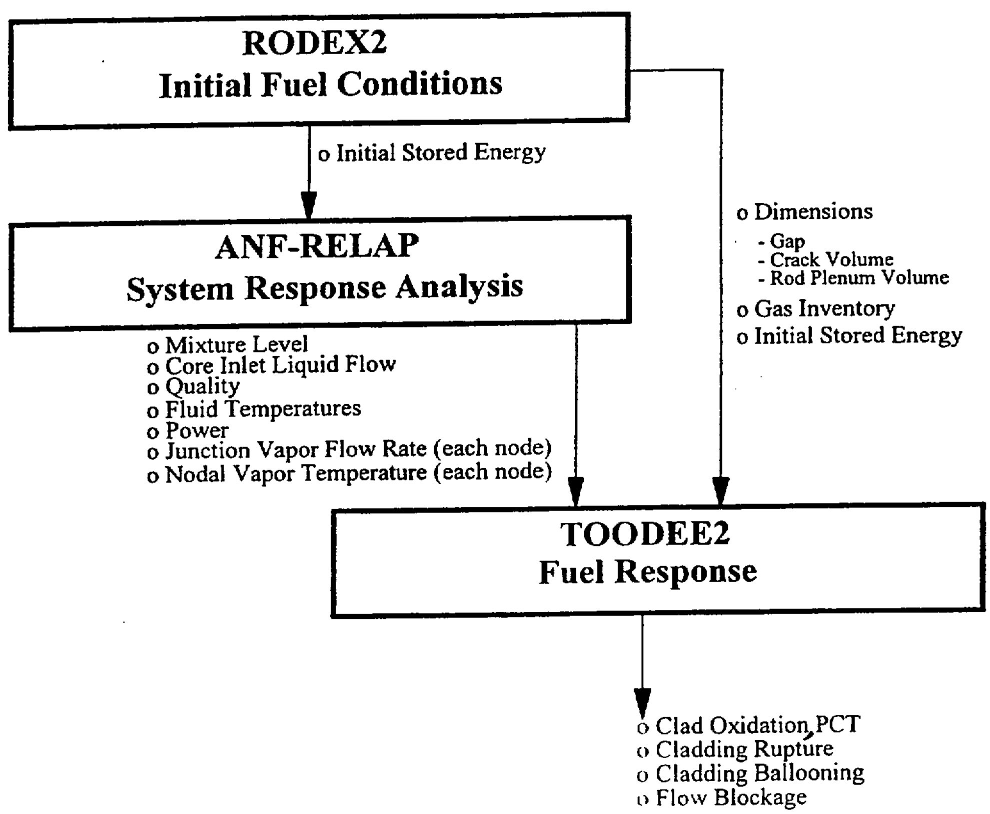

Figure 2.3

Heat Capacity of ZIRLO™ versus Zircaloy-4

as Implemented in TXU Electric's Methodologies

a,b,c

Figure 2.4

ZIRLO^{TM} NUREG-0630 Burst Temperature Model

as Implemented in TXU Electric's Methodologies

a,b,c

Figure 2.5

ZIRLO™ Burst Temperature Model versus Hoop Stress

as Implemented in TXU Electric's Methodologies

a,b,c

[ ]

CHAPTER 3

BORON COATING IMPLEMENTATION

3.1 INTRODUCTION

One of the fuel features under consideration for future cycles at Comanche Peak Steam Electric Station Units 1 and 2 is a thin [ ]^{a,c} boron coating on the fuel pellet surface. The resulting product is referred to as an Integral Fuel Burnable Absorber (IFBA).

3.2 IMPACTED MODEL AND CORRECTION IN THE TXU ELECTRIC LOCA METHODOLOGIES

The thin [ ]^{a,c} boron coating on the fuel pellet surface is a burnable poison. Its only impact on LOCA analysis is that it affects the initial (pre-LOCA) gas content of the fuel rod, due to the helium generated as the coating becomes depleted with burnup. Therefore, only the RODEX2 code, which calculates the initial fuel rod conditions, for both the SBLOCA and the LBLOCA, is potentially impacted.

