The Light company Houston Lighting & Power P.O. Box 1700 Houston, Texas 77001 (713) 228-9211

October 30, 1985
ST-HL-AE-1468
File No.: G9.17

Mr. George W. Knighton, Chief
Licensing Branch No. 3
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, DC 20555

South Texas Project
Units 1 and 2
Docket Nos. STN 50-498, STN 50-499
Responses to DSER/FSAR Items
Regarding Stiff Pipe Clamps

Dear Mr. Knighton:

The attachment enclosed provides STP's response to Draft Safety Evaluation Report (DSER) or Final Safety Analysis Report (FSAR) items.

The item number listed below correspond to those assigned on STP's internal list of items for completion which includes open and confirmatory DSER items, STP FSAR open items and open NRC questions. This list was given to your Mr. N. Prasad Kadambi on October 8, 1985 by our Mr. M. E. Powell.

The attachment includes mark-ups of FSAR pages which will be incorporated in a future FSAR amendment unless otherwise noted below.

The item which is attached to this letter is:

Attachment	Item No.*	Subject
1	Q210.061N-1	Update response to Q210.61N and provide report regarding "Summary of Study Calculations for Stiff Pipe Clamps". Note that the report itself will not be incorporated into the FSAR.

* Legend
D - DSER Open Item C - DSER Confirmatory Item
F - FSAR Open Item Q - FSAR Question Response Item

L1/DSER/aar

B001
1/1

If you should have any questions concerning this matter, please contact Mr. Powell at (713) 993-1328.

Very truly yours,

M. R. Wisenburg
Manager, Nuclear Licensing

CAA/bl

Attachments: See above

L1/DSER/aar

cc:

Hugh L. Thompson, Jr., Director
Division of Licensing
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Robert D. Martin
Regional Administrator, Region IV
Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 1000
Arlington, TX 76011

N. Prasad Kadambi, Project Manager
U.S. Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, MD 20814

Claude E. Johnson
Senior Resident Inspector/STP
c/o U.S. Nuclear Regulatory
Commission
P.O. Box 910
Bay City, TX 77414

M.D. Schwarz, Jr., Esquire
Baker & Botts
One Shell Plaza
Houston, TX 77002

J.R. Newman, Esquire
Newman & Holtzinger, P.C.
1615 L Street, N.W.
Washington, DC 20036

Director, Office of Inspection
and Enforcement
U.S. Nuclear Regulatory Commission
Washington, DC 20555

E.R. Brooks/R.L. Range
Central Power & Light Company
P.O. Box 2121
Corpus Christi, TX 78403

H.L. Peterson/G. Pokorny
City of Austin
P.O. Box 1088
Austin, TX 78767

J.B. Poston/A. vonRosenberg
City Public Service Board
P.O. Box 1771
San Antonio, TX 78296

Brian E. Berwick, Esquire
Assistant Attorney General for
the State of Texas
P.O. Box 12548, Capitol Station
Austin, TX 78711

Lanny A. Sinkin
3022 Porter Street, N.W. #304
Washington, DC 20008

Oreste R. Pirfo, Esquire
Hearing Attorney
Office of the Executive Legal Director
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Charles Bechhoefer, Esquire
Chairman, Atomic Safety &
Licensing Board
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dr. James C. Lamb, III
313 Woodhaven Road
Chapel Hill, NC 27514

Judge Frederick J. Shon
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Mr. Ray Goldstein, Esquire
1001 Vaughn Building
807 Brazos
Austin, TX 78701

Citizens for Equitable Utilities, Inc.
c/o Ms. Peggy Buchorn
Route 1, Box 1684
Brazoria, TX 77422

Docketing & Service Section
Office of the Secretary
U.S. Nuclear Regulatory Commission
Washington, DC 20555
(3 Copies)

Advisory Committee on Reactor Safeguards
U.S. Nuclear Regulatory Commission
1717 H Street
Washington, DC 20555

Revised 9/25/85

L1/DSER/aar

ATTACHMENT ST-HL-AE- 1468 PAGE 1 OF 10

Question 210.61N

Describe what actions have been taken to address the staff concerns regarding stiff pipe clamps as described in IE Information Notice 83-80.

