PSE&G Public Service Electric and Gas Company

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Robert L. Mittl General Manager
Nuclear Assurance and Regulation

August 10, 1984

Director of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, MD 20814

Attention: Mr. Albert Schwencer, Chief
Licensing Branch 2
Division of Licensing

Gentlemen:

HOPE CREEK GENERATING STATION
DOCKET NO. 50-354
DRAFT SAFETY EVALUATION REPORT
OPEN ITEM STATUS

Attachment 1 is a current list which provides a status of the open items identified in Section 1.7 of the Draft Safety Evaluation Report (SER). Items identified as "complete" are those for which PSE&G has provided responses and no confirmation of status has been received from the staff. We will consider these items closed unless notified otherwise. In order to permit timely resolution of items identified as "complete" which may not be resolved to the staff's satisfaction, please provide a specific description of the issue which remains to be resolved.

Attachment 2 is a current list which identifies Draft SER Sections not yet provided.

In addition, enclosed for your review and approval (see Attachment 4) are the resolutions to the Draft SER open items, listed in Attachment 3.

Should you have any questions or require any additional information on these open items, please contact us.

Very truly yours,

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PDR ADOCK 05000354
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Attachments

1/1

The Energy People

95-4912 (3M) 4-84

C D. H. Wagner
USNRC Licensing Project Manager

W. H. Bateman
USNRC Senior Resident Inspector

FM05 1/2

DATE: 8/10/84

ATTACHMENT 1

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
1	2.3.1	Design-basis temperatures for safety-related auxiliary systems	Open	
2a	2.3.3	Accuracies of meteorological measurements	Complete	7/27/84
2b	2.3.3	Accuracies of meteorological measurements	Complete	7/27/84
2c	2.3.3	Accuracies of meteorological measurements	Complete	7/27/84
2d	2.3.3	Accuracies of meteorological measurements	Open	
3a	2.3.3	Upgrading of onsite meteorological measurements program (III.A.2)	Complete	8/01/84
3b	2.3.3	Upgrading of onsite meteorological measurements program (III.A.2)	Complete	8/01/84 (Rev. 1)
3c	2.3.3	Upgrading of onsite meteorological measurements program (III.A.2)	Open	
4	2.4.2.2	Ponding levels	Complete	8/03/84
5a	2.4.5	Wave impact and runup on service Water Intake Structure	Complete	6/01/84
5b	2.4.5	Wave impact and runup on service water intake structure	Open	
5c	2.4.5	Wave impact and runup on service water intake structure	Complete	7/27/84
5d	2.4.5	Wave impact and runup on service water intake structure	Complete	6/01/84
6a	2.4.10	Stability of erosion protection structures	Open	
6b	2.4.10	Stability of erosion protection structures	Open	
6c	2.4.10	Stability of erosion protection structures	Complete	8/03/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
7a	2.4.11.2	Thermal aspects of ultimate heat sink	Complete	8/3/84
7b	2.4.11.2	Thermal aspects of ultimate heat sink	Complete	8/3/84
8	2.5.2.2	Choice of maximum earthquake for New England - Piedmont Tectonic Province	Open	
9	2.5.4	Soil damping values	Complete	6/1/84
10	2.5.4	Foundation level response spectra	Complete	6/1/84
11	2.5.4	Soil shear moduli variation	Complete	6/1/84
12	2.5.4	Combination of soil layer properties	Complete	6/1/84
13	2.5.4	Lab test shear moduli values	Complete	6/1/84
14	2.5.4	Liquefaction analysis of river bottom sands	Complete	6/1/84
15	2.5.4	Tabulations of shear moduli	Complete	6/1/84
16	2.5.4	Drying and wetting effect on Vincentown	Complete	6/1/84
17	2.5.4	Power block settlement monitoring	Complete	6/1/84
18	2.5.4	Maximum earth at rest pressure coefficient	Complete	6/1/84
19	2.5.4	Liquefaction analysis for service water piping	Complete	6/1/84
20	2.5.4	Explanation of observed power block settlement	Complete	6/1/84
21	2.5.4	Service water pipe settlement records	Complete	6/1/84
22	2.5.4	Cofferdam stability	Complete	6/1/84
23	2.5.4	Clarification of FSAR Tables 2.5.13 and 2.5.14	Complete	6/1/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
24	2.5.4	Soil depth models for intake structure	Complete	6/1/84
25	2.5.4	Intake structure soil modeling	Complete	8/10/84
26	2.5.4.4	Intake structure sliding stability	Open	
27	2.5.5	Slope stability	Complete	6/1/84
28a	3.4.1	Flood protection	Complete	7/27/84
28b	3.4.1	Flood protection	Complete	7/27/84
28c	3.4.1	Flood protection	Complete	7/27/84
28d	3.4.1	Flood protection	Complete	7/27/84
28e	3.4.1	Flood protection	Complete	7/27/84
28f	3.4.1	Flood protection	Complete	7/27/84
28g	3.4.1	Flood protection	Complete	7/27/84
29	3.5.1.1	Internally generated missiles (outside containment)	Complete	8/3/84 (Rev. 1)
30	3.5.1.2	Internally generated missiles (inside containment)	Closed (5/30/84-Aux.Sys.Mtg.)	6/1/84
31	3.5.1.3	Turbine missiles	Complete	7/18/84
32	3.5.1.4	Missiles generated by natural phenomena	Complete	7/27/84
33	3.5.2	Structures, systems, and components to be protected from externally generated missiles	Complete	7/27/84
34	3.6.2	Unrestrained whipping pipe inside containment	Complete	7/18/84
35	3.6.2	ISI program for pipe welds in break exclusion zone	Complete	6/29/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
36	3.6.2	Postulated pipe ruptures	Complete	6/29/84
37	3.6.2	Feedwater isolation check valve operability	Open	
38	3.6.2	Design of pipe rupture restraints	Open	
39	3.7.2.3	SSI analysis results using finite element method and elastic half-space approach for containment structure	Complete	8/3/84
40	3.7.2.3	SSI analysis results using finite element method and elastic half-space approach for intake structure	Complete	8/3/84
41	3.8.2	Steel containment buckling analysis	Complete	6/1/84
42	3.8.2	Steel containment ultimate capacity analysis	Complete	6/1/84
43	3.8.2	SRV/LOCA pool dynamic loads	Complete	6/1/84
44	3.8.3	ACI 349 deviations for internal structures	Complete	6/1/84
45	3.8.4	ACI 349 deviations for Category I structures	Complete	6/1/84
46	3.8.5	ACI 349 deviations for foundations	Complete	6/1/84
47	3.8.6	Base mat response spectra	Complete	8/10/84 Rev.1
48	3.8.6	Rocking time histories	Complete	6/1/84
49	3.8.6	Gross concrete section	Complete	6/1/84
50	3.8.6	Vertical floor flexibility response spectra	Complete	6/1/84
51	3.8.6	Comparison of Bechtel independent verification results with the design-basis results	Complete	8/10/84 Rev.

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
52	3.8.6	Ductility ratios due to pipe break	Complete	8/3/84
53	3.8.6	Design of seismic Category I tanks	Complete	6/1/84
54	3.8.6	Combination of vertical responses	Complete	8/10/84 Rev.1
55	3.8.6	Torsional stiffness calculation	Complete	6/1/84
56	3.8.6	Drywell stick model development	Complete	6/1/84
57	3.8.6	Rotational time history inputs	Complete	6/1/84
58	3.8.6	"O" reference point for auxiliary building model	Complete	6/1/84
59	3.8.6	Overturning moment of reactor building foundation mat	Complete	6/1/84
60	3.8.6	BSAP element size limitations	Complete	6/1/84
61	3.8.6	Seismic modeling of drywell shield wall	Complete	6/1/84
62	3.8.6	Drywell shield wall boundary conditions	Complete	6/1/84
63	3.8.6	Reactor building dome boundary conditions	Complete	6/1/84
64	3.8.6	SSI analysis 12 Hz cutoff frequency	Complete	6/1/84
65	3.8.6	Intake structure crane heavy load drop	Complete	6/1/84
66	3.8.6	Impedance analysis for the intake structure	Complete	8/10/84 Rev.1
67	3.8.6	Critical loads calculation for reactor building dome	Complete	6/1/84
68	3.8.6	Reactor building foundation mat contact pressures	Complete	6/1/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
69	3.8.6	Factors of safety against sliding and overturning of drywell shield wall	Complete	6/1/84
70	3.8.6	Seismic shear force distribution in cylinder wall	Complete	6/1/84
71	3.8.6	Overturning of cylinder wall	Complete	6/1/84
72	3.8.6	Deep beam design of fuel pool walls	Complete	6/1/84
73	3.8.6	ASHSD dome model load inputs	Complete	6/1/84
74	3.8.6	Tornado depressurization	Complete	6/1/84
75	3.8.6	Auxiliary building abnormal pressure	Complete	6/1/84
76	3.8.6	Tangential shear stresses in drywell shield wall and the cylinder wall	Complete	6/1/84
77	3.8.6	Factor of safety against overturning of intake structure	Complete	6/1/84
78	3.8.6	Dead load calculations	Complete	6/1/84
79	3.8.6	Post-modification seismic loads for the torus	Complete	6/1/84
80	3.8.6	Torus fluid-structure interactions	Complete	6/1/84
81	3.8.6	Seismic displacement of torus	Complete	6/1/84
82	3.8.6	Review of seismic Category I tank design	Complete	6/1/84
83	3.8.6	Factors of safety for drywell buckling evaluation	Complete	6/1/84
84	3.8.6	Ultimate capacity of containment (materials)	Complete	6/1/84
85	3.8.6	Load combination consistency	Complete	6/1/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
86	3.9.1	Computer code validation	Open	
87	3.9.1	Information on transients	Open	
88	3.9.1	Stress analysis and elastic-plastic analysis	Complete	6/29/84
89	3.9.2.1	Vibration levels for NSSS piping systems	Complete	6/29/84
90	3.9.2.1	Vibration monitoring program during testing	Complete	7/18/84
91	3.9.2.2	Piping supports and anchors	Complete	6/29/84
92	3.9.2.2	Triple flued-head containment penetrations	Complete	6/15/84
93	3.9.3.1	Load combinations and allowable stress limits	Complete	6/29/84
94	3.9.3.2	Design of SRVs and SRV discharge piping	Complete	6/29/84
95	3.9.3.2	Fatigue evaluation on SRV piping and LOCA downcomers	Complete	6/15/84
96	3.9.3.3	IE Information Notice 83-80	Complete	6/15/84
97	3.9.3.3	Buckling criteria used for component supports	Complete	6/29/84
98	3.9.3.3	Design of bolts	Complete	6/15/84
99a	3.9.5	Stress categories and limits for core support structures	Complete	6/15/84
99b	3.9.5	Stress categories and limits for core support structures	Complete	6/15/84
100a	3.9.6	10CFR50.55a paragraph (g)	Complete	6/29/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
100b	3.9.6	10CFR50.55a paragraph (g)	Open	
101	3.9.6	PSI and ISI programs for pumps and valves	Open	
102	3.9.6	Leak testing of pressure isolation valves	Complete	6/29/84
103a1	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103a2	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103a3	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103a4	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103a5	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103a6	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103a7	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103b1	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103b2	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103b3	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103b4	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103b5	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
103b6	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103c1	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103c2	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103c3	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103c4	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
104	3.11	Environmental qualification of mechanical and electrical equipment	NRC Action	
105	4.2	Plant-specific mechanical fracturing analysis	Complete	7/18/84
106	4.2	Applicability of seismic andd LOCA loading evaluation	Complete	7/18/84
107	4.2	Minimal post-irradiation fuel surveillance program	Complete	6/29/84
108	4.2	Gadolina thermal conductivity equation	Complete	6/29/84
109a	4.4.7	TMI-2 Item II.F.2	Open	
109b	4.4.7	TMI-2 Item II.F.2	Open	
110a	4.6	Functional design of reactivity control systems	Complete	7/27/84
110b	4.6	Functional design of reactivity control systems	Complete	7/27/84
111a	5.2.4.3	Preservice inspection program (components within reactor pressure boundary)	Complete	6/29/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
111b	5.2.4.3	Preservice inspection program (components within reactor pressure boundary)	Complete	6/29/84
111c	5.2.4.3	Preservice inspection program (components within reactor pressure boundary)	Complete	6/29/84
112a	5.2.5	Reactor coolant pressure boundary leakage detection	Complete	7/27/84
112b	5.2.5	Reactor coolant pressure boundary leakage detection	Complete	7/27/84
112c	5.2.5	Reactor coolant pressure boundary leakage detection	Complete	7/27/84
112d	5.2.5	Reactor coolant pressure boundary leakage detection	Complete	7/27/84
112e	5.2.5	Reactor coolant pressure boundary leakage detection	Complete	7/27/84
113	5.3.4	GE procedure applicability	Complete	7/18/84
114	5.3.4	Compliance with NB 2360 of the Summer 1972 Addenda to the 1971 ASME Code	Complete	7/18/84
115	5.3.4	Drop weight and Charpy v-notch tests for closure flange materials	Complete	7/18/84
116	5.3.4	Charpy v-notch test data for base materials as used in shell course No. 1	Complete	7/18/84
117	5.3.4	Compliance with NB 2332 of Winter 1972 Addenda of the ASME Code	Open	
118	5.3.4	Lead factors and neutron fluence for surveillance capsules	Open	

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
119	6.2	TMI item II.E.4.1	Complete	6/29/84
120a	6.2	TMI Item II.E.4.2	Open	
120b	6.2	TMI Item II.E.4.2	Open	
121	6.2.1.3.3	Use of NUREG-0588	Complete	7/27/84
122	6.2.1.3.3	Temperature profile	Complete	7/27/84
123	6.2.1.4	Butterfly valve operation (post accident)	Complete	6/29/84
124a	6.2.1.5.1	RPV shield annulus analysis	Complete	6/1/84
124b	6.2.1.5.1	RPV shield annulus analysis	Complete	6/1/84
124c	6.2.1.5.1	RPV shield annulus analysis	Complete	6/1/84
125	6.2.1.5.2	Design drywell head differential pressure	Complete	6/15/84
126a	6.2.1.6	Redundant position indicators for vacuum breakers (and control room alarms)	Open	
126b	6.2.1.6	Redundant position indicators for vacuum breakers (and control room alarms)	Open	
127	6.2.1.6	Operability testing of vacuum breakers	Complete	7/18/84
128	6.2.2	Air ingestion	Complete	7/27/84
129	6.2.2	Insulation ingestion	Complete	6/1/84
130	6.2.3	Potential bypass leakage paths	Complete	6/29/84
131	6.2.3	Administration of secondary containment openings	Complete	7/18/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
132	6.2.4	Containment isolation review	Complete	6/15/84
133a	6.2.4.1	Containment purge system	Open	
133b	6.2.4.1	Containment purge system	Open	
133c	6.2.4.1	Containment purge system	Open	
134	6.2.6	Containment leakage testing	Complete	6/15/84
135	6.3.3	LPCS and LPCI injection valve interlocks	Open	
136	6.3.5	Plant-specific LOCA (see Section 15.9.13)	Complete	7/18/84
137a	6.4	Control room habitability	Open	
137b	6.4	Control room habitability	Open	
137c	6.4	Control room habitability	Open	
138	6.6	Preservice inspection program for Class 2 and 3 components	Complete	6/29/84
139	6.7	MSIV leakage control system	Complete	6/29/84
140a	9.1.2	Spent fuel pool storage	Complete	7/27/84
140b	9.1.2	Spent fuel pool storage	Complete	7/27/84
140c	9.1.2	Spent fuel pool storage	Complete	7/27/84
140d	9.1.2	Spent fuel pool storage	Complete	7/27/84
141a	9.1.3	Spent fuel cooling and cleanup system	Complete	8/1/84
141b	9.1.3	Spent fuel cooling and cleanup system	Complete	8/1/84
141c	9.1.3	Spent fuel pool cooling and cleanup system	Complete	8/1/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
141d	9.1.3	Spent fuel pool cooling and cleanup system	Complete	8/1/84
141e	9.1.3	Spent fuel pool cooling and cleanup system	Complete	8/1/84
141f	9.1.3	Spent fuel pool cooling and cleanup system	Complete	8/1/84
141g	9.1.3	Spent fuel pool cooling and cleanup system	Complete	8/1/84
142a	9.1.4	Light load handling system (related to refueling)	Closed (5/30/84-Aux.Sys.Mtg.)	6/29/84
142b	9.1.4	Light load handling system (related to refueling)	Closed (5/30/84-Aux.Sys.Mtg.)	6/29/84
143a	9.1.5	Overhead heavy load handling	Open	
143b	9.1.5	Overhead heavy load handling	Open	
144a	9.2.1	Station service water system	Complete	7/27/84
144b	9.2.1	Station service water system	Complete	7/27/84
144c	9.2.1	Station service water system	Complete	7/27/84
145	9.2.2	ISI program and functional testing of safety and turbine auxiliaries cooling systems	Closed (5/30/84-Aux.Sys.Mtg.)	6/15/84
146	9.2.6	Switches and wiring associated with HPCI/RCIC torus suction	Closed (5/30/84-Aux.Sys.Mtg.)	6/15/84
147a	9.3.1	Compressed air systems	Complete	8/3/84 (Rev 1)
147b	9.3.1	Compressed air systems	Complete	8/3/84 (Rev 1)

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
147c	9.3.1	Compressed air systems	Complete	8/3/84 (Rev 1)
147d	9.3.1	Compressed air systems	Complete	8/3/84 (Rev 1)
148	9.3.2	Post-accident sampling system (II.B.3)	Open	
149a	9.3.3	Equipment and floor drainage system	Complete	7/27/84
149b	9.3.3	Equipment and floor drainage system	Complete	7/27/84
150	9.3.6	Primary containment instrument gas system	Complete	8/3/84 (Rev. 1)
151a	9.4.1	Control structure ventilation system	Complete	7/27/84
151b	9.4.1	Control structure ventilation system	Complete	7/27/84
152	9.4.4	Radioactivity monitoring elements	Closed (5/30/84-Aux.Sys.Mtg.)	6/1/84
153	9.4.5	Engineered safety features ventilation system	Complete	8/1/84 (Rev 1)
154	9.5.1.4.a	Metal roof deck construction classificiation	Complete	6/1/84
155	9.5.1.4.b	Ongoing review of safe shutdown capability	NRC Action	
156	9.5.1.4.c	Ongoing review of alternate shutdown capability	NRC Action	
157	9.5.1.4.e	Cable tray protection	Open	
158	9.5.1.5.a	Class B fire detection system	Complete	6/15/84
159	9.5.1.5.a	Primary and secondary power supplies for fire detection system	Complete	6/1/84
160	9.5.1.5.b	Fire water pump capacity	Open	

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
161	9.5.1.5.b	Fire water valve supervision	Complete	6/1/84
162	9.5.1.5.c	Deluge valves	Complete	6/1/84
163	9.5.1.5.c	Manual hose station pipe sizing	Complete	6/1/84
164	9.5.1.6.e	Remote shutdown panel ventilation	Complete	6/1/84
165	9.5.1.6.g	Emergency diesel generator day tank protection	Complete	6/1/84
166	12.3.4.2	Airborne radioactivity monitor positioning	Complete	7/18/84
167	12.3.4.2	Portable continuous air monitors	Complete	7/18/84
168	12.5.2	Equipment, training, and procedures for inplant iodine instrumentation	Complete	6/29/84
169	12.5.3	Guidance of Division B Regulatory Guides	Complete	7/18/84
170	13.5.2	Procedures generation package submittal	Complete	6/29/84
171	13.5.2	TMI Item I.C.1	Complete	6/29/84
172	13.5.2	PGP Commitment	Complete	6/29/84
173	13.5.2	Procedures covering abnormal releases of radioactivity	Complete	6/29/84
174	13.5.2	Resolution explanation in FSAR of TMI Items I.C.7 and I.C.8	Complete	6/15/84
175	13.6	Physical security	Open	
176a	14.2	Initial plant test program	Open	

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
176b	14.2	Initial plant test program	Open	
176c	14.2	Initial plant test program	Complete	7/27/84
176d	14.2	Initial plant test program	Complete	7/27/84
176e	14.2	Initial plant test program	Complete	7/27/84
176f	14.2	Initial plant test program	Open	
176g	14.2	Initial plant test program	Open	
176h	14.2	Initial plant test program	Open	
176i	14.2	Initial plant test program	Complete	7/27/84
177	15.1.1	Partial feedwater heating	Complete	7/18/84
178	15.6.5	LOCA resulting from spectrum of postulated piping breaks within RCP	NRC Action	
179	15.7.4	Radiological consequences of fuel handling accidents	NRC Action	
180	15.7.5	Spent fuel cask drop accidents	NRC Action	
181	15.9.5	TMI-2 Item II.K.3.3	Complete	6/29/84
182	15.9.10	TMI-2 Item II.K.3.18	Complete	6/1/84
183	18	Hope Creek DCRDR	Open	
184	7.2.2.1.e	Failures in reactor vessel level sensing lines	Complete	8/1/84 (Rev 1)
185	7.2.2.2	Trip system sensors and cabling in turbine building	Complete	6/1/84
186	7.2.2.3	Testability of plant protection systems at power	Complete	8/3/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
187	7.2.2.4	Lifting of leads to perform surveillance testing	Complete	8/3/84
188	7.2.2.5	Setpoint methodology	Complete	8/1/84
189	7.2.2.6	Isolation devices	Complete	8/1/84
190	7.2.2.7	Regulatory Guide 1.75	Complete	6/1/84
191	7.2.2.8	Scram discharge volume	Complete	6/29/84
192	7.2.2.9	Reactor mode switch	Complete	6/1/84
193	7.3.2.1.10	Manual initiation of safety systems	Complete	8/1/84
194	7.3.2.2	Standard review plan deviations	Complete	8/1/84 (Rev 1)
195a	7.3.2.3	Freeze-protection/water filled instrument and sampling lines and cabinet temperature control	Complete	8/1/84
195b	7.3.2.3	Freeze-protection/water filled instrument and sampling lines and cabinet temperature control	Complete	8/1/84
196	7.3.2.4	Sharing of common instrument taps	Complete	8/1/84
197	7.3.2.5	Microprocessor, multiplexer and computer systems	Complete	8/1/84 (Rev 1)
198	7.3.2.6	TMI Item II.K.3.18-ADS actuation	Open	
199	7.4.2.1	IE Bulletin 79-27-Loss of non-class IE instrumentation and control power system bus during operation	Complete	8/1/84
200	7.4.2.2	Remote shutdown system	Complete	6/1/84
201	7.4.2.3	RCIC/HPCI interactions	Complete	8/3/84
202	7.5.2.1	Level measurement errors as a result of environmental temperature effects on level instrumentation reference leg	Complete	8/3/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
203	7.5.2.2	Regulatory Guide 1.97	Complete	8/3/84
204	7.5.2.3	TMI Item II.F.1 - Accident monitoring	Complete	8/1/84
205	7.5.2.4	Plant process computer system	Complete	6/1/84
206	7.6.2.1	High pressure/low pressure interlocks	Complete	7/27/84
207	7.7.2.1	HELBs and consequential control system failures	Complete	8/1/84
208	7.7.2.2	Multiple control system failures	Complete	8/1/84
209	7.7.2.3	Credit for non-safety related systems in Chapter 15 of the FSAR	Complete	8/1/84 (Rev 1)
210	7.7.2.4	Transient analysis recording system	Complete	7/27/84
211a	4.5.1	Control rod drive structural materials	Complete	7/27/84
211b	4.5.1	Control rod drive structural materials	Complete	7/27/84
211c	4.5.1	Control rod drive structural materials	Complete	7/27/84
211d	4.5.1	Control rod drive structural materials	Complete	7/27/84
211e	4.5.1	Control rod drive structural materials	Complete	7/27/84
212	4.5.2	Reactor internals materials	Complete	7/27/84
213	5.2.3	Reactor coolant pressure boundary material	Complete	7/27/84
214	6.1.1	Engineered safety features materials	Complete	7/27/84
215	10.3.6	Main steam and feedwater system materials	Complete	7/27/84
216a	5.3.1	Reactor vessel materials	Complete	7/27/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
216b	5.3.1	Reactor vessel materials	Complete	7/27/84
217	9.5.1.1	Fire protection organization	Open	
218	9.5.1.1	Fire hazards analysis	Complete	6/1/84
219	9.5.1.2	Fire protection administrative controls	Open	
220	9.5.1.3	Fire brigade and fire brigade training	Open	
221	8.2.2.1	Physical separation of offsite transmission lines	Complete	8/1/84
222	8.2.2.2	Design provisions for re-establishment of an offsite power source	Complete	8/1/84
223	8.2.2.3	Independence of offsite circuits between the switchyard and class IE buses	Complete	8/1/84
224	8.2.2.4	Common failure mode between onsite and offsite power circuits	Complete	8/1/84
225	8.2.3.1	Testability of automatic transfer of power from the normal to preferred power source	Complete	8/1/84
226	8.2.2.5	Grid stability	Complete	8/1/84
227	8.2.2.6	Capacity and capability of offsite circuits	Complete	8/1/84
228	8.3.1.1(1)	Voltage drop during transient conditions	Complete	8/1/84
229	8.3.1.1(2)	Basis for using bus voltage versus actual connected load voltage in the voltage drop analysis	Complete	8/1/84
230	8.3.1.1(3)	Clarification of Table 8.3-11	Complete	8/1/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
231	8.3.1.1(4)	Undervoltage trip setpoints	Complete	8/1/84
232	8.3.1.1(5)	Load configuration used for the voltage drop analysis	Complete	8/1/84
233	8.3.3.4.1	Periodic system testing	Complete	8/1/84
234	8.3.1.3	Capacity and capability of onsite AC power supplies and use of administrative controls to prevent overloading of the diesel generators	Complete	8/1/84
235	8.3.1.5	Diesel generators load acceptance test	Complete	8/1/84
236	8.3.1.6	Compliance with position C.6 of RG 1.9	Complete	8/1/84
237	8.3.1.7	Decription of the load sequencer	Complete	8/1/84
238	8.2.2.7	Sequencing of loads on the offsite power system	Complete	8/1/84
239	8.3.1.8	Testing to verify 80% minimum voltage	Open	
240	8.3.1.9	Compliance with BTP-PSB-2	Complete	8/1/84
241	8.3.1.10	Load acceptance test after prolonged no load operation of the diesel generator	Complete	8/1/84
242	8.3.2.1	Compliance with position 1 of Regulatory Guide 1.128	Complete	8/1/84
243	8.3.3.1.3	Protection or qualification of Class 1E equipment from the effects of fire suppression systems	Complete	8/1/84
244	8.3.3.3.1	Analysis and test to demonstrate adequacy of less than specified separation	Complete	8/1/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
245	8.3.3.3.2	The use of 18 versus 36 inches of separation between raceways	Complete	8/1/84
246	8.3.3.3.3	Specified separation of raceways by analysis and test	Complete	8/1/84
247	8.3.3.5.1	Capability of penetrations to withstand long duration short circuits at less than maximum or worst case short circuit	Complete	8/1/84
248	8.3.3.5.2	Separation of penetration primary and backup protections	Complete	8/1/84
249	8.3.3.5.3	The use of bypassed thermal overload protective devices for penetration protections	Complete	8/1/84
250	8.3.3.5.4	Testing of fuses in accordance with R.G. 1.63	Complete	8/1/84
251	8.3.3.5.5	Fault current analysis for all representative penetration circuits	Complete	8/1/84
252	8.3.3.5.6	The use of a single breaker to provide penetration protection	Complete	8/1/84
253	8.3.3.1.4	Commitment to protect all Class 1E equipment from external hazards versus only class 1E equipment in one division	Complete	8/1/84
254	8.3.3.1.5	Protection of class 1E power supplies from failure of unqualified class 1E loads	Complete	8/1/84
255	8.3.2.2	Battery capacity	Complete	8/1/84
256	8.3.2.3	Automatic trip of loads to maintain sufficient battery capacity	Open	

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
257	8.3.2.5	Justification for a 0 to 13 second load cycle	Complete	8/1/84
258	8.3.2.6	Design and qualification of DC system loads to operate between minimum and maximum voltage levels	Complete	8/1/84
259	8.3.3.3.4	Use of an inverter as an isolation device	Complete	8/1/84
260	8.3.3.3.5	Use of a single breaker tripped by a LOCA signal used as an isolation device	Complete	8/1/84
261	8.3.3.3.6	Automatic transfer of loads and interconnection between redundant divisions	Complete	8/1/84
TS-1	2.4.14	Closure of watertight doors to safety-related structures	Open	
TS-2	4.4.4	Single recirculation loop operation	Open	
TS-3	4.4.5	Core flow monitoring for crud effects	Complete	6/1/84
TS-4	4.4.6	Loose parts monitoring system	Open	
TS-5	4.4.9	Natural circulation in normal operation	Open	
TS-6	6.2.3	Secondary containment negative pressure	Open	
TS-7	6.2.3	Inleakage and drawdown time in secondary containment	Open	
TS-8	6.2.4.1	Leakage integrity testing	Open	
TS-9	6.3.4.2	ECCS subsystem periodic component testing	Open	
TS-10	6.7	MSIV leakage rate		

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
TS-11	15.2.2	Availability, setpoints, and testing of turbine bypass system	Open	
TS-12	15.6.4	Primary coolant activity		
LC-1	4.2	Fuel rod internal pressure criteria	Complete	6/1/84
LC-2	4.4.4	Stability analysis submitted before second-cycle operation	Open	

ATTACHMENT 2 DATE: 8/10/84

DRAFT SER SECTIONS AND DATES PROVIDED

SECTION	DATE
3.1	
3.2.1	
3.2.2	
5.1	
5.2.1	
6.5.1	
8.1	
8.2.1	
8.2.2	
8.2.3	
8.2.4	
8.3.1	
8.3.2	
8.4.1	
8.4.2	
8.4.3	
8.4.5	
8.4.6	
8.4.7	
8.4.8	
9.5.2	
9.5.3	
9.5.7	
9.5.8	
10.1	
10.2	
10.2.3	
10.3.2	
10.4.1	
10.4.2	
10.4.3	
10.4.4	
11.1.1	
11.1.2	
11.2.1	
11.2.2	
11.3.1	
11.3.2	
11.4.1	
11.4.2	
11.5.1	
11.5.2	
13.1.1	
13.1.2	
13.2.1	
13.2.2	
13.3.1	
13.3.2	
13.3.3	
13.3.4	
13.4	
13.5.1	
15.2.3	
15.2.4	
15.2.5	
15.2.6	
15.2.7	
15.2.8	
15.7.3	
17.1	
17.2	
17.3	
17.4	

CT:db

MP 84 95/03 01

DATE: 8/10/84

ATTACHMENT 3

OPEN ITEM	DSER SECTION	SUBJECT
25	2.5.4.	Intake structure soil modeling
47	3.8.6	Base mat response spectra
51	3.8.6	Comparision of Bechtel independent verification results with the design-basis results.
54	3.8.6	Combination of vertical responses
66	3.8.6	Impedance analysis for the intake structure

ATTACHMENT 4

DSER Open Item No. 25 (DSER Section 2.5.4)

INTAKE STRUCTURE SOIL MODELING

Assess and justify that the current soil modeling for the intake structure adequately accounts for:

a. Soil property variability along the depth
b. Sheet piling
c. Lavering of soil including inclined lavering

RESPONSE

This item corresponds to Item A.14 from the NRC Structural/ Geotechnical meeting of January 11, 1984. A response to this item is attached.

Meeting Date: January 11, 1984

Question No: A-14

Question: Assess and justify that the current soil modeling for the intake structure adequately accounts for:

- o Soil property variability along the depth
- o Sheet piling
- o Layering of soil including inclined layering

Response:

As requested by the NRC, independent finite element analyses have been performed by Bechtel to verify the adequacy of the current design requirements for the Service Water Intake Structure (SWIS). Figure A-14-1 shows the plot plan of the SWIS and the adjacent sheet piles and cofferdams. The generalized North-South and East-West cross sections through SWIS are shown in Figures A-14-2 and A-14-3, respectively. To confirm the soil properties and soil profile offshore of the SWIS, four additional soil borings were performed in May 1984. This information was supplemented to the existing boring data to develop the soil profiles which were used as the basis for the soil structure interaction analyses described herein. Tables A-14-1 and A-14-2 show the simplified dynamic soil column models used for the seismic soil-structure interaction analysis (SSI) for the West (River) and East (Landward) side of SWIS area.

1. Evaluation Procedure

A total of ten separate seismic soil-structure interaction (SSI) analyses of the SWIS were performed using the finite element method (Table A-14-3). Each SSI analysis consisted of a free-field deconvolution analysis followed by a finite element interaction analysis. The interaction analysis takes into consideration the coupled effect of the structure and the supporting soil. The computer code FLUSH was used. The East-West and North-South soil-structure models used in the analysis are shown in Figures A-14-4 and A-14-5, respectively. The vertical SSI analysis is performed using the model shown in Figure A-14-4. It is noted that sheet piles and cofferdams are explicitly represented in the soil-structure interaction model as appropriate. As the slanted soil layering is not significant (less than 5°) discretized horizontal layers with average layer thicknesses are used to represent the soil strata in the finite element SSI model.

The following criteria were followed in the development of the soil-structure models:

A. Depth of Soil-Structure Model

- o The model depth is greater than twice the base dimensions.
- o The fundamental frequency of the soil stratum is well below the structural frequencies of interest.
- o The input motion at the base for the discrete soil model produces the specified design spectra at the control point (input level) of the soil profile in the free field.

B. Side Boundaries of the Soil-Structure Model

- o Transmitting boundaries are used where applicable.
- o Where transmitting boundaries are not used, the distance of the boundaries to the edge of the foundation is kept equal to or greater than three time the base slab dimension.
- o The aspect ratio of finite elements is increased in a gradual way from edge of the foundation to the boundary.
- o Elements in the neighborhood of the foundation are kept sufficiently small to reproduce adequately the static stress distributions and to transmit waves at all frequencies of interest.

The SSI Runs 1 and 2 were performed to determine whether the landward side or the river side soil column will provide the governing SWIS responses. Similarly, the SSI Runs 1 and 3 were performed to investigate whether the upper bound (30 ft) or the lower bound (10 ft) kirkwood clay layer thickness will provide governing SWIS responses. The effects of soil property variation on the SWIS responses were evaluated using the results obtained from the SSI Runs 3, 4, and 5. The SSI Runs 3 and 6 through 10 were performed to develop the seismic structural responses due to the SSE and OBE for the three earthquake directions.

2. <u>Results of Evaluation</u>

A. <u>Landward versus River Side Soil Column</u>

Figure A-14-6 shows the 2% damping response spectrum comparison plots for results obtained from SWIS SSI analyses performed using the simplified landward and riverside soil columns. Response spectra obtained

A. Landward versus River Side Soil Column (Cont'd)

from the SSI analysis using the landward side soil column generally envelop those obtained using riverside soil column except in the frequency range around 0.9 Hz. Since the differences in spectral acceleration at 0.9 Hz range are of no practical importance to the design of the SWIS structure and the piping and components inside the structure (there is no equipment or component in this frequency range), the use of landward side soil column are, therefore, judged to produce conservative SWIS responses and has been selected as the free-field soil column for the SSI model.

B. Upper Bound versus Lower Bound Kirkwood Clay Thickness

As can be seen from Figure A-14-7, upper bound (30') Kirkwood clay layer thickness provides more conservative SWIS response. This upper bound thickness is used in the subsequent analysis.

C. Soil Property Variation

The effects of the upper bound and the lower bound soil properties on dominant spectral peak frequency shift were evaluated for two typical elevations of the structure. - The results are as follows:

Elevation (ft)	Upper bound	Lower bound
93 (operating floor)	+28%	- 11%
135 (top of SWIS)	+44%	- 11%

Therefore, results of soil property variation studies (SSI Run 3, 4, and 5) confirm that the existing response spectrum broadening criteria (±50% widening of the dominant spectral peak) used for the SWIS are conservative.

D. Design Basis Analysis Results

Based on the conclusions of the parametric studies discussed in Items A, B, and C above, additional SSI runs are made to develop the response spectra in the two horizontal and the vertical directions for both the SSE and the OBE cases. Figures A-14-8 through A-14-25 provide response spectrum comparison plots for the design basis, the impedance approach (half-space) and the FLUSH analysis results. The response spectrum comparison plots for the design basis and the impedance approach analysis results were presented and discussed in the response to NRC Audit Question No. A-16, Meeting Date January 11, 1984.

D. Design Basis Analysis Results (cont'd)

In general, the Bechtel FLUSH analysis results are in good agreement with the SWIS seismic design requirements currently being used in the project. There are some exceedances in the frequency ranges approximately 1 to 4 H_z and 15 to 20 H_z between the Bechtel FLUSH and the design basis analysis results. These exceedances are listed in Table A-14-4. The effects of these exceedances are evaluated for the combined responses in three directions using the SRSS approach and compared with the design basis results. Table A-14-5 provides these comparisons. In all cases, these variations are judged to be minor. In areas where multimodal analysis is performed, the effects of these variations will be further reduced. It has been concluded that the variations between these two analyses are within the accuracy of analyses and can be accommodated within the design margin.

TABLE A-14-1

SIMPLIFIED DYNAMIC SOIL MODEL (RIVERSIDE INTAKE STRUCTURE AREA)

FOR SOIL STRUCTURE INTERACTION-AVERAGE SOIL PROPERTIES

Elevation (Feet, PSE&G Datum)	Thickness (ft)	Soil Type	Saturated Unit Weight (pcf)	Poisson's Ratio	A	n	G_o (psf) $x10^6$	K Curve # From Fig.8	Damping Curve From Fig.
67-58	9	SP/ML/CH	107	0.48	-	-	.2	5	4
58-50	8	SC/GC/CH	128	0.40	45,000	0.5	-	5	4
50-40	10	SM (Oxidized (Vincentown)	121	0.43	3,160	1	-	2	4
40-(-28)	65	SM (Vincentown)	121	0.43	3,160	1	-	2	4
(-28)-(-46)	18	SM (Hornerstown)	121	0.43	3,160	1	-	2	4
(-46)-(-68)	22	SM (Navesink)	121	0.43	3,160	1	-	2	4
(-68)-(-100)	32	SM (Various)	121	0.43	3,160	1	-	2	4
(-100)-(-300)	200	Various	121	0.40	1,890,000	0.3	-	2	4

Notes: $G_o = A\bar{\sigma}_a^{\,n}$ Shear modulus at small strains K = 1.

$G = K A\bar{\sigma}_a^{\,n}$ Value of K depends on strain level. It is obtained from corresponding curve in Fig. 8.

D = Damping ratio is obtained from Figs. 4 & 5 as a function of strain.

Figure numbers correspond to the Figures in the June 13, 1975 Dames and Moore soil report.

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TABLE A-14-2

SIMPLIFIED DYNAMIC SOIL MODEL (LANDWARD INTAKE STRUCTURE AREA) FOR SOIL STRUCTURE INTERACTION - AVERAGE SOIL PROPERTIES

Elevation (Feet, PSE&G Datum) (ft)	Thickness (ft)	Soil Type	Saturated Unit Weight (pcf)	Poisson's Ratio	A	n	G_o (psf) $x10^6$	K Curve From Fig. 8	Damping Curve From Fig.
100-91	9	ML (Fill)	110	0.48	-	-	.15	3	5
91-74	17	CL (Fill	96	0.48	-	-	.30	3	5
74-65	9	OL (Fill)	96	0.48	-	-	.30	3	5
65-60	5	SP (River Bottom)	124	0.40	3160	1	-	2	4
60-50	10	CH (Kirkwood)	124	0.40	-	-	5.5	4	5
50-42	8	SM (Basal)	124	0.40	3160	1	-	2	4
42-37	5	SM (Oxidized Vincentown)	121	0.43	3160	1	-	2	4
37-(-28)	65	SM (Vincentown)	121	0.43	3160	1	-	2	4
(-28)-(46)	18	SM (Hornerstown)	121	0.43	3160	1	-	2	4
(-46)-(68)	22	SM (Navesink)	121	0.43	3160	1	-	2	4
(-68)-(100)	32	SM (Various)	121	0.43	3160	1	-	2	4
(-100)-(-300)	200	Various	121	0.40	1,890,000	0.3	-	2	4

NOTES: $G_o = A\bar{\sigma}_a{}^n$ Shear modulus at small strains K = 1.

$G = K A \bar{\sigma}_a{}^n$ Value of K depends on strain level. It is obtained from corresponding curve in Fig. 8.

D = Damping ratio is obtained from Figs. 4 & 5 as a function of strain.

Figure numbers correspond to the Figures in the June 13, 1975 Dames and Moore soil report.

Water table two feet below ground surface.

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TABLE A-14-3

MATRIX OF INTAKE STRUCTURE SOIL-STRUCTURE INTERACTION ANALYSES

Soil-Structure Interaction Analysis Cases	Analysis Parameters											
	Earthquake Direction			Design Earthquake		Soil Column		Soil Layering		Soil Property Variation		
	N-S	E-W	V	SSE	OBE	Landward	Riverside	10' thickness Kirkwood Clay	30' thickness Kirkwood Clay	Upper Bound 1.5 G_o	Average 1.0 G_o	Lower Bound 1/1.5 G_o
1	-	x	-	x	-	x	-	x	-	-	x	-
2	-	x	-	x	-	-	x	x	-	-	x	-
3	-	x	-	x	-	x	-	-	x	-	x	-
4	-	x	-	x	-	x	-	-	x	x	-	-
5	-	x	-	x	-	x	-	-	x	-	-	x
6	-	x	-	-	x	x	-	-	x	-	x	-
7	x	-	-	x	-	x	-	x	-	-	x	-
8	x	-	-	-	x	x	-	x	-	-	x	-
9	-	-	x	x	-	x	-	x	-	-	x	-
10	-	-	x	-	x	x	-	x	-	-	x	-

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TABLE A-14-4

Comparison of Design Basis and Independent Finite Element Verification Response Spectra For Intake Structure

Item No.	Key Elevation Ft.	Design Earthquake	Earthquake Direction	Location of Exceedances (Note 1)	Figure No.	Spectral Acceleration (Note 2)	
						Design Basis (g)	Bechtel FLUSH (g)
1	93	SSE	E-W	1.80 Hz.	A-14-11	0.85	0.89
2	114	SSE	E-W	1.80 Hz.	A-14-12	0.84	1.04
3	135	SSE	E-W	1.80 Hz.	A-14-13	1.01	1.17
4	135	SSE	VERT.	3.60 Hz.	A-14-16	1.79	1.81
5	135	SSE	VERT.	18.0 Hz.	A-14-16	1.50	1.59
6	135	OBE	VERT.	4.0 Hz.	A-14-25	1.41	1.44
7	135	OBE	VERT.	18.0 Hz.	A-14-25	1.24	1.30

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NOTES:

1. This column identifies those locations where the results of the independent analysis exceed those of the design basis analysis.

2. For vertical earthquake direction, spectral acceleration includes the effect of gravity load (1.0 g).

TABLE A-14-5

SRSS Spectral Acceleration Comparison between Design Basis and Finite Element Verification Analysis for Intake Structure

Item No.	SRSS Spectral Acceleration Comparison (g)(Note 1)		
	Design Basis (A)	Bechtel FLUSH (B)	Difference (%) (B)-(A) / (A)
1	2.16	1.88	-13
2	2.23	2.01	-10
3	2.23	2.09	-6
4	2.24	2.05	-8
5	1.62	1.62	0
6	1.64	1.53	-7
7	1.29	1.31	+2

NOTE: 1. The SRSS spectral acceleration values include the effect of gravity loads (1.0 g)

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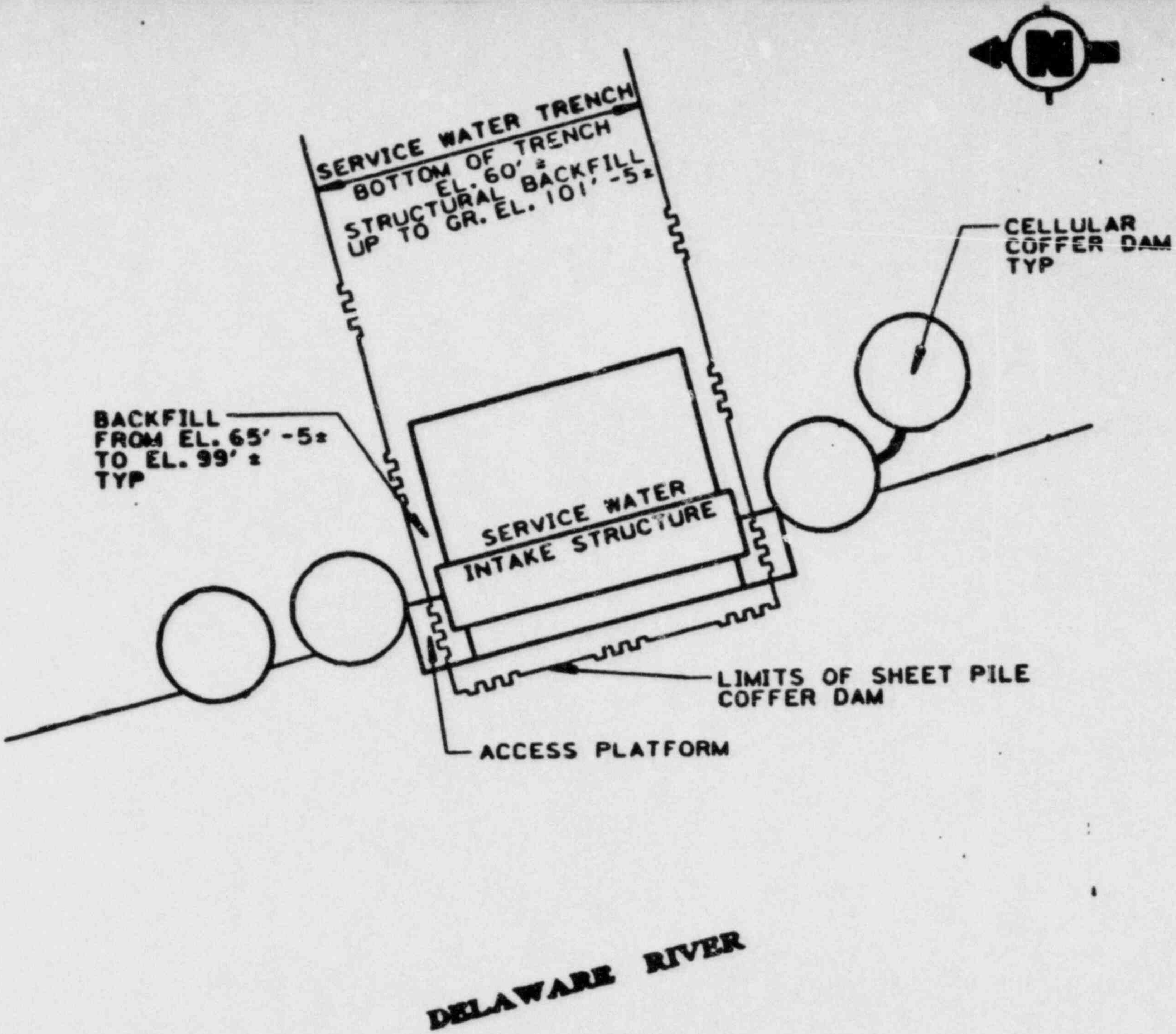
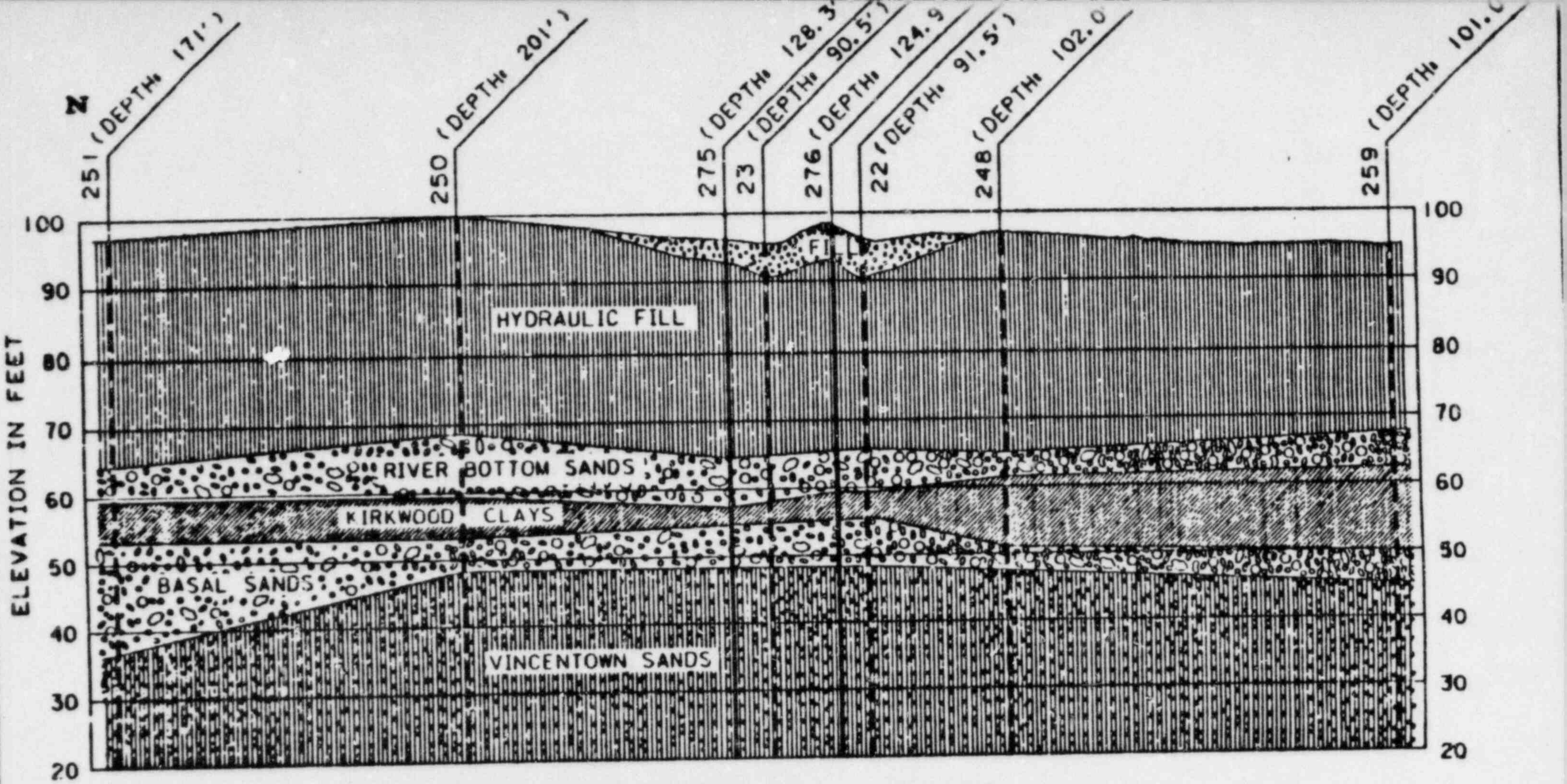
FIGURE A-14-1


N
SERVICE WATER TRENCH
BOTTOM OF TRENCH
EL. 60' ±
STRUCTURAL BACKFILL
UP TO GR. EL. 101' -5±
CELLULAR
COFFER DAM
TYP
BACKFILL
FROM EL. 65' -5±
TO EL. 99' ±
TYP
SERVICE WATER
INTAKE STRUCTURE
LIMITS OF SHEET PILE
COFFER DAM
ACCESS PLATFORM
DELAWARE RIVER



GENERALIZED NORTH-SOUTH CROSS SECTION
THROUGH SERVICE WATER INTAKE STRUCTURE
HOPE CREEK GENERATING STATION

NOTES :

1. THE SUBSURFACE SECTION REPRESENTS OUR EVALUATION OF THE MOST PROBABLE CONDITIONS BASED UPON INTERPRETATION OF PRESENTLY AVAILABLE DATA. SOME VARIATIONS FROM THESE CONDITIONS MUST BE EXPECTED.
2. ELEVATIONS SHOWN REFER TO PUBLIC SERVICE DATUM.

50 0 50 100

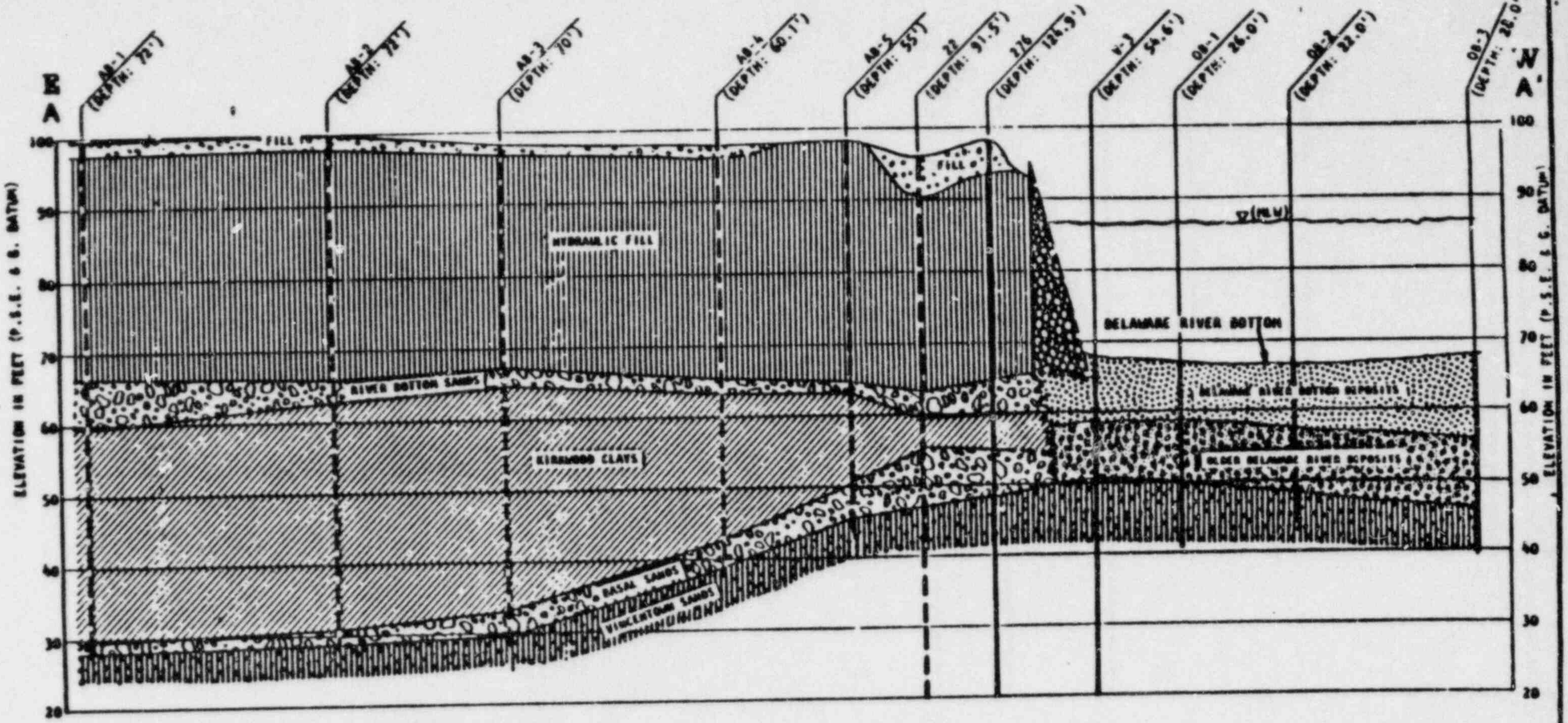
HORIZONTAL SCALE
IN FEET

KEY:

| BORING ON CROSS-SECTION

¦ BORING PROJECTED ONTO CROSS-SECTION

FIGURE A-14-2



NOTES:

1. THE SUBSURFACE SECTION REPRESENTS OUR EVALUATION OF THE MOST PROBABLE CONDITIONS BASED UPON INTERPRETATION OF PRESENTLY AVAILABLE DATA. SOME VARIATIONS FROM THESE CONDITIONS MUST BE EXPECTED.

