CP&L

Carolina Power & Light Company

File: NG-3514(B) May 21, 1979 SERIAL: GD-79-1342

Office of Nuclear Reactor Regulation
ATTENTION: Mr. T. A. Ippolito, Chief
Operating Reactors Branch No. 3
United States Nuclear Regulatory Commission
Washington, D. C. 20555

BRUNSWICK STEAM ELECTRIC PLANT, ~~UNIT~~ NOS. 1 AND 2
DOCKET NOS. 50-325 and 50-324
LICENSE NOS. DPR-71 AND ~~DPR-62~~
SEISMIC ANALYSIS OF SAFETY-RELATED PIPING

Dear Mr. Ippolito:

This letter supplements our letters of April 24, 1979 and May 16, 1979 on the Carolina Power and Light Company's response to IE Bulletin 79-07. It addresses the specific requests for additional data that were discussed in our meeting with the NRC on May 16, 1979. This letter contains the results of the seismic pipe stress reanalyses completed to date, a compilation of the original seismic stress data for the pipe yet to be reanalyzed, the schedule for completing the reanalysis, and the conclusions reached from the evaluation of the technical information available.

It was determined that algebraic summations were used in the seismic stress analyses portion of the computer code that was used in the original analysis. Realizing that a total reanalysis could not be completed in the time frame required to respond to the bulletin, ten (10) lines were selected for reanalysis in order to determine the effect of algebraic summation. The computer code currently in use by United Engineers & Constructors, a proprietory copy of which was given to you on May 16, 1979, does not use algebraic summations. The criteria for selection of the ten (10) lines was based on line function, size, and ability to project adequacy for other lines of similar function and size. This criteria is explained in more detail on Attachment 1. Subsequent to our May 16th meeting, additional lines have also been reanalyzed. As discussed in our meeting these lines were selected on the basis of completing the larger pressure boundary and other safety systems piping. In addition other lines having high stress values in the original stress analysis were reanalyzed. The results of these 39 lines are tabulated on Attachment 2. This table shows the maximum total stress and the maximum seismic stress component of each line for the original analysis and the reanalysis. In all cases, the calculated total stresses for the design basis earthquake are less than the allowable.

Another item discussed at our May 16th meeting was the loads on the pipe supports as a result of the reanalysis. These new loads are being evaluated and results for the first ten (10) lines will be filed the week of May 28.

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A total of 147 stress analyses problems have been identified for Unit 2. Most lines are identical between Unit 2 and Unit 1 so the stress analyses are applicable to both units. However, 24 cases where the lines are different were identified and will be reanalyzed separately for each unit. The total number of computer problems for Units 1 and 2 is 171 (with 39 already completed). Attachment 3 shows those lines that have not yet been reanalyzed with the total stress and seismic stress component for DBE from the original analysis. Also, the reanalysis priority category is shown and is based on the reanalysis priority criteria shown on Attachment 4. The schedule for completion of the reanalysis is given on Attachment 5.

There was some discussion on the confidence that the design analyzed for stress was the "as built" design. The quality assurance program used during construction, and in effect today, uses a "walk off" of each as installed system or modification. This inspection identifies discrepancies between system design and installation. These discrepancies are evaluated by the architect/engineer for acceptability. In addition, for piping and support differences, a stress analyst ascertains whether or not the system must be reanalyzed. If not, the isometric drawing and associated computer data deck remain unchanged. If the analyst concludes that the differences between "as-designed" and "as-built" would require reanalyses, the isometric is revised, the data deck is changed as necessary, and the stress analysis rerun. Whether the stress analysis was rerun or not, the design engineering drawing is changed to reflect the as-built configuration. This scenario is shown on the block diagram on Attachment 6.

After a thorough review of the original seismic piping design criteria, and the reanalysis of selected significant safety class piping, CP&L has concluded that Units 1 and 2 at Brunswick Steam Electric Plant can be safely operated without undue risk to the health and safety of the public. This conclusion is based on:

1. Evaluation of the conservative design margins provided in the original piping design, as discussed in Attachment 7.

2. The satisfactory results of the reanalysis of 39 selected major lines. The reanalysis shown in Attachment 2 represents approximately 60% of the lines 2½" and over in the pressure boundary and approximately 40% of the lines 2½" and over in the emergency core cooling systems.

3. An investigation of the as built versus as analyzed conditions.

4. The aseismic nature of the site as confirmed by an extensive on site and regional seismic program. See Attachment 10.

5. The accelerated schedule of pipe reanalysis. The final report will be filed on July 21, 1979. Interim reports of results of reanalysis will be filed at the completion of the reanalysis of each category.

Yours very truly,

B J Furr

B. J. Furr
Manager,
Generation

cc: Mr. James P. O'Reilly
NRC Region II
Office of Inspection & Enforcement

May 21, 1979

ATTACHMENT 1

INITIAL REANALYSIS SELECTION CRITERIA

CRITERIA	BASIS
Function	Major operating system with Primary Pressure Boundary (Mainsteam, Feedwater and SRV Line) or Safe Shutdown System (HPCI, RHR, Core Spray)
Size	Larger lines generally have higher stresses and hence less margin to the allowable
Similarity	Select the line which had the highest stresses from original analyses for those groups of lines with similar function (1 of 4 Mainsteam, 4 of 11 SRV, 1 of 2 Feedwater, 2 of 4 HPCI, 2 of 14 RHR and Core Spray)

ATTACHMENT 2

PIPE STRESS REEVALUATION
SUMMARY

		LINE		EMERGENCY CONDITION (PSI)			
SYSTEM NAME	ISO NO.	SIZE (NPS)	ORIGINAL TOTAL	ORIGINAL SEISMIC	NEW TOTAL	NEW SEISMIC	ALLOWABLE
Main Steam	MS-15B	24	10724	3942	10640	3858	27000
Safety/Relief Valve	SRVL-121	10 & 6	23012	12280	21910	11180	27000
Safety/Relief Valve	SRVL-122	10 & 6	19685	15800	24439	13352	27000
Safety/Relief Valve	SRVL-237	10 & 6	20432	12004	24588	16160	27000
Safety/Relief Valve	SRVL-125	10 & 6	24270	13347	24316	20270	27000
Feedwater	FW-16	18 & 12	18007	12420	20028	13296	27000
Residual Heat Removal	RHR-6	20	19406	13582	12644	6820	27000
Core Spray	CS-24	10	16952	10076	14366	7490	27000
High Press Cool Injct	HPCIS-17	14	12200	6446	12502	6748	27000
High Press Cool Injct	HPCIS-510	14 & 12 & 10	12004	7994	12092	8082	27000
High Press Cool Injct	HPCIS-10	14 & 12 & 10	9733	3886	11152	5530	27000
Residual Heat Removal	RHR-1	24 & 20	24094	18584	17972	14366	27000
Residual Heat Removal	RHR-2	20 & 16 & 12	13309	7654	11471	5948	27000
Residual Heat Removal	RHR-5	24	9848	3896	9514	2960	27000
Residual Heat Removal	RHR-25	4 & 6	18558	12904	18530	12876	27000
Nuclear Steam Supply	NSS-14	24 & 10	14745	8446	16335	10036	27000
Safety/Relief Valve	SRVL-124	6 & 10	25536	15928	25984	16376	27000
Safety/Relief Valve	SRVL-126	6 & 10	23361	18000	22197	17422	27000
Residual Heat Removal	RHR-52	14 & 12	23271	17936	19539	14204	27000
Reactor Core Isolat. Cool	RCIC-21	3	7603	3588	7601	3586	27000
Resid Heat Rem Drain Line	RHR-173-B	1½	3808	2186	3838	2216	27000
Residual Heat Removal	RHR-28	20 & 16 & 12	15298	8814	13626	7142	27000
Nuclear Steam System	NSS-15 Line C	24	10974	4420	10458	3904	27000
Nuclear Steam System	NSS-120 (15C)	10 & 6	19443	8902	17899	8298	27000
High Press Cool Injct.	HPCIS-4	3 & 6 & 10 & 12	23609	20876	25481	22748	27000

ATTACHMENT 2 Cont'd

SYSTEM NAME	ISO NO.	LINE SIZE (NPS)	EMERGENCY CONDITION (PSI)				
			ORIGINAL TOTAL	ORIGINAL SEISMIC	NEW TOTAL	NEW SEISMIC	ALLOWABLE
Nuclear Steam System	NSS-123 (15C)	6 & 10	21027	16098	18577	16782	27000
Nuclear Steam System	NSS-187 (15C)	10 & 6	21856	11337	23596	16424	27000
Residual Heat Removal	RHR-42	12 & 14	18116	12976	17480	12340	27000
Residual Heat Removal	RHR-3	14 & 16 & 20 & 24	25317	18328	23379	15590	27000
Residual Heat Removal	RHR-13	4 & 8 & 14	12532	10018	12620	10106	27000
Residual Heat Removal	RHR-59	4 & 6 & 10	12664	9970	13344	10650	27000
* Residual Heat Removal	RHR-60	4 & 6 & 10	34618	33658	32971	32012	27000
Residual Heat Removal	RHR-168	1	23580	22658	26910	26198	27000
Residual Heat Removal	RHR-61	4 & 6 & 3/4	21117	17038	19393	15314	27000
High Pressure Coolant Injunction	HPCI-11	16 & 14 & 6	21386	19790	17214	15618	27000
Reactor Core Injunction Cooling	RCIC-196	1 & 3/4	22706	19504	22504	19302	27000
Residual Heat Removal	RHR-41	3 & 4	26802	20728	26824	20750	27000
Residual Heat Removal	RHR-199	4 & 1 & 1½ & 3/4	23410	20242	23398	20230	27000
Reactor Core Isol. Cooling	RCIC-194	2 & 1¼ & 1	24519	24118	24559	24156	27000

NOTE: Seismic stresses shown are obtained by multiplying the OBE Seismic Stresses by 2.