Response

The applications of stiff pipe clamps on STP will be reviewed based on IE Information Notice 83-80. Section III of the ASME B&PV Code does not provide rules for evaluating stresses due to loadings from nonintegral attachments such as clamps; however, clamp-induced stresses will be evaluated by methods consistent with the intent of the Section III of the ASME B&PV Code. The procedure will include the following:

1. Identify the locations of "stiff" clamps installed on ASME Section III Nuclear Class 1 piping systems.

2. Identify the types of clamps, the loads acting on the clamps and the bolt pre-load values used in their installation. In piping, stresses due to all loading conditions at the locations of stiff clamps will also be identified and reviewed.

3. Add the primary membrane and primary bending stresses caused by the load being transmitted to the pipe through the clamp to the stresses caused by internal pressure and bending computed by equation 9 of NB-3652. Clamp-induced stresses caused by the constraint of the expansion of the pipe due to the internal pressure will be added to other secondary and peak stresses by calculating the effective increases in the C_1 and K_1 stress indices in accordance with NB-3681. Clamp induced stresses due to differential-temperature and differential-thermal-expansion coefficients will be accounted for by computing the effective C_3 and K_3 stress indices. Clamp-induced stresses on elbows caused by the constraint of pipe wall ovalization will be accounted for by computing the effective increases in C_2 and K_2 bending indices. The fatigue usage from clamp-induced plus other stresses will be calculated at governing locations.

Although bolt preloads are not addressed under the ASME B&PV Code rules for piping, bolt preloads could result in damage to pipe if a clamp were poorly designed. Calculations will be made to ensure that bolt preloads could not result in plastic deformation of the pipe walls.

A brief summary of the criteria used and the results of the analysis will be submitted in October, 1985.

Stiff clamps were not used on STP to meet stiffness criteria. They were designed to meet the requirements for strength and load distribution using a minimum of space. The STP position is to minimize the use of stiff clamps.

The clamp design utilizes a double nut arrangement to prevent the nuts from backing off. The low temperature (600°F) and stresses in the bolt from preloads will not cause a relaxation of the material. Consequently, no lift off from the piping will occur.

INSERT A

calculated and added to other operating secondary and peak stresses. The fatigue usage factor at the clamp location ~~is~~ was computed taking into ~~account~~ consideration clamp induced stresses from pressure, temperature and support loadings. The clamp induced stresses were added to the stresses in the pipe including secondary and peak stresses computed for each load set pair.

ATTACHMENT 1
ST-HL-AE-1468
PAGE 3 OF 10

SUMMARY OF

STUDY CALCULATION

FOR

STIFF PIPE CLAMP

CALCULATION NO. 1L029RC9977

PREPARED FOR

SOUTH TEXAS PROJECT

BY

BECHTEL ENERGY CORPORATION

PLANT DESIGN STRESS GROUP

OCTOBER 21, 1985

PREPARED BY [signature]

CHECKED BY P. V[signature]

APPROVED BY [signature]

4752c/0181c

ATTACHMENT 1
ST-HL-AE- 1468
PAGE 4 OF 10

TABLE OF CONTENTS

1.0 INTRODUCTION

The ASME Code Section III Subsection NB3645 requires that the effects of attachments which could produce thermal stresses, stress concentrations, and restraints on pressure retaining members be taken into account when checking for compliance with the stress criteria.

In November 1983, the Nuclear Regulatory Commission issued IE Information Notice 83-80 'Use of Specialized "Stiff" Pipe Clamps' which identified three concerns with stiff pipe clamps. The three concerns are: (a) excessive bolt preload induced stresses in the pipe, (b) small clamp contact bearing areas that could induce local overstress, and (c) the effect of the clamp on elbow stress indices.

Attachments to piping are generally categorized as integral attachments and non-integral attachments. Lugs and stanchions welded to the pipe wall are integral attachments. Clamps used for attaching hangers and snubbers to the pipe by bolting are non-integral attachments.