2. REFER TO TEXT FOR A DISCUSSION OF OFFSHORE SUBSURFACE CONDITIONS.

3. REFER TO FIGURE 1 FOR LOCATION OF CROSS SECTION.

GENERALIZED EAST-WEST CROSS SECTION
THROUGH SERVICE WATER INTAKE STRUCTURE
HOPE CREEK GENERATING STATION

50 0 50 100
HORIZONTAL SCALE IN FEET

KEY:

| BORING ON CROSS-SECTION

¦ BORING PROJECTED ONTO CROSS-SECTION

FIGURE A-14-3

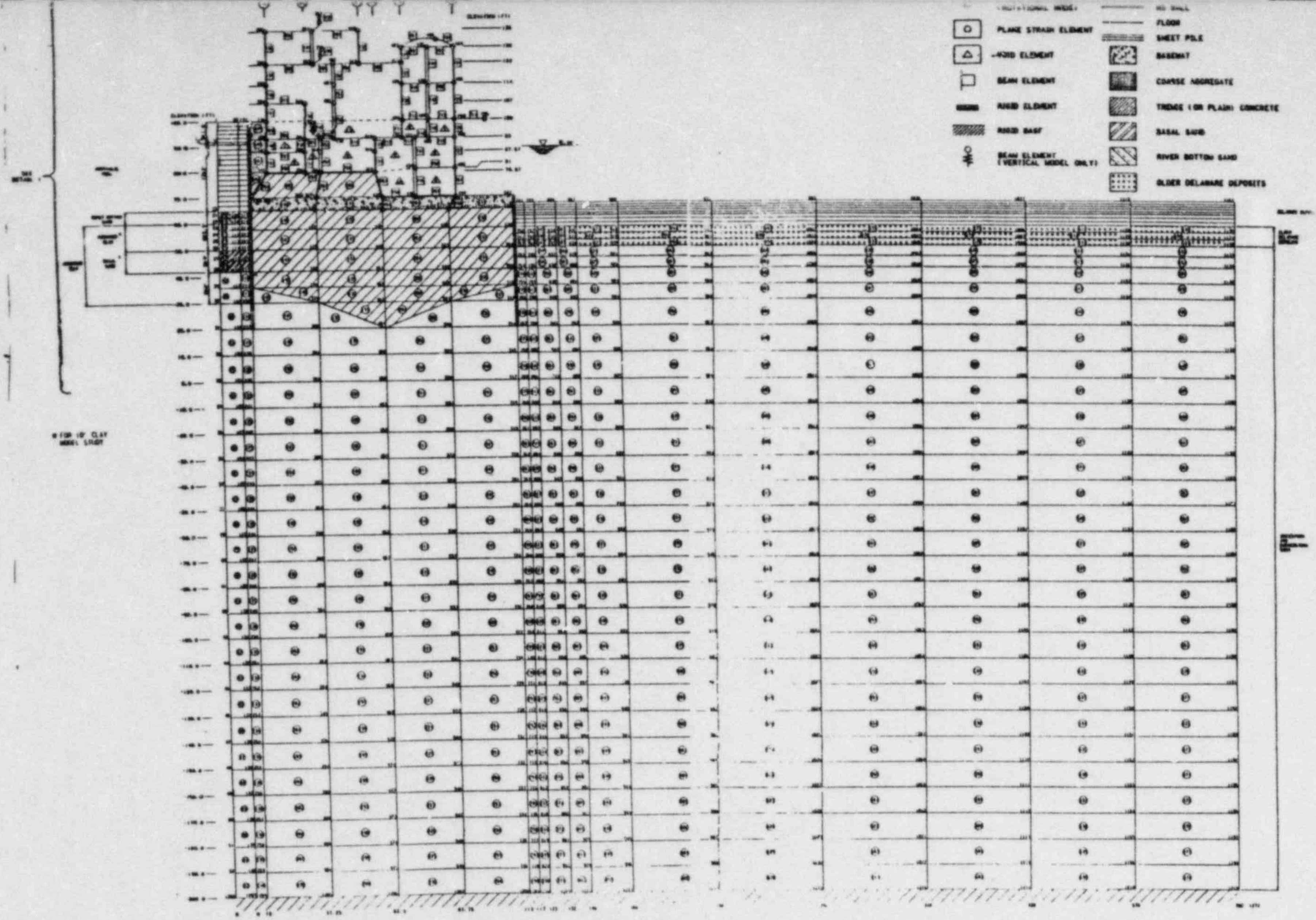


FIGURE A-14-4A

NOTE: NOT TO SCALE

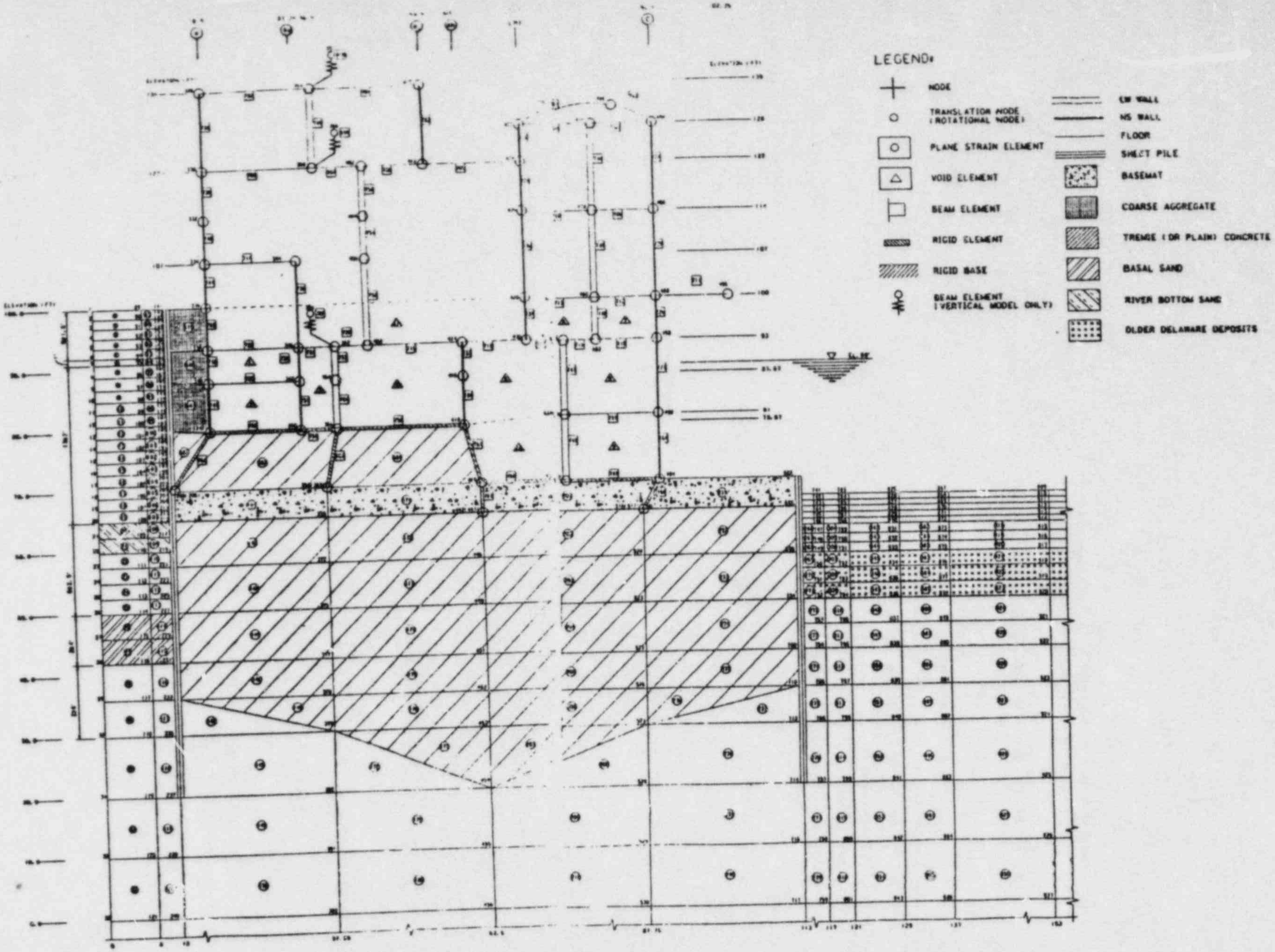


FIGURE A-14-4B

DETAIL

FLUSH EAST-WEST & VERTICAL SOIL-STRUCTURE INTERACTION MODEL
(INTAKE STRUCTURE)

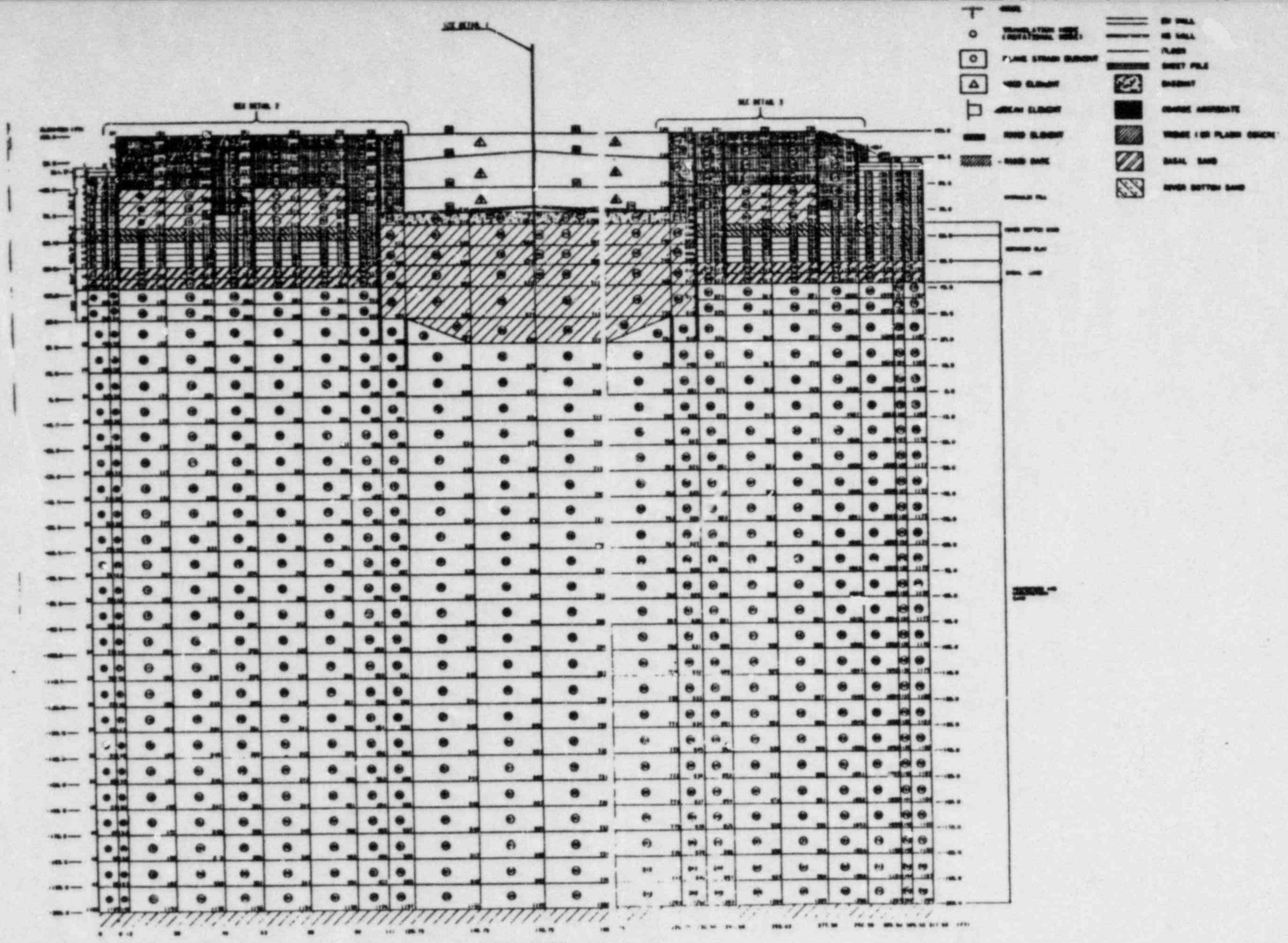


FIGURE A-14-5A
FLUSH NORTH-SOUTH SOIL-STRUCTURE INTERACTION MODEL

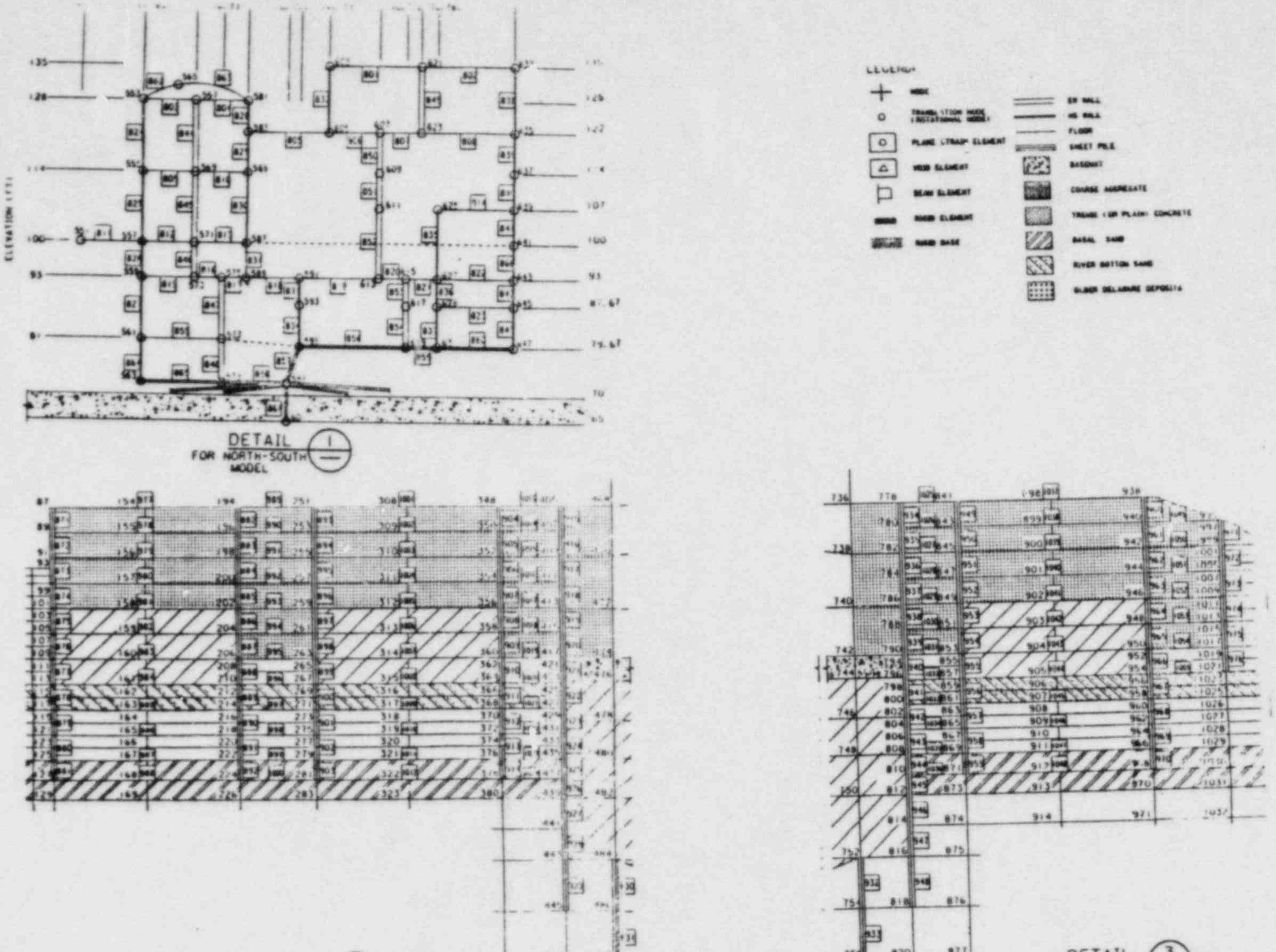
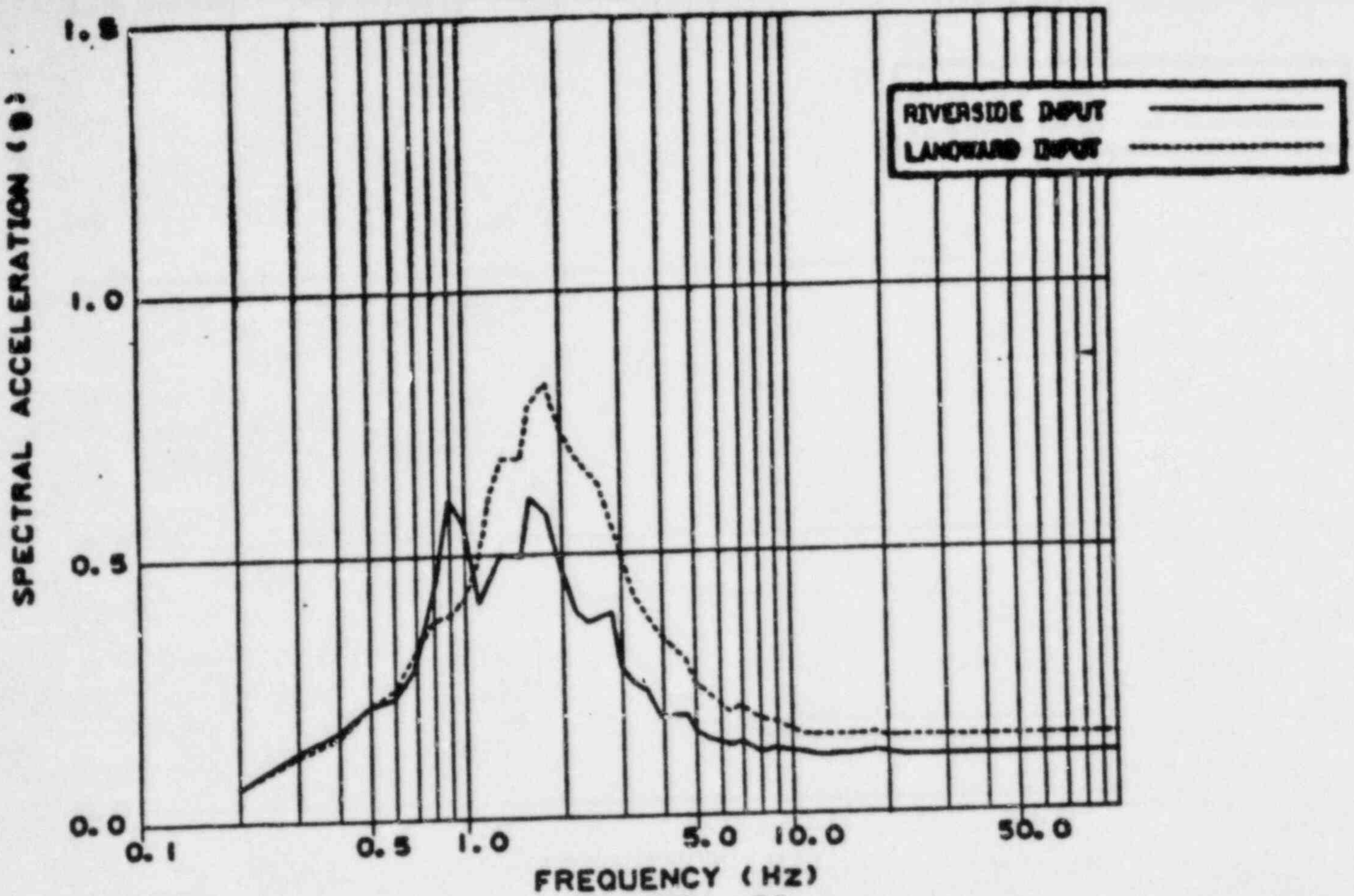
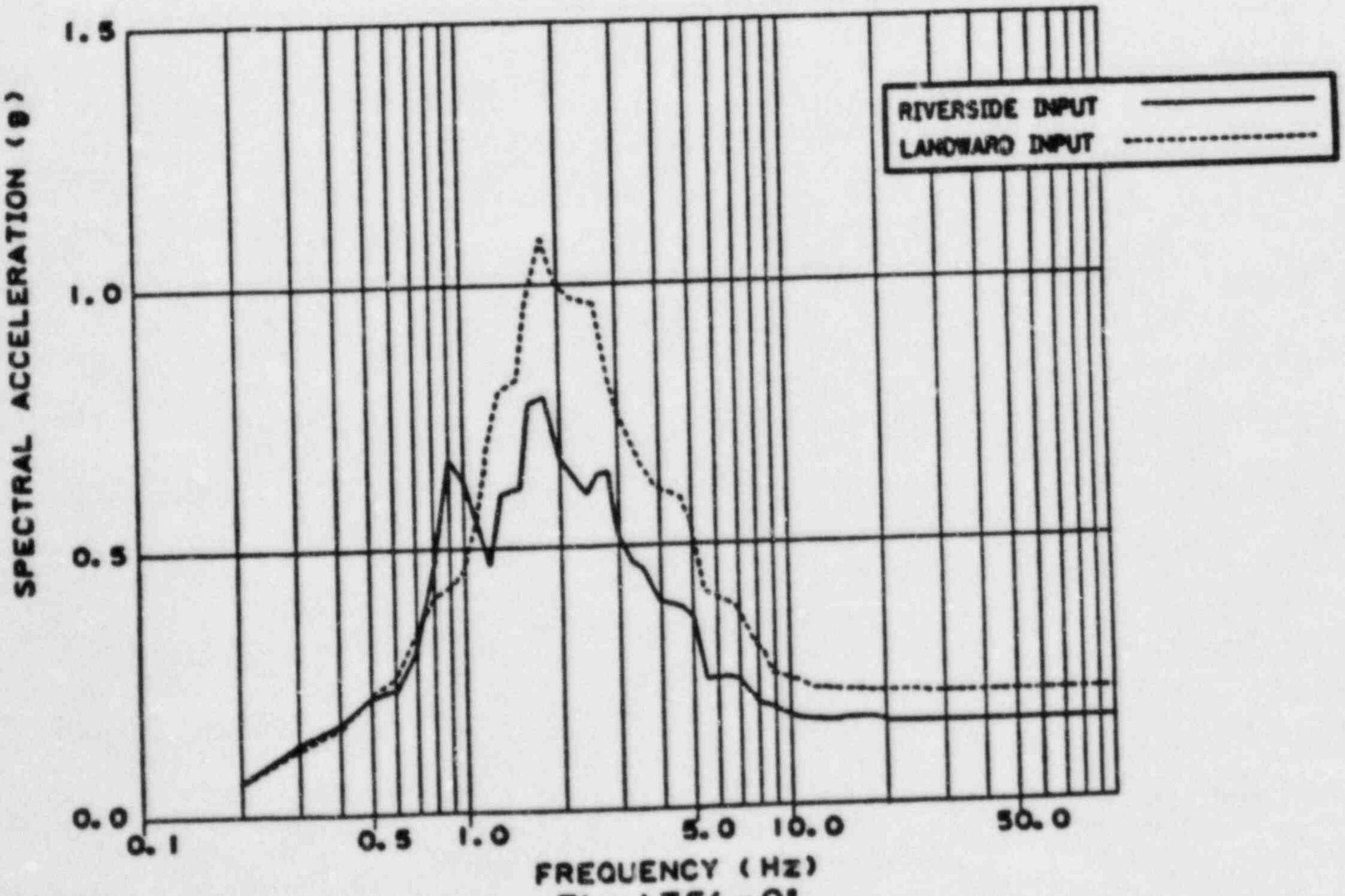


FIGURE A-14-9B

DETAILS 1, 2 AND 3
FLUSH NORTH-SOUTH SOIL-STRUCTURE INTETERACTION MODEL
(INTAKE STRUCTURE)



EL. 93' -0"

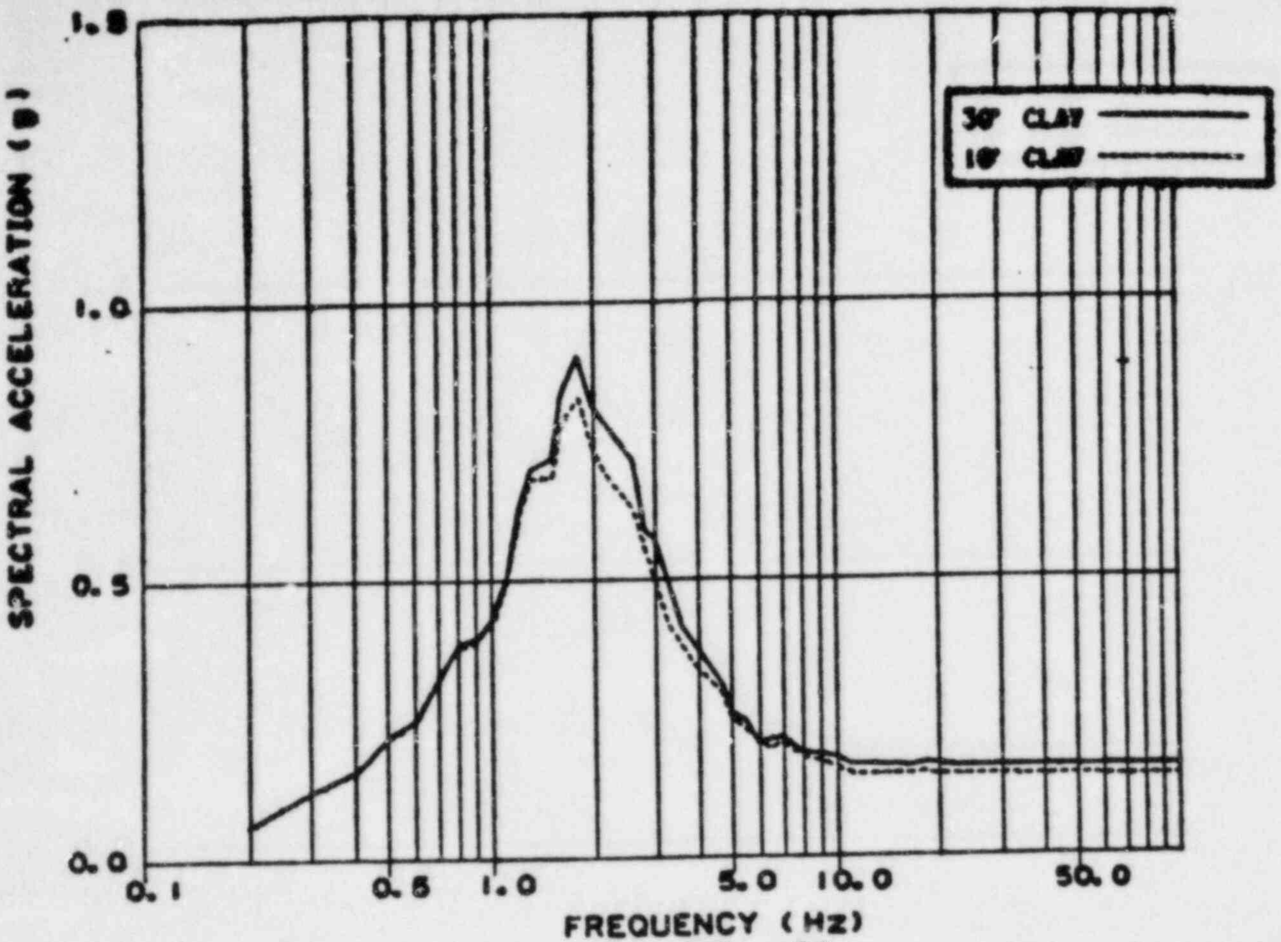


EL. 135' -0"

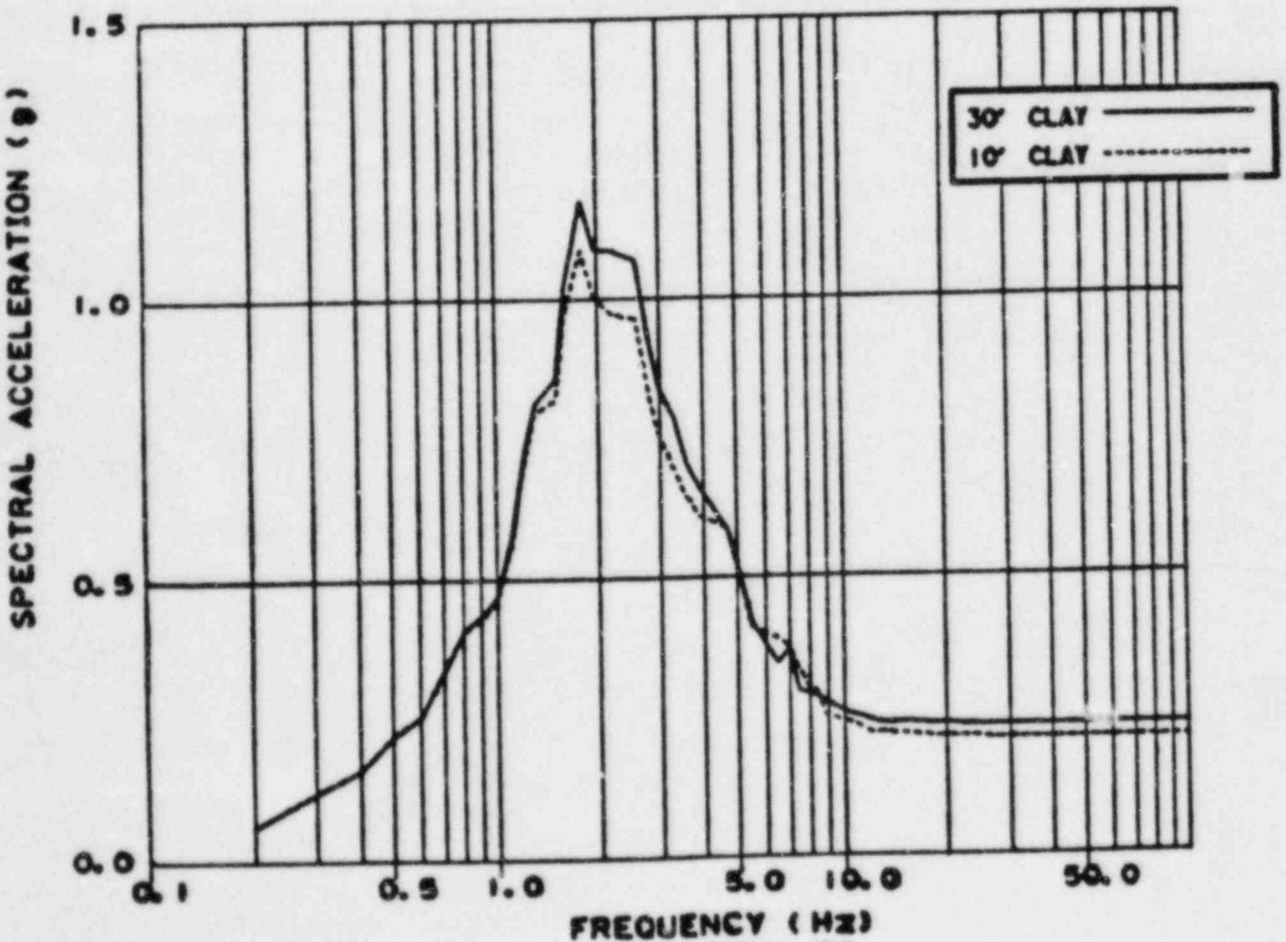
FIGURE A-14-6

RESPONSE SPECTRA COMPARISON,
LANDWARD VS. RIVERSIDE

HOPE CREEK UNIT 1
CAD. LO SHT 3, REV 0
07/10/84



EL. 93' -0"



EL. 135' -0"

FIGURE A-14-7

RESPONSE SPECTRA COMPARISON,
30' CLAY VS. 10' CLAY

HOPE CREEK UNIT 1
CAQ LOG SHT 3, REV 0

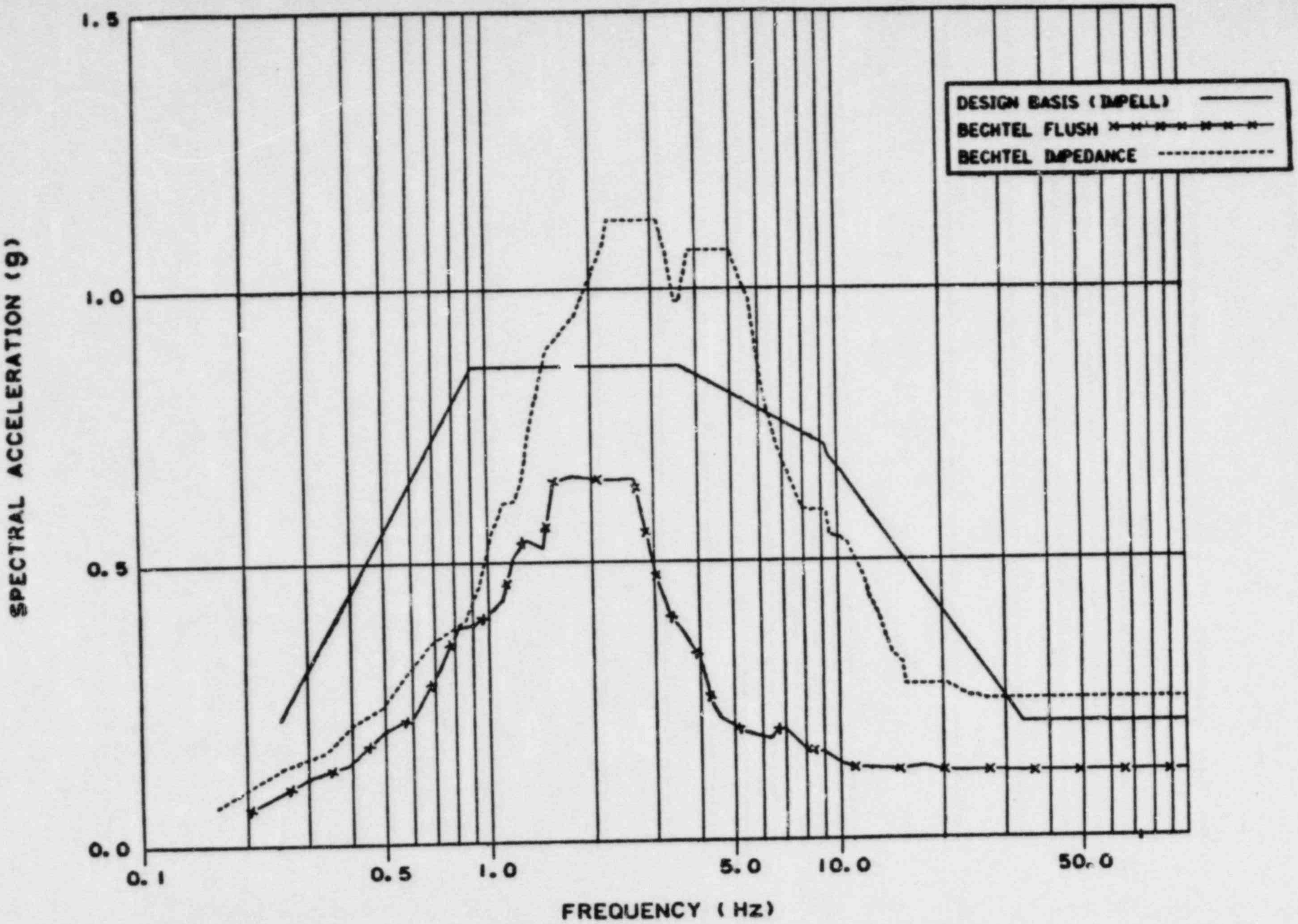


FIGURE A-14-8

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 93'-0",
N-S, SSE, 2% DAMPING

HOPE CREEK UNIT 1
CAD, L39 SHT 3, REV 0
07/20/84

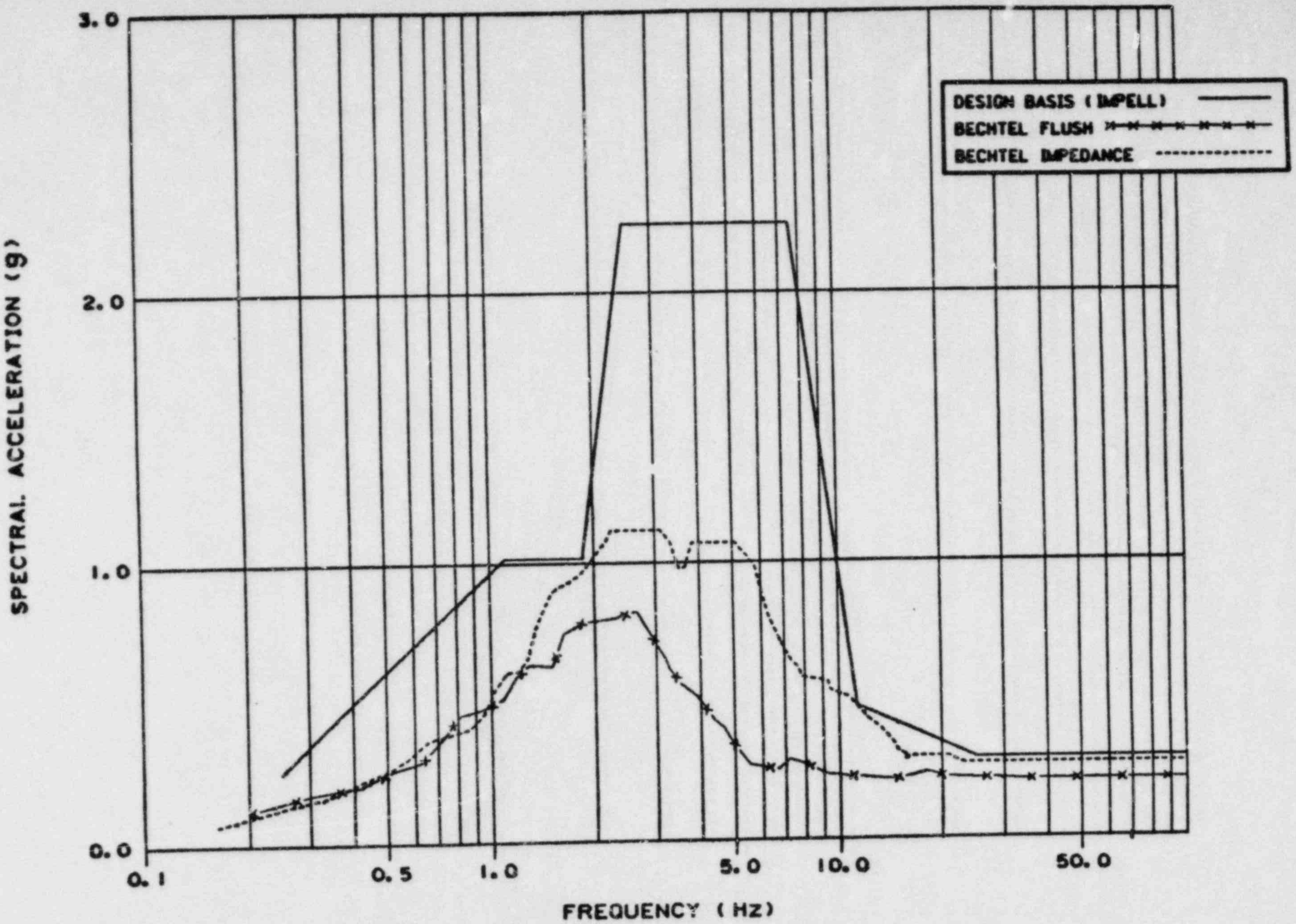


FIGURE A-14-9

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 114'-0",
N-S, SSE, 2% DAMPING

HOPE CREEK UNIT 1
CAD. L44 SHT 3, REV 0
07/20/84

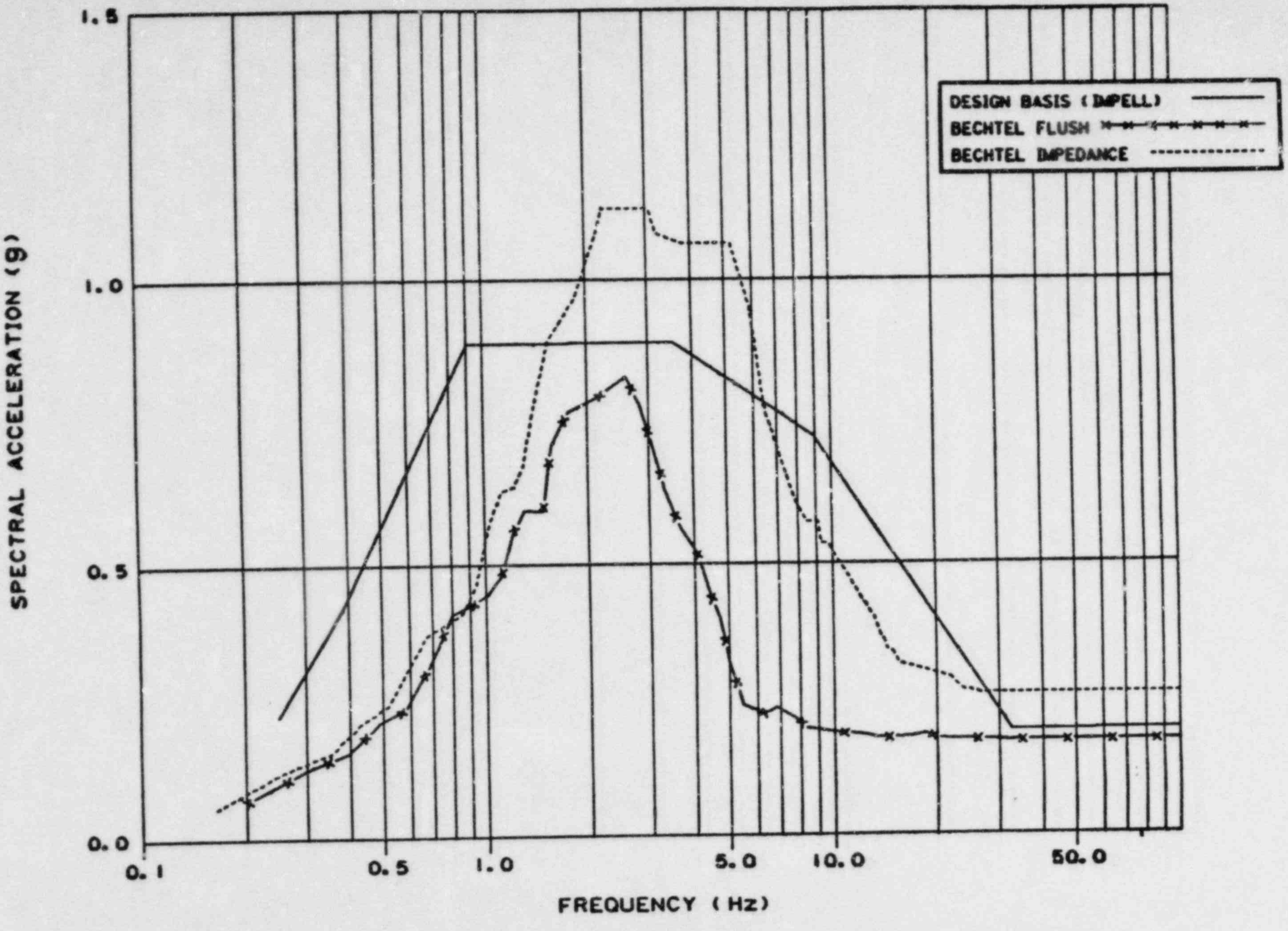


FIGURE A-14-10

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 135'-0",
N-S, SSE, 2% DAMPING

HOPE CREEK UNIT 1
CAD. L52 SHT 3. REV 0
07/20/84

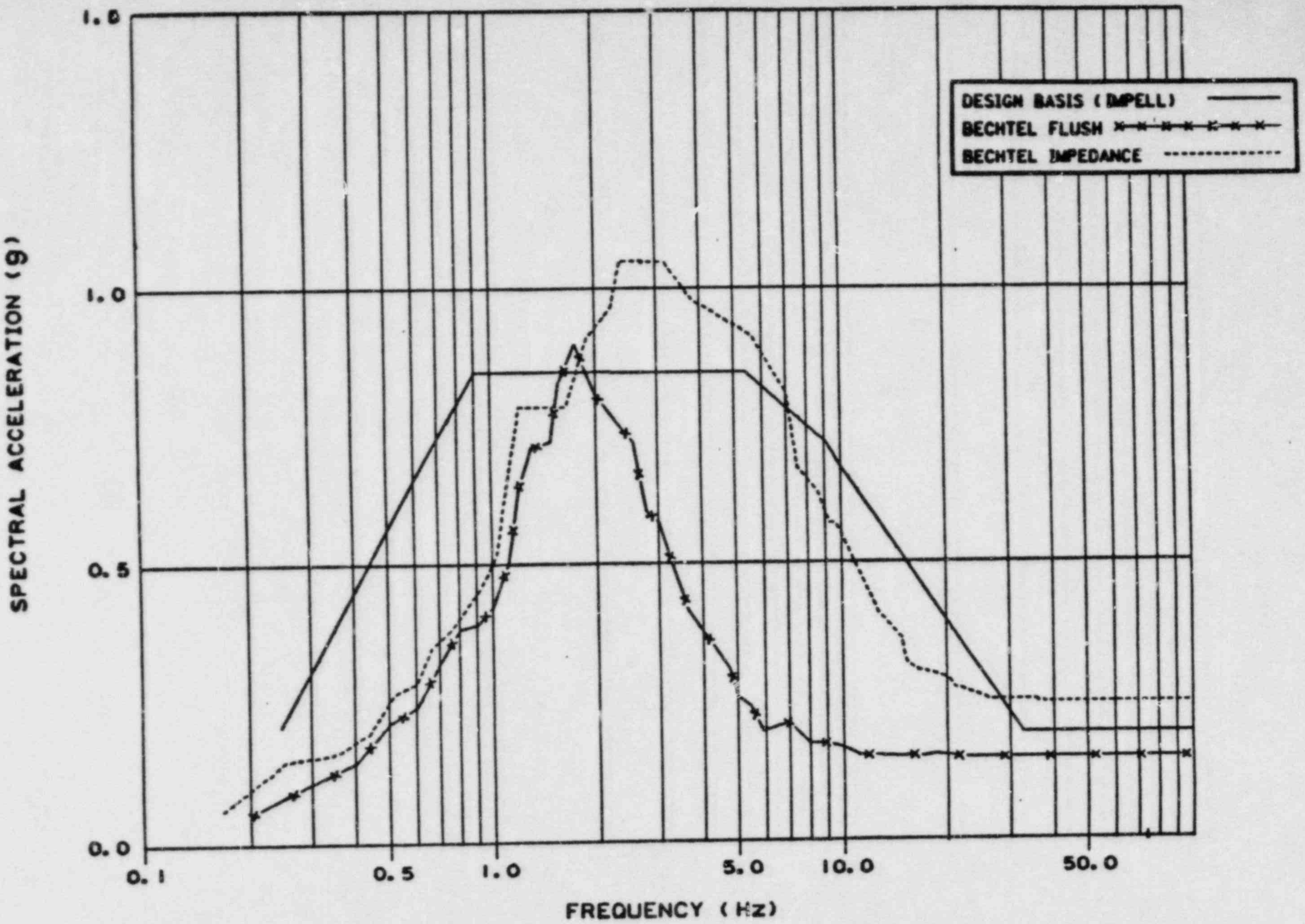


FIGURE A-14-11

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 93' -0",
E-W, SSE, 2% DAMPING

HOPE CREEK UNIT 1
CAD. L37 SHT. 3, REV 0
07/20/84

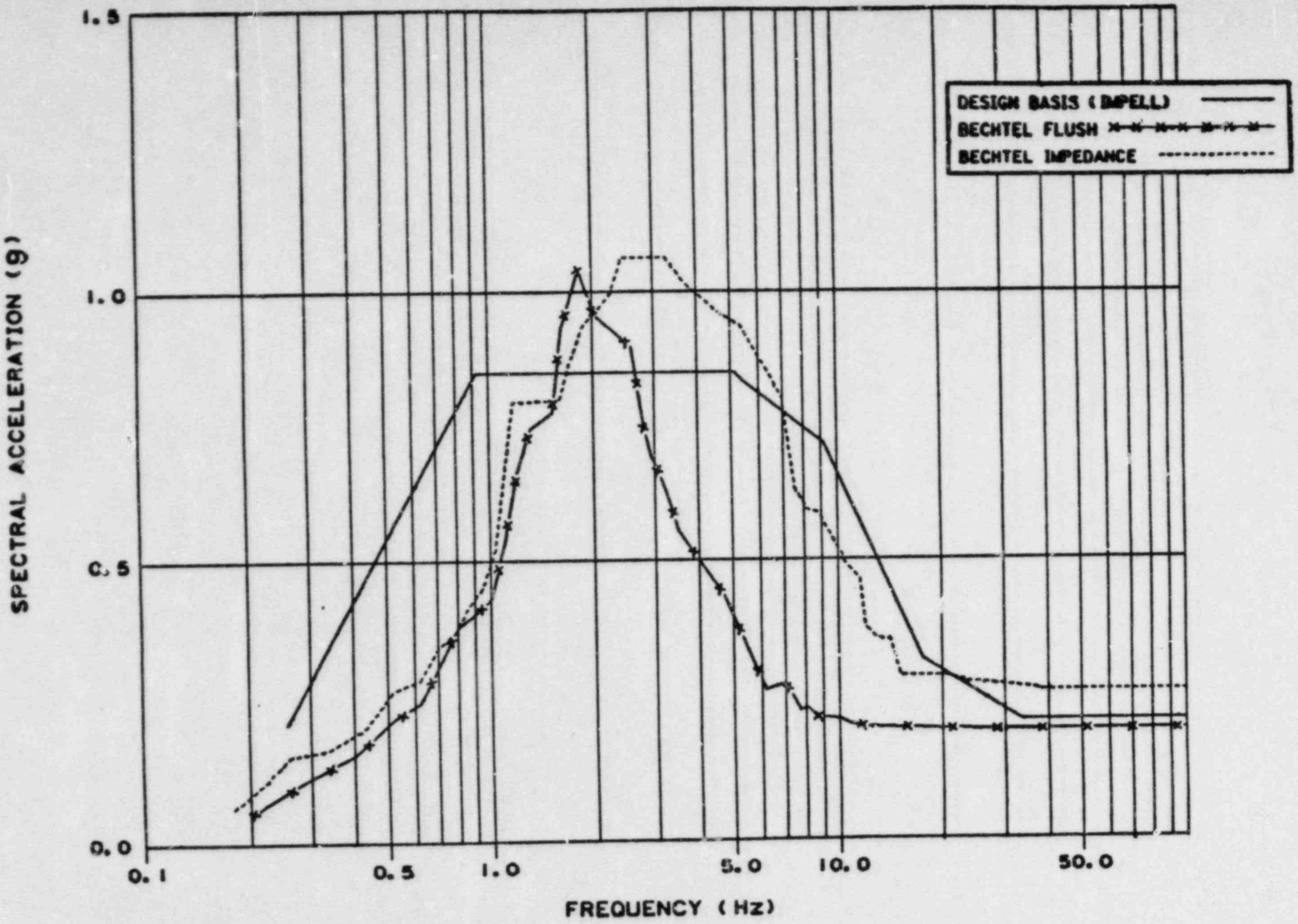


FIGURE A-14-12

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 114'-0",
E-W, SSE, 2% DAMPING

HOPE CREEK UNIT 1
CAD. L43 SHT. 3, REV 0
07/20/84

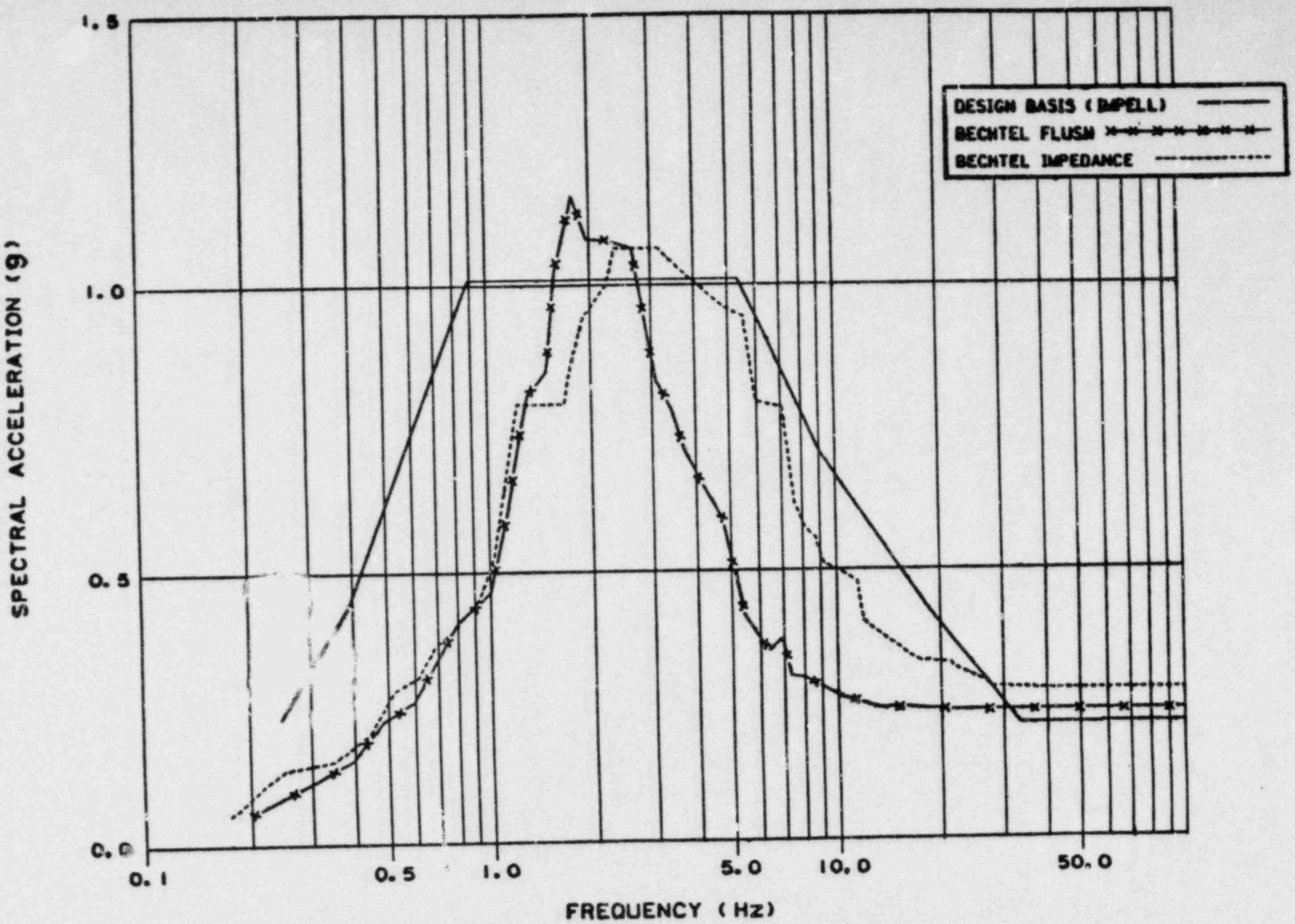


FIGURE A-14-13

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 135' -0",
E-W, SSE, 2% DAMPING

HOPE CREEK UNIT 1
CAD, L53 SHT. 3, REV 0
07/20/84

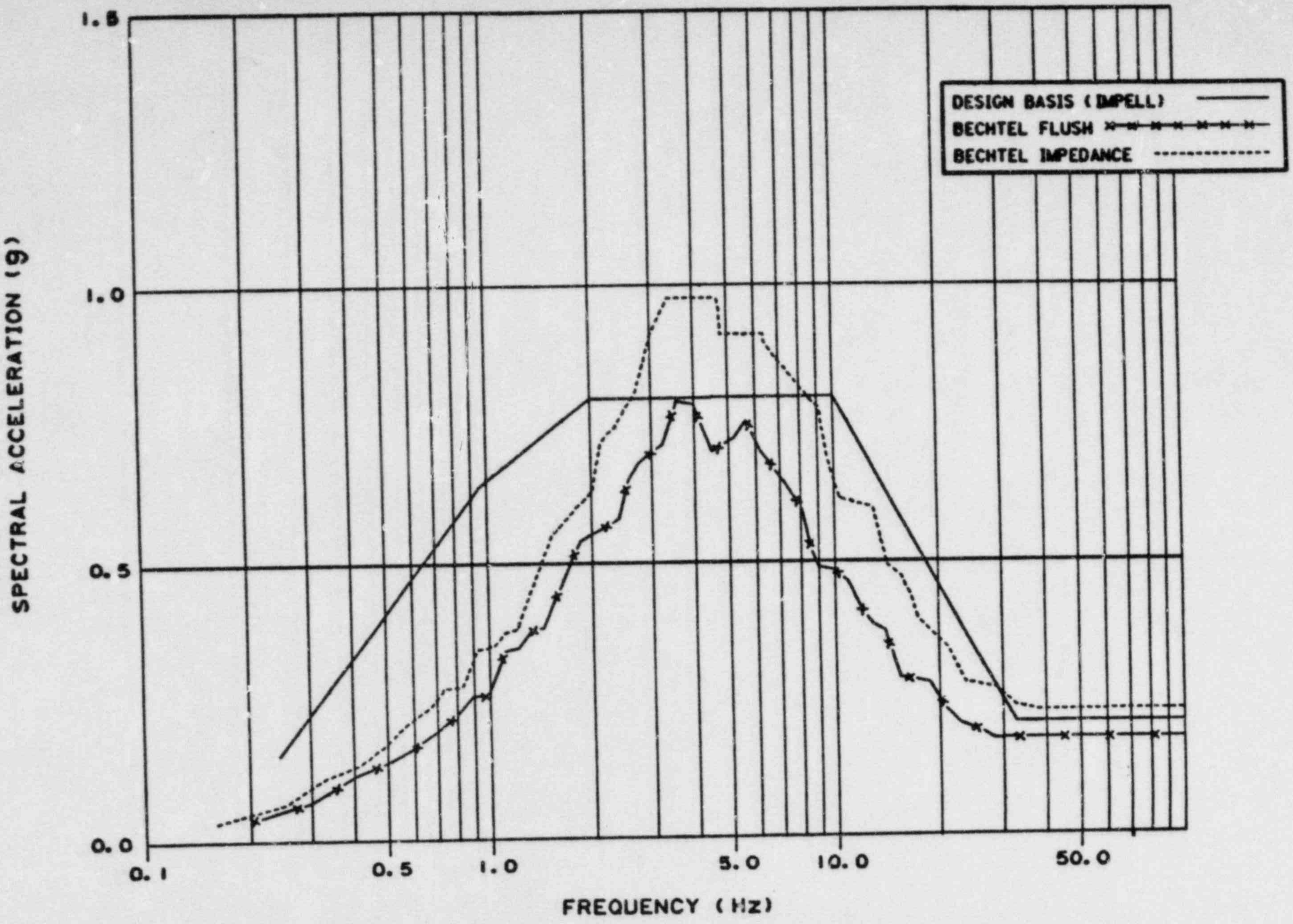


FIGURE A-14-14

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 93'-0",
VERTICAL, SSE, 2% DAMPING

HOPE CREEK UNIT 1
CAD. L38 SHT 3, REV 0
07/20/84

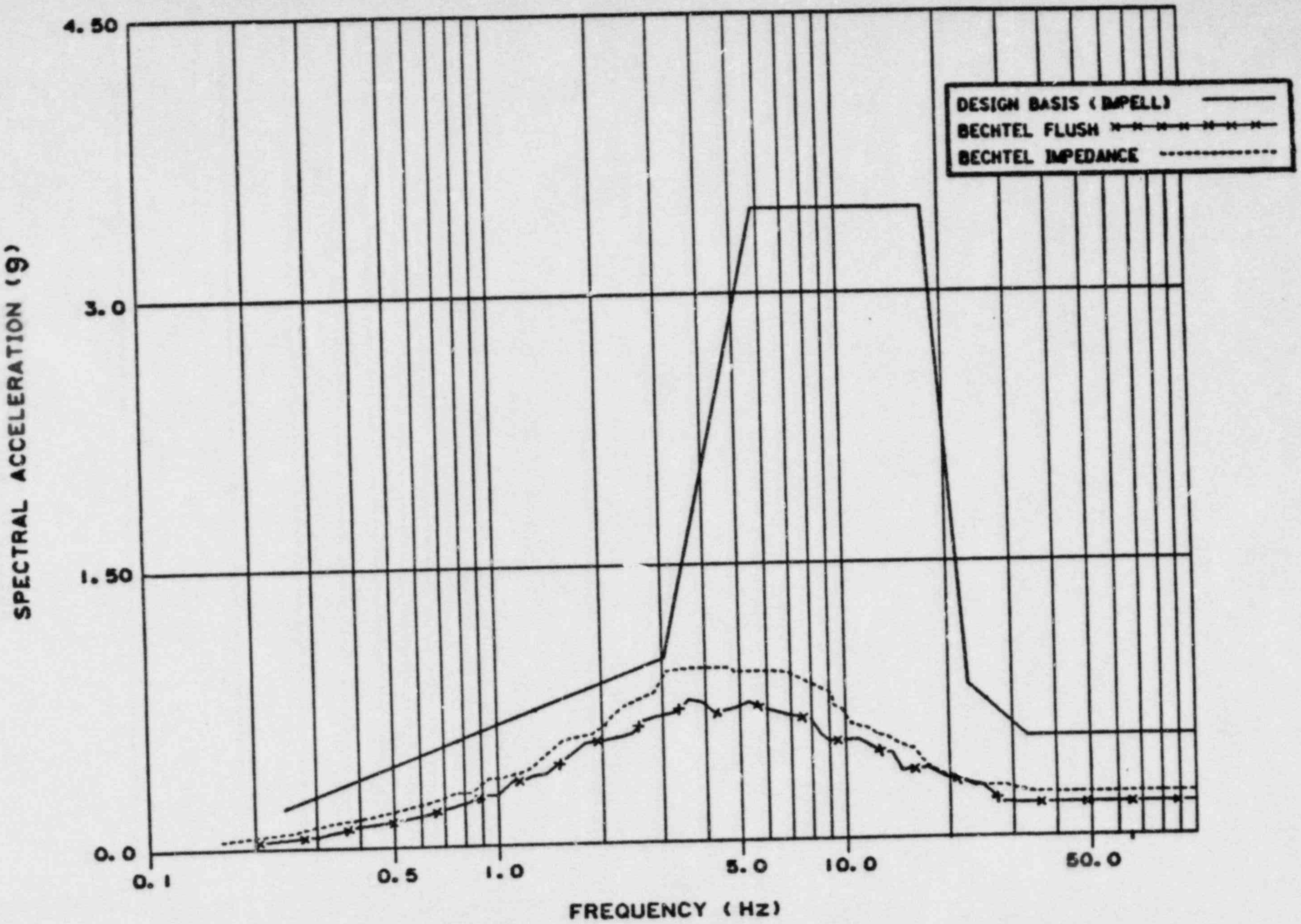


FIGURE A-14-15

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 114'-0",
VERTICAL, SSE, 2% DAMPING