* Total stresses are within allowable using applicable factor to compute DBE stress from OBE stresses.

ATTACHMENT 3

FINAL STRESS REPORT TABULATI

May 21, 1979

Sheet No. 1 of 16

Job Order Number

PROB NO.	SYSTEM	ISO/ SHEET NO.	LOCATION Ins. or Outside Cont.	LINE SIZE	EMERGENCY CONDITION STRESS (PSI)				PRIO-RITY CATEG	REMARKS
					TOTAL STRESS	SEISMIC (DBE)	ALLOWABLE (1.8 S_h)	SEISMIC/ ALLOWABLE		
1	Nuclear Steam Supply (Vent & Inst. Line Above Bulkhead)	32	In	3/4	11282	5198	25900	20	1	
			In	4	3963	354	27000	1		
			In	2	10458	7672	27000	28		
			In	1	4316	1672	27000	6		
2	Primary Steam Condensate Drain Inside Dry Well (East) & West)	87, 128	In	3	12237	9380	27000	34	1	
			In	2	24225	20022	27000	74		
			In	1 1/2	8345	5838	27000	21		
			In	1	15171	12006	27000	44		
76	Control System - NSS (Inst. Sensing Line)	7	In	3/4	17945	12954	25900	50	2	
3	Residual Heat Removal Minimum Flow By-Pass RHR Pumps 2A & 2C	43	Out	4	6434	3732	27000	13		
			Out	4	3288	1762	27000	6		
			Out	3	21856	16332	27000	60		
4	Residual Heat Removal Torus Spray (South)	44	Out	6	9536	6784	27000	25		
5	Residual Heat Removal Drain Piping - RHR Pumps 2B, 2D	45	Out	4	14859	12378	27000	45		
			Out	4	18562	12462	27000	46		
6	Residual Heat Removal Drain Piping - RHR Pumps 2A, 2C	46	Out	4	21248	17250	27000	63		
7	Residual Heat Removal (Cross Conn. Drain Piping RHR Pumps 2A, B, C, D & RHR Drain Conn. to Rad-waste)	47,	Out	4	18944	15888	27000	58		
		48	Out	4	20325	17512	27000	64		
8	Residual Heat Removal Cross Conn. Drain Piping RHR Pumps 2A, B, C, & D South Co. 20R	65	Out	4	3335	928	27000	3		

Job Order Number

PROB NO.	SYSTEM	ISO/ SHEET NO.	LOCATION Ins. or Outside Cont.	LINE SIZE	EMERGENCY CONDITION STRESS (PSI)				PRIO-RITY CATEG	REMARKS
					TOTAL STRESS	SEISMIC (DBE)	ALLOWABLE (1.8 S_h)	SEISMIC/ ALLOWABLE		
9	Residual Heat Removal (Torus Spray - North)	51	Out	6	6588	3222	27000	11	2	
10	Residual Heat Removal (Head Spray Line)	54,	Out	4	14082	7416	27000	27		
		55,	Out	4	5922	1946	27000	7		
		56	Out	4	13253	2532	28800	8	2	
			Out	3/4	8048	4274	28800	14		
			Out	3/4	8289	4914	27000	18		
11	Residual Heat Removal (RHR Exchgr 2A to RCIC Suct.)	57,	Out	4	21987	17544	27000	64	2	
		58	Out	4	11899	7846	27000	29		
12	Residual Heat Removal Relief Line Around Valves F004A & C	170	Out	1	19175	18076	27000	66		
			Out	1	11735	9560	27000	35	5	
			Out	½	14138	13930	27000	51		
13	Residual Heat Removal Relief Lines Around Valves F004B & D	171	Out	1	3006	1694	27000	6		
			Out	1	5232	3334	27000	12		
			Out	½	1446	1260	27000	4		
	Relief Lines From RHR Exchgr 2A, 2B		Out	1	3298	1596	27000	5		
			Out	3/4	4063	1762	27000	6		
14	Residual Heat Removal Side Vent & Sample Conn. Exchgrs 2A, 2B	172	Out	1	10005	7116	27000	26		
			Out	1	12998	9904	27000	36		

FINAL STRESS REPORT TABULATI

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PROB NO.	SYSTEM	ISO/ SHEET NO.	LOCATION Ins. or Outside Cont.	LINE SIZE	EMERGENCY CONDITION STRESS (PSI) TOTAL STRESS	SEISMIC (DBE)	ALLOWABLE (1.8 S_h)	SEISMIC/ ALLOWABLE	PRIORITY CATEG	REMARKS
15	Residual Heat Removal & Fuel Pool Colling & Filtering (RHR Suct. to Skimmer Tanks 2A, 2B	64	Out	8	17652	15652	27000	57	6	
			Out	8	10658	7774	27000	28		
16	Residual Heat Removal (Exchgr 2B to RCIC Suction	31	Out	4	21014	17402	27000	64	2	
			Out	6	[illegible]76	4396	27000	16		
			Out	4	15[illegible]53	13516	27000	50		
			Out	3	7331	6696	27000	24		
17	Reactor Core Isolation Cooling (Steam Supply to RCIC Turb.)	33	Out	3	8337	5668	27000	20		
			Out	3	15615	12356	27000	45		
18	Reactor Core Isolation Cooling (RCIC Turbine Steam Exhaust)	34	Out	8	21108	16218	27000	50		
19	Reactor Core Isolation Cooling (RCIC Pump Disch-Bel. 10'6" 49, Above 10'6", 35)	35, 49	Out	4	12793	6402	27000	23		
			Out	4	9520	6134	27000	22		
			Out	2	18881	13096	27000	48		
			Out	2	4829	514	27000	1		
			Out	1	3315	586	27000	2		
20	Reactor Core Isolation Cooline (Test Conn. to HPCI)	50	Out	4	7221	2900	27000	10	3	
21	Reactor Core Isolation Cooling (RCIC Conn. to Feedwater)	63	Out	4	15098	9488	27000	35		
			Out	4	13357	6534	26100	25		
22	Reactor Core Isolation Cooling RCIC Pump Disch. Line	66, 67	Out	4	12805	6932	27000	25		

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23	Reactor Core Isolation	92B,	Out	1	10999	5938	27000	21		
	Cooling System	92C	Out	2	4350	2888	27000	10		
	(Misc. Lines at Turbine)		Out	½	21144	18498	27000	68		
			Out	3	8015	5410	27000	20		
			Out	3/4	12427	10438	27000	38		
24	Reactor Core Isolation	161	Out	1	11796	8352	27000	30		
	Cooling		Out	3/4	7972	5024	27000	18		
	Drain From Turbine Inlet		Out	½	1855	1260	27000	4		
25	Reactor Core Isolation	164	Out	2	5559	4638	27000	17	5	
	Cool. Barometric		Out	1¼	3303	3128	27000	11		
	Condensate Pump Disc. to		Out	3/4	4471	3552	27000	13		
	Suppression Chamber									
26	Reactor Core Isolation	195	Out	1	16705	15826	27000	58		
	Cool. Turbine Drains &									
	Relief Lines									
27	Reactor Core Isolation	12	Out	6	19870	16526	27000	61		
	Cool. (RCIC Pump Suction		Out	6	4391	150	27000	0	3	
	Lines)		Out	6	16311	12594	27000	46		
28	High Press. Coolant Inj.	9	Out	24	10395	4268	27000	15		
	(Exhaust Steam Line)		Out	20	11629	7672	27000	28	2	
			Out	18	3707	1680	27000	6		
			Out	16	4467	614	27000	2		
29	High Pressure Coolant Inj.	151	Out	3/4	3438	1491	27000	6		
	(Misc. Vents & Drains		Out	3/4	2570	770	27000	3		
	Main Pump		Out	3/4	4560	1056	27000	4	5	
			Out	3/4	2404	522	27000	2		
			Out	3/4	4455	2566	27000	10		
			Out	3/4	5920	3706	27000	14		
			Out	3/4	3753	1272	27000	5		
			Out	3/4	3398	1258	27000	5		
			Out	3/4	3127	567	27000	2		
			Out	3/4	2303	254	27000	1		