The Code does not provide the design rules for the evaluation of non-integral attachments; however, methods consistent with the intent of the Code have been developed to address the concerns of Information Notice 83-80 and the Code.

2.0 PURPOSE

The purpose of this analysis is to evaluate the impact of piping local stresses induced by "stiff" pipe clamps used on Nuclear Class 1 piping systems on the South Texas Project (STP). There are four (4) stiff clamps used, three located on the RHR/SI system, and one located on the pressurizer surge line.

The "stiff" clamps utilized on STP are manufactured by NPSI. IE Information Notice 83-80 did not identify NPSI as one of the stiff clamp suppliers. However, NPSI's stiff clamps are similar to those supplied by other manufacturers. None of the stiff clamps used on STP were installed on an elbow. The pertinent pipe and clamp data are summarized as follows:

STIFF CLAMP ASSEMBLIES

ME 101 DP	PIPE OD (INCHES)	PIPE NOMINAL THICKNESS (INCHES)	BOLT SIZE (INCHES)	BOLT PRETORQUE (FT-LB)	CLAMP RATING A&B SERVICE LEVELS (KIPS)	NPSI CLAMP IDENTIFICATION
311	12.75	1.125	1	170	15.7	SSC-14-120
286	12.75	1.125	1	170	15.7	SSC-14-120
74	8.862	0.906	0.75	80	10.0	SSC-10-080
52	16.00	1.593	1.75	250	53.00	SSC-24-160

3.0 SUMMARY

The piping stresses calculated per ASME Section III NB3650 are combined with the local stresses induced by "stiff" pipe clamps for all the operating conditions. The loading combinations are shown in Appendix 1. The results of calculations show that the primary stress intensities for all operating conditions, the primary plus secondary stress intensities, and the cumulative usage factors meet the Code requirements. The calculated stresses and usage factors are summarized in Appendix 2.

3.1 Primary Membrane Stresses

The existence of a pipe clamp does not affect the calculation for minimum wall, in fact, the primary membrane hoop stresses are less than that of straight pipe due to clamp reinforcement of effective thickness.

3.2 Primary Membrane Plus Primary Bending Stresses

The primary membrane plus primary bending stresses introduced by the presence of the clamp come from two different loadings. First, the loading transmitted from the pipe through the clamp pad to the support structure. This bearing load will result in local stress in the pipe wall. Secondly, the constraint of the clamp on the pipe under internal pressure will produce local stress in the pipe wall. These stresses are conservatively calculated and added to the membrane and overall bending stresses computed by equation 9 of the Code. Satisfying equation 9 will prevent collapse of the piping system due to loads that produce primary stresses.

3.3 Stress due to Bolt Preload

The preload will produce stress in the pipe wall when the clamp is initially installed on the piping system and the bolts are tightened. Although local stress produced by preload is a nonrecurring type stress in nature it could result in damage to the pipe if a clamp was poorly designed. Stresses of this type need not be included in the fatigue evaluations required by NB-3600. Calculations have been made to ensure that bolt preloads could not result in local plastic deformation of the piping.

3.4 Stresses due to Constraint of Expansion from Internal Press re

Clamp induced stresses caused by the constraint of e expansion due to internal pressure have been added to other primary (refer to 3.2), and primary plus secondary stresses (refer to 3.6) to statisfy the required criteria.

3.5 Stresses due to Constraint of Differential Thermal Expansion

Clamp induced stresses due to differential temperatures and material expansion coefficients have been calculated and added to other operating secondary and peak stresses.

3.6 Fatigue Usage

The fatigue usage at the clamp location has been conservatively computed taking into consideration clamp induced stresses from pressure, temperature and support loadings. The clamp induced stresses were added to the stresses computed for each load set pair using equations 10 and 11 of NB-3650. Cumulative fatigue usage was computed according to the Code.

3.7 Protection from Loosening & Lift-off from Pipe

A calculation was made to assure that the clamp will not lift off from the pipe during fast cool down transients. In order to prevent loosening of bolts from the pipe, all bolts have double nuts. In addition, bolt stresses have been calculated and found to be well within the elastic range. The bolt material was selected to preclude relaxation at the maximum temperature of the pipe.

