March 21, 2003

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

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION, UNIT 2 - RE: RELIEF FROM THE REQUIREMENTS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS BOILER AND PRESSURE VESSEL CODE, SECTION XI, CONCERNING RELIEF REQUEST B-10 FOR REPAIR OR REPLACEMENT OF CONTROL ROD DRIVE MECHANISM CANOPY SEAL WELDS (TAC NO. MB7742)

Dear Mr. Terry:

By letter dated February 11, 2003, TXU Generation Company, LP (the licensee) requested relief from the requirements of the 1986 Edition of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), with no Addenda, Section XI, Article IWA-4000 for the purpose of repair or replacement of control rod drive mechanism canopy seal welds. As an alternative, the licensee has proposed to follow the guidelines of ASME Code Case N-504-2, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping."

Based on its evaluation, the Nuclear Regulatory Commission (NRC) staff concludes that the Code-required repair method and the surface examination of the canopy seal welds would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore, pursuant to Section 50.55a(a)(3)(ii), "Codes and standards," of Title 10 of the *Code of Federal Regulations*, the licensee's proposed alternative described in the Relief Request is authorized for the second 10-year inservice inspection interval for repair or replacement of the subject welds.

The NRC staff's evaluation and conclusions are contained in the enclosed safety evaluation. Should you have any questions regarding this safety evaluation, please contact Mr. David H. Jaffe, at (301) 415-1439.

Sincerely,

/RA/

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

Docket No. 50-446

Enclosure: Safety Evaluation

cc w/encl: See next page

The NRC staff's evaluation and conclusions are contained in the enclosed safety evaluation. Should you have any questions regarding this safety evaluation, please contact Mr. David H. Jaffe, at (301) 415-1439.

Sincerely,

/RA/

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

Docket No. 50-446

Enclosure: Safety Evaluation

cc w/encl: See next page

DISTRIBUTION:
PUBLIC
PDIV-1 Reading
RidNrrDlpmLpdiv (HBerkow)
RidsNrrDlpmLpdiv1 (RGramm)
RidsNrrPMDJaffe
RidsNrrLADJohnson
RidsNrrDeEmcb (WBateman)
RidsOgcRp
GHill (2)
RidsAcrsAcnwMailCenter
RidsRgn4MailCenter (AHowell)
SMorris (EDO)

ADAMS Accession No.: ML030800600 NRR-028

OFFICE	PDIV-1/PM	PDIV-1/LA	EMCB/SC	OGC	PDIV-1/SC
NAME	DJaffe	DJohnson	TChan	RHoefling	RGramm
DATE	3/10/2003	3/06/2003	3/12/2003	3/18/2003	3/20/2003

OFFICIAL RECORD COPY

cc:
Senior Resident Inspector
U.S. Nuclear Regulatory Commission
P.O. Box 2159
Glen Rose, TX 76403-2159

Regional Administrator, Region IV
U.S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011

Mr. Roger D. Walker
Regulatory Affairs Manager
TXU Generation Company LP
P.O. Box 1002
Glen Rose, TX 76043

George L. Edgar, Esq.
Morgan, Lewis & Bockius
1800 M Street, N.W.
Washington, DC 20036-5869

County Judge
P.O. Box 851
Glen Rose, TX 76043

Environmental and Natural
Resources Policy Director
Office of the Governor
P.O. Box 12428
Austin, TX 78711-3189

Mr. Richard A. Ratliff, Chief
Bureau of Radiation Control
Texas Department of Health
1100 West 49th Street
Austin, TX 78756-3189

Mr. Brian Almon
Public Utility Commission
William B. Travis Building
P.O. Box 13326
1701 North Congress Avenue
Austin, TX 78701-3326

Ms. Susan M. Jablonski
Office of Permitting, Remediation
and Registration
Texas Commission on Environmental
Quality
MC-122
P.O. Box 13087
Austin, TX 78711-3087

G. R. Bynog, Program Manager/
Chief Inspector
Texas Department of Licensing
and Regulation
Boiler Division
P.O. Box 12157, Capitol Station
Austin, TX 78711

