DIRECTIONS FOR INSERTING SUPPLEMENT 1 OF THE SEISMIC REEVALUATION REPORT

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LIST OF FIGURES (CONT'D)

2.6 Section VI discusses the evaluation of selected mechanical equipment, electrical equipment, and instrumentation. All of the equipment listed in Attachment 1 to the Staff's January 30, 1979 letter has been addressed. The data sheet for the emergency diesel generator will be submitted in a supplement to this report after the vendor completes a reevaluation. As discussed in Section VI, Paragraph 4.2.7, we anticipate that the reevaluation will verify the conclusion that there is adequate margin when subjected to a 0.20g SSE. 1

2.7 Section VII discusses the conclusions drawn from the reevaluation.

3. <u>Summary</u>

3.1 The results of the reevaluation, which are discussed more fully throughout this report show that, even utilizing an SSE with an acceleration of 0.20g, the systems required to accomplish safe shutdown and continued shutdown heat removal will be able to function as designed. Furthermore, these results are themselves quite conservative, as discussed in the conclusions of Section VII. This demonstrates that the Davis-Besse, Unit 1 design is acceptable in the event of a 0.20g SSE. 1

TABLE II-2 (Continued)

Figure No.	Location Bldg.	Location Area	Location Elevation	Spectra Description	Percent Damping 0.20g SSE	Percent Damping 0.15g SSE
II-19A	CIS	-	595	Hor. NS	2	0.5
II-19B	CIS	-	595	Hor. EW	2	0.5
II-19C	CIS	-	595	Vert.	2	0.5
II-20A	CIS	-	603	Hor. NS	2	0.5
II-20B	CIS	-	603	Hor. EW	2	0.5
II-20C	CIS	-	603	Vert.	2	0.5
II-21A	CIS	-	618	Hor. NS	2	0.5
II-21B	CIS	-	618	Hor. EW	2	0.5
II-21C	CIS	-	618	Vert.	2	0.5
II-22A	CIS	-	630	Hor. NS	2	0.5
II-22B	CIS	-	630	Hor. EW	2	0.5
II-22C	CIS	-	630	Vert.	2	0.5
II-23A	CIS	-	653	Hor. NS	2	0.5
II-23B	CIS	-	653	Hor. EW	2	0.5
II-23C	CIS	-	653	Vert.	2	0.5
II-24A	CV	-	589	Hor.	2	0.5
II-24B	CV	-	589	Vert.	2	0.5
II-25A	CV	-	595	Hor.	2	0.5
II-25B	CV	-	595	Vert.	2	0.5
II-26A	CV	-	609	Hor.	2	0.5
II-26B	CV	-	609	Vert.	2	0.5
II-27A	Aux.	6	585	Hor. NS	3	1
II-27B	Aux.	6	585	Hor. EW	3	1
II-27C	Aux.	6	585	Vert.	3	1

TABLE II-2 (Continued)

Figure No.	Location Bldg.	Location Area	Location Elevation	Spectra Description	Percent Damping 0.20g SSE	Percent Damping 0.15g SSE
II-28A	Aux.	6	603	Hor. NS	3	1
II-28B	Aux.	6	603	Hor. EW	3	1
II-28C	Aux.	6	603	Vert.	3	1
II-29A	Aux.	7	623	Hor. NS	3	1
II-29B	Aux.	7	623	Hor. EW	3	1
II-29C	Aux.	7	623	Vert.	3	1
II-30A	Aux.	6	603	Hor. NS	3	1
II-30B	Aux.	6	603	Hor. EW	3	1
II-30C	Aux.	6	603	Vert.	3	1
II-31A	Aux.	7	565	Hor. NS	3	1
II-31B	Aux.	7	565	Hor. EW	3	1
II-31C	Aux.	7	565	Vert.	3	1
II-32A	Aux.	7	585	Hor. NS	3	1
II-32B	Aux.	7	585	Hor. EW	3	1
II-32C	Aux.	7	585	Vert.	3	1
II-33A	Aux.	7	623	Hor. NS	4	1
II-33B	Aux.	7	623	Hor. EW	4	1
II-33C	Aux.	7	623	Vert.	4	1
II-34A	INTS.	-	576	Hor. NS	3	5
II-34B	INTS.	-	576	Hor. EW	3	5
II-34C	INTS.	-	576	Vert.	3	-

1

LEGEND:
Aux. - Auxiliary Building
INTS. - Intake Structure
CIS - Containment Internal Structures
CV - Containment Vessel

