NSP

NORTHERN STATES POWER COMPANY

MINNEAPOLIS, MINNESOTA 55401

May 10, 1976

Mr Victor Stello, Director
Division of Operating Reactors
U S Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr Stello:

MONTICELLO NUCLEAR GENERATING PLANT
Docket No. 50-263 License No. DPR-22

In-Plant Safety Relief Valve Test

The January 6, 1976 General Electric letter from Mr Ivan F Stuart to Mr R S Boyd, U S Nuclear Regulatory Commission described an In-Plant Safety/Relief Valve Test to be conducted as part of the long term program for evaluation of Mark I containment systems.

Northern States Power Company has agreed to the performance of this test at the Monticello Nuclear Generating Plant. Instrumentation essentially as described for purposes of this test has been installed at the Monticello Plant. We now anticipate this test will be completed during the week of May 23, 1976. In order to obtain meaningful information with respect to the test objectives, the testing must be performed under conditions wherein the pressure between drywell and torus is equalized. Present test plans indicate that containment pressure equalization will be required for approximately four days for the conduct of the test. The pressure differential will be restored after completion of the test. If the test sequence is interrupted for scheduled periods in excess of 24 hours, the differential pressure will be restored during the interruption.

Our February 6, 1976 letter to you provided the basis for continued Monticello operation with respect to results of the short term program then available; this letter briefly described certain structural modifications being considered. Based on further information and evaluation, and in view of the longer interval required for implementation of structural improvements, Mark I owners met with you in Bethesda on February 26 to discuss operational measures which could be instituted promptly to enhance safety margins by reducing potential loads. Mr Rusche's letter of February 27, 1976 summarized that meeting wherein Mark I onwers agreed to establish at least a one psi differential pressure between drywell and torus. Our March 1, 1976 letter to you confirmed that NSP would establish and maintain this differential pressure at the Monticello Plant until other appropriate measures could be instituted.

The structural modifications were discussed in further detail with your technical staff on April 9, 1976. These modifications and their evaluation are represented in detail in the attachment to this letter. These modifications will be completed prior to equalizing the containment pressure differential for performing the safety relief valve test.

Information in the attachment shows that safety margins with the modifications installed and the differential pressure removed for the conduct of the test are actually enhanced in comparison to pre-existing conditions with differential pressure prior to any modifications of the structure. Further, conditions under which the test is to be performed will provide safety margins conservatively within and consistent with the margins of safety discussed in Mr Rusche's letter of February 27, 1976.

In summary, the test is currently scheduled for the week of May 23, 1976. The structural modifications will be completed prior to performing the test. Containment differential pressure will be restored after completion of the test.

Yours very truly,

L. O. Mayer

L O Mayer, PE
Manager, Nuclear Support Services

LOM/LLT/deb

cc: J C Keppler
G Charnoff
MPCA
Attn: J W Ferman

ATTACHMENT

Our February 6, 1976 letter stated that NSP had undertaken a course of action to "develop detailed engineering designs and determine the feasibility of installation of these designs for modifications to improve the structural elements of the torus support system that are subject to high loadings". We further stated that NSP was prepared to discuss this action plan at NRC convenience.

On April 9, 1976 these modifications were discussed in a preliminary way with NRC Staff personnel. The attached documentation, consisting of drawings and tables, was presented in that discussion. The modifications described by these documents are currently in progress with completion anticipated on or before May 21, 1976.

The table entitled "Summary-Downward Loading Phase", illustrates the substantial improvement in safety margins resulting from these modifications. The ratios of load to ultimate capacity show that the modifications produce a 46% improvement in margins without drywell pressurization over the pre-existing condition with drywell pressurization. A similar comparison for up-loads shows an improvement in margins in excess of 100%

These modifications represent completion of the action plan discussed in our February 6, 1976 letter.

UNITED STATES NUCLEAR REGULATORY COMMISSION

NORTHERN STATES POWER COMPANY

MONTICELLO NUCLEAR GENERATING PLANT

Docket No. 50-263

License No. DPR-22

LETTER DATED MAY 10, 1976
RESPONDING TO NRC REQUESTS
FOR INFORMATION ON CONTAINMENT DESIGN

Northern States Power Company, a Minnesota corporation, by this letter dated May 10, 1976 hereby submits information in response to NRC requests for information concerning the Mark I Containment.