Westinghouse calculates the helium released from the boron coating in its PAD 3.4 code as follows(Reference 9):

[

][a,c]

[ ][a,b,c]

[

][a,c]

It would be a simple matter to modify RODEX2 so as to calculate and add this amount of He. However, instead of modifying this code, TXU Electric has elected to simply correct the number of moles calculated by RODEX2 by adding the He moles calculated manually (or by a utility code) using above formulae and to input the corrected number of moles into the next steps (codes) in the LOCA methodology. This approach was tested by making two runs with the PAD 3.4 code. In the base case (case 9 in Table 4.1), the nominal values for the coating variables were input and the code was allowed to calculate all fuel rod initial conditions which were then fed into the rest of the LBLOCA methodology and the PCT was calculated. In the test case (case 6 in Table 4.1), the coating variables were set to zero, as they would be in

RODEX2, which does not have the capability to model this feature, but the calculated moles were manually corrected for the number of moles of He produced by boron depletion, as explained above. The initial fuel rod conditions for the test case were then also fed into the rest of the LBLOCA methodology and the PCT was also calculated. The PCT in the base case differed from the test case PCT by approximately 4^0F, demonstrating that correcting the number of gas in moles in RODEX2 for the He generated by the boron coating depletion is a valid way to account for this fuel feature in the TXU Electric LOCA methodologies.

It should also be noted that this correction need only be applied for middle or end of life analyses which have never been most limiting for either CPSES Unit 1 or Unit 2. This is because for beginning of life conditions, the depletion term DEPL above is near zero, so that the magnitude of the correction is negligible, given that no depletion of the coating has taken place.

Therefore, as a practical matter, the thin boron coating has no impact on the LOCA PCTs for either CPSES Unit 1 or Unit 2 because those PCTs have always occurred at the beginning of life, where the coating has no impact on the analysis. Still, to enable the TXU Electric LOCA methodologies to be applied to middle of life and end of life conditions, when the thin boron coating is present on the fuel, a correction is added to the number of gas moles calculated by RODEX2 and fed into the next steps of the methodology as initial conditions for the LOCA analysis. This correction is simply the number of He moles resulting from the depletion of the thin boron coating, hand calculated as above.

CHAPTER 4

RESULTS

Regarding the analyses being presented in this chapter, the beginning of life cases, including the SBLOCA case, were performed with fuel of Framatome design where the only change between cases was to assume ZIRLO™ versus Zircaloy-4 cladding. This was done in order to utilize the existing analyses of record, upon which the impact of changes would be of interest, and because these were the highest PCTs. The end of life cases were all performed with fuel of Westinghouse design, where the differences between cases are also only in the models, i.e., they compare ZIRLO™ versus Zircaloy-4 cladding, the presence or absence of the boron coating and/or both. However, in all cases, the comparisons focus on the effect of the Evaluation Model changes presented in this report. Clearly, fuel characteristics from the different vendors are different, therefore while results compared across fuel types may be interesting, they are not necessary to the points being made in this report.

Seven LBLOCA and two SBLOCA analyses are presented in this chapter. The results of these analyses are summarized in Table 4.1 and are presented to illustrate the following comparisons:

(a) The results of implementing the ZIRLO™ cladding models are compared (at end of life in case 7 and at beginning of life in case 10) to identical cases except that the Zircaloy-4 (case

3 for end of life and case 0 for beginning of life) models are used. No correcting for the boron coating is made in any of these cases. The end of life Zircaloy-4 case has a 12^{0}F higher PCT (1721^{0}F versus 1709^{0}F). This difference is in line with differences seen by CE (Reference 4, Table 6.6.1.3-3) for their end of life cases, where Zircaloy-4 had PCTs 7^{0}F and 13^{0}F higher in two cases. The beginning of life ZIRLO™ case has a 10^{0}F higher PCT (1973^{0}F versus 1963^{0}F). This difference is also in line with differences seen by CE (Reference 4, Table 6.6.1.3-3) for their beginning of life cases, where ZIRLO™ had a PCT 12^{0}F higher in one case. These cases demonstrate the proper implementation of ZIRLO™ cladding models into the TXU Electric LBLOCA methodology, for beginning of life, end of life as well as for fuel of Framatome and Westinghouse designs.

