PDR.H9

Nebraska Public Power District

GENERAL OFFICE
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June 29, 1979

Mr. Karl V. Seyfrit, Director
U.S. Nuclear Regulatory Commission
Office of Inspection and Enforcement
Region IV
611 Ryan Plaza - Suite #1000
Arlington, TX 76011

Subject: IE Bulletin No. 79-07
Seismic Stress Analysis of Safety Related Piping

Dear Mr. Seyfrit:

In our initial response to the subject Bulletin, Nebraska Public Power District committed to provide a complete re-evaluation of the Safety/Relief Valve (SRV) discharge piping at Cooper Nuclear Station. Enclosure 1 contains the results of this re-evaluation as well as the response to additional concerns on this subject raised during recent discussions with the Staff.

Enclosure 2 addresses in detail the computer code validation program requested in Item 3 of the Bulletin.

If you have any questions or require additional information, please do not hesitate to contact me.

Sincerely yours,

Jay M. Pilant

Jay M. Pilant
Director of Licensing
and Quality Assurance

JDW/cmk
Enclosures

cc: U.S. Nuclear Regulatory Commission
Office of Inspection and Enforcement
Division of Reactor Operations Inspection
Washington, DC 20555

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Response to IE Bulletin 79-07

Seismic Stress Analysis of Safety Relating Piping

Item (1)

Identify which, if any, of the methods specified below were employed or were used in computer codes for the seismic analysis of safety related piping in your plant and provide a list of safety systems (or portions thereof) affected:

Response Spectrum Modal Analysis:

a. Algebraic (considering signs) summation of the codirectional spatial components (i.e., algebraic summation of the maximum values of the codirectional responses caused by each of the components of earthquake motion at a particular point in the mathematical model).

b. Algebraic (considering signs) summation of the codirectional inter modal responses (i.e., for the number of modes considered, the maximum values of response for each mode summed algebraically).

Time History Analysis:

a. Algebraic Summation of the codirectional maximum responses or the time dependent responses due to each of the components of earthquake motion acting simultaneously when the earthquake directional motions are not statistically independent.

Response

A version of the ADLPIPE Computer Program, which includes an algebraic summation technique, has been used to do the seismic analysis of discharge piping for the Safety/Relief Valves (SRV's). The portions of this piping system affected are identified in the response to Item 4.

The above methods do not describe explicitly the summation techniques used in ADLPIPE for determining final mathematical model responses.

This version of ADLPIPE Computer Program uses the intra-modal algebraic summation for codirectional components resulting from multiple earthquake directional motions. The Square Root of the Sum of Squares summation is used to determine the combined response for all modes to obtain directional forces at a point in the pipe system. Closely spaced modes (within 10%) are absolutely summed.

Item (2)

Provide complete computer program listings for the dynamic response analysis portions for the codes which employed the techniques identified in Item (1) above.

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Response

The ADLPIPE Computer Program is a proprietary program owned and technically supported by:

Arthur D. Little, Inc.
Acorn Park
Cambridge, MA 02140

Because of this proprietary nature, letters have been written directing the three Computer facilities, listed below, where Burns and Roe engineers utilize the ADLPIPE Computer Program, to expeditiously forward directly to the USNRC listings as called for in Item (2) above.

This direction specifically asks that this listing contain Old Versions of ADLPIPE from 1972 up to the present version.

1. Call Data Systems, Inc.
   20 Crossways Park N.
   Woodbury, NY 11797

2. Control Data Corp.
   8100 34th Ave. A
   Minneapolis, MN 55440

3. Control Data Corp.
   1151 Seven Locks Road
   Rockville, MD 20840

Item (3)

Verify that all piping computer programs were checked against either piping benchmark problems or compared to other piping computer programs. You are requested to identify the benchmark problems and/or the computer programs that were used for such verifications, or describe in detail how it was determined that these programs yielded appropriate results (i.e., gave results which corresponded to the correct performance of their intended methodology).

Response

A summary of the verification program performed by EDS Nuclear, Inc. was submitted April 24, 1979 in the District's initial response to IE Bulletin No. 79-07. EDS Nuclear performed the original seismic stress analyses for both the architect-engineer and vendor on Cooper Nuclear Station and certain modifications to the original design were analyzed by Burns and Roe, Inc.

For operational piping analyses, Burns and Roe has exclusively used Arthur D. Little piping analysis program, ADLPIPE. This computer program was the only program in the public domain which considered the nuclear piping requirements for the Code, ANSI-B31.7.