This request contains no restricted or other defense information.

NORTHERN STATES POWER COMPANY

By L J Wachter

L J Wachter
Vice President, Power Production
& System Operation

On this 10th day of May 1976, before me a notary public in and for said County, personally appeared L J Wachter, Vice President, Power Production and System Operation, and being first duly sworn acknowledged that he is authorized to execute this document on behalf of Northern States Power Company, that he knows the contents thereof and that to the best of his knowledge, information and belief, the statements made in it are true and that it is not interposed for delay.

Denise E. Branau

DENISE E. BRANAU
NOTARY PUBLIC – MINNESOTA
HENNEPIN COUNTY
My Commission Expires Oct. 10, 1981

4/9/76

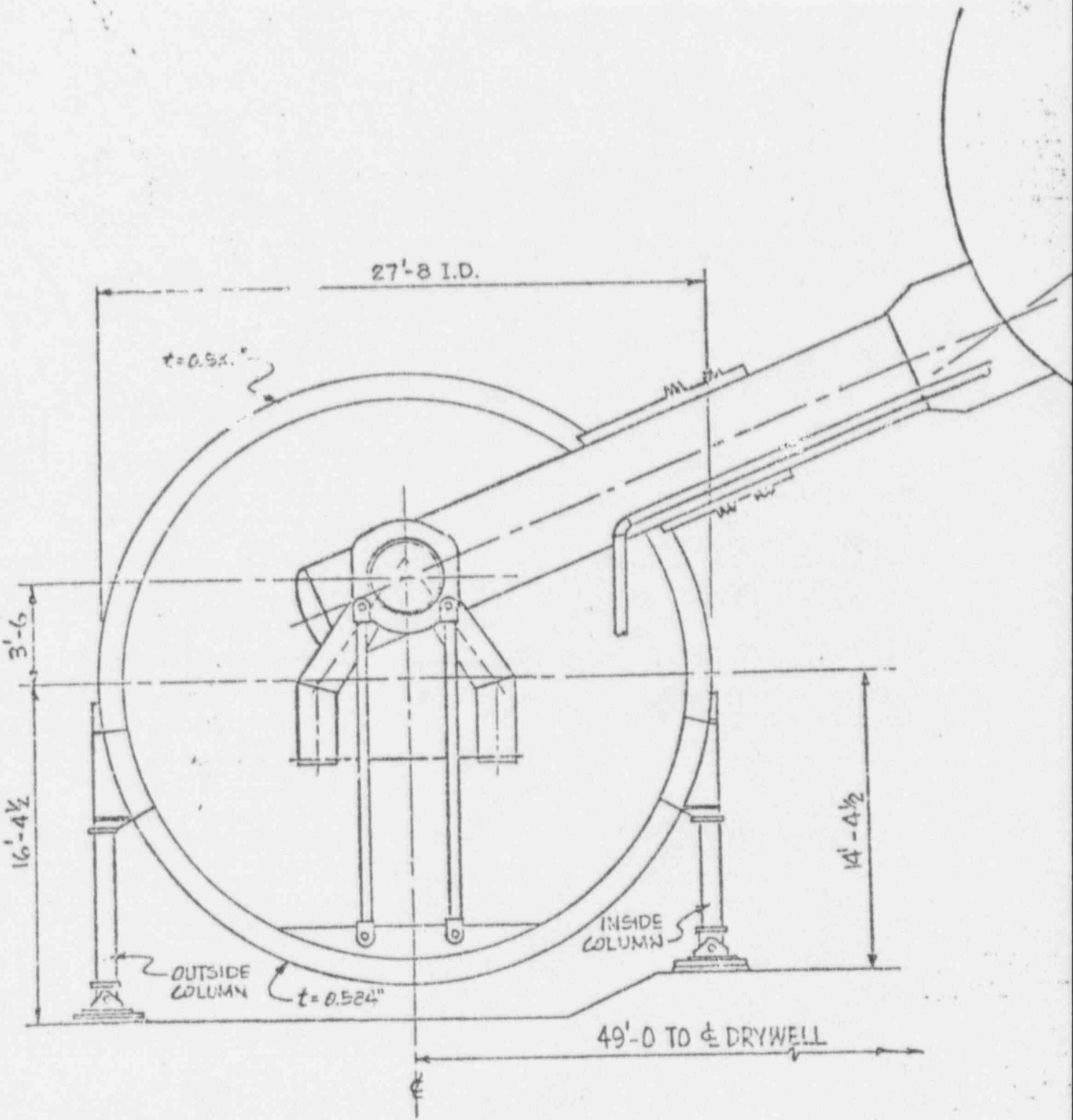
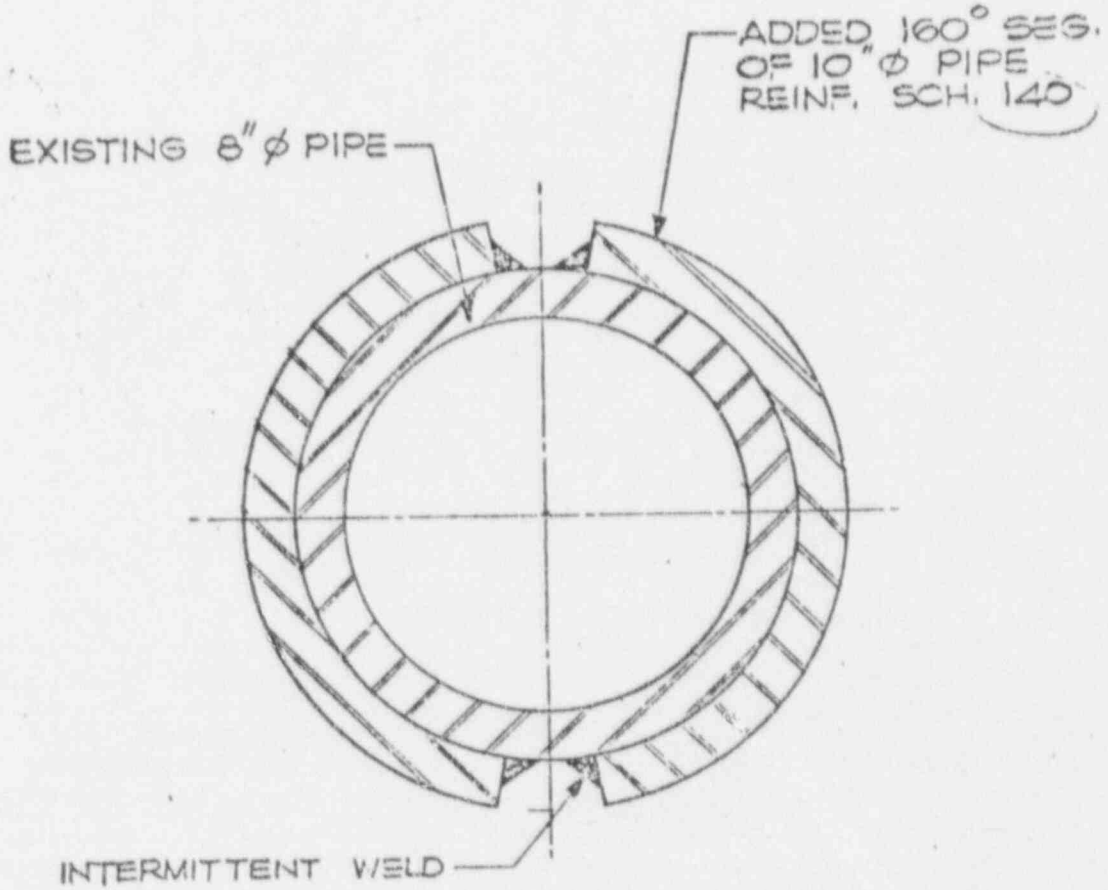