(b) The results of implementing the boron coating correction (case 8) are compared to an identical case except that the boron coating is not accounted for (case 7). Both cases use the ZIRLO™ cladding models. It is seen that the corrected case has an 11^{0}F higher PCT (1720^{0}F versus 1709^{0}F). This case shows the effect of the correction, within the framework of the TXU Electric methodology. There are two other cases discussed below, cases 6 and 9, that demonstrate the validity of the correction.

(c) The results of implementing both the ZIRLO™ cladding models and the boron correction (case 8) are compared to an identical case except that the Zircaloy-4 models are used and the boron coating is not accounted for (case 3). The PCTs for these cases are within approximately 1^{0}F of each other (1720^{0}F versus 1721^{0}F). This case shows that the combined effect of implementing both the ZIRLO™ cladding models and the boron correction is less than the effect of implementing each separately. Since TXU Electric fuel is likely to have both features if either, these cases show that their combined effect on LBLOCA results will be small, and in all likelihood insignificant.

Two additional LBLOCA analyses are presented where the initial conditions were calculated with the Westinghouse fuel code PAD 3.4, instead of RODEX2, which is the TXU Electric methodology counterpart. These cases compare the results of implementing the boron coating correction (case 9) to an identical case except that the boron coating is accounted for by activating the proper options in PAD 3.4 (case 6). Both cases use the ZIRLO™ cladding models. Although the PAD 3.4 code is not part of the TXU Electric methodology, the purpose of these cases is to demonstrate that correcting for the boron coating after running the fuel code gives essentially the same result as running the fuel code with the boron coating options activated, i.e., the PCTs are within 5 ^{0}F (actually 4 ^{0}F) of each other. This means that correcting for the boron coating after the fuel code run, as described in Section 3.2, is an adequate way to account for the coating in the TXU Electric LOCA methodologies. TXU Electric considered substituting the PAD 3.4 code for its RODEX2 code. However, in order to remain consistent with and to be able to reproduce and evaluate sensitivities involving results of past analyses, and because the combined changes for ZIRLO™ and the boron coating are not significant, it is clearly preferable to remain with RODEX2 and simply correct results as indicated. This choice is reinforced by the observation that differences in PCT are greater between the same case run with the different fuel codes than between different cases run with the same fuel code. For example, cases 6 and 8 are the same case run with PAD 3.4 versus RODEX2 and show the RODEX2- based PCT to be 28 ^{0}F higher. In contrast, the difference between ZIRLO™ and Zircaloy-4, i.e. between cases 3 and 7 is only 11 ^{0}F for RODEX2 and even less in preliminary PAD 3.4 calculations. Finally, the choice to remain with RODEX2 is conservative, i.e., it is further justified by the fact that RODEX2 consistently gives higher PCTs than PAD 3.4 for the same cases.

TABLE 4.1

Comparison of TXU Electric's Methodology LOCA Analysis Results Using ZIRLO™ versus Zircaloy-4 Models plus with versus without Correction for Boron Coating

Case #	Fuel Code	Correction for boron Coating	Cladding Material	LOCA ANALYSIS RESULTS		
				PCT	Node Oxid.	Pin Oxid.
3	RODEX2	NO	Zircaloy-4	1721°F	1.946%	0.283%
7	RODEX2	NO	ZIRLO™	1709°F	1.345%	0.248%
8	RODEX2	YES	ZIRLO™	1720°F	1.415%	0.258%
9	PAD 3.4	NO (by code[1])	ZIRLO™	1696°F	1.264%	0.235%
6	PAD 3.4	YES	ZIRLO™	1692°F	1.256%	0.228%
0[2]	RODEX2	NO (BOL)	Zircaloy-4	1963°F	3.195%	0.504%
10	RODEX2	NO (BOL)	ZIRLO™	1973° F	3.304%	0.504%
18tda	RODEX2	NO (BOL)	Zircaloy-4	1859°F[3]	1.994%	0.300%
18tda	RODEX2	NO (BOL)	ZIRLO™	1866°F	2.047%	0.303%

[1]The PAD 3.4 code has the models to calculate the effects of the boron coating. Case 9 has the models turned on while case 6 has them off. The results of case 6 are manually corrected after the PAD 3.4 run and the corrected results are passed on to the next stages of the LOCA analysis, as shown in Section 3.2. The similarity of results between cases 9 and 6 demonstrates that this manual correction technique is adequate. The manual correction is also implemented in the other cases labeled "yes" in this column.

