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May 30, 1984

Director, Office of Nuclear Reactor Regulation
Attention: D. M. Crutchfield, Chief
Operating Reactors Branch No. 5
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

Subject: Docket No. 50-206
Seismic Evaluation of Piping
San Onofre Nuclear Generating Station
Unit 1

By letter dated September 12, 1983, the NRC forwarded a report containing audit calculations of the safety injection piping and the charging and pressurizer spray piping at San Onofre Unit 1. This report was prepared for the NRC by EG&G, Idaho.

SCE and its consultant, Bechtel Power Corporation, have reviewed the EG&G analysis of the safety injection piping included in this report. The enclosed comments are provided for your consideration. It is concluded that some of the items included in these comments may have resulted in the overstress conditions identified in the EG&G analyses. SCE is still reviewing the analysis of the charging and pressurizer spray piping. The results of this review will be provided by June 29, 1984.

If you wish to discuss any of these comments, please let me know.

Very truly yours,

M O Medford

Enclosure

cc: S. Morton (EG&G Idaho, Inc.)

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1/1

Enclosure

SCE COMMENTS ON EGG-EA-6365

1. EG&G modeling of the orientation of five supports is not consistent with the pipe support drawings (see attachment I). One of the supports, S1-06-6002-H008, was oriented in the EG&G analysis input in such a way that it represents a vertical support instead of a support in the N-S direction. Hence, there is no support in the EG&G model for approximately 56 feet in the N-S direction. This results in a piping system which is overly flexible. In accordance with the applicable stress isometric and support drawings, this support is located approximately 34 feet west from hanger S1-05-6005-H023.

2. There are three pieces of equipment connected to the piping in this analysis. BPC and EG&G have each assumed anchor points at the equipment but, the stiffness values used by BPC and EG&G respectively are different for this analysis. EG&G has used 10^{12} lb./in. in all translational directions and 10^{13} in lb./rad. in all rotational directions. BPC has used stiffness values equal to 10^6 lb./in. for all translational directions and 10^8 in. lb./rad. for all rotational directions. It is our conclusion that the latter values are more accurate approximations of the equipment stiffness.

3. There are a total of 37 rigid restraints and 8 snubbers in the analysis. The stiffness values used by BPC and EG&G in the analysis are different for 12 rigid restraints and 6 snubbers. EG&G has used 10^5 lb./in. for rigid restraints versus 10^6 lb./in. used by BPC. For snubbers, BPC used 3.41×10^5 lb./in. or 1.19×10^6 lb./in., depending upon the characteristics of the various sizes of the snubbers and in light of the fact that these snubbers typically are attached to rigid structures (versus 10^5 lb./in. used by EG&G). The stiffness values of 4 snubbers near the Feedwater Pump G-3A are lower by 30% to 90% compared to stiffness values used by BPC in analysis (see attachment 2). This may have contributed to the higher seismic inertia stresses indicated by the EG&G analysis.

4. The pipe support location of hanger No. S1-14-6002-H502 is modeled 1'-6" west of hanger No. S1-14-6002-H503 instead of 7'-6", in accordance with the applicable drawings.

5. In the EG&G computer input it appears that the seismic anchor movement (SAM) data for the north-south direction was interchanged with the east-west direction data at all horizontal supports. Also, at a few locations, the magnitude of the SAM data does not correlate with the current values which were used by BPC (see attachment 2).

6. There are three variable spring supports in the analysis; two of them are located near the Feedwater Pump. A variable spring hanger is used to carry only the dead weight of a piping system. Detailed review of the EG&G modeling indicates an external static force applied at all spring support locations and the force is considered in the dead weight, thermal and dynamic analysis. This force should not be acting on the piping system for the thermal weight and seismic analyses. For this reason, the EG&G analysis is computing very high nozzle loads at the equipment and also high seismic stresses in adjacent areas of piping.