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30	High Pressure Coolant Inj.	53	Out	4	6988	2300	27000	8	2	
	(HPCI Pump 2A, Min Flow By-Pass		Out	4	12284	11072	27000	41		
31	High Pressure Coolant Inj.	146	Out	4	736	100	27000	0		
	Condensate Pump Disch.Piping		Out	2	2339	1252	27000	4		
			Out	1½	1228	626	27000	2		
			Out	1	17588	16350	27000	60		
			Out	½	283	142	27000	0		
32	High Pressure Coolant Inj.	152	Out	4	707	64	27000	0	2	
	(Main Pump to Barometer		Out	2	10581	9074	27000	33		
	Cond.)		Out	2	4893	3454	27000	12		
			Out	1½	23242	22760	27000	84		
			Out	3/4	638	220	27000	0		
			Out	½	5132	3769	27000	14		
			Out	3	17373	16790	27000	62		
33	High Pressure Coolant Inj.	153	Out	1	1489	168	27000	0	5	
	(Turbine Ring Drains)		Out	3/4	1410	120	27000	0		
			Out	3/4	5103	580	27000	2		
34	High Pressure Coolant Inj.	154	Out	3/4	23191	20780	27000	76		
	(Misc. Vents & Drains		Out	3/4	21673	20780	27000	76		
	Booster Pump)		Out	3/4	21782	20780	27000	76		
			Out	3/4	2043	760	27000	2		
			Out	3/4	21693	20780	27000	76		
35	High Pressure Coolant Inj.	155	Out	2	23245	20990	27000	77		
	(Turbine Exh.)		Out	3/4	4873	2706	27000	10		
			Out	½	14831	14554	27000	53		
			Out	2	23346	21800	27000	80		
			Out	3/4	2793	1664	27000	6		
			Out	½	23762	23476	27000	86		
36	High Pressure Coolant Inj.	156	Out	1	10838	5900	27000	21		
	(Turbine Drains)		Out	3/4	11067	5134	27000	19		
			Out	3/4	4197	2644	27000	9		
37	High Pressure Coolant Inj.	157	Out	1	20511	16780	27000	62		
	(Turbine Steam Pot Drains)		Out	3/4	17927	14866	27000	55		

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PROB NO.	SYSTEM	ISO/ SHEET NO.	LOCATION Ins. or Outside Cont.	LINE SIZE	EMERGENCY CONDITION STRESS (PSI) TOTAL STRESS	SEISMIC (DBE)	ALLOWABLE (1.8 S_h)	SEISMIC/ ALLOWABLE%	PRIO-RITY CATEG	REMARKS
38	High Pressure Coolant Inj.	158	Out	1	27538	25060	27000	93		
	(Misc. Vent, Test & Drains		Out	3/4	24715	22760	27000	84		Note 1
	Lines)		Out	3/4	25923	22010	27000	81		
			Out	3/4	3896	928	27000	3	5	
39	High Pressure Coolant Inj.	159	Out	1	2132	234	27000	0		
	(Piping for Relief, Test &		Out	1	16518	13414	27000	49		
	Valve Stem. Drains)									
40	Core Spray & Gravity	18	Out	14	6901	4898	27000	18		
	Condensate System		Out	14	2073	14	27000	0	2	
	(Core Spray Pump Suction 2A)		Out	12	19617	14674	27000	54		
41	Core Spray & Gravity	18	Out	14	6901	4898	27000	18		
	Condensate System		Out	14	2073	14	27000	0		
	(Core Spray Pump Suction 2B)		Out	12	19617	14674	27000	54		
42	Core Spray Pump Dischar	19	Out	12	21811	16624	27000	61		
	(South)		Out	10	10290	5416	27000	20		
			Out	10	14747	9748	27000	36		
43	Core Spray Pump Dischar	20	Out	10	11112	6438	27000	23		
	(North)		Out	10	7188	3120	27000	11		
			Out	12	14673	9400	27000	34		
44	Core Spray Pump Discharge	25	Out	10	19272	13462	27000	49		
	(South)		Out	10	9832	3826	27000	14		
			Out	12	17062	11662	27000	43		
45	Core Spray Pump Discharge	26	Out	10	15044	9218	27000	34		
	(North)		Out	10	9124	3316	27000	12	2	
			Out	12	22547	16786	27000	62		
46	Core Spray System	39	Out	3	29154	26788	27000	99	2	
	(C.S. Min. Flow By-Pass Pump		Out	3	25456	21860	27000	81		Note 1
	2A)									

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PROB NO.	SYSTEM	ISO/ SHEET NO.	LOCATION Ins. or Outside Cont.	LINE SIZE	EMERGENCY CONDITION STRESS (PSI)				PRIO-RITY CATEG	REMARKS
					TOTAL STRESS	SEISMIC (DBE)	ALLOWABLE ($1.8\ S_h$)	SEISMIC/ ALLOWABLE%		
47	Core Spray System (C.S. Min. Flow By-Pass Pump 2B)	40	Out	3	16187	12944	27000	47	2	
			Out	3	20665	16720	27000	61		
48	Core Spray System (RHR Conn from C.S.Pump 2A)	105	Out	2	17172	13524	27000	50		
			Out	2	25235	22438	27000	83		
48	Core Spray System (RHR Conn from C.S. Pump 2B)	105	Out	2	17172	13524	27000	50		
			Out	2	25235	22438	27000	83		
49	Core Spray System (Make-Up Demin Water for Pump 2A)	166	Out	2	4185	868	27000	3	6	
			Out	1	4105	2850	27000	10		
			Out	3/4	4898	2034	27000	7		
			Out	2	3234	1460	31500	4		
			Out	3/4	3597	1780	31500	5		
49	Core Spray System (Make-Up Demin Water for Pump 2B)	166	Out	2	4099	782	27000	2		
			Out	1	1950	692	27000	2		
			Out	3/4	4082	1072	27000	3		
			Out	2	2681	226	31500	0		
			Out	3/4	2090	660	31500	2		

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PROB NO.	SYSTEM	ISO/ SHEET NO.	LOCATION Ins. or Outside Cont.	LINE SIZE	EMERGENCY CONDITION STRESS (PSI)				PRIO-RITY CATEG	REMARKS
					TOTAL STRESS	SEISMIC (DBE)	ALLOWABLE (1.8 S_h)	SEISMIC/ ALLOWABLE		
50	Residual Heat Removal and	29	Out	20	4397	332	27000	1		
	Service Water		Out	16	10822	5214	27000	19	4	
	(Cooling H_2O for Xchgr 2B)									
51	Residual Heat Removal and	30	Out	20	7761	2086	27000	7		
	Service Water		Out	16	8026	3650	27000	13	4	
	(Cooling H2O Piping, Excgr 2A)									
52	Service Water	85	Out	16	11781	7292	27000	27		
	RHR Service Water		Out	12	7503	3632	27000	13		
	Pumps 2B & 2D		Out	8	8436	5262	27000	19	4	
53	Service Water	86	Out	16	6271	3778	27000	13		
	RHR Service Water		Out	12	7062	3826	27000	14		
	Pumps 2A & 2C		Out	8	7875	5098	27000	18	4	
54	Service Water	82,	Out	20	29536	25810	27000	95		Note 1
	Salt Water Supply to RHR	83,	Out	16	11672	9262	27000	34		
	Service Water Pumps (South)	84	Out	14	4760	3300	27000	12	4	
			Out	24	17987	15900	31500	50		
			Out	8	992	216	31500	0		
			Out	30	22964	18064	31500	57		
55	Service Water System	106	Out	6	13688	11548	27000	42		
	6" Return Line From Pump		Out	4	26139	25100	27000	92	4	
	Room Cooler 2A									
56	Service Water System	107	Out	6	24965	17948	27000	66		
	6" Supply Header (South)		Out	4	29907	28212	27000	104		Note 1
			Out	2	1477	66	27000	0	4	
57	Service Water System	108	Out	6	15040	12450	27000	46		
	6" Supply Header (North)		Out	4	8112	5154	27000	19		
			Out	2	24300	21352	27000	79		
58	Service Water (Ret. From	109	Out	6	18921	15280	27000	56		
	Pump Room Cooler 2B)		Out	4	14224	11798	27000	43	4	
59	Service Water (Cooling	110	Out	20	19323	18532	27000	68		
	Water Ret. Above 39)		Out	10	12255	11526	27000	42		
			Out	4	10332	7660	27000	28		
			Out	3	15073	13466	31500	42	4	

FINAL STRESS REPORT TABULAT

Job Order Number

PROB NO.	SYSTEM	ISO/ SHEET NO.	LOCATION Ins. or Outside Cont.	LINE SIZE	EMERGENCY CONDITION STRESS (PSI)				PRIORITY CATEG	REMARKS
					TOTAL STRESS	SEISMIC (DBE)	ALLOWABLE (1.8 S_h)	SEISMIC/ ALLOWABLE		
60	Service Water System	142A	Out	1½	17673	15660	31500	49		
	Return From Motor		Out	3	1128	802	31500	1		
	Coolers R.H.R. S.W.	142B	Out	1½	22372	20844	31500	66		
	Pumps 2A, B, C, D	142C	Out	1½	11892	10312	31500	32	4	
61	Service Water Supply and	162	Out	6	1595	37	27000	0		
	Return Headers At RHR Pump		Out	6	1373	180	31500	0		
	Room Coller 2A		Out	3	1095	158	31500	0		
			Out	2½	2285	648	31500	2		
			Out	6	2852	312	27000	1		
			Out	6	2127	296	31500	0		
			Out	3	1678	160	31500	0		
			Out	2½	2217	458	31500	1	4	
62	Service Water Supply and	163	Out	6	1567	490	27000	1		
	Return Headers At RHR Pump		Out	6	1948	770	27000	2		
	Room Coller "2B"		Out	3	1825	816	27000	3		
			Out	2½	2445	1370	31500	4		
			Out	6	4390	3358	27000	12		
			Out	6	3405	2392	27000	8		
			Out	3	5305	4488	27000	16		
			Out	2½	8209	7330	31500	23	4	
63	Service Water RHR Pumps	214	Out	2	9846	8568	32400	26		
	2B, 2D		Out	1½	7102	4740	32400	15		
			Out	1	5632	3474	32400	11		
			Out	3/4	18217	17338	32400	54		
			Out	2	4304	3660	32400	11		
			Out	1½	6256	5630	32400	17		
			Out	1	18556	17610	32400	54		
			Out	3/4	17955	17568	32400	54	6	
64	Service Water RHR Pumps	215	Out	3/4	19128	15778	33660	46		
	2A, 2C		Out	1	11897	9012	33660	26		
			Out	1½	15043	11032	33660	32		
			Out	2	6718	2708	33660	8		
			Out	3/4	5735	4784	33660	14		
			Out	1	16717	15180	33660	45		
			Out	1½	9702	7978	33660	23		
			Out	2	8440	7132	33660	21	6	

