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February 3, 1983

In the Matter of	)	
	)	Docket Nos. 50-329-OM
CONSUMERS POWER COMPANY	)	50-330-OM
	)	50-329-OL
(Midland Plant, Units 1 and 2)	)	50-330-OL

Charles Bechhoefer, Esq.
Atomic Safety & Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dr. Jerry Harbour
Atomic Safety & Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dr.Frederick P. Cowan
6152 N. Verde Trail
Apt. B-125
Boca Raton, Florida 33433

Dear Administrative Judges:

During the hearings which were held in November and December, 1982, Applicant agreed to provide (or in one case, to consider providing) the parties and the Board with the following additional information:

1. List of Category I structures not included in Seismic Margin Review (see Tr. 9720).

2. List of Underground Pipe & Conduit hit by Drilling (Tr. 10137).

3. Certain "Raw Data" from Quality Improvement Plan (Tr. 10146; there is no promise to provide this data but we said we would consider doing so.)

D502

4. Possible Inappropriateness of Using Al Oxide grinding wheels because of alleged ferric oxide contamination (Tr. 10005).

5. New boring information referred to in Mr. Brunner's examination of Dr. Woods (Tr. 9768).

6. Dr. Peck's analysis of recent settlement data (Tr. 10406).

7. Exhibit 29 as redrafted, relating to DGB crack monitoring (Tr. 11072)

8. Seismic Analysis of Certain Underground Piping (Tr. 9043).

9. We promised to confirm that separation of DGB from electrical duct banks is about 2 inches (Tr. 10921).

10. List of Underground Piping protected by the galvanic protection system. (Tr. 10137).

This letter and the enclosures constitute Applicant's response to all of the above items, except Nos. 6, 7 and 10. Item No.7, Exhibit 29R was sent to the Board and all parties on January 17, 1983. We hope to submit responses to Items 6 and 10 in the near future.

Applicant's Response to Item 1.

Enclosure A is a response prepared by a CPCo engineer under the supervision of Dr. Thiruvengadam.

Applicant's Response to Item 2.

Enclosure B is a response prepared by an engineer working with Consumers Power Company's Legal Department.

Applicant's Respnse to Item 3.

Applicant has decided not to provide this Quality Improvement Program "raw data" for the reasons stated at the hearings by Mr. Brunner. (Tr. 10140-10146). If Ms. Stamiris wishes to pursue the matter we assume she will file an appropriate motion with the Board.

Applicant's Resonse to Item 4.

Enclosure C was prepared by an engineer working with the Consumers Power Company's Legal Department, who investigated the substance of Ms. Sinclair's concern about possible ferric oxide contamination of grinding wheels. Based on this investigation, Applicant does not perceive a problem and does not intend to pursue the matter further. Mr. Brunner sent the Board and the parties a copy of NCR MO1-9-2-172, which is referred to in this response, on December 14, 1982.

Applicant's Response to Item 5.

See Enclosure D, which was prepared by an engineer working with CPCo's Legal Department.

Applicant's Response to Item 8.

See Enclosure E, the Affidavit of Dr. Thiru Thiruvengadam. Dr. Thiruvengadam explains that even though Bechtel used the FSAR SSE (0.12g) in developing the seismic

input for the analysis of the buried service water piping which is to be reinstalled, it did so in such a conservative way (using enveloping floor response spectra from inside the SWPS for service water piping buried outside the SWPS) that the actual seismic input to the analysis exceeded the SSRS.

Applicant's Response to Item 9.

Applicant has confirmed by reference to design drawings, field records, and by interviews with construction personnel who did the work, that a minimum horizontal clearance between the walls of the Diesel Generator Building and the duct banks is 2 inches. (The vertical clearance is 12 inches).

By providing this information, Applicant does not concede that these are issues that have to be taken up in the hearings. We expect, of course, that the list of Category I structures not included in the seismic margin review may be relevant to further testimony by Dr. Kennedy when the results of the seismic margin review are discussed in subsequent stages of the operating license proceeding. We assume that Ms. Stamiris may use the information provided in Item 2 in her cross-examination of Mr. Bird and Mr. Wheeler concerning similar drilling incidents at the site. Similarly, the information supplied about duct bank clearances (Item 9) may be relevant to Dr. Shunmugavel's duct bank testimony filed January 24, 1983. But Item 4 (ferric oxide contamination of

grinding wheels) has never been an issue in controversy in this proceeding. The significance of the new boring information provided to Ms. Stamiris in Item 5 has already been addressed in Dr. Woods' testimony. Applicant hopes that the affidavit of Dr. Thiruvengadam obviates any need for further evidentiary presentation on seismic analysis of buried service water piping (Item 8). We request that the other parties or the Board let us know a reasonable time in advance of February 14 if there is a need to cross-examine Dr. Thiruvengadam concerning his affidavit.

Sincerely,

Philip P. Steptoe
One of the Attorneys for
Consumers Power Company

cc Service List

Isham, Lincoln & Beale
3 First National Plaza
Chicago, Illinois 60602
(312) 558-7500

ITEM 1

SEISMIC MARGIN STUDY SCOPE (TR. 9720)

While discussing the scope of the seismic margin study it was stated that only Category I structures, containing equipment which is necessary for the safe shutdown of the plant, were included. Although that included most of the Category I structures, the Applicant agreed to identify those Category I structures, as defined in subsection 3.8.4.1 of the FSAR, that have not been considered in the seismic margin review. They are as follows:

. Retaining walls, valve pits, and meter pits associated with the Service Water Pump structure

. The Feedwater Isolation Valve Pits

. Foundations for the control room pressurization tanks, and

. Foundations for the penetration pressurization tanks.

The reasons for their exclusion will be provided by Dr. R P Kennedy to the NRC Staff when the results of the Seismic Margin Review program are presented.

Item 2

List of underground pipe and conduit hit by drilling (TR 10137).

Ms. Stamiris requested that "the Board direct the applicant to provide us with a complete list of all the unanticipated events that have occurred at the Midland Site and regarding any of the Soils Remedial Work which would include the borings and the drillings associated with "dewatering," Pages 10136 and 10137 of the transcript.

Investigation of this "complete list," which included contacts with personnel within Bechtel's Site Management Office, Bechtel's QC Section, Bechtel's Ann Arbor Office, CP Co's Site Contraction Management Office and CP Co's NPQAD Office indicates that a "complete list" of underground utility damage that has occurred at the Midland Plant does not exist.

The history of reporting, repairing and logging damaged underground utilities was based on whether the utility was Q or Non-Q. In the event the utility was Non-Q, the utility (pipes, duct, line, etc) was identified and repaired. Each occurrance was not similarly logged on a master damage list. If the incident was significant in cost or time of repair, a file was kept.

Damage to underground utilities which were Q-listed entailed a different type of response. Q-listed items which are damaged to the extent they become "reportable" have either Bechtel and/or CPCo NCRs or other type of action document written against that damaged item. The issuance of an action document for Q-related damage is mandatory and both Bechtel

and CP Co. Project Management maintain that on all Q-related damaged items, which were reportable, an action document was produced. The most comprehensive approach to the logging (listing) of underground utilities damaged is the compilation of various logs from Bechtel and CP Co, which on a monthly basis is summarized and distributed with enclosures. This month' report is the ALAB-106 monthly report for Docket Nos. 50-329 and 50-330.

The ALAB-106 monthly report contains Associated Quality Action Requests (QAR's) and Non-Conformance Reports (NCR's), written or closed during the month the QAR's, NCR's are logged in the following documents, which comprise the ALAB-106 monthly report.

1. Bechtel Nonconformance Reports.
2. Sheets from the Bechtel Nonconformance Report Log.
3. Bechtel Quality Action Requests.
4. Bechtel Management Corrective Action Requests.
5. Bechtel Quality Action findings.
6. Bechtel FLAGS Quality Action Reports.
7. Babcock and Wilcox Reports of Nonconformity.
8. Babcock and Wilcox In-Service Inspection Nonconformance Reports.
10. Quality Action Requests.
11. Corrective Action Reports.
12. Management Corrective Action Reports.

Unfortunately, none of this material is indexed in a way which would allow one to identify those documents which relate to drilling incidents

in accordance with Ms Stamiris' request. Therefore, to be sure of a complete list one would have to examine each NCR, QAR etc. since the start of construction, which would be unreasonably burdensome. We do not believe that under NRC rules Applicant would be required to perform such a compilation even if discovery were still open.

Notwithstanding the foregoing, a Bechtel employee named Bill Netzela kept an unofficial log of such incidents for a period of time in 1982. This log is provided. In addition, we provide a list prepared by an engineer working with CPCo's legal department which includes the items in Mr. Netzela's list, the NCR's discussed by Mr. Bird and Mr. Wheeler in their testimony, and all other drilling incidents of this nature which Bechtel and CPCo employees at the site and in Ann Arbor could recall. Thus we have made reasonable efforts to prepare a list which includes all the drilling incidents that we (the CPCo Legal Department IL&B, and the persons at Bechtel and CPco we talked to) know about. We have also included NCR 2072, a 1979 incident which we discovered in the course of our investigation.

NCR No.		Description		Date Damaged
M01-4-2-008		42" Hole for Cassion	(Q)	02-25-82
M01-9-2-038		Two 4" Test Borings	(Q)	03-8-82
M01-9-2-051		Bwst #2, Exc. Beneath Valve Pit	(Q)	04-21-82
4199		Drilled into Deep Elect. Duct Bank	(Q)	04-29-82
4245	A.	Created Void at Observation Well #4	(Q)	05-19-82

NCR No.	Description		Date Damaged
	B. Damaged 12" Circulating Water Line		
No Action	Damaged Water Line While Drilling DSB-ANI	(Non-Q)	04-16-82
No Action	Abandoned Sewer Line	(Non-Q)	02-4-82
No Action	72" Pond Fill Line	(Non-Q)	04-13-81
No Action	Damaged Man Hole #10	(Non-Q)	04-16-82
4252	Ejector Well Drilled Without QC Inspection	(Q)	09-23-83
4265	Ejector Well ME-54 Drilled Leaving Sloughing Around Hole	(Q)	05-28-82
No Action	Electric Grid Ground		01-13-82
No Action	Electric Grid Ground		01-19-82
No Action	Railroad Communications(?)		01-19-82
No Action	Damaged Diesel Oil Line		01-19-82
No Action	Damaged Gas Line		01-21-82
No Action	Damaged Gas Line		01-26-82
No Action	Damaged Grid Ground		02-2-82
No Action	Damaged Oil Waste Line		02-25-82
---	Damaged Rubber Coating	(Q)	03-1-82
No Action	Damaged Grid Ground		03-1-82
No Action	Damaged Grid Ground		03-1-82
No Action	Damaged Grid Ground		03-1-82
No Action	Damaged 2" Metal Line		03-14-82
No Action	Damaged Elect. Duct Bank		03-29-82
No Action	Damaged Temp. Gas Line		04-27-82

2/3/83

NCR No.	Description	Date Damaged
No Action	Damaged Elect. Duct Bank	04-24-82
2072	Damaged Elect. Duct Bank (Q)	04-6-79

BORING LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
MIDLAND POWER PLANT	7220-101	1 of 1	SWL-3

SITE	COORDINATES	ANGLE FROM HORIZ.	BEARING
Between Units 1 & 2 Service Water Line	S 4980 E 725	90°	N. A.