FIGURE II-30A

DAVIS-BESSE UNIT 1 AUX BLDG AREA 6 NS FLOOR RESPONSE SPECTRA

ACCELERATION SPECTRUM POINT 4 ELEV= 603.00 DMPG= .030

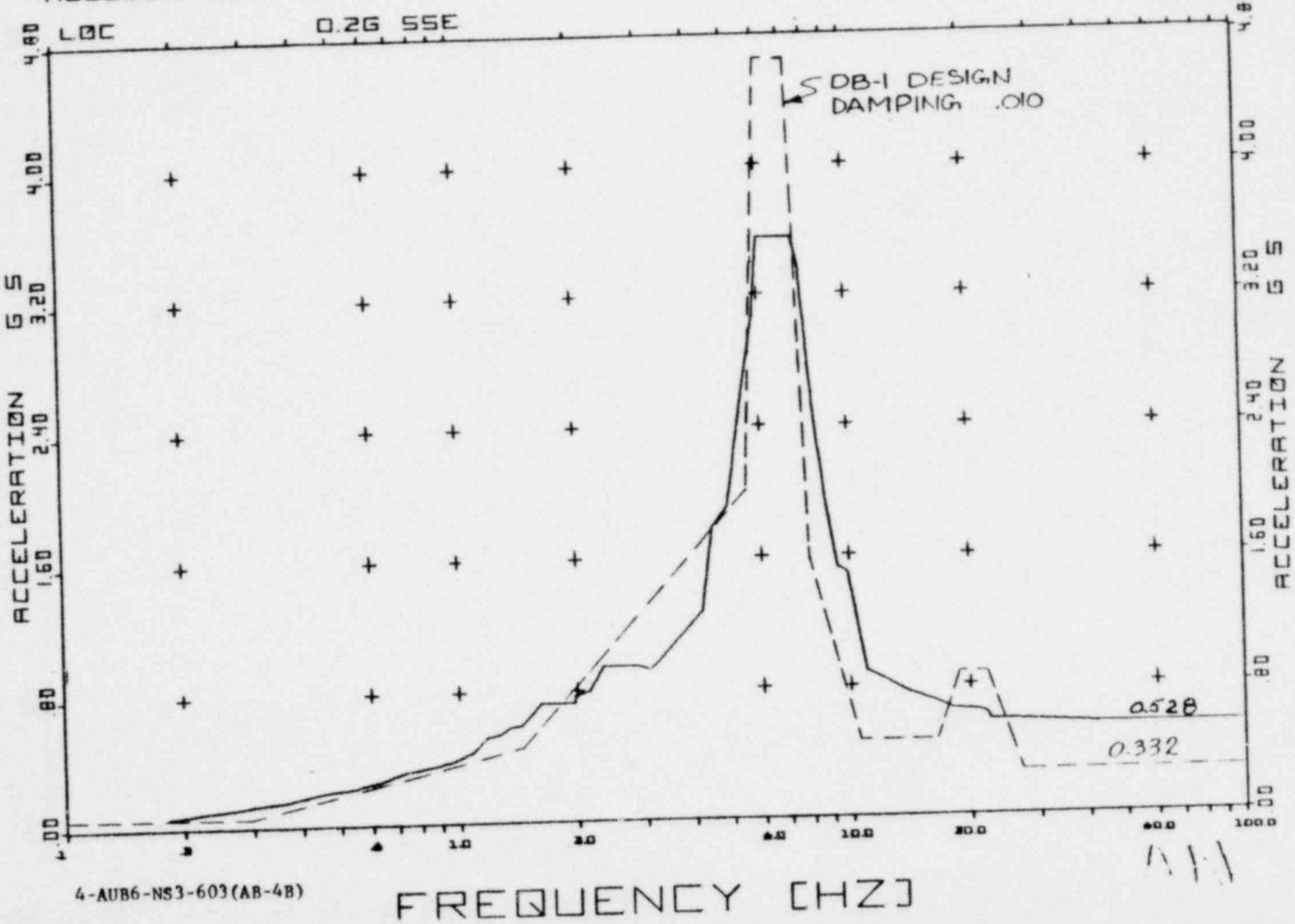


FIGURE II-30B

DAVIS-BESSE UNIT 1 AUX BLDG AREA 6 EW FLOOR RESPONSE SPECTRA

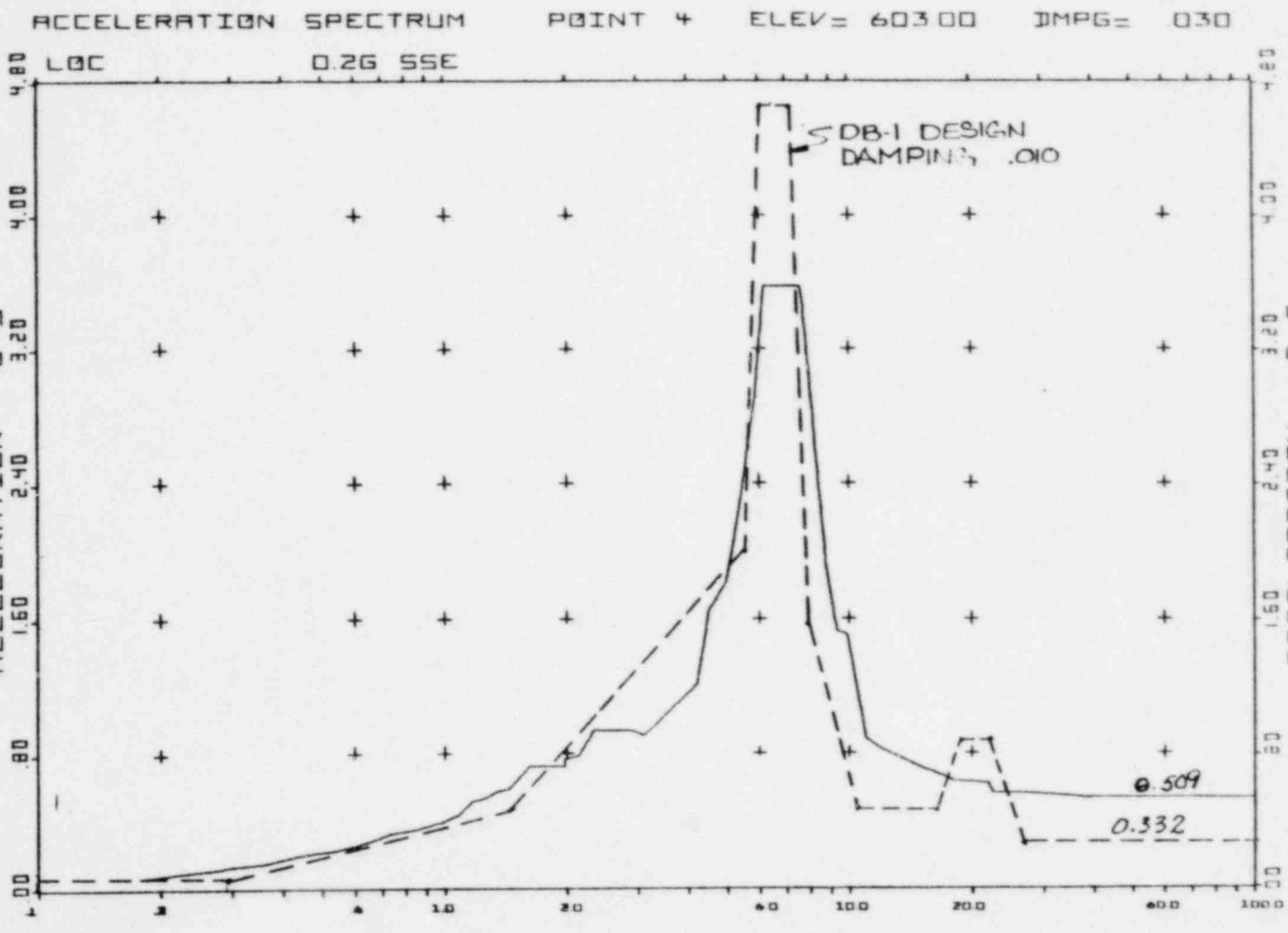
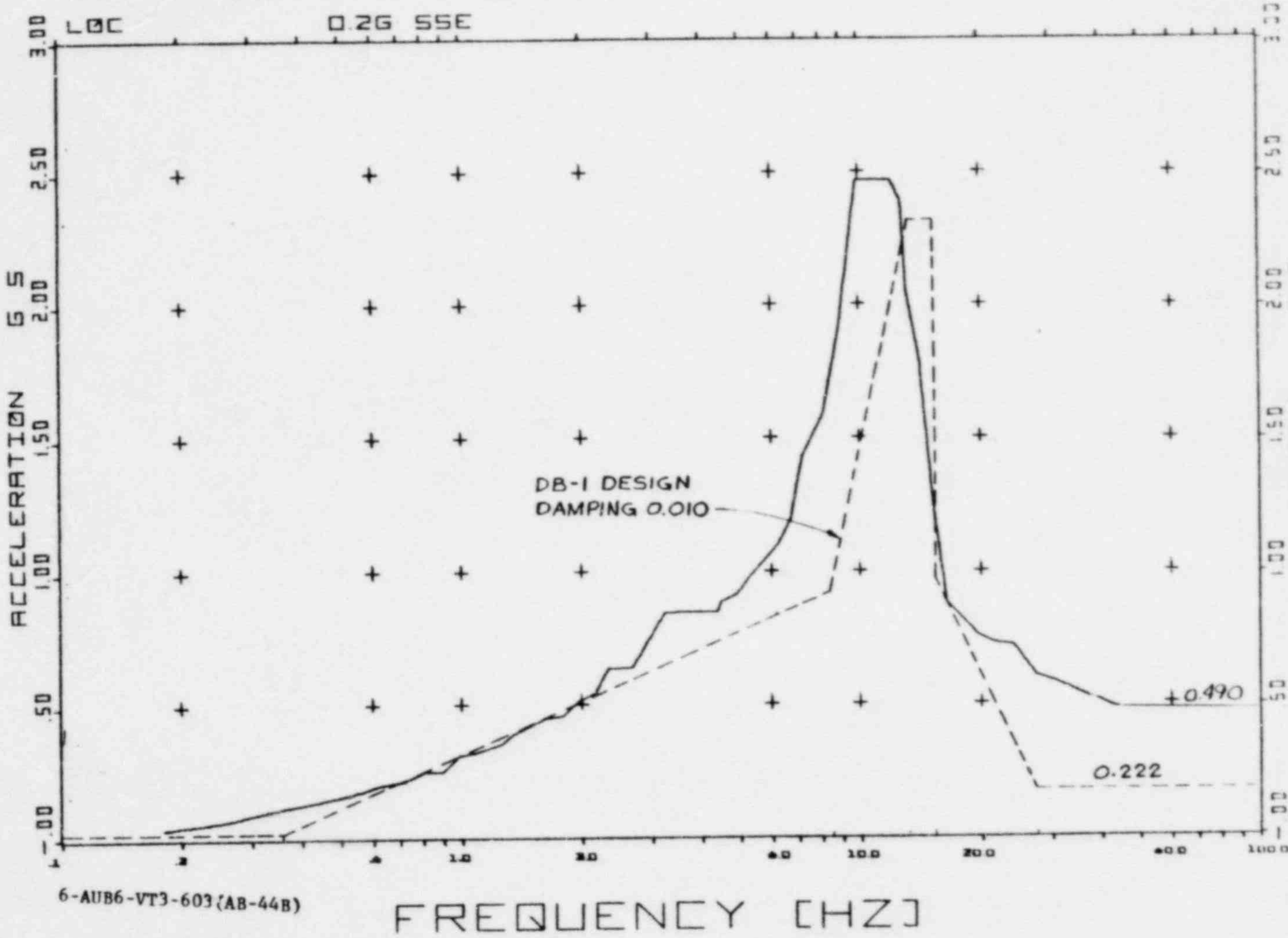