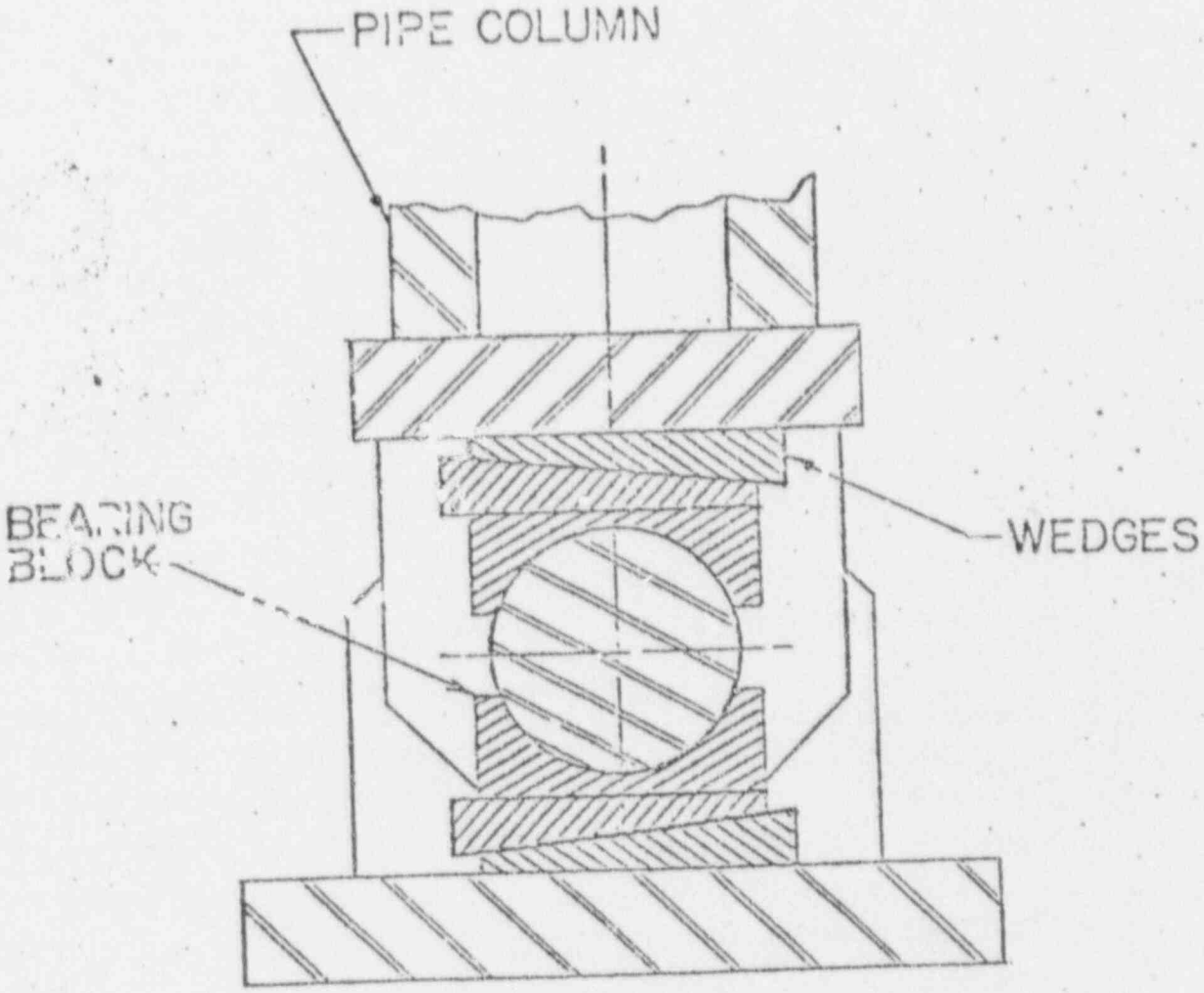
FIGURE 3.1-1

MONTICELLO COMPOSITE SECTION THROUGH SUPPRESSION CHAMBER



COLUMN REINFORCEMENT

Figure 4.1-1



COLUMN PIN CONNECTION REINFORCEMENT

Figure 4.2-1

TABLE 6.0-1

MATERIAL PROPERTIES

MATERIAL	MINIMUM YIELD STRENGTH (ksi)	MINIMUM ULTIMATE TENSILE STRENGTH
C-1018	40	60
A-106-GR B	35	60
A-36	36	58
A-283-GR C	30	55
A-615-GR 75	75	100
A-516-GR 70	38	70
API-5LX-GR X42	42	60

Pins	C-1018
Existing Pipe Columns	API-5LX-GR X42
Pin Connection Clevi.-	A-283-GR C
Colu . Reinforcement -	A-106-GR B
Existing Anchors -	A-36
Reinforcement Anchors-	A-615-GR 75
Pin Support Cradles -	A-516-GR 70
Pin Support Wedges -	A-516-GR 70
Anchor Plate Washers -	A-36

TABLE 6.0-2

ACTUAL COLUMN

MATERIAL PROPERTIES

Column	Yield Strength (ksi)	Ultimate Strength (ksi)
Inside	43.1	73.2
Outside	50.5	82.5

Column material is API-5LX-GR X42

the design reports for all Mark I plants. It was concluded that an across the board value of 0.80" would be reasonable for all plants.