HOPE CREEK UNIT 1
CAD. L45 SHT 3, REV 0
07/20/84

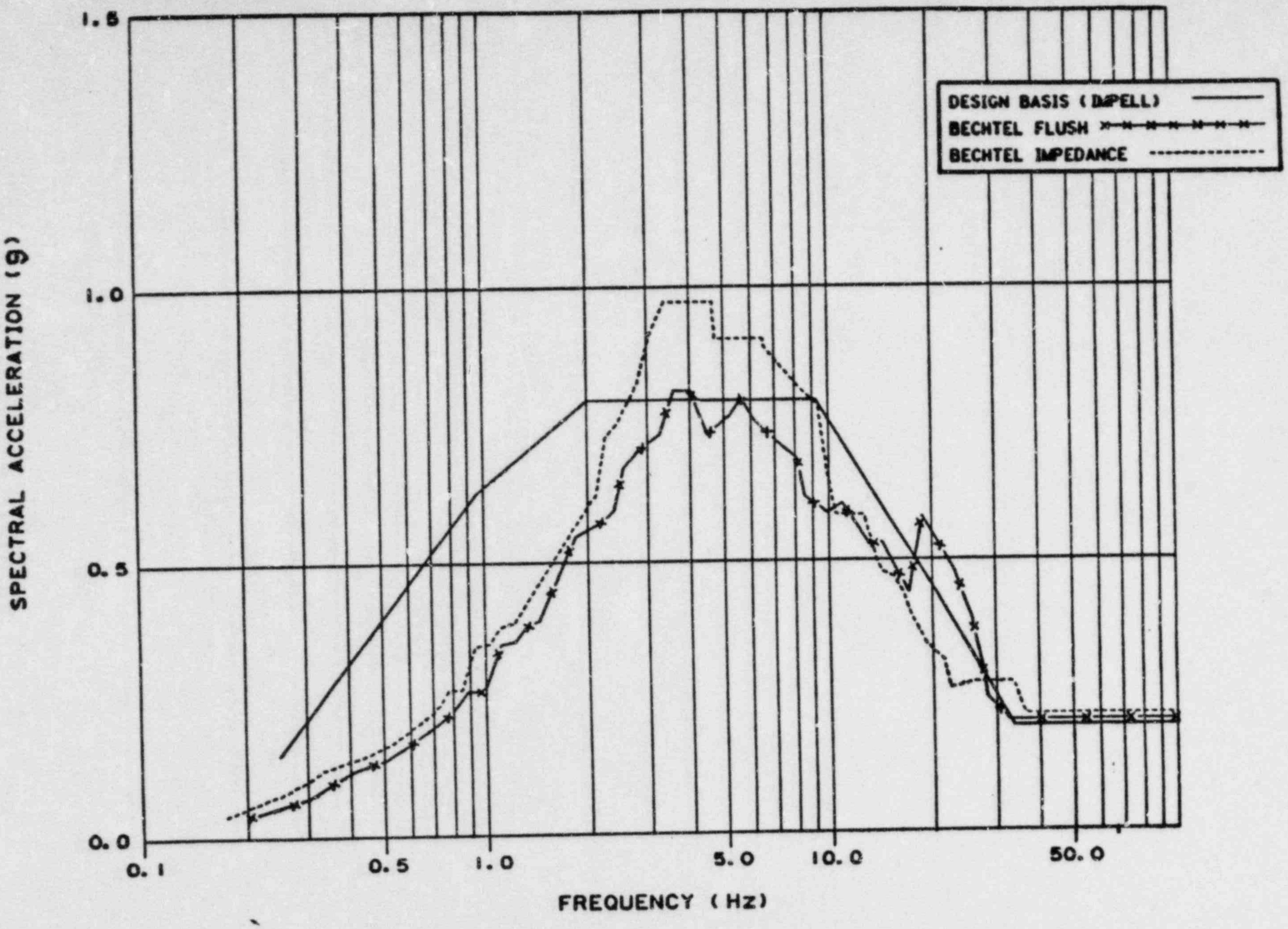


FIGURE A-14-16

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 135'-0",
VERTICAL, SSE, 2% DAMPING

HOPE CREEK UNIT 1
CAD. L54 SHT 3, REV 0
07/20/84

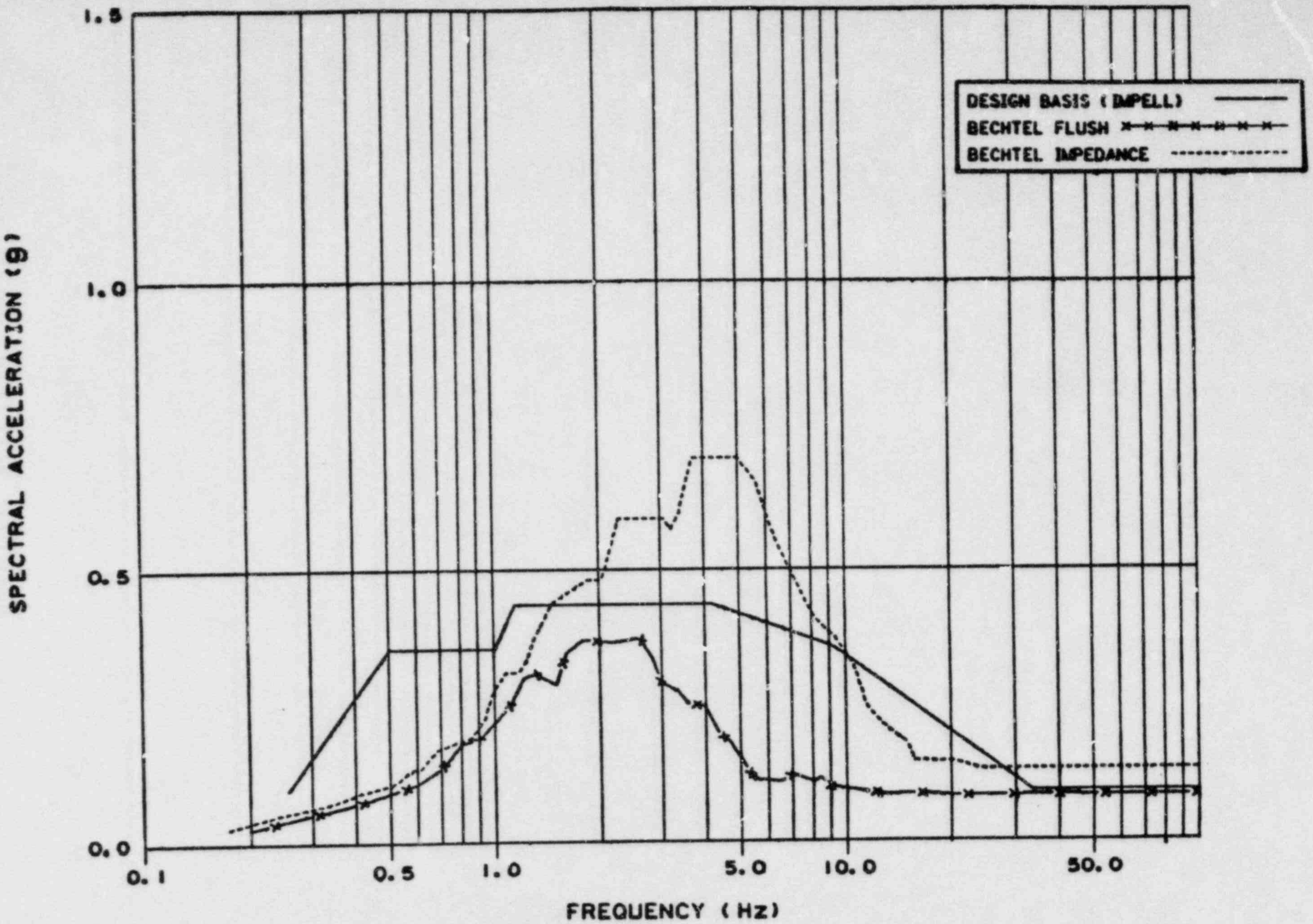


FIGURE A-14-17

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 93'-0",
N-S, OBE, 2% DAMPING

HOPE CREEK UNIT 1
CAD, LST SHT 3, REV 0
07/20/84

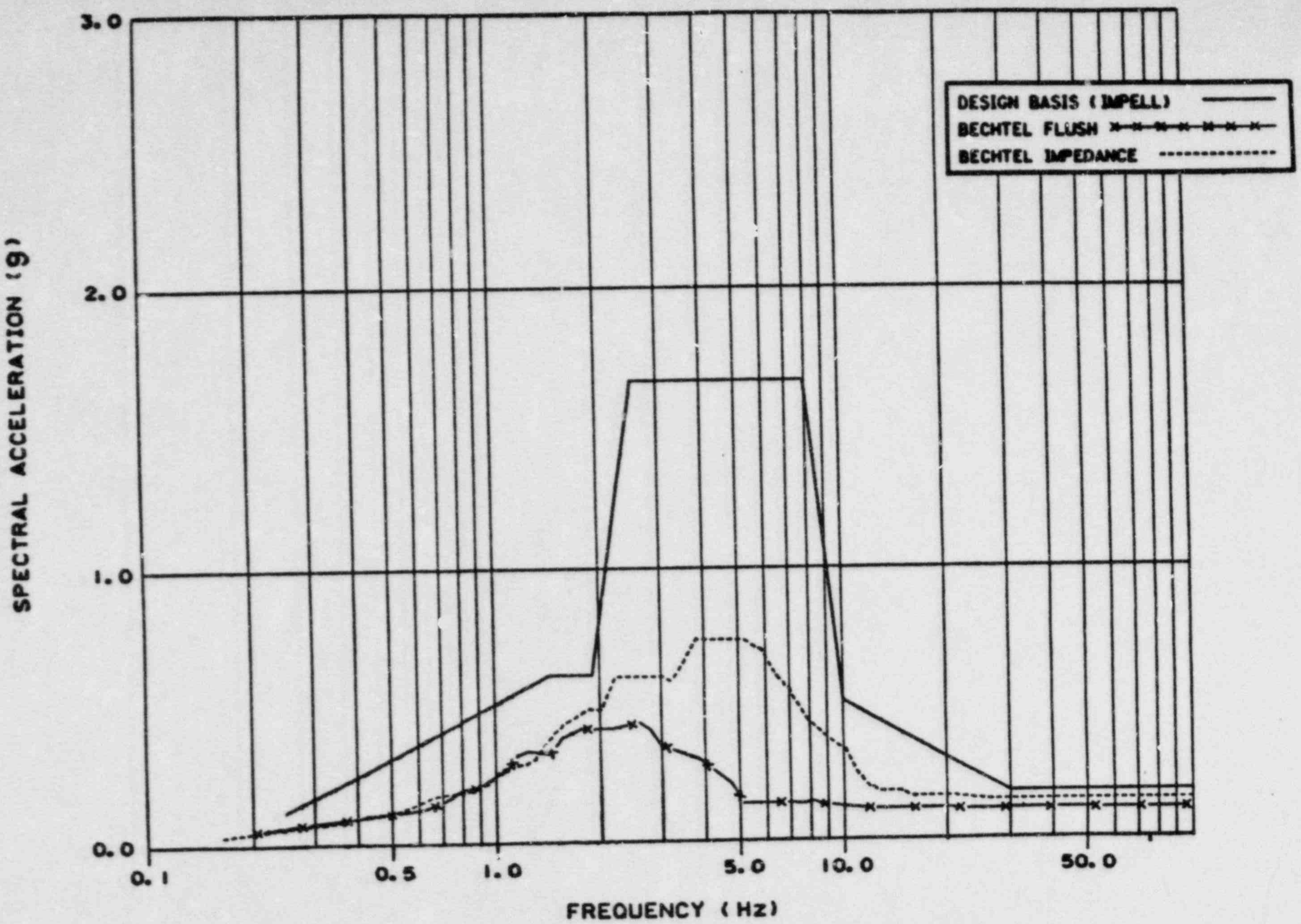


FIGURE A-14-18

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 114'-0",
N-S, OBE, 2% DAMPING

HOPE CREEK UNIT 1
CAD, L62 SHT 3, REV 0
07/20/84

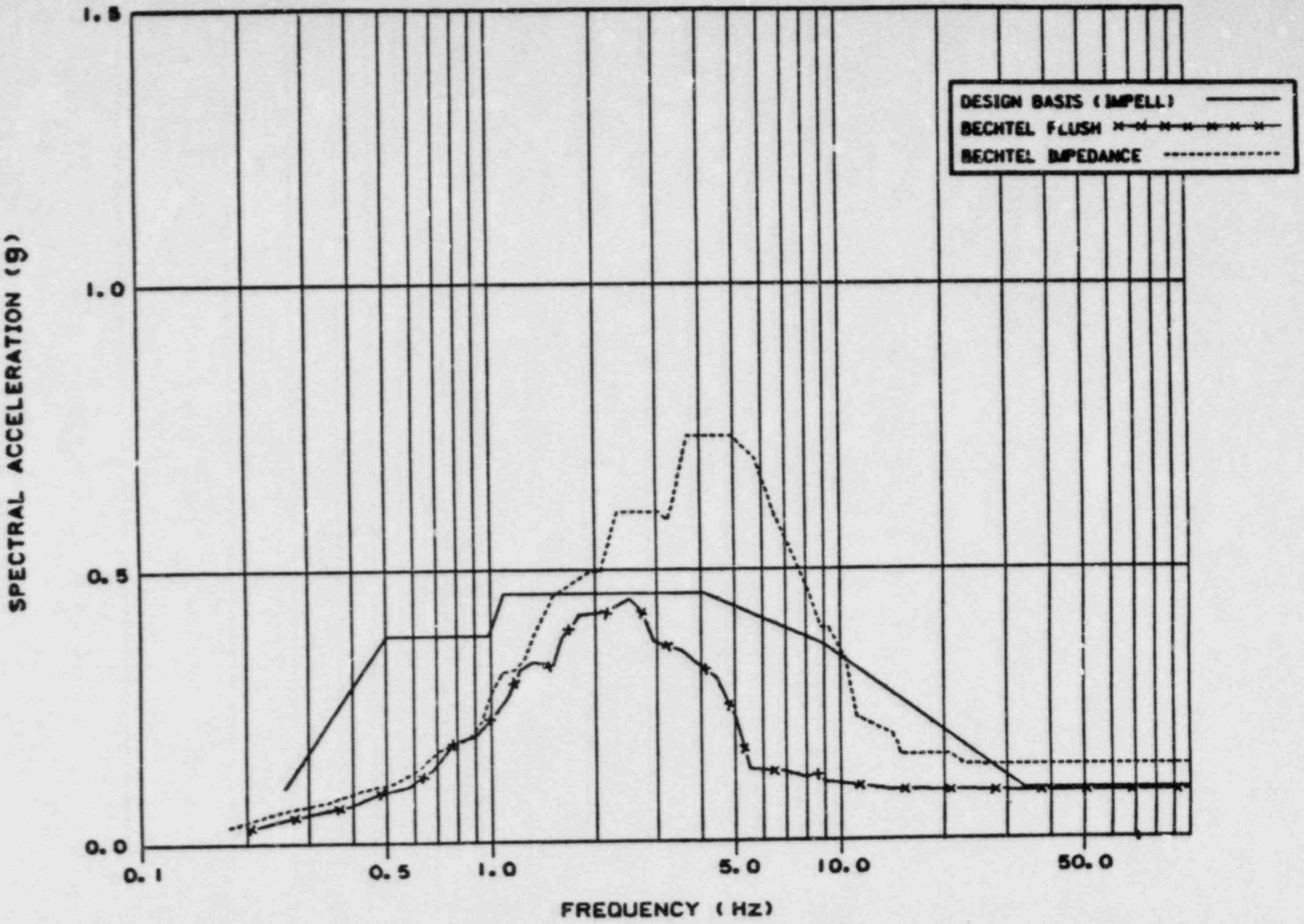


FIGURE A-14-19

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 135'-0",
N-S, OBE, 2% DAMPING

HOPE CREEK UNIT 1
CAD. LTO SHT 3, REV 0
07/20/84

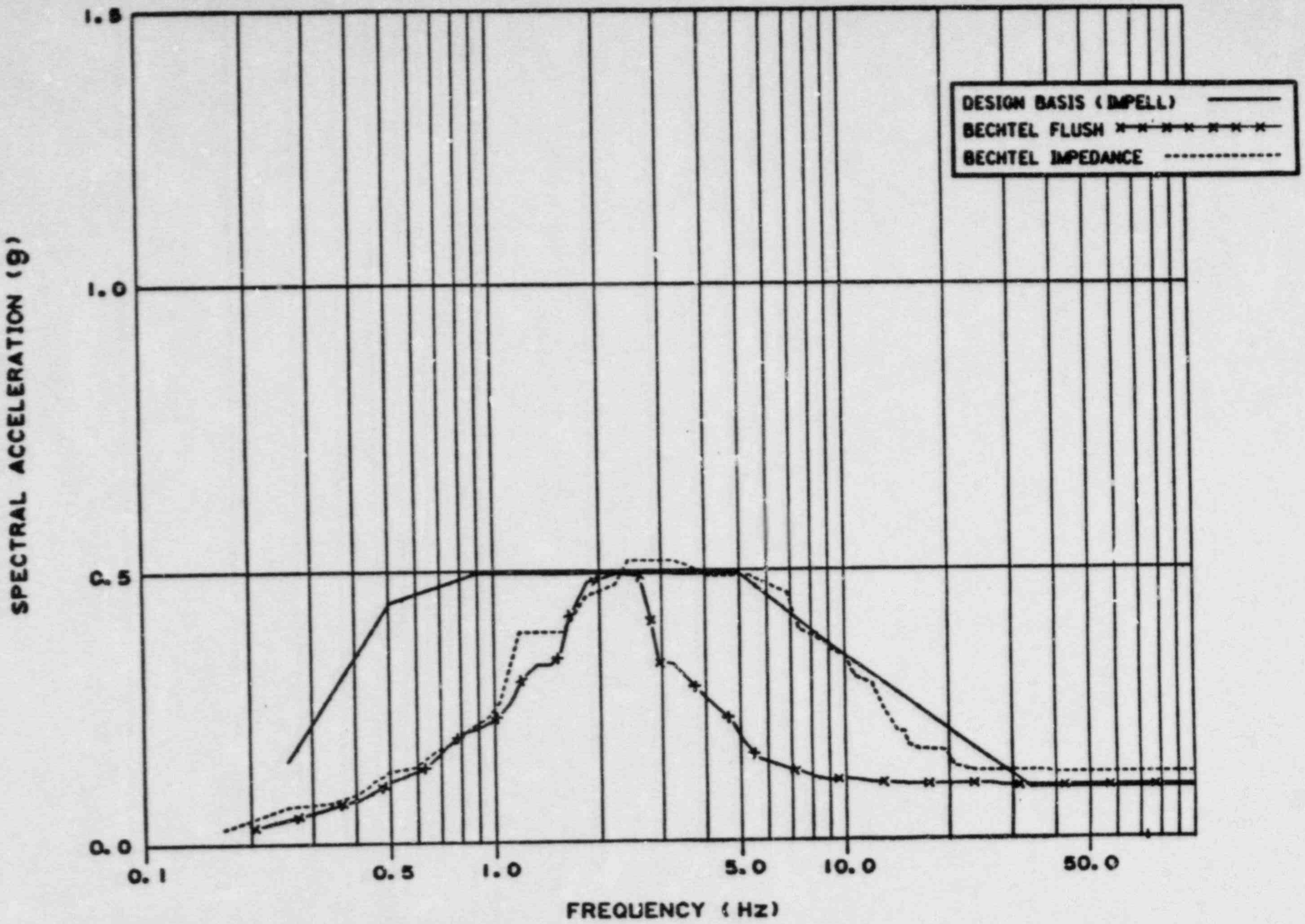


FIGURE A-14-20

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 93'-0",
E-W, OBE, 2% DAMPING

HOPE CREEK UNIT 1
CAD, L55 SHT. 3, REV 0
07/20/84

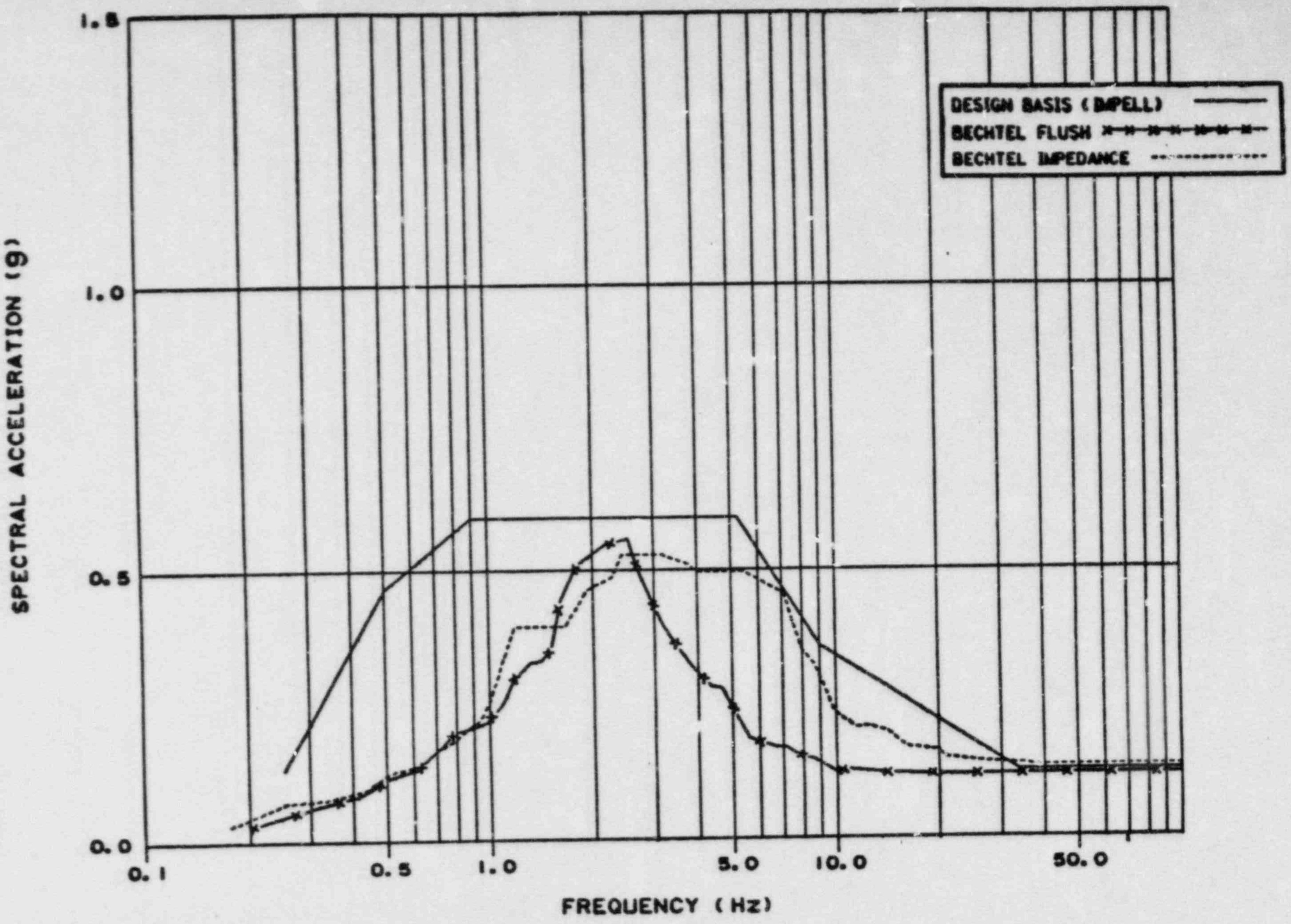


FIGURE A-14-21

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 114' -0",
E-W, OBE, 2% DAMPING

HOPE CREEK UNIT 1
CAD, L61 SHT. 3, REV 0
07/20/84

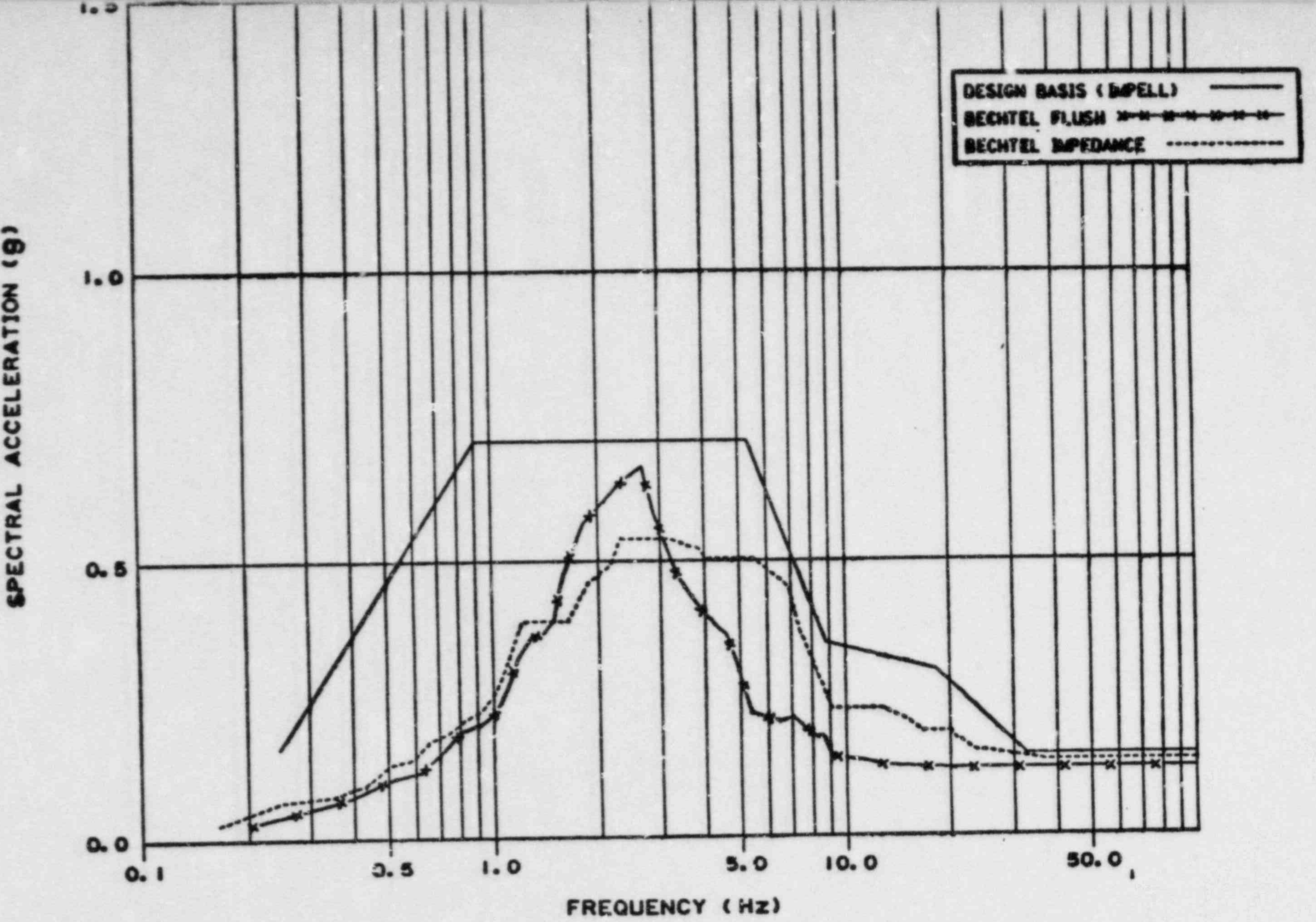


FIGURE A-14-22

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 135'-0",
E-W, OBE, 2% DAMPING

HOPE CREEK UNIT 1
CAD, L71 SHT. 3, REV 0
07/20/84

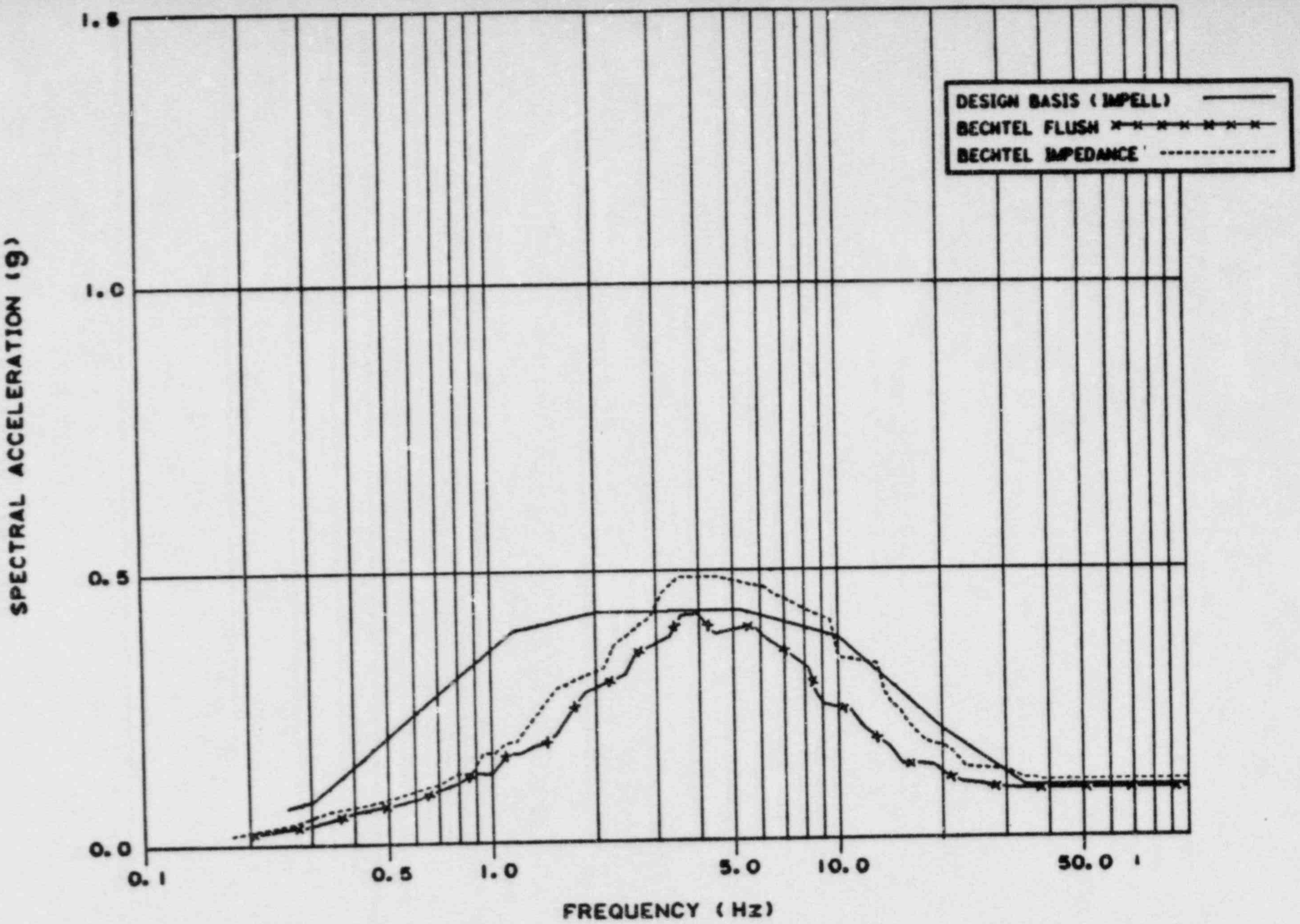


FIGURE A-14-23

RESPONSE SPECTRA COMPARISON
INTAKE STRUCTURE AT ELEV. 93' -0",
VERTICAL, OBE, 2% DAMPING

HOPE CREEK UNIT 1
CAD. L56 SHT 3, REV 0
07/20/84

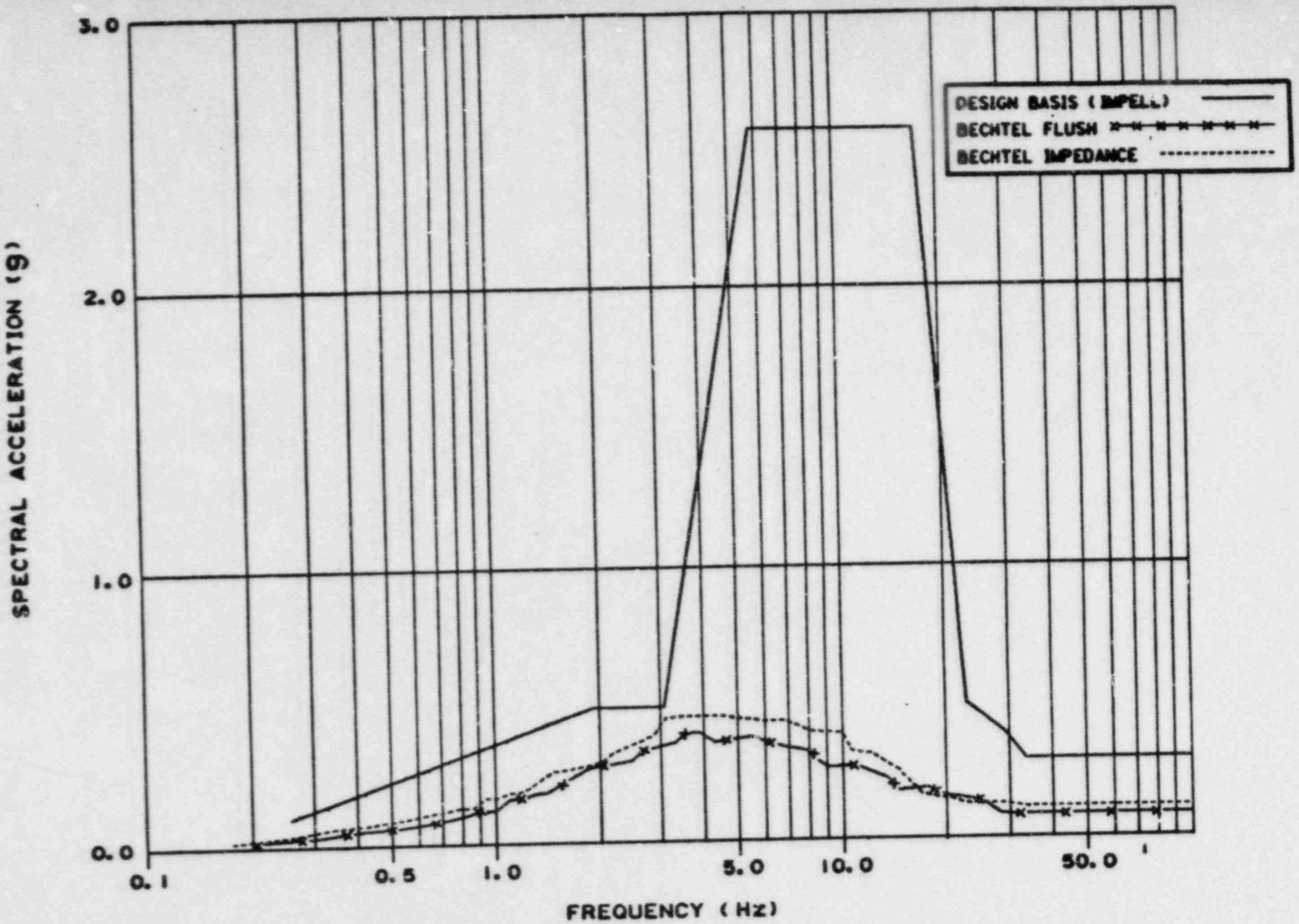


FIGURE A-14-24

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 114'-0",
VERTICAL, OBE, 2% DAMPING

HOPE CREEK UNIT 1
CAD, L63 SHT 3, REV 0
07/20/84

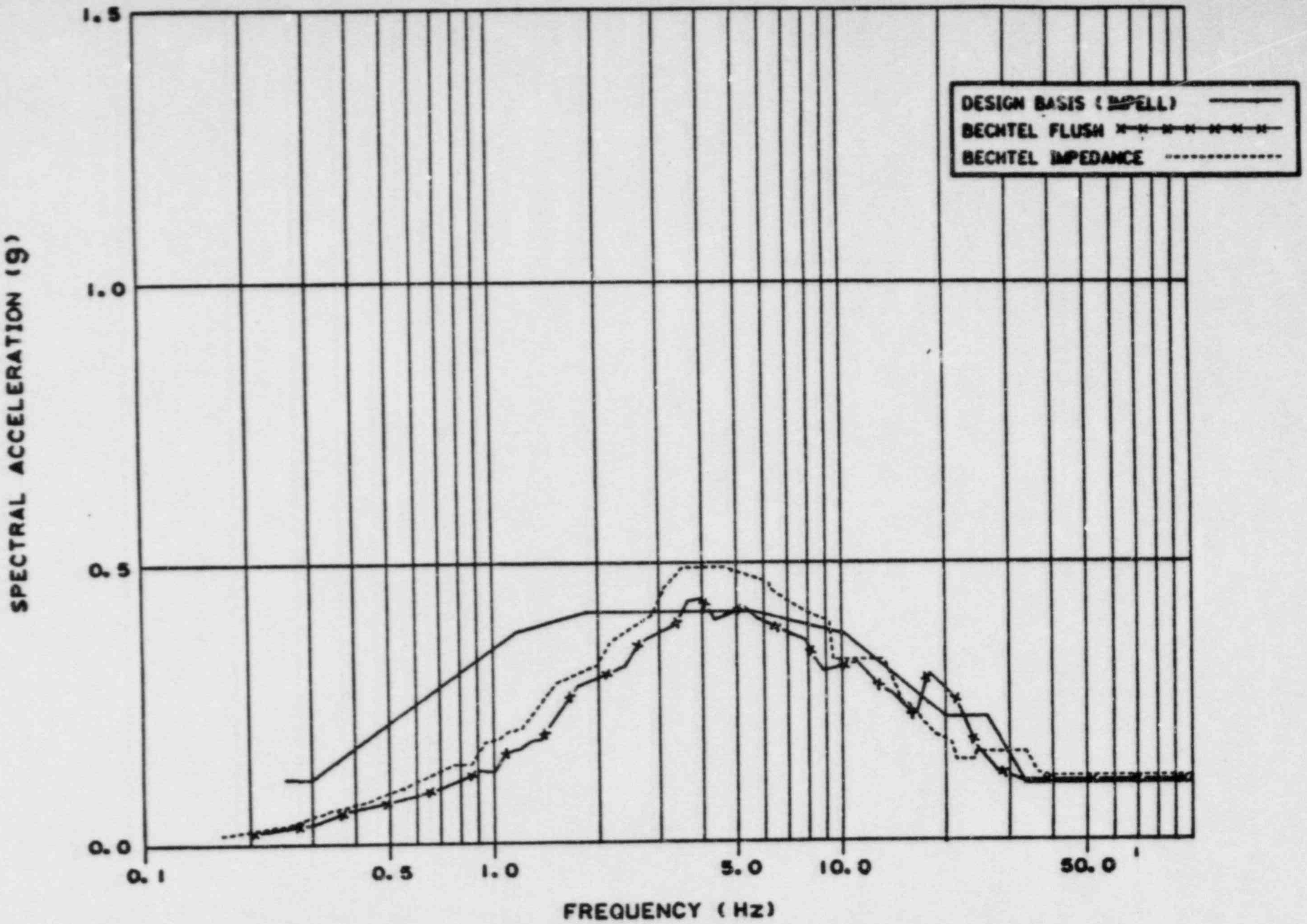


FIGURE A-14-25

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 135'-0",
VERTICAL, OBE, 2% DAMPING

HOPE CREEK UNIT 1
CAD. L72 SHT 3, REV 0
07/20/84

DSER Open Item No. 47 (DSER Section 3.8.6) Rev. 1

BASE MAT RESPONSE SPECTRA

From January 10 through January 12, 1984, the staff met with the applicant and his consultants to conduct the structural audit. The audit covered each major safety-related structure at the Hope Creek Generating Station.

As a result of the audit, the staff identified 39 action items. The applicant has submitted preliminary responses to 22 of the 39 action items. The staff is in the process of reviewing these responses. The final resolution of the action items and any additional questions, which may be raised further, will be reported in the Final SER. The resolution of these action items will be needed before the issuance of the Final SER.

RESPONSE

This item corresponds to Item A.3 from the NRC Structural/Geotechnical meeting of January 10, 1984. A response to this item has been submitted to the NRC by a letter dated February 17, 1984, from R. L. Mittl to A. Schwencer. As a result of discussions with the NRC staff, a revised response to this item is attached.

AUG -7 [illegible] 69095

Response to NRC Audit

Meeting Date: January 10, 1984

Question No.: A-3

Revised Response
Revision 2
August 3, 1984

QUESTION: Provide comparison between basemat response spectra and regenerated response spectra at basemat.

RESPONSE: Comparison of spectra for 2% damping was provided in the original response for both SSE and OBE cases.

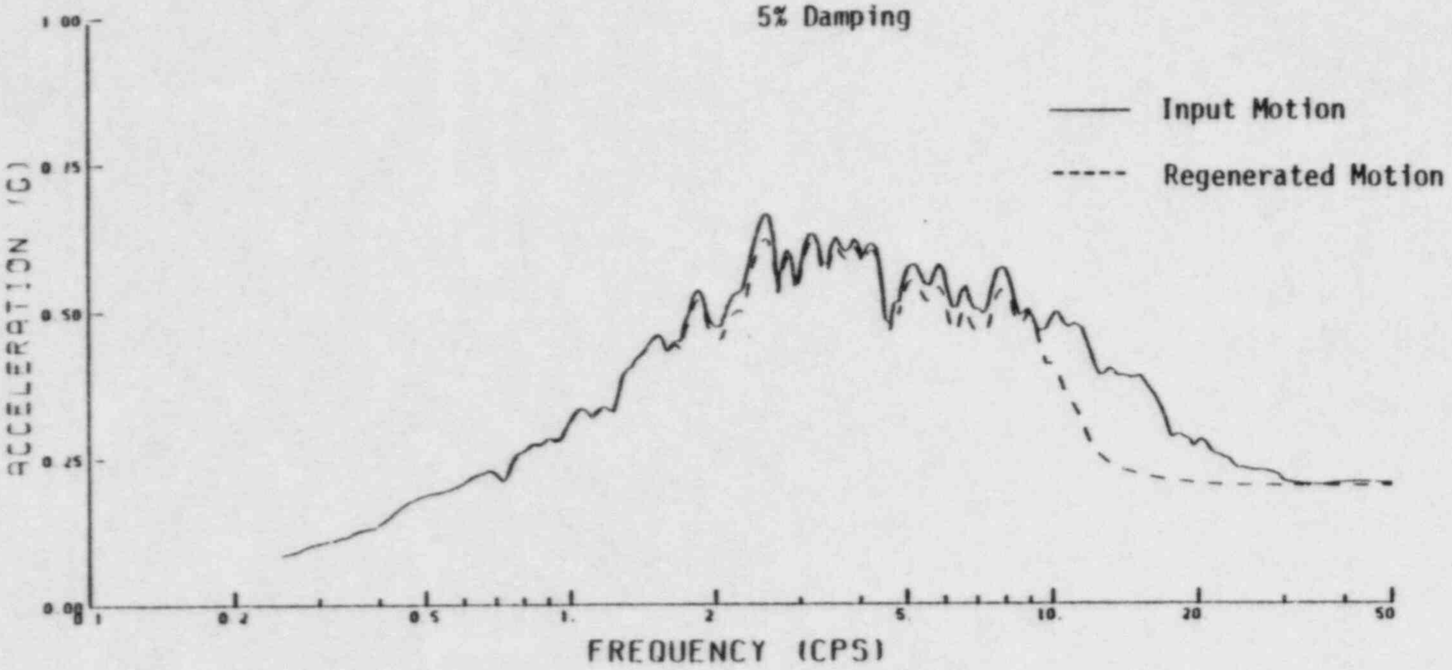
ADDITIONAL INFORMATION REQUESTED: Provide the same comparison for 5% damping value.

RESPONSE: Figures 1 and 2 provide the comparison between the response spectra of the defined input motion and regenerated response at the basemat elevation. These spectra were generated for 5% damping and show the comparison for the SSE and OBE events, respectively.

A 12 Hz. cutoff frequency has been used in these analyses. As observed from Figures 1 and 2, the match between the two spectra are adequate below the 12 Hz. cutoff frequency. The adequacy of the 12 Hz. cut off frequency is addressed in a separate response to Question A-12 from the audit meeting on January 11, 1984.

The spectra for the input motion at the basemat level is obtained from Section 3.7.1.2 of the Hope Creek FSAR. Justification for the adequacy of the response spectra for the input motion versus the R.G. 1.60 spectra is provided in response to NRC Question 220.20. Comparison of the response spectra between the regenerated motion and the R.G. 1.60 spectra for 5% damping are provided in Figures 3 and 4. These figures correspond to the SSE and OBE events, respectively.

Revised Response
January 10/A-3

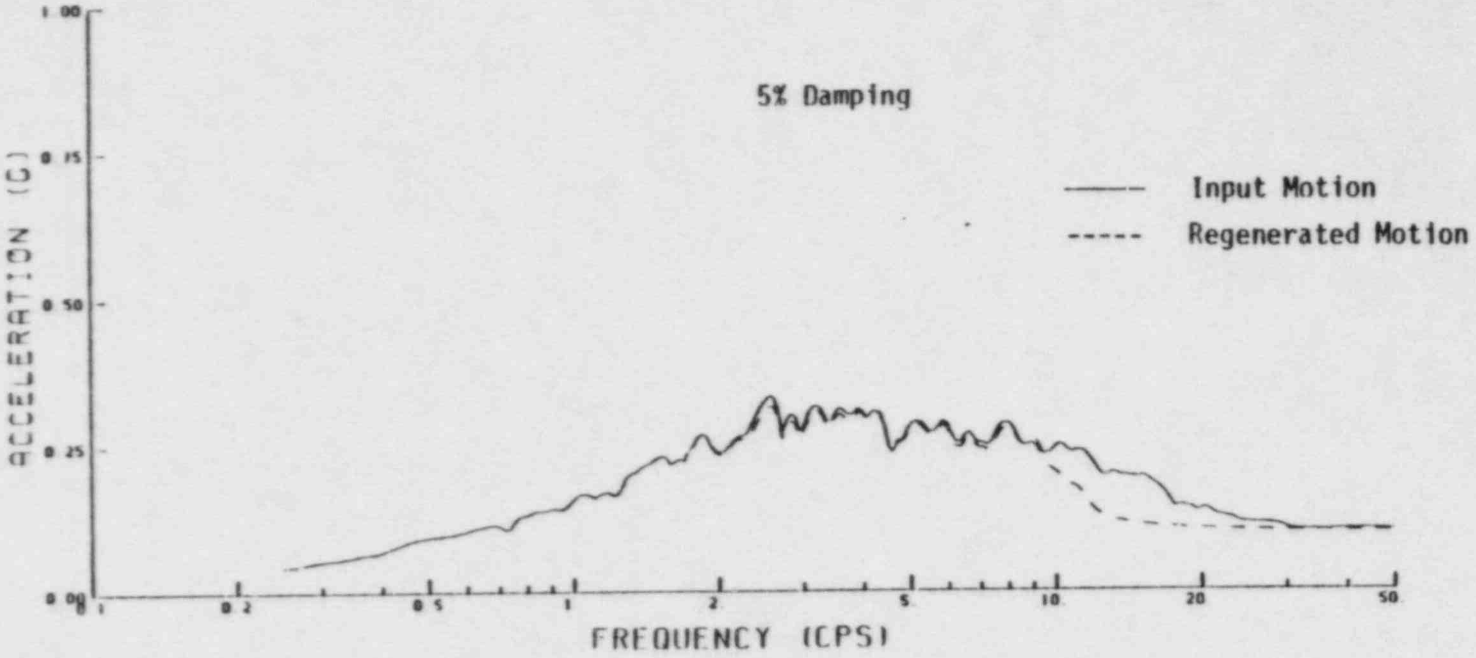


SSE CASE - AVERAGE SOIL PROPERTIES
COMPARISON OF RECOVERED VS. INPUT MOTIONS
ELEVATION 40.0 FT., FREE FIELD

HOPE CREEK
SOIL STRUCTURE INTERACTION

Figure 1

Revised Response
January 10/A-3

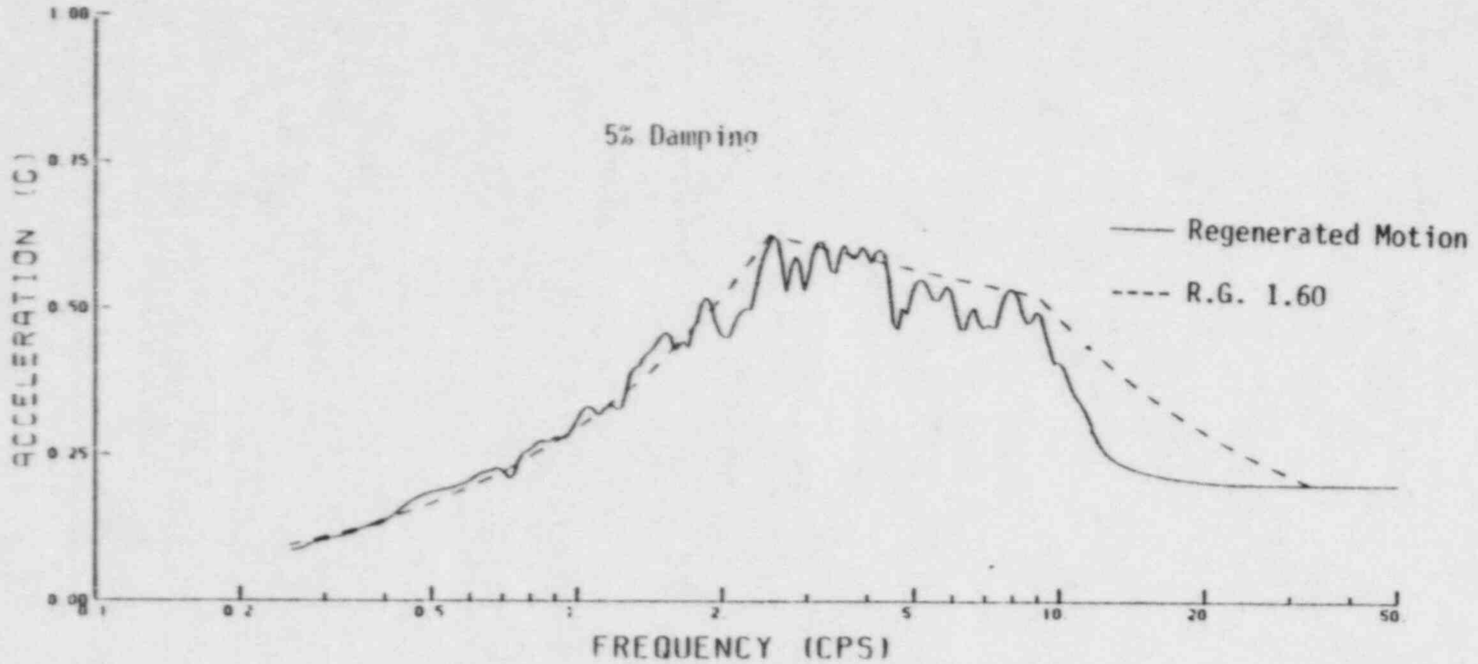


OBE CASE - AVERAGE SOIL PROPERTIES
COMPARISON OF RECOVERED VS. INPUT MOTIONS
ELEVATION 40.0 FT., FREE FIELD

HOPE CREEK
SOIL STRUCTURE INTERACTION

Figure 2

Revised Response
January 10/A-3

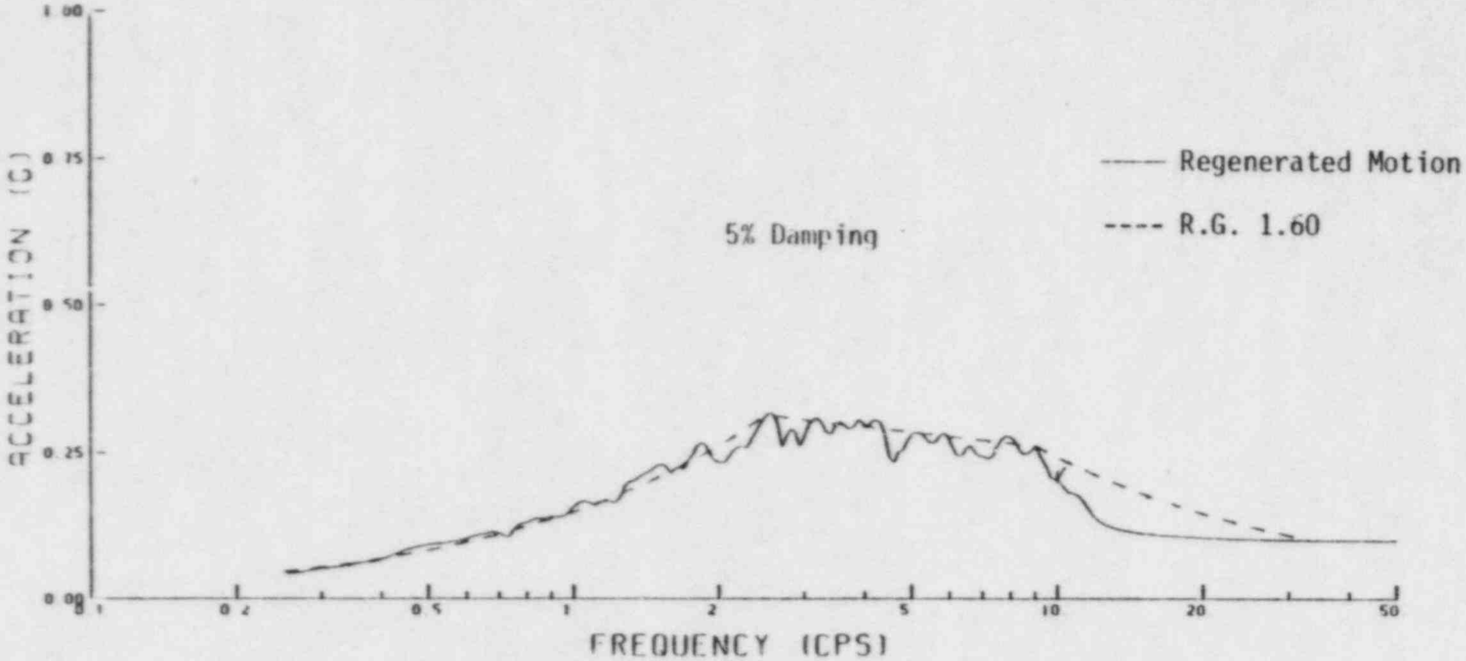


SSE CASE - AVERAGE SOIL PROPERTIES
COMPARISON OF RECOVERED VS. R.G. 1.60 MOTIONS
ELEVATION 40.0 FT., FREE FIELD

HOPE CREEK
SOIL STRUCTURE INTERACTION

Figure 3

Revised Response
January 10/A-3



OBE CASE - AVERAGE SOIL PROPERTIES
COMPARISON OF RECOVERED VS. R.G. 1.60 MOTIONS
ELEVATION 40.0 FT., FREE FIELD

HOPE CREEK
SOIL STRUCTURE INTERACTION

Figure 4

DSER Open Item No. 51 (DSER Section 3.8.6)

COMPARISON OF BECHTEL INDEPENDENT VERIFICATION RESULTS WITH THE DESIGN_BASIS RESULTS

From January 10 through January 12, 1984, the staff met with the applicant and his consultants to conduct the structural audit. The audit covered each major safety-related structure at the Hope Creek Generating Station.

As a result of the audit, the staff identified 39 action items. The applicant has submitted preliminary responses to 22 of the 39 action items. The staff is in the process of reviewing these responses. The final resolution of the action items and any additional questions, which may be raised further, will be reported in the Final SER. The resolution of these action items will be needed before the issuance of the Final SER.

RESPONSE

This item corresponds to Item A.13 from the NRC Structural/ Geotechnical meeting of January 10, 1984. A response to this item has been submitted to the NRC by a letter dated August 3, 1984, from R. L. Mittl to A. Schwencer. As a result of discussion with the NRC staff, a revised response to this item is attached.

Revised Response
Revision 2
August 3, 1984

Meeting Date: January 10, 1984

Question No: A-13

Question: Provide comparison of Bechtel Independent Verification Results with the Design Basis Results.

Response:

As described in Amendment 1 of the FSAR (Section 3.7.2.4), three independent seismic soil-structure interaction analyses are performed for the major plant structures. The design basis analyses are performed using the finite element method by EDS Nuclear, Inc. (presently known as Impell Corporation). Independent finite element soil-structure interaction analyses are subsequently performed by Bechtel to verify the design basis analyses. In addition, in accordance with the requirements of the Standard Review Plan, Section 3.7.2 (NUREG 0800), impedance approach (the half-space) soil-structure interaction analyses are performed by Bechtel. The analytical method utilized for the impedance approach seismic soil-structure interaction analyses of power block structures and service water intake structure is given in FSAR Section 3.7.2.1. Figure A-13-1 summarizes the division of responsibilities for the seismic analyses. The structural models and soil properties used in the analysis are given in Appendix A.

Figures A-13-2 to A-13-37 show the comparison of the response spectra (2% damping) obtained from the above three seismic soil-structure interaction analyses. Discussions of these comparisons are as follows:

Power Block Structures

I. Comparison of Design basis and Independent Finite Element Verification Response Spectra

Bechtel's independent soil-structure interaction analyses are performed using the computer code FLUSH. The results of independent finite element analyses are in reasonable agreement with those of the design basis analyses. As can be seen from Figures A-13-2 through A-13-37, the horizontal response spectra obtained from the independent finite element analyses are generally enveloped by those obtained from the design basis analyses except for the frequency range lower than 2 Hz. The vertical response spectra showed some exceedances at the frequency range of 18 Hz. These exceedances are listed in Table A-13-1.

The effects of these exceedances are evaluated for the combined responses in three directions using the SRSS approach and compared with the design basis results. Table A-13-2 provides these comparisons. In all cases, these variations are judged to be minor and can be accommodated within the design margin. In areas where multimodal analysis is performed, the effects of these variations will be further reduced. It has been concluded that the variations between these two analyses are within the accuracy of analyses and can be accommodated within the design margin.