FINAL STRESS REPORT TABULAT

Job Order Number

PROB NO.	SYSTEM	ISO/ SHEET NO.	LOCATION Ins. or Outside Cont.	LINE SIZE	EMERGENCY CONDITION STRESS (PSI) TOTAL STRESS	SEISMIC (DBE)	ALLOWABLE (1.8 S_h)	SEISMIC/ ALLOWABLE	PRIORITY CATEG	REMARKS
65	Service Water Well Water	216	Out	1½	10090	8214	31500	26		
	Conn. To Vital Service		Out	1½	2840	1182	31500	3		
	Header		Out	2	8089	6460	31500	20	6	
66	Service Water C.S. Pump	217	Out	2½	1098	660	31500	2		
	Room Cooling Units 2C, 2D		Out	2	5354	1772	31500	5		
	Supply and Return		Out	2½	1873	1304	31500	4		
			Out	2	7731	2578	31500	8		
			Out	1	3996	3730	31500	11		
			Out	4	1389	320	31500	1		
			Out	2½	675	196	31500	0		
			Out	2	2554	1576	31500	5		
			Out	1	649	384	31500	1		
			Out	2½	1126	680	31500	2		
			Out	2	6584	1598	31500	5		
			Out	1	1668	1404	31500	4		
			Out	4	1358	306	31500	0	4	
67	Service Water RHR Service	218	Out	2	1559	746	33800	2		
	Water Pumps 2A, 2B, 2C, 2D		Out	1½	18318	15052	33800	44	6	
68	Service Water Supply and	300	Out	14	4791	1262	27000	5		
	Return Unit 1 & 2	301	Out	10	14310	10898	27000	40		
		302	Out	4	7539	4284	33228	16		
			Out	3	14175	10932	33228	33		
			Out	2½	10823	7610	33228	23		
			Out	2	15776	12572	33228	38		
			Out	1½	16182	13020	33228	39		
			Out	1¼	10466	7318	33228	22	4	
69	Service Water	62	Out	20	4515	200	27000	0		
	(Cooling Water Return -		Out	16	5879	3318	27000	12		
	South)		Out	16	4412	1822	31500	5		
			Out	16	9875	3948	31500	12		
			Out	10	14230	7256	31500	23	4	
70	Reactor Water Clean-up R.W.C.U. Pump Suction	22	In	6	24303	17134	25940	66	1	
71	Reactor Water Clean-up	132	In	2	9690	6548	27000	24		
	(Reactor Drain & Conn. To		In	2	17800	13618	25920	52	5	
	Reactor Water Clean-up									

PROB NO.	SYSTEM	ISO/ SHEET NO.	LOCATION Ins. or Outside Cont.	LINE SIZE	EMERGENCY CONDITION STRESS (PSI)				PRIORITY CATEG	REMARKS
					TOTAL STRESS	SEISMIC (DBE)	ALLOWABLE (1.8 S_h)	SEISMIC/ ALLOWABLE		
72	C.R.D. Hydraulic System (Drive Water Pump Disch.	27	In	3	8217	4408	27000	16		
			In	3	4653	982	28260	3	1	
73	Standby Liquid Control (Liquid Control Pump Disch.)	36	In	1½	18419	14068	27900	52	1	
74	Fuel Pool Cooling and Filtering System (Line to Fuel Storage Pool) (From RHR System)	138, 139	Out	8	8110	4350	27000	16		
			Out	8	21071	17094	27000	63		
			Out	6	21127	16736	27000	61		
			Out	6	8910	2718	31680	8	6	
75	Fuel Pool Cooling and Filtering System (Surge Tank Outlet) (Pumps 2A, 2B Suction Piping	144, 145	Out	12	15604	13712	27000	50		
			Out	10	4180	2452	27000	9		
			Out	8	15862	11428	27000	42		
			Out	6	6196	4428	27000	16		
			Out	4	2300	1476	27000	5	6	

FINAL STRESS REPORT TABULATION

Job Order Number

PROB NO.	SYSTEM	ISO/ SHEET NO.	LOCATION Ins. or Outside Cont.	LINE SIZE	EMERGENCY CONDITION STRESS (PSI) TOTAL STRESS	SEISMIC (DBE)	ALLOWABLE (1.8 S_h)	SEISMIC/ ALLOWABLE	PRIORITY CATEG	REMARKS
77	Cont. Atmos. Control Sys.	148	Out	24	8101	1868	27000	6		
	Ventilation System		Out	20	5106	1222	27000	4		
	Vent Purge Line	149	Out	30	11924	10408	27000	38		
	Standby Gas Treatment		Out	24	2059	1278	27000	4		
	Filters 2A, 2B		Out	18	20687	18166	27000	67	6	
78	Ventilation Sys. (SBGT)	150	Out	24	13333	12762	27000	47		
	Exhaust From Gas Purge		Out	18	9531	8588	27000	31	6	
79	Cont. Atmospheric Control	209	In	24	1997	272	27000	1		
	Supply to Drywell		In	20	10870	8650	27000	32		
			In	18	1372	254	27000	0		
	Supply to Suppression Pool	210	Out	8	5988	4404	27000	16	6	
80	Cont. Atmospheric Control	211	Out	1	5923	1702	27000	6		
	Valve By-Pass Piping		Out	2	26825*	24396*	27000	90		
			Out	1	10654	3436	27000	12		
			Out	½	5244	3686	27000	13		
			Out	1	14428	6834	27000	25	6	
	Note: *Stress Based on .75i in lieu of 1.0i. See para. 104.8.1 and 104.8.2 Power Piping Code									
81	Cont. Atmospheric Control Vent Purge Line From Drywell	212	Out	4	23948*	21750*	27000	80	6	
82	Cont. Atmospheric Control	213	Out	2	2109	654	27000	2		
	Relief Valve Piping		Out	1	2404	1596	27000	5		
			Out	3/4	4102	3734	27000	13		
			Out	½	11831	6408	27000	23		
			Out	1	1138	620	27000	2		
			Out	3/4	2723	2464	27000	9		
			Out	2	118	6	27000	0		
			Out	1	6932	4642	27000	17		
			Out	3/4	2842	2322	27000	8	6	
83	Containment Venting	230	Out	½	25268*	14896*	27000	55		
			Out	1½	3012	966	27000	3	6	
	Note: *Stress Based on .75i in lieu of 1.0 i. See Para. 104.8.1 and 104.8.2 Power Piping Code									

FINAL STRESS REPORT TABULATION

Job Order Number

PROB NO.	SYSTEM	ISO/ SHEET NO.	LOCATION Ins. or Outside Cont.	LINE SIZE	EMERGENCY CONDITION STRESS (PSI) TOTAL STRESS	SEISMIC (DBE)	ALLOWABLE (1.8 S_h)	SEISMIC/ ALLOWABLE	PRIORITY CATEG	REMARKS
84	Instrument Air System Inlet Line To Air Receiver	174	Out	2	2496	2492	27000	9	6	
85	Instrument Air System Outlet Line from Air Receiver	175	Out	2	4698	3448	27000	12		
			Out	3/4	14973	13812	27000	51	6	
86	Instrument Air System Supply Line (South)	176	Out	2	2454	1204	27000	4	6	
87	Instrument Air System Supply Line (South) East of Col. "P"	177	Out	2	16406	15036	27000	55		
			Out	3/4	3153	2028	27000	7		
			Out	2	12534	12284	27000	45	6	
88	Instrument Air System Main Steam Valves Accumulators - Piping	178	Out	1	11851	10710	27000	39		
			Out	1½	3749	2542	27000	9		
			Out	2	8328	7078	27000	26		
89	Instrument Air System Supply Line (North) West "L"	179	Out	2	24598	23348	27000	86		
			Out	3/4	2687	1562	27000	5	6	Note 1
90	Instrument Air System Supply Line (North) East "L"	180	Out	2	9614	8364	27000	30		
			Out	3/4	2679	1554	27000	5	6	
91	Instrument Air System Supply to Air Recvr Col."R"	182	Out	2	20284	19034	27000	70	6	
92	Instrument Air System Supply Line (North)	183	Out	2	9398	8148	27000	30		
			Out	3/4	14961	13836	27000	51	6	
93	Instrument Air System Supply Header (North)	184	In	2	30632	29382	27000	108		
			In	3/4	9353	8228	27000	30		Note 1
		185	In	2	15820	14570	27000	53		
			In	3/4	6469	5344	27000	19	6	
94	Instrument Air System Supply Header (South)	186	In	2	16026	14776	27000	54	6	
95	Instrument Air System	188	In	2	9596	8346	27000	30		
	Pipe to Accum. A1001C&D	189	In	1½	25719	24512	27000	90		
	Pipe to Accum A1001A&B		In	1	16209	15068	27000	55	6	
96	Instrument Air System Supply Lines to Filters D-0005 and D-0006	190	Out	2	20860	19610	27000	72		
			Out	1½	7629	6422	27000	23		Note 1
			Out	3/4	30507	29382	27000	108	6	

