April 23, 2003

Mr. William T. Cottle
President and Chief Executive Officer
STP Nuclear Operating Company
South Texas Project Electric
Generating Station
P.O. Box 289
Wadsworth, TX 77483

SUBJECT: SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION, UNITS 1 AND 2 - REQUEST FOR RELIEF, RR-ENG-2-27, REVISION 3, FROM AMERICAN SOCIETY OF MECHANICAL ENGINEERS CODE REQUIREMENTS FOR REPAIR/REPLACEMENT ACTIVITY OF REACTOR PRESSURE VESSEL HEAD PENETRATION CANOPY SEAL WELDS (TAC NOS: MB8398 AND MB8399)

Dear Mr. Cottle:

By letter dated March 17, 2003, South Texas Project Nuclear Operating Company (licensee), requested relief from the requirements of the 1989 Edition of American Society of Mechanical Engineers (ASME) Code, Section XI, Article IWA-4000. Relief is requested from the requirement of IWA-4000, which would require 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 and perform the liquid penetrant examination of the Reactor Pressure Vessel (RPV) head penetration canopy seal welds repair/replacement in accordance with ASME Code, Section III. As an alternative to ASME Code, Section XI, Article IWA-4000 requirements, the licensee has proposed to follow the guidelines of Code Case N-504-2, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping." Also, the licensee proposes to perform a 5X VT-1 visual examination in lieu of the surface examination of the seal welds.

The licensee's basis for the request is that boric acid walkdowns have revealed evidence of minor leakage on RPV head penetration canopy seal welds, and 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.

Based on its evaluation, the Nuclear Regulatory Commission (NRC) staff concludes that the Code-required repair method of 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) of Title 10 of the *Code of Federal Regulations*, the licensee's proposed alternative described in Relief Request RR-ENG-2-27, Revision 3, is authorized for the second 10-year inservice inspection interval.

The NRC staff's evaluation and conclusions are contained in the enclosed safety evaluation.

Sincerely,

/RA/

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

Docket Nos. 50-498 and 50-499

Enclosure: Safety Evaluation

cc w/encl: See next page

safety. Therefore, pursuant to Section 50.55a(a)(3)(ii) of Title 10 of the *Code of Federal Regulations*, the licensee's proposed alternative described in Relief Request RR-ENG-2-27, Revision 3, is authorized for the second 10-year inservice inspection interval.

The NRC staff's evaluation and conclusions are contained in the enclosed safety evaluation.

Sincerely,

/RA/

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

Docket Nos. 50-498 and 50-499

Enclosure: Safety Evaluation

cc w/encl: See next page

DISTRIBUTION:
PUBLIC
PDIV-1 Reading
RidsNrrDlpmLpdiv (HBerkow)
RidsNrrDlpmLpdiv1 (RGramm)
RidsNrrPMMThadani
RidsNrrPMBVaidya
RidsNrrLAMMcAllister
RidsNrrDeEmcb (WBateman)
RidsOgcRp
RidsAcrsAcnwMailCenter
RidsRgn4MailCenter (BJohnson)
GHill (4)
PPatnaik
~~RLorson~~ BMcDermott

*No substantial change from SE
**See previous concurrence

ADAMS Accession No.: ML031150090 NRR-028

OFFIC	PDIV-1 PM	PDIV-1/PM	PDIV-1/LA	*EMCB/SC	OGC	PDIV-1/SC
NAME	Bvaidya	MThadani	MMcAllister	TChan**	SUttal (NLO)	RGramm
DATE	4/18/03	4/18/03	4/18/03	4/17/03	4/22/03	4/23/03

OFFICIAL RECORD COPY

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

THE REQUEST FOR RELIEF NO. RR-ENG-2-27, REV. 3, SECOND 10-YEAR INSERVICE

INSPECTION INTERVAL PROGRAM PLAN

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY

SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION, UNITS 1 AND 2

DOCKET NOS. 50-498 AND 50-499

1.0 INTRODUCTION

By letter dated March 17, 2003, South Texas Project Nuclear Operating Company (STPNOC, licensee), requested relief from the requirements of the 1989 Edition of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Section XI, Article IWA-4000. Relief is requested from the requirement of IWA-4000, which would require 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 and perform the liquid penetrant (PT) examination of the Reactor Pressure Vessel (RPV) head penetration canopy seal welds repair/replacement in accordance with ASME Code, Section III. As an alternative to ASME Code, Section XI, Article IWA-4000 requirements, the licensee has proposed to follow the guidelines of Code Case N-504-2, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping." Also, the licensee proposes to perform a 5X VT-1 visual examination in lieu of the surface examination of the seal welds.