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN(FT.)	ROCK(FT.)	TOTAL DEPTH
4/6/79	4/6/79	Raymond International J. Hamman	Mobil B-61	3 3/4"	-	None	21.0'

CORE RECOVERY(FT.)/%	CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
N. A.	N. A.	8	N. A.	635.0	Not Determined	N. A.

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA. DEPTH	LOGGED BY:
140 lb. / 30 inches	None	L. Matthews

SAMPLE TYPE AND DESIGNATION	SAMPLER ADVANCE (CORE BARREL)	SAMPLE RECOVERY (CORE RECOVERY)	SAMPLE BLOWS "N" PERCENT CORE RECOVERY	PENETRATION BLOWS 0-6"	6-12"	12-18"	ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							635.0	0				
											0-2.5' No samples (Fill)	Augered to 7.5'.
							632.5					Pushed casing to 8.3' and began wash boring with roller bit and recirculating water.
SS 2"	18	10	8	6	5	3				1	2.5-4' Silty Clay, gray, damp, medium stiff, little fine-coarse sand, trace fine gravel (CL)(Fill)	
							631.0					
							630.0	5			4-5.5' Fine-medium Sand, yellow brown, damp, medium dense (SP)(Fill)	
SS 2"	18	11	8	2	4	4				2	5.5-18.5' Sandy Clay, gray to brown, damp to moist, soft to medium stiff, trace fine gravel(CL)(FILL)	
SS 2"	18	10	4	2	2	2				3	5.6' Trace paper and black organic material	
								10				
SS 2"	18	11	8	6	3	5				4		
SS 2"	18	6	3	1	1	2				5		
								15				
SS 2"	18	4	3	1	1	2				6		
SS 2"	18	11	8	4	4	4				7		
							615.0				18.5-18.9' Fine-medium gravel, gray, wet, loose (GP) (Fill)	Lost portion of drill fluid at 18.5'.
								20			18.9-19.5' Silty Clay, yellow brown, damp to moist, medium stiff, trace fine sand and fine gravel (CL) (Fill)	Lost additional drill fluid at 19.5'.
SS 2"	6	6	-	5	Refusal		614.0			8	19.5-20.5' Silty medium-coarse Sand and fine-medium Gravel, gray to gray brown, wet, loose (SM-GM) (Fill)	Used drilling mud from 20' to 21'.
											20.5-21' Hard, lost drill mud	Very slow drilling from 20.5-21' (rods bouncing).
											Bottom of boring at 21 feet	Lost mud return after drilling through hard material at 21'-flushed hole with clear water but unable to overflow casing with pump wide open.
												Boring grouted to ground surface

SS = SPLIT SPOON ST = SHELBY TUBE
D = DENISON P = PITCHER O = OTHER

SITE	HOLE NO.
Between Units 1 & 2 Service Water Line	SWL-3

Reference

Lynn Curtis

S/U. Non Testable Unit.

NONCONFORMANCE REPORT

1. PROJECT NAME: Midland
JOB NO.: 07220
19. NO. 2072
20. PAGE 1 OF 1

2. UNIT(S): II
3. DRAWING/PART NO.: E-510
REV: 11
4. ITEM DESCRIPTION: Conduit 2BA074
5. ITEM LOCATION: Service Water Struct.

6. P.O. OR SPEC NO.: N/A
7. SERIAL NO.: N/A
8. REPLACEMENT PART P/N N/A REV N/A SER NO. N/A
9. SOURCE: Construction
10. CONTRACTOR/SUPPLIER: N/A

11. INSPECTION CRITERIA ( ) DWG ( ) SPEC (X) OTHER — IR NO. E-1.0 NO. C/W
12. ASME AUTHORIZED INSPECTION REQ'D ( ) YES (X) NO
13. SKETCH ATTACHED ( ) YES (X) NO
14. Discovered During ( ) Rec'g (X) Const ( ) Test
15. Equip Furnished By ( ) Client ( ) Eng (X) FLD

16. NONCONFORMING CONDITION:

Conduit 2BA074 entering Service Water Structure through North wall at Elevation 621' from duct bank, has a stream of water about the size of a pencil flowing from it. For location refer to drawing E-510Q Section D.

Q-List # 3.006 One (1) Hold Tag X Applied Hold For Engineering Disposition

17. REPORTED BY: CE Bractinkernes DATE: 4/16/79
18. VALIDATED BY: TK Barclay DATE: 4-16-79

21. ROUTING: (X) TO FIELD ENGINEERING ( ) TO OTHERS (SPECIFY)

22. (x) Field Engineering Disposition ( ) Field Engineering Recommended Disposition to Project Engineering

Conduit to be repaired in accordance with note 27, sheet 11B, of Dwg E-42(Q). [signature]

N.B. Hayes 7/11/79

Route to Project Engineering for repair disposition

[signature]

23. PROJECT ENGINEERING DISPOSITION

Repair conduit 2BA074 per DCN 112 against dwg. E-42. G. R. Whitaker 3/6/80 Thomas [signature] 3-6-80

DCN 112 against dwg. E-42(Q) has been issued

24. DISPOSITION CONCURRENCE

rework	reject	repair	use as is
		✓	

PROJECT FIELD ENGINEER: [signature] DATE: 7-11-79
PROJECT ENGINEER: DATE:
PROJ CONSTR QC ENGINEER: TK Barclay DATE: 7-17-79
AUTHORIZED INSPECTOR: DATE:

concurrence

25. DISPOSITION RESULTS

26. QC ACCEPTANCE
QC ENGINEER DATE
AUTHORIZED INSPECTOR DATE

NONCONFORMANCE REPORT (CONT'D)

20. PAGE ___ OF ___ 19. NCR NO. 78-5-80

24. Disposition Concurrence
Item

REWORK	REJECT	REPAIR	USE AS IS
		X	

PROJECT FIELD ENGINEER [signature] — DATE 3/7/80
PROJECT ENGINEER [signature] — DATE 3/10/80
PROJECT CONSTR QC ENGINEER — DATE
AUTHORIZED INSPECTOR — DATE

24. Disposition Concurrence
Item

REWORK	REJECT	REPAIR	USE AS IS

PROJECT FIELD ENGINEER — DATE
PROJECT ENGINEER — DATE
PROJECT CONSTR QC ENGINEER — DATE
AUTHORIZED INSPECTOR — DATE

24. Disposition Concurrence
Item

REWORK	REJECT	REPAIR	USE AS IS

PROJECT FIELD ENGINEER — DATE
PROJECT ENGINEER — DATE
PROJECT CONSTR QC ENGINEER — DATE
AUTHORIZED INSPECTOR — DATE

24. Disposition Concurrence
Item

REWORK	REJECT	REPAIR	USE AS IS

PROJECT FIELD ENGINEER — DATE
PROJECT ENGINEER — DATE
PROJECT CONSTR QC ENGINEER — DATE
AUTHORIZED INSPECTOR — DATE

24. Disposition Concurrence
Item

REWORK	REJECT	REPAIR	USE AS IS

PROJECT FIELD ENGINEER — DATE
PROJECT ENGINEER — DATE
PROJECT CONSTR QC ENGINEER — DATE
AUTHORIZED INSPECTOR — DATE

24. Disposition Concurrence
Item

REWORK	REJECT	REPAIR	USE AS IS

PROJECT FIELD ENGINEER — DATE
PROJECT ENGINEER — DATE
PROJECT CONSTR QC ENGINEER — DATE
AUTHORIZED INSPECTOR — DATE

24. Disposition Concurrence
Item

REWORK	REJECT	REPAIR	USE AS IS

PROJECT FIELD ENGINEER — DATE
PROJECT ENGINEER — DATE
PROJECT CONSTR QC ENGINEER — DATE
AUTHORIZED INSPECTOR — DATE

24. Disposition Concurrence
Item

REWORK	REJECT	REPAIR	USE AS IS

PROJECT FIELD ENGINEER — DATE
PROJECT ENGINEER — DATE
PROJECT CONSTR QC ENGINEER — DATE
AUTHORIZED INSPECTOR — DATE

24. Disposition Concurrence
Item

REWORK	REJECT	REPAIR	USE AS IS

PROJECT FIELD ENGINEER — DATE
PROJECT ENGINEER — DATE
PROJECT CONSTR QC ENGINEER — DATE
AUTHORIZED INSPECTOR — DATE

24. Disposition Concurrence
Item

REWORK	REJECT	REPAIR	USE AS IS

PROJECT FIELD ENGINEER — DATE
PROJECT ENGINEER — DATE
PROJECT CONSTR QC ENGINEER — DATE
AUTHORIZED INSPECTOR — DATE

24. Disposition Concurrence
Item

REWORK	REJECT	REPAIR	USE AS IS

PROJECT FIELD ENGINEER — DATE
PROJECT ENGINEER — DATE
PROJECT CONSTR QC ENGINEER — DATE
AUTHORIZED INSPECTOR — DATE

24. Disposition Concurrence
Item

REWORK	REJECT	REPAIR	USE AS IS

PROJECT FIELD ENGINEER — DATE
PROJECT ENGINEER — DATE
PROJECT CONSTR QC ENGINEER — DATE
AUTHORIZED INSPECTOR — DATE

(1)

FIELD ENGINEER'S REPORT FORM

MIDLAND UNITS 1 & 2

JOB 7220 DATE 29 MAY 79 PAGE 1 OF 3

ITEM NO	INSPECTION DESCRIPTION	ACTION REQUIRED/TAKEN
	PURSUANT TO RESOLUTION OF NCR # 2072, REGARDING EMBEDDED CONDUIT 2BA074, THE FOLLOWING INSPECTION WAS PERFORMED:	
	ALL UNUSED CONDUITS IN THE ASSOCIATED DUCTBANKS WERE INSPECTED AS DESCRIBED ON ATTACHED FSK-EY-136 REV 0. RESULTS ARE NOTED BELOW	