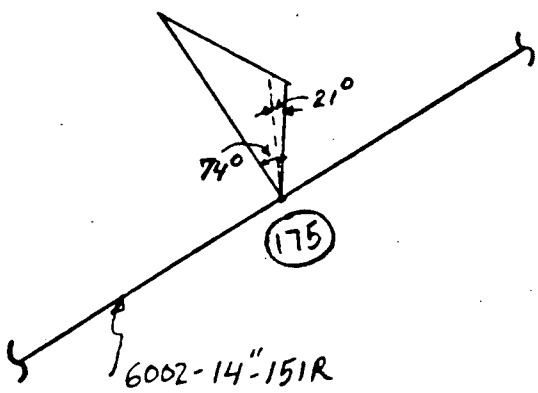
7. Review of the EG&G computer output indicated that the seismic stress and support reactions were calculated by the addition of the combined results of the modes by RMS summation and rigid range pseudo modes. BPC calculated the seismic stress and support reactions by enveloping the dynamic results computed by the closely spaced modes summation method (Regulatory Guide 1.92) and static seismic load case. It is our conclusion that the former method may result in conservative support reactions and pipe stresses, if indeed the modal response and rigid range response is added absolutely.

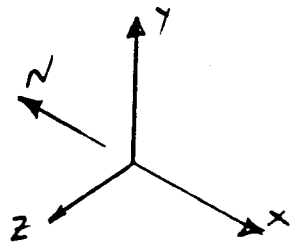
8. It is noted that the acceptance criteria agreed to by the NRC for the seismic reevaluation of piping at San Onofre Unit 1 is identified in SCE's letter to the NRC dated May 23, 1983 as clarified by letter dated November 21, 1983. These letters include some differences with the NRC's general guidelines for the Group II SEP plants.

JLR:1642F

ATTACHMENT - 1
(ORIENTATION OF PIPE SUPPORTS)

PIPE SUPPORT NO.	EG&G				BPC			
	NODE POINT	DIRECTION COSINES			NODE POINT	DIRECTION COSINES		
		X	Y	Z		X	Y	Z
S1-06-6002-H008	175	-0.369	0.932	0.0	165	-0.961	0.276	0.0
S1-05-6002-H002	200	-0.54	0.0	0.84	190	-0.183	0.0	0.983
S1-05-6002-H008	280	0.448	-0.773	-0.448	232	0.595	-0.773	0.223
S1-05-6002-H024	280	0.33	-0.881	0.33	232	-0.235	-0.883	-0.406
S1-05-0318-H012	440	-0.707	0.0	0.707	316	-0.599	0.0	0.8





— PER DWG. S1-06-6002-H008, REV. 0, 7/31/82

--- EG&G MODELED IN THE ANALYSIS

ATTACHMENT-2
STIFFNESS VALUES AND SAM DATA

SUPPORT NUMBER	BPC NODE POINT	EG&G NODE POINT	SUPPORT TYPE & DIR.	STIFFNESS VALUE USED, #/in		SEISMIC ANCHOR MOVEMENT, in		REMARK
				BPC	EGG	BPC	EG&G	
S1-14-6002-H013	26	15	Y	10^6	10^6	ΔY = 0.0	ΔY = 0.0	
S1-14-6002-H502	50	45	X Y	10^6 10^6	10^5 10^5	ΔX = 0.0 ΔY = 0.0	ΔX = 0.0 ΔY = 0.0	SUPPORT LOCATION IS OFF BY 6' IN EG&G ANALYSIS COMPARED TO STRESS ISO. NO. 334584
S1-14-6002-H503	60	50	Y	10^6	10^5	ΔY = 0.0	ΔY = 0.0	
S1-14-6002-H504	70	60	Y	10^6	10^5	ΔY = 0.0	ΔY = 0.0	
S1-14-6002-H505	80	70	X Y	10^6 10^6	10^5 10^6	ΔX = 0.0 ΔY = 0.0	ΔX = 0.0 ΔY = 0.0	
S1-14-6002-H009	90	76	Z (SNUB.)	1.19×10^6	10^6	ΔZ = 0.0	ΔZ = 0.0	
S1-14-6002-H507	100	85	Y	10^6	10^6	ΔY = 0.0	ΔY = 0.0	
S1-06-6002-H501	110	100	X Y	10^6 10^6	10^6 10^5	ΔX = 0.24 ΔY = 0.46 ΔZ = 0.0	ΔX = 0.0 ΔY = 0.26 ΔZ = 0.24	
S1-06-6002-H002	120	110	Y	10^6	10^5	ΔY = 0.14	ΔY = 0.14	
S1-06-6002-H003 S1-06-6002-H012	130 130	120 120	Y X	10^6 10^6	10^5 10^6	ΔX = 0.34 ΔY = 0.14 ΔZ = 0.0	ΔX = 0.0 ΔY = 0.14 ΔZ = 0.34	
S1-06-6002-H004	140	130	Y	10^6	10^6	ΔY = 0.1	ΔY = 0.1	
S1-06-6002-H005	150	145	Incl. (X,Y)	10^6	10^6	ΔX = 0.44 ΔY = 0.1 ΔZ = 0.0	ΔX = 0.0 ΔY = 0.1 ΔZ = 0.44	
S1-06-6002-H510 S1-06-6002-H006	153	150	Y	10^6	10^6	ΔY = 0.1	ΔY = 0.1	
S1-06-6002-H007	165	175	Y	10^6	10^5	ΔY = 0.52	ΔY = 0.52	
S1-06-6002-H008	165	175	Incl. (X,Y)	10^6	10^6	ΔX = 0.64 ΔY = 0.52	ΔX = 0.64 ΔY = 0.52	