FIGURE II-30C

DAVIS-BESSE UNIT 1 AUX BLDG AREA 6 VT FLOOR RESPONSE SPECTRA

ACCELERATION SPECTRUM   POINT 4   ELEV= 603.00   DMPG= .030



6-AUB6-VT3-603 (AB-44B)

FREQUENCY [HZ]

FIGURE II-31A

DAVIS-BESSE UNIT 1 AUX BLDG AREA 7 NS FLOOR RESPONSE SPECTRA

ACCELERATION SPECTRUM   POINT 1   ELEV= 565.00   DMPG= .030

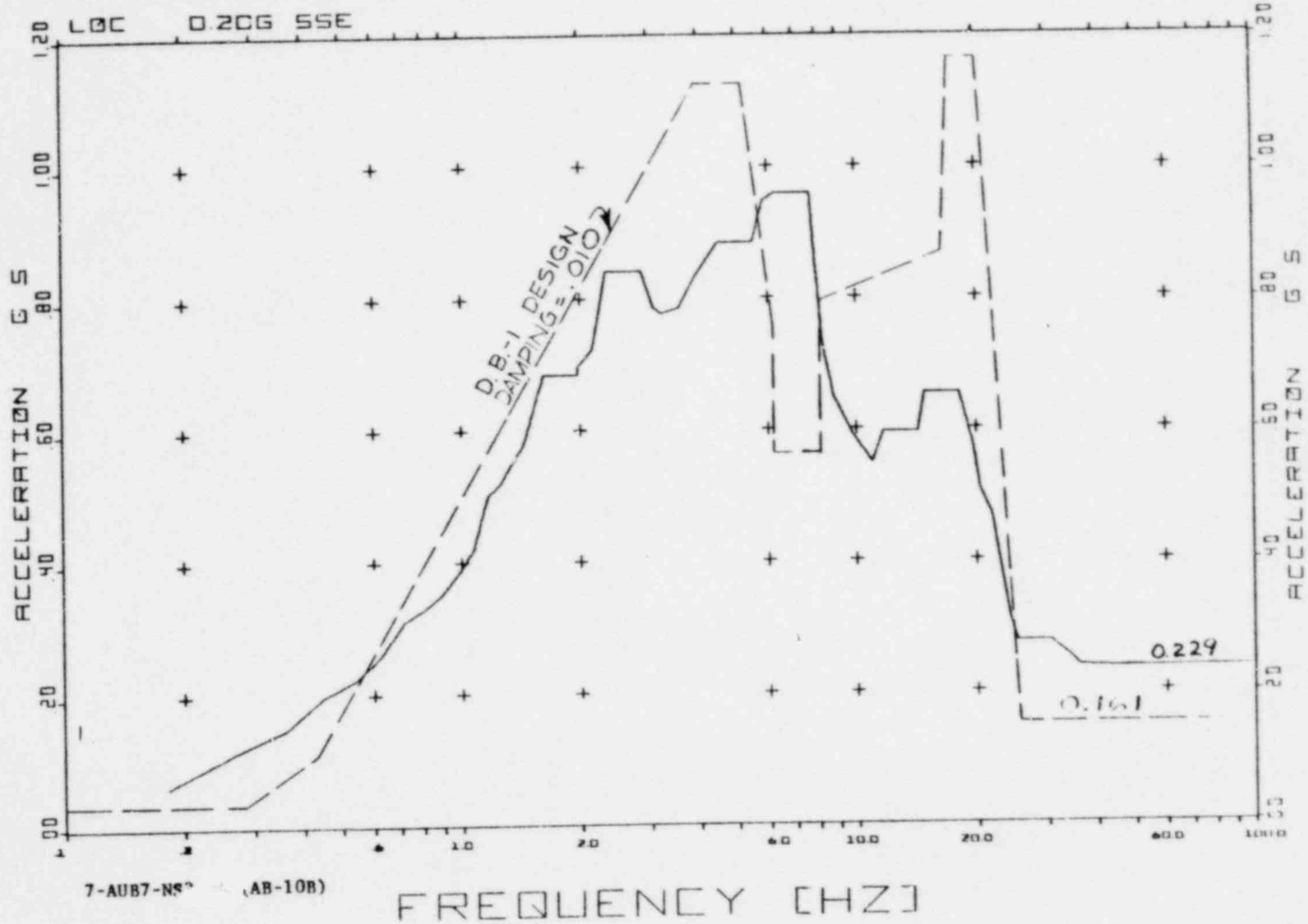


FIGURE II-31B

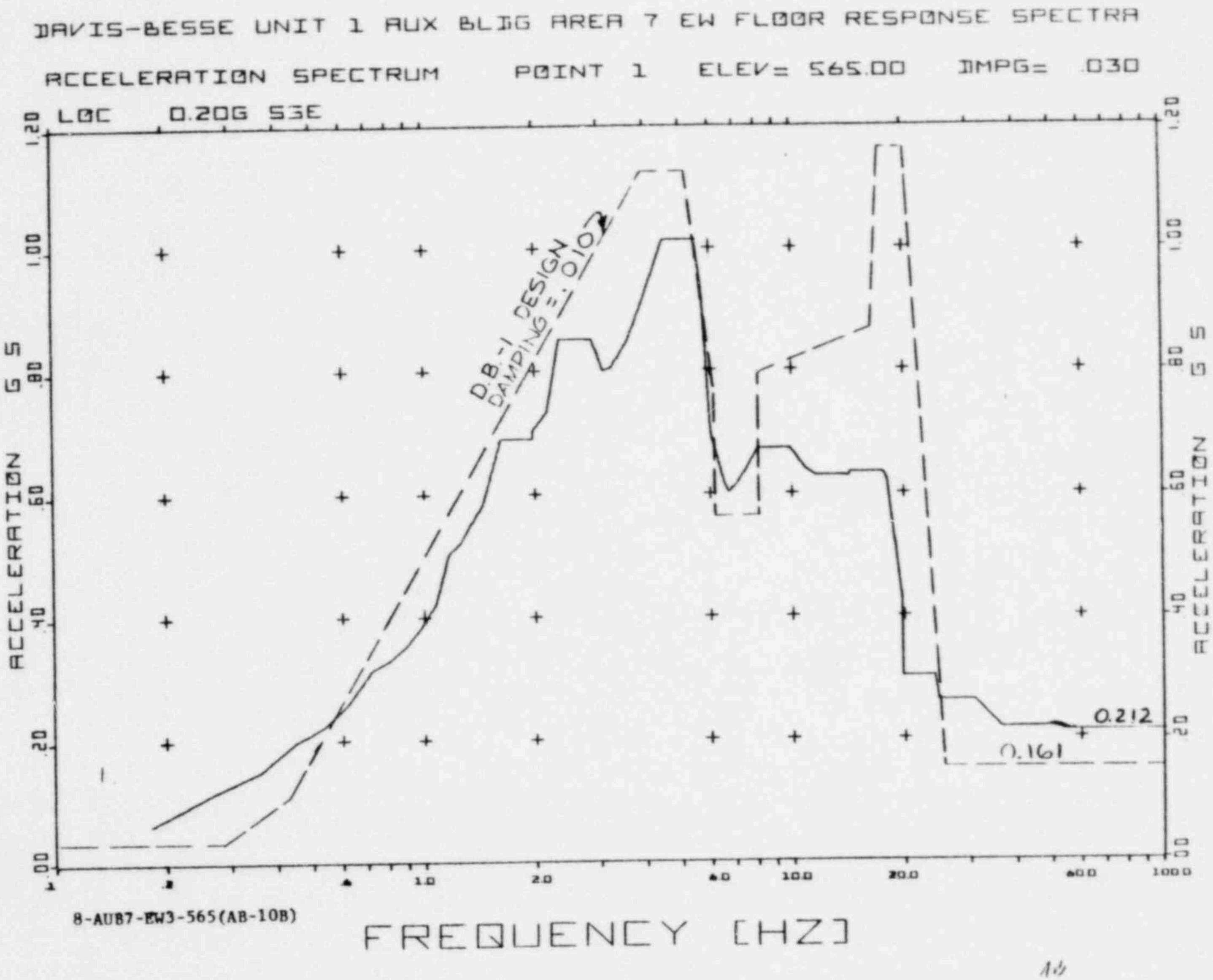


FIGURE II-31C

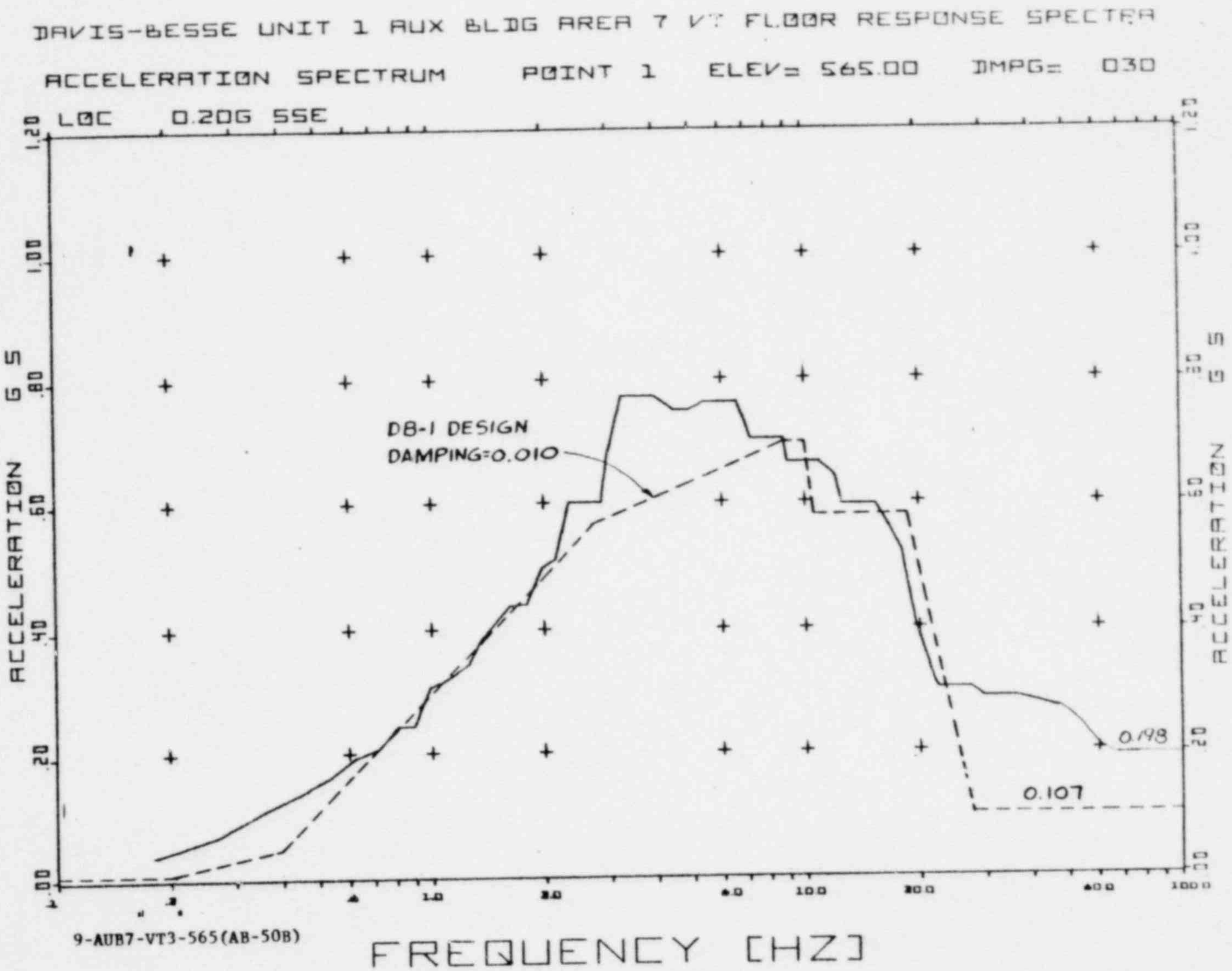


FIGURE II-32A