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In the year 1972, an updated version enabled the user to produce a partial stress report required to meet the requirements of the B&PV ASME Section III, Div. 1 Code, as well as ANSI-B31.1 Code for piping and components. It also contained, for the first time, a spectra modal response analysis for redundant pipe systems.

Arthur D. Little performed the validation of the Code in their support of the ADLPIPE Program. This validation is discussed in Enclosure 2.

Burns and Roe also has an ongoing validation program. Typical spectra response and time history analyses from the ADLPIPE Program have been compared with the results from ANSYS and STARDYNE Computer Programs. Minor differences, due to different numerical techniques used within the programs, have been identified but verification has been demonstrated by these comparisons.

In addition, the following comparisons have been made of the different summation options of ADLPIPE against other recognized industry methods and benchmarks

I. Comparison of ADLPIPE vs NUPIPE Computer Program. This study included eight (8) typical pipe systems having various diameter pipe sizes.

    ADLPIPE Algebraic Summation vs NUPIPE
    ADLPIPE Opt. 192 vs NUPIPE
    ADLPIPE Opt. 160 vs NUPIPE

II. Second comparison of ADLPIPE Program was to selected problems in report BNL_NUREG-21241-R2 issued by Department of Nuclear Energy Brookhaven National Laboratory.

    ADLPIPE Algebraic Summation vs BNL Hovgaard Problem
    ADLPIPE Opt. 192 vs BNL Hovgaard Problem
    ADLPIPE Opt. 160 vs BNL Hovgaard Problem
    ADLPIPE Algebraic Summation vs BNL Coffee Table Problem
    ADLPIPE Opt. 192 vs BNL Coffee Table Problem
    ADLPIPE Opt. 160 vs BNL Coffee Table Problem

<u>Item (4)</u>

If any of the methods listed in Item (1) are identified, submit a plan of action and an estimated schedule for the re-evaluation of the safety related piping, supports, and equipment affected by these analysis techniques. Also provide an estimate of the degree of which the capability of the plant to safely withstand a seismic event in the interim is impacted.

<u>Response</u>

The following list identifies those piping systems at Cooper Nuclear Station which have been run on ADLPIPE using Algebraic Summation intra-mode.

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Iso Nos'	System	Code/Class
MSRV #71G	MS	B31.1
MSRV #71F	MS	B31.1
MSRV #71A	MS	B31.1
MSRV (Piping in Torus)	MS	B31.1

In compliance with NPPD FSAR Appendix C, paragraph 3.3.3.2, earthquake analysis was performed by separate calculations applying seismic shock response spectra in the X and Y (vertical) directions acting simultaneously; and then in the Z and Y directions acting simultaneously.

All of the above piping systems have been re-run, using ADLPIPE Option 192. In compliance with USNRC Regulatory Guide 1.92, this option uses the Square Root of the Sum of Squares (SRSS) summation to determine the combined response for all modes (inter-modal combination) to obtain directional forces at all points in the piping system, except that closely spaced modes (within 10%) are absolutely summed. The combination of special modes thus derived, are then summed by use of SRSS summation.

Additionally, these piping systems were also re-analyzed using ADLPIPE Option 160, which uses absolute summation for each mode (intra-modal combination), and inter-modal combination as described above for Option 1.92.

In both cases, the above piping systems have been found to be within Code limits for pipe stress allowables. Pipe supports and supplemental structures were also reviewed and with the exception of one pipe support structure discussed below, were found to be within current rated load capacity.

One pipe support structure, SSX-MSRV #71A, was found to have an over-stressed condition. Analysis of this as-built support steel structure indicates stresses of 99% of minimum yield stress, when elastically analyzed for MSRV blowdown transient and 110% of minimum yield stress, when analyzed for MSRV blowdown transient in combination with OBE. Analysis of the as-built welding configuration for this support structure indicates stresses of 46% of minimum yield stress of the electrode weld metal when elastically analyzed for MSRV blowdown transient and 51% of minimum yield stress of the electrode weld metal, when analyzed for MSRV blowdown transient in combination with OBE. Based on the above, this support will not lose function upon load application. Of the eight MSRV's at Cooper Nuclear Station, this pipe support is on the discharge line of a MSRV set to relieve at the highest system pressure. Normal plant transients would not be expected to lift this MSRV and exert load on the pipe support structure.