FINAL STRESS REPORT TABULAT

Job Order Number

PROB NO.	SYSTEM	ISO/ SHEET NO.	LOCATION Ins. or Outside Cont.	LINE SIZE	EMERGENCY CONDITION STRESS (PSI)				PRIORITY CATEG	REMARKS
					TOTAL STRESS	SEISMIC (DBE)	ALLOWABLE (1.8 S_h)	SEISMIC/ ALLOWABLE		
97	Instrument Air System	181	Out	2	28127	26922	27000	99		
	Outlet from RCVR at "18R"		Out	3/4	3573	2448	27000	9		
	Supply West Col. "T"	191	Out	2	17274	16024	27000	59	6	
98	Instrument Air System Inner	192,	In	2	28344	27094	27000	100	6	
	Air Supply Header	193								Note 1
	Outer Air Supply Header									
99	Instrument Air System	201	In	3/4	25822	18666	25920	72	6	
	Recirc. Pump 2B									
100	Instrument Piping Recirc.	202	In	1	2916	732	25920	2		
	Pump 2A Disch.			3/4	11476	5764	25920	22	6	
101	Instrument Piping	206	In	2	11088	9598	27900	34		
	Piping at Temp. Equalizing		In	1½	4252	3546	27900	12		
	D003B		In	1	15627	13970	27900	50		
			In	3/4	24990	22410	27900	80	6	
102	Instrument Piping	207	In	3/4	20130	17540	26028	67		
	Lines 2E21-701 & 702		In	3/4	21655	19622	26028	75	6	
104	Instrument Air System	231	Out	3/4	6436	5372	27000	20		
	N^2 Supply From CAC to Instr		Out	3/4	3825	2700	27000	10	6	
	Air Line (South)									
105	Instrument Air System	232	Out	3/4	8281	7204	27000	27	6	
	N^2 Supply From CAC to Instr									
	Air Line (East)									
106	Instrument Air System	233	Out	3/4	8901	7824	27000	29	6	
	N^2 Supply From CAC to Instr.									
	Air Line (North)									
107	Instrument Air Supply	306	Out	1	12183	9043	27000	33	6	
	Header From CAD Storage									
	Tank Unit 1 & 2									
108	Nitrogen & Off Gas Services	309	Out	3/4	27170	24018	27000	89		
	Bldg. Instr. Air Interrupt-		Out	2	15349	15062	27000	56		
	able		Out	1½	1978	1744	27000	6	6	

FINAL STRESS REPORT TABULAT

Job Order Number

PROB NO.	SYSTEM	ISO/ SHEET NO.	LOCATION Ins. or Outside Cont.	LINE SIZE	EMERGENCY CONDITION STRESS (PSI) TOTAL STRESS	SEISMIC (DBE)	ALLOWABLE (1.8 S_h)	SEISMIC/ ALLOWABLE	PRIORITY CATEG	REMARKS
109	Core Spray Sys.	524	In	10	13226	6232	26000	23	1	
			In	10	13770	7362	27000	27		
			In	10	15824	8830	26000	33		
			In	10	12642	6234	27000	23		
110	RHR	545	Out	4	23765	18128	27000	65	6	
			Out	4	17334	15000	27000	54		
111	RCIC	535	Out	4	13755	7606	27000	28		
		549	Out	4	5160	794	27000	2		
			Out	2	8896	5100	27000	18	3	
			Out	2	6603	1290	27000	4		
			Out	1	4591	1324	27000	4		
			Out	1	6080	2662	27000	9		
112	RHR Pumps - 1A & 1C	546		4	20416	17624	27000	65		
	RHR Pumps - 2A,B,C & D	565		4	13146	11930	27000	44	6	
113	RHR 1A,B,C & D	547		4	12445	9072	27000	34		
	RHR Drain to RW	548		4	23806	21690	27000	80	6	
114	RCIC Conn. to FW	563		4	19799	14074	27000	52	3	
	RCIC	568		4	17477	8958	28901	31		
				4	17137	10310	28901	36		
115	Condensate Drain N.S.S.	571		3	11374	9420	27000	35	6	
116	RHR Pumps 1A & 1B Suction Lines	605		2	24752	20878	27000	77	1	
117	Service Water Sys.	606		6	26321	23760	27000	88	1	
				4	7198	4738	27000	18		
118	Service Water Sys.	607		6	15932	13604	27000	50	5	
				4	19645	17400	27000	64		
				2	2611	116	31500	4		
		608		6	12432	10180	27000	38		
				4	6125	3872	27000	14		
				2	9931	8314	31500	31		
119	Service Water Sys.	609		6	18163	15348	27000	57	2	
				4	14771	12518	27000	46		
120	High Pressure Coolant Injection System	657		1	12239	10234	27000	38		
				3/4	5496	4619	27000	17	5	
				½	261	168	27000	1		
121	Service Water	662		6	1486	32	27000	1	4	
				6	2469	78	33120	3		
				3	880	116	33120	4		
				2½	1457	310	33120	1		

FINAL STRESS REPORT TABULATION

Job Order Number

PROB NO.	SYSTEM	ISO/ SHEET NO.	LOCATION Ins. or Outside Cont.	LINE SIZE	EMERGENCY CONDITION STRESS (PSI)				PRIO-RITY CATEG	REMARKS
					TOTAL STRESS	SEISMIC (DBE)	ALLOWABLE ($1.8\ S_h$)	SEISMIC/ ALLOWABLE		
122	Instrument Air	674		2	6405	5065	27000	19		
				1½	2053	756	27000	3	6	
				3/4	2773	1560	27000	6		
123	Instrument Air	675		2	10007	8730	27000	32	6	
				3/4	11262	10112	27000	37		
124	Instrument Air	677		2	21584	20244	27000	75	6	
125	Instrument Air	690		2	13912	12662	27000	47		
				1½	3675	2468	27000	9	6	
				3/4	26655	25529	27000	95		
126	Instrument Air	679		2	11940	3676	27000	14	6	
				3/4	8660	506	27000	2		
127	Instrument Air	680		2	8153	4817	27000	18	6	
128	Instrument Air	682		2	12316	10975	27000	41	6	
				1½	1299	2	27000	0		
129	Cont. Atmos. Control Sys.	709		24	2962	464	27000	2	6	
	Sup. Lines	710		20	12551	9450	27000	35		
				18	2522	298	27000	1		
				8	15579	11038	27000	41		
130	Instrument Air	681		2	11483	10142	27000	38		
		691							6	
131	Cont. Atmos. Control Sys.	713		1	20574	14480	27000	54	6	
	Relief Valve Piping			2	5408	4000	27000	15		
				3/4	5180	4000	27000	15		
				½	5168	4000	27000	15		
132	Service Water	716		1½	23143	18610	27000	69	6	
				1½	1457	276	27000	1		

Note 1: Total stress below allowable using "greater of $1.8\ S_h$ or $.9\ S_y$"