II. Comparison of Design Basis and Impedance Approach Response Spectra

The peak spectral accelerations obtained from the impedance approach analyses are generally lower than those obtained from the design basis analyses. However, these response spectra are not completely enveloped by those obtained from the design basis analysis, especially in the frequency range between 1.0 and 3.5 Hz. Also, there are some local exceedances in the higher frequency range, as shown in Figures A-13-2 through A-13-37.

As discussed during the NRC Structural Design Audit, dated January 10, 1984, sampling studies have been performed to confirm the adequacy of the plant design. Table A-13-3 describes the criteria used in selection of the samples for this study.

The results of sampling studies are as follows:

1. Structures

All major reinforced concrete shear walls at the base of the reactor building have been evaluated for seismic forces and moments obtained from the impedance approach analyses. These walls represent approximately 40 percent of the total number of shear walls in the reactor building. The actual shear stresses resulting from the impedance approach analyses were evaluated and found to be lower than the design basis stresses. Table A-13-4 provides the comparision of shear stresses at El. 54'-0. Tables A-13-5a and A-13-5b show the comparision of impedance approach and design basis moments for OBE and SSE cases respectively. The impedance approach moments exceed the design basis moments at a few wall locations as identified on Tables A-13-5a and A-13-5b. These walls were reevaluated and the resulting moments were found to be less than the allowables.

The auxiliary building seismic forces and moments obtained from the impedance approach analysis are less than the design basis shears and moments. Therefore, no further evaluation of the auxiliary building structure is necessary.

Based on the above, it is concluded that the as-built power block structures can accommodate the loads obtained from the impedance approach analysis.

2. Equipment

The effects of the impedance approach response spectra was evaluated on 26 types of equipment. The selected items are located in the areas where the impedance approach spectra were found to have higher spectral accelerations than those of the design basis response spectra. Each equipment was evaluated in accordance with the procedure described in Table A-13-3, and the results of the evaluation are summarized in Table A-13-6. In all cases, the as-built equipment designs were found acceptable.

3. Cable Tray and HVAC Supports

   a. Cable Tray Support

   Approximately 200 supports were evaluated. In all cases, the existing designs were determined to be acceptable.

   b. HVAC Supports

   Over 200 supports were evaluated. In all cases, it was found that the design basis spectral accelerations exceeded the impedance approach spectral accelerations for the support frequencies. Therefore, the HVAC supports were considered acceptable.

4. Piping and Pipe Supports

A total of 10 representative piping system calculations were selected out of 64 calculations affected by the impedance approach analysis results. The selection of these calculations was based on the criteria given in Table A-13-3.

The objective of performing detailed dynamic seismic analysis of the sample calculation was to demonstrate that although the design basis curve did not envelop the impedance curves in the low frequency range, such deviation do not have any affect on the adequacy of existing piping analysis and support design. In other words, the stresses and loads generated using the impedance response spectra curve as input are still within the ASME Section III code allowable for pipe and pipe support design.

The methodology used for evaluation was to subject the selected existing mathematical models of piping systems to the impedance approach response spectra and to compare the resulting pipe stresses with the ASME Section III code allowables for pipe and pipe support design. The reactions at equipment nozzles were compared with vendor's design allowables. All pipe supports were evaluated for adequacy under the revised loads.

In all cases, the pipe stresses were found to be within the code allowables as shown in Table A-13-7. Also, as illustrated in Table A-13-7, the equipment nozzle allowables were also met. The existing pipe support designs were also found adequate for the new Loads and met the ASME Section III code Subsection NF allowables. This is illustrated in Table A-13-8.

Intake Structure

See responses to questions A-14 and A-16, meeting date January 11, 1984.

APPENDIX A

Impedance Approach Structural Models and Soil Properties

In the soil-structure interaction analysis, using the impedance approach, the effect of dynamic stiffness of the foundation medium is represented by the foundation impedances, which are functions of the base mat dimensions, embedment depth, elastic properties of the foundation medium, and forcing frequencies. With the foundation impedance known, the structure-foundation system is modeled by coupling the fixed-base structure model with the foundation impedances through the basemat (Figure A-13-38). For this study the effects of embedment which increase both damping and stiffness of the soil-structure systems are considered. However, the wave scattering effect is conservatively neglected in the present impedance approach analysis. This is consistent with the requirement specified in SRP Section 3.7.2.

The impedance approach seismic soil-structure interaction analysis of the reactor building (Figure A-13-39) and the auxiliary building (Figure A-13-40) is performed for both the SSE and OBE cases. The foundation soil is assumed to be a uniform visco-elastic half space. The weighted average of the final iterated shear moduli of 3,522 ksf (shear wave velocity of 989 ft./sec.) and 5,235 ksf (shear wave velocity of 1,205 ft./sec.) respectively, are used in calculating the horizontal SSE and OBE impedance functions. Since the groundwater table is located at elevation 98.0 ft., a compressional wave velocity, Vp, of 4,800 ft./sec. is used for the vertical analysis. The computed OBE and SSE translational and rocking impedances for the embedded reactor building and auxiliary building foundations are given in Tables A-13-9 to A-13-12.

Table A-13-1

Comparison of Design basis and Independent Finite Element Verification Response Spectra

Building	Key Elevation	Design Earthquake	Earthquake Direction	Locations of Variations (Note 1)	Figure No.	Item No.	Spectral Acceleration (Note 2)	
							Design Basis (g)	Bechtel FLUSH (g)
REACTOR	102	SSE	N-S	1.8 Hz	A-13-3	1	0.62	0.75
	201	SSE	N-S	1.8 Hz	A-13-4	2	1.00	1.22
	54	SSE	Vertical	18.5 Hz	A-13-8	3	1.50	1.75
	102	SSE	Vertical	22.0 Hz	A-13-9	4	1.35	1.68
	201	SSE	Vertical	18.0 Hz	A-13-10	5	2.15	2.45
AUXILIARY	54	SSE	N-S	3.6 Hz	A-13-11	6	1.34	1.56
	54	SSE	E-W	3.0 Hz	A-13-14	7	0.88	1.44
	102	SSE	E-W	3.0 Hz	A-13-15	8	1.10	1.68
	178	SSE	E-W	3.2 Hz	A-13-16	9	1.40	1.92
	102	SSE	Vertical	14.0 Hz	A-13-18	10	1.83	1.95
	178	SSE	Vertical	22.0 Hz	A-13-19	11	1.53	1.85

Table A-13-1 (Cont'd)

Comparison of Design Basis and Independent Finite Element Verification Response Spectra

Building	Key Elevation	Design Earthquake	Earthquake Direction	Locations of Variations (Note 1)	Figure No.	Item No.	Spectral Acceleration (Note 2)	
							Design Basis (g)	Bechtel FLUSH (g)
REACTOR	102	OBE	N-S	1.7 Hz	A-13-21	12	0.34	0.42
	54	OBE	E-W	4.3 Hz	A-13-23	13	0.50	0.67
	201	OBE	E-W	1.8 Hz	A-13-25	14	0.38	0.55
	102	OBE	Vertical	22.0 Hz	A-13-27	15	1.20	1.42
	201	OBE	Vertical	18.0 Hz	A-13-28	16	1.68	1.85
AUXILIARY	54	OBE	N-S	4.9 Hz	A-13-29	17	1.15	1.40
	54	OBE	E-W	4.4 Hz	A-13-32	18	0.75	0.85
	54	OBE	Vertical	22.0 Hz	A-13-35	19	1.17	1.26
	102	OBE	Vertical	18.0 Hz	A-13-37	20	1.47	1.54
	178	OBE	Vertical	18.0 Hz	A-13-37	21	1.80	1.95

NOTES:

1. This column identifies those locations where the results of the independent analysis exceed those of the design basis analysis.
2. For vertical earthquake direction, spectral acceleration includes the effect of gravity load (1.0 g).

Table A-13-2

SRSS Spectral Acceleration Comparison between Design Basis and Finite Element Verification Analysis

Item No.	SRSS Spectral Acceleration Comparison(g) (Note 1)		
	(A) Design Basis	(B) Bechtel-FLUSH	(B-A)/A Difference (%)
1	1.97	1.75	-11
2	2.24	2.20	-2
3	1.53	1.78	16
4	1.39	1.72	24
5	2.23	2.49	12
6	2.86	2.68	-6
7	2.34	2.32	-1
8	2.56	2.48	-3
9	4.27	3.44	-19
10	1.87	1.93	4
11	1.73	1.93	11
12	1.41	1.38	-2
13	2.02	1.66	-18
14	1.52	1.50	-1
15	1.21	1.43	18
16	1.71	1.86	9
17	2.24	2.07	-8
18	2.23	1.94	-13
19	1.19	1.27	7
20	1.86	1.99	7
21	1.51	1.56	3

NOTE: 1. The SRSS spectral acceleration values include the effect of gravity loads (1.0 g)

TABLE A-13-3
PROCEDURES FOR EVALUATION OF STRUCTURES, EQUIPMENT & COMPONENTS USING IMPEDANCE ANALYSIS RESULTS

INTRODUCTION

The results of the impedance analysis are used to assess the existing design of the HCGS structures, equipment and components. A sampling approach is used. The procedure for this evaluation is as follows:

A. STRUCTURES:

Since the maximum shear and axial forces and the maximum overturning moments occur at the base of the structures, and the design margins for the upper elevations are greater than those of the base, the effects of these loads at the base of each structure are evaluated.

B. EQUIPMENT:

The impedance analysis spectra in general are not completely enveloped by the design basis spectra in the following areas,

i) 1.0 to 3.5 Hz range throughout the reactor and auxiliary buildings

ii.) 6 to 15 Hz range in the reactor building at elevation 102 ft and below.

iii.) 6 to 15 Hz in the auxiliary building at elevation 54 ft.

Since typical equipment frequencies are not found in the range of 1.0 to 3.5 Hz, the item (i) above does not need any further evaluation. Items (ii) and (iii) are reconciled as follows:

- Review the significant frequencies of approximately 30% of all equipment selected at random and located in the areas where spectral variations were noted.
- If the significant equipment frequencies fall in the range where the difference in the spectra exist, additional evaluation is necessary. No further evaluation is necessary if the significant frequencies are outside the frequency range in question.
- The evaluation is performed either by comparing the test response spectra of the equipment with the impedance spectra (if the equipment is qualified by testing) or comparing the actual-to-allowable stress ratios with the spectrum exceedance ratios.
- If the above evaluation shows the equipment may not be qualified for the impedance spectra, detailed evaluation consisting of analysis and/or testing is performed.

- As a result of evaluation, if equipment requires modifications, the sample size for this evaluation is expanded as required.

C. CABLE TRAY AND HVAC SUPPORTS

Cable tray and HVAC supports do not have frequencies in the range of 1.0 to 3.5 Hz. Therefore any differences between the two spectra in this frequency range do not require any evaluation.

The effects of the spectrum exceedances at frequency range between 6 and 15 Hz are evaluated for approximately 200 cable tray and HVAC supports. These supports are selected at random but are located at the lower elevation (Reactor Building El. 54 to 102 ft., Auxiliary Building El. 54 ft.) where the spectrum differences exist. If the results of evaluation indicate need for modifications to any support, the sample size for this evaluation is expanded as required.

D. PIPING AND PIPE SUPPORTS

In general, impedance curves resulted in significant reductions in response spectrum peak accelerations as compared to those of the design basis curves. However, frequency shifts were observed in some curves, particularly in the low frequency ranges. To evaluate the effects of the frequency shift, a "biased" sample of affected piping systems is reanalyzed and reevaluated. The sample is selected as follows:

Individual impedance curves for various elevations and structures are superimposed on their corresponding design basis curves to identify those impedance curves which are not enveloped by design basis curves. Those impedance curves are then superimposed on the design basis "enveloped" response spectra used for various piping system design calculations. If the design basis enveloped response spectra curves affecting a calculation did not totally envelop all the corresponding impedance curves, that particular calculation is then identified as "affected" and a candidate for sampling.

A "biased" sample of the "affected" calculations was selected which emphasized the following important piping parameters:

1. Stress levels in the existing pipe stress calculations. Samples included systems with high stress levels.
2. Difference in "g" level (Δg) between impedance and design basis curves in the affected frequency zones. Sample selected to include curves showing significant differences.
3. High equipment nozzle loads in existing calculation.
4. Relative location of piping system in the plant in an attempt to include response of all structures in the sample selected.

The number of calculations included in the sample is:

Building	Total No. of Q-Calcs	No. of Calcs Reviewed	No. of Calcs affected	No. of Calcs in the sample
Drywell	32	32	23	3
Reactor	213	213	34	5
Auxiliary	124	124	7	2

Results of the analysis including support loads are compared against the design basis values for acceptability.

TABLE A-13-4

REACTOR BUILDING SHEAR STRESSES AT EL. 54'-0"

Wall Location	Design Basis Psi	Impedance Approach Psi	Allowable Psi
North Wall	323	207	630
South Wall	333	224	630
East Wall	298	261	630
West Wall	303	268	630
Cylindrical Shell	257	251	630
Pedestal	27	91	126

SOUTH RADWASTE SHEAR STRESSES AT EL. 54'-0"

Wall Location	Design Basis Psi	Impedance Approach Psi	Allowable Psi
North Wall	183	207	630
South Wall	216	224	630
East Wall	208	276	630
West Wall	458	257	630

Notes: 1. Concrete f'c = 4000 Psi

2. See FSAR Figures 1.2-2 for wall location.

TABLE A-13-5a

REACTOR/RADWASTE BUILDING - OBE SEISMIC MOMENTS AT EL. 54'0"

Wall Location	Design Basis Method (Kip-Ft)	Impedance Approach Method (Kip-Ft)
North-Reactor North-Radwaste	359,200	414,500
South-Reactor South-Radwaste	517,400	847,700
East-Radwaste	461,000	421,900
West-Radwaste	329,000	290,700
East-Reactor	434,500	276,900
West-Reactor	588,600	482,900
Cylindrical Shell	2,772,000 (N-S) 1,723,000 (E-W)	1,847,000 (N-S) 1,639,000 (E-W)

Note: See FSAR Figure 1.2-2 for wall location.

TABLE A-13-5b

REACTOR/RADWASTE BUILDING - SSE SEISMIC MOMENTS AT EL. 54'0"

Wall Location	Design Basis Method (Kip-Ft)	Impedance Approach Method (Kip-Ft)
North-Reactor North-Radwaste	912,100	699,100
South-Reactor South-Radwaste	1,344,000	1,429,000
East-Radwaste	675,000	732,300
West-Radwaste	654,000	504,500
East-Reactor	909,000	480,200
West-Reactor	1,320,000	837,400
Cylindrical Shell	4,471,000 (N-S) 3,054,000 (E-W)	3,092,000 (N-S) 2,668,000 (E-W)

Note: See FSAR Figure 1.2-2 for wall location.

TABLE A-13-6

POWER BLOCK SEISMIC CATEGORY I EQUIPMENT

Equipment or Component	Tag No.	Location Blgd./El.	Equipment Frequencies (Hz)	Method of Seismic Qualification	Applicable Note
HPCI Turbine	E41-C002	Reactor Bldg. El. 54	Horizontal- 10, 12 Vertical - 23	Testing	1
Residual Heat Removal Pump/ Motor	E11-C002	Reactor Bldg. El. 54	Horizontal- 8.7, 9.7 Vertical - >33	Analysis	3
Control Room Panels	H11-P617 H11-P618 H11-P640 H11-P641	Aux. Bldg. El. 102	Horizontal- 11.5, 16 Vertical - >33	Testing	1
Control Room Panels	H11-P620 through H11-P623 H11-P628 H22-P631	Aux. Bldg. El. 102	Horizontal- 21, 29 Vertical - >33	Testing	1
Control Room Panels	H11-P635 H11-P636	Aux. Bldg. El. 137	Horizontal- 19, 37 Vertical - >33	Testing	1
Control Room Panels	H11-608	Aux. Bldg. El. 137	Horizontal- 7, 12 Vertical - >33	Testing	1
Control Room Panels	H11-609 H11-611	Aux. Bldg. El. 137	Horizontal- 22, 37 Vertical - >33	Testing	1
RCIC Turbine	E51-C002	Reactor Bldg. El. 54	Horizontal- 16 Vertical - 18	Analysis & Testing	1, 2
LPCS Pump/ Motor	E21-C001	Reactor Bldg. El. 54	Horizontal- 11.5, 12.7 Vertical - >33	Analysis	2

TABLE A-13-6 (Cont'd)

POWER BLOCK SEISMIC CATEGORY I EQUIPMENT

Equipment or Component	Tag No.	Location Blgd./El.	Equipment Frequencies (Hz)	Method of Seismic Qualification	Applicable Note
Chiller Water Tank	IAT, BT 410, 413	D. G.* El. 178	Horizontal - >33 Vertical - >33	Analysis	2
ECCS Jockey Pump	IAP, BP, CP, DP 228	Reactor Bldg. El. 54	Horizontal - >33 Vertical - >33	Analysis	2
SACS Expansion Tank	IAT, BT 205	Reactor Bldg. El. 201	Horizontal - 12.5 Vertical - >33	Analysis	2
5.0 Kv Switchgear	IAN, BN, CN, DN 205	Reactor Bldg. El. 102	Horizontal - 8, 14 Vertical - 30	Testing	1
DC Switchgear & Control Center	IOD 251, 261	Reactor Bldg. El. 54	Horizontal - 8, 35 Vertical - 20	Testing	1
Batteries Racks	IOD 421, 431	Aux. Bldg. El. 54	Horizontal - 14, 16 Vertical - 28	Testing	1
Inst.AC Power Panel	IYF 401-407 IYF 209	Aux. Bldg. El. 102	Horizontal - 17, 21 Vertical - 6	Testing	1
Control Panel	IAC, BC 201	Reactor Bldg. El. 102	Horizontal - 8, 17 Horizontal - >33	Analysis	2

Note: *D.G. - Diesel generator area of the auxiliary building.

TABLE A-13-6 (Cont'd)

POWER BLOCK SEISMIC CATEGORY I EQUIPMENT

Equipment or Component	Tag No.	Location Blgd./El.	Equipment Frequencies (Hz)	Method of Seismic Qualification	Applicable Note
Standby Diesel Generator Set	1(A-D)G 400	D. G. E1. 102	Horizontal - >15 Vertical - >15	Analysis	2
SACS Heat Exchanger	1AIE, 1A2E201 1BIE, 1B2E201	Reactor Bldg. El. 54	Horizontal - 8, 10.4 Vertical - 21	Analysis	2
SACS Pumps	1(A-D)P210	Reactor Bldg. El. 201	Horizontal - >33 Vertical - >33	Analysis	2
Control Panel	ICC, DC201	Reactor Bldg. El. 102	Horizontal- 12.7, 17.6 Vertical - 29	Analysis	2
Accumulator Tank	1AT, BT412	D. G. EL. 54	Horizontal - 31, 33 Vertical - 35	Analysis	2
Air Handling Units A/C Units	1AVH407 1BVH407	D. G. El. 178	Horizontal - 16.6, 18 Vertical - 19	Analysis	2
Unit Cooler	1AVH208 1AVH209 1BVH208 1BVH209	Reactor Bldg. El. 102	Horizontal - 9.4, 21 Vertical - 26.4	Analysis	2
HVAC Control Panels	1AC, CC285 1AC, CC281 1AC, DC483	D. G. El. 178	Horizontal - 12.7, 16.4 Vertical - 16.9	Analysis	2
Centrifugal Water Chiller	1AK, BK403	D. G. El. 178	Horizontal - >30 Vertical - >30	Analysis	2

Notes:
1. TRS envelopes impedance approach spectra.
2. Impedance approach spectral acceleration is lower than that of the design-basis response spectra in the major equipment frequencies.
3. Although impedance approach spectral acceleration exceeds that of design basis response spectra in the equipment frequency range, a more detailed calculation showed that the equipment stresses are within the code allowables.

TABLE A-13-7

POWER BLOCK PIPE STRESS SUMMARY

Building	Calc. No.	Max. Seismic Stress Ratios Max. Impedance Stress Max. Design Basis Stress		ASME Code Equation Evaluation		Vendor Equip. Nozzle Allowables Met
				Eq. 9B* Code Allowable	Eq. 9D* - Code Allowable	
		OBE	SSE	Upset	Faulted	
Auxiliary	C1549	0.51	0.76	0.29	0.66	YES
	C1581	0.64	0.86	0.40	0.28	YES
Drywell	C118	0.75	0.83	0.44	0.34	YES
	C1842	0.65	0.83	0.63	0.85	YES
	C120	0.30	0.52	0.49	0.39	YES
Reactor	C988	0.88	0.75	0.54	0.35	YES
	C911	0.88	0.94	0.84	0.63	YES
	C963	1.10	1.18	0.71	0.47	YES
	C918	0.29	0.39	0.33	0.21	YES
	C937	0.90	1.15	0.70	0.38	YES

*ASME Section III NC, ND-3652

TABLE A-13-8

POWER BLOCK PIPE SUPPORT LOAD SUMMARY

Building	Calc. No.	Total No. of Supports	No. of Supports with Load Increase	Average Percentage increase in Load		Support Design Adequate
				Upset	Faulted	
Auxiliary	C1549	5	0	N/A	N/A	YES
	C1581	16	5	11%	NONE	YES
Drywell	C118	8	1	2%	1%	YES
	C1842	34	0	N/A	N/A	YES
	C120	18	2	7%	NONE	YES
Reactor	C988	11	3	NONE	14%	YES
	C911	34	6	20%	17%	YES
	C963	7	4	27%	28%	YES
	C918	10	0	N/A	N/A	YES
	C937	17	5	17%	21%	YES

TABLE A-13-9

VALUES OF SOIL STIFFNESS AND DAMPING COEFFICIENTS OF REACTOR BUILDING (OBE CASE)

DIRECTION	STIFFNESS COEFFICIENTS	DAMPING COEFFICIENTS
VERTICAL TRANSLATION	1.53×10^7 k/ft	9.19×10^5 k-sec/ft
NORTH-SOUTH TRANSLATION	7.26×10^6 k/ft	6.42×10^5 k-sec/ft
EAST-WEST TRANSLATION	5.90×10^6 k/ft	5.74×10^5 k-sec/ft
ROCKING ABOUT NORTH-SOUTH AXIS	1.26×10^{11} k/ft/rad	9.50×10^9 k-ft-sec/rad
ROCKING ABOUT EAST-WEST AXIS	7.56×10^{10} k/ft/rad	3.31×10^9 k-ft-sec/rad

K56(2)

TABLE A-13-10

VALUES OF SOIL STIFFNESS AND DAMPING COEFFICIENTS OF 3-D REACTOR BUILDING (SSE CASE)

DIRECTION	STIFFNESS COEFFICIENTS	DAMPING COEFFICIENTS
VERTICAL TRANSLATION	1.53×10^{7} k/ft	9.19×10^{5} k-sec/ft
NORTH-SOUTH TRANSLATION	4.74×10^{6} k/ft	5.17×10^{5} k-sec/ft
EAST-WEST TRANSLATION	4.03×10^{6} k/ft	4.79×10^{5} k-sec/ft
ROCKING ABOUT NORTH-SOUTH AXIS	8.17×10^{10} k-ft/rad	8.47×10^{9} k-ft-sec/rad
ROCKING ABOUT EAST-WEST AXIS	5.14×10^{10} k-ft/rad	2.70×10^{9} k-ft-sec/rad

K56(2)

TABLE A-13-11

VALUES OF SOIL STIFFNESS AND DAMPING COEFFICIENTS OF AUXILILARY BUILDING (OBE CASE)

DIRECTION	STIFFNESS COEFFICIENTS	DAMPING COEFFICIENTS
VERTICAL TRANSLATION	1.40×10^{7} k/ft	7.87×10^{5} k-sec/ft
NORTH-SOUTH TRANSLATION	7.15×10^{6} k/ft	5.71×10^{5} k-sec/ft
EAST-WEST TRANSLATION	5.58×10^{6} k/ft	5.21×10^{5} k-sec/ft
ROCKING ABOUT NORTH-SOUTH AXIS	1.15×10^{11} k-ft/rad	9.32×10^{9} k-ft-sec/rad
ROCKING ABOUT EAST-WEST AXIS	5.56×10^{10} k-ft/rad	1.76×10^{9} k-ft-sec/rad

K56(2)

TABLE A-13-12

VALUES OF SOIL STIFFNESS AND DAMPING COEFFICIENTS OF AUXILIARY BUILDING (SSE CASE)

DIRECTION	STIFFNESS COEFFICIENTS	DAMPING COEFFICIENTS
VERTICAL TRANSLATION	1.40×10^{7} k/ft	7.87×10^{5} k-sec/ft
NORTH-SOUTH TRANSLATION	4.89×10^{6} k/ft	4.26×10^{5} k-sec/ft
EAST-WEST TRANSLATION	3.76×10^{6} k/ft	4.28×10^{5} k-sec/ft
ROCKING ABOUT NORTH-SOUTH AXIS	7.33×10^{10} k-ft/rad	7.72×10^{9} k-ft-sec/rad
ROCKING ABOUT EAST-WEST AXIS	3.61×10^{10} k-ft/rad	1.62×10^{9} k-ft-sec/rad

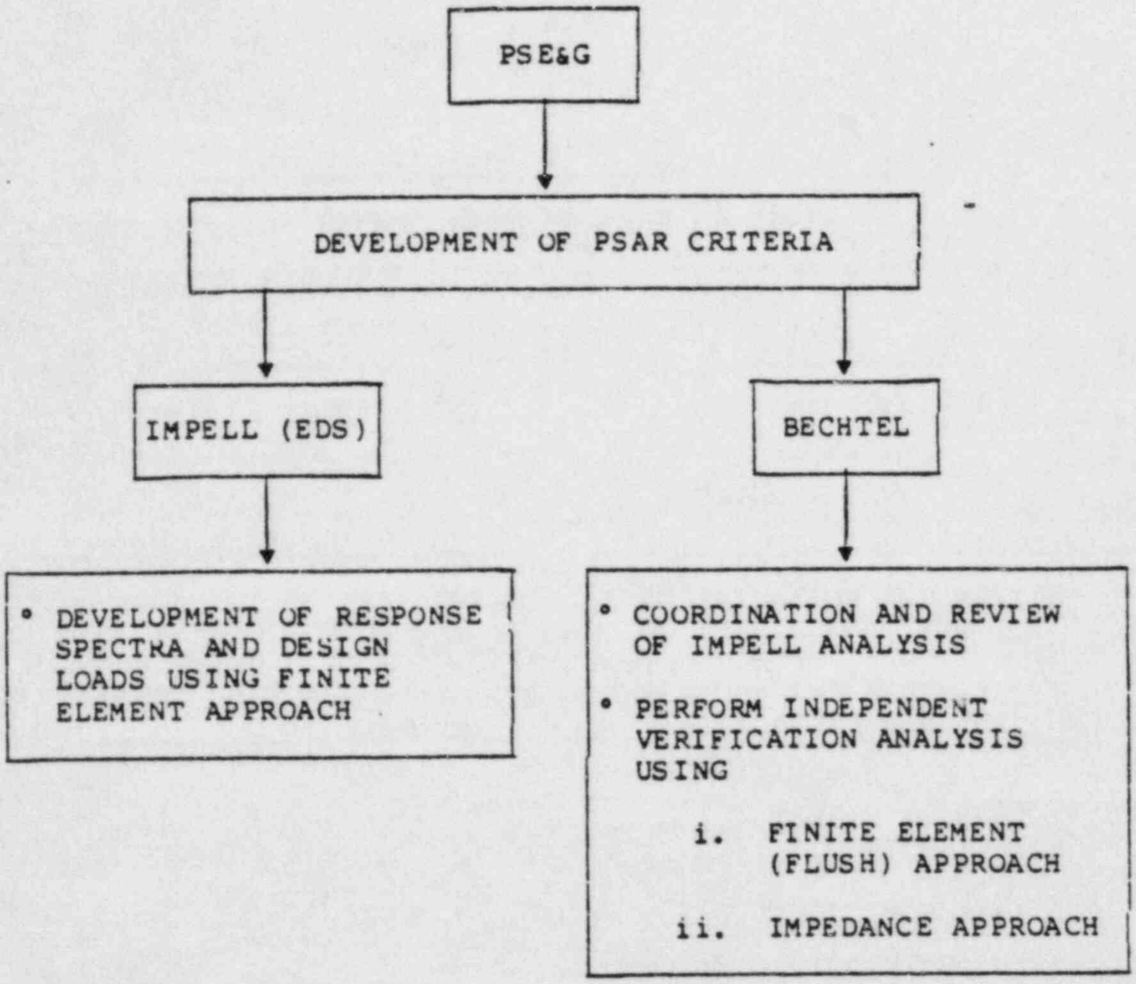


Figure A-13-1

Division of Responsibility

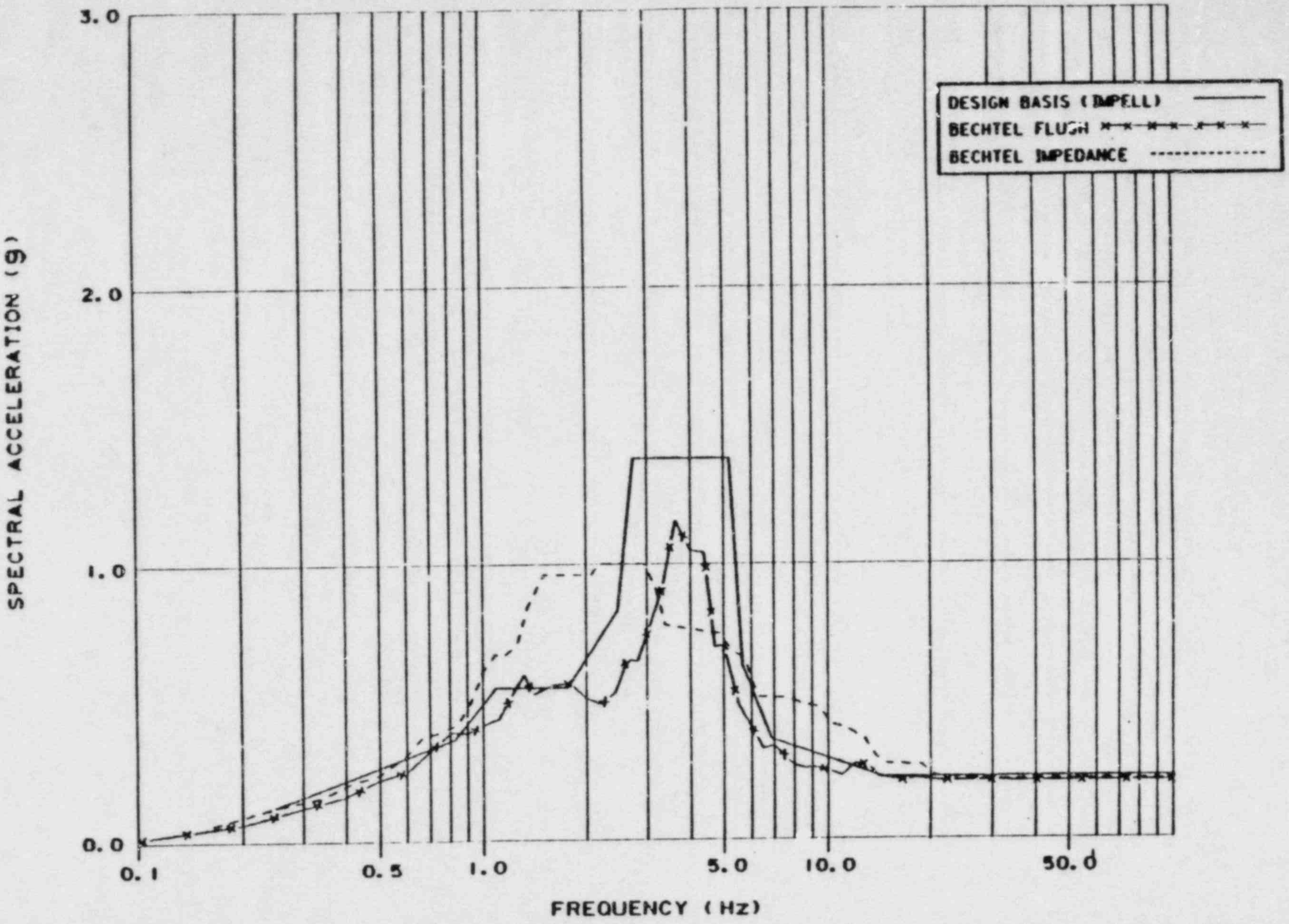


FIGURE A-13-2

RESPONSE SPECTRA COMPARISON,
UNIT I REACTOR BUILDING AT ELEV. 54' -0",
N-S, SSE, 2% DAMPING

HOPE CREEK UNIT I
CAD, LIA, REV I
04/19/84

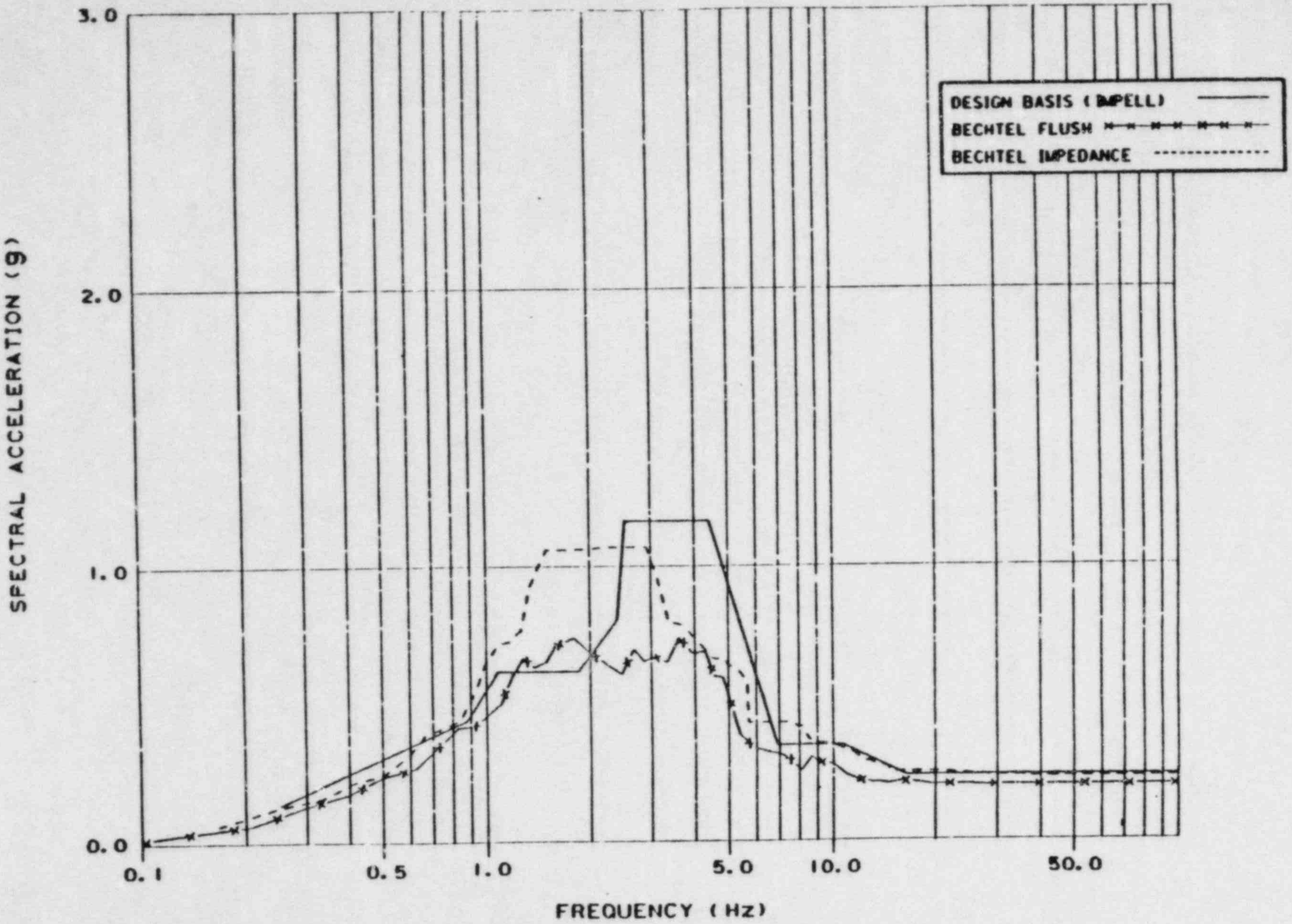


FIGURE A-13-3

RESPONSE SPECTRA COMPARISON,
UNIT I REACTOR BUILDING AT ELEV. 102' -0",
N-S, SSE, 2% DAMPING

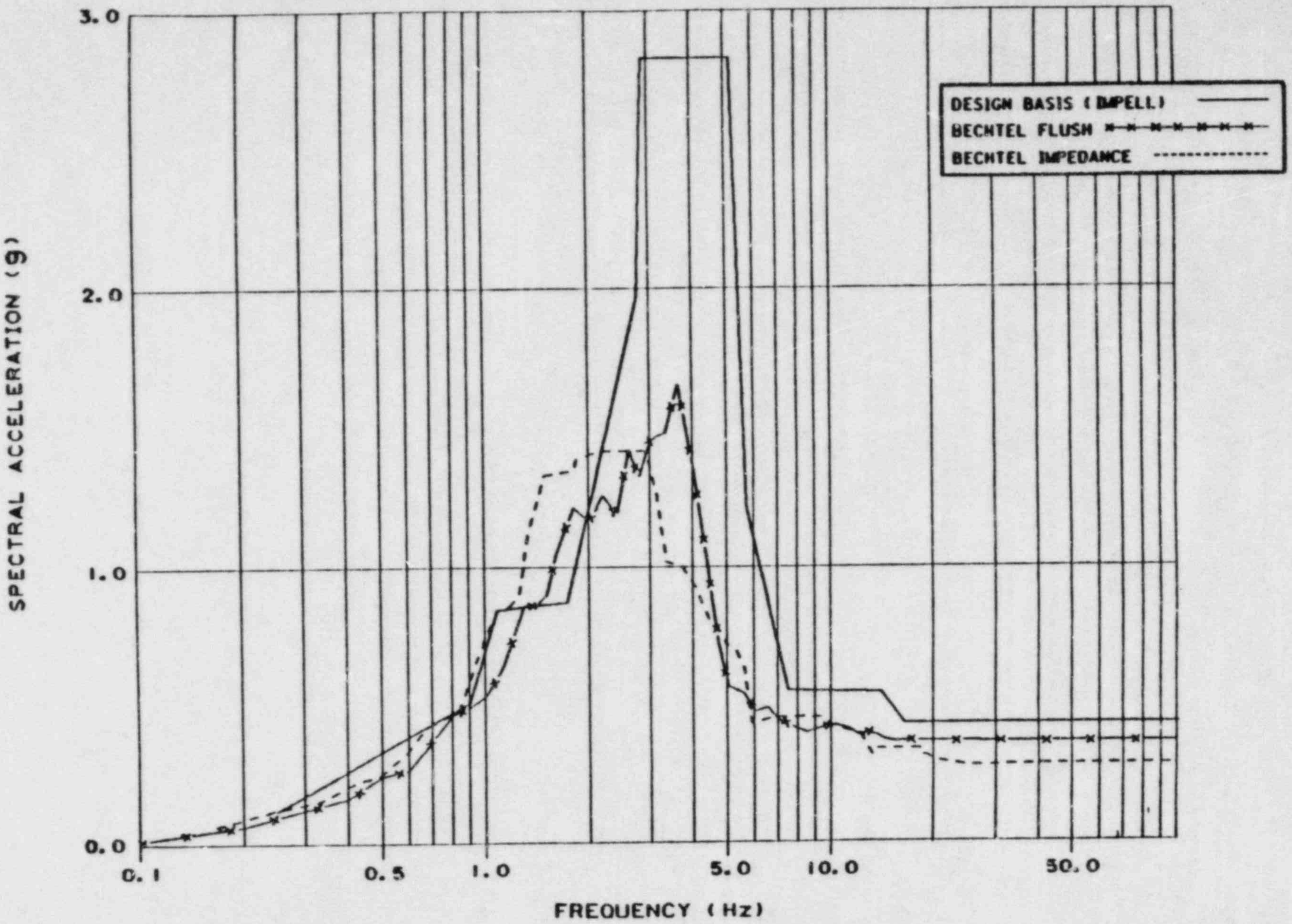


FIGURE A-13-4

RESPONSE SPECTRA COMPARISON,
UNIT I REACTOR BUILDING AT ELEV. 201' -0",
N-S, SSE, 2% DAMPING

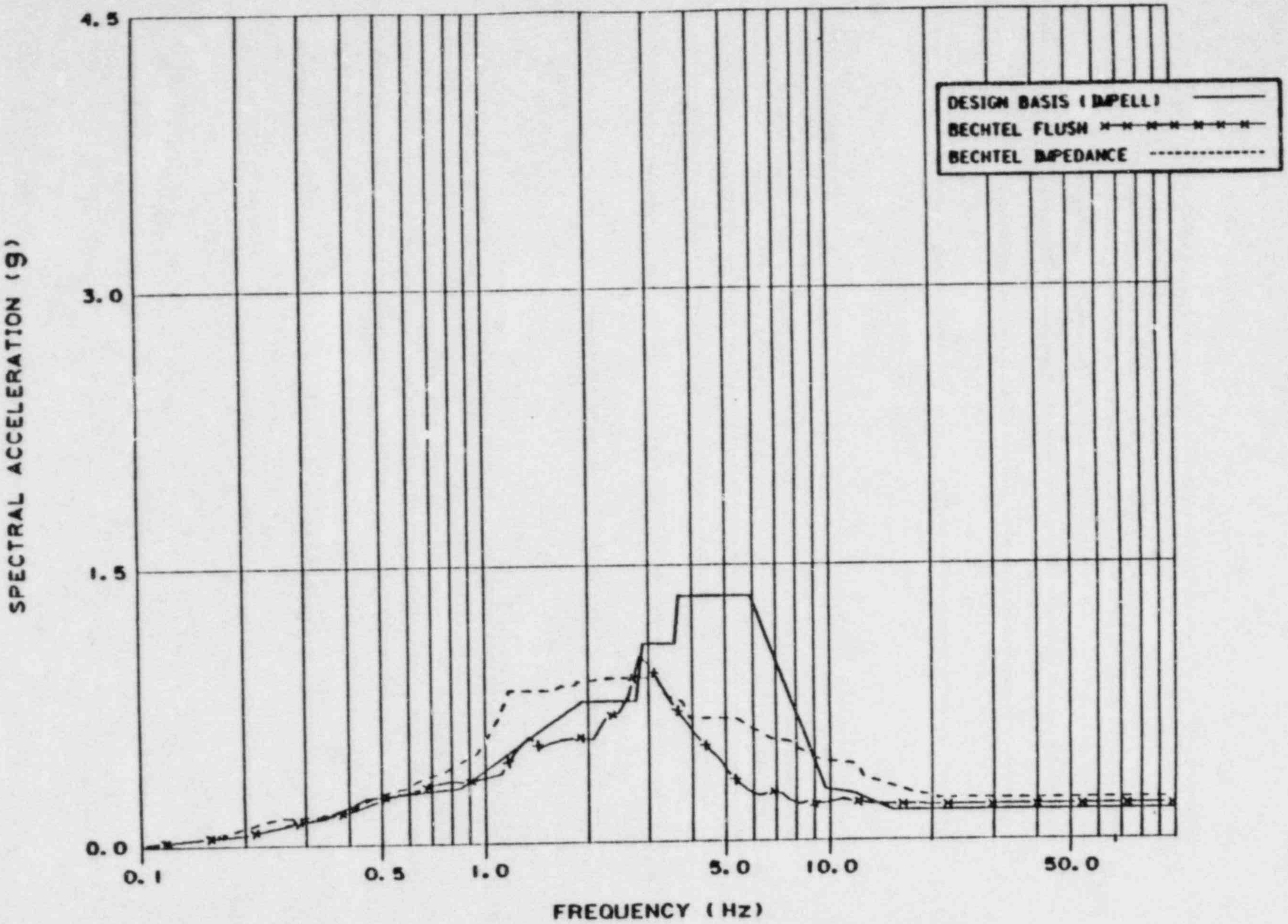


FIGURE A-13-5

RESPONSE SPECTRA COMPARISON,
UNIT 1 REACTOR BUILDING AT ELEV. 54'-0",
E-W, SSE, 2% DAMPING

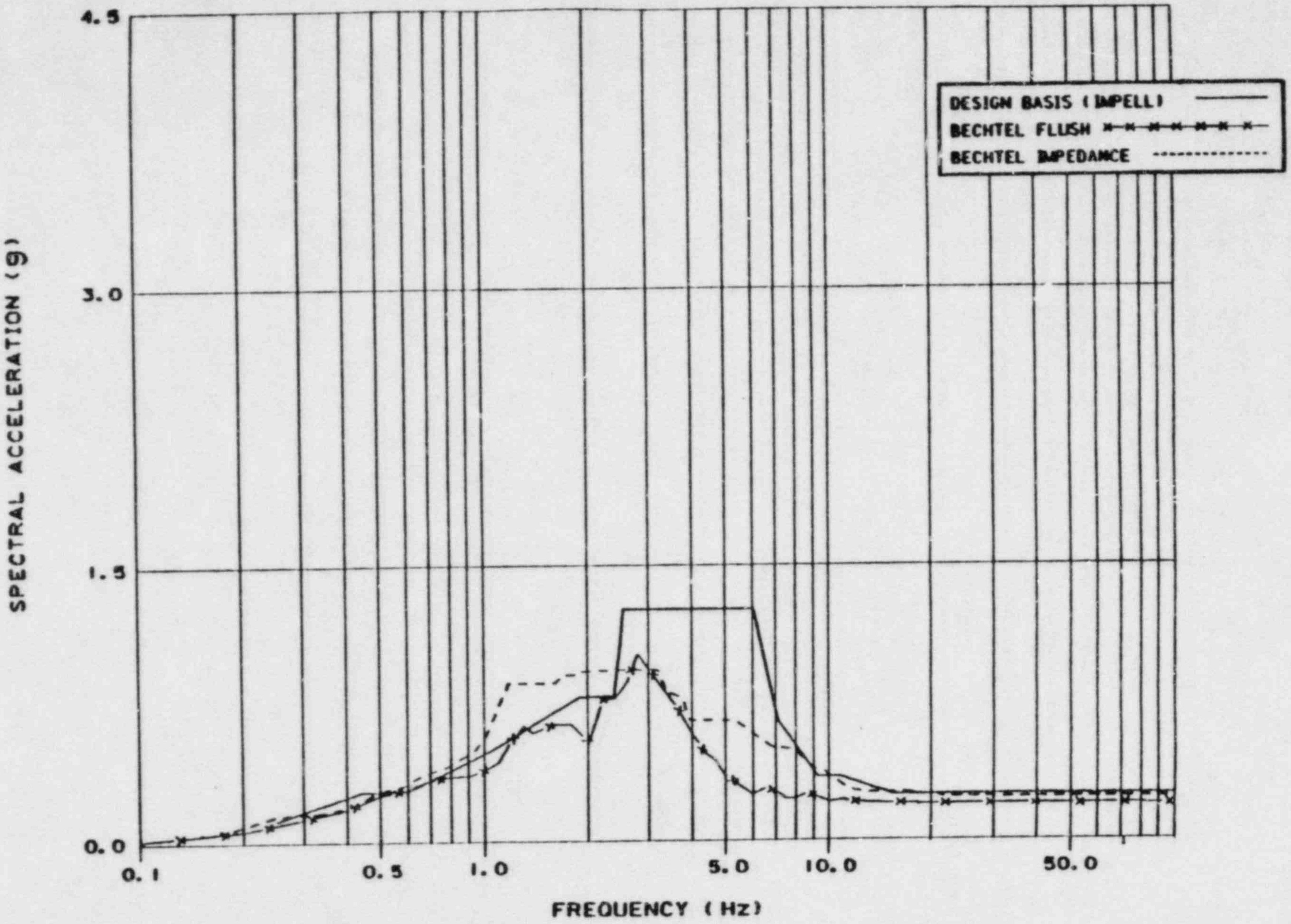


FIGURE A-13-6

RESPONSE SPECTRA COMPARISON,
UNIT I REACTOR BUILDING AT ELEV. 102' -0",
E-W, SSE, 2% DAMPING

)