[2]Unit 1 Cycle 8 analysis of record (Table 4.1 of Reference 1). The BOL cases, including the SBLOCA are also for Framatome fuel, while all the EOL cases are for Westinghouse fuel.

[3]Temperatures are higher than LBLOCA cases 3,7,8,9 and 6 in part because those are end of life cases, whereas the SBLOCA cases are beginning of life. More significantly though, the fuel analyzed for the SBLOCA was Framatome fuel (although ZIRLO™ was used instead of Zircaloy-4 for evaluation model comparisons), whereas the fuel analyzed for the LBLOCA cases was Westinghouse (although Zircaloy-4 was used instead of Zirlo and the boron coating was omitted for evaluation model comparisons).Framatome fuel's smaller diameter is the primary reason for the higher PCT. Burnup is secondary.

CHAPTER 5

CONCLUSION

ZIRLO™ cladding and boron fuel coating models similar to Westinghouse Electric Company's (Reference 3) and (Reference 4) changes (and/or acceptance of the applicability of existing Zircaloy-4 models) within their respective Evaluation Models have been implemented into TXU Electric's large and small Break LOCA USNRC-approved ECCS Evaluation Models (References 1 and 5).

TXU Electric's implementation, is fundamentally the same as those by Westinghouse (Reference 3) and CE plant applications (Reference 4). Since those have been[4] accepted by the USNRC, it follows that TXU Electric's implementation should also be acceptable. This report demonstrates that the implementation in TXU Electric's large and small break LOCA methodologies is indeed similar to those approved by the USNRC.

The changes for ZIRLO™ cladding are described in Chapter 2 and are essentially the same as those by Westinghouse which are described in References 3 and 4. The boron fuel coating implementation is described in Chapter 3 is also essentially the same as Westinghouse's implementation described in Reference 9. Nine LOCA analyses have been presented to

[4] Reference 4 has been submitted but not yet approved as of the writing of this report.

demonstrate various aspects of TXU Electric's implementation:

1. The effect of ZIRLO™ cladding in comparison to Zircaloy-4 cladding in large break LOCA analyses at beginning of life and at end of life. The end of life case shows a PCT difference of about 12^{0}F and the beginning of life a difference of 10^{0}F.

2. The effect of the boron fuel coating in comparison to not having such a coating in large break LOCA analyses at end of life. The end of life difference was of about 11^{0}F. The coating has no effect at beginning of life, which has always been the most limiting condition for CPSES.

3. The combined effect of both ZIRLO™ cladding together with the boron fuel coating in comparison to Zircaloy-4 cladding where the fuel has no such a coating, in large break LOCA analyses at end of life. Although the previous differences were already minor, the difference of the combined cases was only about 1^{0}F.

4. The effect of ZIRLO™ cladding in comparison to Zircaloy-4 cladding in small break LOCA analyses at beginning of life. This case shows a PCT difference of about 7^{0}F .

These analyses demonstrate the proper implementation of the changes described in Chapters 2 and 3 and the overall conclusion from these analyses is that the changes to the methodologies are not significant, whether taken separately or together.

TXU Electric will therefore incorporate these changes into its large and small break LOCA methodologies to account for ZIRLO™ cladding and/or boron fuel coating as needed. These changes include all codes, input decks, results, conclusions, and application procedures presented in this report to perform large and small break LOCA analyses and evaluations in compliance with 10 CFR 50.46 criteria and 10 CFR 50, Appendix K requirements, for both CPSES Unit 1 and Unit 2.