Using the Bechtel method but utilizing the actual yield strength of the materials vs. the minimum specified yield, and utilizing a preliminary plant unique analysis to arrive at an upper bound for the column eccentricity (δ), the following values for the ultimate column capacities can be computed.

Column	Estimated Ultimate Capacity (kips)
Inside - Existing	889.
Inside - Reinforced	1606.
Outside - Existing	1282.
Outside - Reinforced	1753.

TABLE 6.1-1

COLUMN ULTIMATE CAPACITIES

Upward load ultimate capacity is presented in Table 7.2-1. The capacity is the column cross-sectioned area times the material ultimate tensile strength. Actual material properties of the existing material is used. Upward load capacity is controlled by the strength of the pin/lug base connection. Refer to section 6.3.

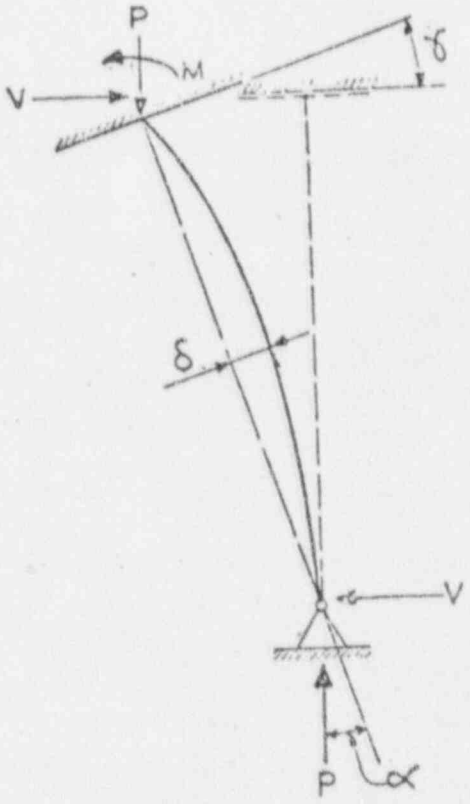


Figure 6.2-3

EXAGGERATED COLUMN DEFORMATION

From Figure 6.2-3 above, the following categorization of stresses can be made:

Stresses Resulting From	Category
$\frac{P}{\cos\alpha}$ (axial load)	Primary
$\frac{P}{\cos\alpha} \times \delta$ (bending along the column)	Primary
M (bending moment at top of column)	Secondary

Table 6.2-1

CATEGORIZATION OF COLUMN STRESSES

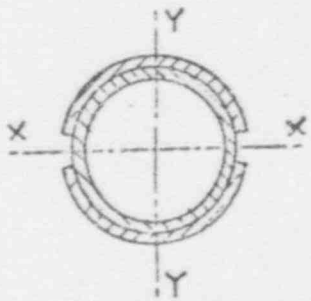
TABLE 6.2-2

COLUMN PROPERTIES

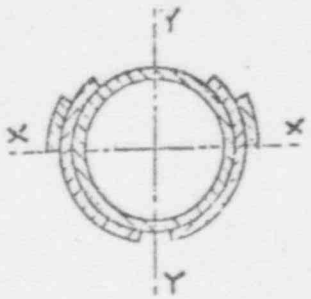
	MAT'L & F_y		AREA (IN^2)		S_{xx} IN^3		r (IN)					Kℓ/r					F_a KSI		F'_{ex}		F_{bx}	
							X-X AXIS		Y-Y AXIS			ABOUT X-X AXIS		Y-Y AXIS								
COLUMNS	EXISTING COL.	ADDED REIN.	WITHOUT REIN.	WITH REIN.	WITHOUT REIN.	WITH REIN.	WITHOUT REIN.	WITH REIN.	WITHOUT REIN.	WITH REIN.	ℓ_{IN}	WITHOUT REIN.	WITH REIN.	WITHOUT REIN.	WITH REIN.	C_{mx}	WITHOUT REIN.	WITH REIN.	WITHOUT REIN.	WITH REIN.	WITHOUT FIX	WITH FIX
MONT I.S.	API STD. 51.X 42 42.0	SAIOG GR. B 35.0	23.94	51.14	41.0	100.5	2.72	3.25	2.72	3.00	80.25	29.54	24.60	29.51	26.75	0.6	23.05	19.50	16.46	235.7	28.0	23.3
MONT O.S.	API STD. 51.X 42 42.0	SAIOG GR B 35.0	31.30	58.50	49.4	82.1	2.61	2.66	2.61	3.50	104.25	39.99	39.26	39.93	29.75	0.6	22.01	18.69	89.84	93.21	28.0	23.3
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]