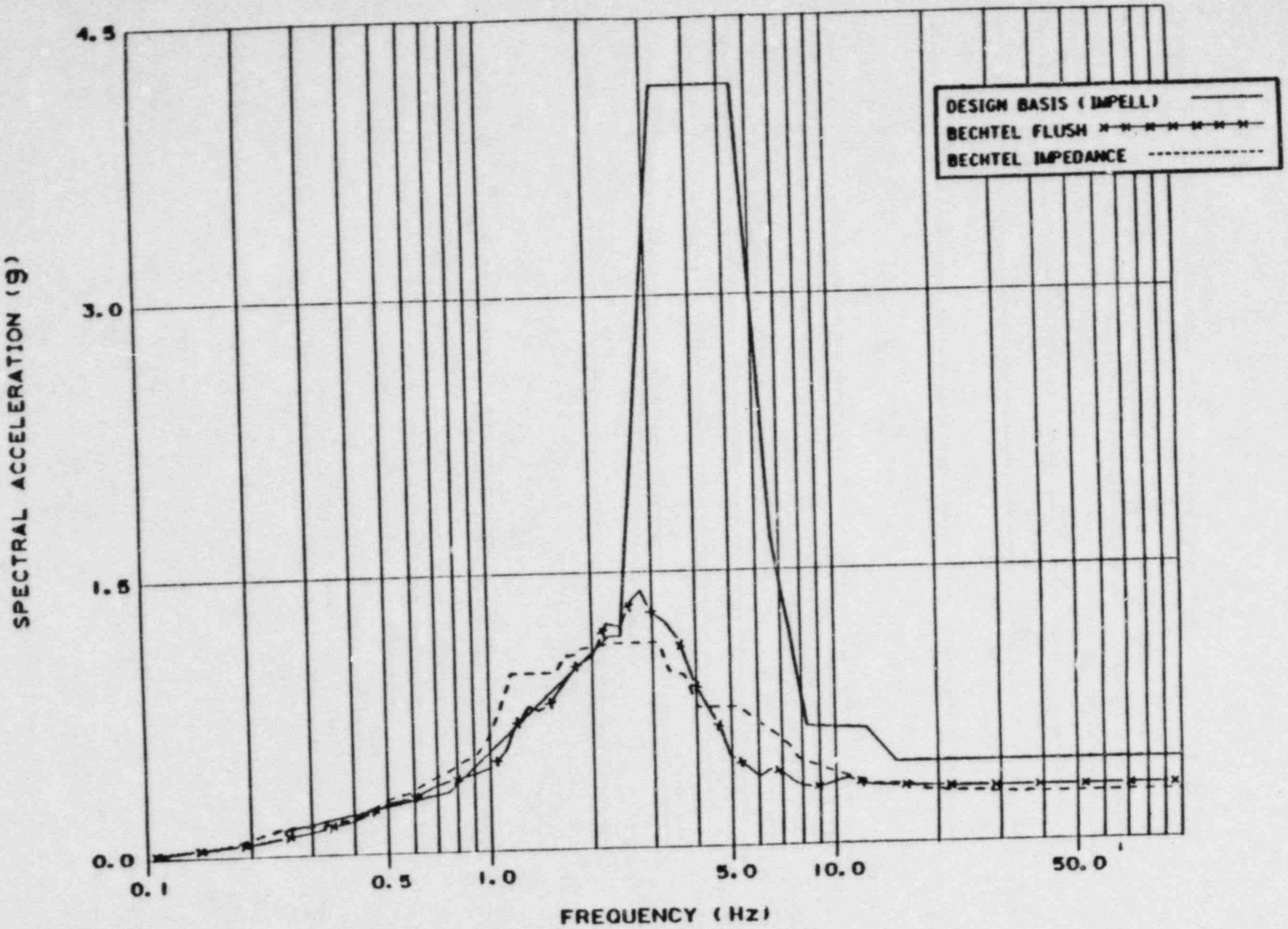


FIGURE A-13-7

RESPONSE SPECTRA COMPARISON,
UNIT 1 REACTOR BUILDING AT ELEV. 201'-0",
E-W, SSE, 2% DAMPING

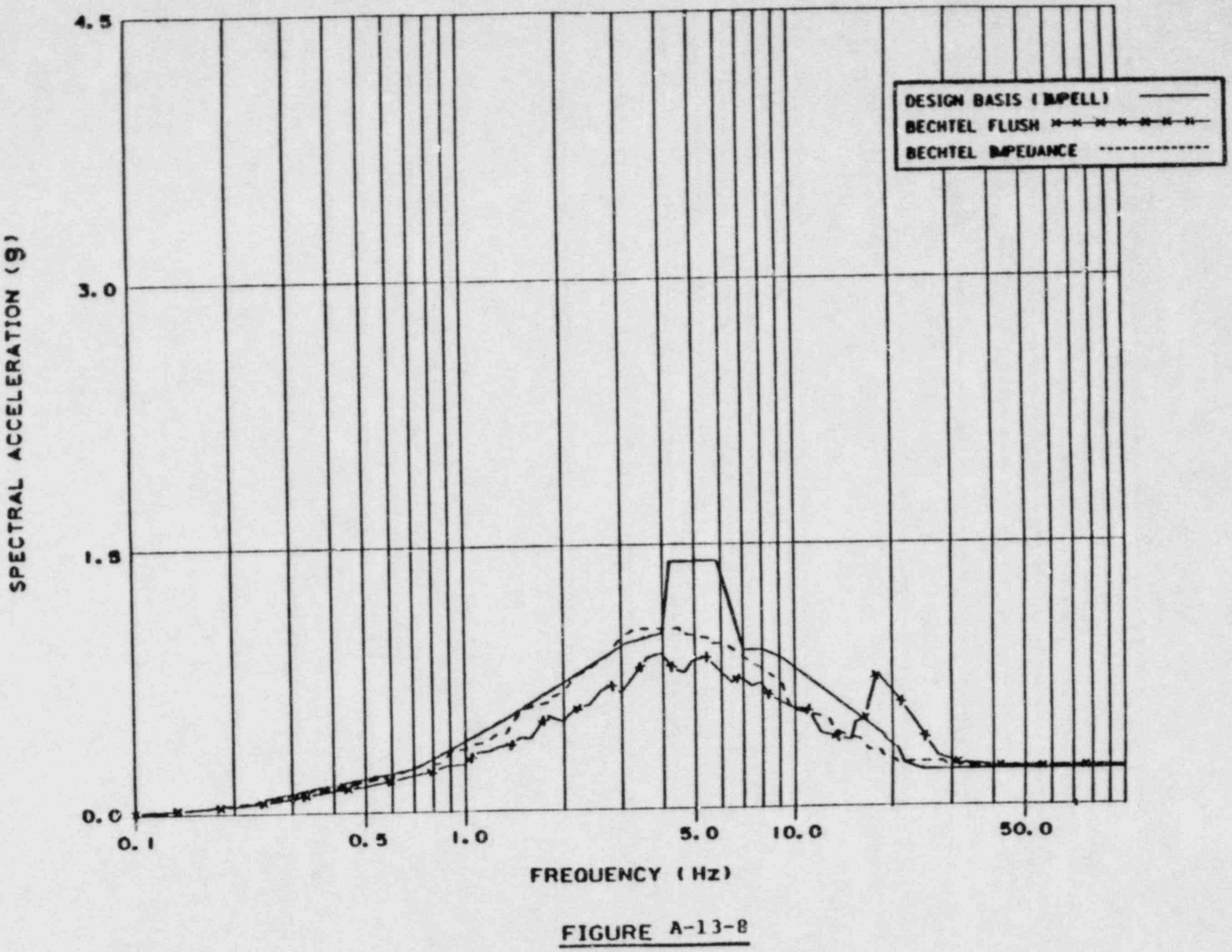


FIGURE A-13-8

RESPONSE SPECTRA COMPARISON,
UNIT 1 REACTOR BUILDING AT ELEV. 54'-0",
VERTICAL, SSE, 2% DAMPING

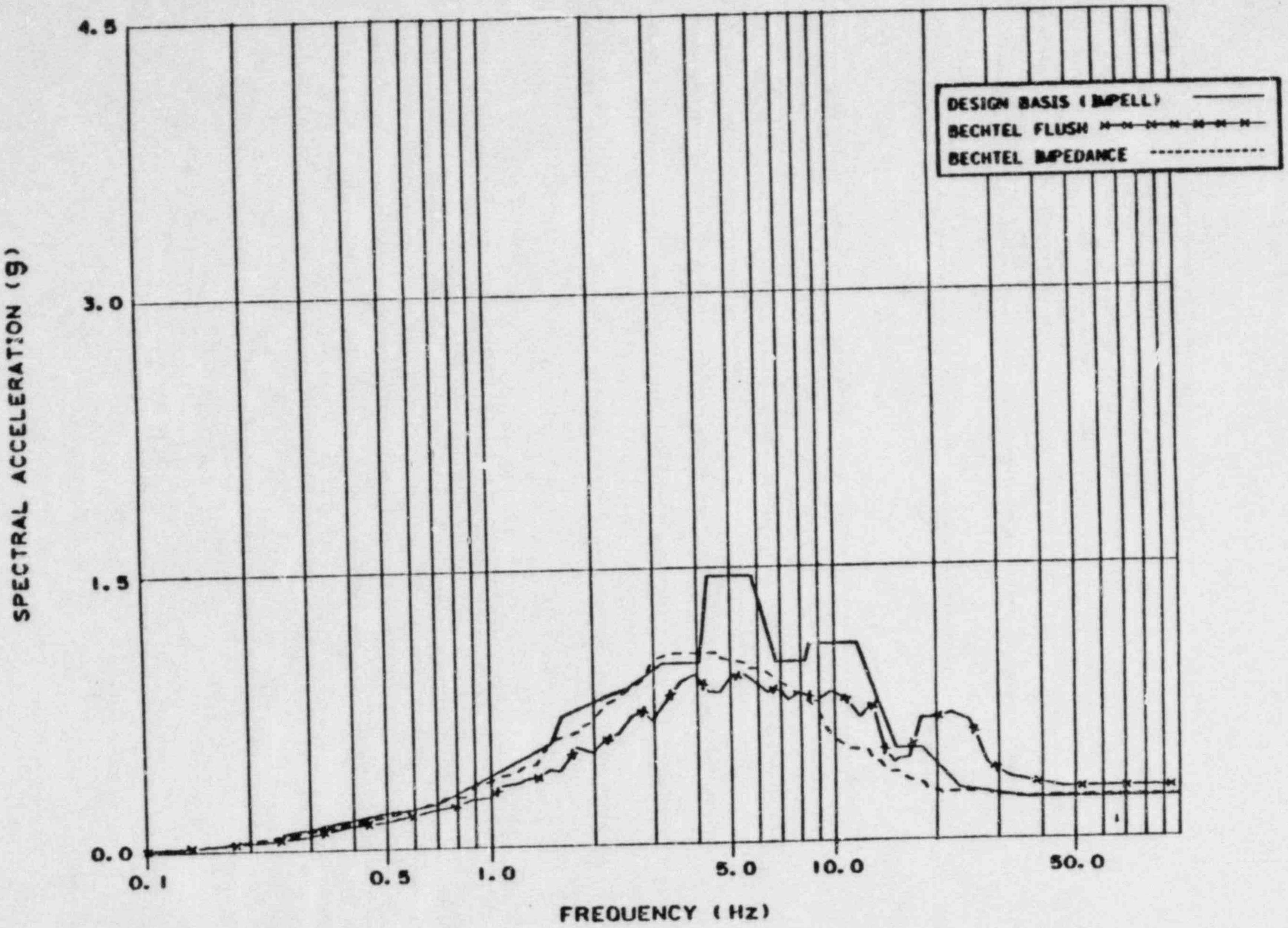


FIGURE A-13-9

RESPONSE SPECTRA COMPARISON,
UNIT I REACTOR BUILDING AT ELEV. 102' -0",
VERTICAL SSE, 2% DAMPING

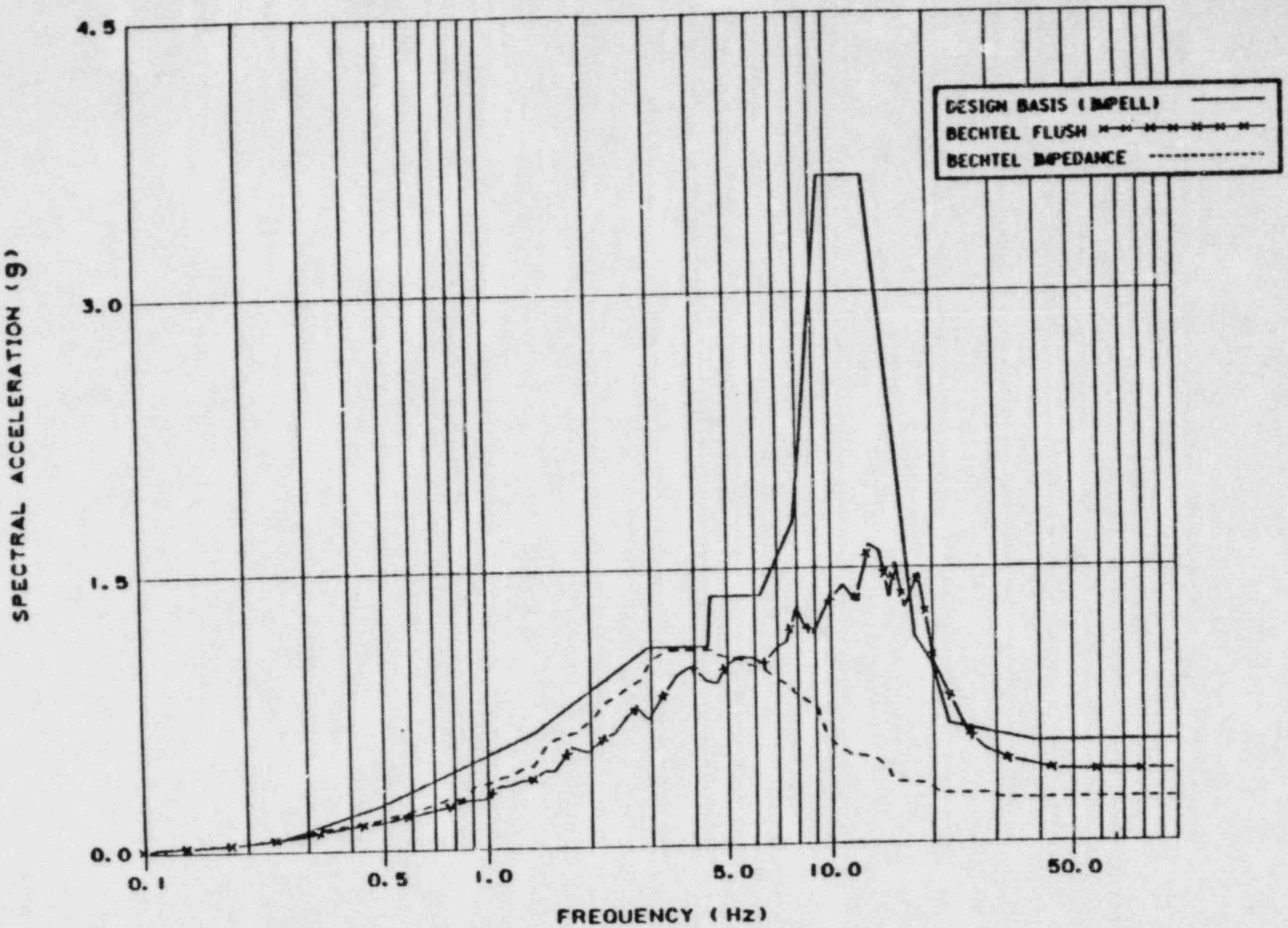


FIGURE A-13-10

RESPONSE SPECTRA COMPARISON,
UNIT I REACTOR BUILDING AT ELEV. 201'-0",
VERTICAL, SSE, 2% DAMPING

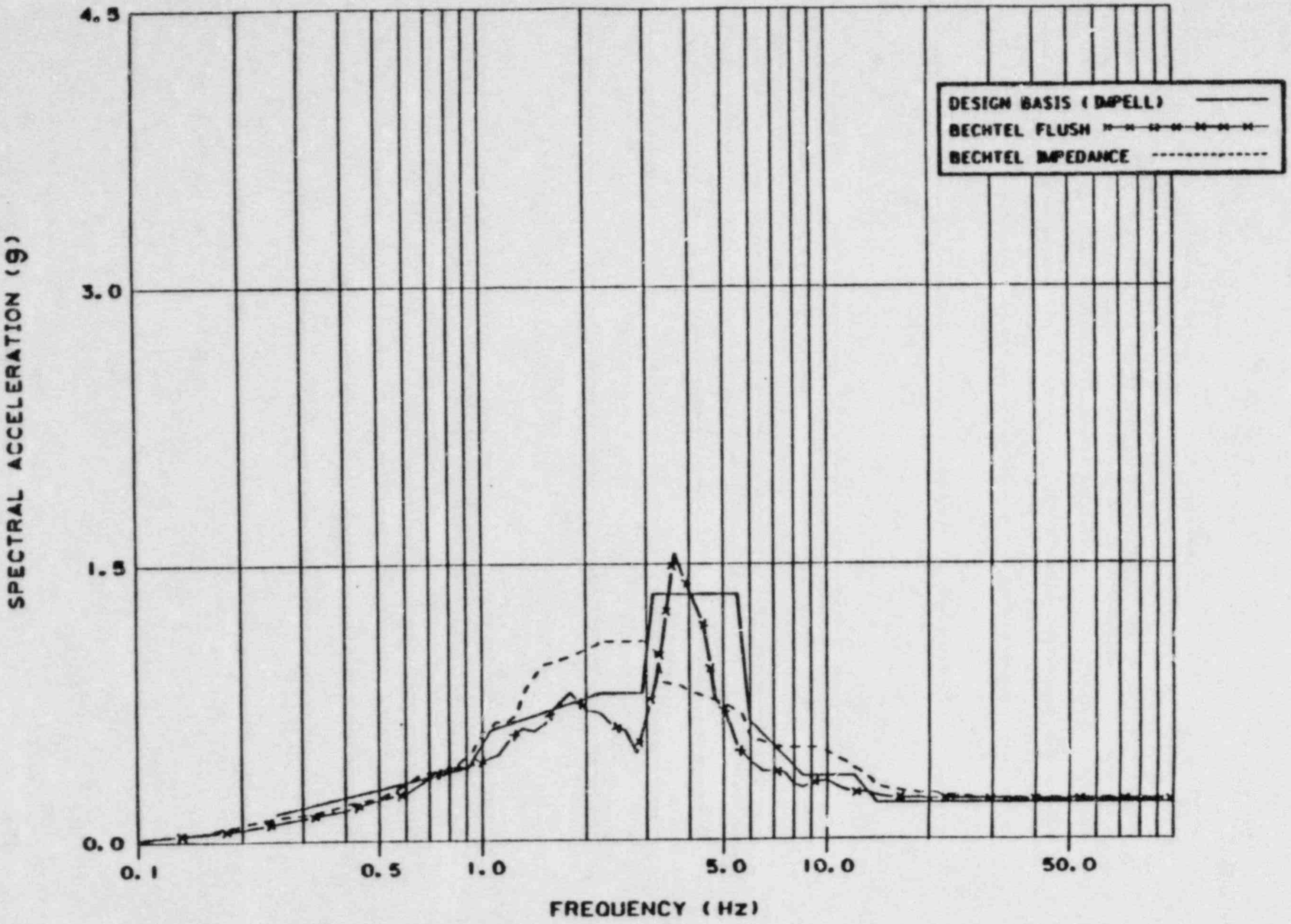


FIGURE A-13-11

RESPONSE SPECTRA COMPARISON,
AUXILIARY BUILDING AT ELEV. 54' -0",
N-S. SSE. 2% DAMPING

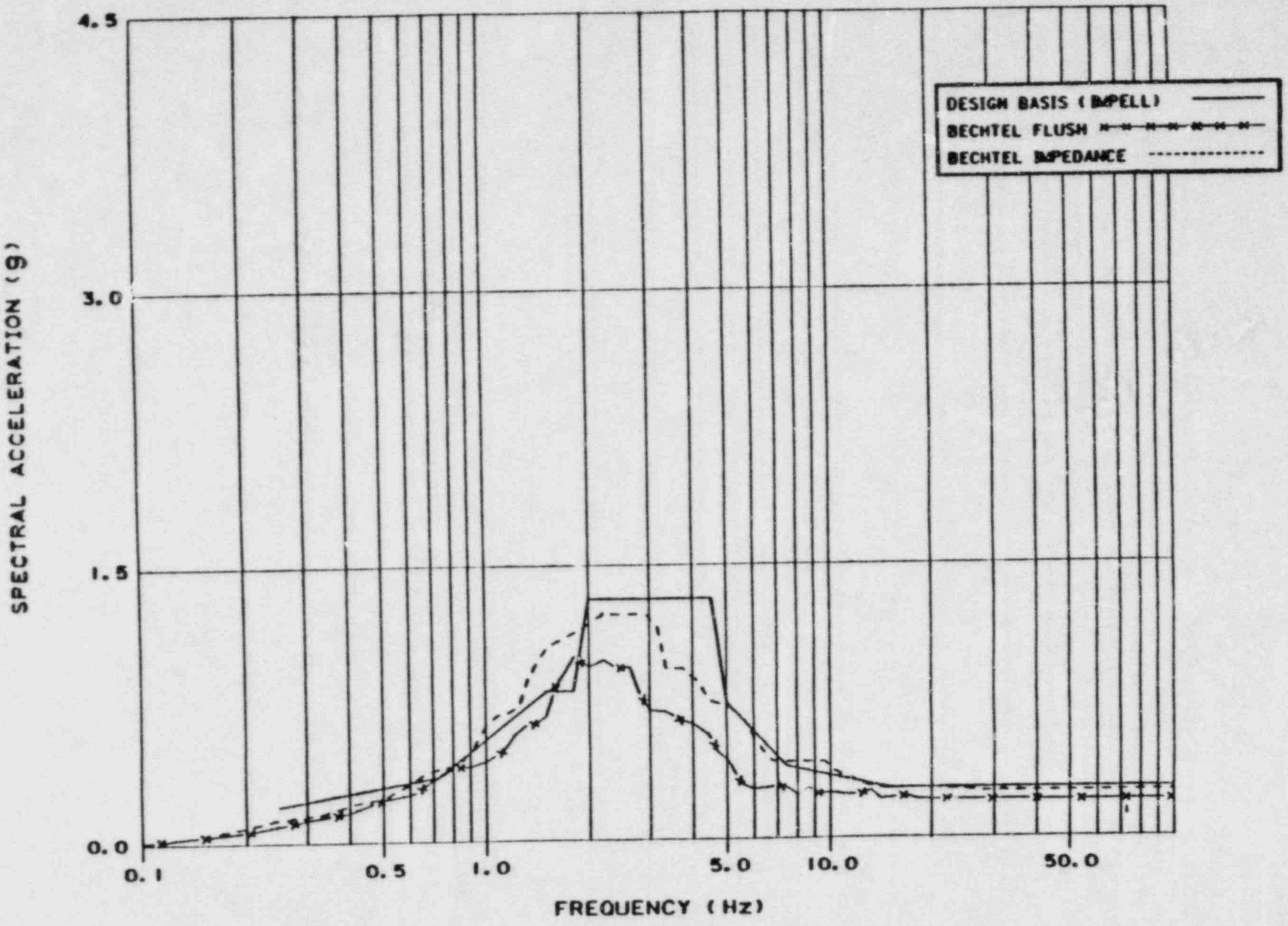


FIGURE A-13-12

RESPONSE SPECTRA COMPARISON,
AUXILIARY BUILDING AT ELEV. 102' -0",

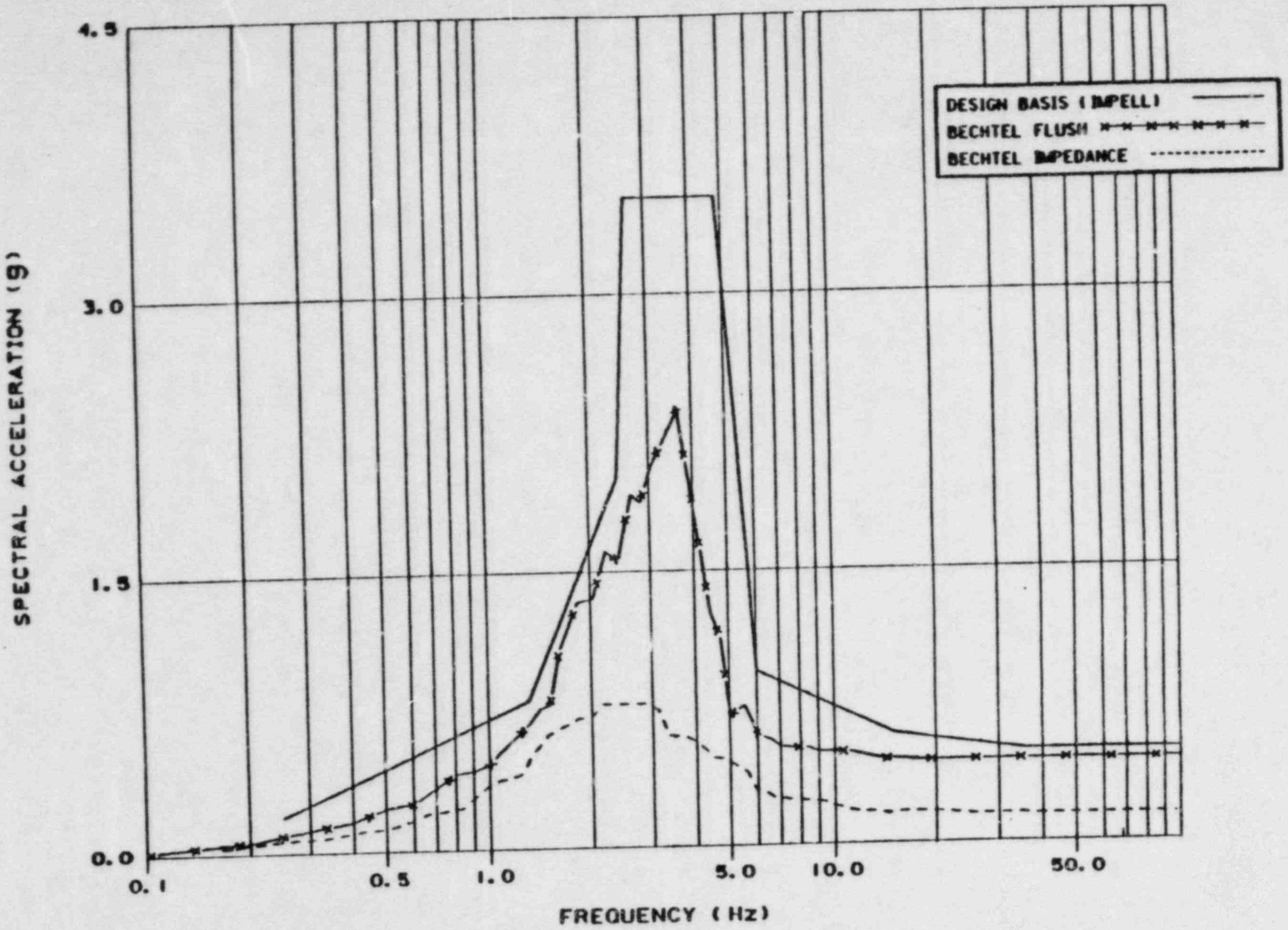


FIGURE A-13-13

RESPONSE SPECTRA COMPARISON,
AUXILIARY BUILDING AT ELEV. 178' -0",
N-S. SSE. 2% DAMPING

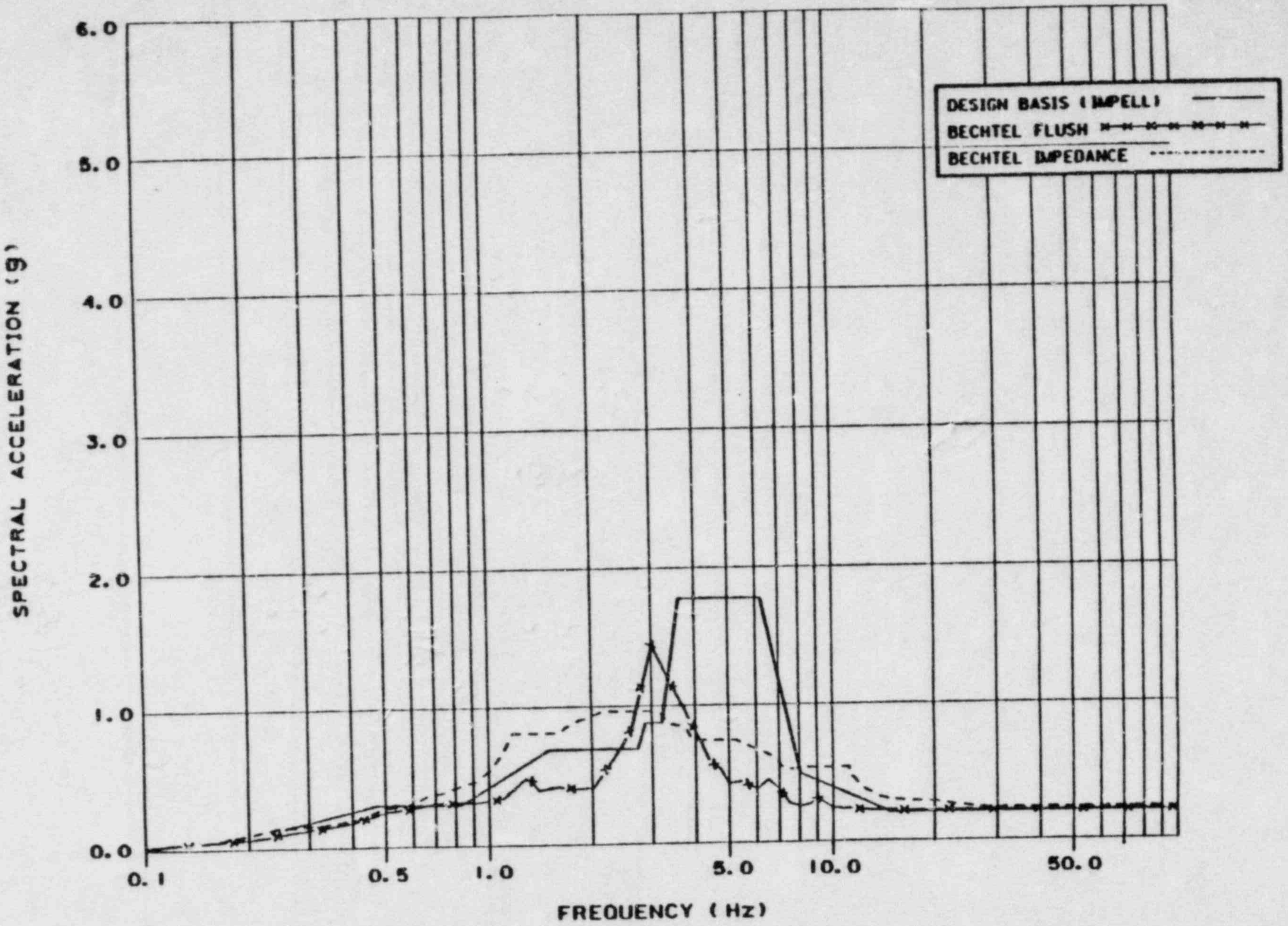


FIGURE A-13-14

RESPONSE SPECTRA COMPARISON,
AUXILIARY BUILDING AT ELEV. 54' -0",
E-W, SSE, 2% DAMPING

HOPE CREEK UNIT 1
CAD. L19A, REV 1

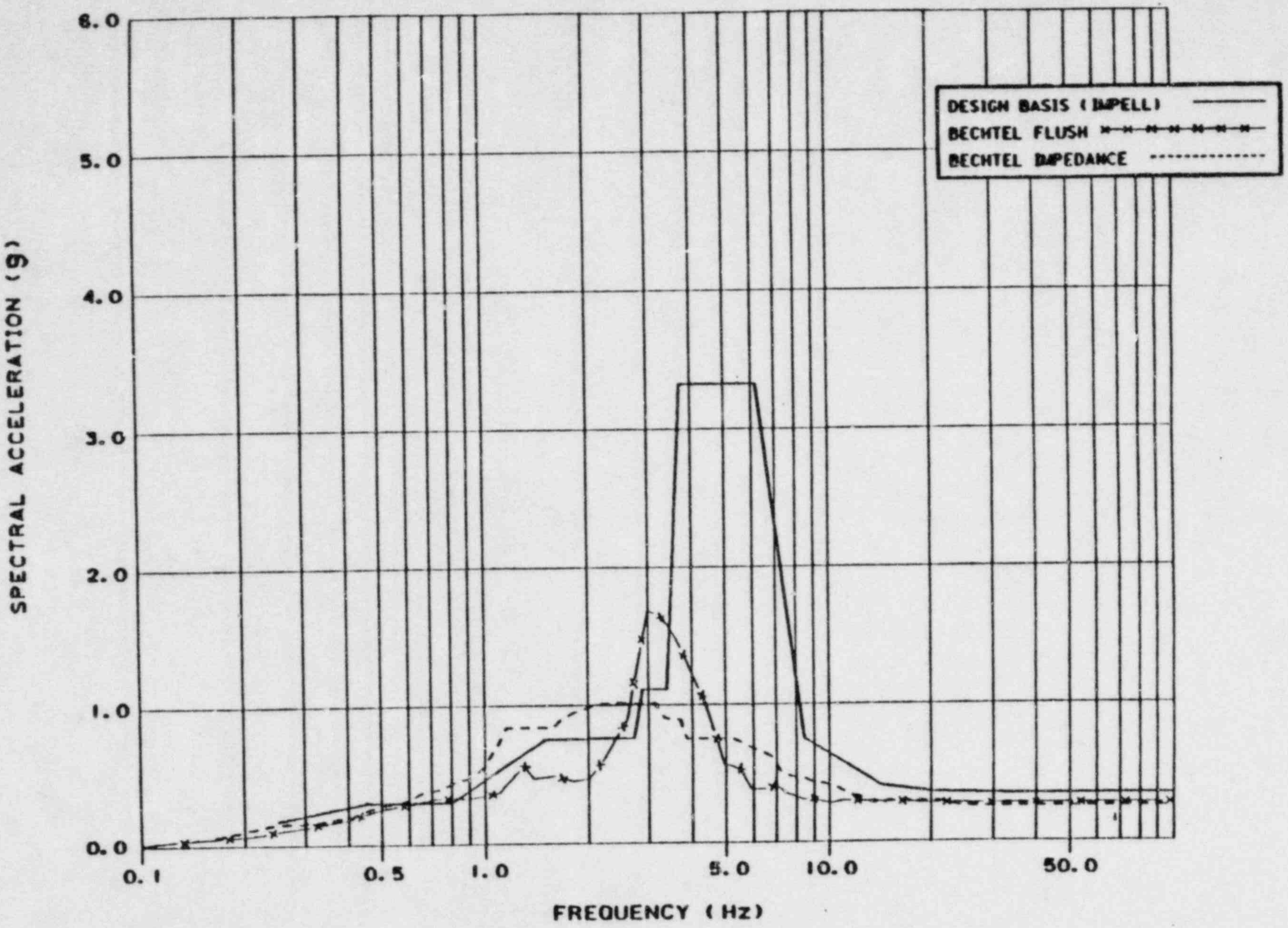


FIGURE A-13-15

RESPONSE SPECTRA COMPARISON,
AUXILIARY BUILDING AT ELEV. 102' -0",
E-W SSE 2% DAMPING

HOPE CREEK UNIT 1

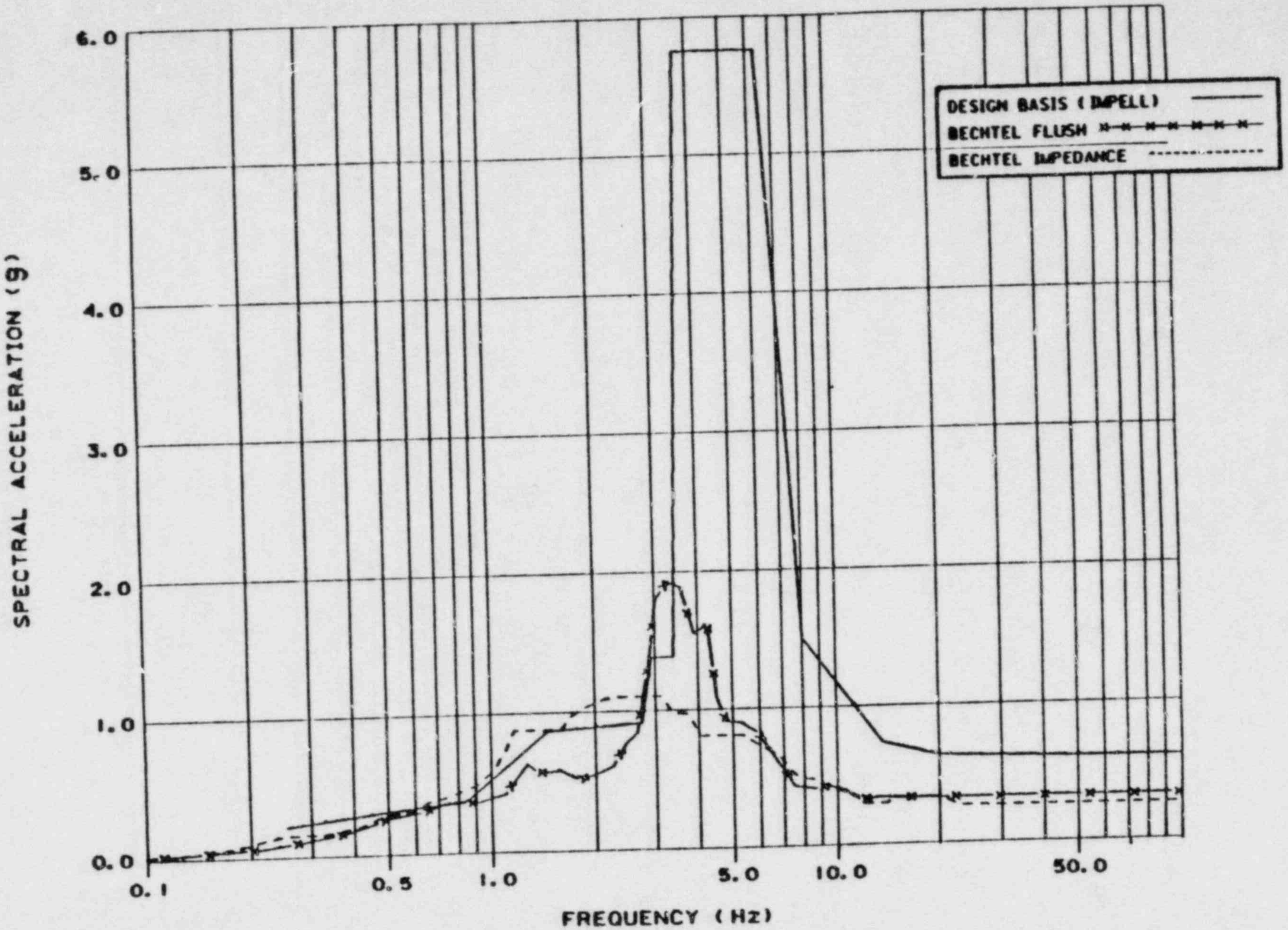


FIGURE A-13-16

RESPONSE SPECTRA COMPARISON,
AUXILIARY BUILDING AT ELEV. 178' -0",
E-W, SSE, 2% DAMPING

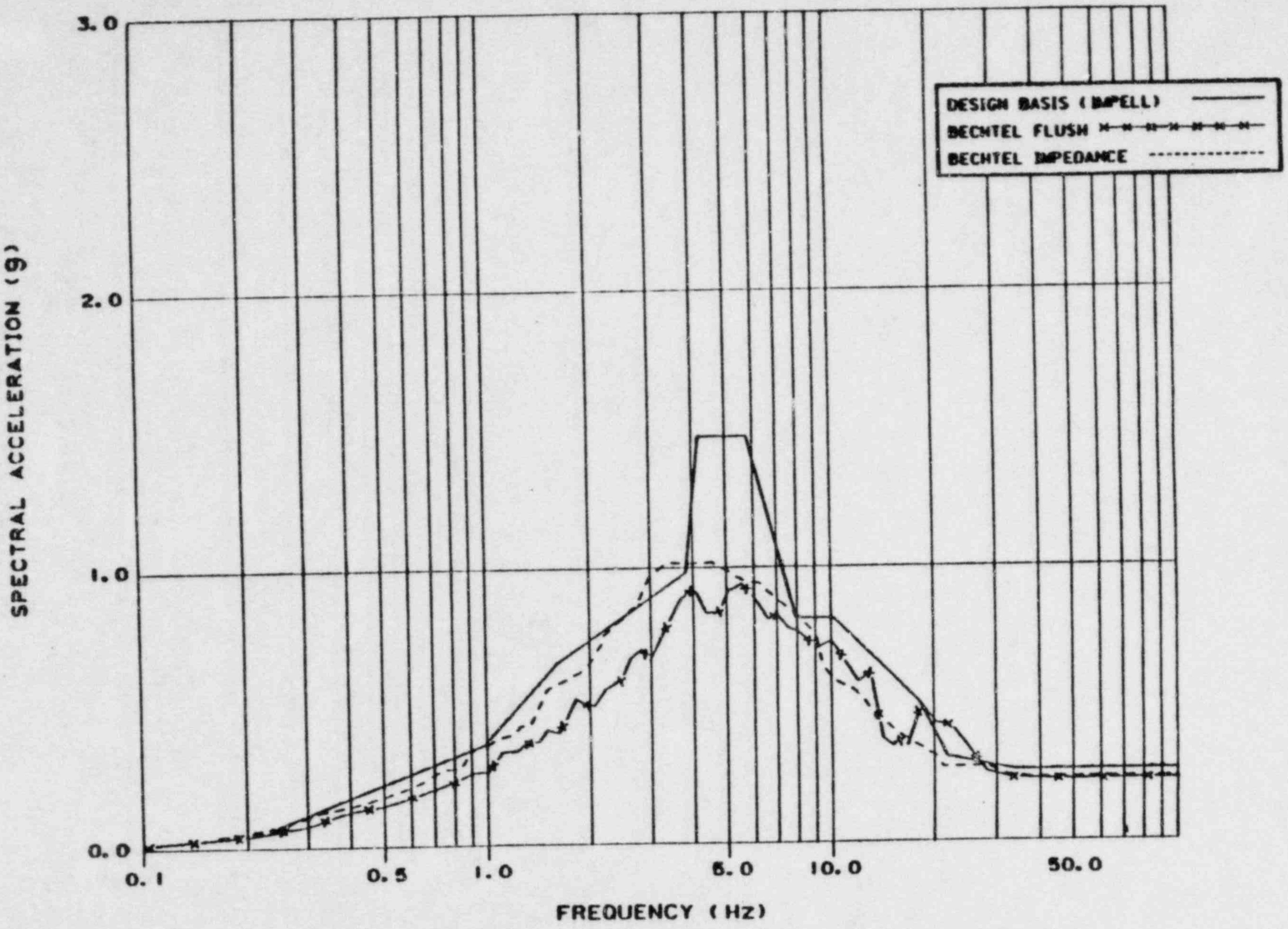


FIGURE A-13-17

RESPONSE SPECTRA COMPARISON,
AUXILIARY BUILDING AT ELEV. 54′-0″,
VERTICAL, SSE, 2% DAMPING

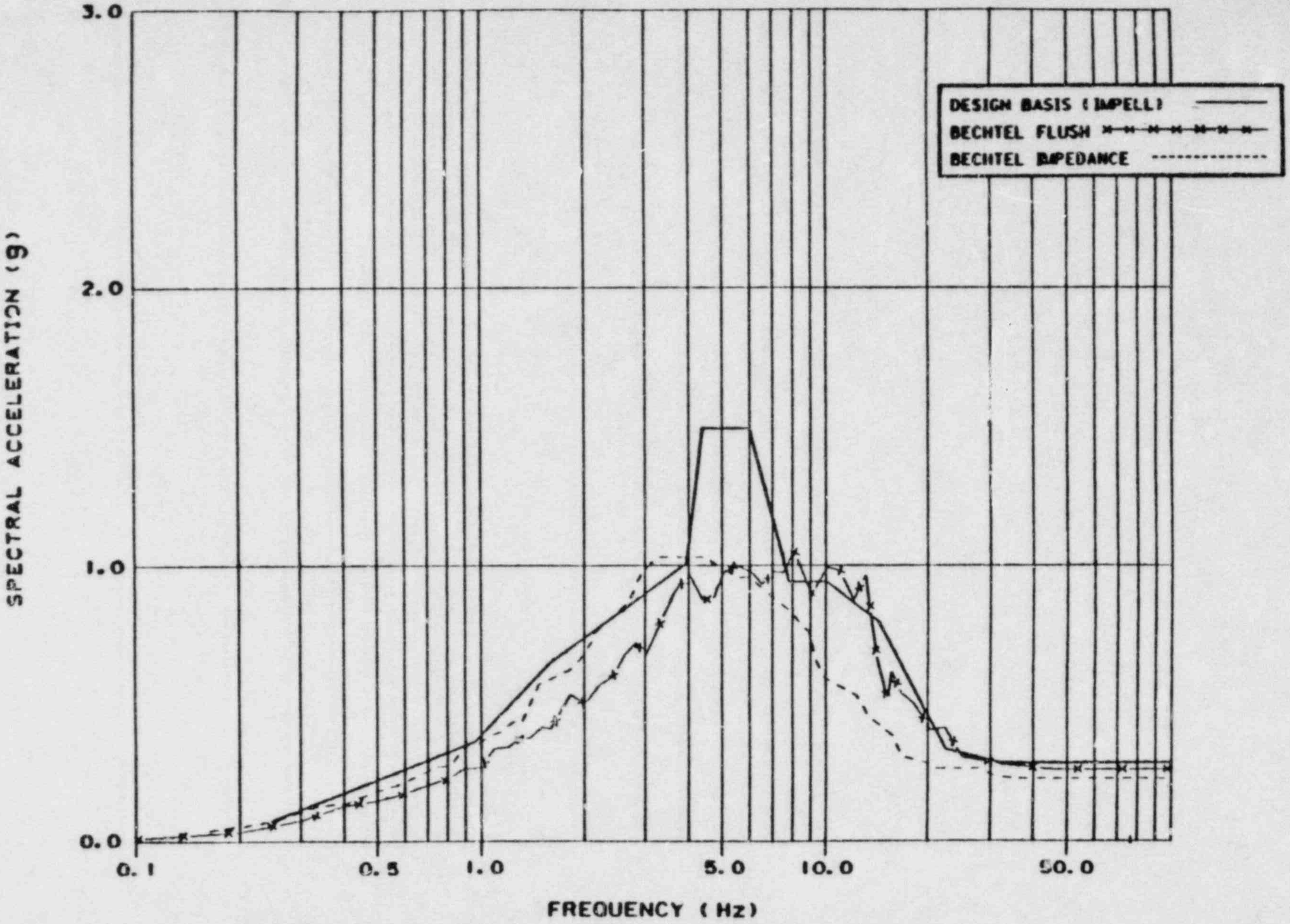


FIGURE A-13-18

RESPONSE SPECTRA COMPARISON,
AUXILIARY BUILDING AT ELEV. 102' -0",
VERTICAL, SSE, 2% DAMPING

HOPE CREEK UNIT I
CAD. L32A, REV I
04/20/84

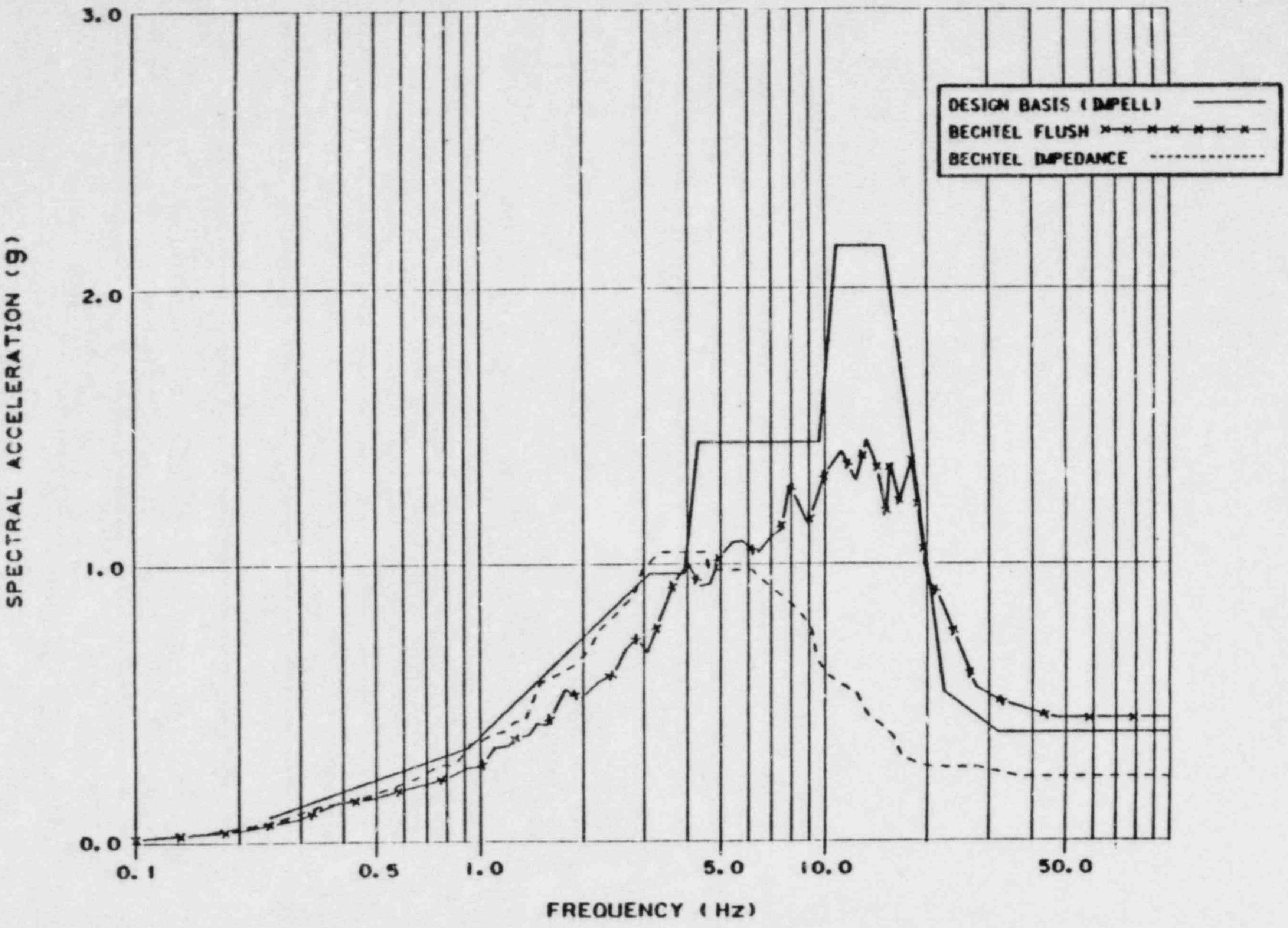


FIGURE A-13-19

RESPONSE SPECTRA COMPARISON,
AUXILIARY BUILDING AT ELEV. 178'-0",
VERTICAL, SSE, 2% DAMPING

HOPE CREEK UNIT 1
CAD, L33A, REV 1
04/20/84

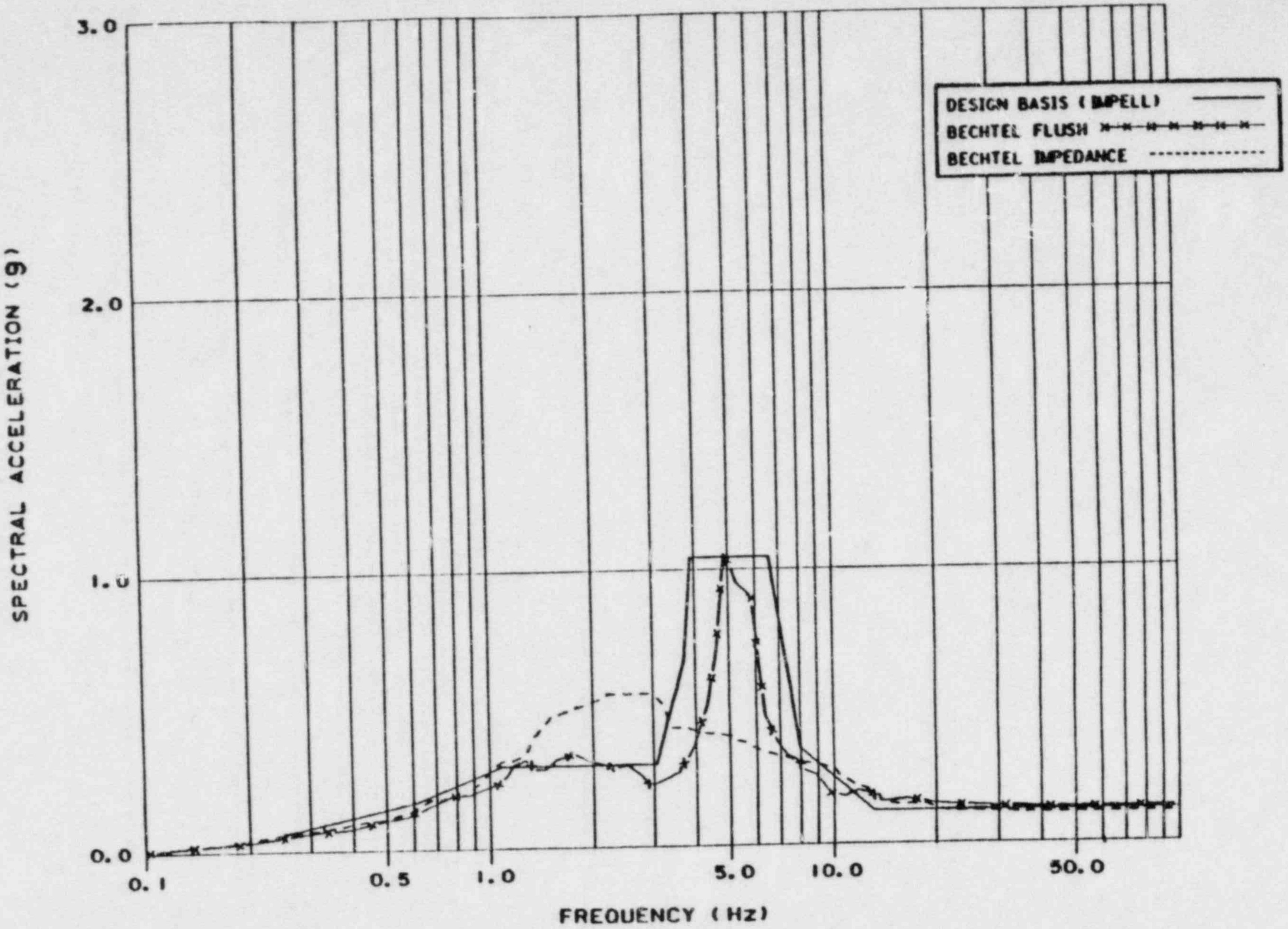


FIGURE A-13-20

RESPONSE SPECTRA COMPARISON,
UNIT I REACTOR BUILDING AT ELEV. 54'-0"
N-S, OBE, 2% DAMPING.

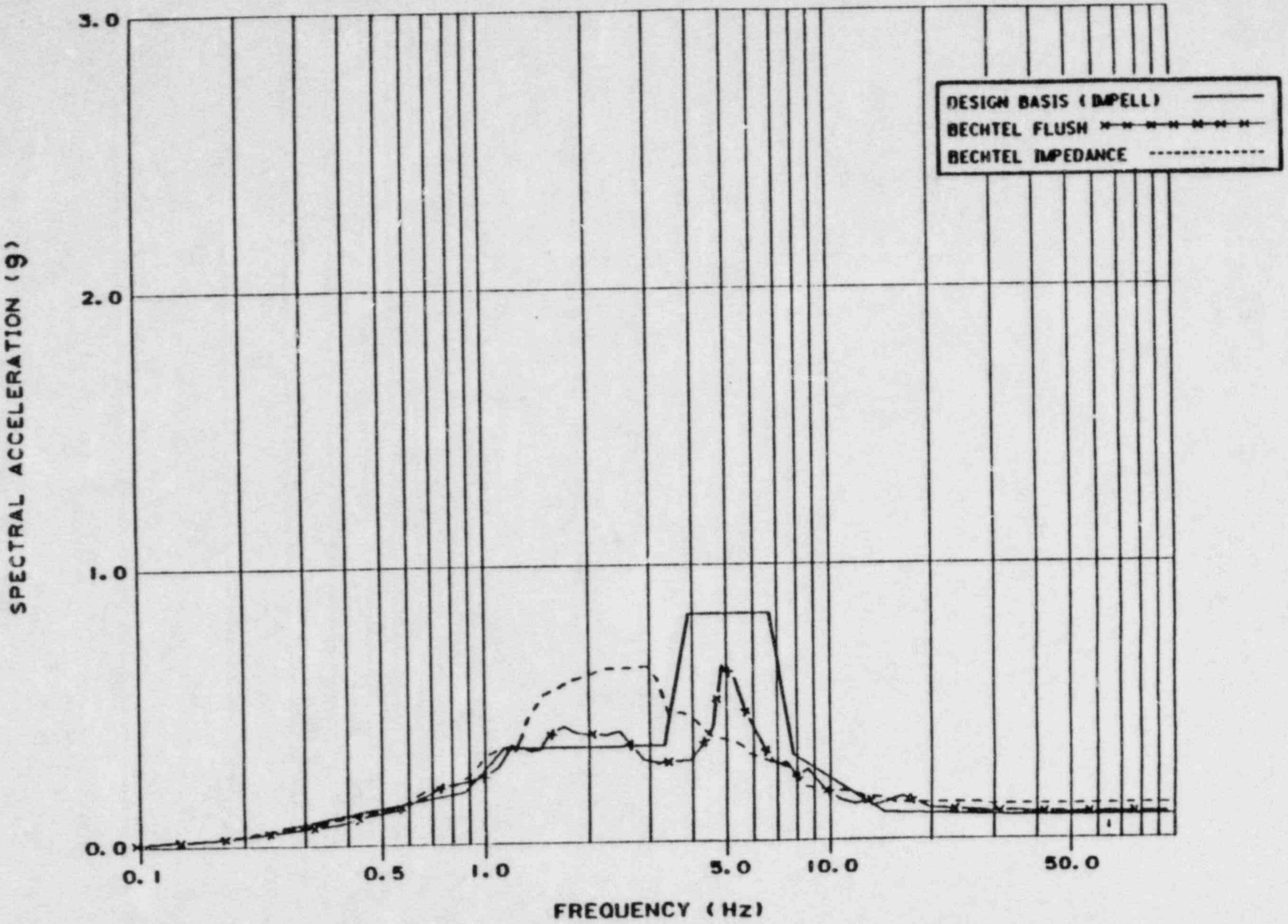


FIGURE A-13-21

RESPONSE SPECTRA COMPARISON,
UNIT I REACTOR BUILDING AT ELEV. 102'-0",
N-S, OBE, 2% DAMPING.