May 21, 1979

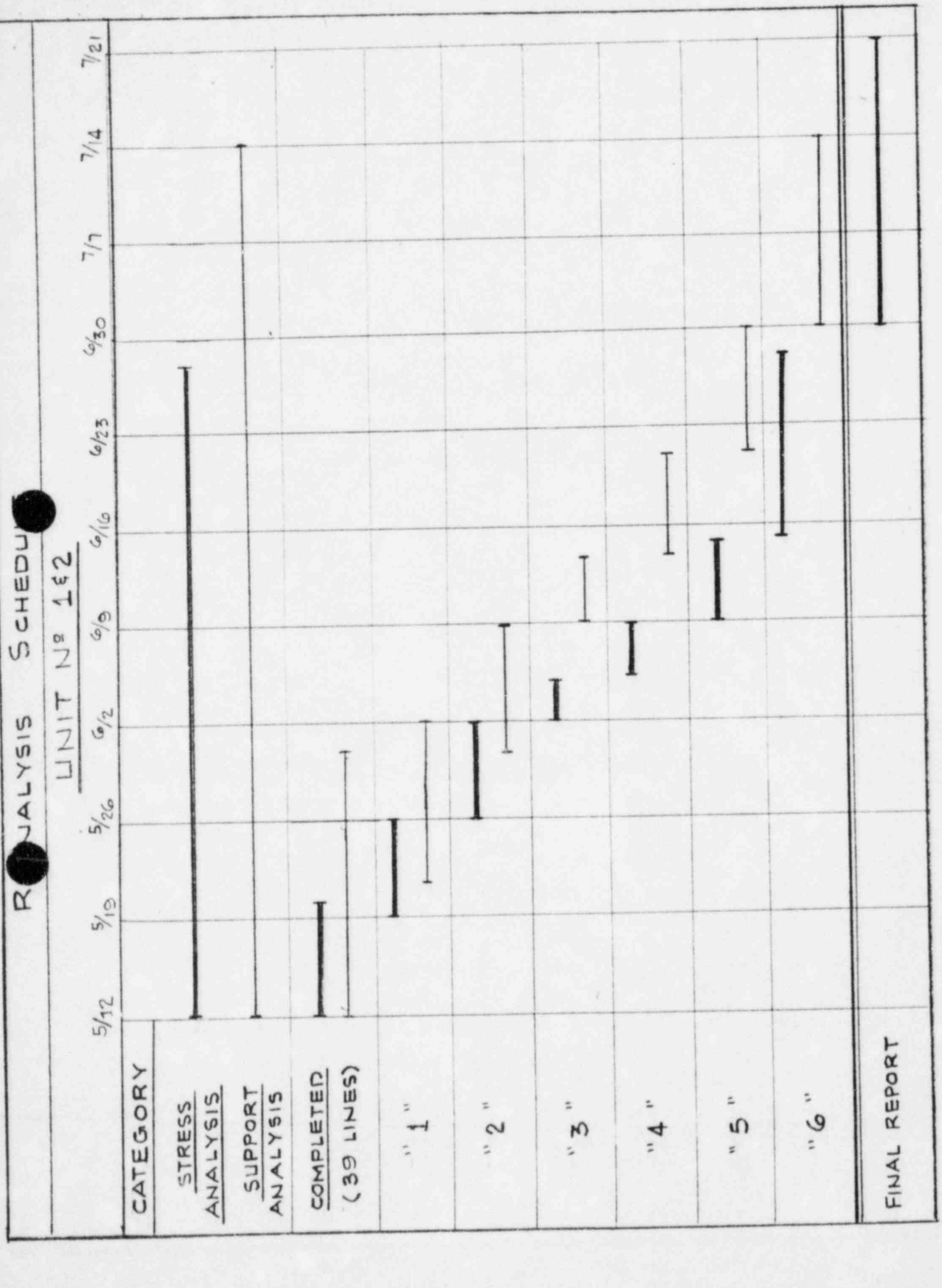
ATTACHMENT 4

REANALYSIS PRIORITY CRITERIA

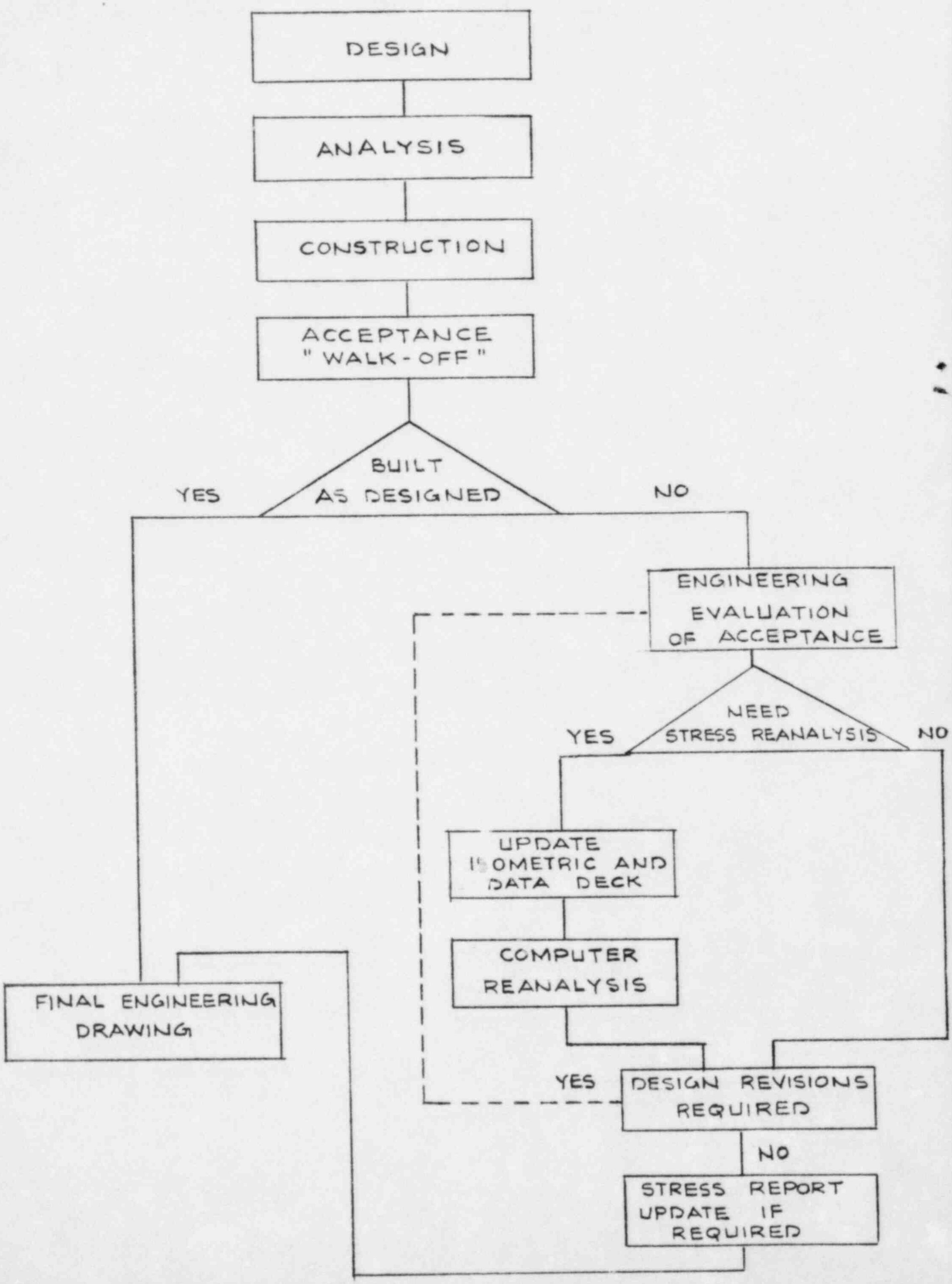
The following is the criteria that was used to establish the priority for the reanalysis for seismic stress of the safety related piping:

CATEGORY	DESCRIPTION
Complete 4/24/79	Initial reanalysis of 10 lines
Complete 5/21/79	Large pressure boundary lines in specified systems and lines with high stress from original analysis.
1.	Other pressure boundary lines 2½" and larger
2.	Other core standby cooling system lines 2½" and larger
3.	Other RCIC lines 2½" and larger
4.	Service Water lines 2½" and larger
5.	Pressure boundary, CSCS, RCIC lines 2" and smaller
6.	Other support systems (standby gas treatment, diesel generation fuel oil and cooling water, fuel pool cooling line to RHR, containment atmospheric control system, noninterruptible air).

ATTACHMENT 5



ATTACHMENT 6



ATTACHMENT 7

REANALYSIS EVALUATION SUMMARY

Reanalysis of pipe stress has been completed for 39 lines. All the results are within applicable allowable limits. In Attachment 2 we have tabulated the results associated with the emergency condition to address in detail the ability of these lines to safely withstand the design basis seismic (DBE) event. A tabulation of original pipe stresses for the combination of all the applicable loading conditions (i.e. pressure, dead weight, seismic, transient, etc.) and the individual seismic loading conditions is provided to determine the variance between the original analysis and the reanalysis. Specifically the ratio between the piping seismic stress obtained from the reanalysis and the original analysis have been evaluated and the summary is presented in Attachments 8 and 9. In this evaluation, the results obtained from a reanalysis of ten lines in the Indian Point Nuclear Unit #3 has been considered. Inclusions of these lines in the evaluation is legitimate since the Brunswick Units and the Indian Point 3 Unit used a) identical computer programs in both the original analysis and the reanalysis, b) identical approach to combine seismic excitation components (i.e. one horizontal and one vertical component simultaneously) and c) comparable piping configuration complexities.

From this evaluation we believe that a value of 1.5 for the ratio R_{MC} represents a realistic upper bound.

To properly evaluate the ability to safely withstand the design basis seismic event for those lines which have not yet been reanalyzed, the above consideration on the ratio R_{MC} must be reviewed together with the conservatism used to evaluate the pipe seismic stresses for the DBE conditions. As shown in the Attachment 2 foot note, the DBE seismic stresses were obtained by multiplying the values obtained for the OBE condition by 2 (two). This approach was used to minimize the number of computer runs required to a) generate Amplified Response Spectra (ARS) and b) to evaluate pipe stresses. This approach was modified only in those rare cases where the pipe stresses exceeded the applicable limits.