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SECOND 10-YEAR INSERVICE INSPECTION INTERVAL

REQUEST FOR RELIEF

TXU GENERATION COMPANY, LP

COMANCHE PEAK STEAM ELECTRIC STATION, UNIT 2

DOCKET NO. 50-446

1.0 INTRODUCTION

By letter dated February 11, 2003, TXU Generation Company, LP (the licensee) requested relief from the requirements of the 1986 Edition of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) with no Addenda, Section XI, Article IWA-4000 for the purpose of repair or replacement of control rod drive mechanism (CRDM) canopy seal welds for Comanche Peak Steam Electric Station (CPSES), Unit 2. Article IWA-4000 of the ASME Code, Section XI, requires that repairs be performed in accordance with the Owner's original construction Code of the component or system, or later editions and addenda of the Code. Article IWA-4300 of the ASME Code, Section XI requires that a defect be removed or reduced in size such that the resultant section thickness is equal to or greater than the minimum design thickness. As an alternative, the licensee has proposed to follow the guidelines of ASME Code Case N-504-2, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping." In this regard, Alloy 52 nickel-base weld repair material would be used rather than austenitic stainless steel as required by Code Case N-504-2, Paragraph (b), for the repair. Consequently, the ferrite requirements of Code Case N-504-2, Paragraph (e) would not apply. In addition, the canopy seal weld is a Code seal weld as described in NB-3227 of Section III and requires a liquid penetrant test (PT) examination of the final weld in accordance with NB-5271. As an alternative to the PT examination, the licensee will perform an enhanced 8X VT-1 visual examination of the surface of the seal welds.

The repair of leaking seal welds would be performed using the guidelines of ASME Code Case N-504-2, which establishes acceptability of a repair by increasing the weld thickness, and performing an enhanced 8X VT-1 visual examination and pressure verification test in lieu of the Code-required surface examination for final acceptance of the repaired weld. The licensee's basis for the request is that the Code-required repair method and the required surface examination of the seal welds would expose personnel to a high radiation dose, which would create a hardship or unusual difficulty without a compensating increase in the level of quality and safety. The use of Alloy 52 nickel-base weld repair material is based upon its resistance to stress corrosion cracking. The licensee has requested that the Relief Request also be granted for replacement of the subject welds.

2.0 REGULATORY EVALUATION

The inservice inspection (ISI) of ASME Code Class 1, Class 2, and Class 3 components is to be performed in accordance with Section XI of the ASME Code and applicable edition and addenda as required by Section 50.55a(g), “Codes and standards,” of Title 10 of the *Code of Federal Regulations* (10 CFR), except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). Section 50.55a(a)(3) states in part that alternatives to the requirements of paragraph (g) may be used, when authorized by the U.S. Nuclear Regulatory Commission (NRC), if the licensee demonstrates that: (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except design and access provisions and preservice examination requirements, set forth in ASME Code, Section XI, "Rules for Inservice Regulation,” that inservice examination of components and system pressure tests, conducted during the first 10-year interval and subsequent intervals, comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The Code of record for the second 10-year ISI interval at CPSES, Unit 2, is the 1986 Edition of Section XI of the ASME Code with no Addenda.

2.1 ASME Code Component Affected:

Reactor CRDM canopy seal welds - Class 1 Appurtenance to the Reactor vessel.

2.2 Applicable Code Edition and Addenda:

ASME Code, Section XI, 1986 Edition with no Addenda. Designed and fabricated to ASME Code, Section III, 1974 Edition, Summer 1974 Addenda.

2.3 Applicable Code Requirements (as stated):

Article IWA-4120 of ASME Code, Section XI requires that repairs be performed in accordance with the Owner’s original construction Code of the component or system, or later editions and addenda of the Code. The canopy seal weld is a Code seal weld as described in NB-3227 of Section III and requires a liquid PT examination of the final weld in accordance with NB-5271. IWB-4120 of Section XI requires that a defect be removed or reduced in size such that the resultant section thickness is equal to or greater than the minimum design thickness.