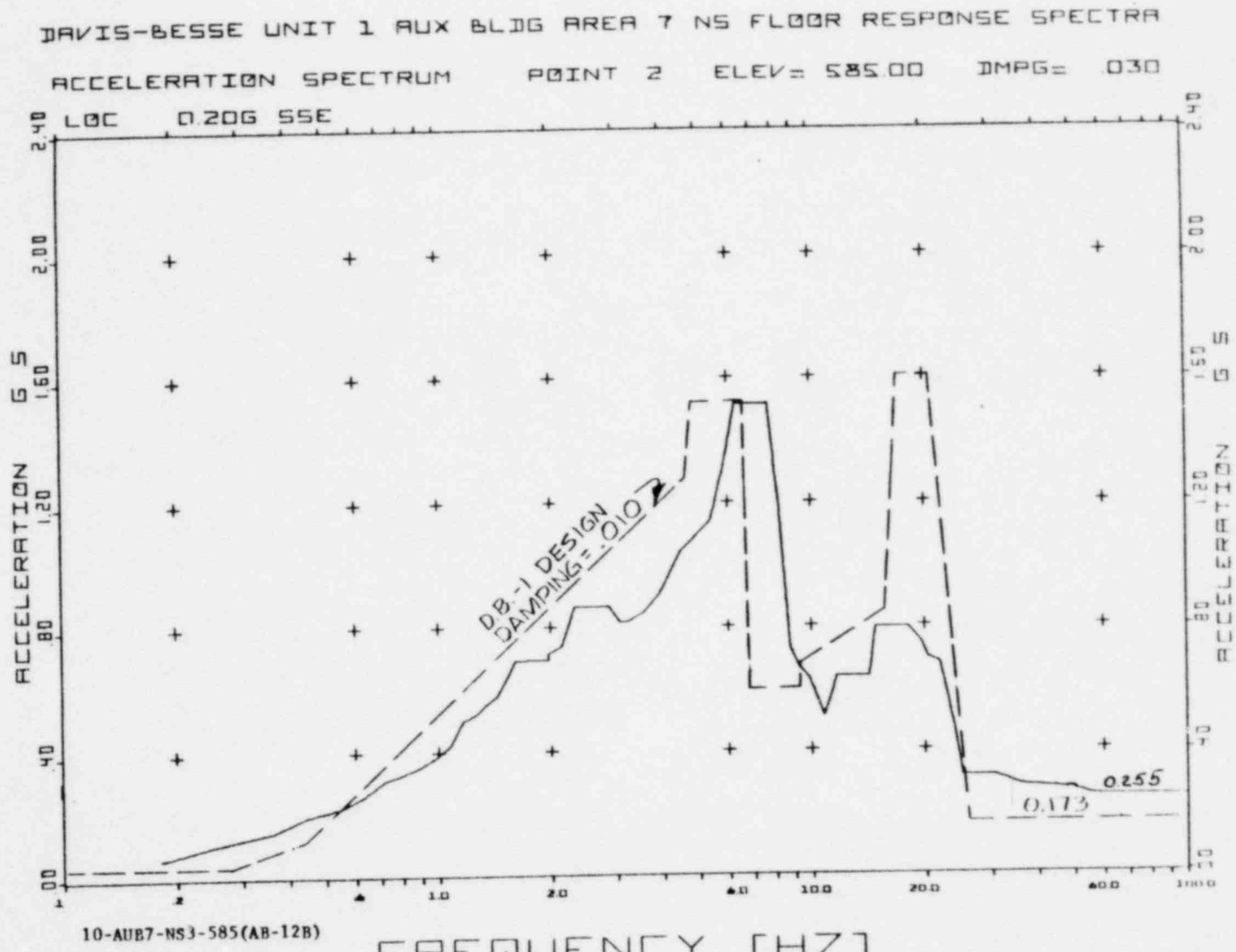


FIGURE II-32B

DAVIS-BESSE UNIT 1 AUX BLDG AREA 7 EW FLOOR RESPONSE SPECTRA

ACCELERATION SPECTRUM POINT 2 ELEV= 585.00 DMPG= .030

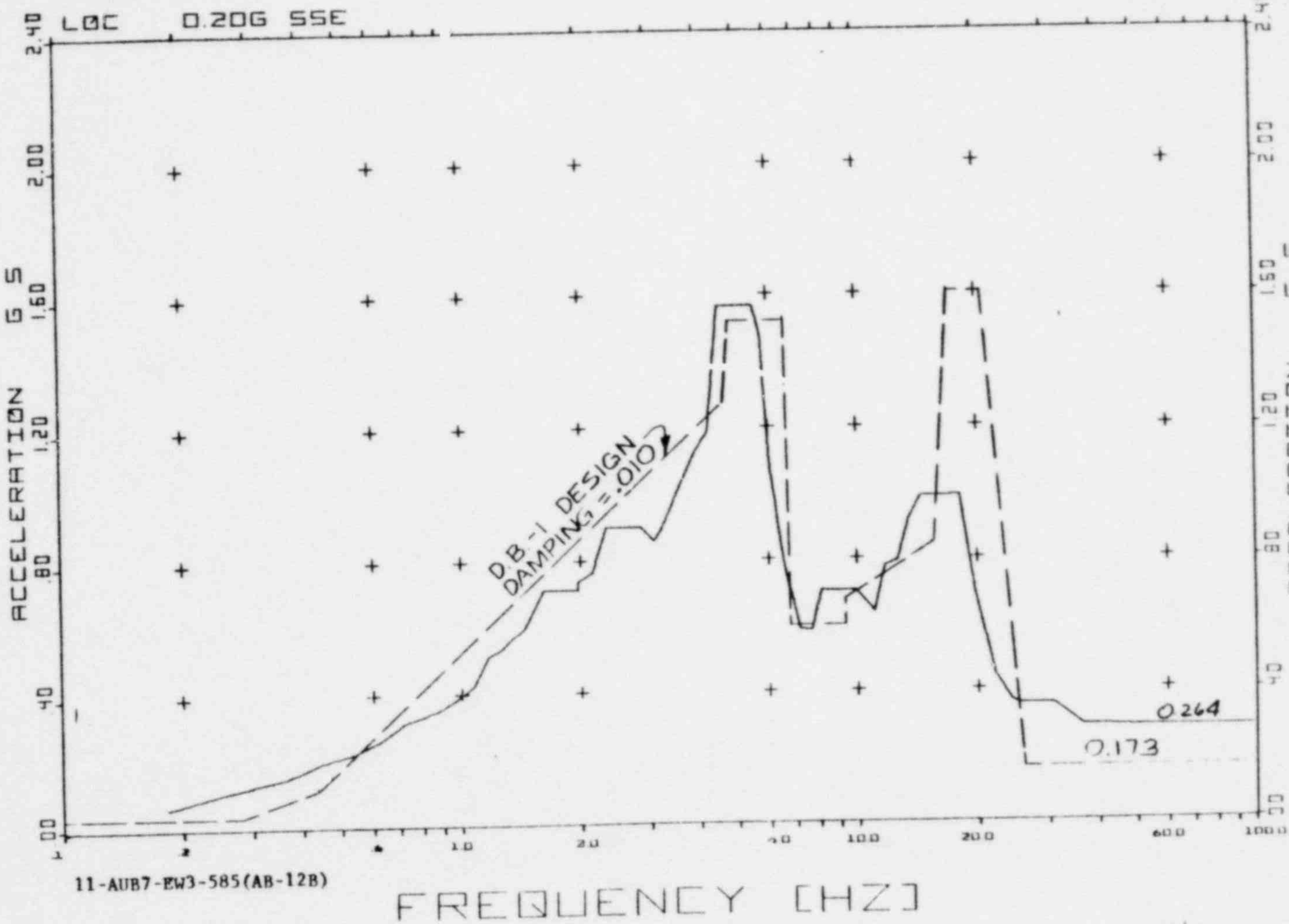


FIGURE II-32C

