MISSISSIPPI POWER & LIGHT COMPANY
Helping Build Mississippi
P. O. BOX 1640, JACKSON, MISSISSIPPI 39205

April 5, 1982

NUCLEAR PRODUCTION DEPARTMENT

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D. C. 20555

Attention: Mr. Harold R. Denton, Director

Dear Mr. Denton:

SUBJECT: Grand Gulf Nuclear Station
Units 1 and 2
Docket Nos. 50-416 and 50-417
File 0260/L-814.2
SQRT - Justification for Interim Operation for Equipment Not In Compliance with the SQRT Criteria
AECM-82/128

With the submittal of Mississippi Power & Light Company's (MP&L) FSAR Amendments 54 and 55, 98.3% (4289 of 4365) of the devices at the Grand Gulf Nuclear Station are in compliance with the SQRT criteria.

The purpose of this letter is to provide to the NRC MP&L's justification for interim operation for the remaining 1.7% (76 devices) of the equipment that is not in compliance with the SQRT criteria.

The following information is provided:

A. Attachment No. 1

Provides justification for interim operation for the 14 BOP devices not in compliance with the SQRT criteria.

B. Attachment No. 2

Provides justification for interim operation for the 62 NSSS devices not in compliance with the SQRT criteria.

If you have any questions or require further information, please contact this office.

Yours truly,

L. F. Dale
Manager of Nuclear Services

RAB/SHH/JDR:lm
Attachments

B001
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1/1

cc: Mr. N. L. Stampley (w/a)
Mr. G. B. Taylor (w/a)
Mr. R. B. McGehee (w/a)
Mr. T. B. Conner (w/a)

Mr. Richard C. DeYoung, Director (w/a)
Office of Inspection & Enforcement
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Mr. J. P. O'Reilly, Regional Administrator (w/a)
Office of Inspection & Enforcement
U.S. Nuclear Regulatory Commission
Region II
101 Marietta St., N.W., Suite 3100
Atlanta, Georgia 30303

ATTACHMENT 1

JUSTIFICATION FOR INTERIM OPERATION

BOP EQUIPMENT

Equipment reviewed and justification for interim operation is attached.

1.	M-257.0/M-258.0	Air Operated Butterfly Valves
2.	M-141.1	Safety Relief Valves

JUSTIFICATION FOR INTERIM OPERATION

NAME: 24" AOV Butterfly Valve - P44-F116, F117, F118, F119
36" AOV Butterfly Valve - P44-F120, F121
30" AOV Butterfly Valve - P44-F122, F123

SPECIFICATION: 9645-M-257.0

NAME: 10" AOV Butterfly Valve - G41-F019, F045

SPECIFICATION: 9645-M-258.0

SAFETY FUNCTION:

Valves are secondary containment (Auxiliary Building) isolation valves.

FAILURE MODES:

Fail Open	X
Fail Closed	X
Loss of Power	X
Loss of Air	X
Loss of Pressure Integrity	
Loss of Structural Integrity	X

FAILURE EFFECT:

A. Effect on Primary Use

Loss of air or power will cause valve to fail closed, which is the "fail safe" position.

Seismic loading could possibly deflect valve so as to prevent closure which could produce a condition where allowable off-site radiation level would be exceeded.

B. Secondary Effect

None

DISCUSSION AND CONCLUSION:

Stress analyses indicate that valve components will not be overstressed due to design seismic accelerations (3g's).

DISCUSSION AND CONCLUSION: (Continued)

Valve vendor statement of December 14, 1981, certifies that the vendor does not differentiate in design between active and non-active valves. Statement certifies the structural integrity of the valves (See Attached).

For similar valve assemblies which were tested to demonstrate operability, no design modificatons were made and valves successfully passed testing.

Therefore, based upon engineering judgement, the current valves can perform their safety function, and interim operation with these valves poses no safety hazard.

TELEPHONE 312-844-4000 · TELEX 720-424

PRATT

HENRY PRATT COMPANY
creative engineering for fluid systems
401 SOUTH HIGHLAND AVENUE · AURORA, ILLINOIS 60507

December 15, 1981

BECHTEL POWER CORP.
RECEIVED
DEC 18 1981

Bechtel Power Corporation
15740 Shady Grove Road
Gaithersburg, MD 20760

ATTN: Mr. R. S. Trickovic
Project Engineer

JOB NO. 9645

SUBJ: Grand Gulf Nuclear Station
P.O. 9645-M-257/258,
Revisions 30 and 36 Respectively
HPCo S.O. D-28579

Gentlemen:

In accordance with the above referenced order, enclosed please find one (1) copy of Henry Pratt certification of nonactive valve assemblies.

Should you have any questions or need additional information, please let us know.

Very truly yours,

HENRY PRATT COMPANY

Roger D. Nelson
Nuclear Project Manager

RDN/clt

Enclosure

TELEPHONE 312-844-4000 · TELEX 720-424

PRATT

HENRY PRATT COMPANY
creative engineering for fluid systems
401 SOUTH HIGHLAND AVENUE · AURORA, ILLINOIS 60507

December 14, 1981

SUBJECT: Bechtel Grand Gulf Project
Seismic Analysis Report for Active & Non-Active Valve Assemblies

Reference: Pratt Job Numbers D-0073-1, D-0073-2
D-0073-3, D-0089-1

Henry Pratt Company does not differentiate between active and non-active in the structural design of nuclear butterfly valves. In view of the fact that the active valve assemblies are already found to be adequate for the specified loading conditions on the basis of the functional qualification reports already approved by Bechtel Power Corporation, and that the Bechtel approved seismic analysis reports for both active and non-active valve assemblies demonstrate the structural integrity of those valve assemblies for conditions more severe than required in the specifications, we hereby certify that the structural integrity of both the active and non-active valve assemblies are considered adequate for their specified service conditions.

JOHN V. BALLUN
39860
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

H B Washburn
H. B. Washburn
Senior Test Engineer

Certified By: J V Ballun
J. V. Ballun, P.E.

HBW:dg

Amsted INDUSTRIES

JUSTIFICATION FOR INTERIM OPERATION

NAME: RHR Heat Exchanger Safety Relief Valve; E12-F055A, B

NAME: Excess Flow Regulating Valve for Fuel Oil System; P75-F026A, B

SPECIFICATION: 9645-M-141.1

MANUFACTURE/MODEL NO.: Lonergan/DB-52Q/LCT-20

FUNCTION:

A. RHR Heat Exchanger SRV

The E12-F055 safety relief valve provides overpressure protection for the RHR heat exchangers and associated piping during the steam condensing mode of operation. However, it should be noted that while the RHR heat exchangers are safety related, the steam condensing mode of operation is not.

B. Fuel Oil System Excess Flow Regulating Valve

The P75-F026 valve functions as an excess flow regulating valve for diesel fuel during operation of a diesel generator.

DISCUSSION AND CONCLUSION:

The subject valves (E12-F055 and P75-F026) have been procured by MP&L as ASME Code valves. The E12-F055 valve was procured as a Class 2 valve. The P75-F026 valve was procured as a Class 3 valve.

The E12-F055 valve is a 6" relief valve and the P75-F026 valve is a 1½" relief valve. These valves are simple in terms of their design and construction. Furthermore, the function of these valves is such that they are in use intermittently; i.e., the F055 valve provides overpressure protection for the RHR heat exchangers and associated piping during the steam condensing mode of operation (note that while the RHR heat exchangers are safety related, the steam condensing mode of operation is not), and the F026 valve functions as an excess flow regulating valve for diesel fuel during operation of a diesel generator.

Although the required input loading is specified as 3.0 g's, the subject valves were analyzed for a static load of 6.0 g's. The resultant stresses are much lower than the code allowables and the calculated natural frequencies are much greater than the required 33 Hz.

In the initial procurement of these valves, operability was not specified as a requirement. Normally, operability of these valves would be demonstrated prior to power ascension. The operability testing for these valves will be completed by December 1982. Attached is the operability test plan and the valve data sheets.

M3D9

DISCUSSION AND CONCLUSION: (Continued)

Therefore, based upon engineering judgement and the above discussion, the subject valves can perform their intended safety function, and interim operation with these valves poses no safety hazard.

Operability Test Plan

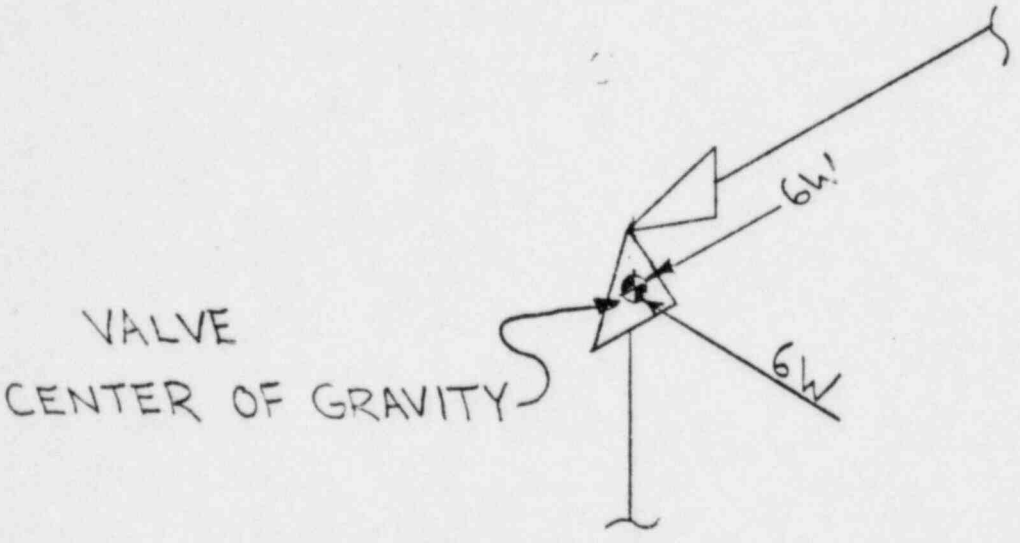
The valve to be tested should be installed in a suitable test facility simulating the plant installation. A static load shall be applied through the center of gravity of the valve. The static load shall be equal to six times the valve weight applied in a direction parallel to the valve discharge nozzle centerline and six times the valve weight in a direction perpendicular to the valve discharge nozzle centerline applied simultaneously (Note-A resultant force that will apply a load equivalent to the loads specified above may be used in lieu of the specified loads). See Figure 1.