* GEOMETRY ANALYZED

INSIDE SUPPORT



OUTSIDE SUPPORT



$$F_a = \frac{\left[1 - \frac{(K\ell/r)^2}{2C_c^2}\right] S_y}{\frac{5}{3} + \frac{3(K\ell/r)}{8C_c} - \frac{(K\ell/r)^3}{8C_c^3}}$$

where $C_c = \sqrt{\frac{2\pi^2 E}{S_y}}$

$$F_e' = \frac{12\pi^2 E}{23(K\ell/r_b)^2} \qquad F_{bx} = .66 S_y$$

nutech

NSP-01-052

TABLE 6.2-4

EVALUATION OF EQUATION (20) OF APPENDIX XVII OF SUBSECTION NA, ASME SECTION III (PRIMARY STRESSES)

COLUMNS	$\frac{f_a}{.65S_Y} + \frac{f_{bx}}{F_{bx}}$			
	WITHOUT ΔP		WITH ΔP = 1 PSI	
	WITHOUT STRUCT FIX	WITH STRUCT FIX	WITHOUT STRUCT FIX	WITH STRUCT FIX
	$\frac{(2)}{.65S_Y} + \frac{(6)}{[22]}$	$\frac{(3)}{.65S_Y} + \frac{(7)}{[23]}$	$\frac{(1)}{.65S_Y} + \frac{(8)}{[22]}$	$\frac{(5)}{.65S_Y} + \frac{(9)}{[23]}$
MONTICELLO I. S.	1.43	0.79	1.08	0.59
MONTICELLO O. S.	1.35	0.88	1.02	0.67
(1)	(2)	(3)	(4)	(5)

○ - VALUE FROM CORRESPONDING COLUMN IN TABLE 6.2-3

[ ] - VALUE FROM CORRESPONDING COLUMN IN TABLE 6.2-2

TABLE 6.3-1

PIN CONNECTION CAPACITY CRITERIA

TYPE OF STRESS	CODE ALLOWABLE	ULTIMATE
Tension at Pin Holes	0.45 F_y	1.0 F_u
Shear	0.4 F_y	$F_u/\sqrt{3}$
Bearing	0.9 F_y	1.0 F_u
Bending	0.75 F_y	1.0 F_u

TABLE 6.3-2

PIN CONNECTION PROPERTIES

ITEM	EXISTING	REINFORCED
Bearing Area	15.00 in^2	36.77 in^2
Pin Section Mod.	12.27 in^3	12.27 in^3
Pin Cross-Sect. Area	19.63 in^2	19.63 in^2
*Clevis Tensile Area	11.82 in^2	11.82 in^2
*Clevis Shear Area	13.26 in^2	13.26 in^2

*See Figure 6.3-1 for failure planes

TABLE 6.3-3

PIN CAPACITY

(loads in kips)

TYPE OF STRESS	ULTIMATE CAPACITY		CODE ALLOW: STRESSES CAPACITY	
	w/o Fix	w/Fix	w/o Fix	w/Fix
Bearing	907	2584	446	1265
Bending	1000	N/A	500	N/A
Shear	1496	N/A	691	N/A

TABLE 6.3-4

CLEVIS UPLIFT CAPACITY

(loads in kips)

TYPE OF STRESS	ULTIMATE CAPACITY	CODE ALLOWABLE STRESS CAPACITY
Bearing	907	446
Tension	650	176
Shear	463	175