3.8 Clamp Design Criteria

Stiff clamps were designed by the pipe support fabricator to provide a high strength/stiffness clamp design that would fit on the smallest practical length of pipe. Stiff clamps were used at STP based on space considerations and not stiffness considerations.

Appendix 1

(Page 1 of 2)

Loading Combination for South Texas Project

(ASME Class 1 Lines)

CODE EQUATION	CONDITION	LOADING COMBINATION	COMMENTS
9	Design Level A/B (Normal/upset) Level C (Emergency) Level D (Faulted)	PD + DW + OBE PO + DW + OBE PO + DW + OBE PO + DW + $(SSE^2 + LOCA^2)^{1/2}$	
10	Level A/B	PO + TH + ΔTab + OBE + SAM (OBE)	If eq. 10 is not satisfied for all pairs of load set, component design is acceptable provided eq. 12, 13 and thermal ratchet range are satisfied
11	Level A/B	PO + TH + ΔTab + ΔT_1 + ΔT_2 + OBE + SAM (OBE)	
12	Level A/B	TH	
13	Level A/B	PO + DW + ΔTab + OBE	
Thermal Ratchet Range	Level A/B	TH1	

Appendix 1

TABLE : LEGEND

DW	-	Deadweight (including any other sustained mechanical load)
LOCA	-	Loss-of-coolant accident - defined in Appendix A of 10CFR Part 50 as "those postulated accidents that result from the loss of reactor coolant, at a rate in excess of the capability of the reactor coolant make-up system, from breaks in the reactor coolant pressure boundary up to and including a break equivalent in size to the double-ended rupture of the largest pipe of the reactor coolant system." This condition includes the loads from the postulated pipe break itself and also any associated system transients or dynamic effects resulting from the postulated pipe break. LOCA is calculated as LOCA = LOCA (JET) + LOCA (MOTION)
OBE	-	Operational-basis earthquake (Inertia)
PD	-	Design Pressure
PO	-	Operating pressure including any transient pressures associated with the plant condition under consideration
SAM	-	Seismic anchor movement
SSE	-	Safe-shutdown earthquake (Inertia)
TH	-	Thermal expansion and thermal anchor movements
ΔT_{ab}	-	Thermal discontinuity stress term (EQ.(10), NB-3653.1, S'79)
ΔT_1	-	Linear temperature distribution term (EQ.(11), NB-3653.2, S'79)
ΔT_2	-	Non-linear temperature distribution term (EQ.(11), NB-3653.2, S'79)
TH1	-	Thermal stress ratchet check per NB-3653.7, S'79.

Appendix 2

(Page 1 of 1)

STRESS SUMMARY

*	Items Evaluated			Highest Calculated Stress (KSI) / Usage Factor	Allowable Limits, KSI	Ratio Actual/ Allowed
	Eq#	Condition	Stress Type			
RC5112 DP #311	9	Design	Primary Stress	17.45	24.98	0.699
		Level A&B		17.45	24.98	0.699
		Level C		17.45	33.21	0.524
		Level D		20.518	49.95	0.411
	10		Primary + Secondary	45.535	49.95	0.912
			Cumulative Usage Factor	0.086	1.0	0.086
RC5112 DP #286	9	Design	Primary Stress	17.146	24.98	0.686
		Level A&B		17.146	24.98	0.686
		Level C		17.146	33.21	0.516
		Level D		33.313	49.95	0.667
	10		Primary + Secondary Stress	49.160	49.95	0.984
			Cumulative Usage Factor	0.0009	1.0	0.0009
RC5100 DP #52	9	Design	Primary Stress	16.522	24.66	0.670
		Level A&B		16.522	24.66	0.670
		Level C		16.522	32.83	0.503
		Level D		21.452	49.32	0.435
	10		Primary + Secondary Stress	47.234	49.32	0.958
			Cumulative Usage Factor	0.4	1.0	0.4

* This calculation brackets the stiff clamp for RC5110 DP No. 74.