While the valve is statically loaded in accordance with the above paragraph, the valve inlet shall be pressurized to the differential set pressure.* The differential set pressure is defined as the pressure differential between the set pressure and the constant, superimposed back pressure. These values can be found on the valve data sheets (Appendix Q of Specification 9645-M-141.1). Under this static loading condition, the valve shall be verified to open at the differential set pressure. After this verification, the static load shall be removed from the valve. The valve shall then be pressurized to the differential set pressure to ensure that it will open. Following the test, the valve shall be inspected to ensure that it has not been damaged.

*Note - For this test, the differential set pressure will have to be compensated for if there is a temperature difference between the testing fluid and the operating fluid normal temperature.

FIGURE 1

TYPICAL ARRANGEMENT FOR TESTING



RELIEF VALVE

W ≡ VALVE WEIGHT

	VALVE TAG NO.			SQ-6-GBB-PSV-F055A&B		SQ-1/2"-HBC-SQ-1/2"-HBC-SQ-1/2"-HBC-PSE-F194A,B		PSV-F300A,B		PSV-F031B			
OPERATING DATA	PRESS PSIG	NORM.	MAX.	200	550	100	193	20	100	55	165		
	TEMP. °F	NORM.	MAX.	388	475	90	90	125	150	110	110		
	OPER. SP. GR.	OPER. VISC. CP		*									
	SP. GR. @ STD P&T	MOL. WT.											
	CP/CV=K	SUPERCOMPRESS.											
	FLUID			Sat Steam*		SSW		Water		SSW		9	
DESIGN BASIS	MAX ALLOW WKG.	PSIG	°F										
	(MAX PRESS) SUPERIMP.	MAX.	MIN.	0	0	0	0	0	0	0	0		
	BUILT-UP	PSIG	15	107		0		0		0			
	BASIS OF SELECTION					Thermal		Thermal		Thermal			
	PERMISSABLE ACCUMULATION	%	PSIG	10	50	10	18	10	10	10	15	9	
						Relief		Relief		Relief			
RELIEVING CONDITIONS	MAX. SET PRESSURE PSIG			500		175		100		150		9	
	MAX. REL. PRESS. INCL. O'PRESS.			550		193		110		165			
	MAX. REL. TEMPERATURE °F			480		90		150		110			
	WEIGHT PERCENT FLASHING		15	0		0		0		0			
	CAPACITY-MAX. REQ'D. & UNITS			966,500 lbs/hr		10 GPM		9.8 GPM		10 GPM		9	
	CAPACITY-RATED & UNITS		*	311,997		13.0 GPM		9.8 GPm		12.0 GPM			
	ORIFICE-SQ. IN.	REQ'D.	RATED*	11.05	11.05	.06	.06	.06	.06	.06	.06		
				A									
VALVE DESIGN	INLET-SIZE, RATING, FACING			6-600# RF		1/2",150#,THD		1/2",150#,THD		1/2",150#,THD			
	OUTLET-SIZE, RATING, FACING			8-150# RF		1",150#,THD		1",150#,THD		1",150#,THD			
	MATL'S. BODY	BONNET		CS	CS	CS	CS	CS	CS	CS	CS		
	NOZZLE	DISC.		SS	SS	SS	SS	SS	SS	SS	SS		
	SPRING & COATING		*	Tungsten		C.S. Cad Pld		C.S. Cad Pld		C.S. Cad Pld.		15	
	LIFTING DEVICE TYPE			Packed Lever		None		None		None			
	PRESS. BAL. TYPE	MATL.	*	YES		No	-	No	-	No	-		
	MAX. BLOWDOWN %	MIN. RESEAT PSIG	*	10%	450	20%	140	20%	80	20%	120		
	SEAT TIGHTNESS												
	CODE STAMP TYPE			NV		NV		NV		NV			
	APPLICABLE CODE			ASME III-2		ASME III-3		ASME III-3		ASME III-3			
	"COLD" DIFF. TEST PRESS		15	500		175		100		150			
MISC.	ACCESSORIES-GAG, ETC.												
			15	*97% Quality									
PURCH.	M.R. / P.O. NUMBER		A	1-3.01a, b		1-1.03f,g		1-1.03h.i		1-1.03j			
	MANUFACTURER		*	Lonergan		Lonergan		Lonergan		Lonergan			
	MODEL NO.		*	DB-52Q		LCT-11		LCT-11		LCT-11			
GENERAL	MPL NO.			E12		P41		G-41		P41		9	
	CRITICAL SERVICE (YES/NO)			N/A		N/A		N/A		N/A			
	QUANTITY Per Unit			2		2		2		1			
	P&ID		A			M-1061		M-1088		M-1061		9	

* DENOTES INFORMATION SUPPLIED BY SELLER.

NO	DATE	REVISIONS	BY	CHK	ENGR SUPV	ENG	CHIEF ENGR	
5	4-28-76	Revised as Noted	MLN	KST		KST		
4	11-24-75	Revise as Noted	WSP			KST		

SCALE ~ | DESIGNED ~ | DRAWN ~

GRAND GULF NUCLEAR STATION

SAFETY AND RELIEF VALVE DATA SHEET UNIT 1

JOB No. 9645 | DRAWING No. | REV.

APPENDIX O | SPEC. 9645-M-141.1 | Page 7 | 15

	VALVE TAG NO.			SQ-L5-DCB-PSV SPARES		SQ-3/4"-HBB-SQ-1.5-GBB- PSV-F031		PSV-F018				SQ-1½"-HBC PSV-F026A,B	
OPERATING DATA	PRESS PSIG	NORM.	MAX.	1220	1540	75	100	325	560			20	40
	TEMP. °F	NORM.	MAX.	90	150	170	215	170	215			80	150
	OPER. SP. GR.	OPER. VISC. CP											
	SP. GR. @ STD P&T	MOL. WT.											
	CP/CV=K	SUPERCOMPRESS.											
	FLUID			Water		Water		Water				#2 Fuel Oil	
DESIGN BASIS	MAX. ALLOW WKG	PSIG	°F										
	BACK PRESS SUPERIMP.	MAX.	MIN.	6 psig	6 psig	0	0	0	0			4 psig	
	BACK PRESS BUILT-UP			0		0		0					
	BASIS OF SELECTION												
	PERMISSABLE ACCUMULATION	%	PSIG	10	154	10	10	10	51			10	4
RELIEVING CONDITIONS	TYPE OF VALVE											Relief	
	MAX. SET PRESSURE PSIG			1386		100		585				40	
	MAX. REL. PRESS. INCL. O'PRESS.			1540		110		644				44	
	MAX. REL. TEMPERATURE °F			150		215		215				150	
	WEIGHT PERCENT FLASHING			0									
	CAPACITY MAX. REQ'D. & UNITS			43 GPM		10 GPM		100 GPM				35 GPM	
	CAPACITY-RATED & UNITS *			66.7 GPM		17.9 GPM		174 GPM				43.2 GPM	
	ORIFICE-SQ. IN.	REQ'D.	RATED*	.110	.110	.110	.110	.307	.442			0.442	
VALVE DESIGN	INLET-SIZE, RATING, FACING			1½, 1500, LG		3/4", 150#, THD		1.5", 300#, THD				1½"-150#Flg	
	OUTLET-SIZE, RATING, FACING			2, 150, RF		1", 150#, THD		2", 150#, THD				2"-150#Flg	
	MATL'S. BODY	BONNET		SS	SS	CS	CS	CS	CS			CS	CS
	MATL'S. NOZZLE	DISC.		SS	SS	SS	SS	SS	SS			SS	SS
	SPRING & COATING *			316 SS		CS-Cad.Pltd		CS-Cad.Pltd					
	LIFTING DEVICE TYPE			None		None		None				None	
	PRESS. BAL. TYPE	MATL. *		No	-	No	-	No	-			No	-
	MAX. BLOWDOWN*	MIN. RESEAT PSIG*		20%	1104	20%	80	20%	468			20%	29
	SEAT TIGHTNESS											NV	
	CODE STAMP TYPE			NV		NV		NV				ASME III-3	
	APPLICABLE CODE			ASME III		ASME III-2		ASME III-2					
	"COLD" DIFF. TEST PRESS			1380		100		585				36	
MISC.	ACCESSORIES-GAG, ETC.												
PURCH.	M. R. / P. O. NUMBER			1-2.01a,b		1-2.01e		1-3.03a				1-1.06a,b	
	MANUFACTURER *			Lonergan		Lonergan		Lonergan				Lonergan	
	MODEL NO. *			B-70D/L3		LCT-20		LCT-20				LCT-20	
GENERAL	MPL NO.					E21		E21				P75	
	CRITICAL SERVICE (YES/NO)			NA		N/A		N/A				N/A	
	QUANTITY Per Unit			2		1		1				2	
	P&ID					M-1087		M-1087				M-1070	

* DENOTES INFORMATION SUPPLIED BY SELLER

No	DATE	REVISIONS	BY	CHK'R	DESIGN SUPV	ENGR	PROJ ENGR	APPR
6	8-16-76	Revised as Noted	MLN			K&T		
5	4-28-76	Revised as Noted	MLN	KSS		KSS		
3	5-14-75	Page Added	JM			KSS		

SCALE | DESIGNED | DRAWN | CHK'R ENGR

GRAND GULF NUCLEAR STATION

SAFETY AND RELIEF VALVE DATA SHEET

JOB No. 0645 | DRAWING No. | REV

APPENDIX Q

ATTACHMENT 2

JUSTIFICATION FOR INTERIM OPERATION

NSSS EQUIPMENT

Equipment reviewed and justification for interim operation is attached.

