

# The Light company

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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:

<u>Attachment</u>	<u>Item No.*</u>	<u>Subject</u>
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 <u>not</u> be incorporated into the FSAR.

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\* Legend

D - DSER Open Item  
F - FSAR Open Item

C - DSER Confirmatory Item  
Q - FSAR Question Response Item

L1/DSER/aar

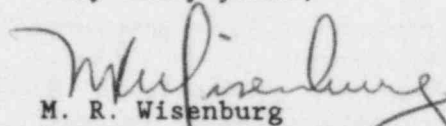
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If you should have any questions concerning this matter, please  
contact Mr. Powell at (713) 993-1328.

Very truly yours,

  
M. R. Wisenburg  
Manager, Nuclear Licensing

CAA/b1

Attachments: See above

L1/DSER/aar

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Revised 9/25/85

## 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 <sup>have been</sup> ~~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 <sup>have been</sup> ~~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. <sup>Identification of</sup> ~~Identify~~ the locations of "stiff" clamps installed on ASME Section III Nuclear Class 1 piping systems.
2. <sup>Identification of</sup> ~~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 <sup>will also be</sup> ~~will~~ also be identified and reviewed. <sup>have</sup>
3. <sup>Addition of</sup> ~~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 <sup>were</sup> ~~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-3681.2. Clamp induced stresses due to differential-temperature and differential-thermal-expansion coefficients <sup>were</sup> ~~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  $C_3$  and  $K_3$  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 <sup>overstress</sup> ~~damage~~ to pipe if a clamp <sup>improperly</sup> ~~were~~ <sup>was</sup> poorly designed. Calculations <sup>were</sup> ~~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~~ <sup>has been</sup> submitted in October, 1985, under separate cover letter (see ST-HL-AE-1468 dated 10/30/85).

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 (<sup>650</sup> ~~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 <sup>was</sup> ~~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.



SUMMARY OF  
STUDY CALCULATION  
FOR  
STIFF PIPE PLAMP  
CALCULATION NO. 11029RC9977

PREPARED FOR  
SOUTH TEXAS PROJECT

BY  
BECHTEL ENERGY CORPORATION  
PLANT DESIGN STRESS GROUP  
OCTOBER 21, 1985

PREPARED BY Melanie Smith  
CHECKED BY P. V. S. S. S. S.  
APPROVED BY [Signature]

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## 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		BOLT SIZE (INCHES)	BOLT PRETORQUE (FT-LB)	CLAMP RATING A&B SERVICE LEVELS (KIPS)	NPSI CLAMP IDENTIFICATION
	OD (INCHES)	NOMINAL THICKNESS (INCHES)				
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

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### 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 Pressure

Clamp induced stresses caused by the constraint of 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 satisfy 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

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## 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 <sup>2</sup> + LOCA <sup>2</sup> ) <sup>1/2</sup>	
10	Level A/B	PO + TH + $\Delta$ Tab + 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 + $\Delta$ Tab + $\Delta T_1 + \Delta T_2 +$ OBE + SAM (OBE)	
12	Level A/B	TH	
13	Level A/B	PO + DW + $\Delta$ Tab + OBE	
Thermal Ratchet Range	Level A/B	TH1	

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
$\Delta T_{ab}$	-	Thermal discontinuity stress term (EQ.(10), NB-3653.1, S'79)
$\Delta T_1$	-	Linear temperature distribution term (EQ.(11), NB-3653.2, S'79)
$\Delta T_2$	-	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

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## STRESS SUMMARY

*	Items Evaluated			Highest Calculated Stress (KSI)	Allowable Limits, KSI	Ratio Actual/ Allowed
	Eq#	Condition	Stress Type	Usage Factor		
RC 5 1 1 2	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
DP # 13 1 1	10		Primary + Secondary	45.535	49.95	0.912
			Cumulative Usage Factor	0.086	1.0	0.086
RC 5 1 1 2	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
DP # 2 8 6	10		Primary + Secondary Stress	49.160	49.95	0.984
			Cumulative Usage Factor	0.0009	1.0	0.0009
RC 5 1 0 0	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
DP # 5 2	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.