DAVIS-BESSE UNIT 1 AUX BLDG AREA 7 VT FLOOR RESPONSE SPECTRA

ACCELERATION SPECTRUM POINT 2 ELEV= 585.00 DMPG= 030

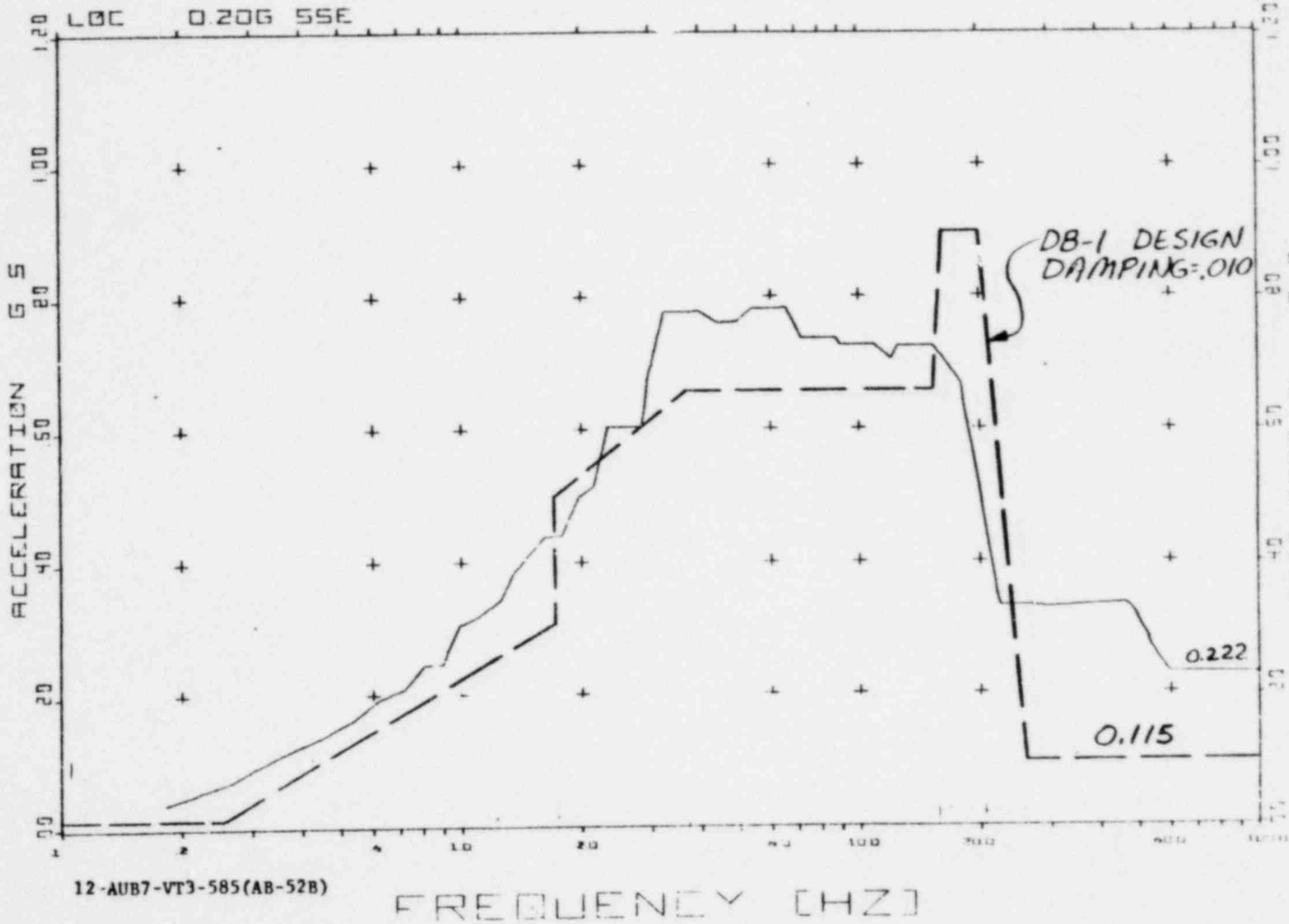


FIGURE II-33A

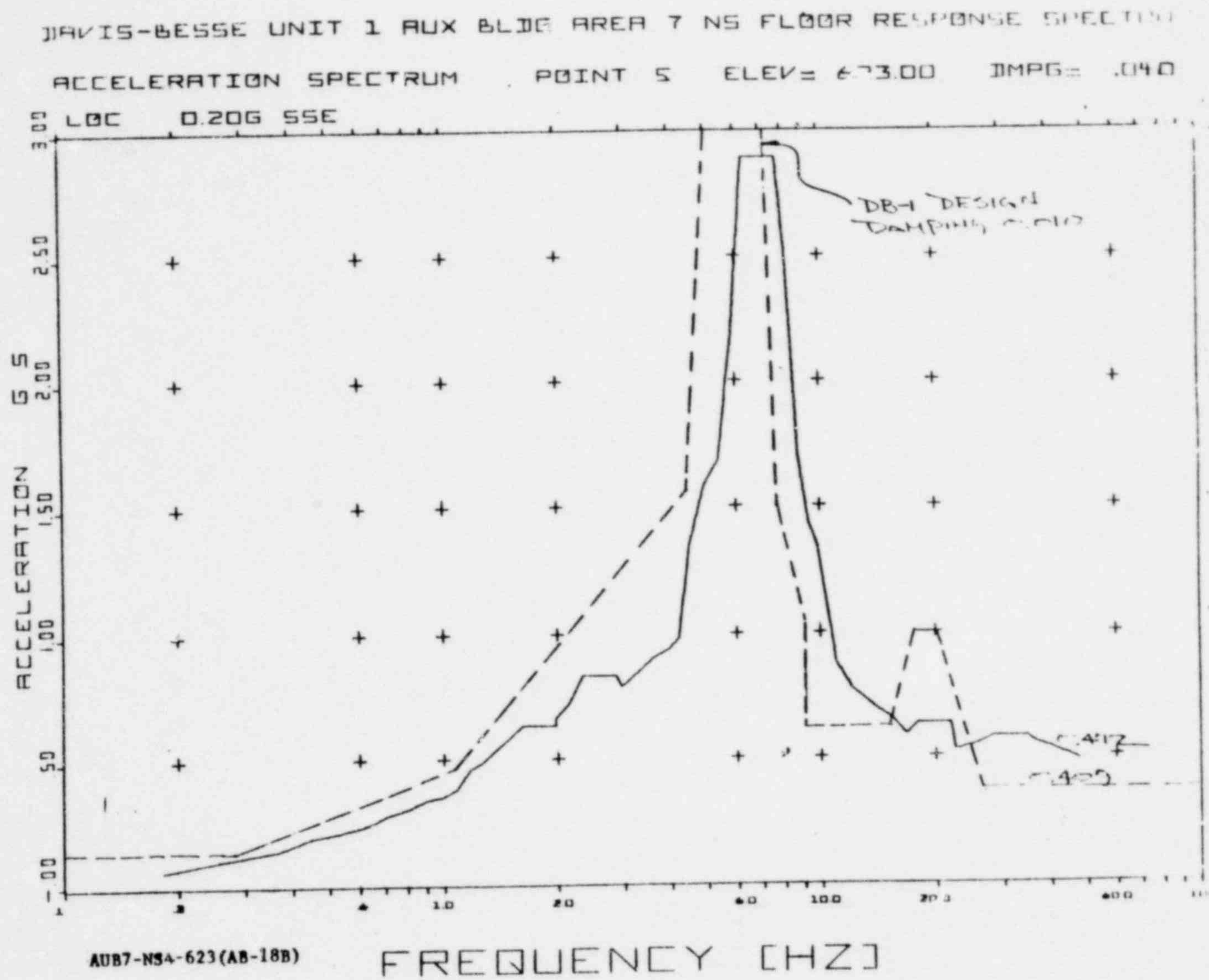
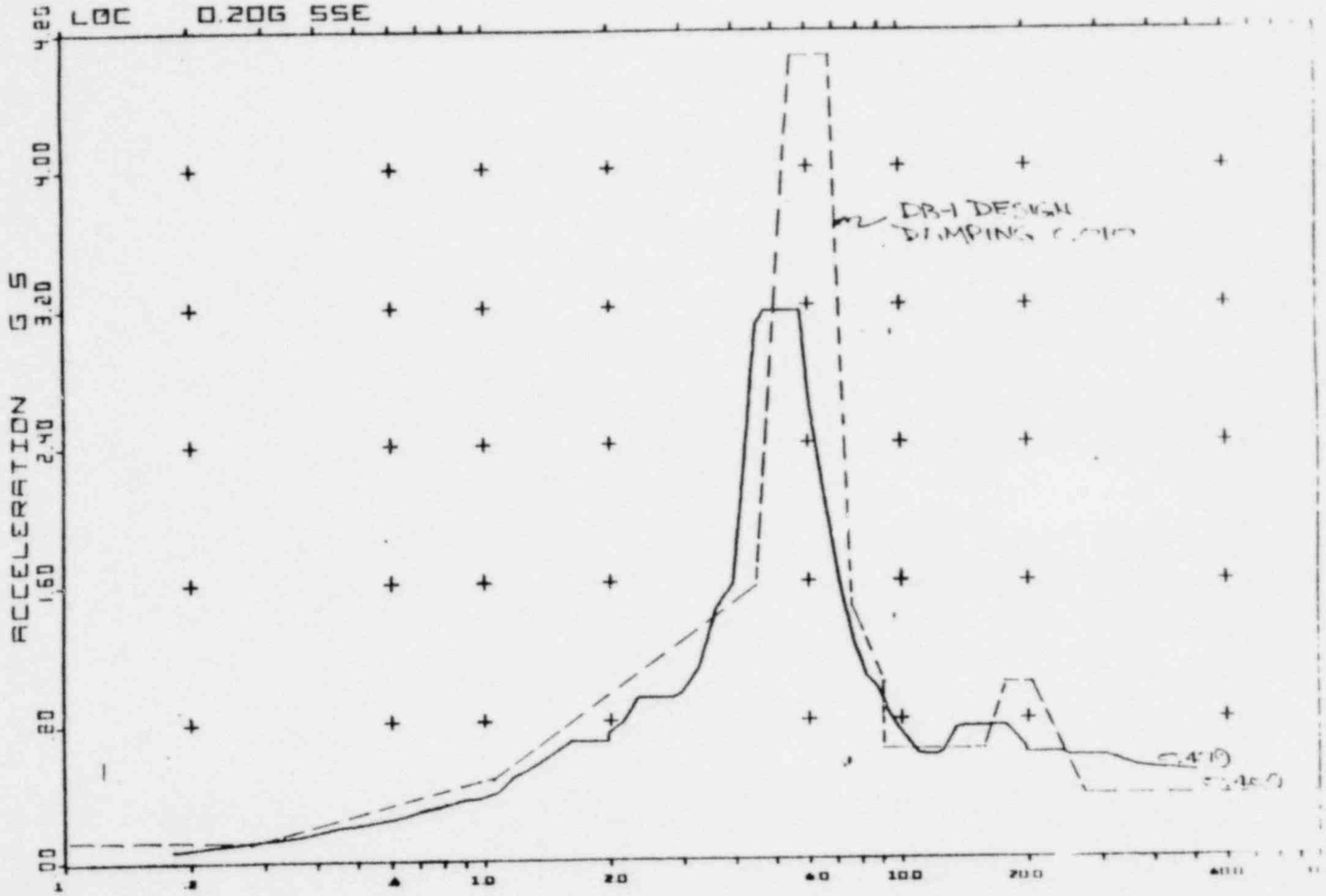