1.	B21-F022/F028	Main Steam Line Isolation Valves
2.	C11-F009	CRD Solenoid Valve
3.	E12-B001/B002	RHR Heat Exchangers
4.	E22-F001/F004/F010 F011/F012/F015/F023	HPCS Valve Actuators
5.	F11-E014, F15-E003/E005	Fuel Handling and Auxiliary Platforms
6.	F16-E006	In-Vessel Rack
7.	F16-E009	Defective Fuel Storage Container
8.	B21-R005/R009	Pressure Indicator
9.	E12-N025A, B	Conductivity Cell
10.	E22-S001/S002/S003/S004	High Pressure Core Spray: - Diesel Generator - Motor Control Center - Transformer - Switchgear
11.	C41A-S01	Switch
12.	E12A-S03	Switch
13.	E12A-S57 E21A-S07 E22A-S03	Switches
14.	E21A-S06	Switch
15.	E22B-S02/S07/S09/ S10/S15/S16	Switches
16.	E51A-S15	Switch
17.	H13-P855/P856/P864/ P870/P871/P872/ P877/P878	BOP/PGCC Panels

M3D8

JUSTIFICATION FOR INTERIM OPERATION

NAME: Main Steam Isolation Valve

MPL: B21-F022/F028

SAFETY FUNCTION:

To close main steam lines in order to isolate containment from reactor building.

FAILURE MODES:

Fail Open	X
Fail Closed	X
Loss of Power	X
Loss of Air	X
Loss of Pressure Integrity	
Loss of Structural Integrity	X
Distortion of Mounting	

FAILURE EFFECT:

A. Effect on Primary Use

Loss of air causes the MSIV to fail closed, which is the fail safe condition.

Bending yoke rods could cause binding so as to prevent closure.

B. Secondary Effect

Failing closed scrams reactor which is fail safe.

DISCUSSION AND CONCLUSION:

The main steam isolation valves are designed to be "fail safe" such that the yoke rod springs of the actuator will close the valve if the pneumatic supply is lost.

The Grand Gulf 28" MSIV assemblies are structurally similar to a 26" assembly that was qualified by a generic test. This test found the measured stresses at the base of the test specimen yoke rods

DISCUSSION AND CONCLUSION: (Continued)

to be about 30% of the material yield stress when subjected to seismic loads that were approximately twice those predicted for Grand Gulf.

A study was performed to identify the differences between the two MSIV assemblies and predictive calculations were performed to determine the effect of these differences on stresses at the base of the MSIV yoke rods. The results of this evaluation predict the stresses at the base of the MSIV yoke rods will be less than 50% of yield stress. It is concluded, therefore, that the MSIV yoke tubes will not suffer permanent deformation that could prevent valve closure due to binding.

Therefore, based upon engineering judgement, the current valves can perform their safety function, and interim operation with these valves poses no safety hazard.

JUSTIFICATION FOR INTERIM OPERATION

NAME: CRD Solenoid Valve

MPL: C11-F009

SAFETY FUNCTION:

To open, permitting air to vent from the air supply header which closes the CRD vent and drain valves.

FAULURE MODES:

Fail Open	X
Fail Closed	X
Loss of Power	X
Loss of Air	
Loss of Pressure Integrity	
Loss of Structural Integrity	X
Distortion of Mounting	

FAILURE EFFECT:

A. Effect in Primary Use

Loss of structural integrity might cause the valve to fail closed. Should this occur the CRD vent and drain valves would remain open permitting the scram discharge volume to drain continuously to the suppression pool.

B. Secondary Effect

None

DISCUSSION AND CONCLUSION:

The CRD solenoid valve used in Grand Gulf is identical to the valve qualified by test for use in the W.H. Zimmer and LaSalle County plants. The test specimen was subjected to loads greater than those required to qualify this valve model for use in Grand Gulf. Work is currently underway to obtain the necessary test report to prepare an updated SQRT form for this component.

Therefore, interim operation with this component does not pose a safety hazard.

JUSTIFICATION FOR INTERIM OPERATION

NAME: RHR Heat Exchanger

MPL: E12-B001/B002

SAFETY FUNCTION:

To remove decay heat from the reactor.

FAILURE MODES:

Fail Open	____
Fail Closed	____
Loss of Power	____
Loss of Air	____
Loss of Pressure Integrity	____
Loss of Structural Integrity	____
Distortion of Mounting	X

FAILURE EFFECT:

A. Effect on Primary Use

Support structure could yield, under excessive seismic loads, causing heat exchanger nozzles to pick up additional load. If nozzles pick up additional load, they too might yield. However, pressure integrity and heat removal capability would be unimpaired.

B. Secondary Effect

None

DISCUSSION AND CONCLUSION:

The Grand Gulf RHR heat exchangers are subject to seismic loads only and were not reanalyzed during the Grand Gulf New Loads Program. The current analysis of the Grand Gulf heat exchangers is not in conformance with the methodology requirements of the SQRT Program and will, therefore, be reanalyzed to comply with SQRT requirements.

DISCUSSION AND CONCLUSION: (Continued)

An analysis performed on a structurally similar, but slightly longer, RHR heat exchanger resulted in adequate stress margins with a seismic loading twice that required for Grand Gulf.

Refined dynamic analysis of heat exchangers from other plants have shown the original stress analysis results to be conservative. Since these heat exchangers are structurally similar to those in the Grand Gulf plant, the results of the analysis should satisfy SQRT requirements with greater margins than are shown by the current analysis.

Therefore, based upon reasonable engineering judgement, interim operation with the Grand Gulf RHR heat exchangers does not pose a safety hazard, as the equipment will remain functional during and after a seismic event.

JUSTIFICATION FOR INTERIM OPERATION

NAME: HPCS Valve Actuators

MPL: E22-F001/F004/F010/F011/F012/F015/F023

SAFETY FUNCTION:

To open or close valves in the high pressure core spray system, in order to line up the system for injection of high pressure cooling water into the reactor.

FAILURE MODES:

Fail Open	X
Fail Closed	X
Loss of Power	X
Loss of Air	
Loss of Pressure Integrity	
Loss of Structural Integrity	
Distortion of Mounting	

FAILURE EFFECT:

A. Effect on Primary Use

Failure of valves to open or close, as required, could result in failure to inject high pressure cooling water into the reactor.

B. Secondary Effect

Failure of HPCS to operate under emergency conditions would cause the automatic depressurization system (ADS) to function, reducing reactor pressure to a level where the low pressure core spray system (LPCS) would supply the required cooling water.

DISCUSSION AND CONCLUSION:

The HPCS valve actuators for E22-F001/F010/F011/F012/F015/F023 are all SMB/SB model actuators manufactured by Limitorque Corporation. Limitorque Corporation designs their actuators according to the "family" concept wherein different sized actuators of the same family have similar st[illegible] levels and mechanical responses. Limitorque Corporation has perfor[illegible] an extensive series of successful seismic qualification tests on the SMB/SB family of actuators. The above listed HPCS actuators

RWH:lm/13U-5
2/19/82

DISCUSSION AND CONCLUSION: (cont'd)

all fall within this family, and are bounded by the existing successful test data. All that remains to be done is to document this fact. Therefore, these actuators would not be expected to fail under the seismic levels expected at Grand Gulf. Even if they did, the backup ADS and LPCS systems would provide emergency cooling water.

The HPCS valve actuator for E22-F004 has a motor brake which has not been subjected to seismic testing. However, the difference in the weight of actuators with and without brakes is not considered significant. Therefore, the test data for actuators without brakes can be used for the actuator with a brake with a high degree of confidence, pending replacement of this actuator with a brakeless model. This confidence is augmented by the fact that even if the brake should happen to contribute to failure, the backup ADS and LPCS systems would provide emergency cooling water.

Therefore interim operation with these actuators does not pose a safety hazard.

RWH:lm/13U-6
2/19/82

JUSTIFICATION FOR INTERIM OPERATION

NAME: Fuel Handling and Auxiliary Platforms

MPL: F11-E014, F15-E003/E005

SAFETY FUNCTION:

To move fuel bundle into and out of the reactor and spent fuel pool without dropping them.