ATTACHMENT - 2

STIFFNESS VALUES AND SAM DATA

SUPPORT NUMBER	BPC NODE POINT	EG&G NODE POINT	SUPPORT TYPE & DIR.	STIFFNESS VALUE USED, #/in		SEISMIC ANCHOR MOVEMENT, in		REMARK
				BPC	EGG	BPC	EG&G	
S1-05-6002-H001	175	190	Y	10^6	10^6	$\Delta Y = 0.56$	$\Delta Y = 0.56$	
S1-05-6002-H002	190	200	INCL. SNUB (X,Z)	1.19×10^6	10^6	$\Delta X = 0.62$ $\Delta Z = 0.90$ $\Delta Y = 0.0$	$\Delta X = 0.9$ $\Delta Z = 0.62$ $\Delta Y = 0.0$	
S1-05-6002-H003	200	205	X	10^6	10^5	$\Delta X = 0.38$ $\Delta Z = 0.0$	$\Delta X = 0.0$ $\Delta Z = 0.38$	
S1-05-6002-H004	210	215	Y	10^6	10^6	$\Delta Y = 0.68$	$\Delta Y = 0.68$	
S1-05-6002-H005	224	245	X Y Z	10^6 10^6 10^6	10^6 10^6 10^6	$\Delta X = 0.34$ $\Delta Y = 0.06$ $\Delta Z = 0.36$	$\Delta X = 0.36$ $\Delta Y = 0.06$ $\Delta Z = 0.34$	
S1-05-6002-H011 S1-05-6002-H025	228	260	Y Z	10^6 10^6	10^6 10^6	$\Delta X = 0.0$ $\Delta Y = 0.16$ $\Delta Z = 0.36$	$\Delta X = 0.36$ $\Delta Y = 0.06$ $\Delta Z = 0.0$	
S1-05-6002-H009	232	280	Incl. SNUB (X,Y,Z)	1.19×10^6	10^5	$\Delta X = 0.0$ $\Delta Y = 0.0$ $\Delta Z = 0.0$	$\Delta X = 0.0$ $\Delta Y = 0.0$ $\Delta Z = 0.0$	
S1-05-6002-H024	232	280	INCL. SNUB (X,Y,Z)	1.19×10^6	10^5	$\Delta X = 0.0$ $\Delta Y = 0.0$ $\Delta Z = 0.0$	$\Delta X = 0.0$ $\Delta Y = 0.0$ $\Delta Z = 0.0$	
S1-05-6002-H009	245	310	SPRING HANGER					
S1-05-0318-H011	283	385	SPRING HANGER					
S1-05-0318-H014	306	425	INCL. SNUB. (X,Z)	3.41×10^5	10^5	$\Delta X = 0.0$ $\Delta Z = 0.0$	$\Delta X = 0.0$ $\Delta Z = 0.0$	