2.4 Basis for Hardship or Unusual Difficulty without Compensating Increase in Level of Quality or Safety (as stated):

During an inspection of a CRDM in Unit 1, TXU Energy [the licensee] identified boric acid crystal buildup on the CRDM housing. Further investigation revealed evidence of minor leakage at the intermediate CRDM canopy seal weld. The CRDM canopy seal welds are located above the Reactor Vessel Closure Head, which is highly congested and subject to high

radiation levels. It is unlikely that CPSES, Unit 2, presently has a similar damaged mechanism. However, the Code-required repair method would involve excavation of the defects and restoration to the original configuration. The Code repair method requires manual excavation of the defects and manual repair welding, and has a higher risk of failure due to the difficulty of making a quality weld on the canopy seal accompanied by the required back-purging and cleaning. In addition to the difficulty and time required to remove the defect and re-weld the canopy, a similar level of difficulty and resultant time is required for a PT examination of the weld repair. The high radiological dose associated with strict compliance with these requirements would be contrary to the intent of the ALARA (as low as reasonably achievable) radiological controls program. The PT examination would result in an estimated total dose of approximately 0.6 person-Rem per CRDM canopy seal weld.

2.5 Proposed Alternative and Basis for Relief (as stated):

TXU Energy requests relief from the requirements of IWA-4000 in accordance with 10 CFR 50.55a(a)(3)(ii) by proposing an alternative method of repair and nondestructive examination due to hardship and unusual difficulty without a compensating increase in quality or safety.

ASME Code Case N-504-2, “Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping, Section XI, Division 1,” (approved in DG-1091 Table 1, page 5) will be used as guidance for repair by weld overlay which increases the weld thickness to establish the acceptability of the defect in accordance with IWB-3640. In addition, alloy 52 nickel-based weld repair material will be used rather than austenitic stainless steel as required by Code Case N-504-2. In lieu of performance of PT examinations of CRDM seal weld repairs or replacement, an enhanced 8X visual (VT-1) examination will be performed after welding is completed.

The alternative method of repair and nondestructive examination is being requested to facilitate such a repair in Unit 2, should the need arise, for the second interval of Unit 2 operation.

Industry experience with failure analyses performed on leaking canopy seal welds removed from service at other plants has attributed the majority of the cases to transgranular stress corrosion cracking (SCC). The size of the opening where leakage occurs has been extremely small, normally a few thousandths of an inch. The crack orientations vary, but often radiate outward such that a pinhole appears on the surface, as opposed to a long crack. The SCC results from exposure of a susceptible material to residual stress, which is often concentrated by weld discontinuities, and to a corrosive environment, such as water trapped in the cavity behind the seal weld that is mixed with the air initially in the cavity, resulting in higher oxygen content than is in the bulk primary coolant.

As allowed by the guidance of Code Case N-504-2, the CRDM canopy seal weld flaws will not be removed, but an analysis of the repaired weldment will be performed using Paragraph (g) of the Code case as guidance to assure that the remaining flaw will not propagate unacceptably. This analysis establishes the critical flaw size used to qualify the VT-1 examination method to ensure capability of detecting a flaw sufficiently small to assure an adequate margin of safety is maintained. The canopy seal weld is not a structural weld, nor a pressure-retaining weld, but provides a seal to prevent reactor coolant leakage if the mechanical joint leaks.

The alternative CRDM canopy seal weld repair uses a Gas Tungsten Arc Welding (GTAW) process and VT-1 examination controlled remotely. The VT-1 examination will use a video camera with approximately 8X magnification within several inches of the weld, qualified to ensure identification of a flaw significantly smaller than the analyzed critical flaw size. The examination technique will be demonstrated to resolve a 0.001 inch thick wire against the surface of the weld. The proposed alternative is an enhanced visual examination technique with resolution and consistency much greater than that provided by the requirements of a Code (visually unaided) VT-1 and comparable to flaw sizes detectable using PT. Based on the capability of the remote visual examination system to resolve flaws of a size 0.001 inch in width, reasonable assurance of the weld integrity is provided.

Additionally, alloy 52 nickel-based weld repair material will be used rather than austenitic stainless steel as required by Code Case N-504-2. Alloy 52 nickel-base weld repair material was selected rather than austenitic stainless steel as required by Code Case N-504-2, Paragraph (b), for the repair because of its resistance to stress corrosion cracking. Consequently, the ferrite requirements of Code Case N-504-2, Paragraph (e) do not apply. The repair will be documented on Form NIS-2, reviewed by the Authorized Nuclear Inspector, and maintained in accordance with the requirements for archiving permanent plant records.

The GTAW weld repair and VT-1 examination methods result in significantly lower radiation exposure because the equipment is remotely operated after setup.

The use of remote visual examination and pressure test provide weld integrity for the multiple layer seal weld repair or the seal weld replacement. The radiation exposure associated with performance of a Code-required repair or surface examination would not result in a compensating increase in the level of quality and safety.