CHAPTER 6

REFERENCES

1. TXU Electric, "Revised Large Break Loss of Coolant Accident Analysis Methodology," ERX-2000-002-P-A, March 2000.

2. Siemens Power Corporation, "SEM/PWR-98: ECCS EvaluationModel for PWR LBLOCA Applications," EMF-2087 (P), Revision 0 , August 1998.

3. Westinghouse Electric Company, "VANTAGE+ Fuel Assembly Reference Core Report", WCAP-12610-P-A, April 1995.

4. CE Nuclear Power, "Implementation of Zirlo Cladding Material in CE Nuclear Power Fuel Assembly Designs," CENPD-404-P, January 2001.

5. TXU Electric, "Small Break Loss of Coolant Accident Analysis Methodology," RXE-95-001-P-A, September 1996.

6. Siemens Power Corporation, "Exxon Nuclear Company Evaluation Model Revised EXEM PWR Small Break Model Applications," XM-NF-82-49 (P) (A), Revision 1 , Supplement 1 , May 1992.

7. USNRC, "Cladding Swelling and Rupture Models for LOCA Analysis," NUREG-0630, April 1980.

8. Siemens Power Company, "TOODEE2 Theory, Programmers And Users Manual," EMF-SDR-124-SDD(P), Volume 11, Rev. 0, November, 1998.

9. Letter J. M. Thompson (Westinghouse Electric Company) to B. W. Coss (TXU Electric), "Response to TXU Questions on PAD 3.4 Fuel Temperature Analysis," 01-TB-G-019, June 8, 2001.

10. Westinghouse Electric Company, "Improved Fuel Performance Models for Westinghouse Fuel Rod Design & Safety Evaluations", WCAP-11873-A, August 1988.

Enclosure 3

Westinghouse Letter CAW-01-1463, "Application for Withholding Proprietary Information from Public Disclosure," with Affidavit, Proprietary Notice, and Copyright Notice

Copyright Notice

Proprietary Information Notice

Transmitted herewith are proprietary and non-proprietary versions of documents furnished to the NRC.

In order to conform to the requirements of 10 CFR 2.790 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.790(b)(1).

Westinghouse Electric Company LLC

Box 355
Pittsburgh Pennsylvania 15230-0355

June 19, 2001

CAW-01-1463
Revision 1

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

Attention: Mr. Samuel J. Collins

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: "Implementation of ZIRLO ™ Cladding and Boron Coating in TXU Electric's Large Break Loss of Coolant Accident Analysis Methodologies," ERX-2001-004-P, (Proprietary) June 2001.

Dear Mr. Collins:

The proprietary information for which withholding is being requested in the above-referenced reports are further identified in Affidavit CAW-01-1463, Revision 1, signed by the owner of the proprietary information, Westinghouse Electric Company LLC. The affidavit, which accompanies this letter, sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR Section 2.790 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying Affidavit by TXU Electric.

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse affidavit should reference this letter, CAW-01-1463, Revision 1, and should be addressed to the undersigned.

Very truly yours,

John S. Galembush, Acting Manager
Regulatory and Licensing Engineering

Enclosures
cc: S. Bloom/NRR/OWFN/DRPW/PDIV2 (Rockville, MD) 1L

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared John S. Galembush, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company, LLC, and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

John S. Galembush, Acting Manager
Regulatory and Licensing Engineering

Sworn to and subscribed
before me this 21st day
of June, 2001.

Notary Public

Notarial Seal
Lorraine M. Piplica, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires Dec. 14, 2003
Member, Pennsylvania Association of Notaries

(1) I am Acting Manager, Regulatory and Licensing Engineering, in the Nuclear Services Division, of the Westinghouse Electric Company, LLC and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rulemaking proceedings, and am authorized to apply for its withholding on behalf of the Westinghouse Energy Systems Business Units.