The factor of two is very conservative and therefore the stresses shown in Attachment 3 for the lines yet to be reanalyzed for DBE stress are very conservative. Since pipe stresses evaluated with a computer code using a modal approach and ARS input (such as the code(s) used) are directly dependent on the values of the ARS, a more realistic approach must consider the actual difference between the ARS for the OBE and DBE. Figure 7-1, 7-2, 7-3 provide plots of portions of ARS for the frequency range generally affecting piping systems. These ARS are representative for those elevations of the reactor building which contain most of the piping systems under investigation.

From these figures it can be seen that the two curves do not significantly differ. This is due primarily to the difference in structural and equipment damping values allowed in the computation of the OBE and DBE ARS.

A review of these figures indicate that piping with different fundamental frequencies may be affected differently and, in certain cases, DBE stress results may be even less than the OBE stress results. Since, in general, pipe stresses are affected mostly by the first fundamental frequency mode and a representative range for the first fundamental frequency is 4-10 cps, it was concluded that a conservative value of 1.2 for the ratio R_{ARS} between the DBE and OBE curves was more representative.

With the above considerations in mind, realistic (but still conservative) values for the DBE pipe stresses can be calculated by multiplying the values shown in Attachment 4 by the factor:

$$\alpha = \frac{R_{MC} \times R_{ARS}}{2}$$

The factor 2 above brings the DBE stress values shown in Attachment 3 back to the computer evaluated OBE results. The R_{ARS} factor accounts for the realistic difference between the DBE and OBE ARS and the R_{MC} factor gives consideration to the effects introduced by using a square root of the sums of the squares approach rather than an algebraic summation for the earthquake component response combinations within each mode.

Since α is approximately 1 and the values shown in Attachment 3 in effect will not change, we conclude that the original values for the total stresses are still representative and therefore the capability of the plant to safely withstand a seismic event in the interim is not impacted.

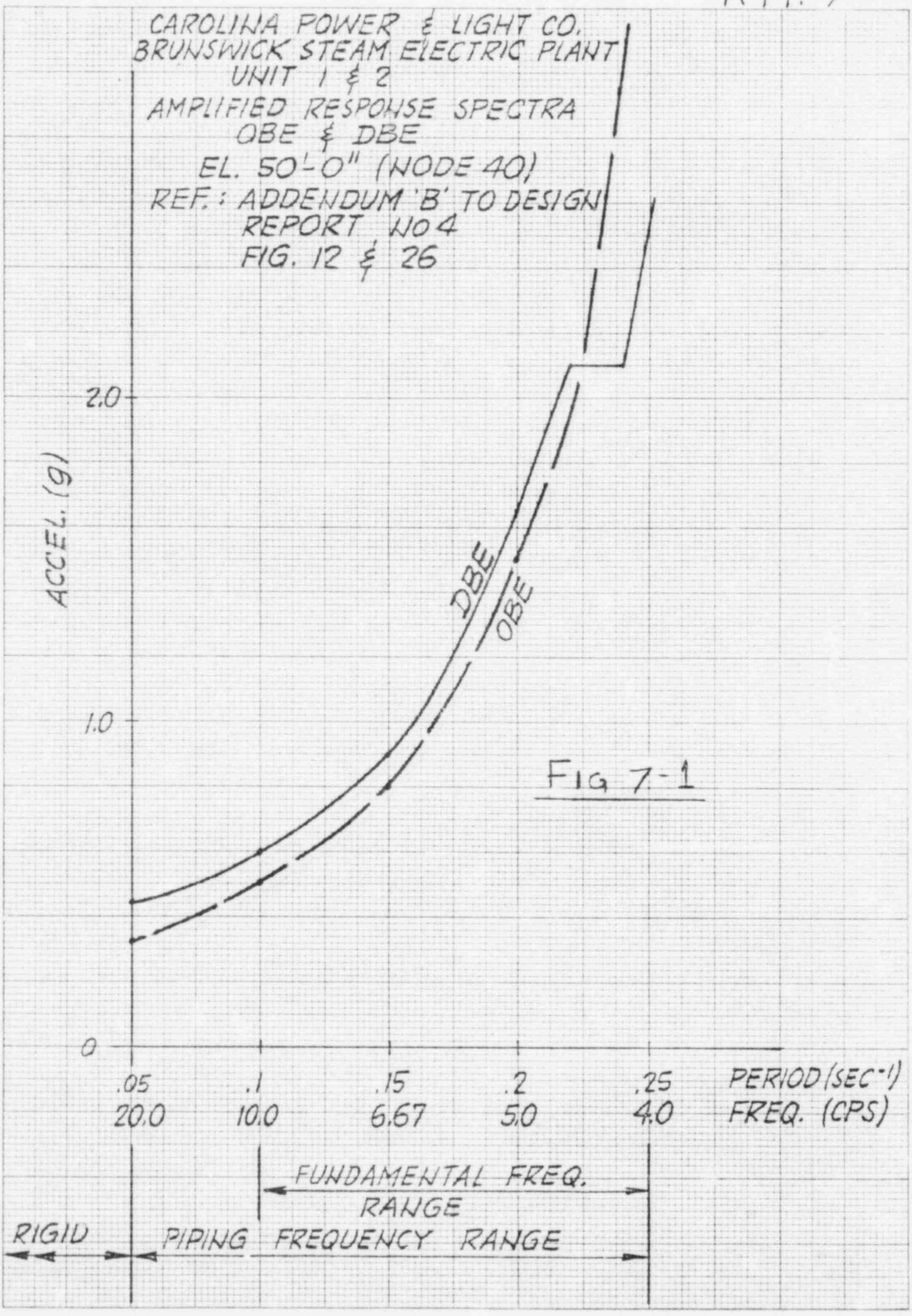
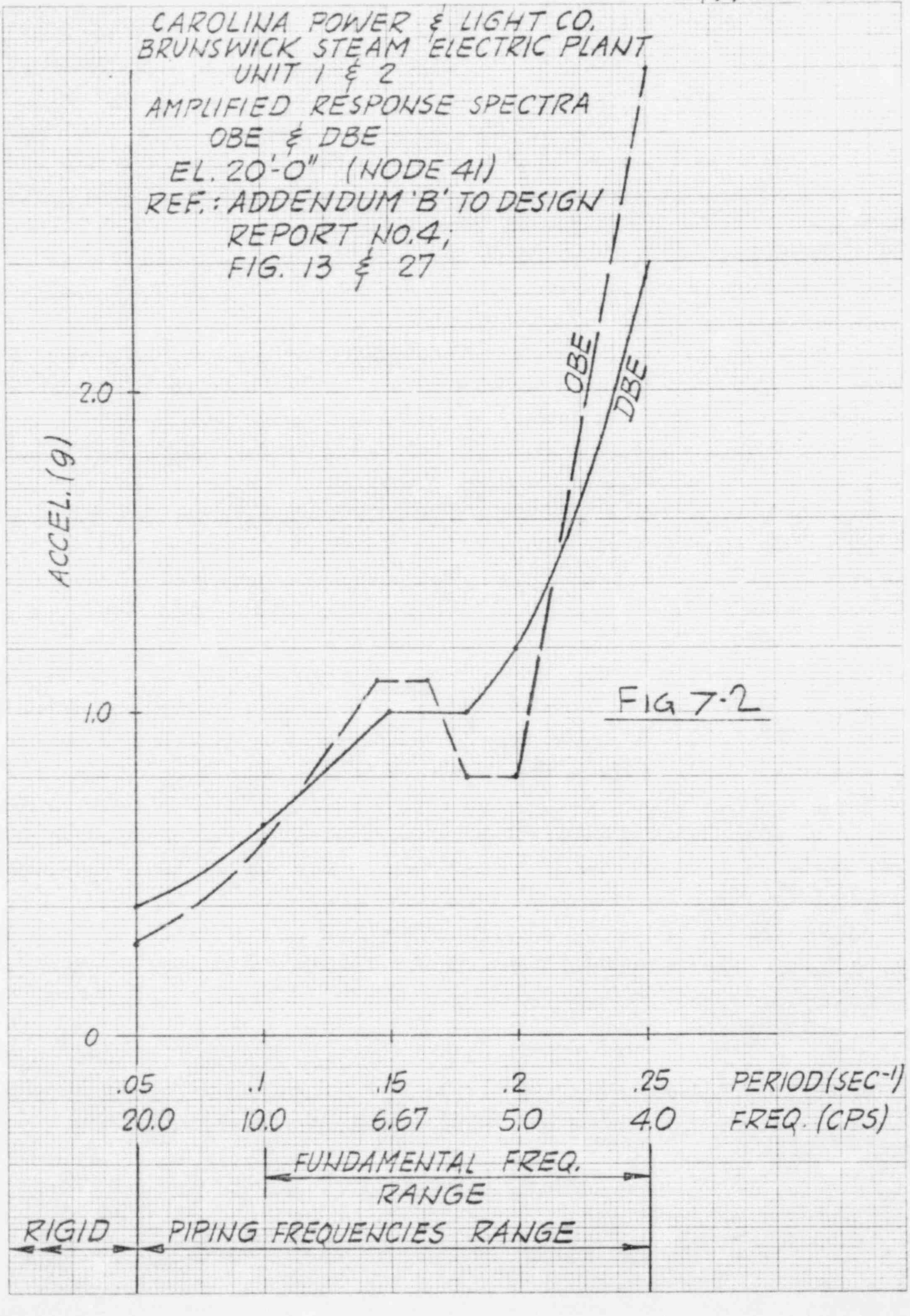