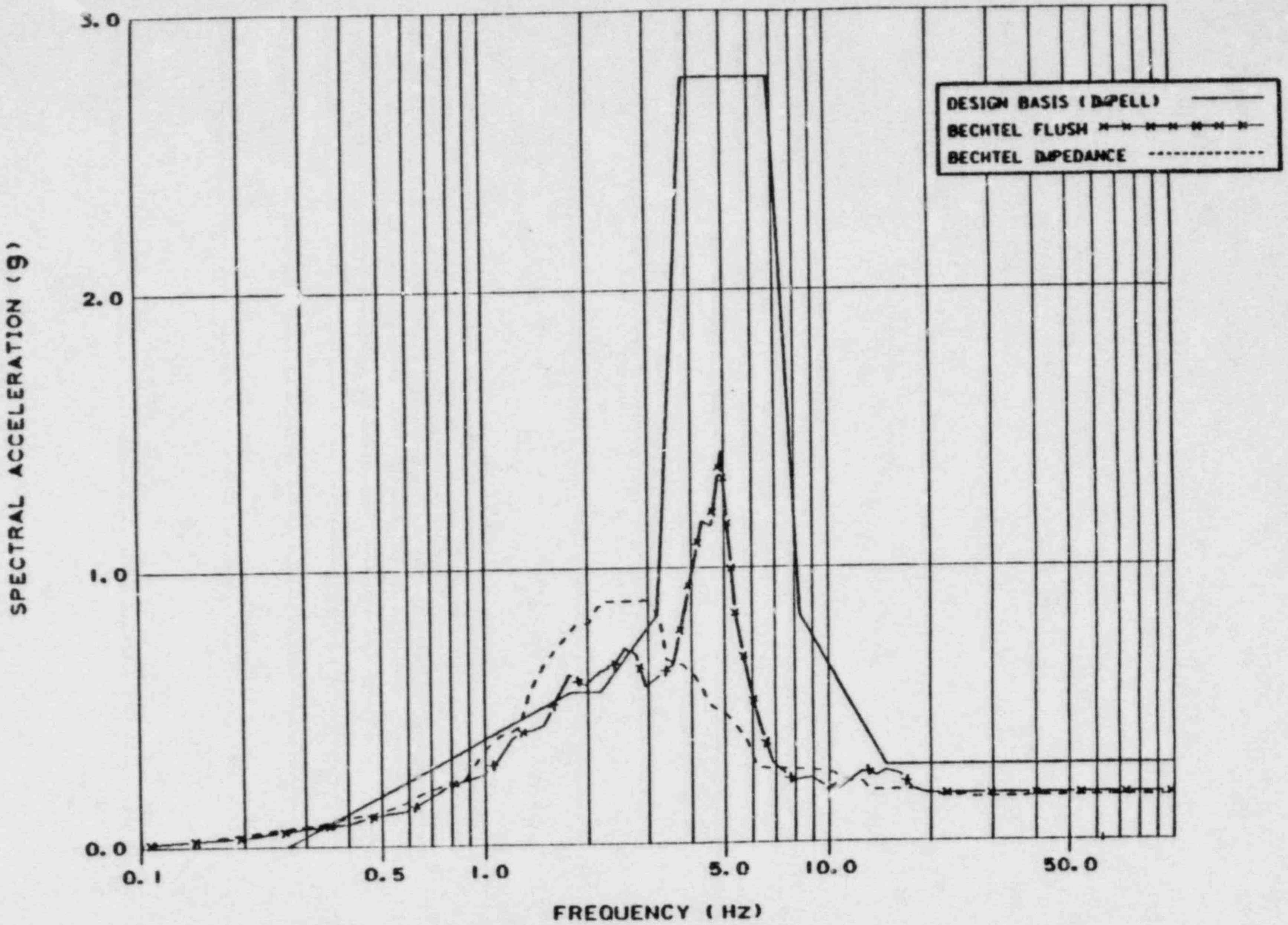


FIGURE A-13-22

RESPONSE SPECTRA COMPARISON,
UNIT I REACTOR BUILDING AT ELEV. 201'-0",
N-S, OBE, 2% DAMPING

HOPE CREEK UNIT I
CAD. L6A, REV I

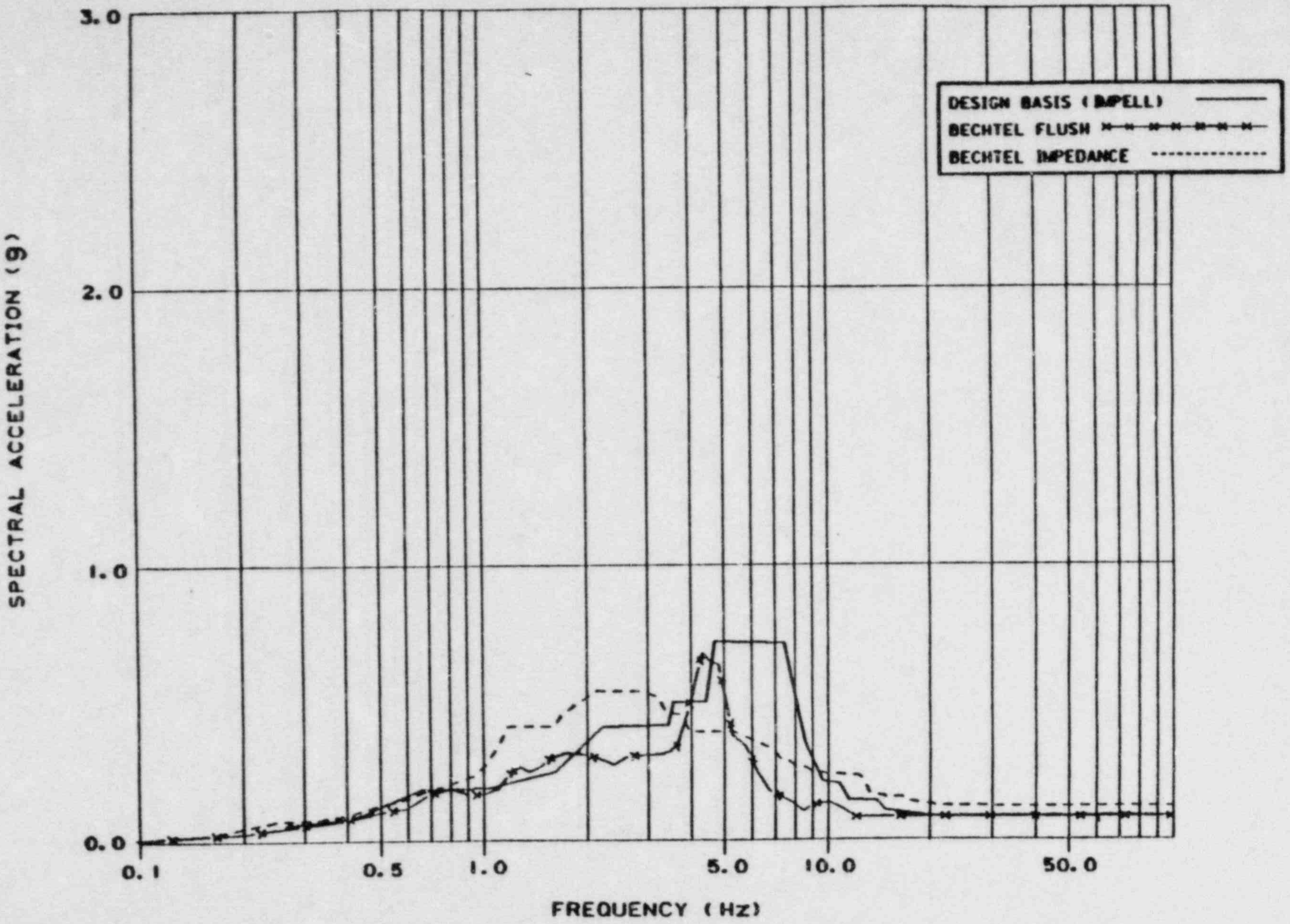


FIGURE A-13-23

RESPONSE SPECTRA COMPARISON,
UNIT I REACTOR BUILDING AT ELEV. 54' -0",
E-W, OBE, 2% DAMPING

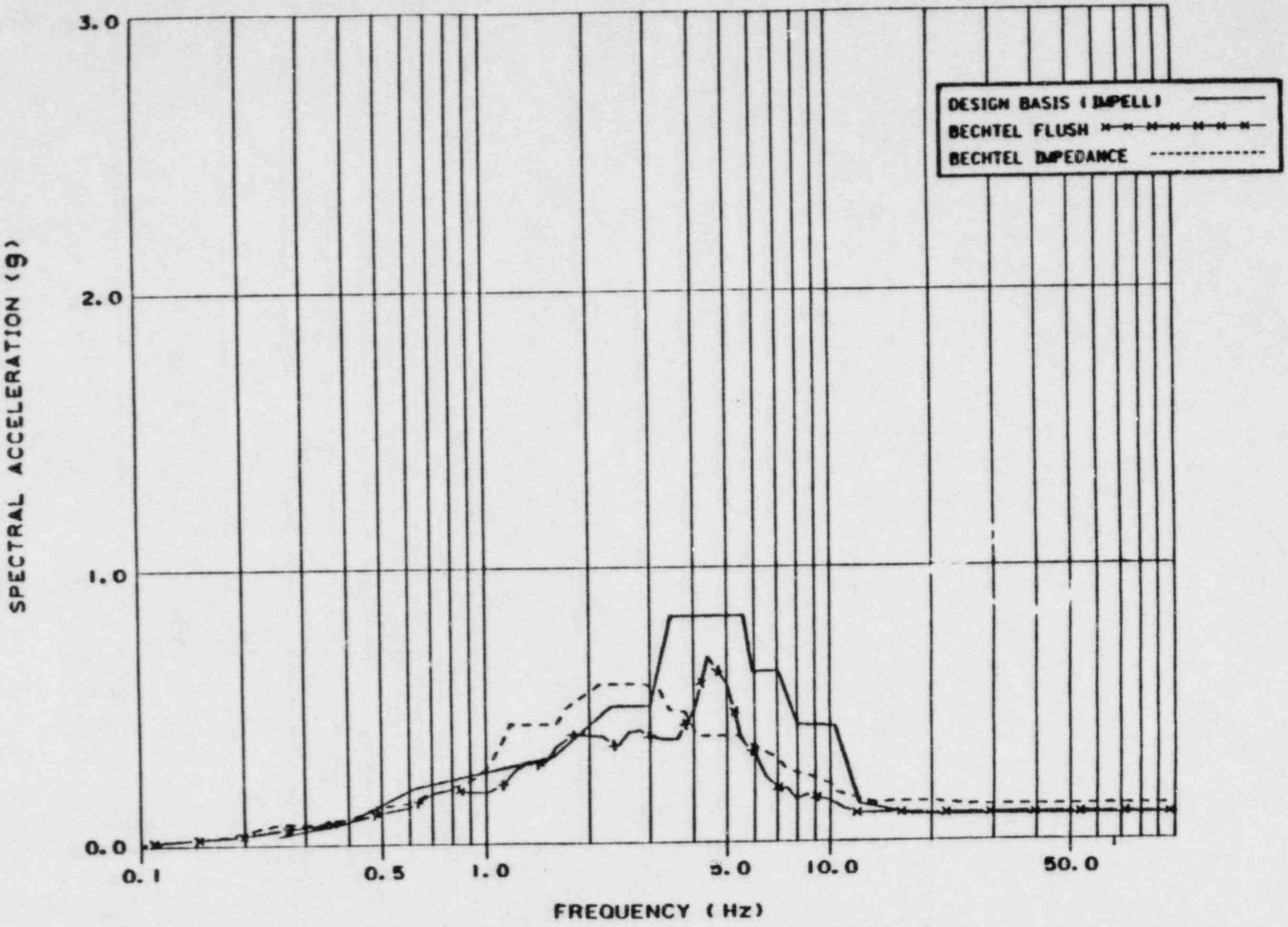


FIGURE A-13-24

RESPONSE SPECTRA COMPARISON,
UNIT I REACTOR BUILDING AT ELEV. 102'-0",
E-W, OBE, 2% DAMPING

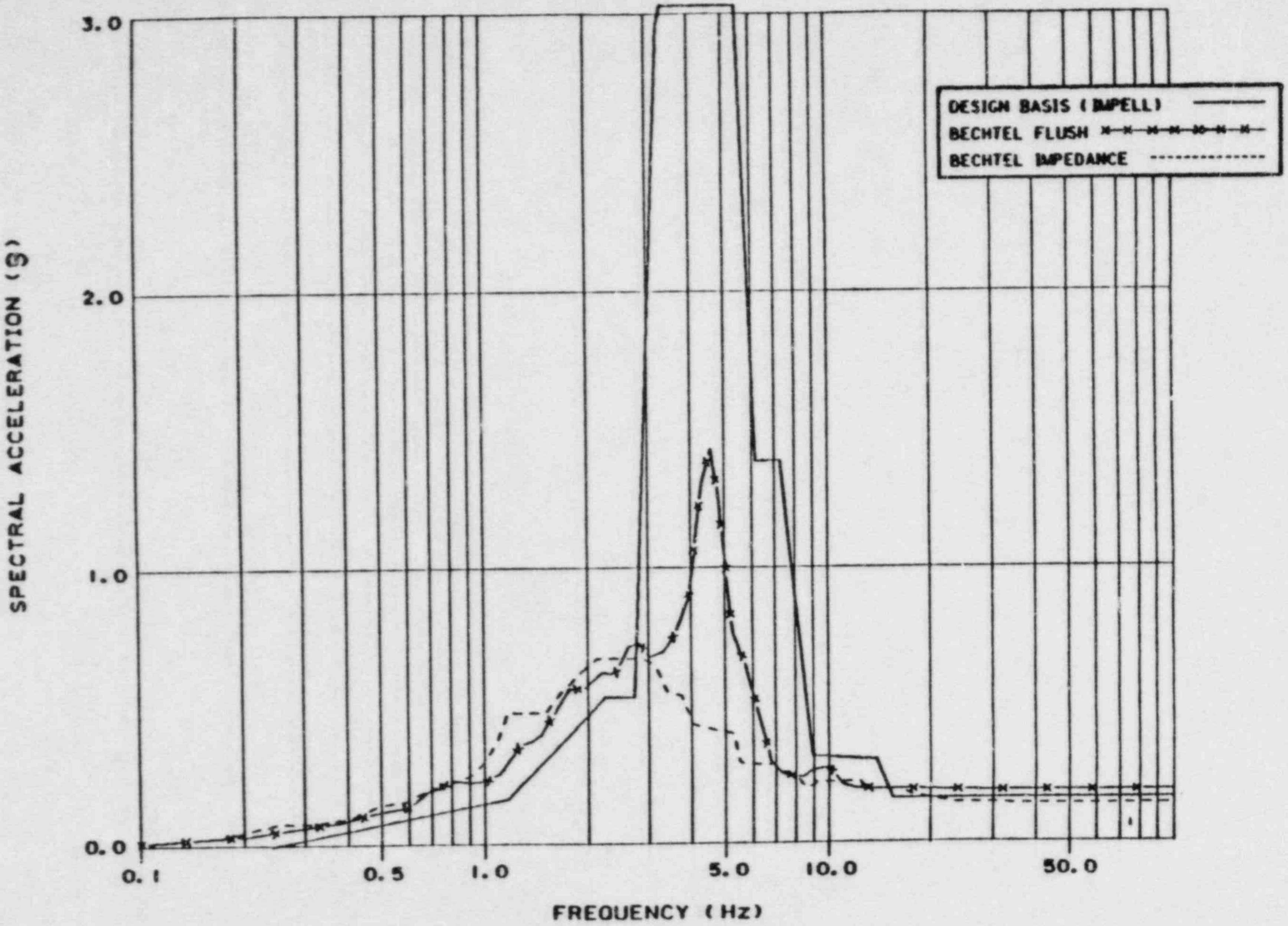


FIGURE A-13-25

RESPONSE SPECTRA COMPARISON,
UNIT I REACTOR BUILDING AT ELEV. 201'-0",
E-W, OBE, 2% DAMPING

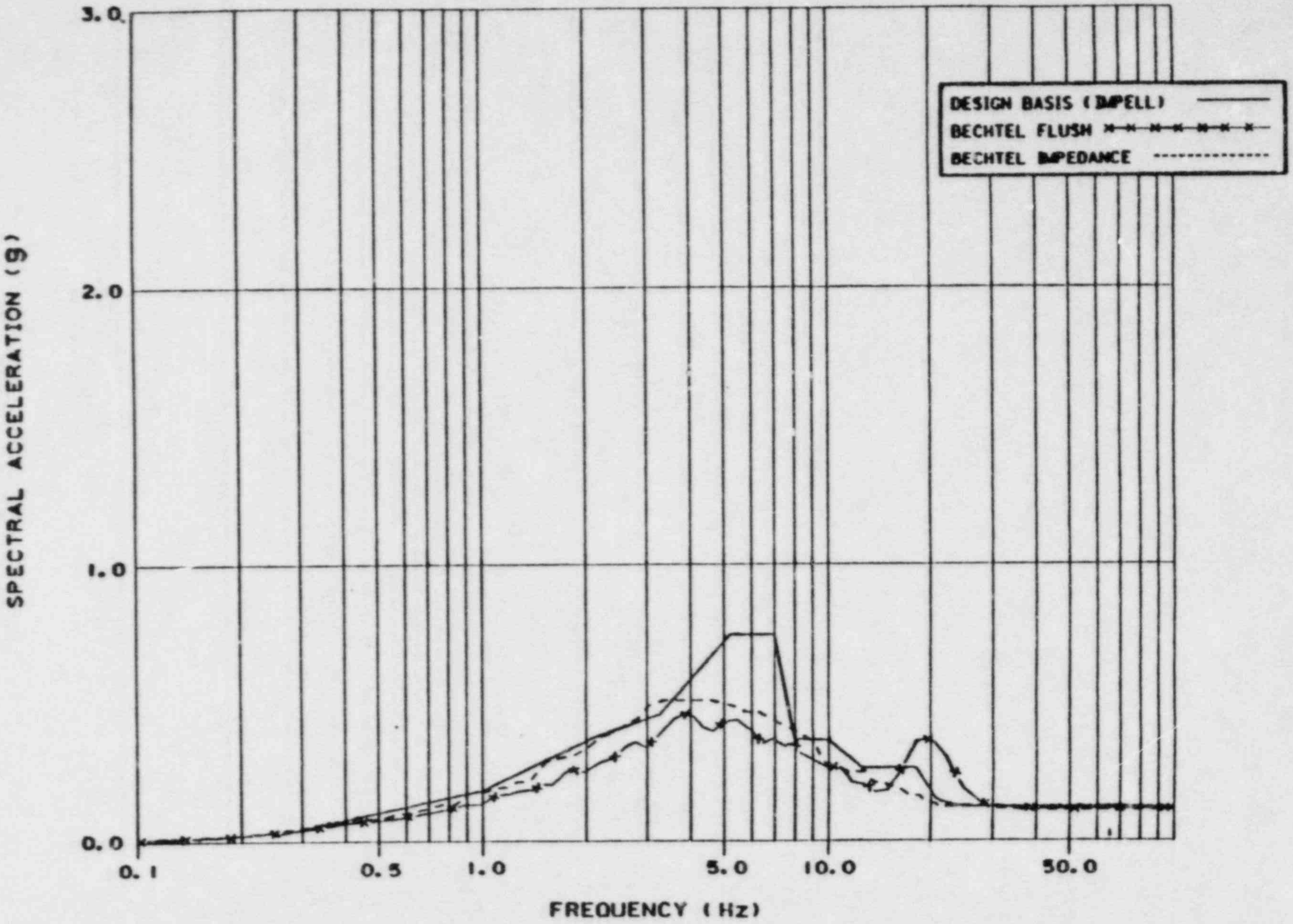


FIGURE A-13-26

RESPONSE SPECTRA COMPARISON,
UNIT I REACTOR BUILDING AT ELEV. 54' -0",
VERTICAL, OBE, 2% DAMPING

HOPE CREEK UNIT I
CAD, L28A, REV I

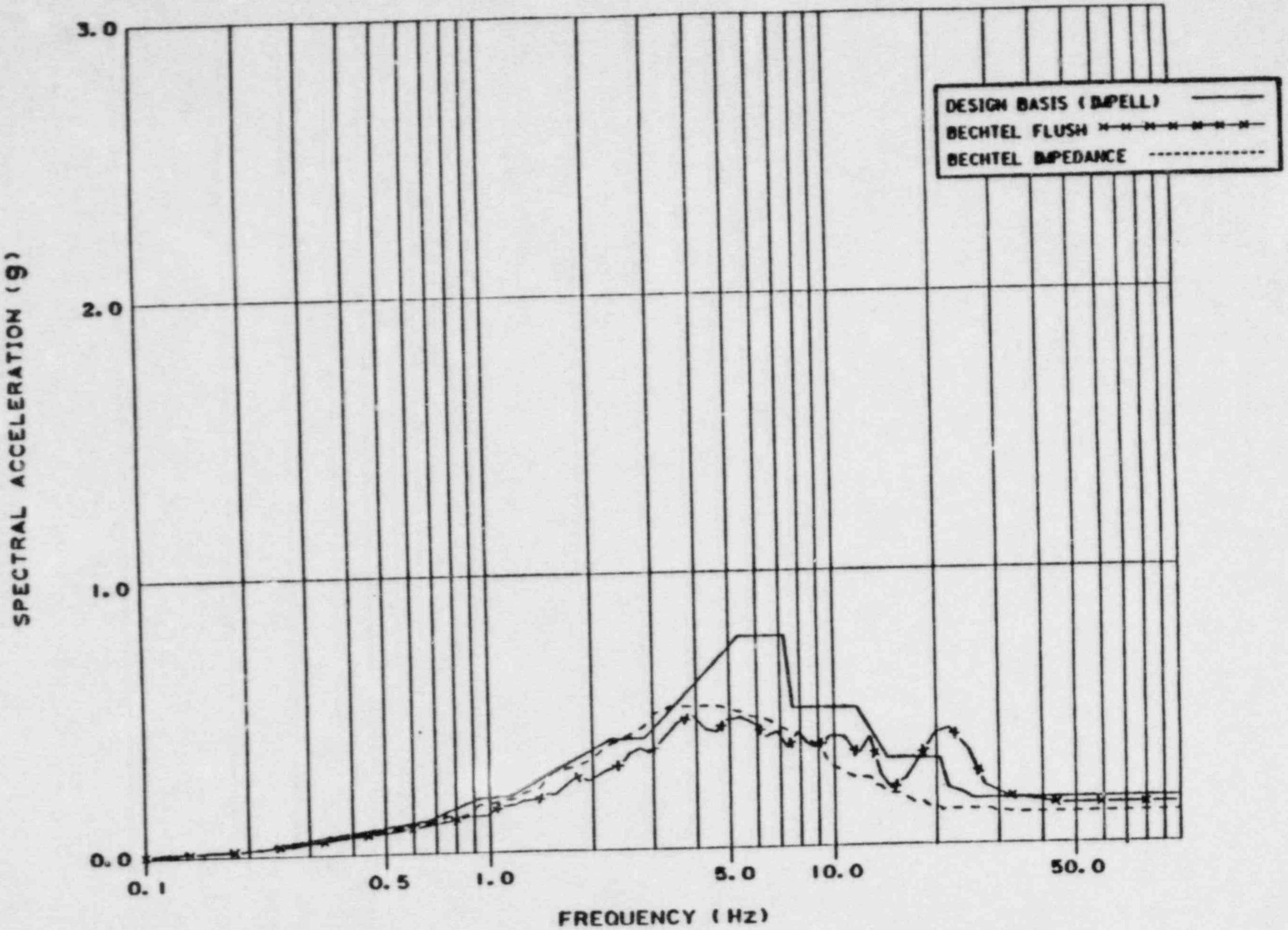


FIGURE A-13-27

RESPONSE SPECTRA COMPARISON,
UNIT 1 REACTOR BUILDING AT ELEV. 102' -0",
VERTICAL, OBE, 2% DAMPING

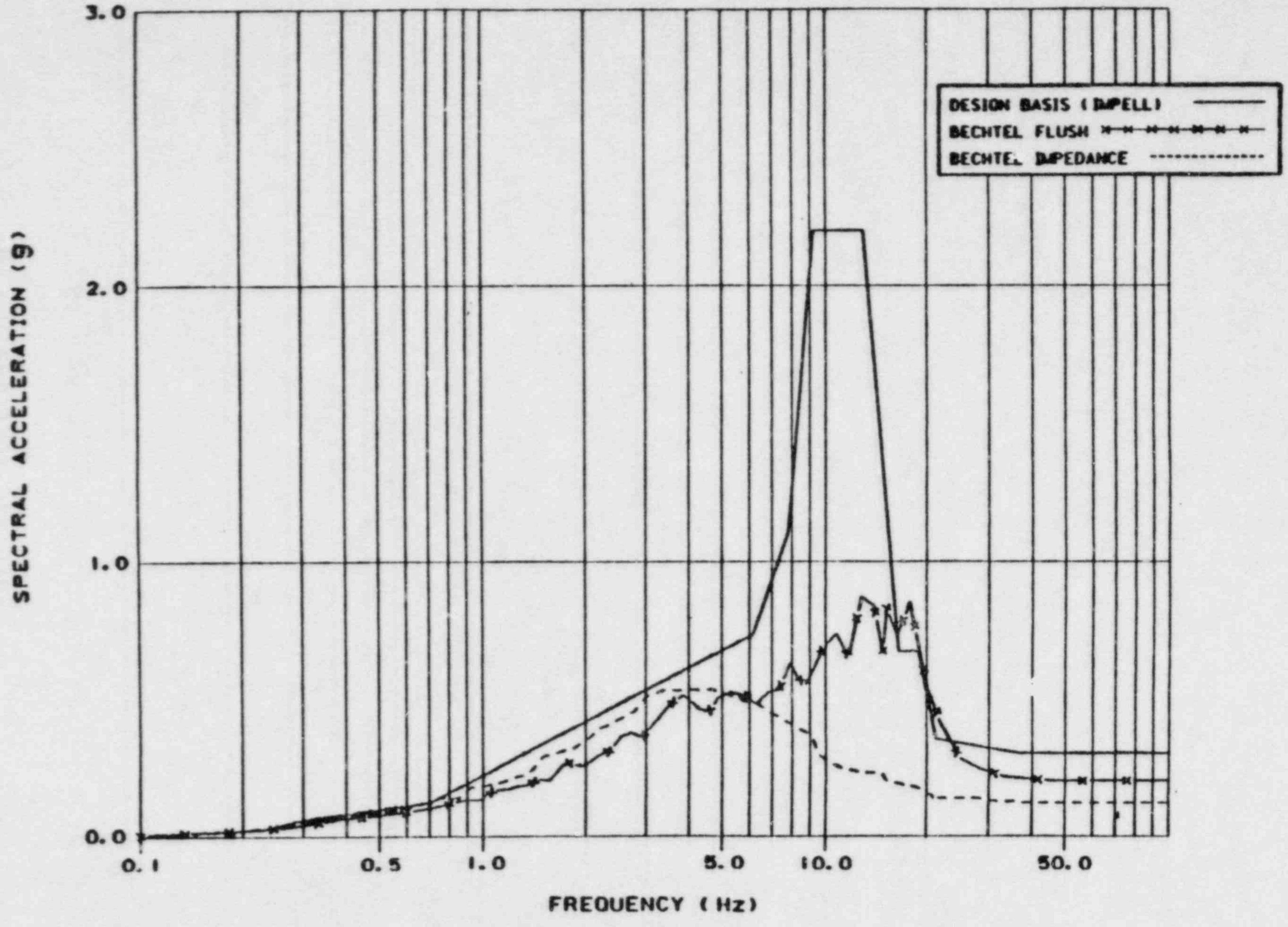


FIGURE A-13-28

RESPONSE SPECTRA COMPARISON,
UNIT 1 REACTOR BUILDING AT ELEV. 201' -0",
VERTICAL, OBE, 2% DAMPING

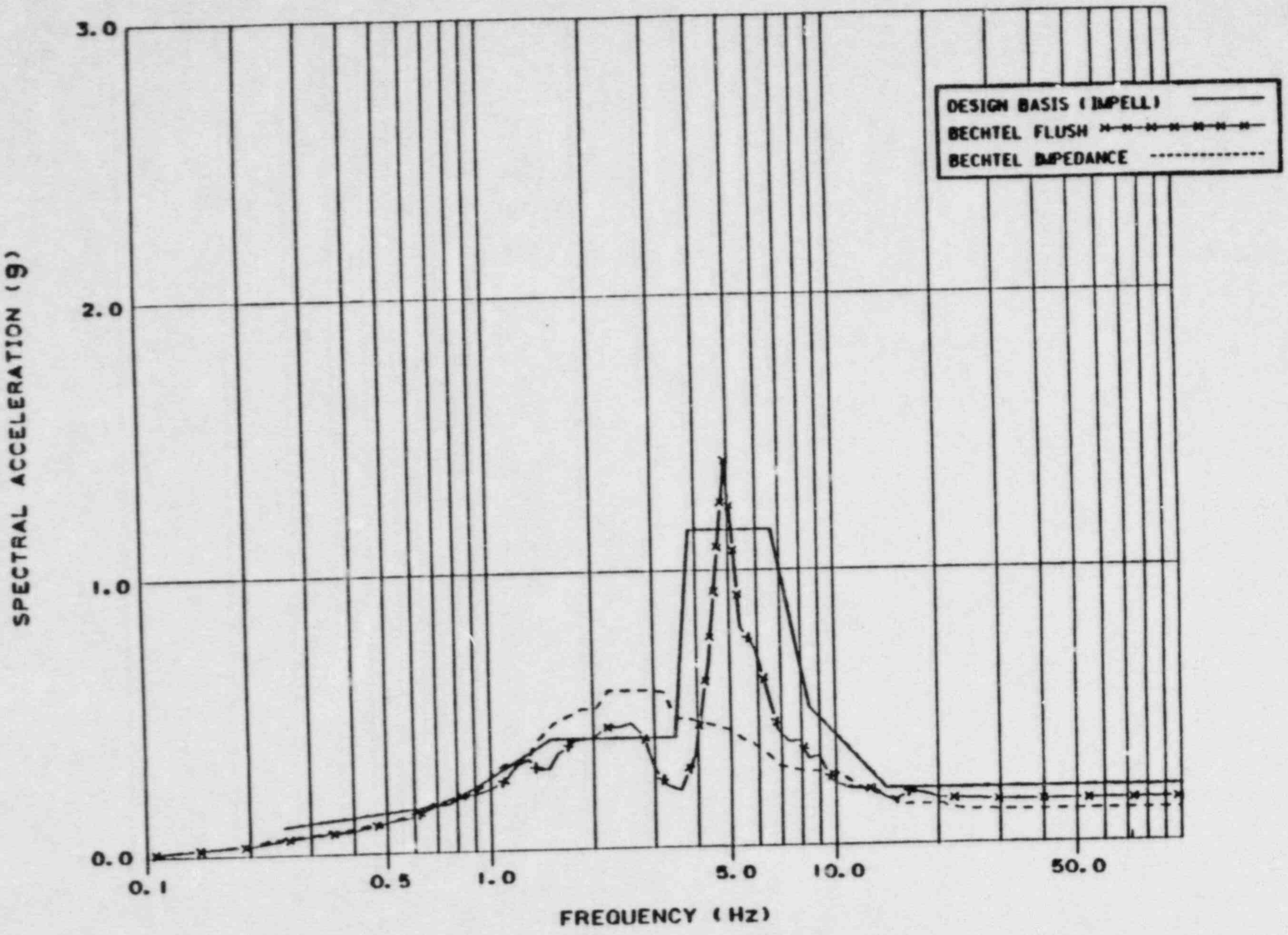


FIGURE A-13-29

RESPONSE SPECTRA COMPARISON,
AUXILIARY BUILDING AT ELEV. 54' -0",
N-S, OBE, 2% DAMPING

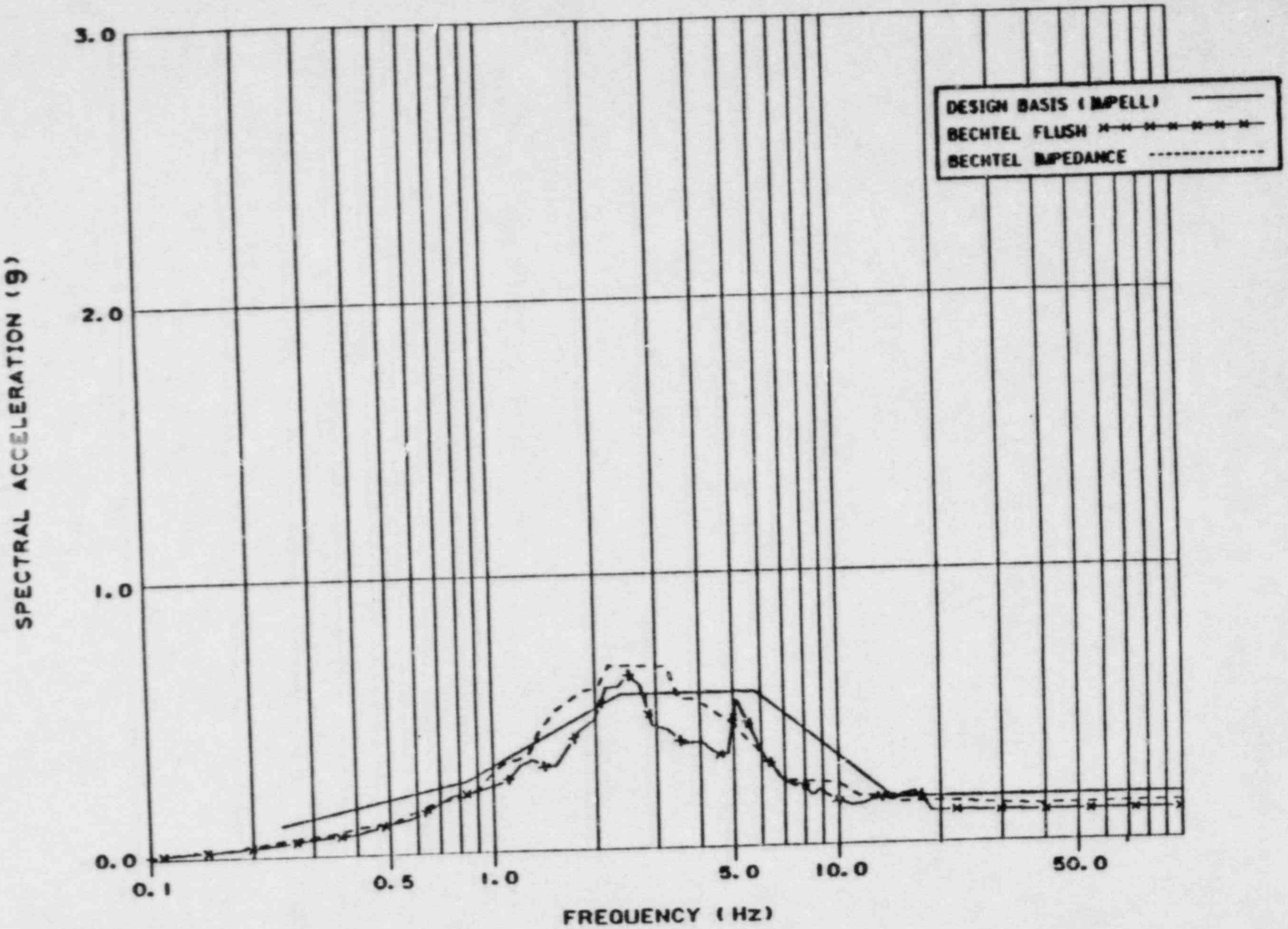


FIGURE A-13-30

RESPONSE SPECTRA COMPARISON,
AUXILIARY BUILDING AT ELEV. 102′-0″,
N-S, OBE, 2% DAMPING

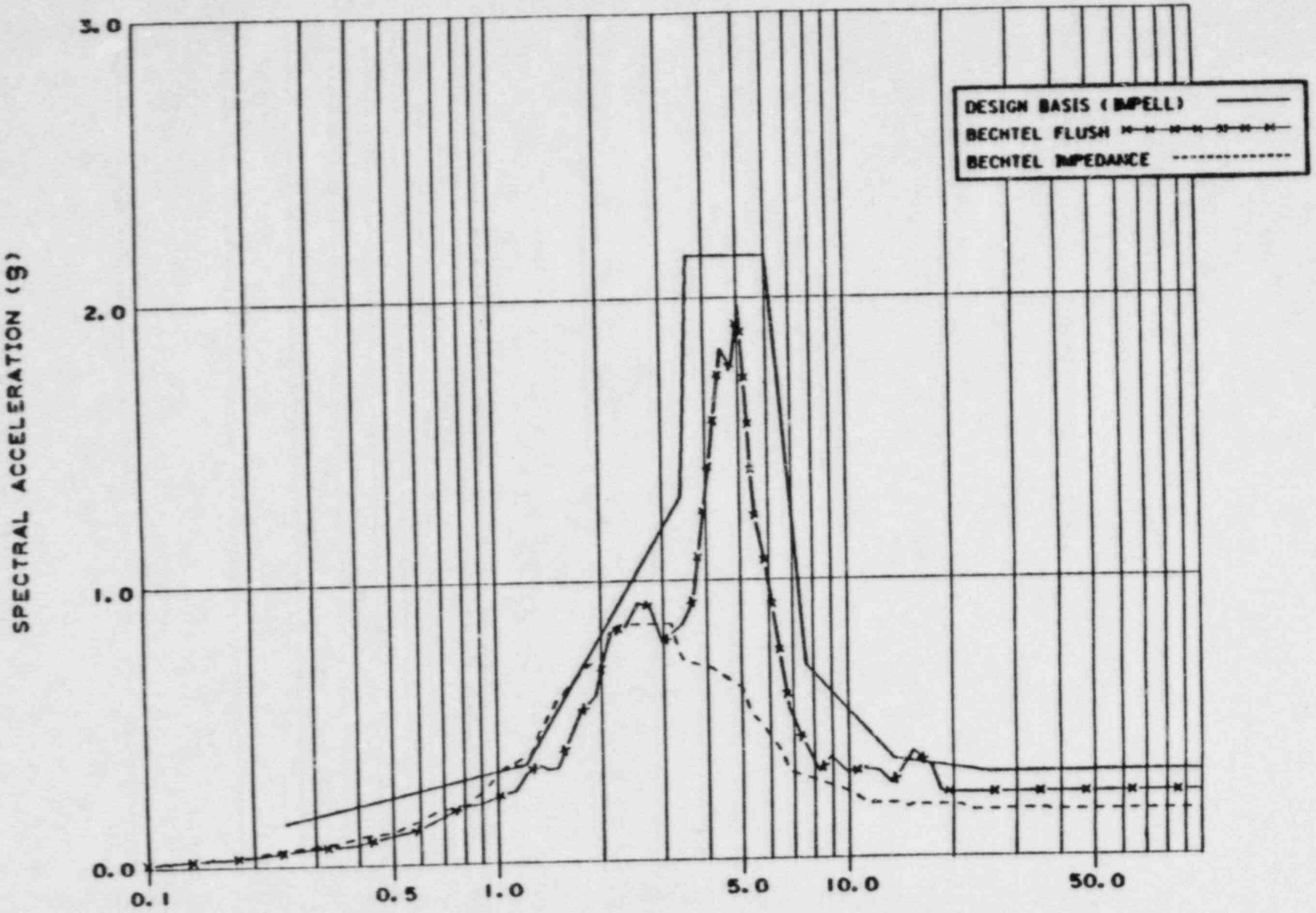


FIGURE A-13-31

RESPONSE SPECTRA COMPARISON,
AUXILIARY BUILDING AT ELEV. 178'-0",
N-S OBE 2% DAMPING

HOPE CREEK UNIT 1

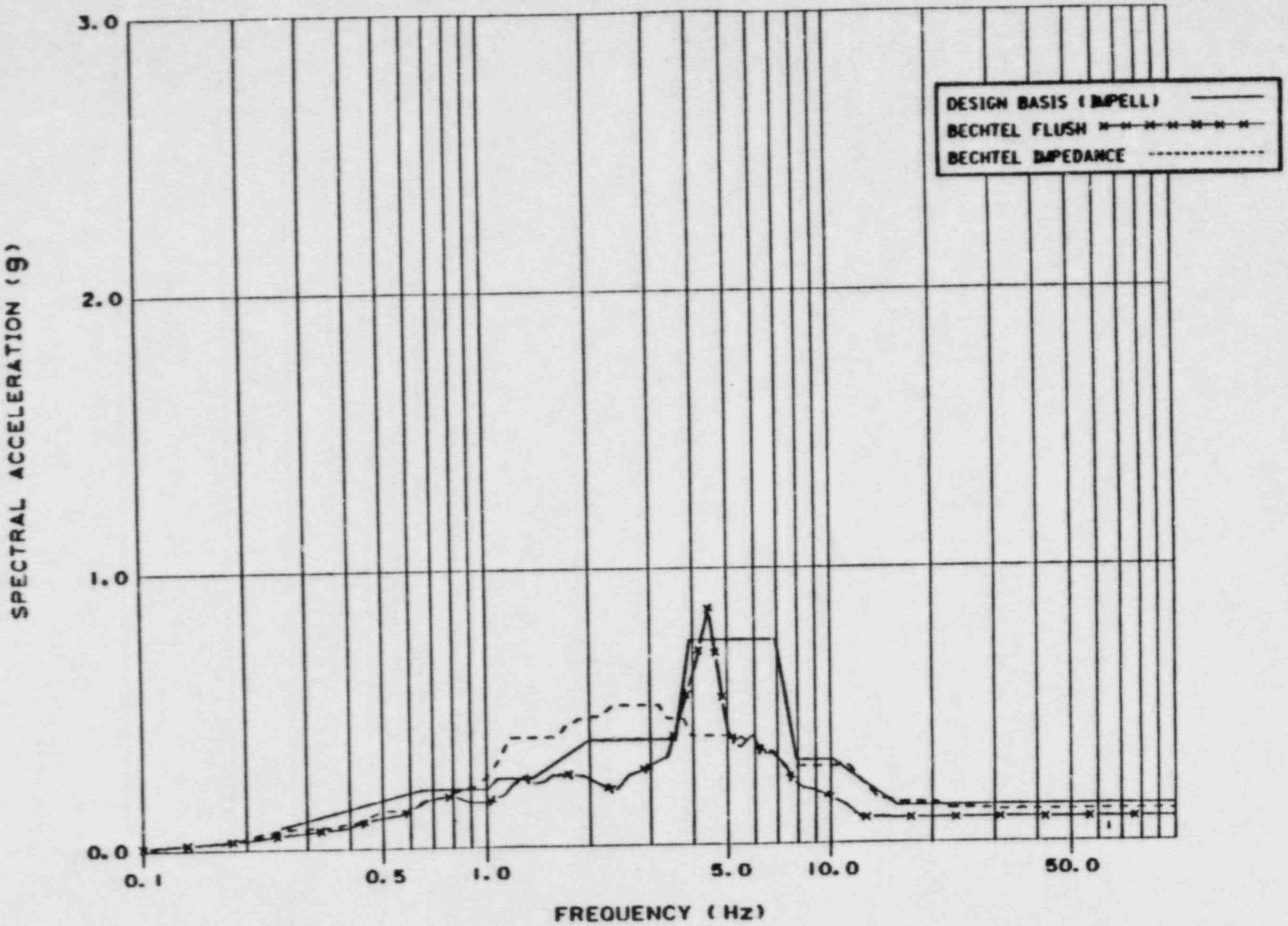


FIGURE A-13-32

RESPONSE SPECTRA COMPARISON,
AUXILIARY BUILDING AT ELEV. 54'-0",
E-W, OBE, 2% DAMPING

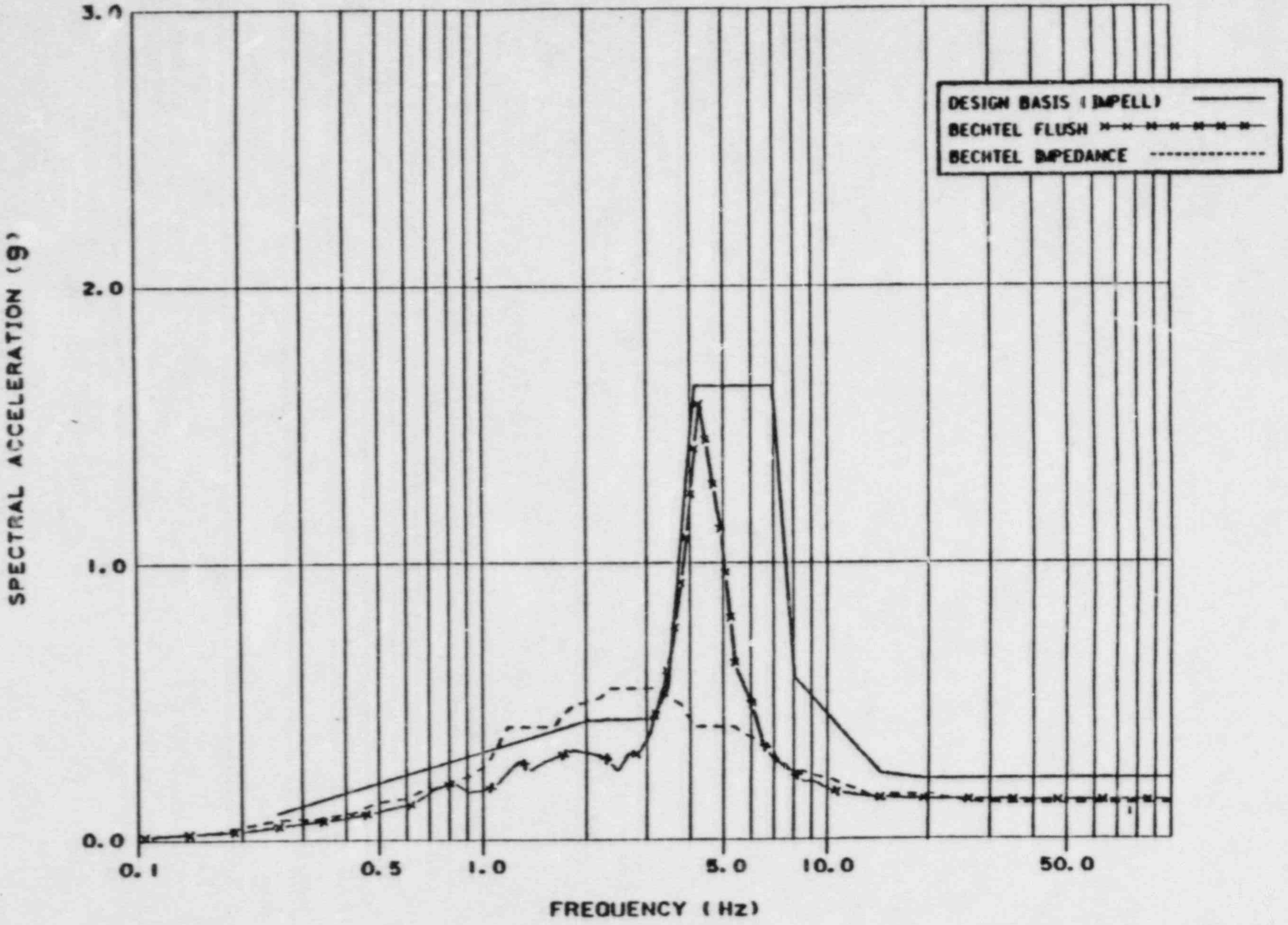


FIGURE A-13-33

RESPONSE SPECTRA COMPARISON,
AUXILIARY BUILDING AT ELEV. 102'-0",
E-W, OBE, 2% DAMPING

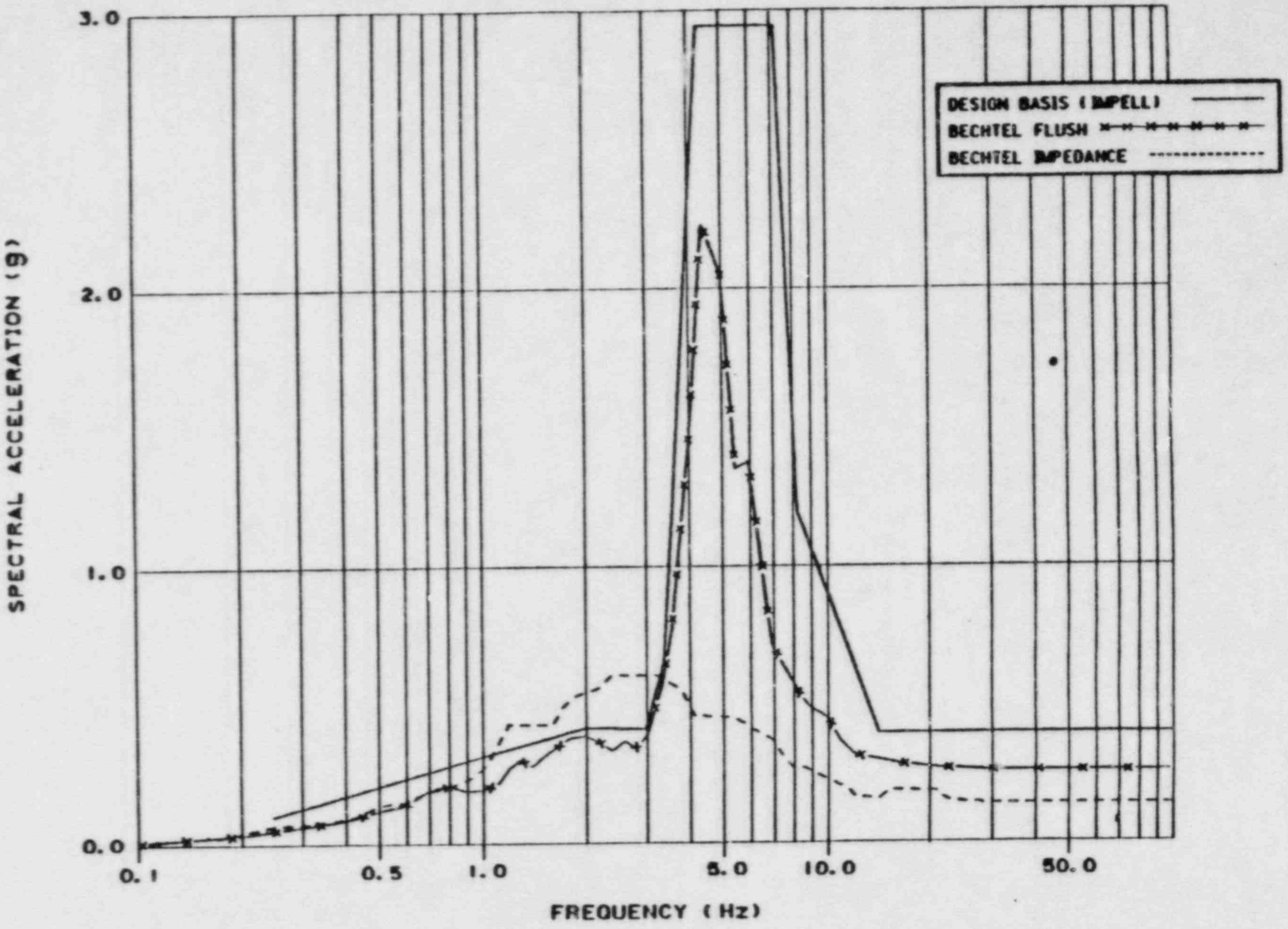


FIGURE A-13-34

RESPONSE SPECTRA COMPARISON,
AUXILIARY BUILDING AT ELEV. 178' -0",
E-W, OBE, 2% DAMPING

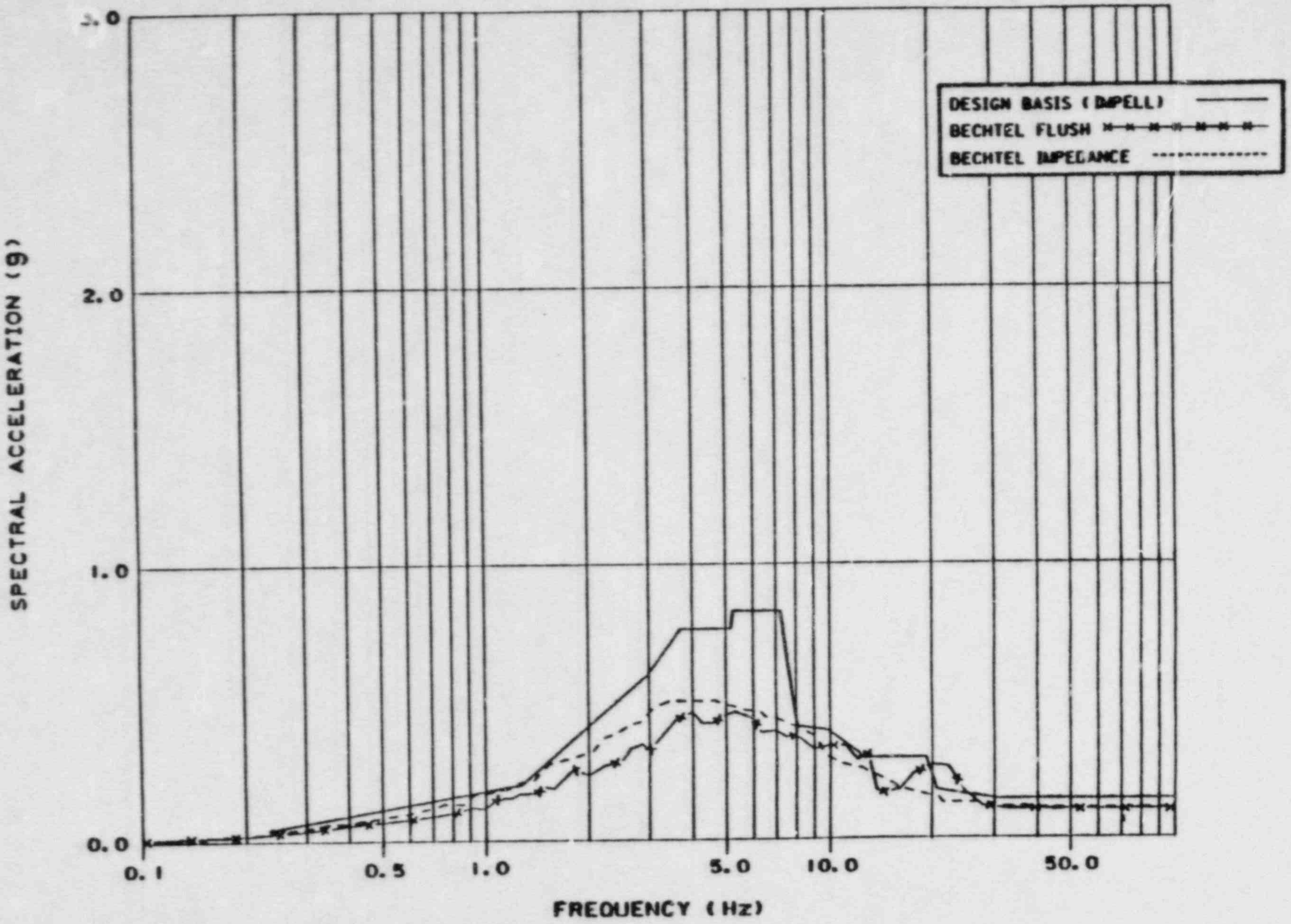


FIGURE A-13-35

RESPONSE SPECTRA COMPARISON,
AUXILIARY BUILDING AT ELEV. 54' - 0",
VERTICAL, OBE, 2% DAMPING

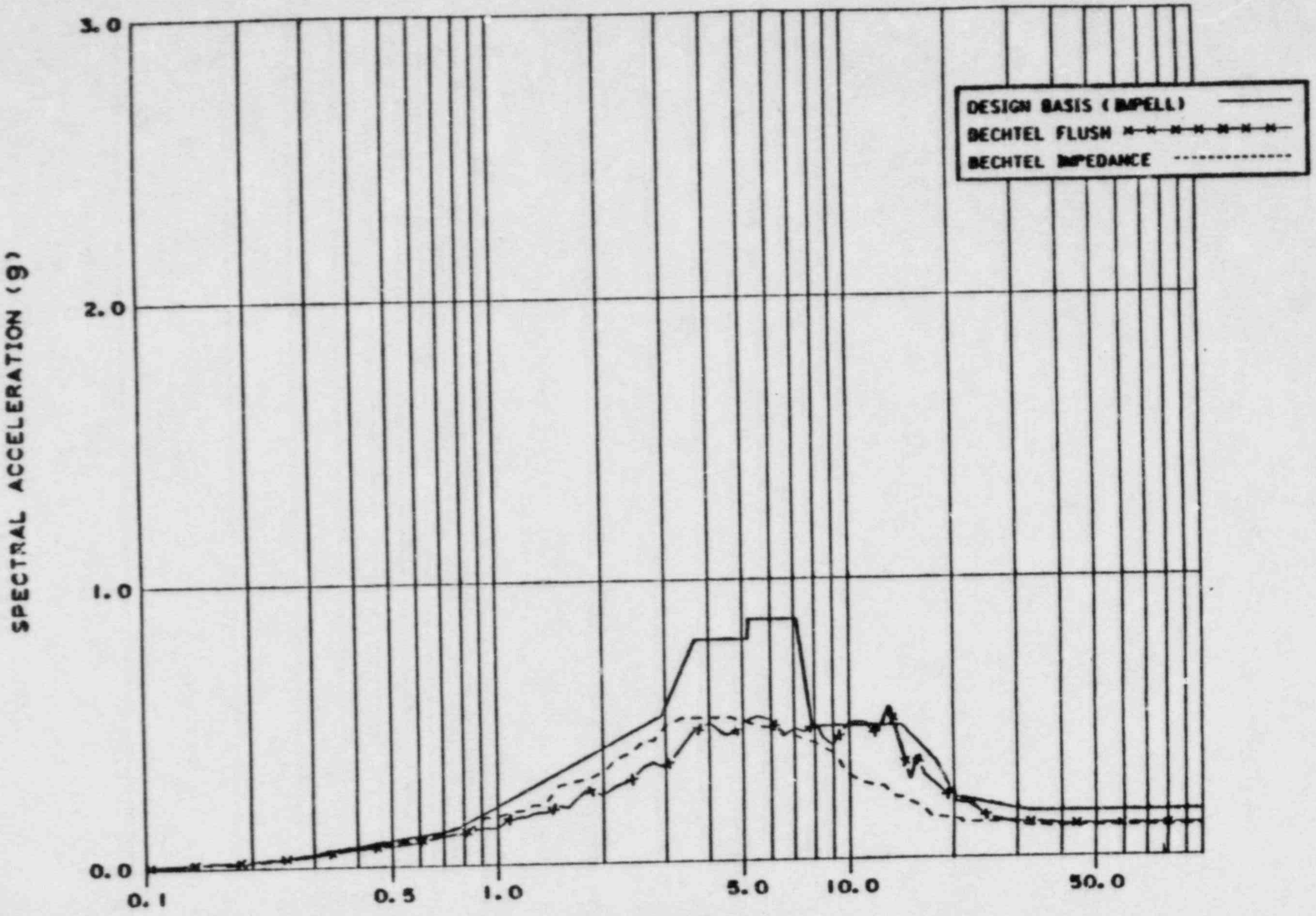


FIGURE A-13-36

RESPONSE SPECTRA COMPARISON,
AUXILIARY BUILDING AT ELEV. 102'-0",
VERTICAL, OBE, 2% DAMPING

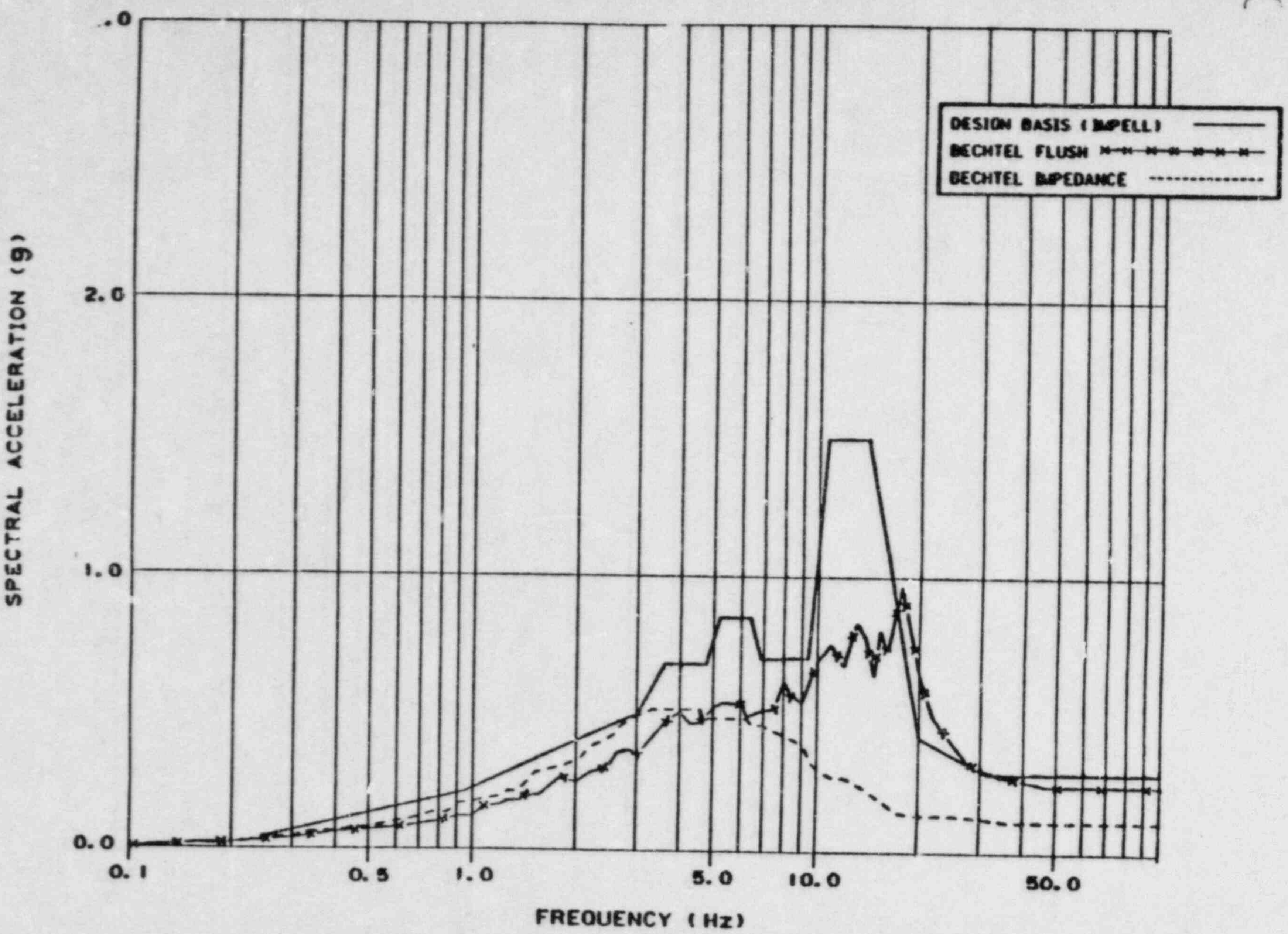


FIGURE A-13-37

RESPONSE SPECTRA COMPARISON,
AUXILIARY BUILDING AT ELEV. 178′-0″,
VERTICAL, OBE, 2% DAMPING

OPE CREEK UNIT 1
AD. L36A, REV 1
4/20/84

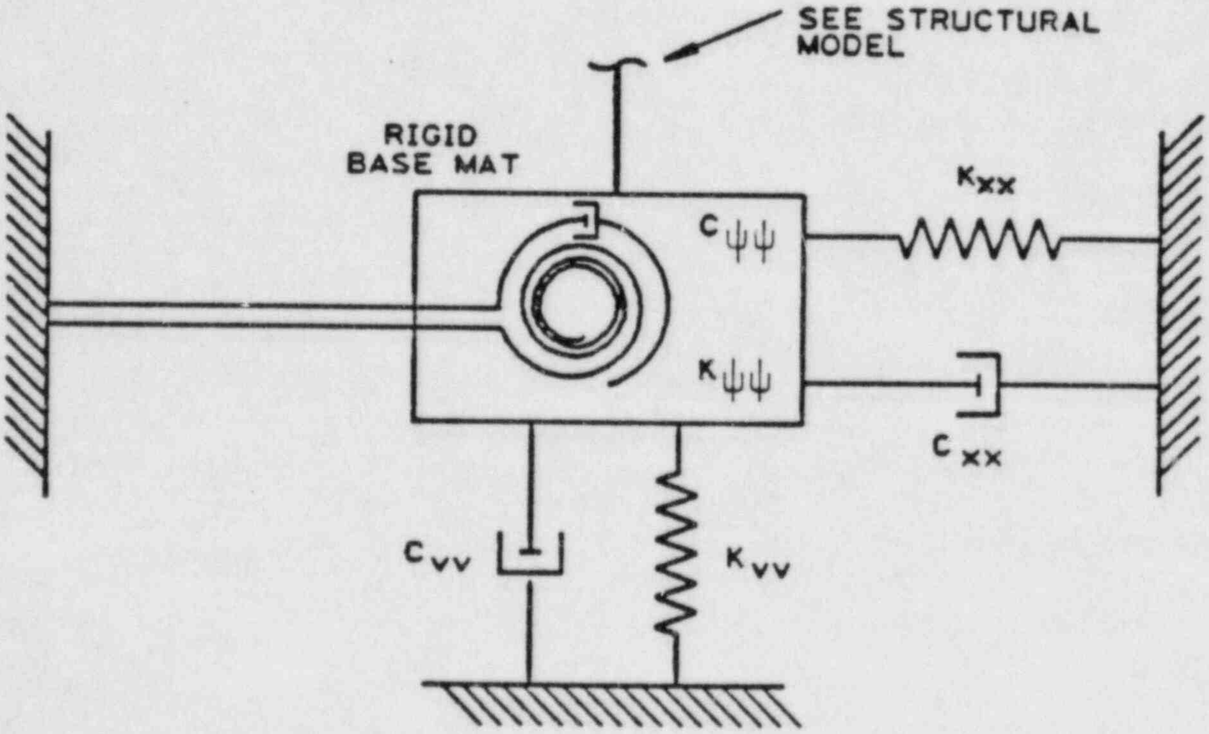


FIGURE A-13.38 IMPEDANCE APPROACH FOUNDATION MODEL

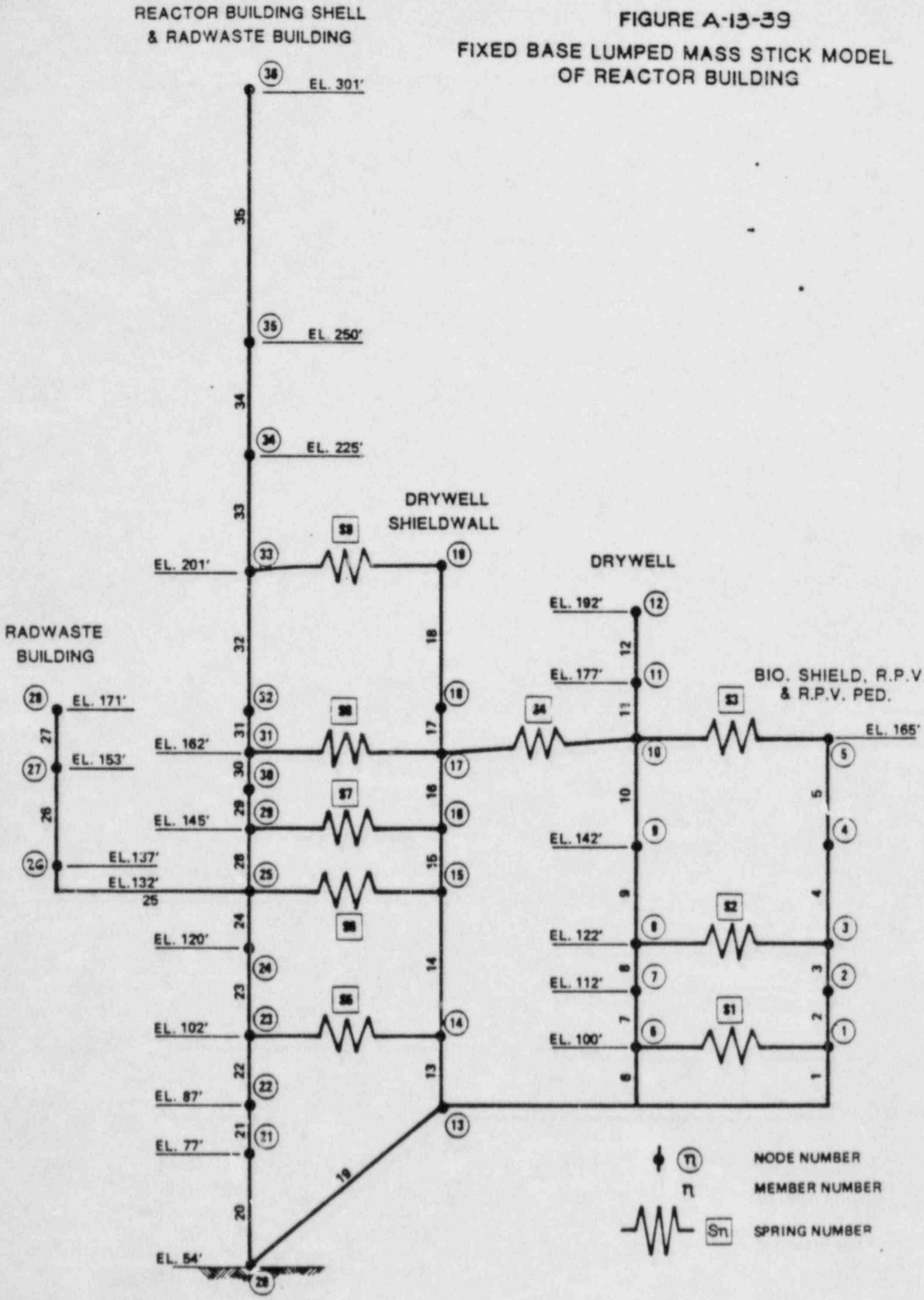


FIGURE A-13-39
FIXED BASE LUMPED MASS STICK MODEL
OF REACTOR BUILDING

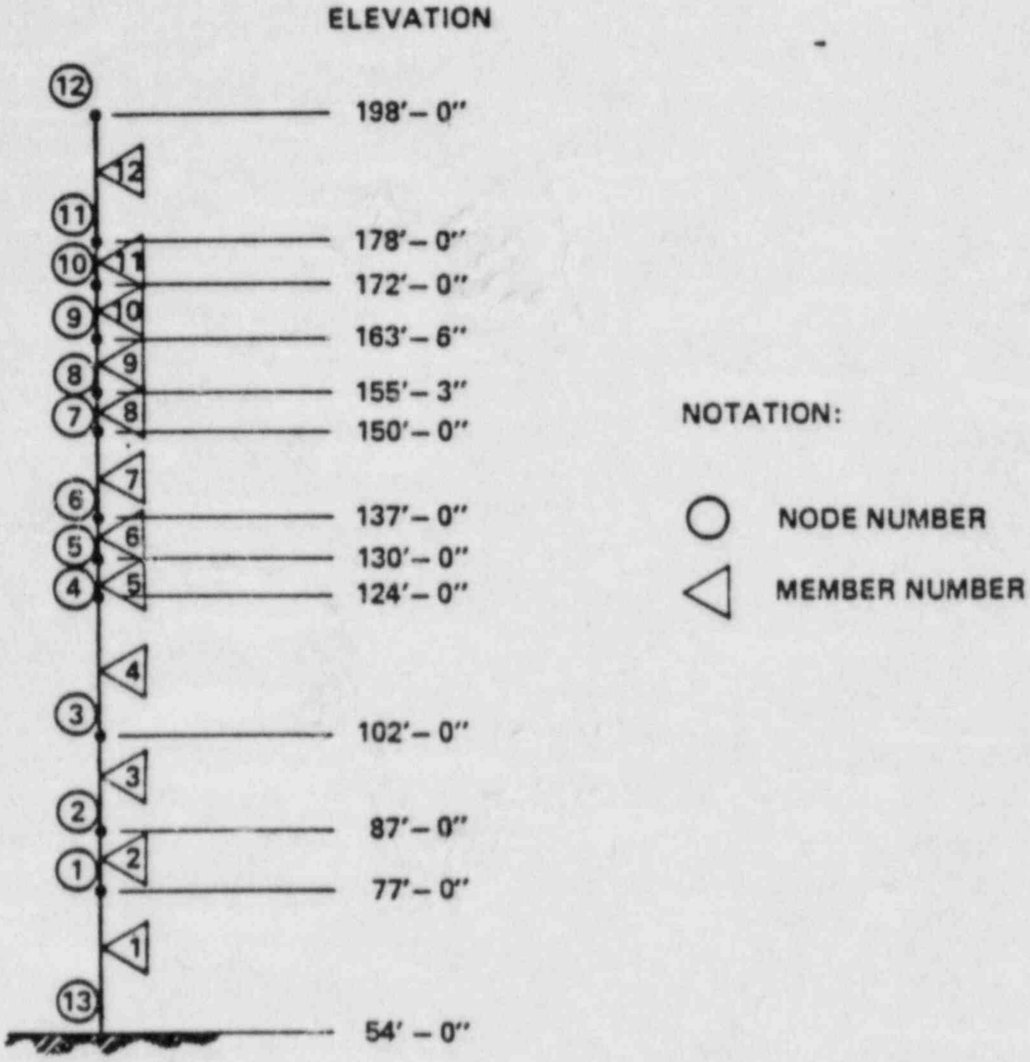


FIGURE A-13-40
FIXED BASE LUMPED MASS STICK MODEL FOR AUXILIARY BUILDING

DSER Open Item No. 54 (DSER Section 3.8.6) Rev. 1

COMBINATION OF VERTICAL RESPONSES

From January 10 through January 12, 1984, the staff met with the applicant and his consultants to conduct the structural audit. The audit covered each major safety-related structure at the Hope Creek Generating Station.