It should be noted that this one pipe support structure is already scheduled to be strengthed during the April 1980 refueling outage. In a conference between the Mark I Owners Group, General Electric, and NRC held in November 1977, the Staff suggested that the Safety/Relief Valve discharge piping be analyzed for newly defined loads identified as part of the Mark I Containment Program. The analysis methods to be employed

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on the discharge line were submitted in General Electric Report NEDO-24583, included on the Cooper Nuclear Station Docket by letter from J. M. Pilant (NPPD) to T. A. Ippolito (NRC) dated February 26, 1979. Section 6.7 of NEDO-24583 reads as follows:

> "An analysis will be performed for each safety/relief valve discharge line. The analytical model will represent the piping and supports, from the nozzle at the Main Steam line to the discharge in the suppression pool. The analytical model will include the discharge device and its supports. Time history dynamic analysis will be performed for the safety/relief valve discharge thrust loads. Dynamic effects of other loads will be considered using either response spectrum analysis or dynamic load factors."

In a letter from J. M. Pilant (NPPD) to V. Stello (NRC) dated May 7, 1979, the District defined the Mark I Containment Program Long Term Program modifications to be performed during the April 1980 refueling outage to restore the original intended design safety margins for the Cooper Station containment systems. Installation of additional snubber supports on the Safety/Relief Valve discharge lines in the drywell was listed as a planned modification.

Since the MSRV discharge piping is at ambient pressure and temperature during normal plant operation and is therefore not classified as a high-energy system, it is not subject to postulation of pipe rupture. Thus, the re-analyses for these piping systems have no bearing on postulated pipe rupture locations.

A summary of old and new seismic stresses is shown in Table 1. Comparison of old and new total load combinations on pipe supports is shown in Table 2.

Enclosure 2
IE Bulletin 79-07
Item No. 3 Response

ADLPIPE PROGRAM

VALIDATION

by

I. W. Dingwell

Arthur D. Little, Inc.

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VERIFICATION OF ADLPIPE

The following is excerpted from:

Letter from I. W. Dingwell (ADL) to J. B. Mahoney (B&R) 4/27/79, Subject: NRC Meeting in Washington D.C. when Staff reported to Commission the Status of I.E. Bulletin 79-07

Verification of ADLPIPE

Verification of ADLPIPE was undertaken in a series of fundamental checks. In important modifications a supporting document was prepared as an ADLPIPE reference. The verification procedure was as follows.

The thermal and deadweight loadings were checked by a Hovgaard Bend and hand calculated systems given in "Design of Piping Systems", M. W. Kellogg, Second Edition, 1956, and "Formulas of Stress and Strain", R. J. Roark, McGraw-Hill.

The dynamic analyses were checked by "Response of Structural Systems to Ground Shock", Shock and Structural Response, ASME, 1960, in "ADLPIPE Results of Model Given by Young (ADLPIPE Reference 4), and "Dynamic Behavior of a Foundation-Like Structure", Mechanical Independence Methods, ASME, 1958, in "Experimental Verification of ADLPIPE Mod 1" (ADLPIPE Reference 3).

The time history analysis was checked by a separate analytical solution of the problem given in "Analytical Methods of Vibrations," page 395, Leonard Meinovitch, "ADLPIPE Time History Response Compared with a Known Solution for a Heavily Damped System (ADLPIPE Reference 14). A second check was made using "Pressure Vessel and Piping 1972 Computer Progress Verification", ASME, 1972 (Problem 5).

The thermal transient analysis was verificed by a separate analysis, "Transient Thermal Gradient Stresses", E. B. Branch, Heating, Piping and Air Conditioning, Volume 43, 1973, pages 132-136, "ADLPIPE Thermal Transient Analysis" (Reference 15).

The computation of intra and inter modal moment component summation has been verified by a separate computer program for that purpose. A report "ADLPIPE Modal Response Combination for Closely Spaced Modes", is available as ADLPIPE reference 24.

Various calculation procedures required by ASME Section III were verified in ADLPIPE references 10, 11, and 18 entitled "ADLPIPE Computation of Bending Stess in Tees and Branch Connections, ASME Section III, Class 1 Piping", "ADLPIPE Computation of Resultant Moments for Section III Class 2 and 3 Stresses", and "ADLPIPE Stress Computation of Piping Components: A comparison with Hand Calculations for ANSI B31 and ASME Section III."

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In 1978 an independent third party review of ADLPIPE (Section III, Class 1) was performed "Verification of ADLPIPE, ASME Section III, Class 1 Piping Stress Program", Teledyne Engineering Services, Report No. TR-2884-1, August 11, 1978.