CONDUIT	REMARKS
1BA037	CABLE IN CONDUIT
1BA001	PRESSURE DROP 100 → 40 PSIG IN 15 MINUTES
1BA003	NO SIGNIFICANT PRESSURE DROP
1BA038	" " " "
1BA002	" " " "
1BA004	CABLE IN CONDUIT
1AA017	NO SIGNIFICANT PRESSURE DROP
2BA042	CABLE IN CONDUIT
2BA044	NO SIGNIFICANT PRESSURE DROP
2BA043	" " " "
1AA060	CABLE IN CONDUIT
1AA061	PRESSURE DROP 100 → 40 PSIG IN 15 MINUTES
2AA062	NO SIGNIFICANT PRESSURE DROP
2AA063	" " " "
2EA029	CABLE IN CONDUIT

REMARKS:

ATTACHMENT: FSK-EY-136-20

SIGNATURE JRKNOKE

ROUTE

DFM MATTHEWS
HARPER
WNIELSON
THOMPSONS

FILE

FIELD ENGINEER'S REPORT FORM

MIDLAND UNITS 1 & 2

JOB 7220 DATE 29MAY79 PAGE 2 OF 3

~~ITEM NO~~	~~INSPECTION DESCRIPTION~~	~~ACTION REQUIRED/TAKEN~~
CONDUIT	REMARKS	
ZBA073	NO SIGNIFICANT PRESSURE DROP	
ZBA074	NO RESISTANCE TO PRESSURE. SUBSEQUENTLY, THIS CONDUIT WAS PRESSURIZED WITH WATER WHICH BUBBLED TO THE SURFACE AT APPROX COORDINATES S4980 / E725. THIS POINT IS COINCIDENT WITH A SITE BORING LOCATION NOTED ON DRAWING C-1145(G) REV 2, WHICH IS ASSUMED TO BE THE CAUSE OF THE LEAK NOTED ON REFERENCED NON-CONFORMANCE REPORT	
ZAA001	CABLE IN CONDUIT	
ZAA004	NO SIGNIFICANT PRESSURE DROP	
ZAA005	" " "	"
ZAA002	CABLE IN CONDUIT	
1AA004	" " "	
1AA005	" " "	
1AA002	NO SIGNIFICANT PRESSURE DROP	

WITH THE EXCEPTION OF ZBA074, A FIBER MANDREL* WAS PULLED BY HAND THROUGH EACH INSPECTED CONDUIT, WITH NO CONSEQUENTIAL OBSTACLES.

*ENSLEY PART # E-882

REMARKS:

ROUTE

SIGNATURE

FILE

FIELD ENGINEER'S REPORT FORM

MIDLAND UNITS 1 & 2

JOB 7220 DATE 2MAY79 PAGE 3 OF 3

~~ITEM NO.~~	~~INSPECTION DESCRIPTION~~	~~ACTION REQUIRED/TAKEN~~
	CONCLUSIONS —	
	WITH THE EXCEPTION OF DAMAGED CONDUIT ZB40 THERE IS NO INDICATION OF ABNORMALITIES WHICH WOULD IMPEDE CABLE PULLING.	
	RECOMMENDATION —	
	PENDING ECONOMIC ANALYSIS OF ALTERNATIVE CABLE ROUTING(S), CONDUIT ZBA074 SHOULD BE EXCAVATED, INSPECTED, AND REPAIRED IF POSSIBLE	

REMARKS:

ROUTE

SIGNATURE JRKNOKE

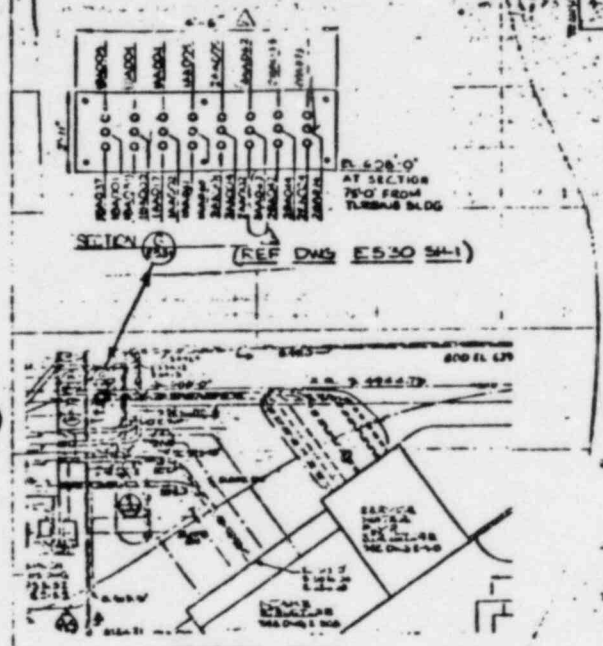
FILE

CALCULATION SHEET

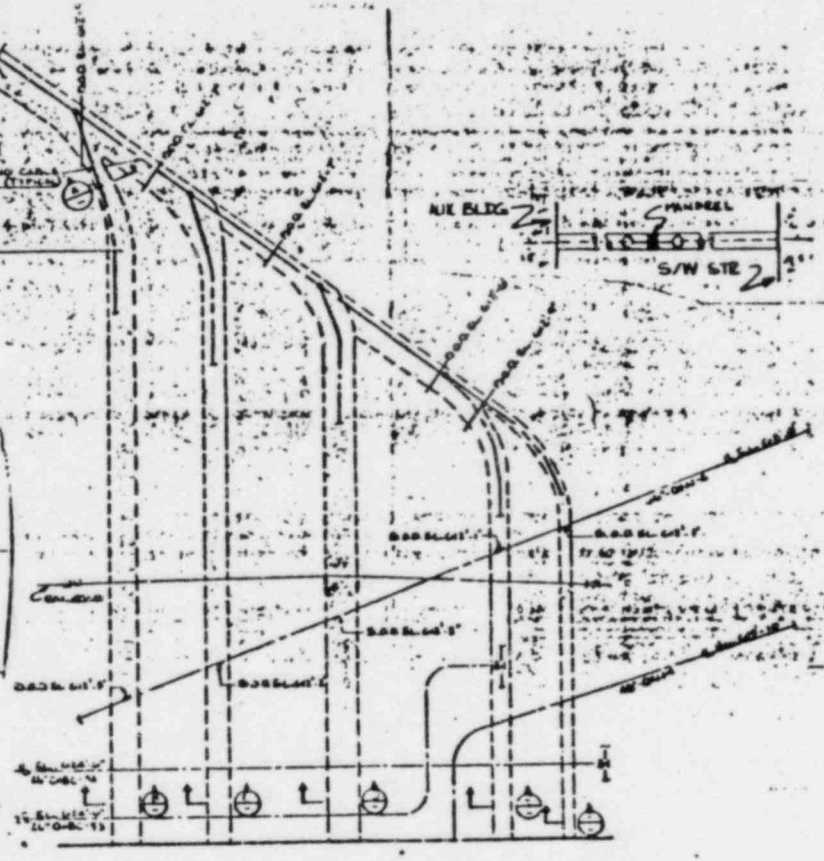
DESIGN BY JRKNOKE DATE 3MAY79

PROJECT MIDLAND UNITS 1&2

SUBJECT



LOCATION PLAN
(REF DWG E531)



INSPECTION PROCEDURE

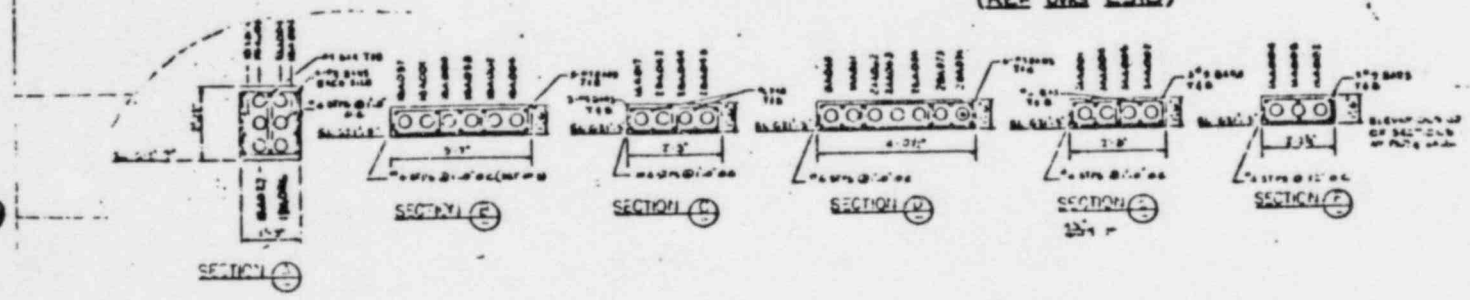
(1) ATTACH PULL ROPE TO EACH END OF MANDREL

(2) PULL MANDREL THROUGH CONDUIT IN EACH DIRECTION

(3) IF OBSTRUCTIONS ARE ENCOUNTERED, MARK LOCATION(S) ON ROPE

(4) MEASURE & RECORD DISTANCES FROM MANDREL TO ROPE MARKS AND ROPE MARKS REFER TO OBSTRUCTION OF DUCT CONDUIT.

(5) PRESSURIZE EACH CONDUIT TO 100 PSIG. AND HOLD FOR 15 MINUTES. NOTE SIGNIFICANT PRESSURE LOSSES



REV	DATE	ITEM	BY
0	3MAY79	ISS FOR INSP	

SERVICE WATER PUMP STR.
DUCT BANK INSPECTION

FSK-EY-136 REV 0

27. PVC Conduit Repair Procedure

a. Remove concrete to expose an area 1-1/2" minimum around the damaged area. Chamfer the inside edge of the hole to clean up and eliminate burrs and create a smooth edge inside the conduit. Clean up the outside of the conduit around the damaged area and apply a section of PVC coupling, sufficient to completely cover the area and cement in place with PVC cement. Repair concrete per Section 17 of civil Specification C-231. This will maintain the integrity of the conduit and the concrete.

b. When the length of the damaged area is greater than that of a coupling, an alternative method of repair may be used as follows:

1) Cut a piece of PVC (same diameter as damaged PVC) 3 inches longer than the damaged area.