The relief was previously requested to support repair/replacement activities being performed on the canopy seal welds on control rod drive mechanism (CRDM) RPV head penetrations at South Texas Project Electric Generating Station (STPEGS), Unit 2, during the ninth refueling outage (2RE09). The NRC approved this request by letter from NRC to STPNOC dated November 5, 2002.

The approved relief request was for the CRDM which has three canopy seal weld configurations. STPNOC subsequently identified a need to apply the relief to other canopy seal welds involving RPV head penetrations that are used for components other than CRDMs. In all cases, the threaded joint provides the structural strength and the seal weld is designed for leak prevention. The canopy seal welds included in the relief request are for the following RPV head penetrations:

1. CRDM (previously approved by letter from NRC to STPNOC dated November 5, 2002) - 3 canopy seal weld locations.
2. Capped latch housing - 2 canopy seal weld locations.
3. Capped spare head adapter - 1 canopy seal weld location.
4. Reactor Vessel Level Indication System (RVLIS) - 1 canopy seal weld location.
5. Core Exit Thermocouple (CET) Instrument Port Column - 1 canopy seal weld location.
6. Internal Disconnect Device (IDD) - 1 canopy seal weld location.

All the additional canopy seal weld locations are identical to the CRDM with the exception of the IDD. The configuration of the IDD canopy seal weld is the same as the CRDM. However, the diameter of the IDD head adapter is 7.148 inches instead of 5.660 inches which is the diameter for the CRDM head adapter.

The repair of leaking seal welds would be performed using the guidelines of ASME Code Case N-504-2. The Code Case provides for deposition of weld metal on the outside surface to increase the weld thickness and the licensee would perform a 5X 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.

2.0 BACKGROUND

The inservice inspection (ISI) of ASME Code Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Code and applicable edition and addenda as required by Section 10 CFR 50.55a(g), 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). The regulations at 10 CFR 50.55a(a)(3) states in part that alternatives to the requirements of paragraph (g) may be used, when authorized by the 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) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code. Section XI, "Rules for Inservice Regulation," require that inservice examination of components and system pressure tests conducted during the first 10-year ISI 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 STPEGS, Units 1 and 2, is the 1989 Edition of Section XI of the ASME Code.

3.0 EVALUATION OF RELIEF REQUEST

Code Relief for Weld Repairs of RPV Head Penetration Canopy Seal Welds

Items for which Relief is Requested

The ASME Code components that are affected are the RPV head penetration canopy seal welds which are Class 1 Appurtenance to the Reactor Vessel. The canopy seal welds included in the relief request are for the following RPV head penetrations:

1. CRDM (previously approved by letter from NRC to STPNOC dated November 5, 2002) - 3 canopy seal weld locations.
2. Capped latch housing - 2 canopy seal weld locations.
3. Capped spare head adapter - 1 canopy seal weld location.
4. Reactor Vessel Level Indication System (RVLIS) - 1 canopy seal weld location.
5. Core Exit Thermocouple (CET) Instrument Port Column - 1 canopy seal weld location.
6. Internal Disconnect Device (IDD) - 1 canopy seal weld location.

Code Requirements

The applicable ASME Code Edition and Addenda is Section XI, 1989 Edition, with no Addenda. The subject components were designed and fabricated to the ASME Code, Section III, 1974 Edition through summer 1974 Addenda.

Article IWA-4000 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-4428 and NB-3227 of Section III and requires a PT examination of the final weld in accordance with NB-5271. Article IWA-4300 of 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.

Reason for the Request

Boric acid walkdowns have revealed evidence of minor leakage on RPV head penetration canopy seal welds.

The RPV head penetration canopy seal welds are located above the Reactor Vessel Closure Head, which is highly congested and subject to high radiation levels. 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 as low as reasonably achievable (ALARA) radiological controls program.