ADLPIPE Development Policy

The following policies have been in effect during the development of ADLPIPE:

1. The details of calculation processes are available to the public by free distribution of operating manuals and references. These are tabulated in Appendix I. Each major new feature of ADLPIPE is documented for user review.

2. Program listings are made available to licensees. Licensees are not restricted from making program changes.

3. ADLPIPE is periodically improved and updated and licensees are notified of the modifications at the time of the release of the modified version.

4. ADLPIPE is hand checked wherever possible. When this is not possible, ADLPIPE is checked by experimental results or the results of other calculation procedures. Every modification, large or small, is checked.

5. Special versions of ADLPIPE will be written to a licensee's specification. However, the version of ADLPIPE released to computer service bureaus generally does not have such special additions.

6. Old versions of ADLPIPE are not retained by Arthur D. Little, Inc. Instead, beginning in 1971, all new versions of ADLPIPE were backward integrated. The present version of ADLPIPE maintains all past features which have been made available to the users during the period 1971 to 1979.

TABLE I

TABLE OF HIGHEST STRESSES

ISOMETRIC MSRV #71A

NEBRASKA PUBLIC POWER DISTRICT
COOPER NUCLEAR STATION

	POINT NO.		ALG SUM	SRSS (ADS) OPT 192	NUPIPE	ADS SUM OPT 160	PERCENTAGE ALG SUM/ SRSS (ADS)	PERCENTAGE ALG SUM/ NUPIPE	PERCENTAGE ALG SUM/ ADS (SUM)	PERCENTAGE ALG SUM/ ALLOWABLE* STRESS
1	12	X-Y	1308	1607		1707	81.4		76.6	10.6
	End	Z-Y	600	902		1097	66.5		54.7	4.9
2	16	X-Y	1357	1564		1605	86.8		84.5	11.0
	Beg.	Z-Y	511	623		684	82.0		74.7	4.1
3	19	X-Y	1386	1518		1590	91.3		87.2	11.2
	End	Z-Y	1019	1150		1253	88.6		81.3	8.2
4	111	X-Y	1192	1481		1585	80.5		75.2	9.6
	Beg	Z-Y	581	833		999	69.7		58.2	4.7
5	10	X-Y	1274	1351		1445	94.3		88.2	10.3
	End	Z-Y	629	811		951	77.6		66.1	5.1

* ALLOWABLE STRESS IS DEFINED FROM ANSI B31.1, EQUATION (12)

ALLOWABLE STRESS $\leq 1.2\, S_h - \frac{PD}{4t_h} - \frac{0.75i}{Z} M_A = 12{,}361$ PSI

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TABLE 1

TABLE OF HIGHEST STRESSES

ISOMETRIC MSRV #71F

NEBRASKA PUBLIC POWER DISTRICT
COOPER NUCLEAR STATION

	POINT NO.		ALG SUM	SRSS (ADS) OPT 192	NUPIPE	ADS SUM OPT 160	PERCENTAGE ALG SUM/ SRSS (ADS)	PERCENTAGE ALG SUM/ NUPIPE	PERCENTAGE ALG SUM/ ADS (SUM)	PERCENTAGE ALG SUM/ ALLOWABLE* STRESS
1	11	X-Y	600	755		822	79.5		73.0	4.9
	Beg.	Z-Y	158	160		161	98.8		98.1	1.3
2	7	X-Y	424	527		575	80.5		73.7	3.4
		Z-Y	118	119		121	99.2		97.5	1.0
3	14	X-Y	364	453		495	80.4		73.5	2.9
	End	Z-Y	24	25		25	96.0		96.0	0.2
4	8	X-Y	361	444		484	81.3		74.6	2.9
		Z-Y	145	147		149	98.6		97.3	1.2
5	2	X-Y	355	434		473	81.8		75.1	2.9
	Beg.	Z-Y	177	179		181	98.9		97.8	1.4

* ALLOWABLE STRESS IS DEFINED FROM ANSI B31.1, EQUATION (12)

ALLOWABLE STRESS = $1.2\ S_h - \frac{PD}{4t_h} - \frac{0.75i}{Z}\ M_A$ = 12,361 PSI