2) Cut a vertical section out of the PVC which will allow it to overlap the damaged section by at least 1/2 inch on each side of the damaged section.

3) Form the PVC by heating and forming it on a piece of GRS of the same diameter.

11 4) Perform Step A using the formed PVC in place of a coupling.

28. Conduit 2 Over 1 Criteria

The adequacy of seismic supports of non-1E raceway will be done by analysis and/or engineering walkdown late in the job. 2 over 1 seismic supports are 11 not "Q".

b. Seismic Class 1E conduit installations shall not be routed under non-Category I components (tray, conduit, piping, valves, or valve operators, ductwork, pumps, or motors, tanks, instrumentation, lighting fixtures, etc.) When this is not possible, and analysis cannot verify that failure is acceptable, the non-Category I component must be seismically supported.

c. Non-Class 1E conduits shall not be routed over Seismic Category I components (tray, conduit, piping, valves or valve operators, ductwork, pumps or motors, tanks, instrumentation and tubing, lighting fixtures, etc.). When this is not possible, and analysis cannot verify that failure is acceptable, the non-Class 1E conduits must be seismically supported.

d. At crossovers, non-Class 1E conduits shall have a seismic support on each side of the crossover spaced in accordance with the Class 1E support criteria. Additional seismic supports need not be provided for the remaining conduit length.

e. Non-Class 1E conduits running parallel and at an elevation above the Seismic Category I installation shall be seismically supported in accordance with the support criteria for Class 1E when the horizontal distance is less than 12 inches and analysis cannot verify that failure is acceptable.

No.	DATE	REVISIONS	BY	CHK'D	GROUP LEAD	GROUP SUPV.	LEAD FIELD ENGR	FIELD ENGR
3	E-5-82	INCORP. DCN #153	GBB	[illegible]	[illegible]	[illegible]		
2	10-23-82	INCORP. DCN #158	CH	[illegible]	[illegible]	[illegible]		
1	1-24-77	ISSUED FOR CONSTRUCTION	RLH	TLS	TLS	WRT	RLC/RH	

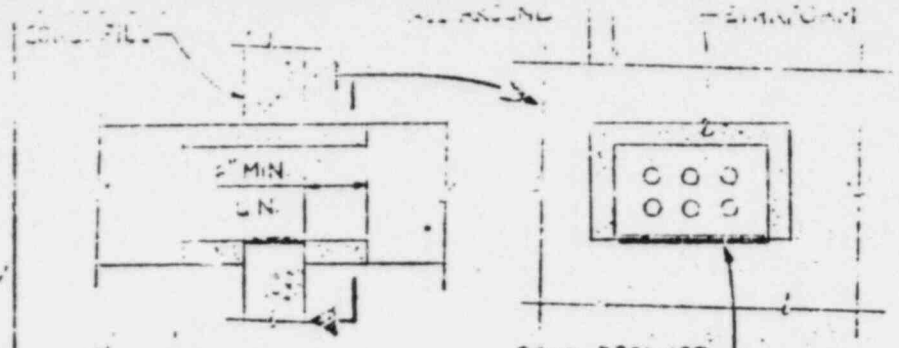
SCALE | DESIGNED | DRAWN

ORIGIN

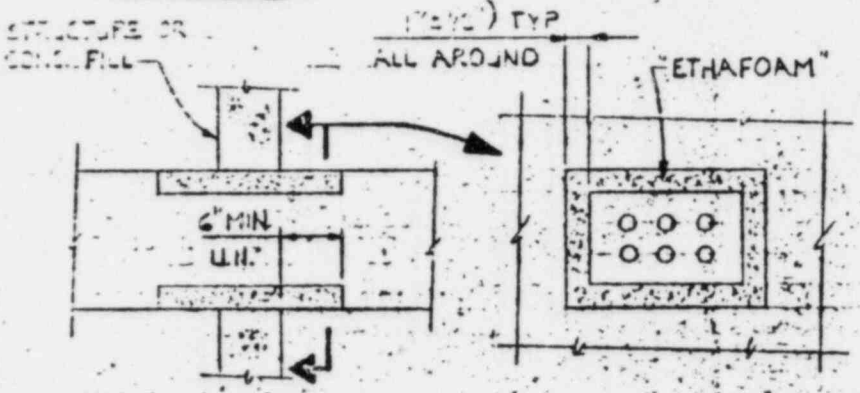
MIDLAND PLANT UNITS 1 & 2
CONSUMERS POWER COMPANY
CONDUIT AND TRAY
NOTES, SYMBOLS AND DETAILS

JOB No. 7220
DRAWING No. E-42(Q) SH. 11B
REV. 1

AA-G-122673 "A" SIZE

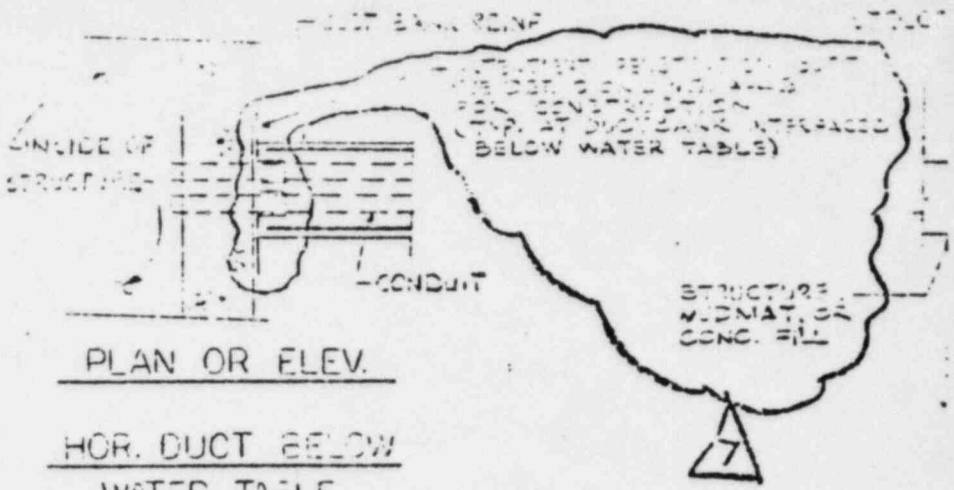


7 ELEVATION
ALTERNATE NO.1



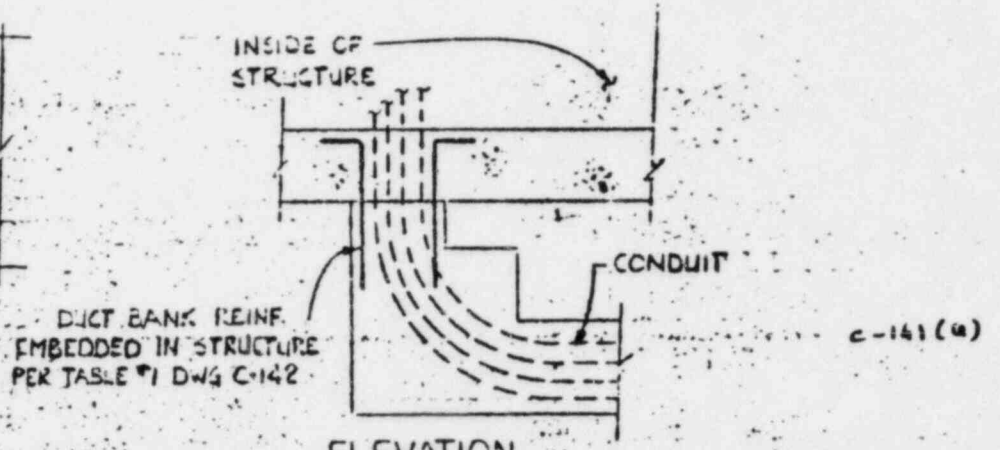
7 ELEVATION
ALTERNATE NO.2

HOR. DUCT ABOVE WATER TABLE



PLAN OR ELEV.

HOR. DUCT BELOW
WATER TABLE



ELEVATION

VERT. DUCT BELOW WATER TABLE
OR WHERE DUCT TURNS HOR.
IMMEDIATELY AFTER LEAVING STRUCTURE

DUCT BANK INTERFACE WITH BUILDING

7 SEE NOTES 1 & 2

DETAIL 12
N.T.S.

DCN 112

DWG E-42

MATERIAL PROCUREMENT RESPONSIBILITY	AFFECTED PURCHASE ORDERS	PM OR MR PREPARED FOR DCN CHANGE
☐ BECHTEL OFFICE ☐ SUPPLIER CONTRACTOR ☐ BECHTEL FIELD ☒ NONE REQUIRED ☐ CLIENT	N/A	YES N/A

DESCRIPTION OF CHANGE: Revise sheet 11B

Addition of step E to note 27 per sheet 2

EFFECTIVITY OF CHANGE:

Date of Issue

INSTRUCTIONS REGARDING USED MATERIAL EQUIPMENT

N/A

ORIGINATOR		APPROVAL		DATE

-SUPPLEMENT-

DRAWING CHANGE NOTICE

DCN NO	DWG NO
112	E42(2)

B When the length of the damaged area is greater than that of a coupling, an alternate method of repair may be used as follows:

1. Cut a piece of PVC (Same diameter as damaged PVC), 3 inches longer than the damaged area.

2. Cut a vertical section out of the PVC which will allow it to overlap the damaged section by at least 1/2" on each side of the damaged section.