(2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.790 of the Commission's regulations and in conjunction with the Westinghouse application for withholding accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by the Westinghouse Nuclear Fuel Business Unit in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.790 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

b) It is information which is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.790, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal is that which is provided in the document, "Implementation of ZIRLO™ Cladding and Boron Coating in TXU Electric's Large Break Loss of Coolant Accident Analysis Methodologies," ERX-2001-004-P, (Proprietary), June 2001, being transmitted by TXU Electric letter and Application for Withholding Proprietary Information from Public Disclosure, to the attention of Mr. S. J. Collins, Chief, Reactor Systems Branch, Division of Systems Safety and Analysis.

This information is part of that which will enable TXU Electric to:

(a) Analyze plant conditions in a post-LOCA accident scenario to assure conformance to acceptance limits of 10CFR 50.46.

(b) Provide safety analysis assurance of the acceptability of new fuel products containing ZIRLO™ with respect to the safety analysis limits.

(c) Assist TXU electric in obtaining license changes for improved operational flexibility

Further this information has substantial commercial value as follows:

(a) Westinghouse can use this information to further enhance their licensing position with their competitors.

(b) Westinghouse can offer this information to other utility customers in defining and licensing acceptable analysis methods with respect to improved fuel products.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar licensing programs for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC licensing requirements without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended for developing the improved fuel design.

Further the deponent sayeth not.

Enclosure 4

Framatome ANP Affidavit regarding withholding proprietary information in TXU Electric report ERX-2001-004-P

AFFIDAVIT

STATE OF WASHINGTON)
) ss.
COUNTY OF BENTON)

1. My name is Jerald S. Holm. I am Manager, Product Licensing, for Framatome ANP ("FRA-ANP"), and as such I am authorized to execute this Affidavit.

2. I am familiar with the criteria applied by FRA-ANP to determine whether certain FRA-ANP information is proprietary. I am familiar with the policies established by FRA-ANP to ensure the proper application of these criteria.

3. I am familiar with the FRA-ANP information presented in the TXU Electric report ERX-2001-004-P, "Implementation of Zirlo™ Cladding and Boron Coating in TXU Electric's Large Break Loss of Coolant Accident Analysis Methodologies," June 2001 that is referred to herein as "Document." Information contained in this Document has been classified by FRA-ANP as proprietary in accordance with the policies established by FRA-ANP for the control and protection of proprietary and confidential information.

4. This Document contains information of a proprietary and confidential nature and is of the type customarily held in confidence by FRA-ANP and not made available to the public. Based on my experience, I am aware that other companies regard information of the kind contained in this Document as proprietary and confidential.

5. This Document has been made available to the U.S. Nuclear Regulatory Commission in confidence with the request that the information contained in the Document be withheld from public disclosure.

6. The following criteria are customarily applied by FRA-ANP to determine whether information should be classified as proprietary:

(a) The information reveals details of FRA-ANP's research and development plans and programs or their results.

(b) Use of the information by a competitor would permit the competitor to significantly reduce its expenditures, in time or resources, to design, produce, or market a similar product or service.

(c) The information includes test data or analytical techniques concerning a process, methodology, or component, the application of which results in a competitive advantage for FRA-ANP.

(d) The information reveals certain distinguishing aspects of a process, methodology, or component, the exclusive use of which provides a competitive advantage for FRA-ANP in product optimization or marketability.

(e) The information is vital to a competitive advantage held by FRA-ANP, would be helpful to competitors to FRA-ANP, and would likely cause substantial harm to the competitive position of FRA-ANP.

7. In accordance with FRA-ANP's policies governing the protection and control of information, proprietary information contained in this Document has been made available, on a limited basis, to others outside FRA-ANP only as required and under suitable agreement providing for nondisclosure and limited use of the information.

8. FRA-ANP policy requires that proprietary information be kept in a secured file or area and distributed on a need-to-know basis.

9. The foregoing statements are true and correct to the best of my knowledge, information, and belief.

Gerald S. Holm

SUBSCRIBED before me this 13th day of June, 2001.

SUSAN K. McCOY
COMMISSION EXPIRES
NOTARY
PUBLIC
1-10-04
STATE OF WASHINGTON

Susan K McCoy

Susan McCoy
NOTARY PUBLIC, STATE OF WASHINGTON
MY COMMISSION EXPIRES: 1/10/04