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TABLE 1

TABLE OF HIGHEST STRESSES

ISOMETRIC MSRV #71G

NEBRASKA PUBLIC POWER DISTRICT
COOPER NUCLEAR STATION

	POINT NO.		ALG SUM	SRSS (ADS) OPT 192	NUPIPE	ADS SUM OPT 160	PERCENTAGE ALG SUM/ SRSS (ADS)	PERCENTAGE ALG SUM/ NUPIPE	PERCENTAGE ALG SUM/ ADS (SUM)	PERCENTAGE ALG SUM/ ALLOWABLE* STRESS
1	101	X-Y	1245	1243		1265	100.2		98.4	10.1
	End	Z-Y	757	773		806	97.9		93.9	6.1
2	27	X-Y	1012	975		1032	103.8		98.1	8.2
	Beg.	Z-Y	629	605		650	104.0		96.8	5.1
3	191	X-Y	1003	1000		1023	100.3		98.0	8.1
	End	Z-Y	630	623		652	101.1		96.6	5.1
4	9	X-Y	944	945		963	99.9		98.0	7.6
	End	Z-Y	615	637		670	96.5		91.8	5.0
5	15	X-Y	915	82[illegible]		927	110.5		98.7	7.4
	End	Z-Y	847	758		885	111.7		95.7	6.9

* ALLOWABLE STRESS IS DEFINED FROM ANSI B31.1, EQUATION (12)

$$\text{ALLOWABLE STRESS} = 1.2\ S_h - \frac{PD}{4t_h} - \frac{0.75i}{Z}\ M_A = 12{,}361 \text{ PSI}$$

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TABLE 1

TABLE OF HIGHEST STRESSES

ISOMETRIC MSRV Piping VR-1 (In Torus)

NEBRASKA PUBLIC POWER DISTRICT
COOPER NUCLEAR STATION

	POINT NO.		ALG SUM	SRSS (ADS) OPT 192	NUPIPE	ADS SUM OPT 160	PERCENTAGE ALG SUM/ SRSS (ADS)	PERCENTAGE ALG SUM/ NUPIPE	PERCENTAGE ALG SUM/ ADS (SUM)	PERCENTAGE ALG SUM/ ALLOWABLE* STRESS
1	9	X-Y	134	165		265	81.2		50.6	1.08
	End	Z-Y								
2	2	X-Y	99	108		204	91.7		48.5	0.8
	Beg.	Z-Y								
3	3	X-Y	61	102		177	59.8		34.5	0.5
	End	Z-Y								
4	1	X-Y	69	82		147	84.1		46.9	0.56
	Beg.	Z-Y								
5	2	X-Y	58	75		134	77.3		43.3	0.47
	End	Z-Y								

* ALLOWABLE STRESS IS DEFINED FROM ANSI B31.1, EQUATION (12)

ALLOWABLE STRESS $\leq 1.2\ S_h - \frac{PD}{4t} - \frac{0.75i}{Z}\ M_A$ = 12.361 PSI

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TABLE 2

MSRV #71A

SUPPORT DESIGNATION	NODE POINT NO.	THERMAL	RELIEF VALVE TRANSIENT (LBS)	O.B.E. SEISMIC (LBS)			TOTAL LOAD (LBS)		
				ORIGINAL	OPTION 1.92	OPTION 1.60	ORIGINAL	RECALCULATED LOADS USING - 1.92 SEISMIC	RECALCULATED LOADS USING - 1.60 SEISMIC
SS-X	65	--	8000	700	883	914	8700	8883	8914
55-9-Z	8	--	5000	500	467	490	5500	5467	5490
55-9-Y	8	--	3000	500	384	405	3500	3384	3405
PS-Y	13	610	2000	510	404	430	3120	3014	3040
55-23-X	13	1435	5000	380	314	341	6815	6749	6776
55-23-Y	21	--	5000	500	289	302	5500	5289	5302
55-26-Z	21	--	8500	500	235	277	9000	8735	8777
SS-Z	17	--	5000	500	316	354	5500	5316	5354
	25	--	3600	400	354	375	4000	3954	3975

OTE: Thermal, Relief Valve Transient and Original O.B.E. obtained from B&R Isometric 1273-55, Rev. Dated 11-17-1973

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TABLE 2

MSRV #71F

SUPPORT DESIGNATION	NODE POINT NO.	THERMAL	RELIEF VALVE TRANSIENT (LBS)	O.B.E. SEISMIC (LBS)			TOTAL LOAD (LBS)		
				ORIGINAL	OPTION 1.92	OPTION 1.60	ORIGINAL	RECALCULATED LOADS USING - 1.92 SEISMIC	RECALCULATED LOADS USING - 1.60 SEISMIC
57-12-Y	34	--	8398	500	364	402	8898	8762	8800
SS-X	10	--	1157	2000	293	320	3157	1450	1477
SS-Z	10	--	971	2000	194	212	2971	1165	1183