3. Form the PVC by heating and forming it on a piece of GRS of the same diameter.

4. Perform step A using the formed PVC in place of a coupling.

O = Q utilities — Any Q utilities by remedial side
D = Drilled

Log Sheet

	Number	Lead		Utility	Dates Out	Dates In	
E	1	Roy Courliss	Elec	Ground	1/13/82	1/13/82	Cur
	2	Roy Courliss	Elec	Ground	1/19/82		
	3	Paul Goguen	civil	R/R	1/19/82		
	(4) Q nicked coating	Kelly Pulito	mech	Diesel Oil Line	1/19/82		
	5 coating	Kelly Pulito	Mech	Gas Line	1/21/82		
	6 coating	Kelly Pulito	Mech	Gas Line	1/26/82		
	7	Roy Courliss	Elec	Ground	2/2/82		
	8	Kelley Pulito ~~Roy Courliss~~	Mech ~~Elec~~	Encts ~~Heat Tracing~~	2/8/82	3/15/82	Roy
D	9 (moved off)	Jay Steele	Civil	Oily waste line	2/25/82		
	(10) Q coating	Kelly Pulito	Mech	rubber coating	3/1/82		
	11	Roy Courliss	Elec	Ground	3/1/82		
	12	Roy Courliss	Elec	Ground	3/1/82		
	13	Roy Courliss	Elec	Ground	3/1/82		
	14 dented	Kelly Pulito	Mech	2" metal Line	3/10/82		
	15	Roy Courliss	Elec	Anode	3/25/82		
D	16	Roy Courliss	Elec	Duct Bank	3/25/82 3/29/82		
	~~[illegible]~~	~~Kelly Pulito~~	~~Mech~~	~~[illegible] Line~~	~~[illegible]~~		
	17	Jay Steele	civil	M/H O/W	4/16/82		
	18	Kelly Pulito	Mech	(Temp Gas Line)	4/27/82	4/27/82	Dale
D	(19)	Roy Courliss	Elec	Duct Bank	4/24/82		

Bill Netzela - BECHTEL
(AUTHOR OF THIS LIST)

ITEM 1

SEISMIC MARGIN STUDY SCOPE (TR. 9720)

While discussing the scope of the seismic margin study it was stated that only Category I structures, containing equipment which is necessary for the safe shutdown of the plant, were included. Although that included most of the Category I structures, the Applicant agreed to identify those Category I structures, as defined in subsection 3.8.4.1 of the FSAR, that have not been considered in the seismic margin review. They are as follows:

. Retaining walls, valve pits, and meter pits associated with the Service Water Pump structure

. The Feedwater Isolation Valve Pits

. Foundations for the control room pressurization tanks, and

. Foundations for the penetration pressurization tanks.

The reasons for their exclusion will be provided by Dr. R P Kennedy to the NRC Staff when the results of the Seismic Margin Review program are presented.

ITEM 5

New boring information referred to in Drunner's examination of Dr Woods. (TR. 9765, 9766, 9767, 9768)

Dr Woods stated in his prepared testimony that the calculations and boring logs furnished to him by Bechtel Engineering were correct. He ran a random sampling of the data and he was satisfied that with the methods available to control the Ground Water Table, (GWT) below 610 feet elevation that the plant area will be safe with respect to liquefaction of the sands encountered during borings.

Dr Woods stated (TR. 9753) that some time after he had written his testimony, that additional information concerning borings related to the underpinning and dewatering work was made available to him. The borings in question were done by Moretrench/Mergentime Co during March and April, 1982. Even though Dr Woods did not have access to the data on the additional new borings prior to completing his written testimony, Dr Woods was aware of and had received copies of location maps and calculations (analysis) some time prior to his oral testimony given on November 20, 1982.

Dr Woods oral testimony (TR. 9746) states, "There were some additional sand pockets identified in those borings. Frequency was no more than that from the previous borings and it does not change my conclusion, any of the conclusions that I stated in the testimony."

The two borings referred to in Dr Woods' testimony are identified on Bechtel drawing SK-G-443, Fig. 2.5-7, Rev. 4 as borings MP-10 and ME-27B.

These borings registered the lowest blow-counts. Bechtel drawing SK-G-942, Fig. L-10, Rev. 0 show boring MP-10 as having a blow-count of 23/24 at elevation 587.5 feet. This drawing also indicates a boring done by a different contractor in the immediate vicinity of MP-10. This boring, LN, had a blow-count of 20/22 at elevation 586.0 feet. The significant point here is that borings taken by two different contractors in different time frames, using the same ASTM standard, D-1586 for blow-counts, show near identical data results.

Bechtel drawing SK-G-944, Fig. L-12, Rev. 0, gives the blow-count for MP-10 and ME-27B between elevations 627 to 610 feet.

MP-10	4/12 at 623.5 feet
ME-27B	4/14 at 619.5 feet
	3/17 at 614.5 feet

Dr Woods was aware of this type of data as listed on the various Bechtel drawings and also of the logs of boring related to the "new" borings. Bechtel Geotechnical personnel (Dr Afifi, D Henderson) state that current information regarding the latest liquefaction analysis is included in FSAR Amendment 47, which was released on or about January 14, 1983.

The Mergentime boring logs for all borings in question are found in pages D.1-1, 331 through D.1-1, 362 of the 50.54(f). Ms Stamiris will be sent a copy of latest data in the next few days as promised (TR. 9768).

Item 4

Possible inappropriateness of using al oxide grinding wheels because of alleged ferric oxide contamination (TR .10005).

Ms Sinclair: "But the information that I have is that aluminum oxide grinding wheels contained Ferric oxide." The allegation that the grinding wheels that have been and are currently being used at Midland Project contain ferric oxide was investigated by contacting MPQAD Personnel (R Witaker; P Musante, NDE and Welding QA Analysis) who were personally involved in researching the use of grinding wheels being used on austenitic stainless steel pipe. First, it has been determined that the only grinding wheels that were ever in use at the Midland Site were aluminum oxide. Even though Bechtel's "Field Material Requisition" used for procurement of various grinding wheels, designated "Grinding Wheels - Metal", receipt was aluminum oxide wheels. In addition, Bechtel Procedure FIG 18, Rev 0, "Identification Marking of Tools For Use on Stainless Steel Materials" states: "All tools and tool accessories intended for use on austenitic stainless steel material shall be identified by the application of a white paint marking the tool and tool accessories. Only those tools and tool accessories so identified will be used on austenitic stainless steel materials. It shall be the responsibility of the craft superintendent that requisitioned the tools and accessories to direct and supervise the identification marking operation upon receipt of the tools and accessories."

Also, Bechtel's Procedure 7220-M-204,1 Rev 10, 5.1.3.e states: "For

austenitic stainless steel piping, only stainless steel brushes or aluminum oxide or silicon-carbide grinding wheels shall be used."

The MPQAD indicates that these procedures have been and are now being implimented. Because of some vagueness in Bechtel's description of items in preparing "Field Material Requisition", Procurement of grinding wheels, CPCo NCR M10-9-2-172 was issued. This NCR imposed that 1) supervision of requirement for purchasing grinding wheels; proper information required on purchase orders. 2) Project Field Quality Control Engineer to incorporate paragraph 5.1.3, subparagraph (e) into applicable PQCI(s) in order to further establish process control in the field. 3) Project Field Quality Control Receipt inspection to perform receipt inspection on all grinding wheels to ensure that only aluminum oxide or silicon carbide grinding wheels are received for use at the Midland Energy Center.

The MPQAD contacted the M K Morse Company, a vendor for Saw Blades and Abrasive Wheels, on the subject of chemical composition of M K Morse Company Abrasive Wheels. MQPAD was informed by Morse that a typical abrasive wheel contains:

97.03% Aluminum Oxide
2.1% Titanium Oxide
.5% Silicon
.2% Ferrous Oxide
.13% Zirconium Oxide
.02% Calcium Oxide and Magnesium Oxide

The .2% ferrous oxide is a trace amount and occurs in the chemical composition of grinding wheels during processing. As the abrasives are crushed to size, they cause minute particles of iron from the crushing cylinders to flake off. Information received from various vendors indicates that ferrous material in the quantity present is not significant to contaminate an aluminum oxide grinding wheel, consequently it is not necessary to refine out of the wheels' chemical composition.

The austenitic stainless steel pipe itself has trace amounts of ferrous oxide in its chemical composition, similar in magnitude to the amounts present in the grinding wheels. The grades of piping used at the Midland Plant, and their associated ferrous content, are listed below.

Grade	Ferrous Content
304	.08%
309	.15%
316	.08%

Again, this ferrous content is obtained through the manufacturing process of the stainless steel, and further shows the insignificance of the trace amounts of ferrous oxide found in the grinding wheels.

[Enclosure E]

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

In the Matter of

CONSUMERS POWER COMPANY

(Midland Plant Units 1 and 2)

Docket Nos. 50-329 OM
50-330 OM

Docket Nos. 50-329 OL
50-330 OL

AFFIDAVIT OF THIRU R. THIRUVENGADAM

My name is Dr. Thiru R. Thiruvengadam. I am employed by Consumers Power Company as Section Head of Civil Engineering, Design Production Department of the Midland Project. In this position, I am responsible for reviewing civil engineering design, including the seismic input to the analysis of structural systems and components, including piping. I am familiar with the techniques of piping seismic analysis described in the affidavit.

I have a Bachelor of Engineering degree in Civil Engineering from the University of Madras, India, a Master of Engineering degree in Power Engineering from the Indian Institute of Science, Bangalore, India; and a PhD degree in Civil Engineering from the University of Illinois, Champaign-Urbana, Illinois.

I have approximately 14 years of experience in Civil/Structural Engineering in firms including Skidmore, Owings and Merrill, Chicago, Illinois; Sargent & Lundy, Chicago, Illinois; Bechtel Power Corporation, Ann Arbor, Michigan; and Consumers Power Company, Jackson, Michigan.

I swear that the statements in this affidavit and in the attachment thereto are true and correct to the best of my knowledge.

Thiru R. Thiruvengadam

Sworn and Subscribed to Before Me This 31 Day of January, 1983.

Beverly A. Bross
Notary Public, Washtenaw County

BEVERLY A. BROSS, Notary Public
WASHTENAW COUNTY - MICHIGAN
MY COMMISSION EXPIRES 10-26-86

Affidavit of Dr. Thiru Thiruvengadam

Introduction

The testimony of Don Lewis regarding underground piping at the Midland Plant presented on November 16, 1982 (following TR. 8868) included stress summary tables for the buried service water system lines being reinstalled as part of the soils remedial work. Mr. Lewis stated that these stress summary tables showed the results of a dynamic seismic analysis of this piping which had been based on the FSAR SSE (0.12g) earthquake. He also stated that all the other underground Category I piping at the Midland Plant had been analyzed using BC-TOP-4A techniques with the 1.5 x FSAR SSE earthquake as input, and that a check analysis of the reinstalled buried service water piping using BC-TOP-4A techniques and 1.5 x FSAR SSE is being carried out. (Tr. 8941-8943.) Mr. Lewis also testified that 1.5 x FSAR SSE response spectra envelopes the site specific response spectra for purposes of the BC-TOP-4A analyses of buried piping. (Tr. 8944). On November 17, 1982 Applicant was granted permission to supplement the record to explain how the underground service water piping to be installed meets current criteria. (Tr. 9041-9043.) The purpose of this affidavit is to show that the input spectra used in the dynamic seismic analysis of the underground service water piping discussed in Don Lewis' testimony actually exceeds current criteria, even though the FSAR SSE(0.12g) earthquake

was used in developing the input spectra.