FAILURE MODES:

Fail Open	___
Fail Closed	___
Loss of Power	X
Loss of Air	___
Loss of Pressure Integrity	___
Loss of Structural Integrity	X
Distortion of Mounting	___

FAILURE EFFECT:

A. Effect on Primary Use

Loss of power would have no effect on the platform's ability to hold onto a fuel bundle.

Loss of structural integrity could conceivably cause a fuel bundle drop.

B. Secondary Effect

None

DISCUSSION AND CONCLUSION:

The fuel handling and auxiliary platforms are used during the initial fuel loading and during subsequent refueling operations. During the initial fuel loading this equipment will be handling unirradiated fuel. The consequences of a fuel assembly drop during this activity would be limited to physical damage to the dropped assembly and any components it may strike and will not result in a fission product release.

DISCUSSION AND CONCLUSION: (Continued)

The initial handling of irradiated fuel assemblies containing significant amounts of fission products will not occur until the first refueling outage which typically occurs about 1½ years after the plant commences full power commerical operation.

The reanalysis of the fuel handling and auxiliary platforms will be completed before December 1982, therefore ample time is available to qualify the Grand Gulf platforms to SQRT criteria. Based on structural similarity to other platforms which have been analyzed dynamically and qualified to larger dynamic loads, the results of the Grand Gulf platform analyses should demonstrate compliance to SQRT criteria without modifying the equipment. Therefore, interim operation with the fuel handling and auxiliary platforms does not pose a safety hazard.

JUSTIFICATION FOR INTERIM OPERATION

NAME: In-Vessel Rack

MPL: F16-E006

SAFETY FUNCTION:

Support fuel bundles inside reactor during refueling.

FAILURE MODES:

Fail Open	___
Fail Closed	___
Loss of Power	___
Loss of Air	___
Loss of Pressure Integrity	___
Loss of Structural Integrity	X
Distortion of Mounting	X

FAILURE EFFECT:

A. Effect on Primary Use

Loss of structural integrity, or distortion of mounting, could permit up to four fuel bundles to fall down upon the top of the reactor core during refueling.

B. Secondary Effect

None

DISCUSSION AND CONCLUSION:

The in-vessel rack is used during refueling outages only, therefore the first use of this rack for holding irradiated fuel assemblies having a significant fission product inventory would not occur until approximately 1½ years after commencing full power commercial operation.

Reanalysis of the in-vessel rack is expected to be complete by December 1982, therefore ample time is available before the first refueling outage to bring this equipment into compliance with SQRT criteria. Even if it is not qualified prior to the first refueling outage, refueling operations could be performed without the use of this rack since it is not essential to this operation but, rather, provides a convenient in-vessel parking place for components when disassembling one control cell.

Therefore, interim operation prior to qualification of the in-vessel rack poses no safety hazard.

JUSTIFICATION FOR INTERIM OPERATION

NAME: Defective Fuel Storage Container

MPL: F16-E009

SAFETY FUNCTION:

To isolate defective fuel bundles stored in the spent fuel pool.

FAILURE MODES:

Fail Open	____
Fail Closed	____
Loss of Power	____
Loss of Air	____
Loss of Pressure Integrity	____
Loss of Structural Integrity	X
Distortion of Mounting	____

FAILURE EFFECT:

A. Effect on Primary Use

Loss of structural integrity could permit defective fuel bundles to fall to the bottom of the spent fuel pool during transfer.

B. Secondary Effect

None

DISCUSSION AND CONCLUSION:

The defective fuel storage container is used to isolate one defective fuel assembly in the spent fuel pool, thereby minimizing contamination of the surrounding water, stored fuel, and other equipment. The container rests on the bottom of the defective fuel storage rack. In addition, when shipping a defective assembly, it is enclosed in this container and then placed into the shipping cask.

The equipment would not be in use until a defective irradiated fuel assembly is discharged from the Grand Gulf reactor core and this event should occur no earlier than the first refueling outage. Qualification of this container to SQRT criteria is expected to be complete before December 1982, well in advance of its first potential usage. Therefore, interim operation prior to qualification of the defective fuel storage container does not pose a safety hazard.

JUSTIFICATION FOR INTERIM OPERATION

NAME: Pressure Indicator

MPL: B21-R005/R009

SAFETY FUNCTION:

To maintain pressure integrity so as not to release radioactive steam outside of the primary containment building.

FAILURE MODES:

Fail Open	____
Fail Closed	____
Loss of Power	____
Loss of Air	____
Loss of Pressure Integrity	X
Loss of Structural Integrity	X
Distortion of Mounting	____

FAILURE EFFECT:

A. Effect on Primary Use

Loss of pressure integrity could release radioactive steam outside the primary containment. The result would be a small leak, which would be detected by the Leakage Detection System.

B. Secondary Effect

None

DISCUSSION AND CONCLUSION:

Since these instruments are not required for safety, they will be valved out whenever readings from the pressure indicators are not necessary. This insures that no leakage could occur should these instruments fail. Additional measures, such as locking the valves closed or complete instrument removal and the lines capped, will be instituted as determined necessary by station staff to insure pressure boundary integrity.

However, should a failure occur during the time the instruments are pressurized, the following is required.

These pressure indicators are passive pressure integrity devices. Failure during the low dynamic loading expected at Grand Gulf is not anticipated, based on stress analyses performed on similar devices. Even if failure should occur, the results would be a small leak which would be detected by the Leakage Detection System. The operator would then take action to isolate the leak and initiate repairs. No threat to the public safety would be involved.

Therefore, interim operation with these pressure indicators poses no safety hazard.

JUSTIFICATION FOR INTERIM OPERATION

NAME: Conductivity Cell

MPL: E12-N025A, B

SAFETY FUNCTION:

To maintain pressure integrity during operation of the RHR system.

FAILURE MODES:

Fail Open	____
Fail Closed	____
Loss of Power	____
Loss of Air	____
Loss of Pressure Integrity	X
Loss of Structural Integrity	____
Distortion of Mounting	____

FAILURE EFFECT:

A. Effect on Primary Use

Loss of pressure integrity could result in spraying contaminated water in the Auxiliary Building.

B. Secondary Effect

None

DISCUSSION AND CONCLUSION:

The pressure boundary associated with the conductivity cell consists of a 1" valve, a 1" pipe nipple, a 6" section of 1" pipe, and a fitting with a 3/8" hole through which the sheathed electrical cable of the conductivity cell passes. The assembly has been hydrostatically tested to 625 psig, which is more than twice the maximum operating pressure.

DISCUSSION AND CONCLUSION: (Continued)

Seismically induced stresses at the seal between the sheathed cable and the fitting will be negligable since the connecting cable external to the pressure boundary is enclosed in flexible conduit. Therefore, the hydrostatic test assures adequate margin for this portion of the pressure boundary.

The critical component in the conductivity cell pressure boundary is the 1" nipple that connects the assembly to the RHR piping. The nipple will be subjected to bending stresses during a seismic event due to the cantilevered mass of the valve and, to a lesser degree, the 1" pipe section.

The actual mass of the valve is not given in data currently available, therefore, a harmonic analysis was performed to determine a conservative value for an allowable valve mass. The analysis assumed a dynamic load factor of 25 and a nipple fabricated from Schedule 40 pipe. The results of this very conservative analysis indicate that the valve mass would have to be over 20 pounds for the nipple to fail. Based upon data found in valve manufacturers catalogs, a similar valve in the 600 pound class would weigh 11 pounds. It is concluded that the nipple may yield but will not fail. Thus there will be no loss of pressure integrity and interim operation prior to qualification of the conductivity cell poses no safety hazard, nor shall it hinder the safe shutdown of the plant.

JUSTIFICATION FOR INTERIM OPERATION

NAME: High Pressure Core Spray - Diesel Generator
- Motor Control Center
- Transformer
- Switchgear

MPL: E22-S001/S002/S003/S004

SAFETY FUNCTION:

To provide emergency power to the high pressure core spray pump motor.

FAILURE MODES:

Fail Open	X
Fail Closed	X
Loss of Power	X
Loss of Air	
Loss of Pressure Integrity	
Loss of Structural Integrity	X
Distortion of Mounting	X

FAILURE EFFECT:

A. Effect on Primary Use

Failure of the HPCS diesel generator, motor control center, transformer or switchgear could result in failure to inject high pressure cooling water into the reactor.

B. Secondary Effect

Failure of HPCS to operate under emergency conditions would cause the automatic depressurization system (ADS) to function, reducing reactor pressure to a level where the low pressure core spray system (LPCS) would supply the required cooling water.

DISCUSSION AND CONCLUSION:

The Grand Gulf high pressure core spray diesel generator, motor control center, transformer and switchgear experience only seismic loads and were therefore not reanalyzed during the Grand Gulf New Loads Program. Reevaluation to the SQRT criteria has not yet been completed. However, similar equipment has been seismically qualified to the IEEE-344-1971

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DISCUSSION AND CONCLUSION: (cont'd)

criteria with substantial margins. This equipments, therefore, would not be expected to fail under the seismic loads expected at Grand Gulf. Even if they did, the backup ADS and LPCS systems would provide backup emergency cooling water.

Therefore, interim operation with this equipment poses no safety hazard.

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2/19/82

JUSTIFICATION FOR INTERIM OPERATION

NAME: Switch

MPL: C41A-S01

SAFETY FUNCTION:

To start and stop the standby liquid control (SLC) system pump, and to open and close SLC valves.