FIGURE II-33B

DAVIS-BESSE UNIT 1 AUX BLDG AREA 7 EW FLOOR RESPONSE SPECTRUM

ACCELERATION SPECTRUM POINT 5 ELEV= 623.00 DAMPING .040

LOC 0.20G SSE



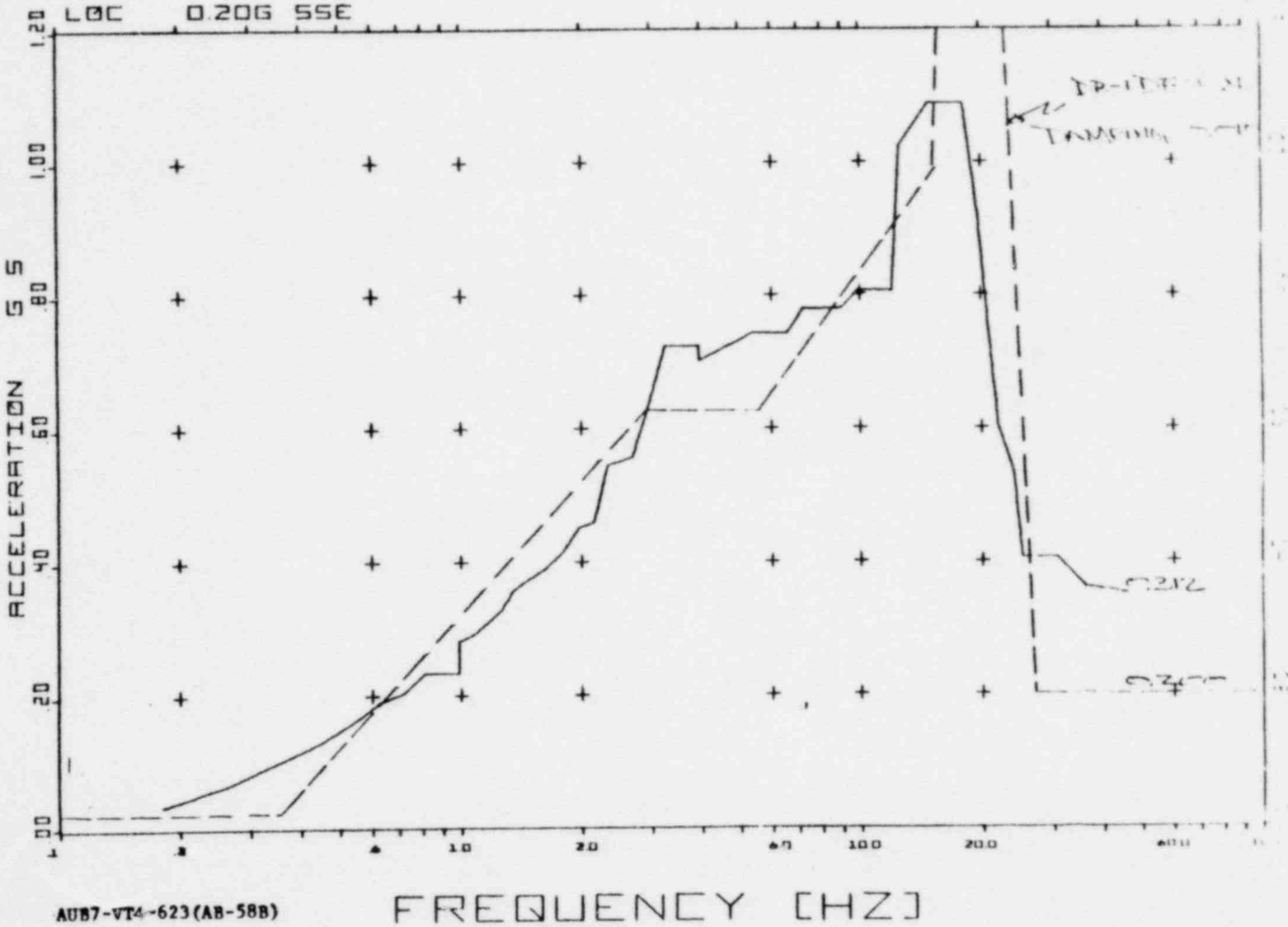
AUB7-EW4-623(AB-18B)

FIGURE II-33C

DAVIS-BESSE UNIT 1 AUX BLDG AREA 7 VT FLOOR RESPONSE SPECTRUM

ACCELERATION SPECTRUM POINT 5 ELEV= 623.00 DMPG= .040

LOC 0.20G SSE

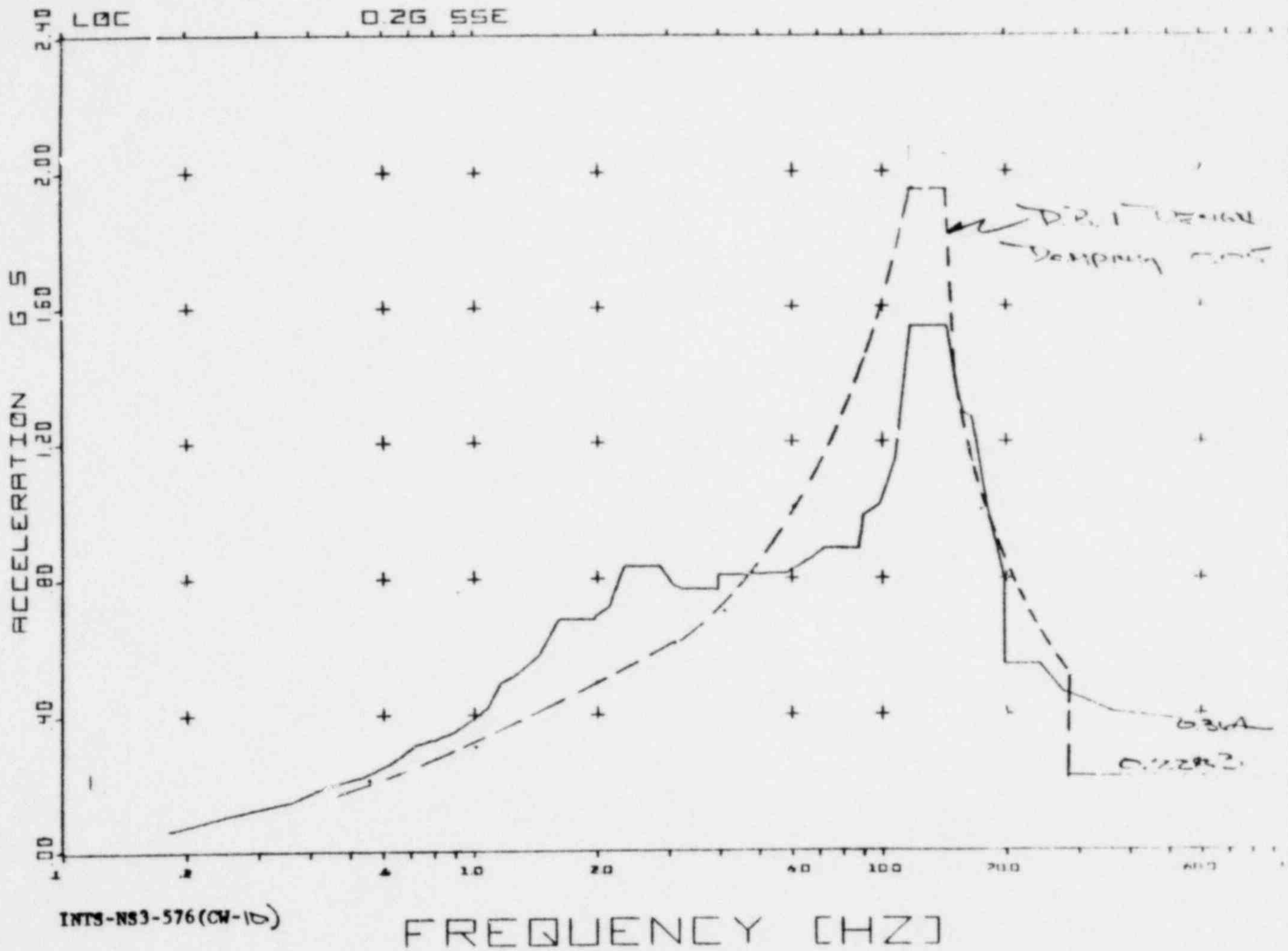


AUB7-VT4-623(AB-58B)