As a result of the audit, the staff identified 39 action items. The applicant has submitted preliminary responses to 22 of the 39 action items. The staff is in the process of reviewing these responses. The final resolution of the action items and any additional questions, which may be raised further, will be reported in the Final SER. The resolution of these action items will be needed before the issuance of the Final SER.

RESPONSE

This item corresponds to Item B.5 from the NRC Structural/Geotechnical meeting of January 10, 1984. A response to this item has been submitted to the NRC by a letter dated February 17, 1984, from R. L. Mittl to A. Schwencer. As a result of discussions with the NRC staff, a revised response to this item is attached.

Response to NRC Audit

Meeting Date: January 10, 1984

Question No.: B-5

Revised Response
Revision 2
August 3,1984

QUESTION: Provide example calculation for combination of N-S, E-W, and vertical responses.

RESPONSE: Example calculation was provided in the original response to this question.

ADDITIONAL INFORMATION REQUESTED: Provide summary tables showing the contributions to the in-plane response due to out-of-plane excitation for three orthogonal directions. Two tables to be provided for both N-S and E-W responses.

RESPONSE: Tables 1 and 2 summarize the N-S and E-W response due to N-S, E-W, and vertical base motions for Reactor Building Unit 1, SSE case. Tables 3 and 4 provide similar information for the OBE case. Individual contributions and the resultant response maxima using the SRSS procedure are listed for selected elements in the Reactor Building mathematical model. As included in the original response, the out-of-plane response maxima (shear and moment) were found to have no significant contribution to the in-plane response maxima values.

Tables 2 and 4 of this attachment supercede the corresponding tables transmitted under the original response to this question. In the original tables, the values of the moment for E-W response due to E-W base motion were taken from the top end of the beam elements. However, the corresponding values of moments due to N-S base motion for the same beam elements were taken from the bottom end of these elements. This was corrected in Tables 2 and 4 of attachment to this response.

TABLE 1

REACTOR BUILDING
OUT-OF-PLANE RESPONSE
SAFE SHUTDOWN EARTHQUAKE

Revised Response
January 10/B-5

			N-S Response			
Element Number	Variable	N-S Base Motion (A)	E-W Base Motion (B)	Vertical Base Motion (C)	SRSS (D)	Ratio (D)/(A)
1	Shear	9.139×10^{2}	1.746×10^{1}	2.053×10^{2}	9.368×10^{2}	1.03
	Moment	8.988×10^{3}	1.663×10^{2}	2.282×10^{3}	9.275×10^{3}	1.03
7	Shear	1.405×10^{4}	2.358×10^{2}	1.324×10^{3}	1.411×10^{4}	1.01
	Moment	9.796×10^{5}	1.646×10^{4}	1.856×10^{5}	9.972×10^{5}	1.02
11	Shear	2.180×10^{4}	3.490×10^{2}	1.714×10^{3}	2.187×10^{4}	1.01
	Moment	3.182×10^{5}	1.027×10^{5}	5.160×10^{4}	3.383×10^{5}	1.06
15	Shear	2.558×10^{4}	4.188×10^{2}	1.103×10^{3}	2.561×10^{4}	1.00
	Moment	2.653×10^{6}	4.347×10^{4}	1.070×10^{5}	2.656×10^{6}	1.00
19	Shear	4.502×10^{4}	2.635×10^{3}	2.949×10^{3}	4.519×10^{4}	1.00
	Moment	4.933×10^{6}	2.904×10^{5}	2.520×10^{5}	4.948×10^{6}	1.00
21	Shear	5.699×10^{4}	2.192×10^{3}	4.310×10^{3}	5.719×10^{4}	1.00
	Moment	6.775×10^{6}	2.881×10^{5}	3.830×10^{5}	6.792×10^{6}	1.00
33	Shear	1.523×10^{3}	5.135×10^{1}	5.328×10^{2}	1.614×10^{3}	1.06
	Moment	2.331×10^{4}	4.271×10^{3}	4.800×10^{3}	2.418×10^{4}	1.04
35	Shear	3.457×10^{3}	1.018×10^{2}	1.093×10^{3}	3.627×10^{3}	1.05
	Moment	8.488×10^{4}	1.374×10^{4}	1.830×10^{4}	8.791×10^{4}	1.04
37	Shear	9.890×10^{3}	2.031×10^{2}	1.022×10^{3}	9.945×10^{3}	1.01
	Moment	3.518×10^{5}	1.983×10^{4}	2.270×10^{4}	3.531×10^{5}	1.00
39	Shear	3.156×10^{4}	4.933×10^{2}	2.417×10^{3}	3.166×10^{4}	1.00
	Moment	1.181×10^{6}	1.984×10^{4}	7.040×10^{4}	1.183×10^{6}	1.00
42	Shear	1.280×10^{4}	1.790×10^{3}	1.153×10^{3}	1.298×10^{4}	1.01
	Moment	9.634×10^{5}	3.389×10^{4}	5.300×10^{4}	9.655×10^{5}	1.00
44	Shear	1.515×10^{4}	2.805×10^{3}	1.420×10^{3}	1.547×10^{4}	1.02
	Moment	1.471×10^{6}	5.650×10^{4}	1.020×10^{5}	1.476×10^{6}	1.00

Note: 1. Units: Kip, Ft.

TABLE 2

REACTOR BUILDING
OUT-OF-PLANE RESPONSE
SAFE SHUTDOWN EARTHQUAKE

Revised Response
January 10/B-5

			E-W Response			
Element Number	Variable	E-W Base Motion (A)	N-S Base Motion (B)	Vertical Base Motion (C)	SRSS (D)	Ratio (D)/(A)
1	Shear	8.829×10^2	1.164×10^1	8.628×10^1	8.872×10^2	1.01
	Moment	8.264×10^3	1.186×10^2	8.103×10^2	8.304×10^2	1.00
7	Shear	1.323×10^4	2.203×10^2	8.034×10^2	1.326×10^4	1.00
	Moment	8.504×10^5	1.267×10^4	6.400×10^4	8.529×10^5	1.00
11	Shear	1.698×10^4	4.092×10^2	3.796×10^2	1.699×10^4	1.00
	Moment	1.583×10^6	2.653×10^5	6.930×10^4	1.607×10^6	1.02
15	Shear	4.918×10^4	5.880×10^2	9.377×10^2	4.919×10^4	1.00
	Moment	8.257×10^5	1.138×10^4	1.230×10^5	8.349×10^5	1.01
19	Shear	6.499×10^4	6.400×10^2	1.204×10^3	6.500×10^4	1.00
	Moment	3.078×10^6	4.853×10^5	1.660×10^5	3.120×10^6	1.01
21	Shear	7.055×10^4	6.283×10^2	1.440×10^3	7.057×10^4	1.00
	Moment	5.337×10^6	1.837×10^5	1.990×10^5	5.344×10^6	1.00
33	Shear	1.601×10^3	5.216×10^1	3.740×10^2	1.645×10^3	1.03
	Moment	1.593×10^4	2.022×10^3	3.370×10^3	1.641×10^4	1.03
35	Shear	3.491×10^3	8.271×10^1	7.104×10^2	3.564×10^3	1.02
	Moment	6.442×10^4	4.509×10^3	1.240×10^4	6.576×10^4	1.02
37	Shear	5.981×10^3	1.188×10^2	7.497×10^2	6.029×10^3	1.01
	Moment	1.025×10^5	9.354×10^3	2.190×10^4	1.052×10^5	1.03
39	Shear	1.482×10^4	1.707×10^2	4.034×10^2	1.483×10^4	1.00
	Moment	3.107×10^5	1.200×10^4	3.630×10^4	3.130×10^5	1.01
42	Shear	8.162×10^3	1.084×10^2	1.621×10^2	8.164×10^3	1.00
	Moment	7.449×10^4	6.000×10^3	6.160×10^3	7.498×10^4	1.01
44	Shear	1.055×10^4	1.284×10^2	2.103×10^2	1.055×10^4	1.00
	Moment	2.138×10^5	6.323×10^3	1.350×10^4	2.143×10^5	1.00

Note: 1. Units: Kip, Ft.

TABLE 3

REACTOR BUILDING
OUT-OF-PLANE RESPONSE
OPERATING BASIS EARTHQUAKE

Revised Response
January 10/B-5

		N-S Response				
Element Number	Variable	N-S Base Motion (A)	E-W Base Motion (B)	Vertical Base Motion (C)	SRSS (D)	Ratio (D)/(A)
1	Shear	8.676×10^2	2.339×10^1	1.283×10^2	8.773×10^2	1.01
	Moment	8.247×10^3	2.239×10^2	1.426×10^3	8.372×10^3	1.02
7	Shear	1.175×10^4	3.322×10^2	8.275×10^2	1.178×10^4	1.00
	Moment	8.243×10^5	2.308×10^4	1.160×10^5	8.327×10^5	1.01
11	Shear	1.515×10^4	4.907×10^2	1.071×10^3	1.520×10^4	1.00
	Moment	2.549×10^5	6.064×10^4	3.225×10^4	2.640×10^5	1.04
15	Shear	1.306×10^4	5.542×10^2	6.894×10^2	1.309×10^4	1.00
	Moment	1.830×10^6	5.553×10^4	6.688×10^4	1.832×10^6	1.00
19	Shear	1.899×10^4	1.561×10^3	1.843×10^3	1.914×10^4	1.01
	Moment	2.873×10^6	1.798×10^5	1.575×10^5	2.883×10^6	1.00
21	Shear	2.406×10^4	1.578×10^3	2.694×10^3	2.426×10^4	1.01
	Moment	3.665×10^6	2.059×10^5	2.394×10^5	3.679×10^6	1.00
33	Shear	6.421×10^2	4.807×10^1	3.330×10^2	7.249×10^2	1.13 (2)
	Moment	7.924×10^3	1.967×10^3	3.000×10^3	8.698×10^3	1.10
35	Shear	1.468×10^3	1.040×10^2	6.831×10^2	1.622×10^3	1.10 (2)
	Moment	3.015×10^4	6.522×10^3	1.144×10^4	3.290×10^4	1.09
37	Shear	4.282×10^3	2.146×10^2	6.388×10^2	4.335×10^3	1.01
	Moment	2.260×10^5	1.090×10^4	1.419×10^4	2.267×10^5	1.00
39	Shear	1.455×10^4	6.914×10^2	1.511×10^3	1.464×10^4	1.01
	Moment	7.580×10^5	2.396×10^4	4.400×10^4	7.597×10^5	1.00
42	Shear	5.381×10^3	8.901×10^2	7.206×10^2	5.502×10^3	1.02
	Moment	5.879×10^5	2.707×10^4	3.313×10^4	5.895×10^5	1.00
44	Shear	6.382×10^3	1.315×10^3	8.875×10^2	6.576×10^3	1.03
	Moment	7.841×10^5	3.660×10^4	6.375×10^4	7.875×10^5	1.00

Notes: 1. Units: Kip, Ft.
2. This is considered insignificant because the shear and moment for this beam are very small.

TABLE 4

REACTOR BUILDING
OUT-OF-PLANE RESPONSE
OPERATING BASIS EARTHQUAKE

Revised Response
January 10/B-5

E-W Response

Element Number	Variable	E-W Base Motion (A)	N-S Base Motion (B)	Vertical Base Motion (C)	SRSS (D)	Ratio (D)/(A)
1	Shear	6.049×10^2	1.604×10^1	5.393×10^1	6.075×10^2	1.00
	Moment	5.660×10^3	1.571×10^2	5.064×10^2	5.685×10^3	1.00
7	Shear	8.723×10^3	2.178×10^2	5.021×10^2	8.740×10^3	1.00
	Moment	5.791×10^5	1.391×10^4	4.000×10^4	5.806×10^5	1.00
11	Shear	9.271×10^3	6.722×10^2	2.373×10^2	9.298×10^3	1.00
	Moment	9.943×10^5	1.798×10^5	4.331×10^4	1.011×10^6	1.02
15	Shear	2.437×10^4	6.431×10^2	5.861×10^2	2.439×10^4	1.00
	Moment	5.180×10^5	1.235×10^4	7.688×10^4	5.238×10^5	1.01
19	Shear	3.187×10^4	7.589×10^2	7.525×10^2	3.189×10^4	1.00
	Moment	1.517×10^6	3.060×10^5	1.038×10^5	1.551×10^6	1.02
21	Shear	3.431×10^4	8.172×10^2	9.000×10^2	3.433×10^4	1.00
	Moment	2.628×10^6	1.406×10^5	1.244×10^5	2.635×10^6	1.00
33	Shear	7.598×10^2	3.297×10^1	2.338×10^2	7.956×10^2	1.05
	Moment	7.889×10^3	9.159×10^2	2.106×10^3	8.217×10^3	1.04
35	Shear	1.679×10^3	5.966×10^1	4.440×10^2	1.738×10^3	1.04
	Moment	3.159×10^4	1.601×10^3	7.750×10^3	3.257×10^4	1.03
37	Shear	2.920×10^3	8.827×10^1	4.686×10^2	2.959×10^3	1.01
	Moment	6.786×10^4	1.183×10^4	1.369×10^4	7.023×10^4	1.04
39	Shear	7.333×10^3	1.910×10^2	2.521×10^2	7.340×10^3	1.00
	Moment	2.000×10^5	8.248×10^3	2.269×10^4	2.015×10^5	1.01
42	Shear	4.065×10^3	1.018×10^2	1.013×10^2	4.068×10^3	1.00
	Moment	3.724×10^4	3.039×10^3	3.850×10^3	3.756×10^4	1.01
44	Shear	5.111×10^3	1.129×10^2	1.314×10^2	5.117×10^3	1.00
	Moment	1.045×10^5	5.758×10^3	8.438×10^3	1.050×10^5	1.01

Note: 1. Units: Kip, Ft.

DSER Open Item No. 66 (DSER Section 3.8.6)

IMPEDANCE ANALYSIS FOR THE INTAKE STRUCTURE

From January 10 through January 12, 1984, the staff met with the applicant and his consultants to conduct the structural audit. The audit covered each major safety-related structure at the Hope Creek Generating Station.

As a result of the audit, the staff identified 39 action items. The applicant has submitted preliminary responses to 22 of the 39 action items. The staff is in the process of reviewing these responses. The final resolution of the action items and any additional questions, which may be raised further, will be reported in the Final SER. The resolution of these action items will be needed before the issuance of the Final SER.

RESPONSE

This item corresponds to Item A.16 from the NRC Structural/ Geotechnical meeting of January 11, 1984. A response to this item has been submitted to the NRC by a letter dated August 3, 1984, from R. L. Mittl to A. Schwencer. As a result of discussions with the NRC staff, a revised response to this item is attached.

Revised Response
Revision 1
August 3, 1984

Meeting Date: January 11, 1984

Question No.: A-16

Question: Perform an independent seismic verification analysis (impedance analysis) for the intake structure and compare the results with design basis results. Consider the effects of side boundaries, embedment and the presence of water masses in the analysis.

Response:

In accordance with the requirements of the Standard Review Plan, Section 3.7.2 (NUREG 0800), impedance approach (half-space) seismic soil-structure interaction verification analyses of the service water intake structure (SWIS) are performed by Bechtel. The analytical method used for the impedance approach seismic soil-structure interaction analyses of the SWIS is described in FSAR Section 3.7.2.1. The effects of side boundaries and embedment are considered using the method described in References A-16-1 to A-16-3. The wave scattering effect is conservatively neglected in the present impedance approach analysis. This is consistent with the requirement specified in SRP Section 3.7.2. The effects of water masses are also accounted for by adding effective water mass to the related nodal points of the structural model in accordance with procedures described in Reference A-16-4. The structural model and soil properties used in the analysis are given in Appendix A.

Figures A-16-1 to A-16-18 show the comparison of the 2 percent damping response spectra obtained from the design basis finite element and the impedance approach seismic soil-structure interaction analyses. The impedance approach response spectra generally are enveloped by those obtained from the design basis analyses at elevation 114.0 feet of the SWIS. For other elevations, the impedance approach spectral accelerations exceed the design basis spectral accelerations in some frequency ranges. These ranges vary approximately between 1.5 and 10.0 Hz.

As discussed during the January 1984 NRC Structural Audit Meeting, sampling studies have been performed to confirm the adequacy of the SWIS design. The criteria used in selection of the samples for this study is given in Table A-16-1. The results of the sampling studies are as follows:

1. <u>Structure</u>

All major reinforced concrete shear walls at the base of the intake structure have been evaluated for seismic forces and moments obtained from the impedance approach analyses. The shear stresses resulting from the impedance approach analyses were compared with those of the design basis analyses. Table A-16-2 shows comparison of shear stresses. In all cases these revised shear stresses were found to be within the allowables.

The moments in the walls, obtained from the impedance analyses, were smaller than those of design basis analyses for both the East-West OBE and SSE cases, therefore, no further evaluation of these walls is required.

For North-South OBE and SSE cases, the moments obtained from impedance approach analyses exceeded the design basis moments. The increase in moments were mostly isolated to the eastern portion of the intake structure. This portion of the intake structure was reevaluated and the resulting moments were found to be less than the allowables.

Based on the above, it is concluded that the as-built SWIS can accommodate loads obtained from the impedance approach analyses.

2. Equipment

The effects of the impedance approach response spectra was evaluated on 8 types of seismic category I equipment located in the areas where the impedance approach spectra were found to have higher spectral accelerations than those of the design basis response spectra. The equipment evaluated represents over 30% of all equipment located in the intake structure.

Table A-16-3 summarizes the results of the above evaluation for equipment in the Intake Structure. It is concluded that all category I equipment can accommodate the response spectra obtained from the impedance analyses.

3. Cable Tray and HVAC Supports

All cable tray and HVAC supports were evaluated using the impedance analysis results. All supports were found to meet the impedance approach spectral response requirements.

4. Piping and Piping Supports

Piping and pipe supports were evaluated using the screening techniques discussed in Table A-16-1. The results are summarized in Tables A-16-4 and A-16-5. The analysis results show that piping stresses and nozzle loads are within allowable limits. There was no load increase found on existing supports.

It is therefore concluded that the existing design margins associated with the present project design basis seismic loading are not affected by the consideration of the loads generated from the impedance approach analyses as demonstrated by the SWIS piping systems.

References: A-16-1, Apsel, R.J., (1979) "Dynamic Green's Functions for Layered Media and Applications to Boundary Value Problems", Ph.D Thesis, University of California, San Diego.

Response to Question A-16 (cont'd)

References: (Cont'd)

A-16-2, Wong, H.L., and Luco, J.E., (1978) "Tables of Impedance Functions and Input Motions for Rectangular Foundations", Report No. CE78-15; University of California, San Diego.

A-16-3, Barneich, J.A., Johns, D.H., and McNeill, R.L., (1974) "Soil-Structure Interaction Parameters for Aseismic Design of Nuclear Power Stations", Preprint 2182, ASCE National Meeting on Water Resources Engineering, January 21-25.

A-16-4, Newmark, N. and Rosenblueth, E., "Fundamentals of Earthquake Engineering," Prentice-Hall, Englewood Cliffs, N.J. (1971)

APPENDIX A

Impedance Analysis Structural Model and Soil Properties

In the soil-structure interaction analysis, using the impedance approach, the effect of dynamic stiffness of the foundation medium is represented by the foundation impedances, which are functions of the base mat dimensions, embedment depth, elastic properties of the foundation medium, and forcing frequencies. With the foundation impedance known, the structure-foundation system is modeled by coupling the fixed-base structure model with the foundation impedances through the basemat (Figure A-16-19).

The impedance approach seismic soil structure interaction analysis of the intake structure (Figure A-16-20) is performed for both the SSE and OBE cases. The foundation soil is assumed to be a uniform linear visco-elastic half space. The weighted average of the final iterated shear moduli of 3,655 ksf (shear wave, velocity of 1,007 ft./sec.) and 6,404 ksf (shear wave velocity of 1,333 ft./sec.) respectively, are used in calculating the horizontal SSE and OBE impedance functions. Since the groundwater table is located at elevation 98.0 ft., a compressional wave velocity, Vp, of 4,800 ft./sec/ is used for the vertical analysis. The computed OBE and SSE translational and rocking impedances for the embedded intake structure foundation are given in Tables A-16-6 and A-16-7.

TABLE A-16-1
PROCEDURES FOR EVALUATION OF INTAKE STRUCTURES, EQUIPMENT & COMPONENTS USING IMPEDANCE ANALYSIS RESULTS

INTRODUCTION

The results of the impedance analysis are used to assess the existing design of the HCGS intake structure, equipment and components. A sampling approach is used. The procedure for this evaluation is as follows:

A. STRUCTURES:

Since the maximum shear and axial forces and the maximum overturning moments occur at the base of the structure, and the design margins for the upper elevations are greater than those of the base, the effects of these loads at the base of the structure are evaluated.

B. EQUIPMENT:

The impedance analysis spectra in general are not completely enveloped by the design basis spectra in the 1.5 to 10.0 Hz and in the ZPA range throughout the intake structure.

The following procedure is selected for review:

- Review the significant frequencies of at least 30% of equipment located in the areas where the impedance approach spectra were found to have higher spectral accelerations than those of the design basis response spectra.
- If the significant equipment frequencies fall in the range where the difference in the spectra exist, additional evaluation is necessary. No further evaluation is necessary if the significant frequencies are outside the frequency range in question.
- The evaluation is performed either by comparing the test response spectra of the equipment with the impedance spectra (if the equipment is qualified by testing) or comparing the actual-to-allowable stress ratios with the spectrum exceedance ratios.
- If the above evaluation shows the equipment may not be qualified for the impedance spectra, detailed evaluation consisting of analysis and/or testing is performed.
- As a result of evaluation, if equipment requires modifications, the sample size for this evaluation is expanded as required.

C. CABLE TRAY AND HVAC SUPPORTS

All cable tray and HVAC supports are evaluated for impedance analysis results.

D. PIPING AND PIPE SUPPORTS

In general, impedance curves resulted in significant reductions in spectral accelerations as compared to those of the design basis curves. However, in some curves, the peak accelerations showed small increases. To evaluate the effects of the increase in peak accelerations a "biased" sample of affected piping systems is reanalyzed and reevaluated. The sample is selected as follows:

Individual impedance curves for various elevations and structures are superimposed on their corresponding design basis curves to identify those impedance curves which are not enveloped by design basis curves. Those impedance curves are then superimposed on the design basis "enveloped" response spectra used for various piping system design calculations. If the design basis enveloped response spectra curves affecting a calculation did not totally envelop all the corresponding impedance curves, that particular calculation is then identified as "affected" calculation and a candidate for sampling.

A "biased" sample of the "affected" calculations was selected which emphasized the following important piping parameters:

1. Stress levels in the existing pipe stress calculations. Samples included systems with high stress levels.
2. Difference in "g" level (▲g) between impedance and design basis curves in the affected frequency zones. Sample selected to include curves showing significant differences.
3. High equipment nozzle loads in existing calculation.

The number of calculations included in the sample is:

Building	Total No. of Q-Calcs	No. of Calcs Reviewed	No. of Calcs affected	No. of Calcs in the sample
Intake Structure	11	11	5	1

Results of the analysis including support loads are compared against the design basis values for acceptability.

Table A-16-2
Intake Structure Shear Stress at the Base

Base Elevation	Wall Location Column Line	Design Base (psi)	Impedance Approach (psi)	Allowable (psi)
79'-8"	Col. A (East Wall)	80	124	630
79'-8"	Col. Ac	66	98	630
79'-8"	Col. Ak	47	73	630
70'-0"	Col. C (West Wall)	47	77	126
79'-8"	Col. 5 (South Wall)	230	214	630
79'-8"	Col. 7	200	176	630
79'-8"	Col. 9 (North Wall)	230	214	630

Notes:
1. Concrete f'c = 4000 psi.
2. See FSAR Figures 1.2-40 and 1.2-41 for wall location.

Table A-16-3
Intake Structure - Seismic Category I Equipment

Equipment or Component	Tag No.	Elev.	Fundamental Frequencies (Hz)	Method of Seismic Qualification	Applicable Note
Travelling Water Screen (T.W.S.)	1(A-D)S501	70'-0"& 114'-0"	Horizontal - 7.4,14 Vertical - >33	Analysis	2
Control Panel (for T.W.S.)	1(A-D)C515	107'-0"	Horizontal - 21, 30 Vertical - >33	Testing	1
Service Water Pumps	1(A-D)P502	93'-0"	Horizontal - 28.4 Vertical - >33	Analysis	3
Supply Fans	0AV558 0BV558	128'-0"	Horizontal - >33 Vertical - >33	Analysis	2
Vane Axial Fans	1AV-DV503 1AV-DV504	122'-0"	Horizontal - >33 Vertical - >33	Analysis	3
HVAC Control Panel	1(A-D)C581	93'-0"	Horizontal - 15, 22 Vertical - >33	Analysis	2
Travelling Screen Spray Water Booster Pumps	1AP-DP507	79'-8"	Horizontal - >33 Vertical - >33	Analysis	2
Transformer Panel Board	10Y501-504	93'-0"	Horizontal - 29,31 Vertical - >33	Testing	1

Notes:
1. TRS envelops impedance approach spectra.
2. Impedance approach spectral acceleration is lower than that of the design basis response spectra in the major equipment frequencies.
3. Although impedance approach spectral acceleration exceeds that of design basis response spectra in the equipment frequency range, a more detailed calculation showed that the equipment stresses are within the code allowables.

Table A-16-4

Intake Structure Pipe Stress Summary

Calc. No.	Max. Seismic Stress Ratios		ASME Code Equation Evaluation		Vendor Equipment Nozzle Allowables Met
	Max. Impedance Stress / Max. Design Basis Stress		Eq. 9B* / Code Allow.	Eq. 9D* / Code Allow.	
	OBE	SSE	Upset	Faulted	
C2019	0.46	0.51	0.26	0.14	Yes

*ASME Section III NC, ND-3652

Table A-16-5

Intake Structure Pipe Support Load Summary

Calc. No.	Total No. of Supports	No. of Supports with load increase	Average Percentage increase in load		Support Design Adequate
			Upset	Faulted	
C2019	15	0	N/A	N/A	Yes

TABLE A-16-6

VALUES OF SOIL STIFFNESS AND DAMPING COEFFICIENTS OF 3-D INTAKE STRUCTURE (OBE CASE)

DIRECTION	STIFFNESS COEFFICIENTS	DAMPING COEFFICIENTS
VERTICAL TRANSLATION	6.03×10^6 k/ft	3.81×10^5 k-sec/ft
NORTH-SOUTH TRANSLATION	4.00×10^6 k/ft	2.22×10^5 k-sec/ft
EAST-WEST TRANSLATION	4.40×10^6 k/ft	2.36×10^5 k-sec/ft
TORSION	2.88×10^{10} k-ft/rad	8.45×10^8 k-ft-sec/rad
ROCKING ABOUT NORTH-SOUTH AXIS	2.50×10^{10} k-ft/rad	7.71×10^8 k-ft-sec/rad
ROCKING ABOUT EAST-WEST AXIS	3.14×10^{10} k-ft/rad	1.12×10^9 k-ft-sec/rad

TABLE A-16-7

VALUES OF SOIL STIFFNESS AND DAMPING COEFFICIENTS OF 3-D INTAKE STRUCTURE (SSE CASE)

DIRECTION	STIFFNESS COEFFICIENTS	DAMPING COEFFICIENTS
VERTICAL TRANSLATION	6.03×10^{6} k/ft	3.81×10^{5} k-sec/ft
NORTH-SOUTH TRANSLATION	2.43×10^{6} k/ft	1.67×10^{5} k-sec/ft
EAST-WEST TRANSLATION	2.51×10^{6} k/ft	1.78×10^{5} k-sec/ft
TORSION	1.66×10^{10}k-ft/rad	6.39×10^{8} k-ft-sec/rad
ROCKING ABOUT NORTH-SOUTH AXIS	1.43×10^{10}k-ft/rad	5.83×10^{8} k-ft-sec/rad
ROCKING ABOUT EAST-WEST AXIS	1.83×10^{10}k-ft/rad	8.62×10^{8} k-ft-sec/rad

F1(75)

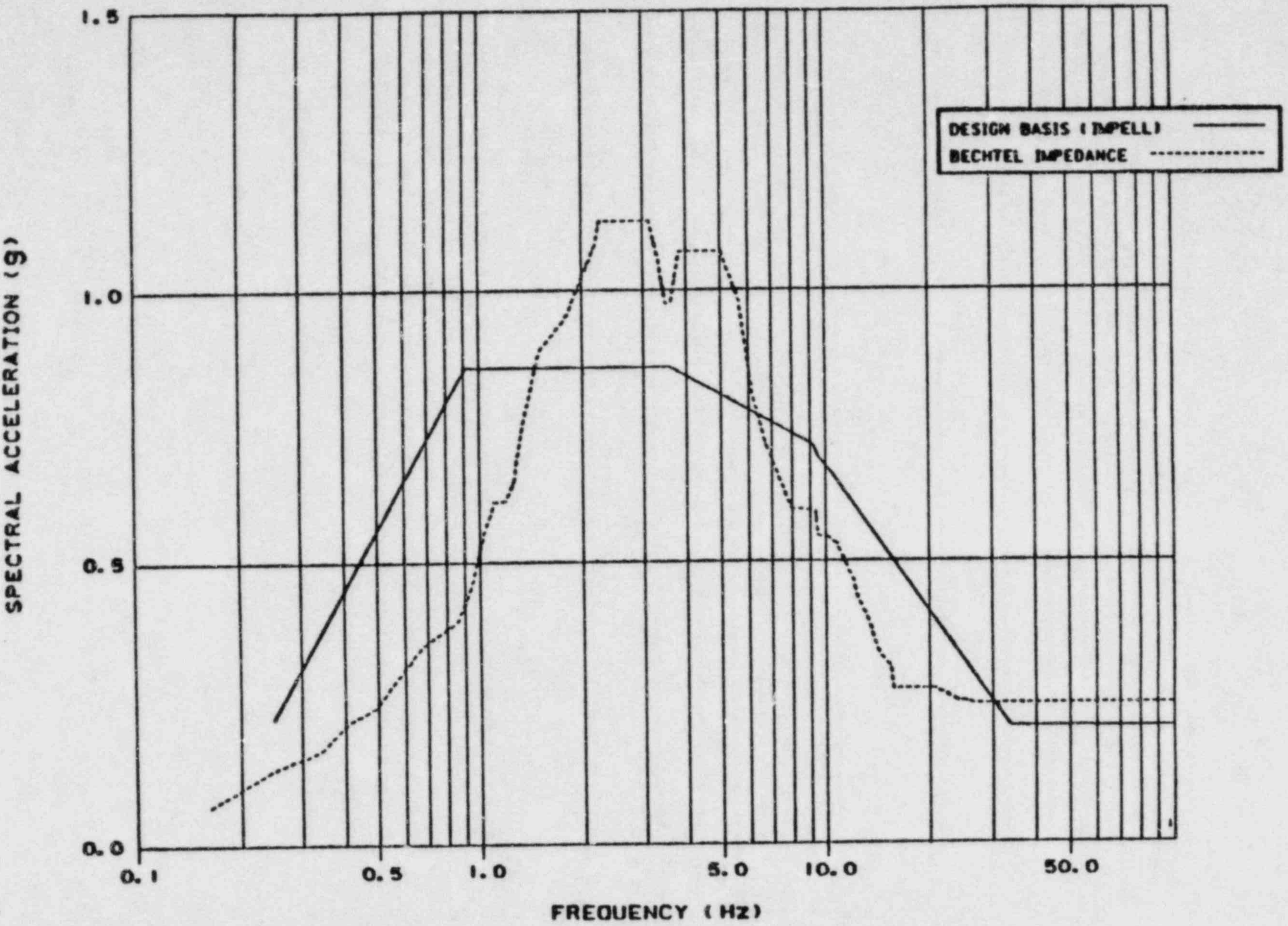


FIGURE A-16-1

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 93' -0",
N-S, SSE, 2% DAMPING

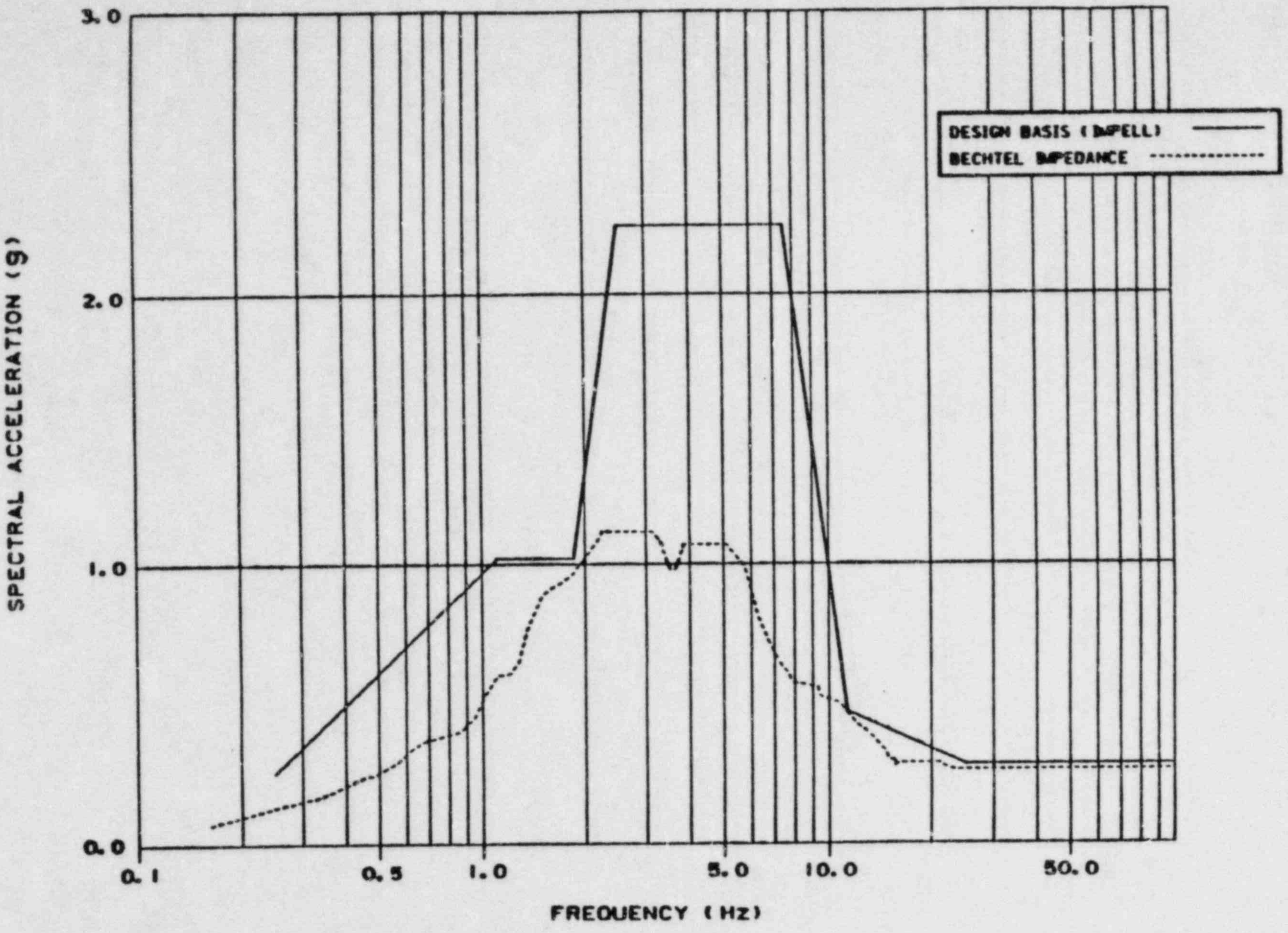


FIGURE A-16-2

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 114'-0",
N-S, SSE, 2% DAMPING

HOPE CREEK UNIT I
CAD. L44. REV 0

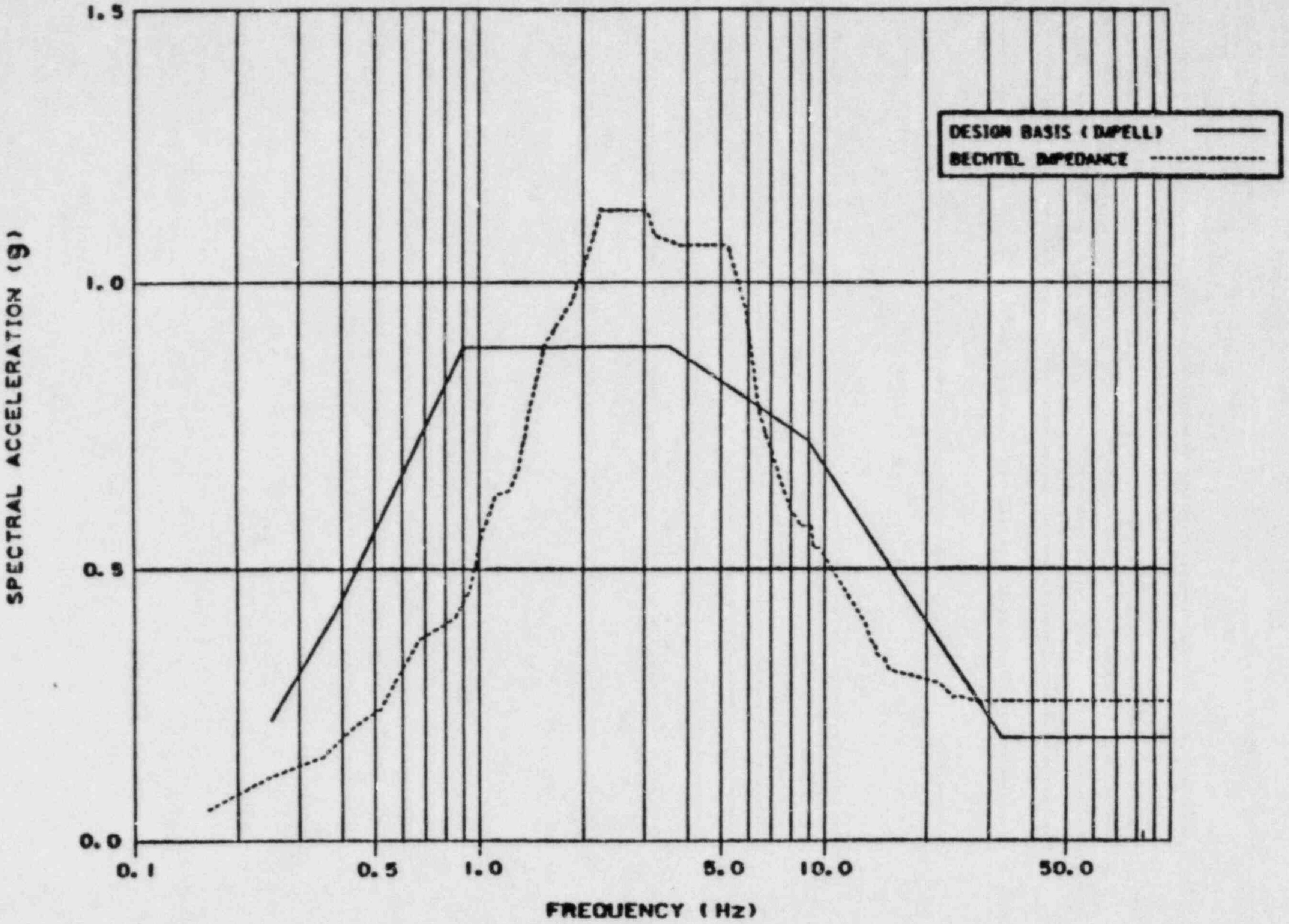


FIGURE A-16-3

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 135'-0",
N-S, SSE, 2% DAMPING

HOPE CREEK UNIT I
CAD. L52, REV 0

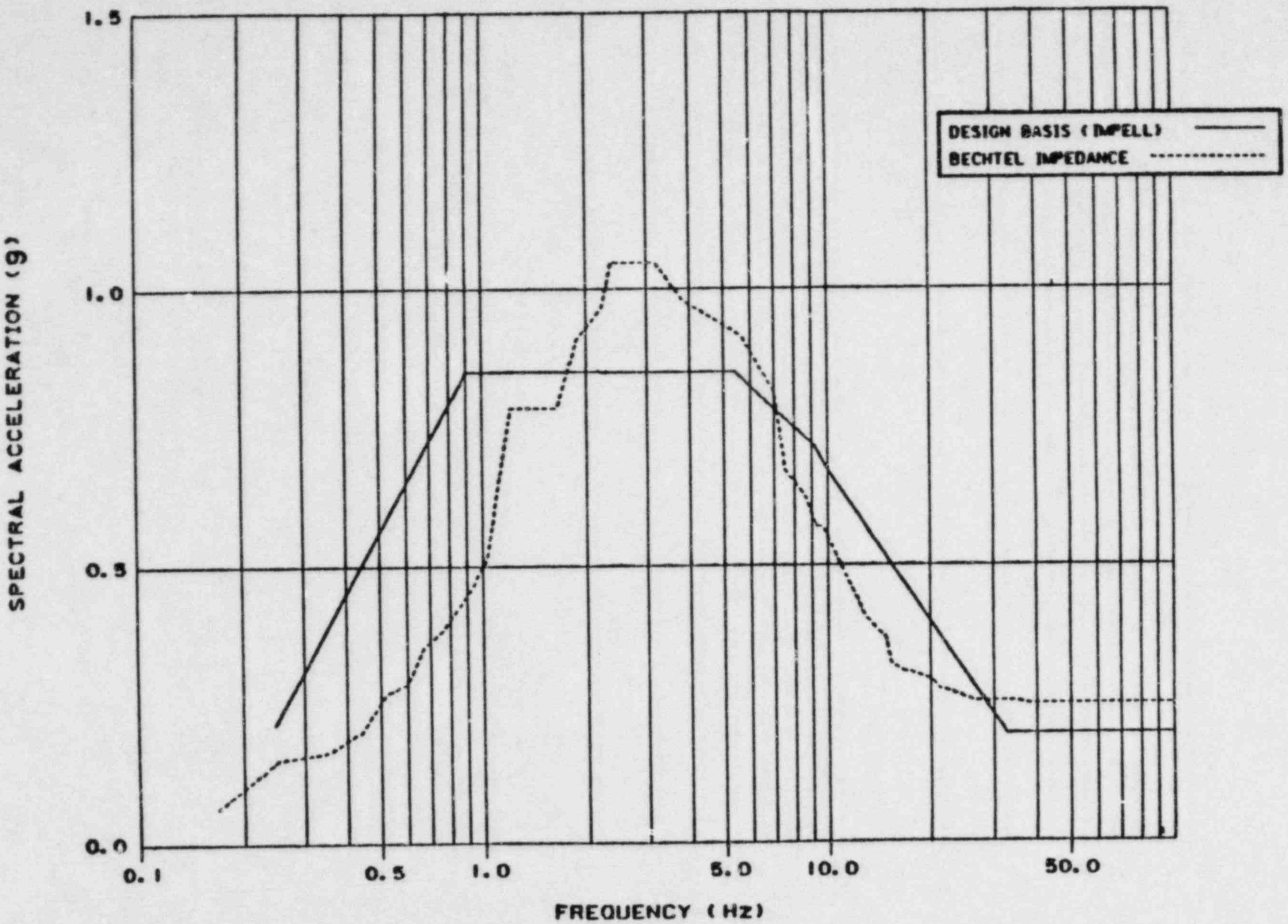


FIGURE A-16-4

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 93'-0".
E-W, SSE, 2% DAMPING

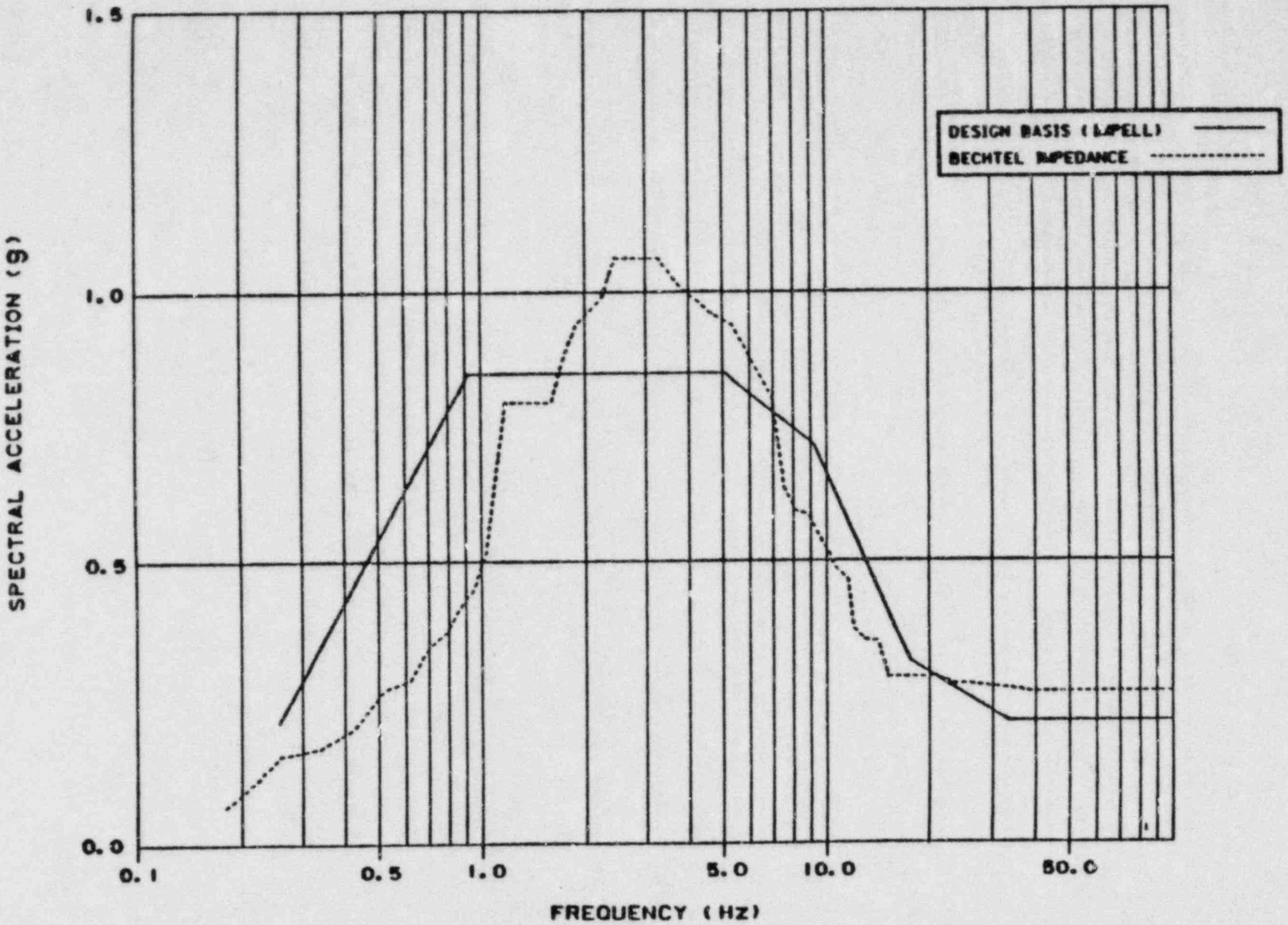


FIGURE A-16-5

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 114' -0",
E-W, SSE, 2% DAMPING

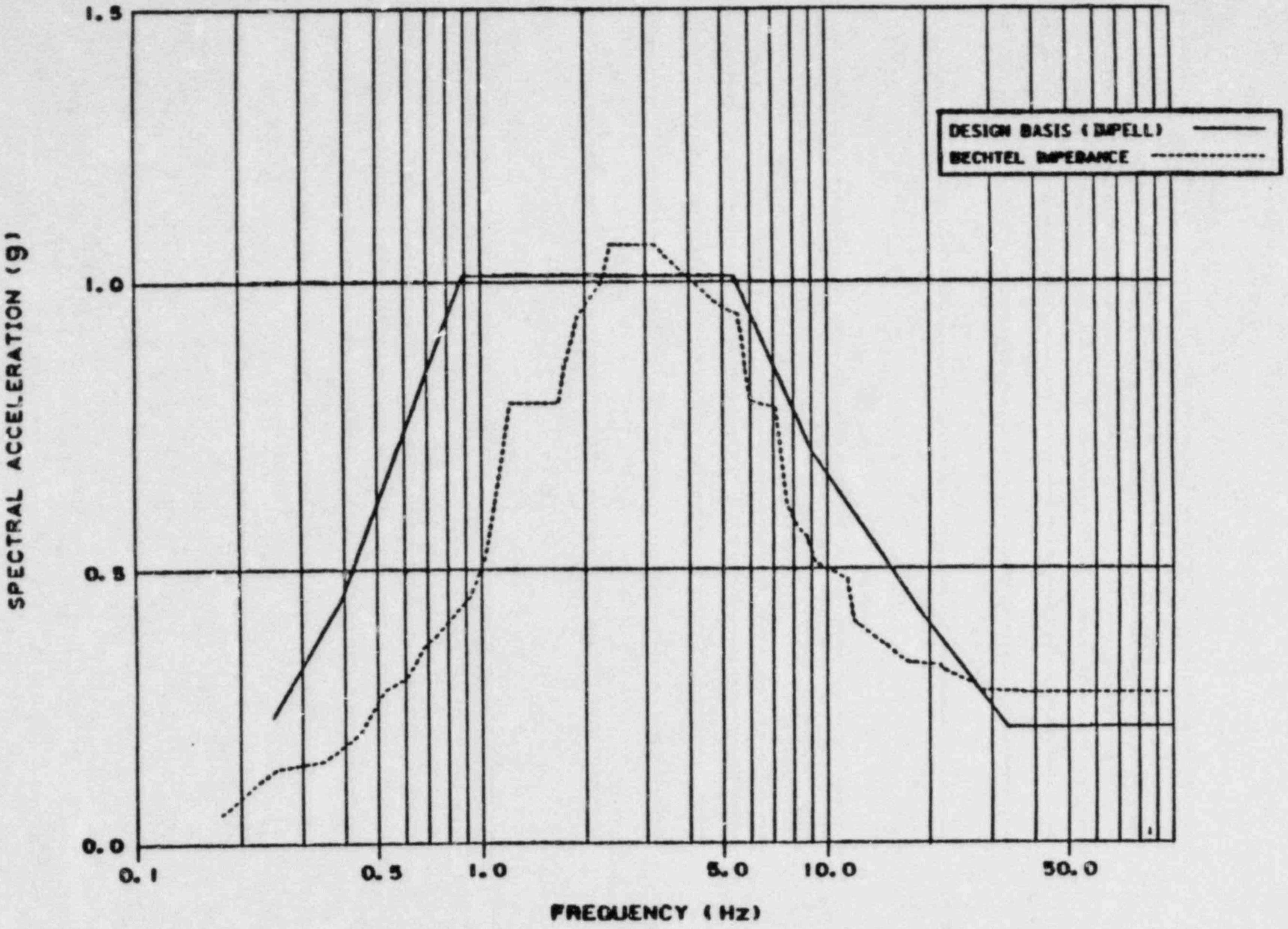


FIGURE A-16-6

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 135' -0",
E-W, SSE, 2% DAMPING

HOPE CREEK UNIT 1
CAD, L53, REV 0

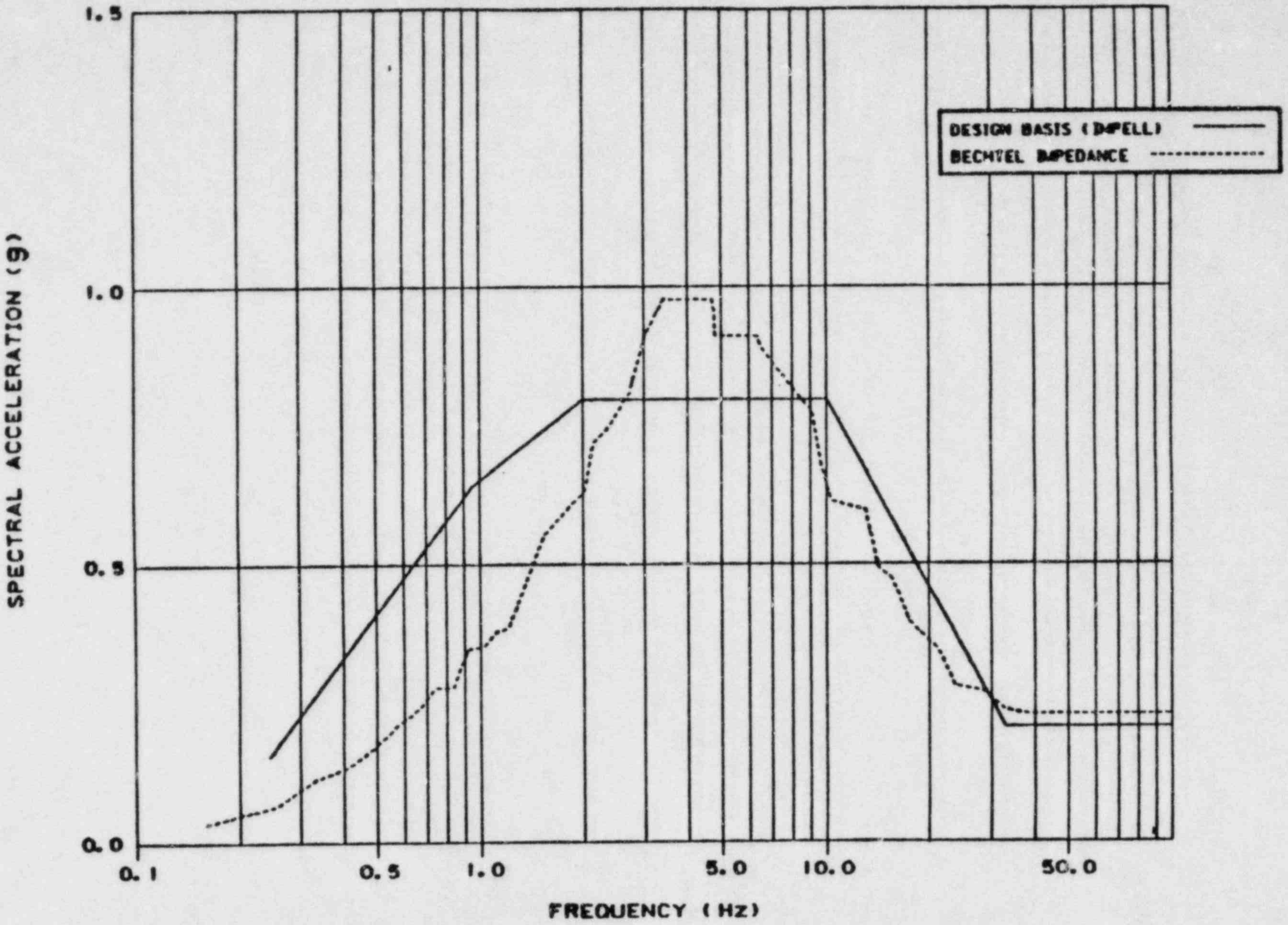


FIGURE A-16-7

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 93′-0″,
VERTICAL, SSE, 2% DAMPING