FAILURE MODES:

Fail Open	X
Fail Closed	X
Loss of Power	____
Loss of Air	____
Loss of Pressure Integrity	____
Loss of Structural Integrity	____
Distortion of Mounting	____

FAILURE EFFECT:

A. Effect on Primary Use

1) Fail and Open Contact - System will stop functioning if it has been actuated. The pump and the storage tank outlet valve will be stopped or closed, although the explosive valve will remain open. The pump discharge pressure indicator and the storage tank level indicator can be used, along with the pump status light, to determine the failure of the system. The operator can then restart the system by the following alternatives:

   a) Turn the S01 switch again.

   b) Try other redundant switch for other loop.

   c) If all above fail, turn switch S03 to open the storage tank outlet valve, then go to local panel to start the appropriate pump.

2) Fail and Close Contact - System (pump, valve) will be actuated; i.e., pump started, explosive valve fired, and storage tank outlet valve opened. The operator does not need to operate the switch to start the system, if the system is required for operation.

FAILURE EFFECT: (Continued)

B. Secondary Effect

None

DISCUSSION AND CONCLUSION:

This switch is the same as those used for E12A-S03, E21A-S06, and E51A-S15 with the exception that it is key locked in the open position. The most reasonable failure mode would be chatter of the spring loaded contacts which will not be present in the post seismic environment when this system is more likely to be initiated. Even in the event of total failure of the switch, redundant pump start capability is availiable at a local control panel.

Further justification is provided by test results published by the manufacturer that indicate that this device has been qualified to response spectra that envelop the requirements for the Grand Gulf installation. A copy of the complete test report is being requested and it is anticipated that these results will demonstrate qualification of this switch to SORT requirements.

Based upon the information presented above, it is concluded that interim operation with this switch poses no safety hazard.

JUSTIFICATION FOR INTERIM OPERATION

NAME: Switch

MPL: E12A-S03

SAFETY FUNCTION:

To start and stop the residual heat removal (RHR) pump.

FAILURE MODES:

Fail Open	X
Fail Closed	X
Loss of Power	____
Loss of Air	____
Loss of Pressure Integrity	____
Loss of Structural Integrity	____
Distortion of Mounting	____

FAILURE EFFECT:

A. Effect on Primary Use

1) Fail Open - If manual initiation is required, the operator will have to start the pump from the local control station at the equipment. Automatic initiation is not effected.

2) Fail in Start Position - Starts the RHR pump. Damage to the pump is averted as the minumum flow bypass path is open, suction being taken from the suppression pool and being available. The operator has to open/close various valves for required mode of operation per normal procedure.

3) Fail in Stop Position - Trips the RHR pump if running. Failure in the tripped condition will prevent manual and automatic initiation.

B. Secondary Effect

None

DISCUSSION AND CONCLUSION:

This switch includes a spring return mechanism that returns the switch handle to the vertical, open circuit, position when released. Construction details of this switch show that failure in either the start or stop position might be possible if the seismic event occurs simultaneously with the operator holding the switch in either of these positions. Should this occur, the most likely mode of failure would be chatter of the spring loaded contacts rather than sticking in the start or stop positions. Since the starting circuit is a seal-in type, contact chatter would not effect the ability to start the pump during a seismic event.

Failure of the switch such that neither the start nor stop functions are available in the control room will not effect the automatic initiation circuit. In addition, a redundant manual switch is available at a local control panel should manual control be required.

Further justification is provided by test results published by the manufacturer that indicate that this device has been qualified to response spectra that envelop the requirements for the Grand Gulf installation. A copy of the complete test report is being requested and it is anticipated that these results will demonstrate qualification of this switch to SQRT requirements.

Based upon the information presented above, it is concluded that interim operation with this switch poses no safety hazard.

JUSTIFICATION FOR INTERIM OPERATION

NAME: Switch

MPL: E12A-S57, E21A-S07, E22A-S03

SAFETY FUNCTION:

These switches start and stop the water leg fill pumps in the residual heat removal (RHR) system, the high pressure core spray (HPCS) system and the low pressure core spray (LPCS) system.

FAILURE MODES:

Fail Open	X
Fail Closed	X
Loss of Power	
Loss of Air	
Loss of Pressure Integrity	
Loss of Structural Integrity	
Distortion of Mounting	

FAILURE EFFECT:

A. Effect on Primary Use

The failure of these switches does not affect the availability of the respective systems, if required for post-seismic action, as the water leg pumps are used only for priming the piping and keeping the system ready.

B. Secondary Effect

None

DISCUSSION & CONCLUSION

These switches are the same as those used for E12A-S03, E21A-S06 and E51A-S15. Construction details of these switches indicate the most reasonable failure mode would be chatter of the spring loaded contacts. This will not effect switch operability in a post-seismic environment. Even in the event of complete failure of these switches, the availability of the systems involved will not be affected.

Further justification is provided by test results published by the manufacturer that indicate that this device has been qualified to response spectra that envelop the requirements for the Grand Gulf installation. A copy of the complete test report is being requested, and it is anticipated that these results will demonstrate qualification of this switch to SQRT requirements.

Based upon the information presented above, it is concluded that interim operation with this switch poses no safety hazard.

JUSTIFICATION FOR INTERIM OPERATION

NAME: Switch

MPL: E21A-S06

SAFETY FUNCTION:

To start and stop the low pressure core spray (LPCS) pump.

FAILURE MODES:

Fail Open	X
Fail Closed	X
Loss of Power	____
Loss of Air	____
Loss of Pressure Integrity	____
Loss of Structural Integrity	____
Distortion of Mounting	____

FAILURE EFFECT:

A. Effect on Primary Use

1) Fail Open - If manual initiation is required, the operator will have to start the pump from the local control station at the equipment. Automatic initiation is not effected.

2) Fail in Start Position - Starts the LPCS pump. Damage to the pump is averted as the minimum flow bypass path is open, suction being taken from the suppression pool and being available. The operator has to open/close various valves for required mode of operation per normal procedure.

3) Fail in Stop Position - Trips the RHR pump if running. Failure in the tripped condition will prevent manual and automatic initiation.

B. Secondary Effect

None

DISCUSSION AND CONCLUSION:

This switch includes a spring return mechanism that returns the switch handle to the vertical, open circuit, position when released. Construction details of this switch show that failure in either the start or stop position might be possible if the seismic event occurs simultaneously with the operator holding the switch in either of these positions. Should this occur, the most likely mode of failure would be chatter of the spring loaded contacts rather than sticking in the start or stop positions. Since the starting circuit is a seal-in type, contact chatter would not effect the ability to start the pump during a seismic event.

Failure of the switch such that neither the start nor stop functions are available in the control room will not effect the automatic initiation circuit. In addition, a redundant manual switch is available at a local control panel should manual control be required.

Further justification is provided by test results published by the manufacturer that indicate that this device has been qualified to response spectra that envelop the requirements for the Grand Gulf installation. A copy of the complete test report is being requested and it is anticipated that these results will demonstrate qualification of this switch to SQRT requirements.

Based upon the information presented above, it is concluded that interim operation with this switch poses no safety hazard.

JUSTIFICATION FOR INTERIM OPERATION

NAME: Switch

MPL: E22B-S02/S07/S09/S10/S15/S16

SAFETY FUNCTION:

To control circuits in the high pressure core spray (HPCS) system circuit breakers.

FAILURE MODES:

Fail Open	X
Fail Closed	X
Loss of Power	
Loss of Air	
Loss of Pressure Integrity	
Loss of Structural Integrity	
Distortion of Mounting	

FAILURE EFFECT:

A. Effect on Primary Use

These switches are in the closing/indicating circuits of the diesel generator/transformer feeder breaker control of the HPCS Power Supply. Their failure does not affect the availability of safety equipment for post seismic operation.

B. Secondary Effect

None

CONCLUSION:

Interim operation before these switches are qualified poses no safety hazard.

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JUSTIFICATION FOR INTERIM OPERATION

NAME: Switch

MPL: E51 A-S15

SAFETY FUNCTION:

To start and stop the gland seal compressor in the reactor core isolation (RCIC) System.

FAILURE MODES:

Fail Open	X
Fail Closed	X
Loss of Power	
Loss of Air	
Loss of Pressure Integrity	
Loss of Structural Integrity	
Distortion of Mounting	

FAILURE EFFECT:

A. Effect on Primary Use

1) Fail Open - Since the RCIC system is designed for operating without the air compressor, this failure does not affect the availability of the RCIC System.

2) Fail In Start Position - Starts the compressor. Does not affect the availability of the RCIC System.

3) Fail In Stop Position - Trips the compressor. Failure in tripped position will prevent manual and automatic initiation. Does not affect the availability of the RCIC System.

DISCUSSION & CONCLUSION

Test results published by the manufacturer indicate that this device has been qualified to response spectra that envelop the requirements for the Grand Gulf installation. A copy of the complete test report is being requested, and it is anticipated that these results will demonstrate qualification of this switch to SQRT requirements.

Based upon the information presented above, it is concluded that interim operation with this switch poses no safety hazard.

JUSTIFICATION FOR INTERIM OPERATION

NAME: Balance of Plant Power Generation Control Complex (BOP/PGCC) Panels

MPL: H13-P855/P856/P864/P870/P871/P872/P877/P878

BACKGROUND:

The panels identified above were not in compliance with the SQRT criteria due to the lack of qualification testing.