HOW THE DYNAMIC SEISMIC ANALYSIS WAS DONE.

The service water system modeled inside and in the vicinity of the service water pump structure consists of lines 36/26"-OHBC-15, 16, 19, 20, 53, 54, 55, and 56. These lines consist of return lines (36/26"-OHBC-16 and 20 and 26"-OHBC-54 and 56) and supply lines (36/26"-OHBC-15 and 19 and 26"-OHBC-53 and 55).

The analyses of these lines were performed in two parts:

A. Supply lines 36/26"-OHBC-15 and 19 and 26"-OHBC-53 and 55 were analyzed seismically from the strainers inside the SWPS (OF-75A through E) to thirty feet beyond the ethafoam outside in the soil to a fictitious anchor. In-structure response spectra were developed for all floor elevations of the SWPS using the FSAR SSE (0.12g) earthquake. The envelope of the floor response spectra for 0.5% damping at elevations 656'-0", 634'-6", and 620'-0" was used as the seismic input at all support points. The pipe outside the building for each line also used the same enveloping spectra used inside the building.

B. Return lines 36/26"-OHBC-16 and 20 and 26"-OHBC-54 and 56 run in a NW-SE direction through the fill, into the SWPS, and out into the soil underneath the cooling pond.

These were analyzed seismically from fictitious anchors in the soil located 30 ft. northwest and 30 ft. southeast of the SWPS. Again, in-structure response spectra were developed in the SWPS using the FSAR SSE (0.12g). The envelope of the floor response spectra for 0.5% damping at elevations ranging from 589'-6" to 634'-6" was used as the seismic input at all support points. The piping outside the building for each line also used the same enveloping spectra as the piping inside the building. For piping to be replaced or rebedded beyond approximately 30 ft. from the SWPS, the seismic analysis in the supply line (described in A above) was used because of similarity in layout.

THE CURRENT CRITERIA.

The design basis for the 36" piping to be replaced and the 26" piping to be rebedded is the site specific response spectra. The design basis for the piping inside the SWPS is the FSAR SSE (0.12g).[1/] The current criterion for damping is 2% in safe shutdown earthquake analyses.

HOW THE DYNAMIC SEISMIC ANALYSIS MEETS THE CURRENT CRITERIA.

The standard design procedure is to use response spectra applicable to the individual piping support points.

1/ There are some modifications presently being performed to the piping inside the SWPS including hanger modifications and installation of expansion bellows on the supply lines.

That is, the designer could have used the response spectra for elevation 589'-6" for piping located at elevation 589'-6", ground response spectra for buried portions of the piping, and so forth, rather than using enveloping response spectra.

Figures 1 through 3, which are applicable to the supply lines, compare the floor response spectra at different elevations inside the SWPS to the site specific response spectra for the top of the fill and to 1.5 x FSAR SSE ground response spectra. Figures 4 through 6 make the same comparison for the return lines. Figure 1, for example, shows that for the enveloping spectra the zero period acceleration is 0.332g, compared to 0.149g for the SSRS and 0.18g for 1.5 x FSAR SSE. (For underground piping outside the building the zero period acceleration is an appropriate basis for comparison.)

The seismic analyses described in A and B above used floor response spectra derived from 0.5% damping rather than the current FSAR requirement of 2% damping. This is a significant source of additional conservatism for piping inside the structure, but it does not add significant conservatism for underground piping outside the SWPS. All of the spectra shown in Figures 1 through 6 are for 0.5% damping.[2/]

2/ There is a minor drafting error in all of the figures which has no effect on the matters discussed in this affidavit. The NRC Staff and Applicant have agreed that the SSRS developed by Western Geophysical should be modified to coincide with the Housner spectrum at long periods (low frequencies). This is not shown in the attached figures. However, the low frequency portions of the response spectra are not important in the seismic analysis of buried piping. In other words, only the right sides of Figures 1 through 6 are relevant for purposes of this discussion.

CONCLUSION

As shown above, the seismic analysis of the buried piping was performed using conservative input spectra which exceed the SSRS. As the testimony of Don Lewis (following Tr. 8868) shows, the stress levels are within allowable values. The piping systems located inside the SWPS, which have been analyzed to meet the FSAR SSE, will be included on a sampling basis in the Seismic Margin Review. The analyses done to date show that the seismic stresses for the piping inside the structure are very low. Therefore I expect that the Seismic Margin Review will show that the piping inside the SWPS is adequate to withstand the SSRS.

The discussion above applies to the dynamic seismic analyses performed using Bechtel's ME-101 computer code. As previously mentioned, a check analysis of the service water piping to be replaced or rebedded is also being performed based on BC-TOP-4A techniques. The BC-TOP-4A analysis uses the 1.5 x FSAR SSE as input. If the check analysis reveals higher stresses than the values tabulated in Don Lewis' testimony, they will be revised by means of an FSAR amendment. I do not expect this check analysis based on BC-TOP-4A techniques to alter the conclusion in this affidavit that the underground service water piping to be rebedded or replaced meets current criteria.

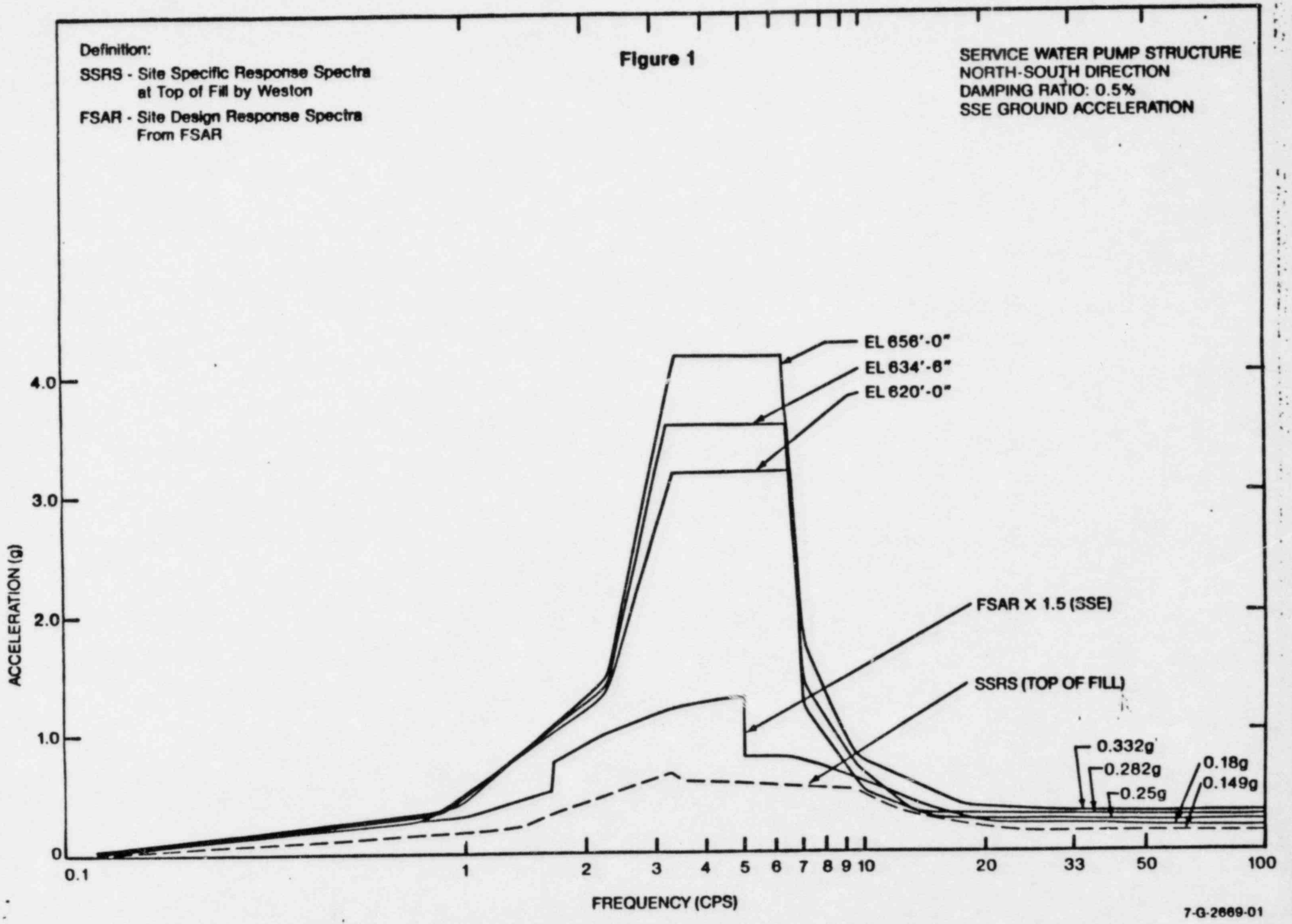
Definition:

SSRS - Site Specific Response Spectra at Top of Fill by Weston

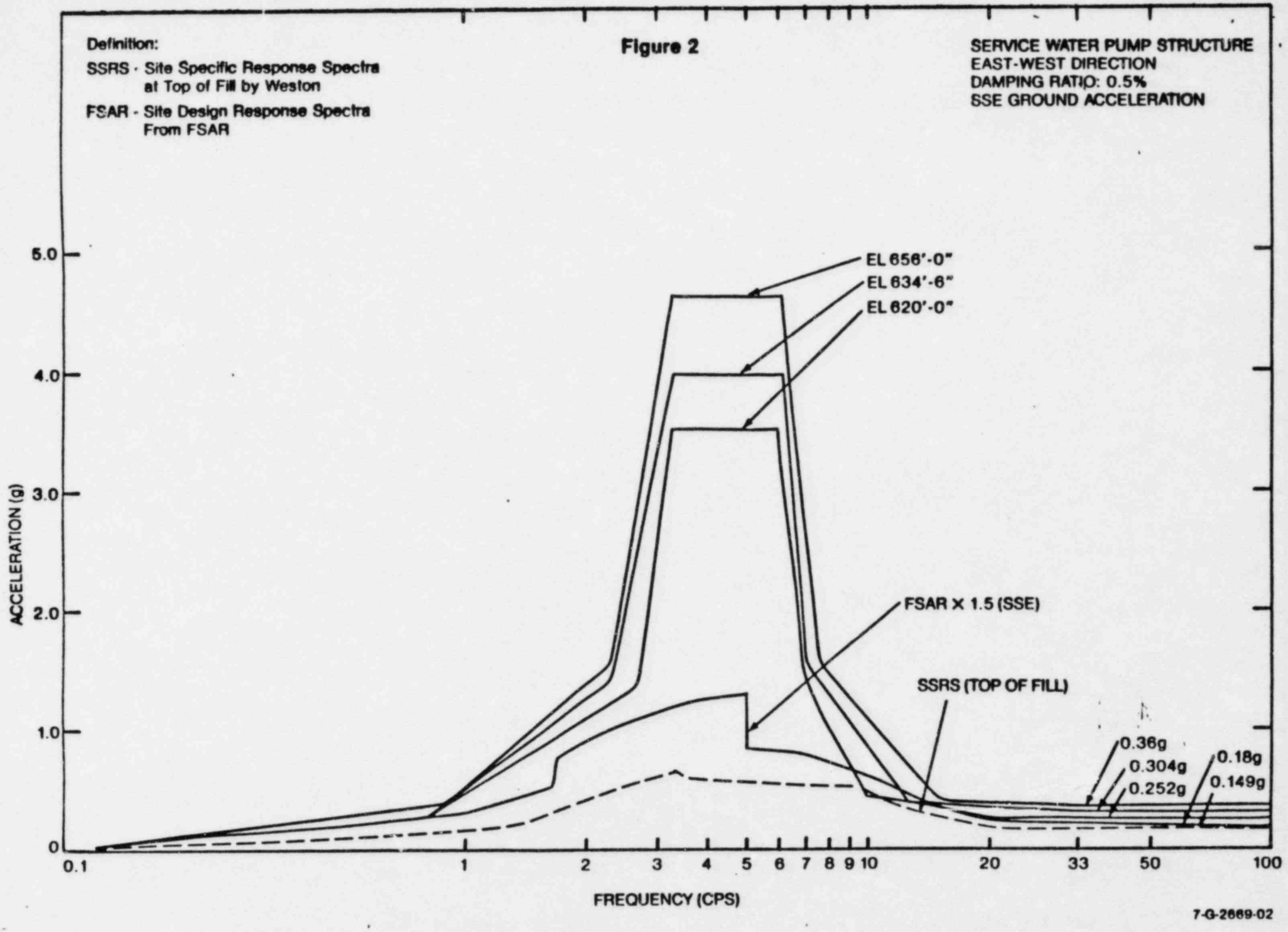
FSAR - Site Design Response Spectra From FSAR

Figure 1

SERVICE WATER PUMP STRUCTURE
NORTH-SOUTH DIRECTION
DAMPING RATIO: 0.5%
SSE GROUND ACCELERATION



7-G-2669-01


Definition:
SSRS - Site Specific Response Spectra at Top of Fill by Weston
FSAR - Site Design Response Spectra From FSAR
Figure 2
SERVICE WATER PUMP STRUCTURE
EAST-WEST DIRECTION
DAMPING RATIO: 0.5%
SSE GROUND ACCELERATION
EL 656'-0"
EL 634'-6"
EL 620'-0"
FSAR X 1.5 (SSE)
SSRS (TOP OF FILL)
0.36g
0.304g
0.252g
0.18g
0.149g
ACCELERATION (g)
5.0
4.0
3.0
2.0
1.0
0
0.1
1
2
3
4
5
6
7
8
9
10
20
33
50
100
FREQUENCY (CPS)
7-G-2669-02

Definition:

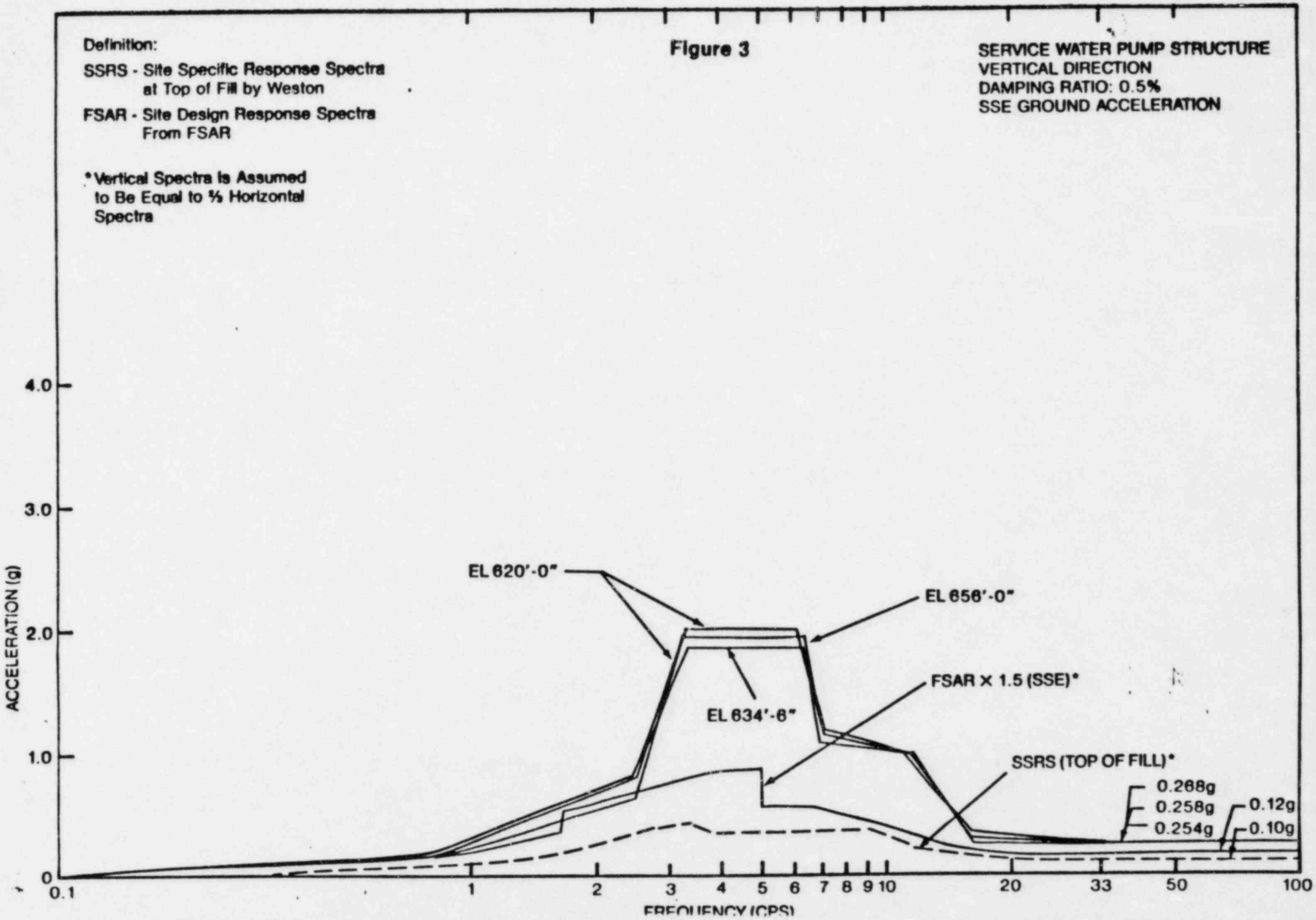
SSRS - Site Specific Response Spectra at Top of Fill by Weston

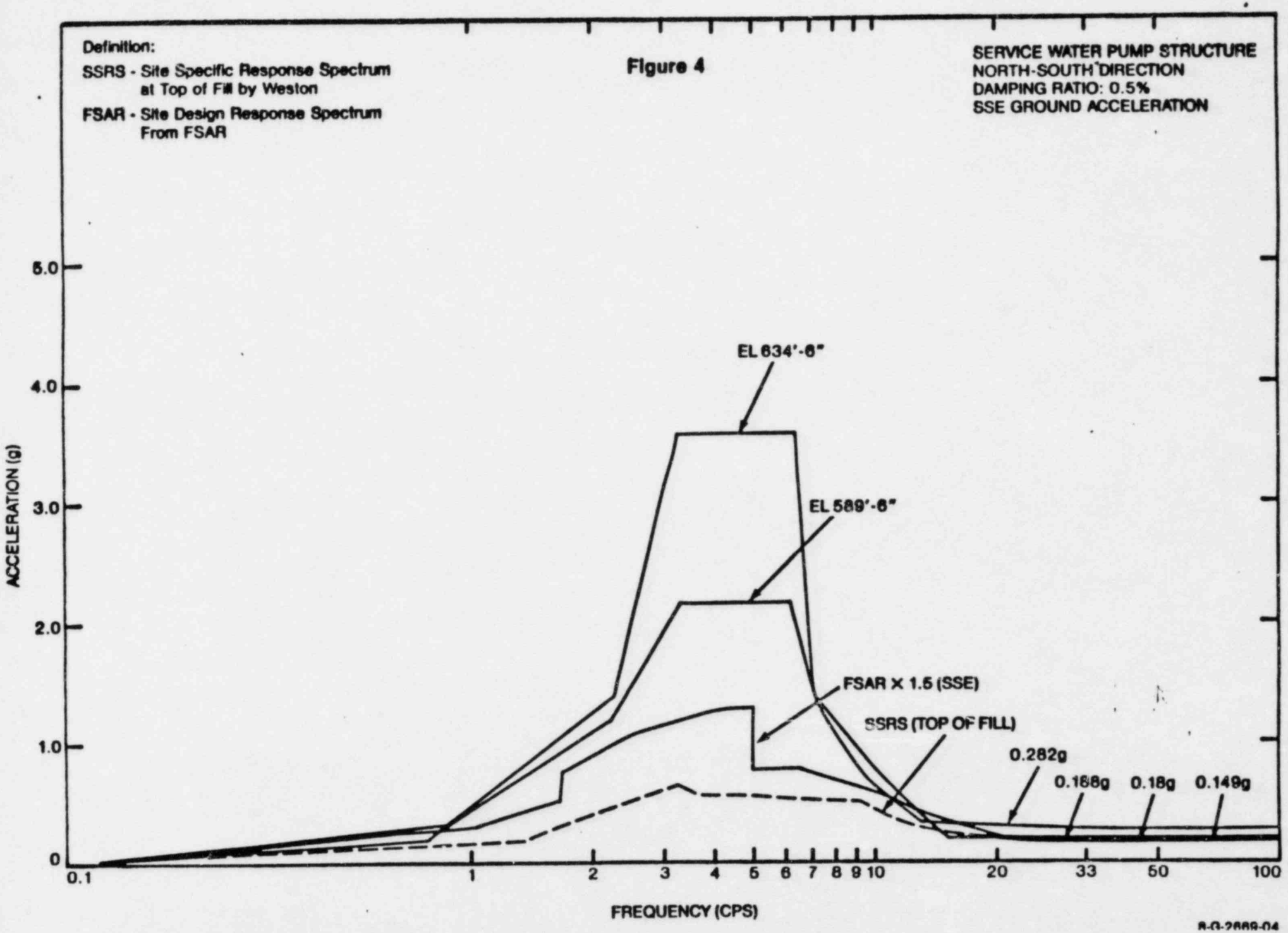
FSAR - Site Design Response Spectra From FSAR