NOTE: Thermal, Relief Valve Transient and Original O.B.E. obtained from B&R Isometric 1273-57, Rev. Dated 7-12-1974

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TABLE 2

MSRV #71G

SUPPORT DESIGNATION	NODE POINT NO.	THERMAL	RELIEF VALVE TRANSIENT (LBS)	O.B.E. SEISMIC (LBS)			TOTAL LOAD (LBS)		
				ORIGINAL	OPTION 1.92	OPTION 1.60	ORIGINAL	RECALCULATED LOADS USING - 1.92 SEISMIC	1.60 SEISMIC
61-8-X	10	--	5273	500	701	707	5773	5974	5980
61-8-Y	7	--	1488	500	437	480	1988	1925	1968
61-8-Z	5	--	3332	500	231	251	3832	3563	3583
PS-Y	111	65	1788	923	198	221	2776	2051	2074
PS-Z	111	580	2747	1403	177	192	4730	3504	3519
61-17-X	133	--	3708	500	186	194	4208	3894	3902
61-17-Z	134	--	3606	500	163	168	4106	3769	3774
SS-Y	17	--	6187	1000	169	207	7187	6356	6394
SS-Z	17	--	2020	1000	263	274	3020	2283	2294

NOTE: Thermal, Relief Valve Transient and Original O.B.E. obtained from B&R Isometric 1273-61, Rev. Dated 7-12-1974

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TABLE 2

MSRV Piping VR-1 (In Torus)

SUPPORT DESIGNATION ANCHOR	NODE POINT NO.	THERMAL	DEAD-WEIGHT	TURNING FORCE	O.B.E. SEISMIC (LBS) ORIGINAL	O.B.E. SEISMIC (LBS) OPTION 1.92	O.B.E. SEISMIC (LBS) OPTION 1.60	TOTAL LOAD (LBS) ORIGINAL	TOTAL LOAD (LBS) RECALCULATED LOADS USING - 1.92 SEISMIC	TOTAL LOAD (LBS) RECALCULATED LOADS USING - 1.60 SEISMIC
@ Pt. 1 LBS FX	1	- 1,811	--	--	±1,800	± 33	± 55	- 3,611	- 1,844	- 1,866
LBX FY	1	+ 4,350	-1,800	--	±1,800	± 33	± 69	+ 4,350	+ 2,583	+ 2,619
LBX FZ	1	- 7,203	--	--	±1,800	± 53	± 92	- 9,003	- 7,256	- 7,295
FTLBS MX	1	+ 9,807	+7,990	--	±7,990	±107	±217	+25,787	+17,904	+18,014
FTLBS MY	1	+24,062	--	--	--	±210	±332	+24,062	+24,272	+24,394
FTLBS MZ	1	+ 8,946	-6,045	--	±6,045	±202	±392	+ 8,946	+ 3,103	+ 3,293

NOTE: Thermal, Deadweight and Original O.B.E. Seismic have been obtained from B&R Calc. "Containment Vessel - Torus R.V. Piping & Support Modification" Sheet 5 of 5

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TABLE 2

MSRV Piping VR-1 (In Torus)

SUPPORT DESIGNATION ANCHOR	NODE POINT NO.	THERMAL	DEAD-WEIGHT	TURNING FORCE	O.B.E. SEISMIC (LBS)			TOTAL LOAD (LBS)		
					ORIGINAL	OPTION 1.92	OPTION 1.60	ORIGINAL	RECALCULATED LOADS USING - 1.92 SEISMIC	1.60 SEISMIC
@ Pt. 9 LBS FX	9	+ 1,811	--	+ 2,000	±1,800	± 82	±126	+ 5,611	+ 3,893	+ 3,937
LBX FY	9	- 4,350	-1,800	-79,000	±1,800	± 16	± 34	-86,950	-85,166	-85,184
LBX FZ	9	+ 7,203	--	--	±1,800	± 54	± 93	+ 9,003	+ 7,257	+ 7,296
FTLBS MX	9	+36,874	-4,255	--	±4,255	±356	±597	+36,874	+32,975	+33,216
FTLBS MY	9	- 3,360	--	--	--	± 65	±116	- 3,360	- 3,425	- 3,476
FTLBS MZ	9	- 8,177	+ 632	--	± 632	±509	±797	- 8,177	- 8,054	- 8,342

NOTE: Thermal, Deadweight, Turning Force and Original O.B.E. Seismic have been obtained from B&R Calc. "Containment Vessel - Torus R.V. Piping & Support Modification" Sheet 4 of 5

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