ATTACHMENT - 2

STIFFNESS VALUES AND SAM DATA

SUPPORT NUMBER	BPC NODE POINT	EG&G NODE POINT	SUPPORT TYPE & DIR	STIFFNESS VALUE USED, #/in		SEISMIC ANCHOR MOVEMENT, in		REMARK
				BPC	EGG	BPC	EG&G	
S1-05-0318-H013	308	430	INCL. SNUB (X,Z)	3.41×10^5	10^5	ΔX = 0.0 ΔZ = 0.0	ΔX = 0.0 ΔZ = 0.0	
S1-05-0318-H015	310	435	Y	10^6	10^6	ΔY = 0.0	ΔY = 0.0	
S1-05-0318-H012	316	440	INCL. SNUB (X, Z)	1.75×10^5	10^6	ΔX = 0.26 ΔZ = 0.27	ΔX = 0.27 ΔZ = 0.26	
S1-05-0318-H006	325	475	Y	10^6	10^5	ΔY = 0.2	ΔY = 0.06	
S1-05-0318-H007 S1-05-0318-H010	330	485	INCL. SNUB (X,Z) INCL. RIGID (Y,Z)	3.41×10^5 10^6	10^5 10^5	ΔX = 0.34 ΔY = 0.2 ΔZ = 0.36	ΔX = 0.36 ΔY = 0.2 ΔZ = 0.34	
S1-05-0318-H002	340	505	Y	10^6	10^6	ΔY = 0.2	ΔY = 0.2	
S1-05-0318-H003	375	525	Y	10^6	10^6	ΔY = 0.2	ΔY = 0.2	
S1-05-0318-H005	390	550	SPRING HANGER					
S1-05-0318-H001	407	575	X Z	10^6 10^6	10^6 10^6	ΔX = 0.34 ΔZ = 0.36	ΔX = 0.36 ΔZ = 0.34	
S1-05-338-H001	430	620	Y Z	10^6 10^6	10^6 10^6	ΔX = 0.0 ΔY = 0.2 ΔZ = 0.34	ΔX = 0.34 ΔY = 0.2 ΔZ = 0.0	
S1-05-338-H002	440	635	Y Z	10^6 10^6	10^6 10^6	ΔY = 0.2 ΔZ = 0.4	ΔY = 0.0 ΔZ = 0.0	

ATTACHMENT-2

STIFFNESS VALUES AND SAM DATA

SUPPORT NUMBER	BPC NODE POINT	EG&G NODE POINT	SUPPORT TYPE	STIFFNESS VALUE USED, #/in		SEISMIC ANCHOR MOVEMENT, in		REMARK
				BPC	EGG	BPC	EG&G	
	5	5	X	10^6	10^{13}	0.0	0.0	ANCHOR
			Y	10^6	10^{13}			G-50A
			Z	10^6	10^{13}			SI-PUMP
			XX	10^8	10^{13}			
			YY	10^8	10^{13}			
			ZZ	10^8	10^{13}			
	280	380	X	10^6	3.2×10^{12}	0.0	0.0	ANCHOR
			Y	10^6	3.2×10^{12}			G-3A
			Z	10^6	3.2×10^{12}			FEEDWATER PUMP
			XX	10^8	3.2×10^{12}			
			YY	10^8	3.2×10^{12}			
			ZZ	10^8	3.2×10^{12}			
	425	600	X	10^6	7.4×10^{12}	$\Delta X = 0.34$	$\Delta X = 0.36$	ANCHOR
			Y	10^6	7.4×10^{12}	$\Delta Y = 0.2$	$\Delta Y = 0.06$	2nd POINT HEATER
			Z	10^6	7.4×10^{12}	$\Delta Z = 0.36$	$\Delta Z = 0.34$	
			XX	10^8	7.4×10^{12}			
			YY	10^8	7.4×10^{12}			
			ZZ	10^8	7.4×10^{12}			