STATUS:

To bring the panels identified above into compliance with the SQRT criteria, a two (2) part test program was undertaken by GE. Part One (1) of the test program involved an interim qualification test program and Part Two (2) involved full qualification testing.

Part One (1) of the qualification test program involved thermal aging to establish a service life of approximately one (1) year plus seismic testing.

Part Two (2) of the qualification test program involved thermal aging to establish a service life of 40 years plus seismic testing.

GE conducted the seismic testing in accordance with GE Specification No. 22A4320, Rev. 2 (attached), which meets the requirements of IEEE 344-1975.

GE has completed the interim qualification test program and has issued the interim qualification test report on December 11, 1981. The results of the interim test report indicate the above identified panels are justified for interim operation until the full qualification testing is completed in June of 1982.

Therefore, based upon engineering judgement and the interim qualification testing, the BOP/PGCC panels can perform their safety function and interim operation with these panels poses no safety hazard.

EIS Ident: SSMC QUAL CL IE ELEC EQPT

GENERAL ELECTRIC

NUCLEAR ENERGY DIVISION

REVISION STAT. SHEET

22A4320

CONT ON SHEET 2 SH NO. 1

DOCUMENT TITLE SEISMIC QUALIFICATION PROCEDURE FOR CLASS 1E ELECTRICAL EQUIPMENT

☒ SPECIFICATION ☐ DRAWING ☐ OTHER _____ TYPE TEST SPECIFICATION

FMF GENERAL USE

LEGEND OF DESCRIPTION OF GROUPS

MPL No. N/A

| - DENOTES CHANGE

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tlv	0	DMF-2873	
tljp	1	HL OCCHI DEC 2 1978 TPH NJ05195 CHKD BY J. Leahey 11-3-78 J LEAHEY	
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230 NL	230 SH	230 RF	230MS	537 DU
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PRINTS TO

DRAWN BY L VUJICH	APPROVAL RE HUTCHINGS June 16 1976	DEPT CSI	LOCATION San Jose
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1. SCOPE

1.1 This document describes a standard procedure to be used for the vibration testing of Control and Instrumentation essential (Class 1E) equipment used in GE Boiling Water Reactor power stations. This procedure will be used to qualify equipment to meet customer and Nuclear Regulatory Commission (NRC) seismic test requirements.

2. REFERENCE DOCUMENTS

2.1 General Electric Company Documents

a. Qualification Test Report Format Instruction 235A1327

2.2 Codes and Standards

a. IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations
- IEEE Standard 323-1974

b. IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations
- IEEE Standard 344-1975

3. DEFINITIONS

3.1 Class 1E Electrical Equipment. The safety classification of the electric equipment and systems that are essential to emergency reactor shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal, or otherwise are essential in preventing significant release of radioactive material to the environment.

3.2 Operating Basis Earthquake (OBE). That earthquake which could reasonably be expected to affect the plant site during the operating life of the plant; it is that earthquake which produces the vibratory ground motion for which those features of the nuclear power plant necessary for continued operation without undue risk to the health and safety of the public are designed to remain functional.

3.3 Safe Shutdown Earthquake (SSE). That earthquake which produces the maximum vibratory ground motion for which certain structures, systems, and components are designed to remain functional. These structures, systems, and components are those necessary to assure: (1) the integrity of the reactor coolant pressure boundary, and (2) the capability to shutdown the reactor and maintain it in a safe condition.

3.4 Response Spectrum. A plot of the maximum response of single-degree-of-freedom bodies, at a damping value expressed as a percent of critical damping of different natural frequencies, when these bodies are rigidly mounted on the surface of interest (ie, on the ground for the ground response spectrum or on the floor for the floor response spectrum) when that surface is subjected to a given earthquake's motion as modified by any intervening structures.

3.5 Required Response Spectrum (RRS). The response spectrum issued by the user or his agent as part of his specification for proof testing, or artificially created to cover future applications. The RRS constitutes a requirement to be met.

3.6 Test Response Spectrum (TRS). The response spectrum that is constructed using analysis or derived using spectrum analysis equipment based on the actual motion of the shake table.

4. EQUIPMENT AFFECTED

4.1 Control and Instrumentation products affected by this specification will be representative types selected from the Class 1 Equipment listed on the Master Parts Lists (MPL) for each plant.

4.2 Classification of Equipment

4.2.1 Control Panels and Racks. This category includes large enclosures and racks of various types into which instruments are mounted.

4.2.2 Instruments. This category includes electronic and electrical equipment, sensors, and parts which provide signals and/or alarms which are critical to Class 1E operation.

4.2.3 Pressure Boundary Devices. These are nonoperating mechanical piece parts which become part of the reactor primary pressure boundary and, therefore, must meet the material type and structural integrity requirements of Section III of the ASME Boiler and Pressure Vessel Code.

4.3 Selection of Equipment

4.3.1 The responsible design engineering organization shall select a generic test sample to represent a type of equipment based on its similarity in design and structural dynamics to other assemblies or components of the type.

5. EVALUATION METHODS

5.1 Control Panel and Rack Testing

5.1.1 Mounting. The control panel or rack shall be mounted on the shaker table using the attachment method and hardware used in actual service. Unless otherwise specified, control panel mounting bolts shall be tightened to a torque of 100 ± 10 pound-feet.

5.1.2 Loading and Monitoring

a. The control panel will be vibration tested with all devices and hardware mounted in place. The weight of any missing equipment must be simulated if the equipment would have a significant effect on the dynamic characteristics of the panel.

b. All Class 1E instruments should be operating and monitored for proper essential functions before, during, and after seismic testing.

c. In cases where it is not feasible to operate the active Class 1E instruments during vibration tests, previous instrument test results may be used to compare the fragility level of the instrument to the acceleration measurements made at the instrument location.

d. Accelerometers will be placed on the shaker table to measure input acceleration to the control panel. Accelerometers will also be located near the Class 1E instruments to measure the input acceleration to each device. The accelerations will also be used to obtain the panel transmissibilities. As many Class 1E device locations as possible should be monitored.

5.1.3 Frequency Range. The frequency range of interest for seismic testing is from 1 to 60 Hz.

5.1.4 Exploratory Tests. A low-level (~ 0.2 g) search for resonance will be conducted over the frequency range of 1 to 60 Hz. The input should be a continuous sinusoidal sweep at a rate no greater than two octaves per minute. The tests will be conducted once in each of three orthogonal axes. All resonant frequencies revealed will be recorded.

5.1.5 Shaker Table Input Motion. The type, magnitude, and frequency range of the motion should conform to requirements of the standard plant floor response spectrum curves (See Paragraph 5.1.5.4) and the damping and response characteristics of the equipment being tested. The test results should demonstrate that the equipment will operate successfully when excited to acceleration levels at least equal to those of the appropriate response spectrum curve. Acceptable table motion parameters are defined in the following subparagraphs.

5.1.5.1 Random or Response Spectrum. The table motion should have magnitude and frequency characteristics such that a test response spectrum would envelope either the required plant floor response spectrum or the standard plant response spectrum.

5.1.5.2 Direction. Shaker table input motion should consist of simultaneous excitation of one horizontal axis and the vertical axis. If independent random inputs are used, the test shall be performed twice with the equipment rotated 90 degrees in the horizontal plane between tests. If independent random inputs are not used, four tests must be run:

a. Inputs in phase

b. One input 180 degrees out of phase

c. Inputs in phase; equipment rotated 90 degrees horizontally

d. One input 180 degrees out of phase; same orientation as 'c'

5.1.5.3 Duration. Random excitation must continue for a minimum of 15 seconds.

5.1.5.4 Required Response Spectrum. The standard required response spectra for the BWR/6 standard plant are shown in Figures 1 and 2. These figures show the horizontal and vertical response, respectively, for control rooms at different damping ratios. Figures 3 and 4 show the dual-axis plant response spectrum curve presently used at the San Jose Test Facility for plants whose required response spectrum falls within that curve. Present machine capability at the facility limits accelerations to the values shown in Figures 3 and 4.

5.1.6 Operating Basis Earthquake (OBE) Tests. Vibration testing to a Safe Shutdown Earthquake (SSE) level must be preceded by five Operating Basis Earthquake (OBE) tests. These OBE tests are to demonstrate that a lower intensity earthquake will not affect essential performance or cause any condition to exist which, if undetected, would cause failure of essential performance during a subsequent SSE.

5.1.7 Test Data. Vibration tests of control panels should yield the following data:

a. Resonant frequencies

b. Transmissibility to Class 1E locations

c. Test response spectrum enveloping required response spectrum

d. Functional test results, before, during, and after vibration

5.2 Instrument Tests

5.2.1 If instruments are to be qualified separately and not as part of a panel assembly, instruments will be vibration tested using either sinusoidal or sinebeat motion as outlined in the following paragraphs. GE's Control and Instrumentation Engineering, with customer concurrence, may authorize deviations as long as requirements of IEEE Standard 344-1975 are met. The equipment to be tested shall be mounted on the shaker table in a manner that simulates the intended service mounting. The mounting method shall use the same bolt size, configuration, weld pattern, etc, as will be used in actual service. The effect of electrical connections, cables, conduits, etc, shall be considered. Class 1E critical operation will be monitored before, during, and after vibration. A vibration qualification test will be conducted first, at the required minimum acceleration levels and frequency range, to measure axis coupling and resonances. This test will be followed by a fragility level test at the resonances (if any) to determine the maximum acceleration required to cause a nondestructive operational failure. If the instrument does not have a resonant frequency in the 1 to 60 Hz range, the fragility test shall be run at 60 Hz. If single frequency testing shows that the device has more than one resonance and these resonances are not widely spaced, then random motion testing must be performed as outlined in Paragraph 5.1.5.