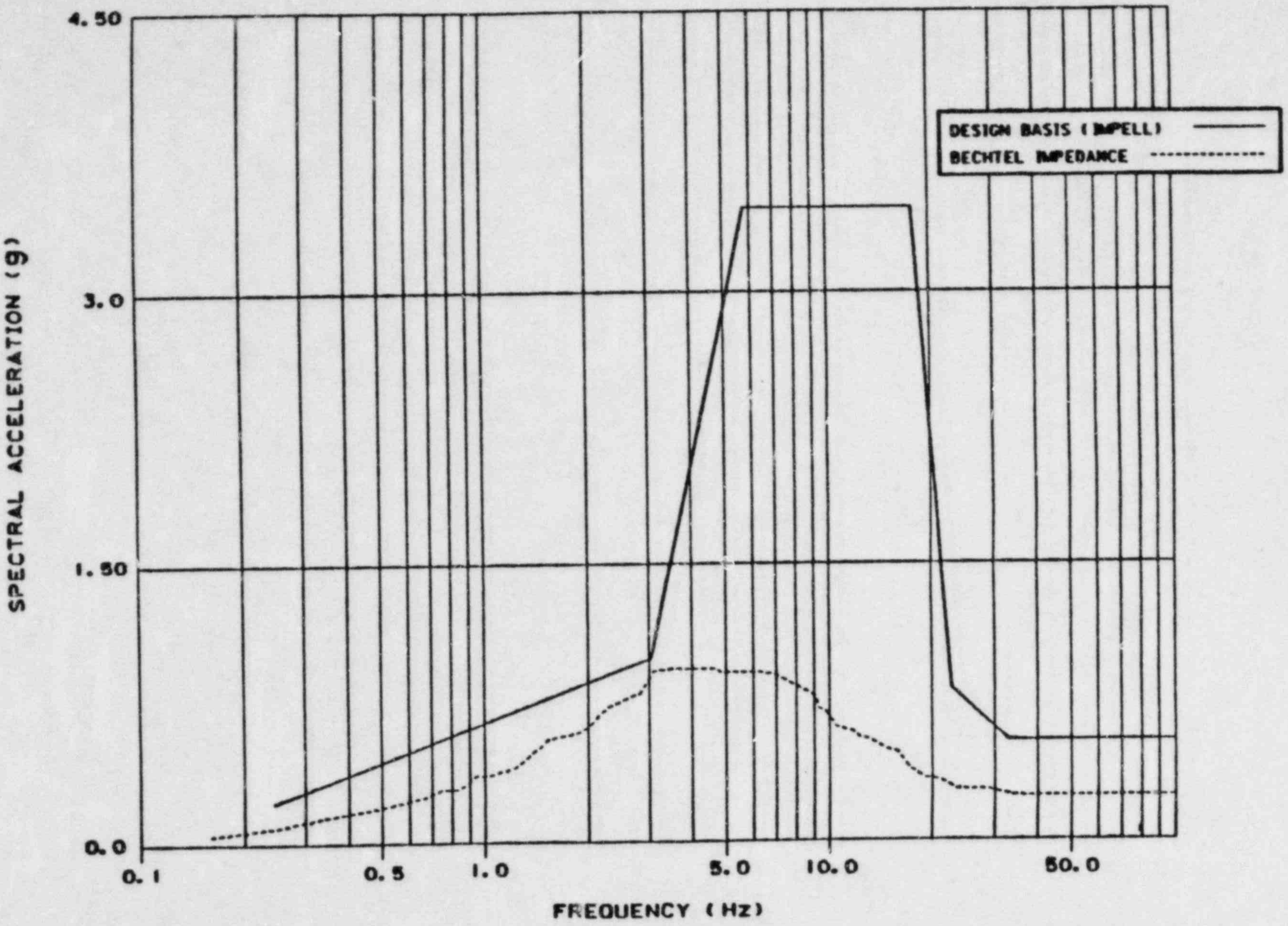


FIGURE A-16-8

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 114' -0",
VERTICAL, SSE, 2% DAMPING

HOPE CREEK UNIT 1
CAD, L45, REV 0

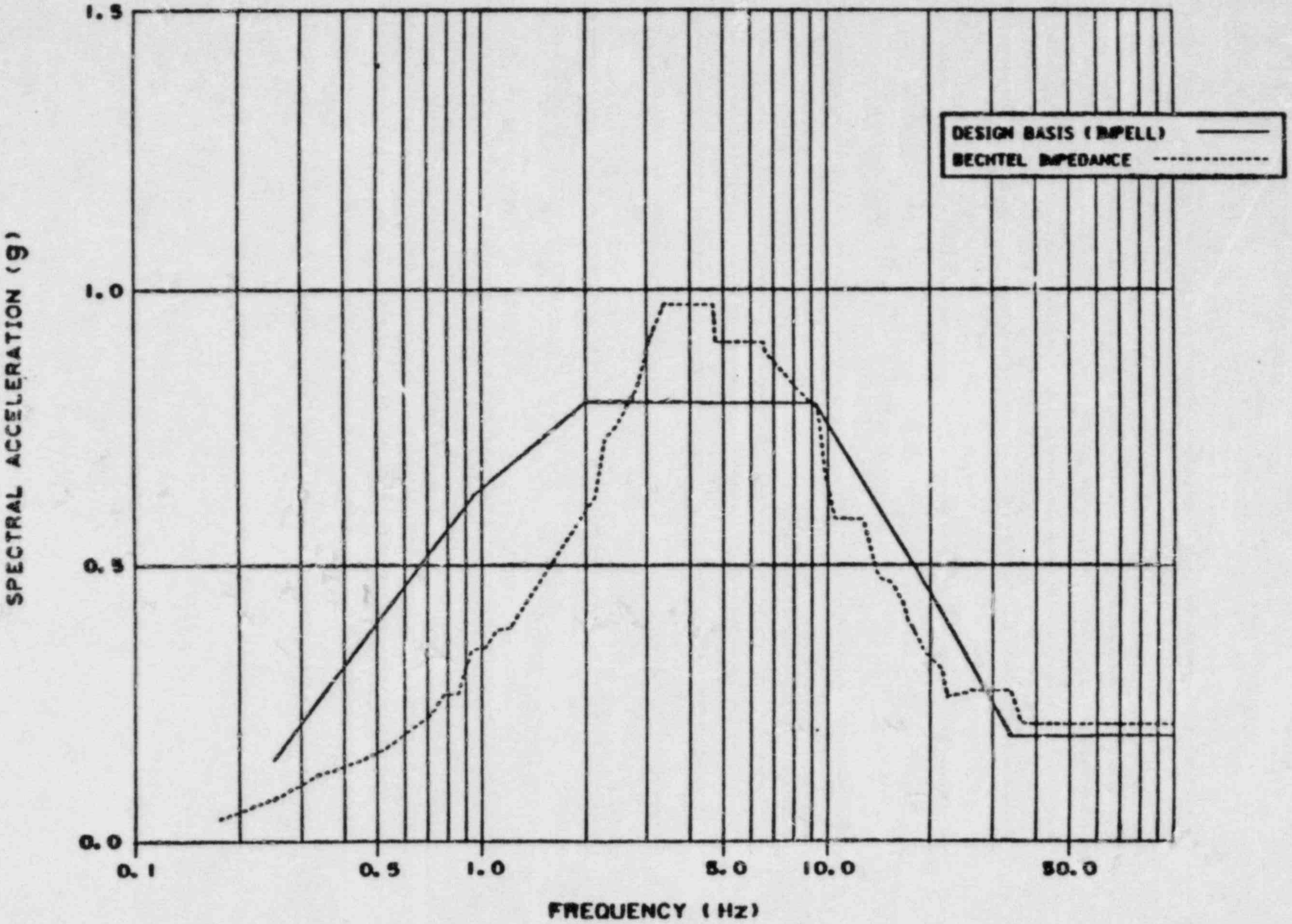


FIGURE A-16-9

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 135'-0",
VERTICAL, SSE, 2% DAMPING

HOPE CREEK UNIT 1
CAD. L54, REV 0

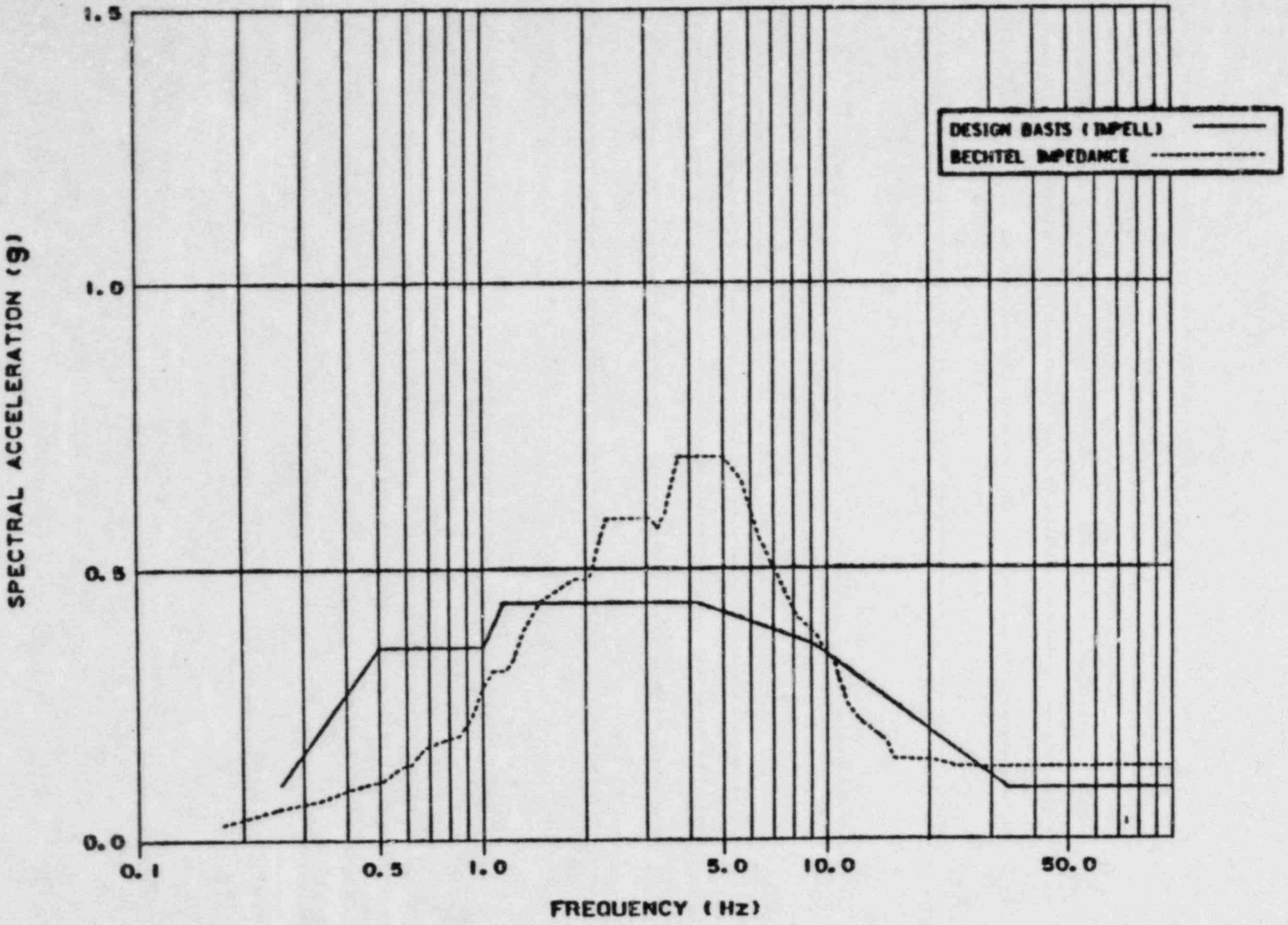


FIGURE A-16-10

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 93' -0",
N-S, OBE, 2% DAMPING

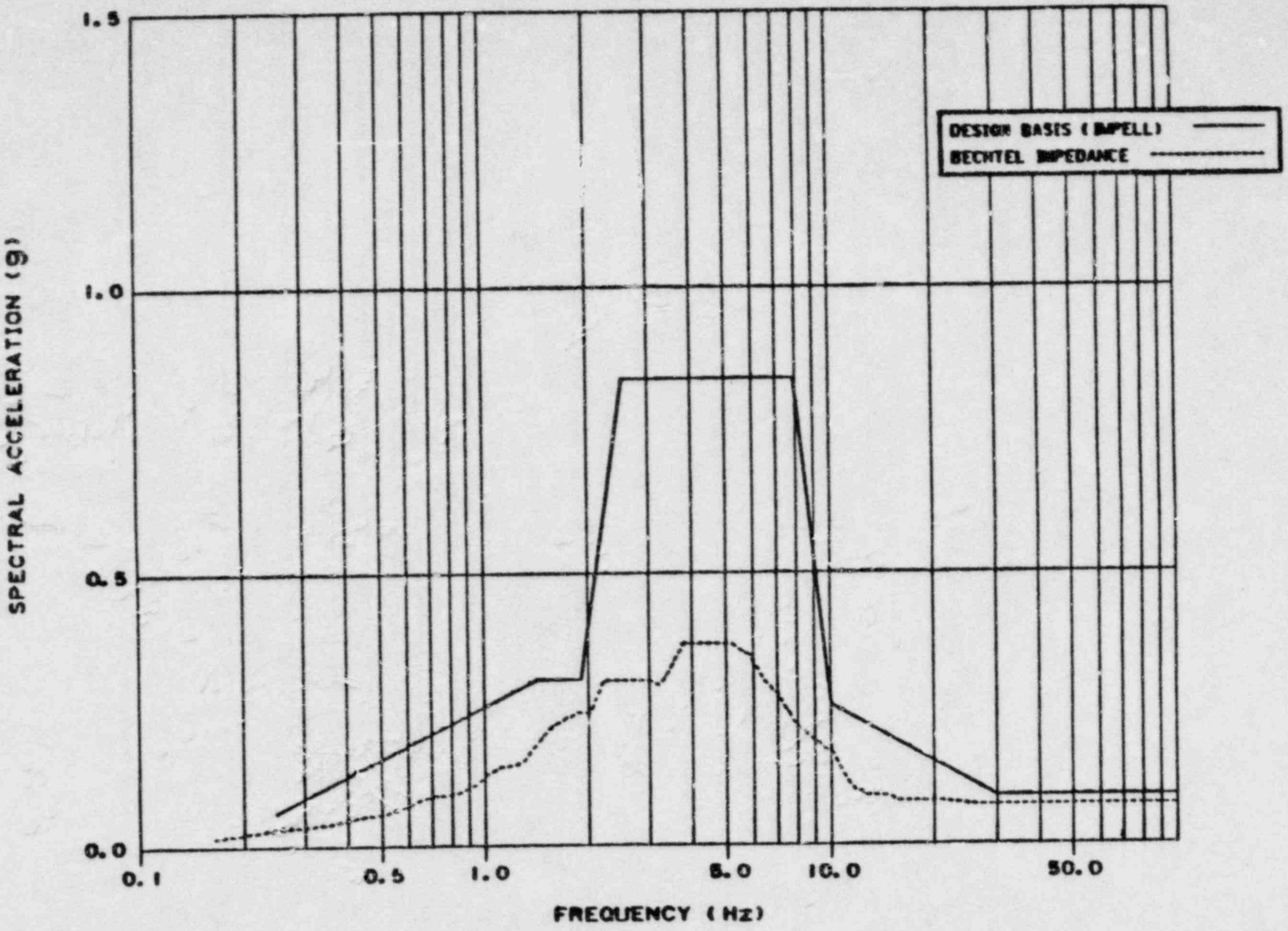


FIGURE A-16-11

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 114' -0",
N-S, OBE, 2% DAMPING

HOPE CREEK UNIT 1
CAD. L62, REV 0

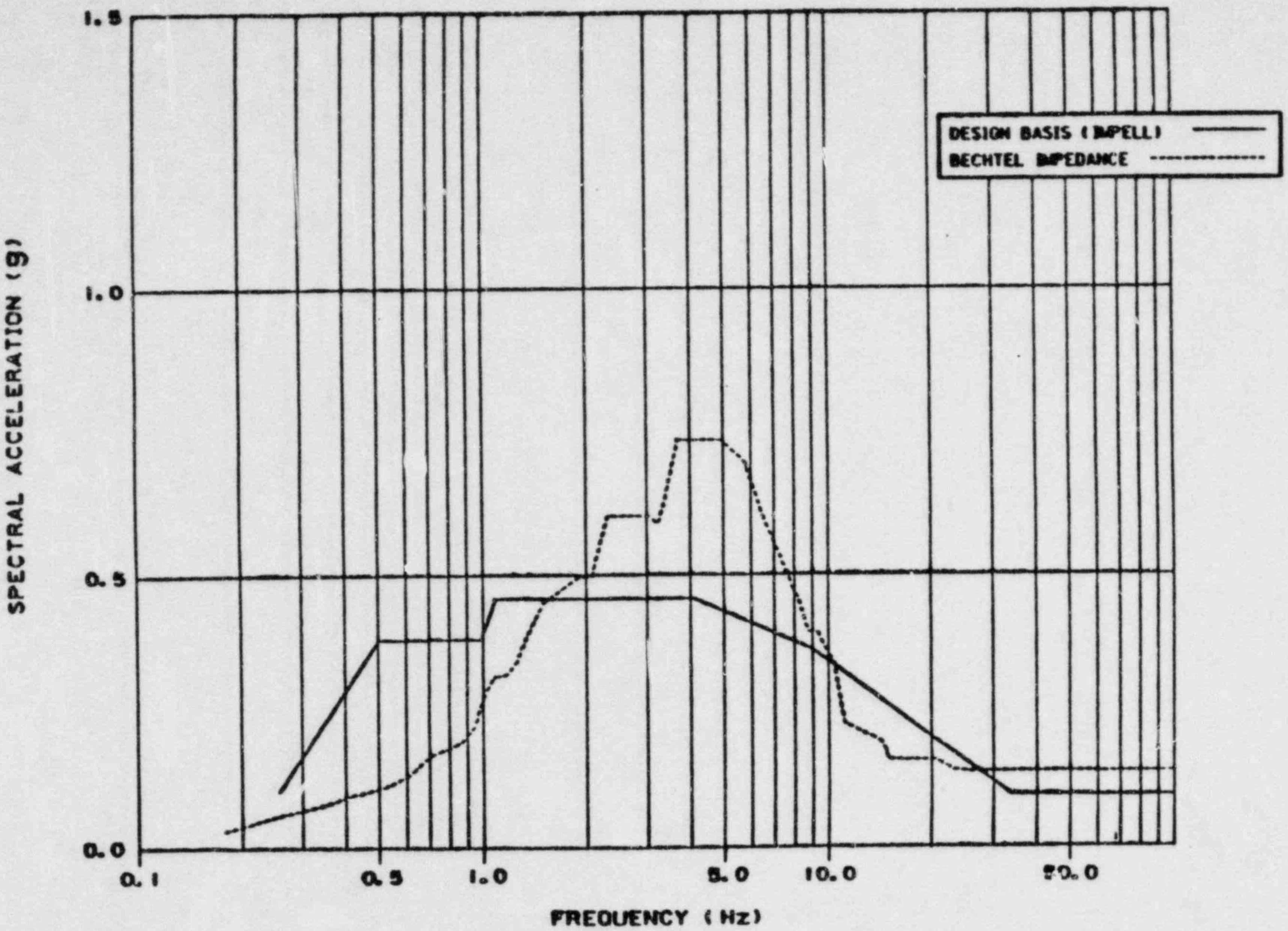


FIGURE A-16-12

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 135'-0",
N-S, OBE, 2% DAMPING

HOPE CREEK UNIT 1
CAD. L70. REV 0

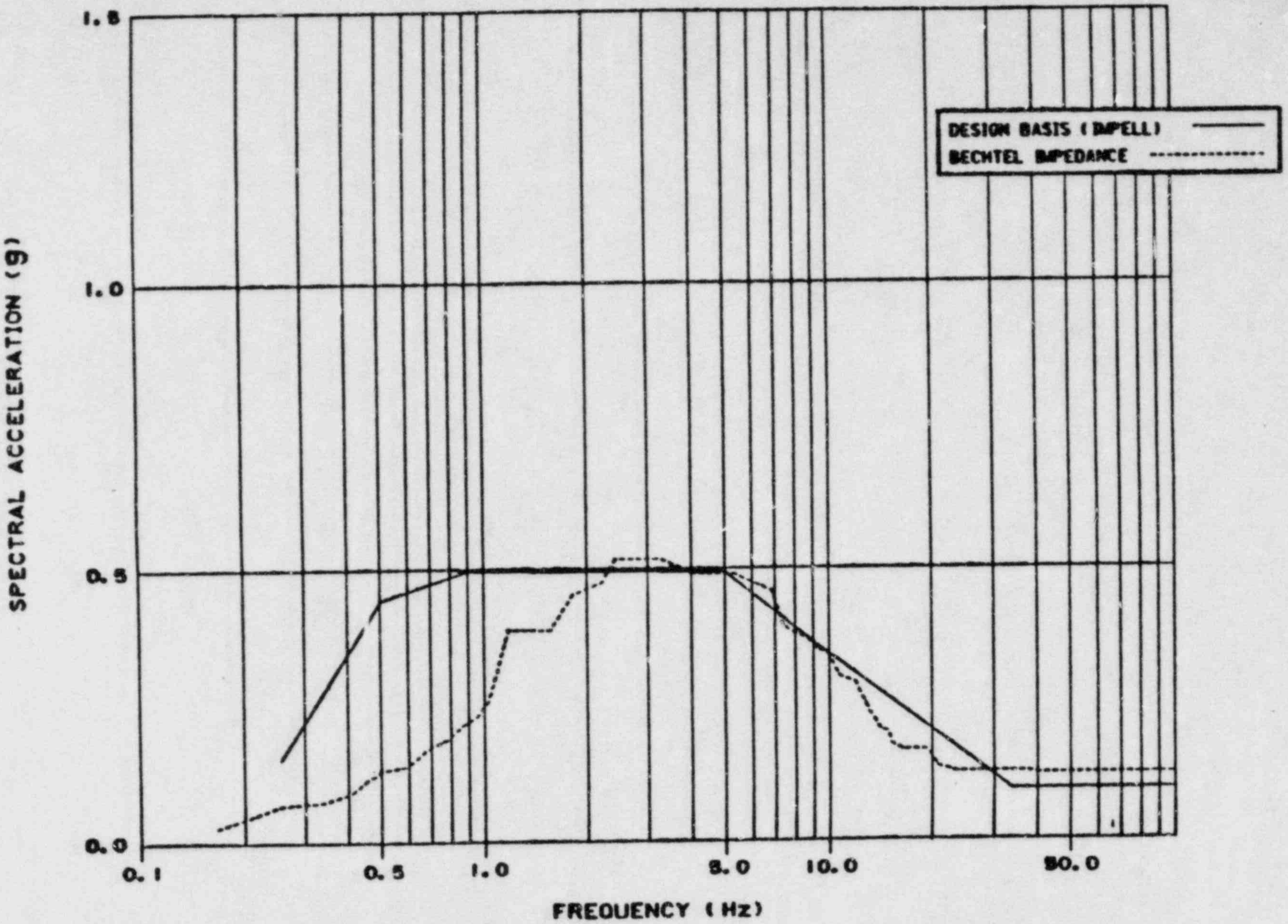


FIGURE A-16-13

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 93' -0",
E-W, OBE, 2% DAMPING

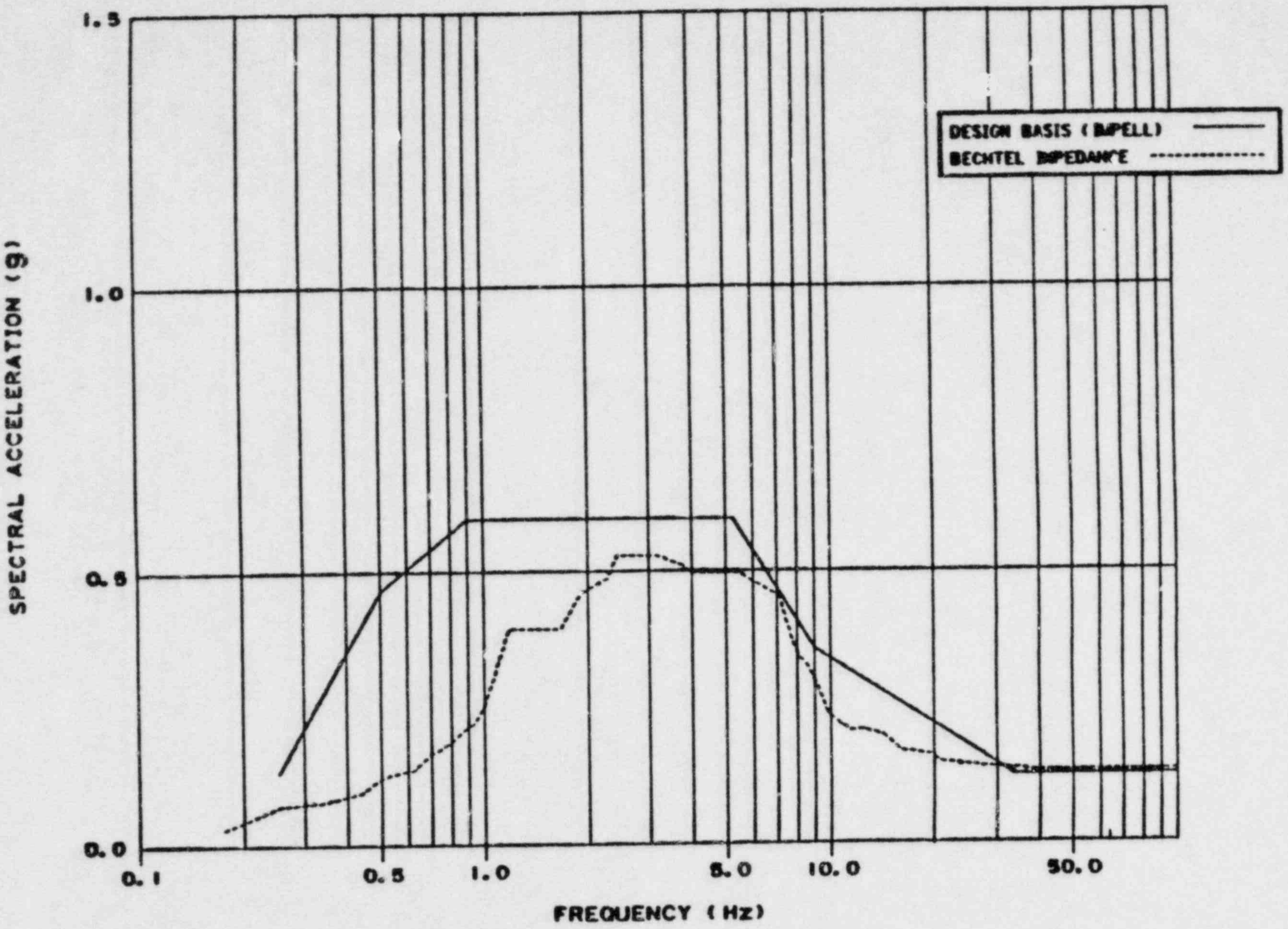


FIGURE A-16-14

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 114'-0",
E-W, OBE, 2% DAMPING

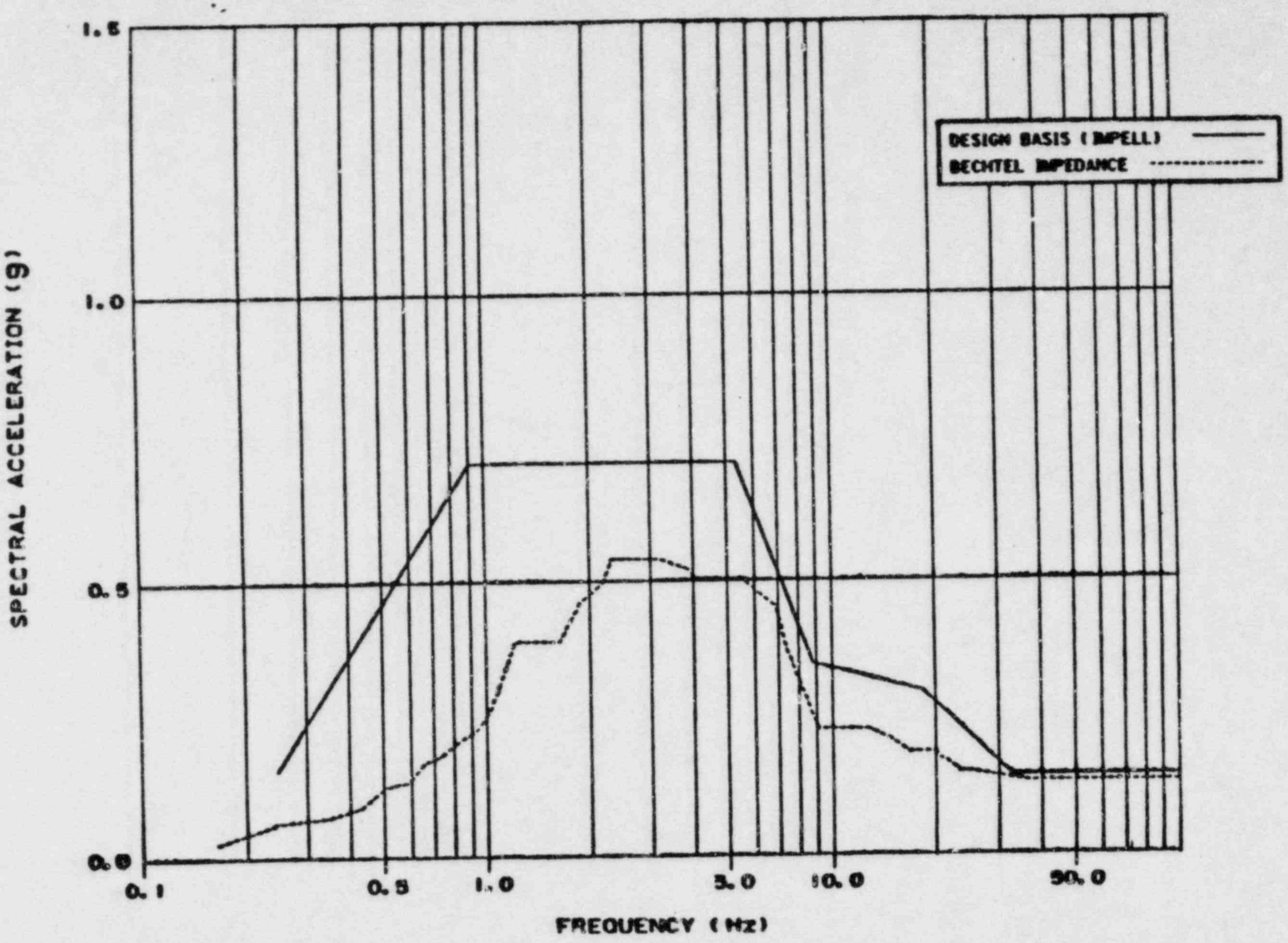


FIGURE A-16-15

RESPONSE SPECTRA COMPARISON.
INTAKE STRUCTURE AT ELEV. 135' -0",
E-W. OBE. 2% DAMPING

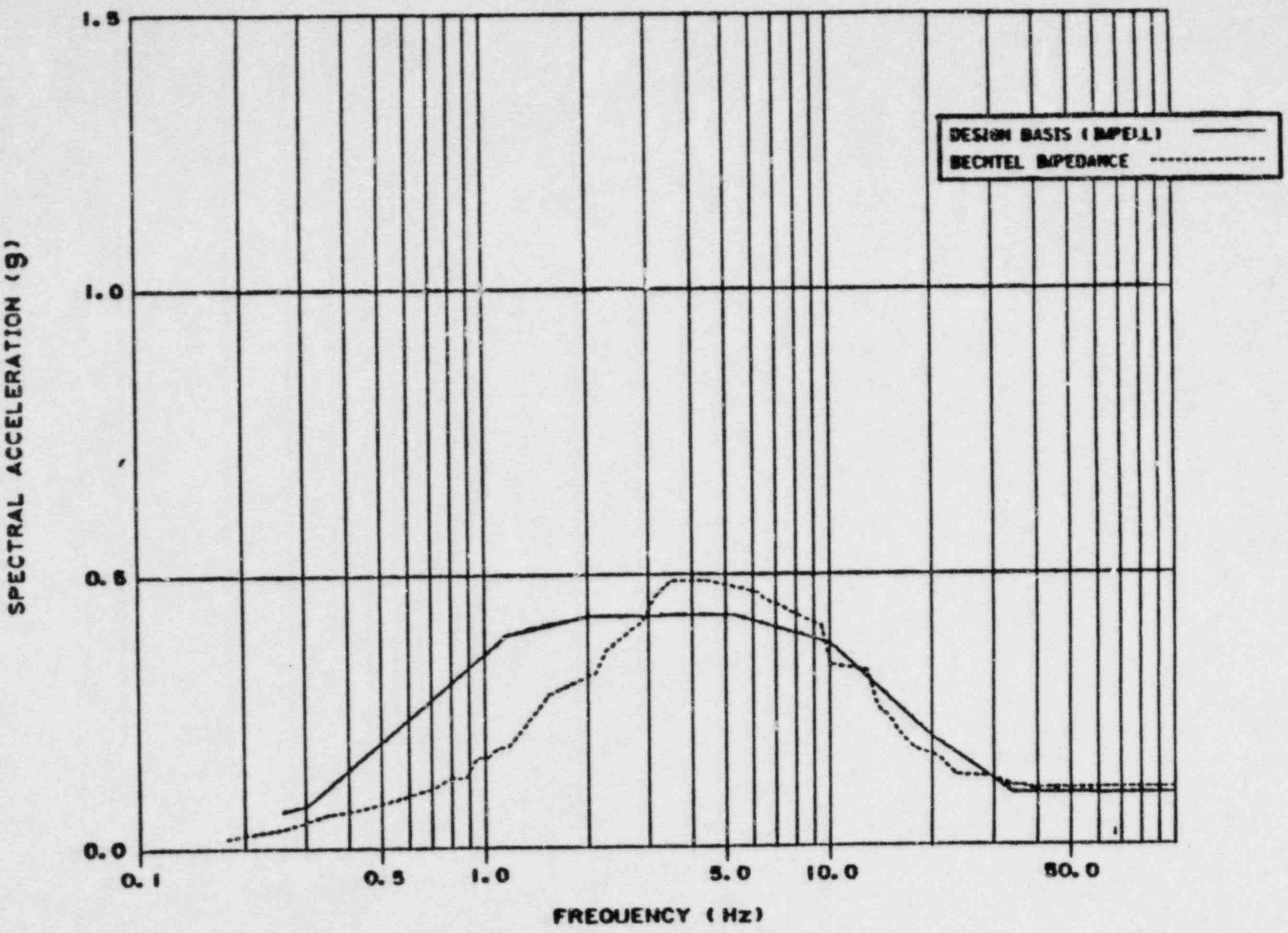


FIGURE A-16-16

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 93' -0",
VERTICAL, OBE, 2% DAMPING

HOPE CREEK UNIT 1
CAD. L56, REV 0

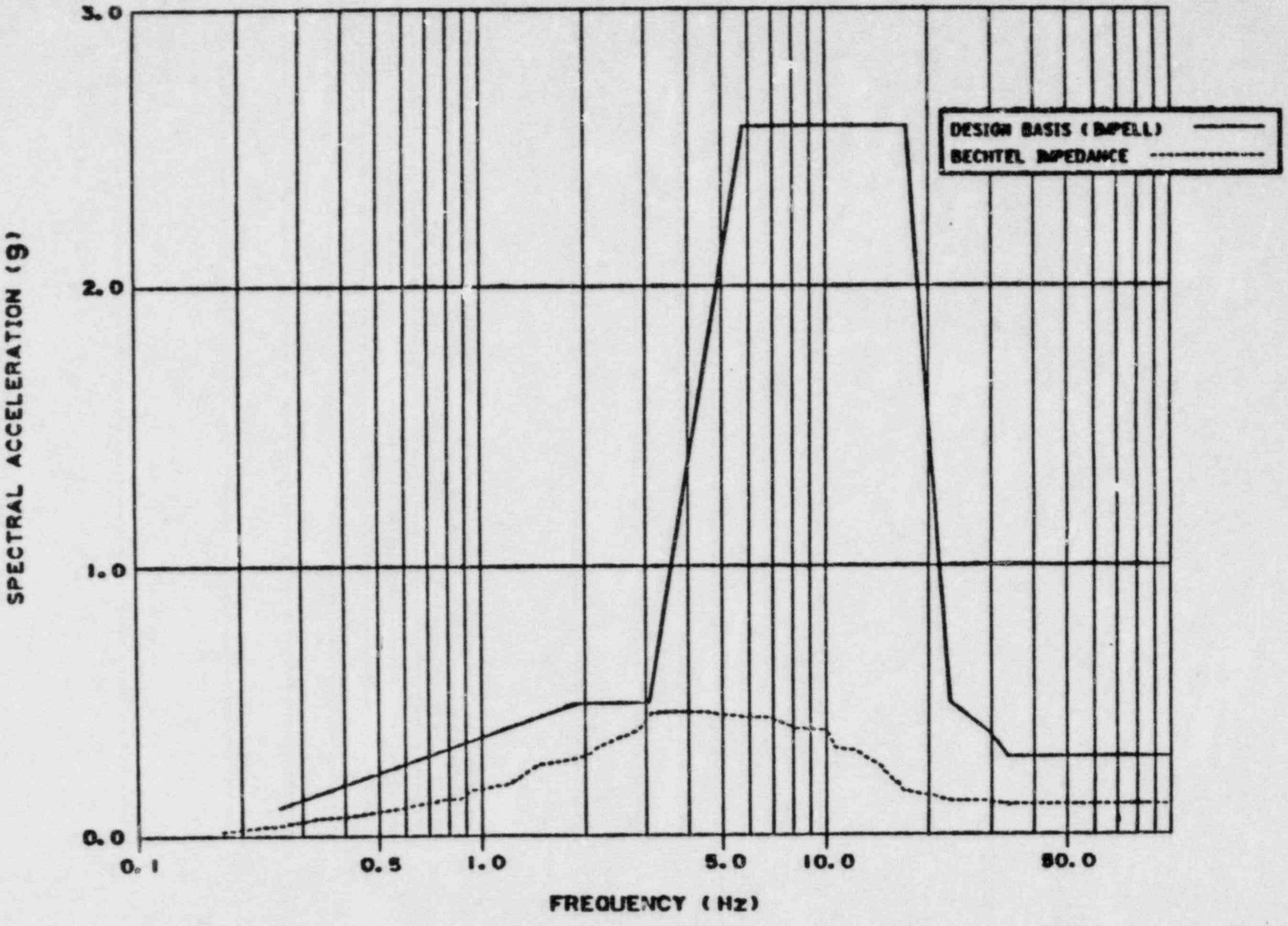


FIGURE A-16-17

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 114' -0".
VERTICAL. OBE. 2% DAMPING

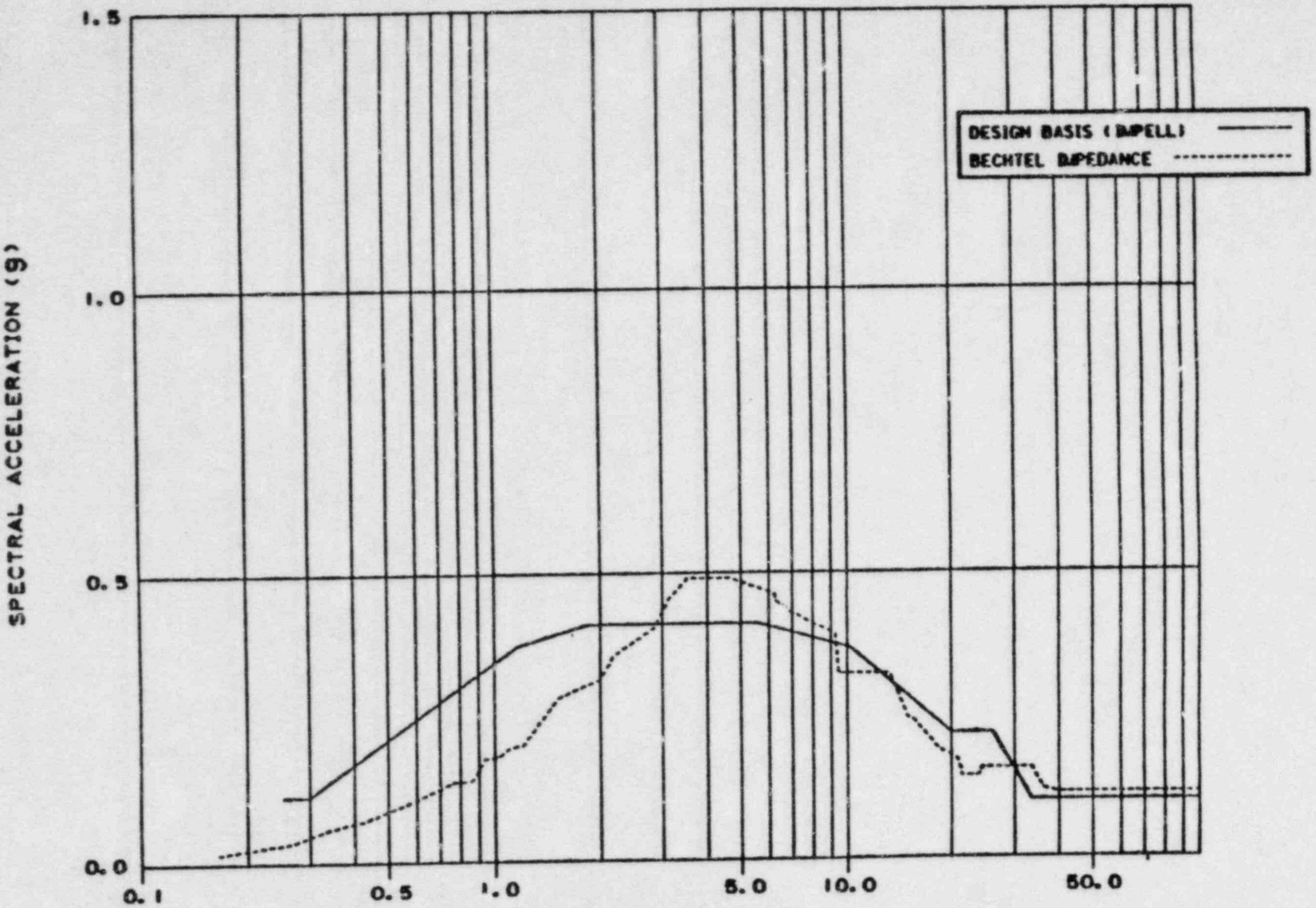


FIGURE A-16-18

RESPONSE SPECTRA COMPARISON,
INTAKE STRUCTURE AT ELEV. 135'-0",
VERTICAL, OBE, 2% DAMPING

HOPE CREEK UNIT I
CAD, LT2, REV 0

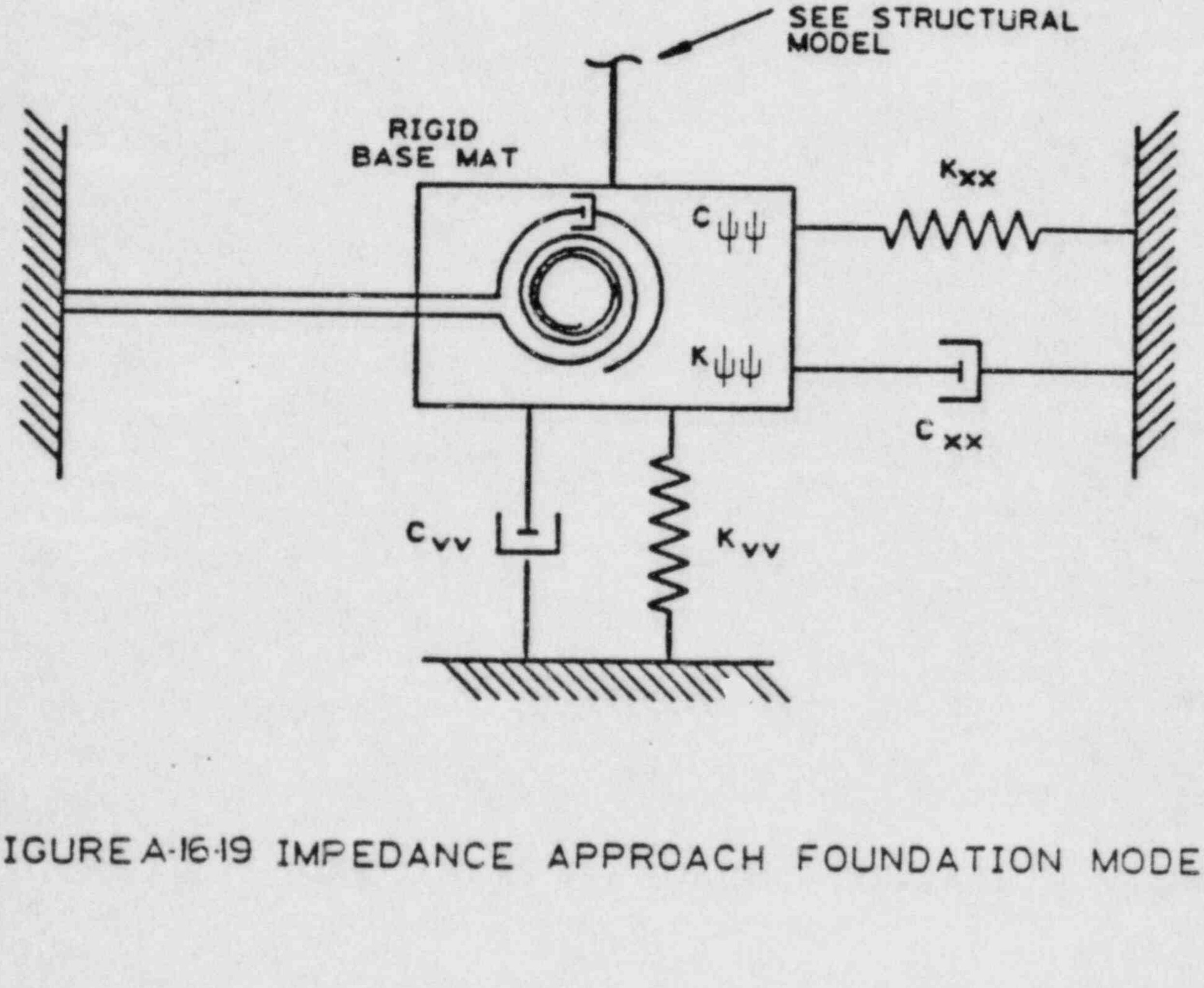


FIGURE A-16-19 IMPEDANCE APPROACH FOUNDATION MODEL

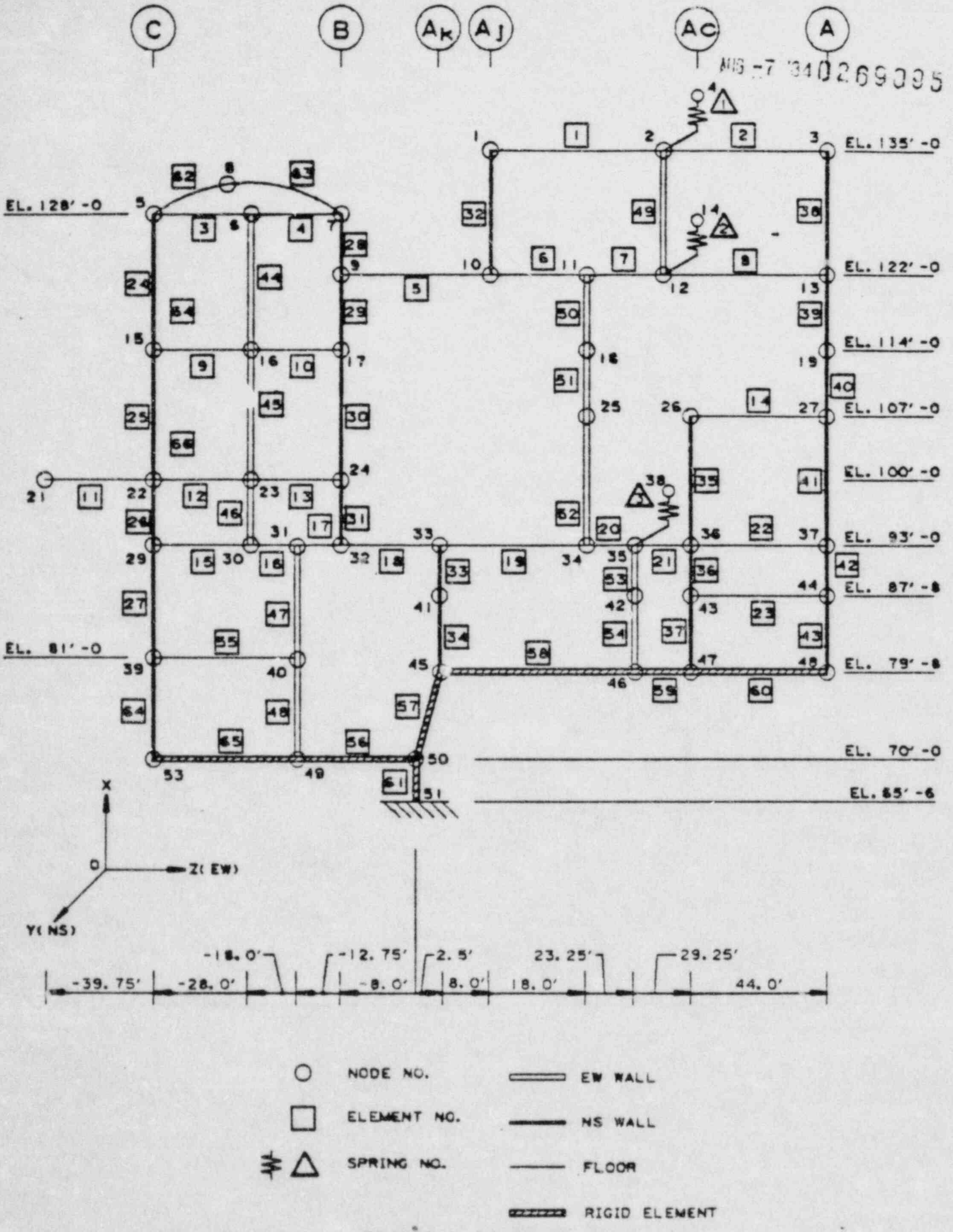


FIGURE A-16-20

FIXED BASE LUMPED MASS STICK MODEL
OF INTAKE STRUCTURE

Jim Lazevnick - PSB

Attached is a proposed change to the River Bend Station cable identification scheme. Basically, we would like to use some excess Red or Blue cable in NON-Safety applications. To differentiate this cable from safety applications, the colored jacket will be painted black and cable ID tags will be used. This will be just the reverse of using black cable in safety applications and painting it red or blue. Also note that this change is only for totally enclosed cables, not for those in open trays.

If there are no problems with this change, we will be submitting it formally in our next Amendment to the FSAR. Thank you for your time and attention.

Eddie R Grant
409-839-3012

X	XXX	X	X	X	XXX
Unit	System Code	Part	Color	Service	Number

Unit - Identifies the station's unit number.

System Code - Three characters identifying the system.

Part - One symbol which can be either an alpha or a numeric designator, e.g., an MCC cubicle section or one pump of a group (A, B, C, etc).

Color - An alpha symbol indicating whether the cable is safety-related or nonsafety-related.

Service - An alpha character indicating the type of service for which the cable will be utilized.

Number - Three characters assigned to specify each individual cable number.

Example: 1ENS AR H307

Insert 'A'

~~All scheduled cables are identified by cable identification number at terminal ends and by a color-coded marker at intervals not exceeding 5 ft of the run for safety-related cables, except for those cables installed in conduit and H and L cable trays, described in Section 8.3.1.4.4.2, which do not have color identification at 5-ft intervals, as discussed in Table 1.8-1, compliance with Regulatory Guide 1.75.~~

The raceway identification has the following format:

X	X	X	XXX	X	X	X
Unit	Type	Service	Number	Color	Condu/A	Condu/N

Unit - Identifies the station's unit number.

Type - Character indicating the type of raceway.

Service - An alpha symbol which indicates the service of cable to be carried in the designated raceway.

Insert A

All scheduled cables are identified by permanent colored markers attached to the cable at each end adjacent to the cable alphanumeric identification marker. The background color of the alphanumeric identification marker may be used as the permanent colored marker. Except for cables run entirely in conduit, color code identification of a circuit is either by the color coded jacket of the cable or by printing the cable jacket with proper color at intervals not exceeding 5 feet. For cables running entirely in conduit, any color coded jacketed cable can be used. Only the permanent colored markers attached at each end of the cable run or where the conduit run is discontinued (e.g. at shake space or sleeves) will serve as color coding identification of the related circuit.

GULF STATES UTILITIES COMPANY

POST OFFICE BOX 2951 • BEAUMONT, TEXAS 77704

AREA CODE 713 838-6631

August 9, 1984
RBG- 18,565
File Code G9.5, G9.19.2

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Denton:

River Bend Station - Unit 1
Docket No. 50-458

This response supplements Gulf States Utilities Company's (GSU) June 22, 1984 letter to your office regarding the Nuclear Regulatory Commission's (NRC) Safety Evaluation Report (SER) confirmatory item No. (3) identified in Section 2.5.5.2 by the Structural and Geotechnical Engineering Branch (SGEB). Addressed herein is the factor of safety against sliding for the service water tunnel (G) that leads to the Unit 2 excavation area. Attached are changes to Section 2.5.4.11 and Table 2.5-16 to be provided in a future amendment to the FSAR.

This completes GSU's response to SER confirmatory item No. (3).

Sincerely,

J. E. Booker

J. E. Booker
Manager-Engineering
Nuclear Fuels & Licensing
River Bend Nuclear Group

JEB/RJK/je

Attachment

2.5.4.11 Design Criteria

The major plant buildings were analyzed to assess their sliding and overturning stability during the SSE and OBE. The analyses included the effects of the Unit 2 excavation and ponded water levels that result from the accumulation of runoff in the Unit 2 excavation as discussed in Section 2.4. Although the groundwater level will be slightly affected by ponding, the stability analyses conservatively consider the groundwater level equal to the ponded water level to simplify the analyses. 13

For the sliding and overturning analyses, a structure is assumed to be driven by the seismic response of the structure and dynamic soil and water pressures. Resistance is assumed to be provided by base friction, ~~and~~ wall friction, where appropriate, in the case of sliding and by the dead weight of the structure in the case of overturning. Since many of the structures will have a shake space adjacent to them (for seismic isolation from other structures), passive soil pressure is not relied upon for resistance in this stability analysis. The compacted sand backfill was modeled with a friction angle of 36 deg and no cohesion. Test results on the backfill indicate this friction angle to be conservative (refer to Fig. 2.5-74 and to Report on Engineering Characteristics of Granular Fill[77]). The friction angle for backfill against formed concrete is taken as 50 percent of the soil friction angle. The base friction angle for concrete poured on compacted fill was taken as ~~90 percent of~~ the soil friction angle~~.~~ ~~This is based on~~ the laboratory test results of Potyondy[84]. For the sliding analysis, the base shear resistance is based on the effective stress during the seismic event.

and soil pressure

13

and soil pressure, where appropriate

13

13

reduced in accordance with

The seismic responses of the structures are the results of the dynamic analyses described in Section 3.7.2. The seismic structural analyses were made for the SSE and OBE cases for soil shear moduli of 12, 18, and 24 ksi. The dynamic analyses provide the axial forces, shear forces, moments, and the three components of acceleration at the foundation level. From these data, the forces and moments acting at the base of the foundations were computed. The critical sliding or overturning situation for a given structure is then based on the least favorable direction of the earthquake in combination with the least favorable soil shear modulus.

For the stability analysis, the soil- and water-driving pressures were computed as shown on Fig. 2.5-79. Note that the increased K_0 due to compaction was included. Dynamic

Insert A

for the at-rest condition

Insert A

except for the analysis of the service water tunnel. Toward the east end of this tunnel, the backfill is placed to the same elevation on the north and south sides of the tunnel. Therefore, it is assumed that at-rest earth pressures act near the east end of the tunnel. Toward the west end of the tunnel, the backfill on the north side is 28 ft. higher than the backfill on the south side. It is assumed that near the west end of the tunnel sufficient movement of the tunnel occurs to reduce driving earth pressure from at-rest to a condition that approaches active earth pressure ($K_o = 0.35$). For intermediate sections of the tunnel, driving earth pressure is varied from slightly above active at the west end to at-rest at the east end.

structural response and the seismic soil and water pressures.

Section 3.8.5 specifies that, for sliding and overturning, the minimum required factors of safety are 1.1 for SSE and 1.5 for OBE. The results of the sliding and overturning analysis are presented in Table 2.5-16, which is a listing of the calculated factors of safety. Note that even with the conservative loading conditions and soil properties used in the analysis, all factors of safety for overturning are
8 above 1.9 and all those for sliding are above 1.5 7. All |2 |13
major structures have adequate sliding and overturning stability for OBE and SSE loading.

The stability of the major structures against flotation was evaluated by comparing maximum buoyant pressure during PMF with total average distributed dead load for a given structure. Table 2.5-17 lists both of these quantities and the ratio of the two. The lowest factor of safety against flotation is 2.6, well above the minimum acceptable of 1.1 |13
which is set forth in Section 3.8.5. Hence, flotation is not a realistic possibility for the plant structures, even under flood conditions.

2.5.4.12 Techniques to Improve Subsurface Conditions

The only techniques used to improve subsurface conditions were the excavation and backfill beneath all Seismic Category I structures (Section 2.5.4.5). In addition, the surface of the excavation was thoroughly compacted with the same vibratory equipment planned for the fill before any backfill was placed.

2.5.4.13 Subsurface Instrumentation

The instrumentation program is intended to measure the magnitude and distribution of vertical soil movements caused by unloading of the foundation soils during excavation and by settlement or reconsolidation of these soils during and subsequent to placement of the structural backfill and foundation loads. The locations of instruments have been chosen to measure both the vertical and horizontal distribution of soil movements, permitting construction of profiles of vertical movements.

The information obtained from this program is used to assess the changes in the subsoils caused by excavation and backfilling, the effects of these changes on the structural foundations, and the long term time-dependent behavior of the foundations.

TABLE 2.5-16

SLIDING AND OVERTURNING FACTORS OF SAFETY FOR MAJOR STRUCTURES

Structure	Factor of Safety			
	OBE		SSE	
	Sliding	Overturning	Sliding	Overturning
Diesel Generator Building	2.6	6.5	1.6	3.6
Control Building	2.3	6.0	1.6	3.7
Fuel Building	2.9	3.8	1.7	2.0
Turbine Building	4.2	23.7	-	-
Reactor Building	5.1	6.5	2.9	3.8
Auxiliary Building	3.3	4.5	1.6	2.4
Standby Service Water Tower	2.7	7.4	1.8	4.7
Service Water Tunnel	$\boxed{2.3}$ ✓ 3.3	2.$\boxed{6}$ ✓ 4	$\boxed{1.5}$ ✓ 1.7	1.$\boxed{9}$ ✓ 8