Figure 6.3-1

CLEVIS FAILURE PLANES

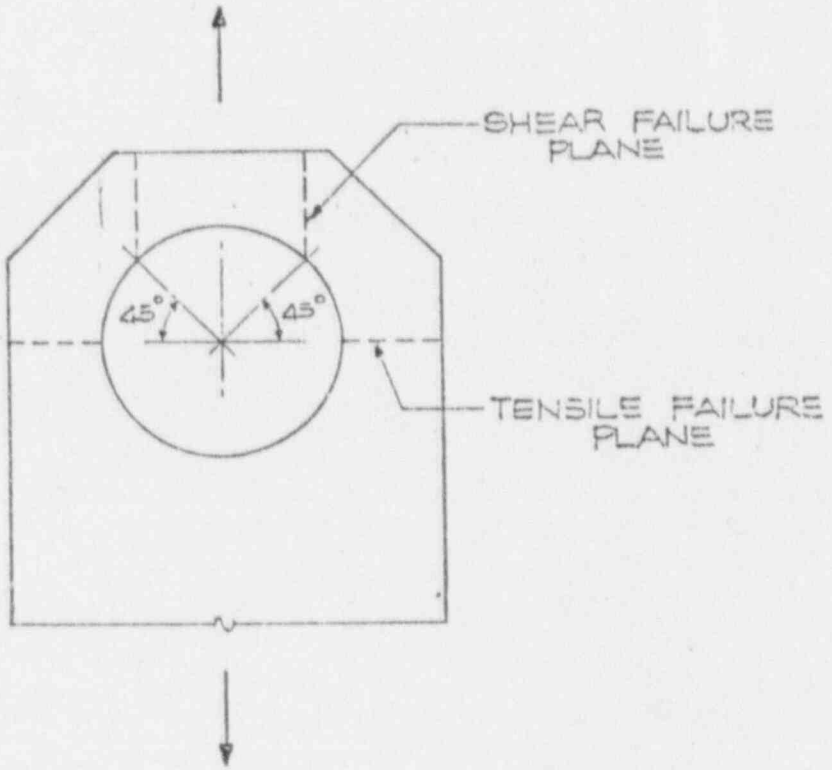


FIGURE 6.5-1

COLUMN CONNECTION

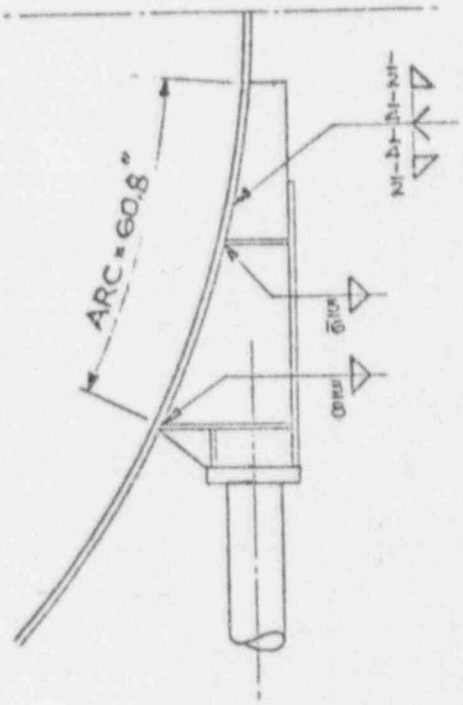


TABLE 7.1-1
SUMMARY - DOWNWARD LOADING PHASE

(LOADING IN KIPS)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	ITEM	DEAD LOAD WATER + STEEL OPERAT. COND.	SEISMIC LOAD VERT + HORIZ	DYNAMIC POOL SWELL LOADS		TOTAL LOAD @ POOL SWELL		ULITIMATE CAPACITY		CODE ALLOW. ~~STRESS~~ CAPACITY		RATIOS OF LOAD TO CAPACITY								REMARKS
												ULTIMATE				CODE ALLOWABLE				
				WITHOUT ΔP	WITH ΔP 1 PSI	WITHOUT ΔP Σ2,3,4 ×.85	WITH ΔP Σ2,3,5 ×.85	WITHOUT STRUCT FIX	WITH STRUCT FIX	WITHOUT STRUCT FIX	WITH STRUCT FIX	WITHOUT ΔP		WITH ΔP		WITHOUT ΔP		WITH ΔP		
												WITHOUT FIX	WITH FIX	WITHOUT FIX	WITH FIX	WITHOUT FIX	WITH FIX	WITHOUT FIX	WITH FIX	
1	I.S. COL	135	16	727	509	746	561	869	1606	501	926	.84	.46	.63	.35	1.49	.80	1.12	.61	
2	I.S. PIN/LUG	135	16	727	509	746	561	907	2584	446	1265	.82	.29	.62	.22	1.67	.59	1.26	.44	
3	I.S. SHELL CONN.	135	16	727	509	746	561	2568	2568	765	765	.29	.29	.22	.22	.98	.98	.73	.73	
4																				
5	O.S. COL	165	20	889	622	912	686	1282	1753	612	980	.71	.52	.54	.39	1.49	.93	1.12	.70	
6	O.S. PIN/LUG	165	20	889	622	912	686	907	2589	446	1269	1.00	.35	.76	.27	2.05	.72	1.54	.54	
7	O.S. SHELL CONN.	165	20	889	622	912	686	2568	2568	765	765	.36	.36	.27	.27	1.19	1.19	.90	.90	