5.2.2 Vibration Qualification Test. The equipment to be tested will be mounted to the surface of the shaker table using the identical attachment method and mounting hardware to be used in service. The equipment will be subjected first to continuous sinusoidal vibration over the 1 to 60 Hz frequency range in at least one-third octave increments. A minimum input acceleration level of 1.75 g for both horizontal and vertical axes will be used.

5.2.2.1 In case of an equipment manfunction, the test will be repeated using sinebeat excitation (ten pulses per beat). Any resonant frequencies detected, and the resulting modes, will be reported. In addition, measurements will be made of the coupling effect (vs frequency) in each axis to the other two axes. If no resonances are detected, the frequency will be increased above 60 Hz until either the first resonance is identified or 100 Hz is reached, whichever comes first.

5.2.3 Vibration Fragility Test. A vibration fragility level test will be performed after the qualification tests. Frequency scans of 1 to 60 Hz with an interval of one-third octave or less will be made. The amplitude of the acceleration will be increased after each scan until a nondestructive malfunction is observed or until the shaker system limit is reached.

5.2.3.1 Upon completion of vibration, the mounting hardware will be inspected and its condition reported. The instrument will also be tested to demonstrate that seismic tests have not affected normal functions.

5.2.4 Test Data. Vibration tests of instruments should provide the following data:

a. Resonant frequencies, if any, within 1 to 60 Hz

b. Graph of fragility level vs frequency for each axis

c. Failure mode at frequency level

d. Transmissibility to components (applicable to large instruments)

e. Functional test results, before, during, and after vibration

5.3 Primary Pressure Boundary Device

5.3.1 The stresses in the material of the primary pressure boundary devices will be calculated to ensure that the combined effects of seismic and normal operating loads will not exceed the stress limits of ASME Boiler and Pressure Vessel Code, Section IV and VIII. Seismic vibration forces will be assumed to be applied statically at the center of mass. These forces will be determined from the accelerations specified in Section 5.2.2 and modified by any known transmission by the mounting structure of resonances in the 1 to 60 Hz frequency band.

6. BASIS OF ACCEPTABILITY

6.1 Acceptability will be based on written assurance of the ability of the equipment to withstand mechanical stresses or to perform its Class 1E functions during seismic vibration without generating spurious signals which might result in a false safety action. Proof will be manifest in the following ways.

6.1.1 Control Panels and Racks. Control panels and racks must be rigid or have damping characteristics that will prevent an acceleration input to any Class 1E instrument that is greater than its fragility level. The word 'rigid', as used here, is defined as having no resonances in the frequency range of 1 to 60 Hz. The panels and racks must demonstrate their ability to meet the test requirements and the test results must be formally documented.

6.1.2 Instruments. Formally documented test results must show that instruments will comply with their Class 1E requirements under the conditions of Paragraph 5.2.2.

6.1.3 Primary Pressure Boundary Devices. Pressure boundary devices will be considered qualified if the calculated and documented combined seismic and normal loads do not exceed the allowable ASME limits.

7. TEST EQUIPMENT CALIBRATION

7.1 Test equipment used for these tests must be in calibration as indicated by the date of calibration on a posted label. If equipment is uncalibrated or out of calibration, the equipment must be calibrated before use and the date of the next calibration affixed.

8. DOCUMENTATION

8.1 A Seismic Qualification Report will be prepared as a permanent and auditable record of the test results.

8.2 Seismic Qualification Report

8.2.1 A comprehensive test report will be prepared in accordance with the provisions of Document 235A1327, Qualification Test Report Format Instruction. In addition to the requirements of this instruction, the following material should be included.

a. Complete identification of the equipment tested.

b. Test facility location.

c. Test equipment used with its serial number and date of previous calibration and due date of next calibration.

d. Test methods and procedures.

e. Description and sketches or photographs of the mounting of the test specimen to the shaker table. The description should include the size, number, and torque of the mounting bolts as well as the weight and dimensions of the test specimen.

f. Photographs of the test setup for all three axes, including accelerometer locations and other special details.

g. Drawings and equipment lists which identify the Class 1E instruments and their location on a control panel, if the test specimen is a panel.

8.2.1 (Continued)

h. Graph of the required response spectrum and the test response spectrum plotted together to show the design margin.

i. Appropriate photographs. Examples: broken structural members, oscillograph or recorder traces of key accelerometer signals with input and output axes labelled, location of accelerometers, calibration information.

j. Recommendations for design changes should be included if instruments or panels fail to meet seismic requirements.

k. Signature and date.

8.3 Seismic Qualification Summaries. Deleted

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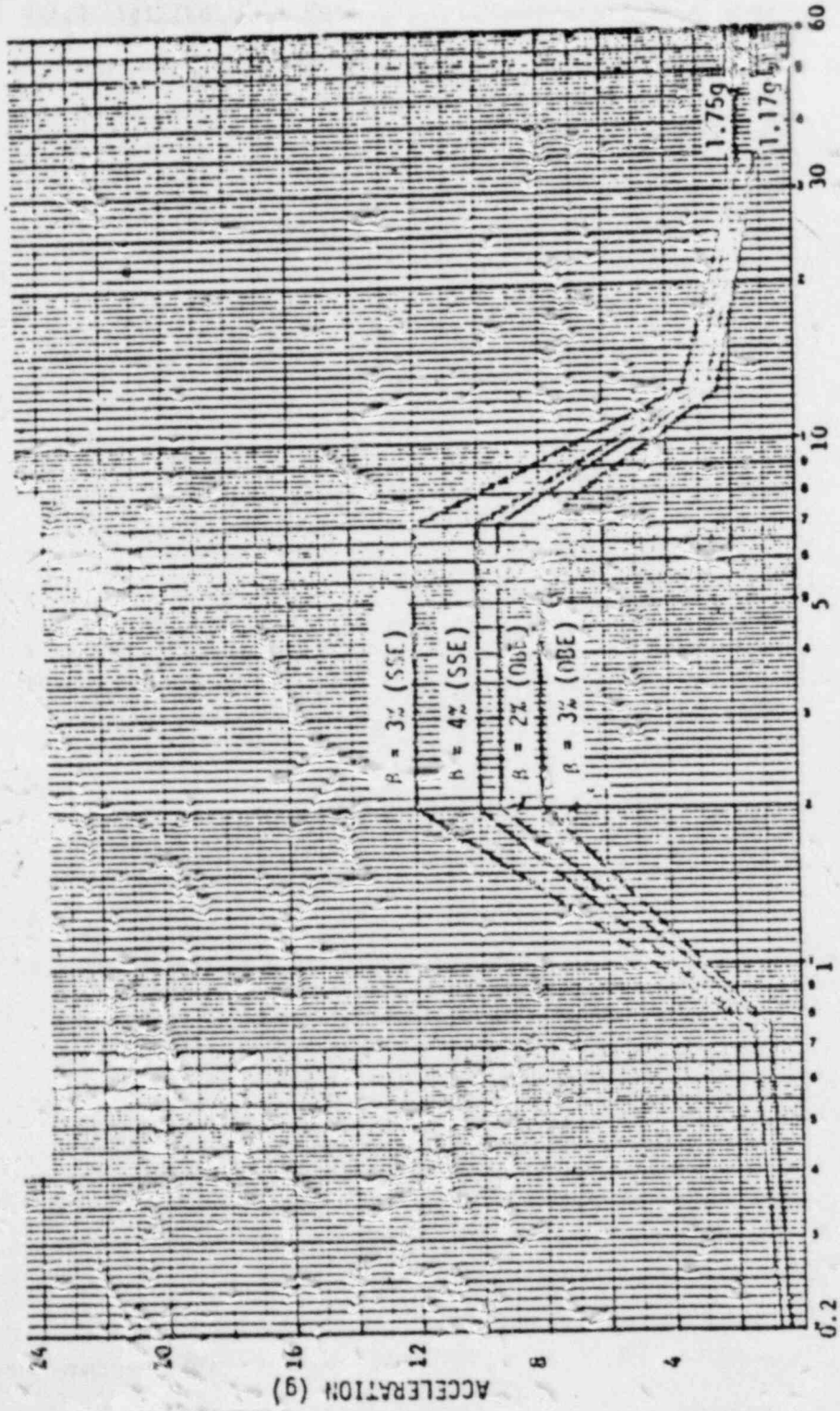