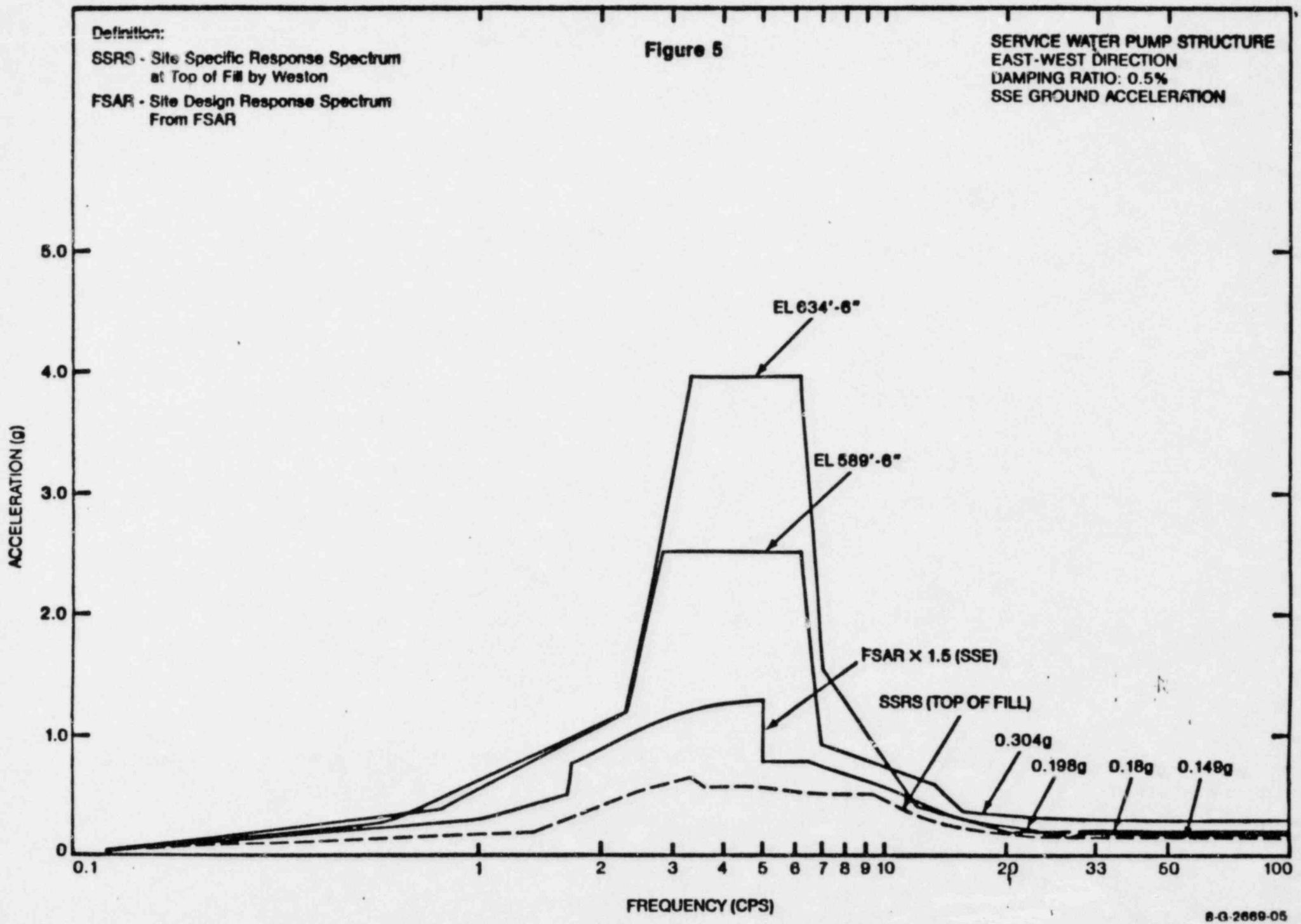
*Vertical Spectra is Assumed to Be Equal to ⅔ Horizontal Spectra

Figure 3

SERVICE WATER PUMP STRUCTURE
VERTICAL DIRECTION
DAMPING RATIO: 0.5%
SSE GROUND ACCELERATION




Definition:
SSRS - Site Specific Response Spectrum at Top of Fill by Weston
FSAR - Site Design Response Spectrum From FSAR
Figure 4
SERVICE WATER PUMP STRUCTURE
NORTH-SOUTH DIRECTION
DAMPING RATIO: 0.5%
SSE GROUND ACCELERATION
ACCELERATION (g)
5.0
4.0
3.0
2.0
1.0
0
EL 634'-6"
EL 589'-6"
FSAR X 1.5 (SSE)
SSRS (TOP OF FILL)
0.282g
0.168g
0.18g
0.149g
0.1
1
2
3
4
5
6
7
8
9
10
20
33
50
100
FREQUENCY (CPS)
8-Q-2669-04


Definition:
SSRS - Site Specific Response Spectrum at Top of Fill by Weston
FSAR - Site Design Response Spectrum From FSAR
Figure 5
SERVICE WATER PUMP STRUCTURE
EAST-WEST DIRECTION
DAMPING RATIO: 0.5%
SSE GROUND ACCELERATION
EL 634'-6"
EL 589'-6"
FSAR X 1.5 (SSE)
SSRS (TOP OF FILL)
0.304g
0.198g
0.18g
0.149g
ACCELERATION (g)
FREQUENCY (CPS)
0
1.0
2.0
3.0
4.0
5.0
0.1
1
2
3
4
5
6
7
8
9
10
20
33
50
100
8-G-2669-05

Definition:

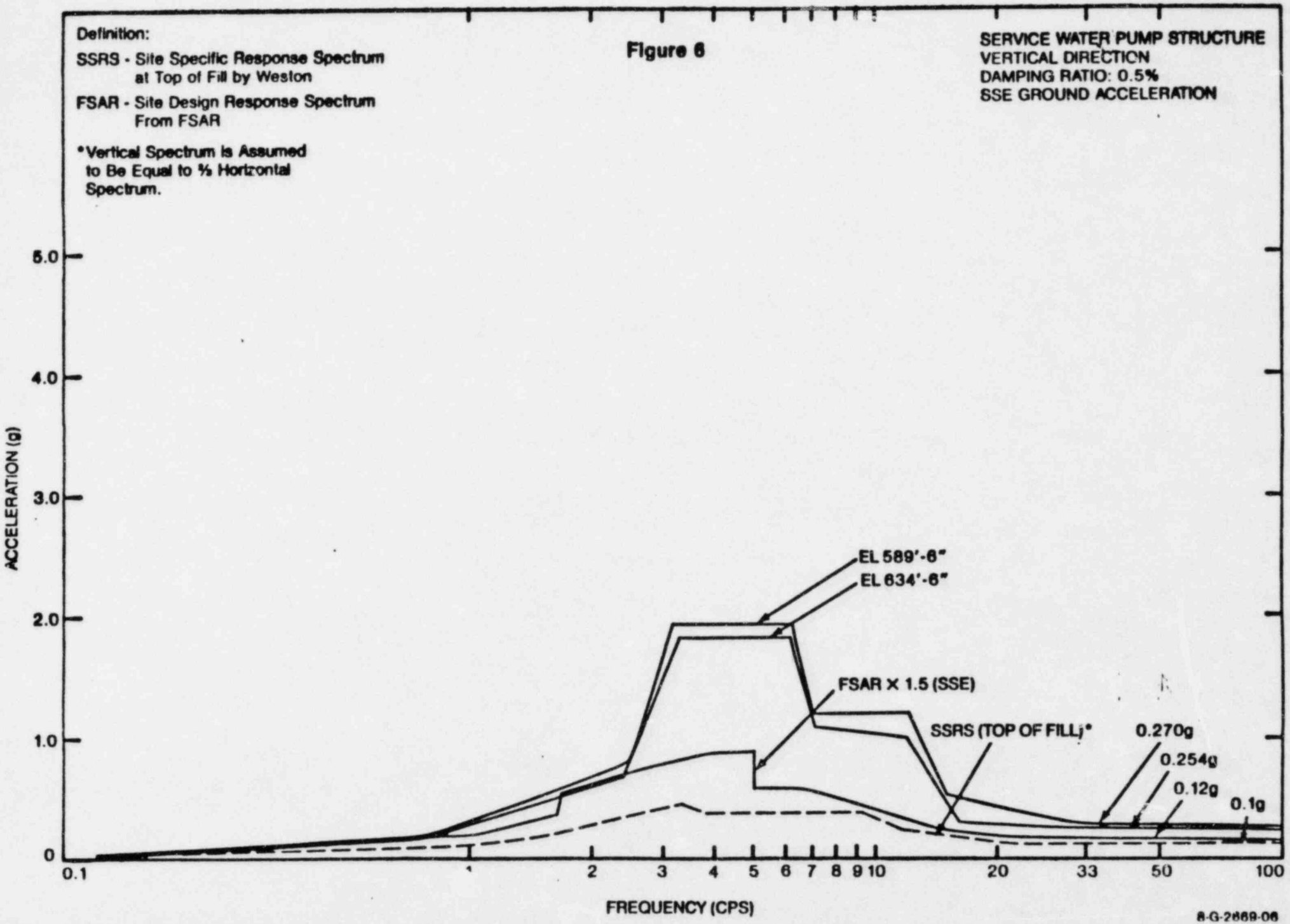
SSRS - Site Specific Response Spectrum at Top of Fill by Weston

FSAR - Site Design Response Spectrum From FSAR

*Vertical Spectrum is Assumed to Be Equal to ⅔ Horizontal Spectrum.

Figure 6

SERVICE WATER PUMP STRUCTURE
VERTICAL DIRECTION
DAMPING RATIO: 0.5%
SSE GROUND ACCELERATION



8-G-2869-06