TABLE 7.2-1
SUMMARY – UPWARD LOADING PHASE

(LOADS IN KIPS)

(RATIOS & LOADS BASED ON ABSOLUTE UPPER BOUND FOR COLUMN TENSILE FORCE WITH MOST PROBABLE LOAD)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	ITEM	DEAD LOAD WATER + STEEL OPERAT. COND.	SEISMIC LOAD VERT + HORIZ	DYNAMIC POOL SWELL LOADS		TOTAL LOAD @ POOL SWELL		ULITIMATE CAPACITY		CODE ALLOW. STRESS CAPACITY		RATIOS OF LOAD TO CAPACITY								REMARKS
												ULTIMATE				CODE ALLOWABLE				
												WITHOUT ΔP		WITH ΔP		WITHOUT ΔP		WITH ΔP		
				WITH-OUT ΔP	WITH ΔP 1 PSI	WITH-OUT ΔP Σ2,3,4	WITH ΔP Σ2,3,5	WITH-OUT STRUCT FIX	WITH STRUCT FIX	WITH-OUT STRUCT FIX	WITH STRUCT FIX	WITH-OUT FIX	WITH FIX	WITH-OUT FIX	WITH FIX	WITH-OUT FIX	WITH FIX	WITH-OUT FIX	WITH FIX	
1	I.S. COL	135↓	16↓	319↓	280↓	200	161	1926	3378	681	1183	.10	.06	.08	.05	.29	.17	.24	.14	
2	I.S. PIN/LUG	135↓	16↓	319↓	280↓	200	161	463	463	175	175	.43	.43	.35	.35	1.14	1.14	.92	.92	
3	I.S. SHELL CONN.	135↓	16↓	319↓	280↓	200	161	2568	2568	765	765	.08	.08	.06	.06	.26	.26	.21	.21	
4	I S ANC.	135↓	16↓	319↓	280↓	200	161	180	620	67	287	1.11	.32	.89	.26	2.99	.70	2.40	.56	
5	O.S. COL	165↓	20↓	389↓	343↓	244	198	2812	3864	1044	1353	.09	.06	.07	.05	.23	.16	.19	.15	
6	O.S. PIN/LUG	165↓	20↓	389↓	343↓	244	198	463	463	175	175	.53	.53	.43	.43	1.39	1.39	1.13	1.13	
7	O.S. SHELL CONN.	165↓	20↓	389↓	343↓	244	198	2568	2568	765	765	.10	.10	.08	.08	.32	.32	.26	.26	
8	O.S. ANC.	165↓	20↓	389↓	343↓	244	198	180	620	67	287	1.36	.39	1.10	.32	3.64	.85	2.96	.69	

NRC FORM 195 (2-76)

U.S. NUCLEAR REGULATORY COMMISSION

DOCKET NUMBER 50-263

FILE NUMBER

NRC DISTRIBUTION for PART 50 DOCKET MATERIAL

TO: Mr Stello	FROM: Northern States Pwr Company Minneapolis, Mn L O Mayer	DATE OF DOCUMENT 5-10-76 DATE RECEIVED 5-12-76

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DESCRIPTION: Ltr re CE ltr to NRC dtd 1-6-76...trans the following:

ENCLOSURE: Information concerning In-Plant Safety Relief testing.....(40 cys encl rec'd)

PLANT NAME: Monticello

SAFETY	FOR ACTION/INFORMATION	ENVIRO 5-14-76 ehf
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