FIGURE 1 HORIZONTAL SPECTRUM

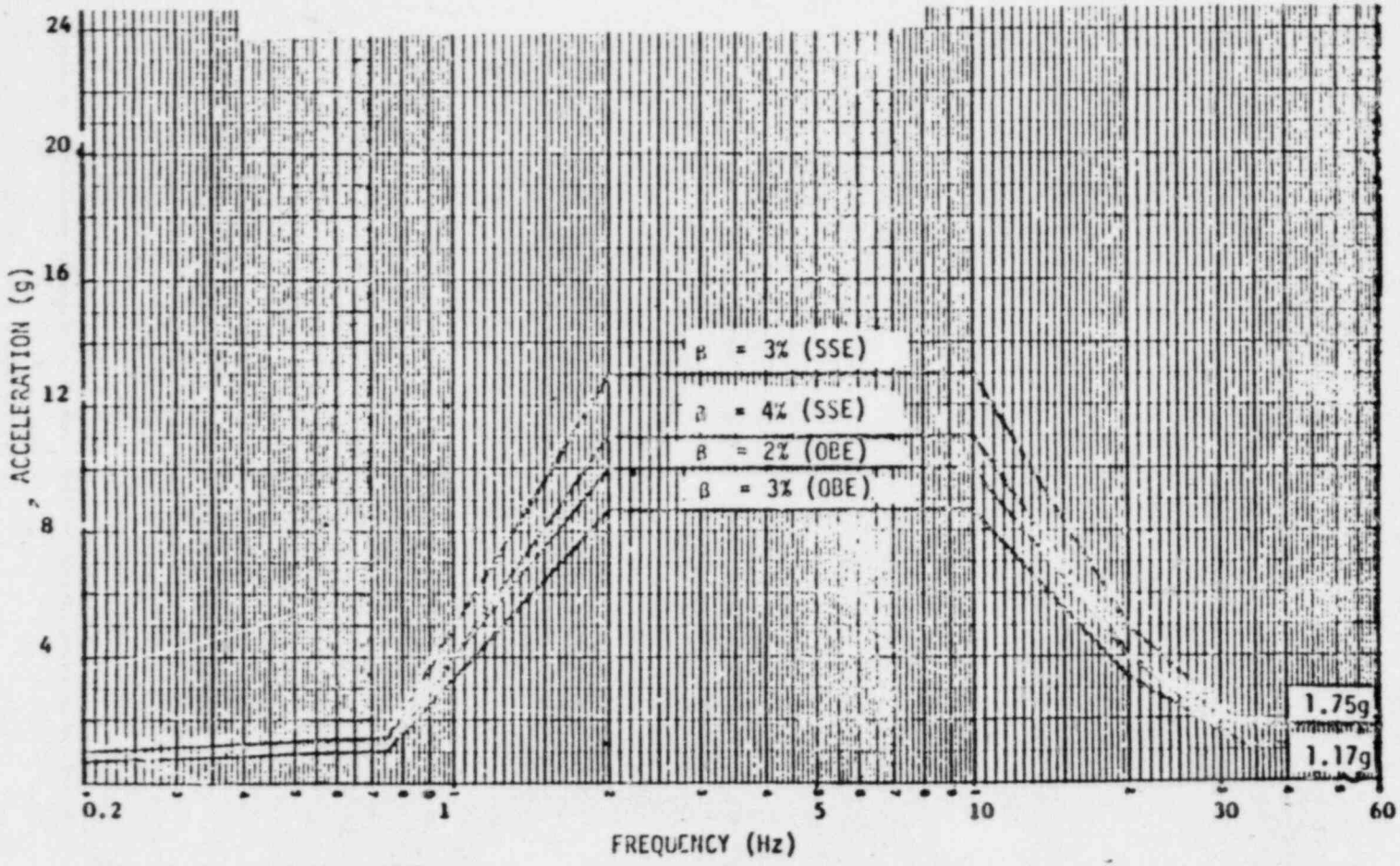

FIGURE 2 VERTICAL SPECTRUM

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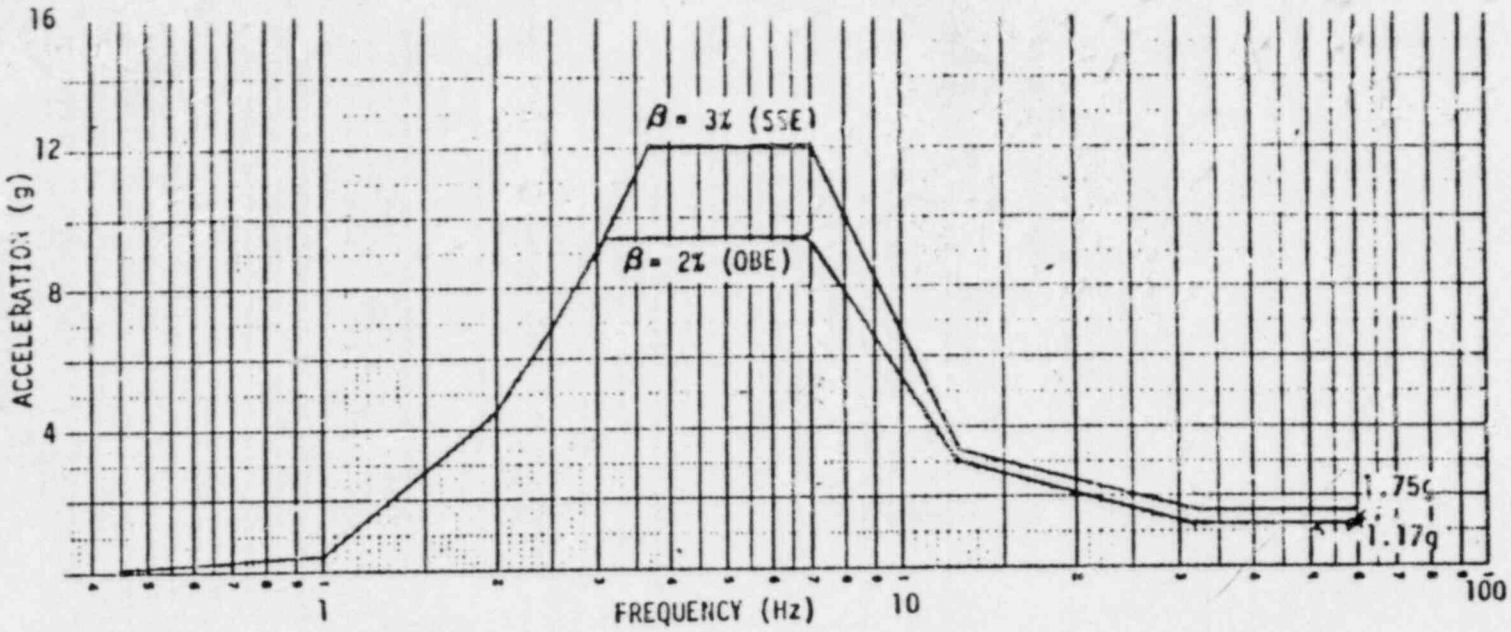

FIGURE 3. SEISMIC TABLE CAPABILITY, HORIZONTAL SPECTRUM

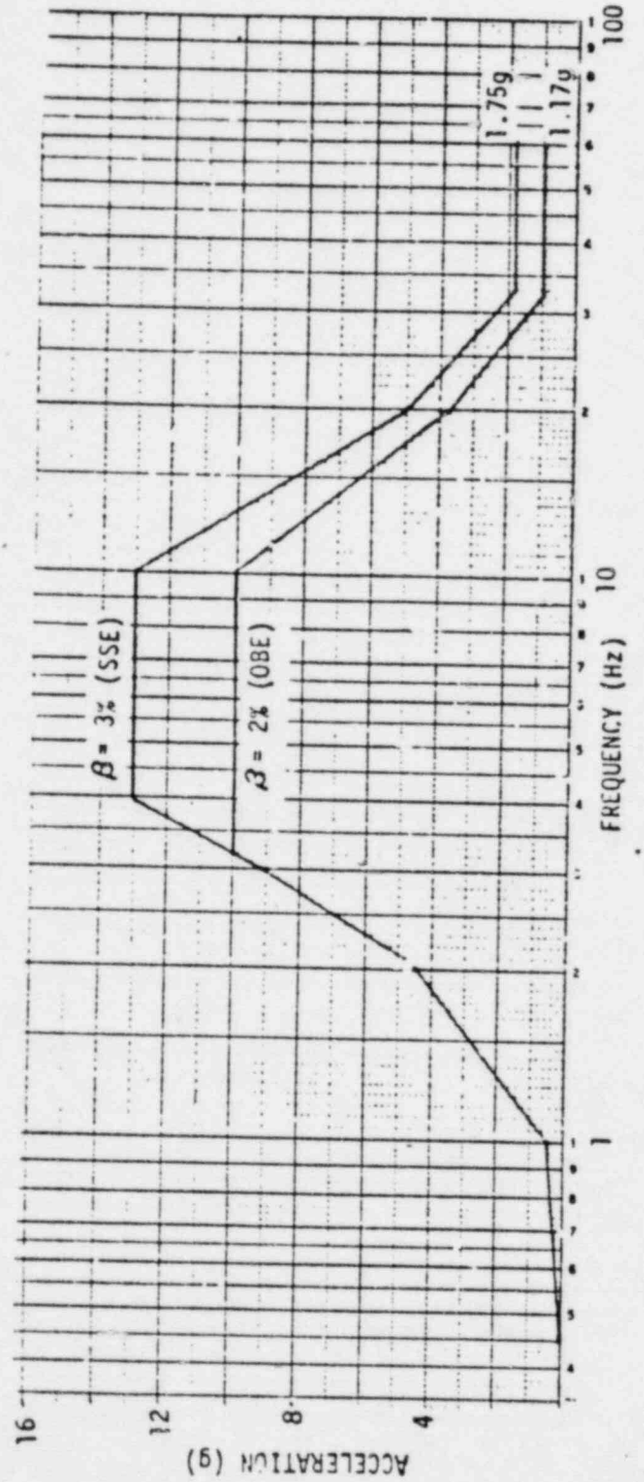

FIGURE 4. SEISMIC TABLE CAPABILITY, VERTICAL SPECTRUM