3.0 TECHNICAL EVALUATION

The licensee has proposed to perform the repair or replacement of leaking seal welds using the applicable provisions of ASME Code Case N-504-2, which establishes acceptability of a repair by increasing the weld thickness and performing an enhanced 8X VT-1 visual examination and pressure verification test, in lieu of the Code-required surface examination for final acceptance of the repaired welds. The Code case allows deposition of one or more layers of weld overlay to seal unacceptable indications in the area to be repaired without excavation. The Code case further requires an analysis of the repaired weldment to assure that the existing flaw will not propagate unacceptably for the design life of the repair, considering potential flaw growth due to fatigue and SCC, the mechanism believed to have caused the flaw. This analysis will establish a critical flaw size that can be used as a benchmark to qualify the VT-1 examination method to ensure the capability of detecting flaws of a size small enough to assure that an adequate margin of safety is maintained. Since the seal weld is neither a structural weld nor a pressure-retaining weld, the NRC staff finds the proposed alternative repair method to be acceptable. The licensee has also proposed to use Alloy 52 nickel-base weld repair material in place of austenitic stainless steel as required by Code Case N-504-2 due to its resistance to SCC and is therefore acceptable.

The proposed remote visual examination would be conducted using a video camera with an 8X magnification and 0.001 inch resolution within several inches of the weld. The visual resolution of the video camera system has greater capability than that of the Code-required direct VT-1

visual examination of resolving a wire segment as narrow as 1/32-inch black line on an 18 percent neutral gray card. The licensee's proposed alternative is an enhanced visual examination technique with resolution and consistency much greater than that provided by the requirements of a Code (visually unaided) VT-1 and comparable to flaw sizes detectable using PT. Moreover, use of the remote visual examination system during the welding process provides for a virtually continuous examination of each weld layer. Based on the capability of the remote visual examination system to detect and characterize fabrication and construction type defects to within construction code acceptance criteria and flaws of a size 0.001 inch in width, and the performance of the enhanced visual examination in accordance with the procedure in which the method and system was qualified (i.e., lighting, distance, travel speed), reasonable assurance of the weld integrity is provided.

The NRC staff notes that the licensee intends to also apply this alternative to replacement canopy seal welds. Because a replacement weld, by its very nature, implies a new joint that is free of flaws, relief from the flaw removal requirements of IWB-4120 is inappropriate. Similarly, relief from the Code requirements to apply a weld overlay over flaws left in place is inappropriate. Therefore, the only proposed alternative that is applicable to replacement canopy seal welds is the use of the enhanced remote visual examination in lieu of the construction code-required surface examination. Provided that the enhanced remote visual examination is demonstrated and performed in the manner discussed above, performance of the enhanced remote visual examination in lieu of the surface examination is acceptable for replacement canopy seal welds.

The welding process consists of multiple layers of weld metal welded over the existing seal weld. The multiple layers of weld metal provide a redundant CRDM nozzle-to-canopy seal. Each layer is a seal in and of itself. The adequacy of the seal is verified with a routine system leakage test that is performed at normal operating temperature and pressure, and held at such conditions for a Code-required soak time prior to returning to the system to service.

The licensee's basis for performing the remote 8X enhanced visual examination with a resolution of 0.001 inch in lieu of a PT is the dose saving that is anticipated to be achieved through the use of the remote visual examination process when compared to a manual PT examination process. The licensee estimated a total dose resulting from the performance of a PT examination on the weld repair to be in the range of .6 person-Rem. This dose estimate represents the total amount that could be averted for the examination since the dose associated with setting up the remote visual examination system is included in the dose associated with installing and removing the GTAW apparatus. Based on the determination above that reasonable assurance of weld integrity is provided of the multiple layer seal weld by use of the remote visual examination and the pressure test, the radiation exposure associated with the performance of a Code-required surface examination, would not result in a compensating increase in the level of quality and safety.

4.0 CONCLUSION

Based on the above evaluation, the NRC staff concludes that the Code-required repair and surface examination of the canopy seal welds would result in a hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), the staff authorizes the proposed alternative stated in Relief Request

B-10 for CPSES, Unit 2, for the second 10-year ISI interval for repair or replacement of the subject welds.

Principal Contributor: D. Jaffe

Date: March 21, 2003