CAROLINA POWER & LIGHT CO.
BRUNSWICK STEAM ELECTRIC PLANT
UNIT 1 & 2
AMPLIFIED RESPONSE SPECTRA
OBE & DBE
EL. 50'-0" (NODE 40)
REF.: ADDENDUM 'B' TO DESIGN
REPORT NO 4
FIG. 12 & 26
ACCEL. (g)
2.0
1.0
0
DBE
OBE
.05
.1
.15
.2
.25
PERIOD (SEC⁻¹)
20.0
10.0
6.67
5.0
4.0
FREQ. (CPS)
FUNDAMENTAL FREQ.
RANGE
RIGID
PIPING FREQUENCY RANGE

FIG 7-1

ATT. 7



CAROLINA POWER & LIGHT CO.
BRUNSWICK STEAM ELECTRIC PLANT
UNIT 1 & 2
AMPLIFIED RESPONSE SPECTRA
OBE & DBE
EL. 20'-0" (NODE 41)
REF.: ADDENDUM 'B' TO DESIGN
REPORT NO.4;
FIG. 13 & 27
OBE
DBE
ACCEL. (g)
2.0
1.0
0
.05
.1
.15
.2
.25
PERIOD (SEC⁻¹)
20.0
10.0
6.67
5.0
4.0
FREQ. (CPS)
FUNDAMENTAL FREQ.
RANGE
RIGID
PIPING FREQUENCIES RANGE

FIG 7-2

ATT. 7

CAROLINA POWER & LIGHT CO.
BRUNSWICK STEAM ELECTRIC PLANT
UNIT 1 & 2
AMPLIFIED RESPONSE SPECTRA
OBE & DBE
EL. (-) 17'-0" (NODE 42)
REF: ADDENDUM 'B' TO DESIGN
REPORT NO 4; FIG. 14 & 23

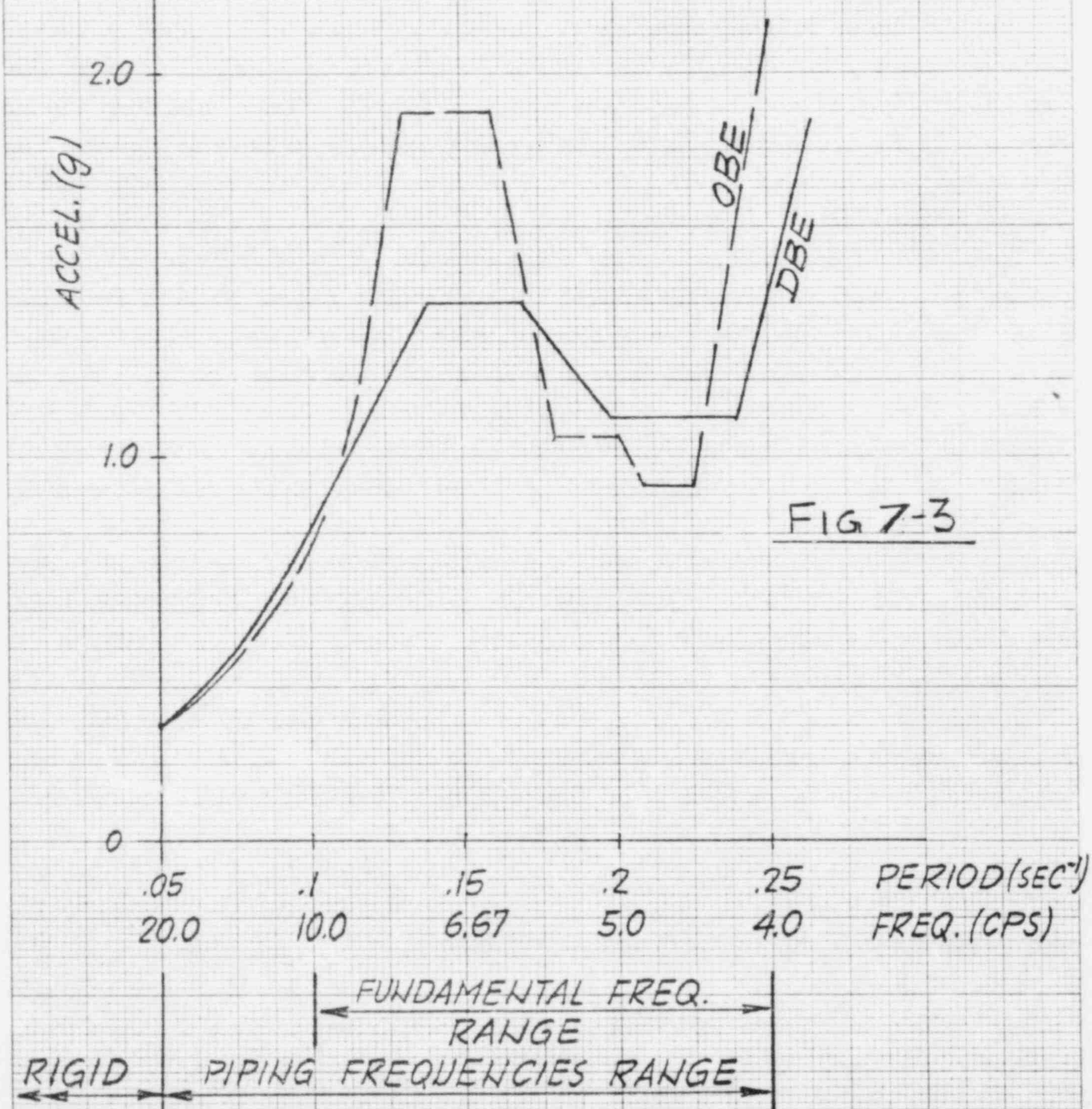


FIG 7-3

ATTACHMENT 8

RATIO R_{MC} EVALUATION SUMMARY

(BRUNSWICK 1 & 2 AND INDIAN PT. 3)
COMBINED

BRUNSWICK 1 & 2 AND INDIAN PT 3

R_{MC}	0.50 (MIN) – 0.75	0.75 – 1.00	1.00 – 1.25	1.25 – 1.50	1.50 – 1.52 (MAX)
NUMBER OF LINES ANALYZED (TOTAL 40)	4	19	12	4	1
PERCENT OF LINES	97.5%				2.5%
PERCENT OF LINES	87.5%			12.5%	
PERCENT OF LINES	58%		42%		

$$R_{MC} = \frac{\text{NEW SEISMIC STRESS}}{\text{ORIGINAL SEISMIC STRESS}}$$

ATTACHMENT 9

RATIO R_{MC} EVALUATION SUMMARY

(BRUNSWICK 1 & 2 AND INDIAN PT 3)

INDIVIDUAL

BRUNSWICK 1 & 2

R_{MC}	0.50(MIN) – 0.75	0.75 – 1.00	1.00 – 1.25	1.25 – 1.50	1.50 – 1.52(MAX)
NUMBER OF LINES ANALYZED (TOTAL 30)	2	14	9	4	1
PERCENT OF LINES	7%	47%	30%	13%	3%
PERCENT OF LINES	54%		46%		

INDIAN PT. 3

R_{MC}	(MIN.) 0.72 – 0.75	0.75 – 1.00	1.00 – 1.10 (MAX)
NUMBER OF LINES ANALYZED (TOTAL 10)	2	5	3
PERCENT OF LINES	20%	50%	30%
PERCENT OF LINES	70%		30%

$$R_{MC} = \frac{\text{NEW SEISMIC STRESS}}{\text{ORIGINAL SEISMIC STRESS}}$$

BSEP SEISMIC MONITORING PROGRAM

ATTACHMENT 10

An intensive seismic monitoring program was conducted at the Brunswick site under NRC direction and review for approximately 2 years, ending in December, 1977. The BSEP seismic monitoring program was directed at predicting an earthquake by identifying precursory phenomena. After nearly two years of seismic analysis, applying state-of-the-art techniques, the NRC granted CP&L's request to terminate the seismic program, stating that "The data reported does not indicate dilatency or other earthquake precursory phenomena is occurring in the Wilmington-Southport area." (Letter: A. Schwenscer to J. A. Jones, December 28, 1977). The staff's safety evaluation further stated, "The lack of detection of such local earthquake activity by the network combined with the low level of recorded historical earthquake activity in this region suggest a low earthquake potential for the region."

The lack of precursory anomalies is significant, in that the duration of a precursor anomaly is related to earthquake magnitude. For example, an event with Richter magnitude 5 is preceded by an anomaly spanning about 4 months, whereas a major earthquake at about magnitude 7 would be preceded by an anomaly lasting about 14 years. Thus, even if a precursor were detected this week, the maximum earthquake magnitude that would be expected by August 21 would be less than magnitude 5. This is equivalent to a ground acceleration of about 0.04g's, The OBE is 0.08g, and the DBE for BSEP is 0.16g. The ongoing seismic monitoring program at our Shearon Harris site, (which commended in September 1977) has a detection threshold such that it can detect seismic precursors in the Southport area.

No seismic events have been recorded by the BSEP or SHNPP Network, or the USGS network in South Carolina; and the SHNPP monitoring program continues to support the conclusion that the Southport area is unusually aseismic.