The PT examination would result in an estimated total dose of 1.487 person-rem per RPV head penetration canopy seal weld. This dose estimate is comprised of the following:

Activity	**Dose (Person-Rem)**
● Access/egress to perform the examination (three trips)	0.121
● Performance of the PT examination (estimated residence time of twenty minutes)	1.366
Total	1.487

Licensee's Proposed Alternative (as stated)

STPNOC requests relief from the requirements of [Article] 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," will be used as guidance for repair by weld overlay by increasing the weld thickness to establish the acceptability of the defect in accordance with IWB-3640. In lieu of performance of PT examinations of RPV head penetration seal weld repairs or replacement, a 5X visual (VT-1) examination and pressure verification testing will be performed after welding is completed. 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.

The alternative method of repair is being requested to facilitate any future choice of using this repair option during the second 10-year ISI interval. The alternative nondestructive examination method is being requested to facilitate examination of either a repair or replacement of a RPV head penetration canopy seal weld during the second 10-year ISI interval. The seal weld repair or replacement is required to be completed prior to plant startup following completion of 1RE11.

The alternative RPV head penetration 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 5X 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.

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.

Licensee's Basis for Relief (as stated)

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, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping Section XI, Division 1," the RPV head penetration 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 weld buildup is considered a repair in accordance with the ASME B&PV Code, Section XI, reference to the original Code of construction because the weld is performed on an appurtenance to a pressure-retaining component.

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

Evaluation

The licensee has proposed to perform the repair of leaking seal welds using the guidance provided in the ASME Code Case N-504-2. The Code Case provides for deposition of weld metal on the outside surface to increase the weld thickness. Also, the licensee proposes to perform a 5X 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 to unacceptable length for the design life of the repair, considering potential flaw growth due to fatigue and SCC, the mechanisms 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 because of its resistance to SCC and is therefore acceptable.

The proposed remote visual examination would be conducted using a video camera with 5X 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. 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.

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 RPV Head Penetration nozzle-to-canopy seal. Each layer is a seal 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 5X 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 each weld repair to be in the range of 1.487 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 by the multiple layer seal weld and 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/replacement and the 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 NRC staff authorizes the proposed alternative stated in Relief Request RR-ENG-2-27, Revision 3, for STPEGS, Units 1 and 2, for the second 10-year ISI interval. All other ASME Code Section XI requirements for which relief was not specifically requested and approved remain applicable, including third party review by Authorized Nuclear Inservice Inspector.

Principal Contributor: Pat Patnaik

Date: April 23, 2003

South Texas Project Electric Generating Station, Units 1 and 2

cc:

Mr. Cornelius F. O'Keefe
Senior Resident Inspector
U.S. Nuclear Regulatory Commission
P.O. Box 910
Bay City, TX 77414

A. Ramirez/C. M. Canady
City of Austin
Electric Utility Department
721 Barton Springs Road
Austin, TX 78704

Mr. M. T. Hardt
Mr. W. C. Gunst
City Public Service Board
P.O. Box 1771
San Antonio, TX 78296

Mr. C. A. Johnson/R. P. Powers
AEP - Central Power and Light Company
P.O. Box 289
Mail Code: N5022
Wadsworth, TX 77483

INPO
Records Center
700 Galleria Parkway
Atlanta, GA 30339-3064

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

D. G. Tees/R. L. Balcom
Texas Genco, LP
P.O. Box 1700
Houston, TX 77251

Judge, Matagorda County
Matagorda County Courthouse
1700 Seventh Street
Bay City, TX 77414

A. H. Gutterman, Esq.
Morgan, Lewis & Bockius
1111 Pennsylvania Avenue, NW
Washington, DC 20004

Mr. T. J. Jordan, Vice President
Engineering & Technical Services
STP Nuclear Operating Company
P.O. Box 289
Wadsworth, TX 77483

S. M. Head
Manager, Licensing
Nuclear Quality & Licensing Department
STP Nuclear Operating Company
P.O. Box 289, Mail Code: N5014
Wadsworth, TX 77483

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

Jon C. Wood
Matthews & Branscomb
112 East Pecan, Suite 1100
San Antonio, TX 78205

Arthur C. Tate, Director
Division of Compliance & Inspection
Bureau of Radiation Control
Texas Department of Health
1100 West 49th Street
Austin, TX 78756

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

South Texas Project Electric Generating Station, Units 1 and 2

cc:

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

Mr. Ted Enos
4200 South Hulen
Suite 630
Ft. Worth, Texas 76109