FIGURE II-34A

DAVIS-BESSE UNIT 1 INTAKE STRUCTURE NS FLOOR RESPONSE

ACCELERATION SPECTRUM POINT 2 ELEV= 576.00



Supplement 1

FIGURE II-34B

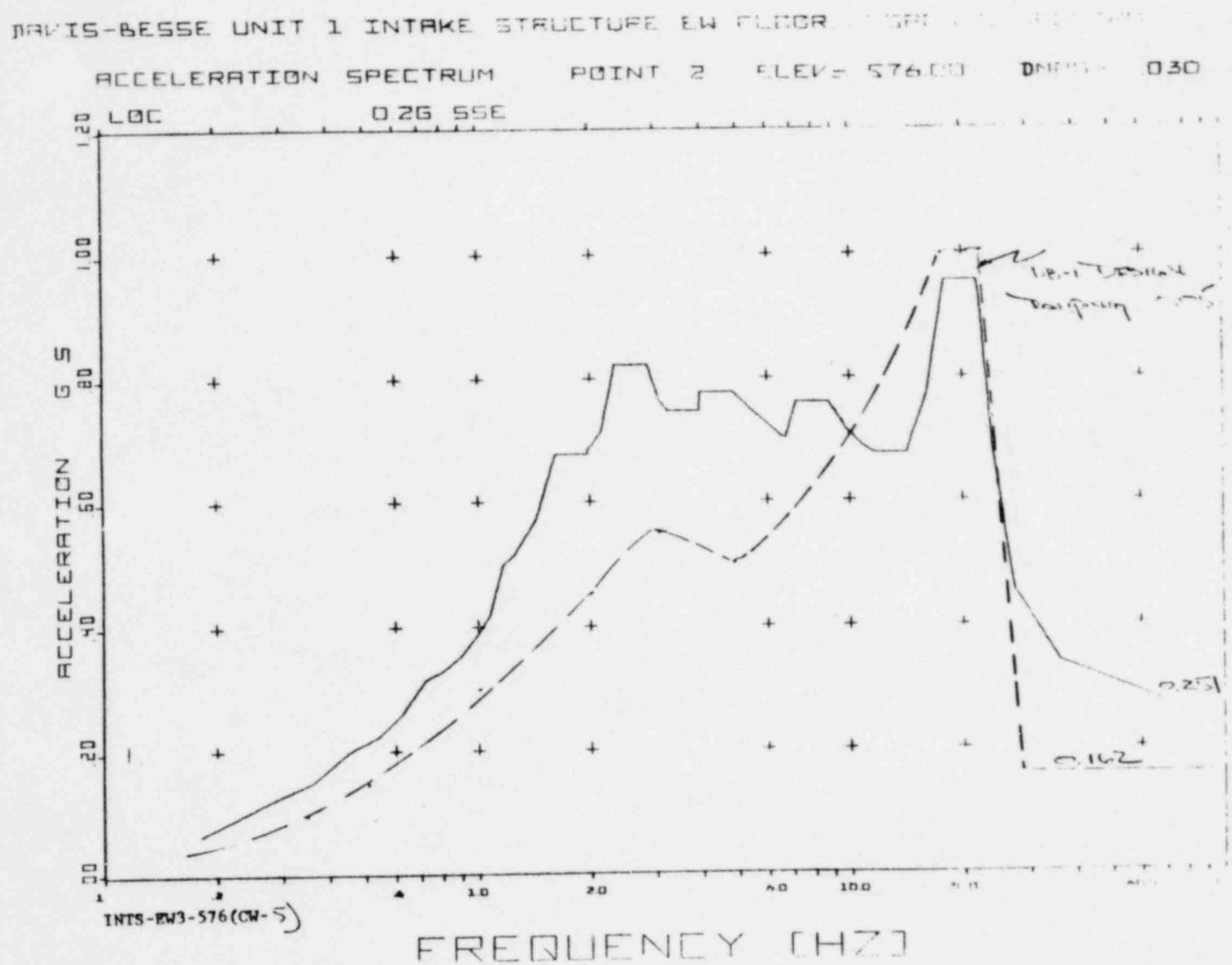
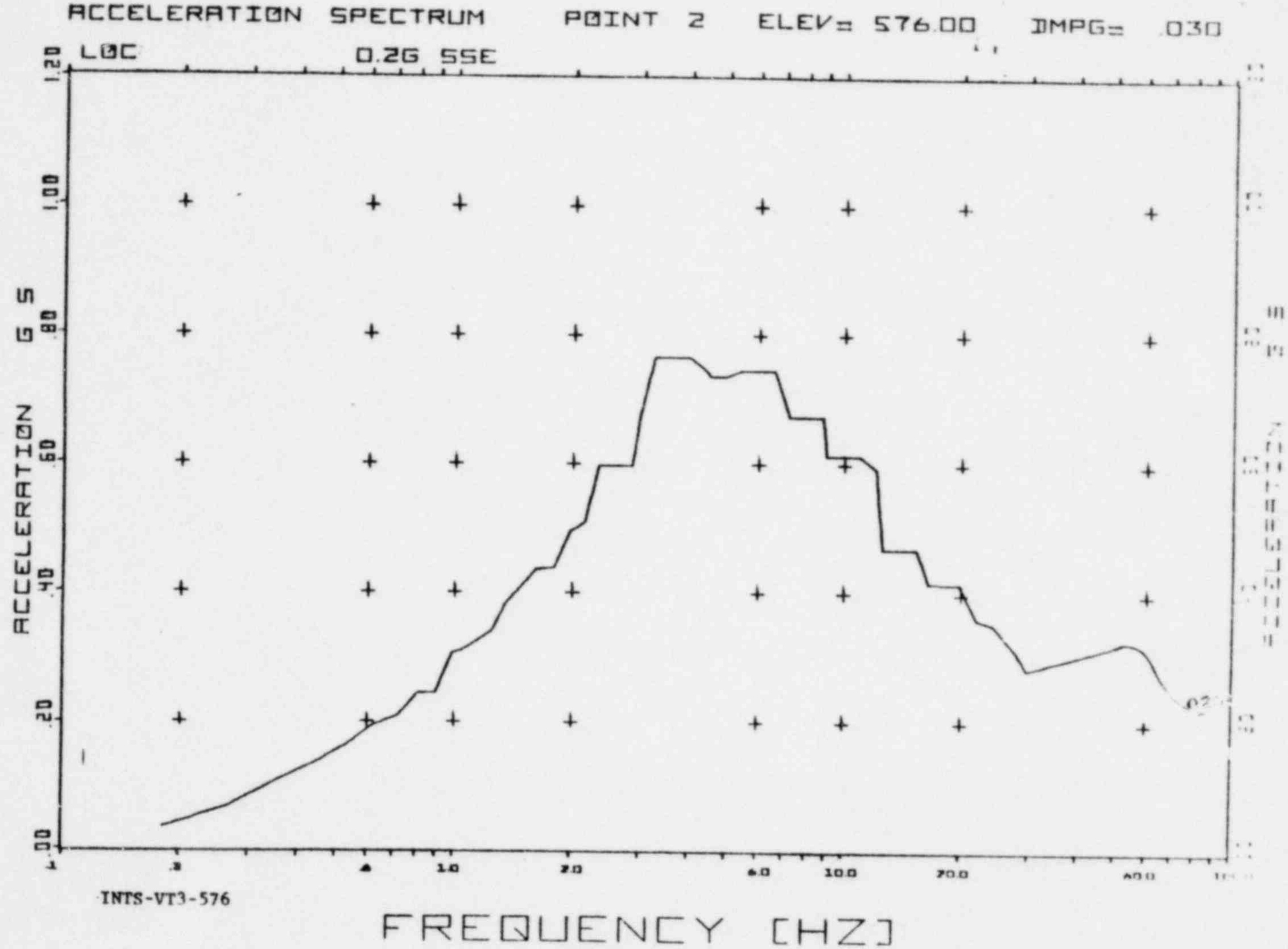


FIGURE II-34C

DAVIS-BESSE UNIT 1 INTAKE STRUCTURE VT FLOOR RESPONSE SPECTRA



VI. EVALUATION OF MECHANICAL EQUIPMENT, ELECTRICAL EQUIPMENT, AND INSTRUMENTATION

1. Introduction

1.1 Various components have been selected for evaluation which are representative of mechanical, electrical, and control systems components required for shutdown. The components selected were those listed in Attachment 1 of the NRC Staff guidance transmittal of January 30, 1979. These components have either been evaluated or are in the process of being evaluated to provide a high degree of assurance that safe shutdown and continued heat removal can be accomplished after an SSE of 0.20g acceleration. As discussed in Section I, the completed reevaluation of the emergency desel generator will be included in a supplement to this report. 1

1.2 Table VI-1 lists the components selected for evaluation and summarizes the pertinent information for each component. It includes the location of the component, the figure number (figure to be found in Section II) giving the appropriate response spectra for that location, the method of qualification for the component, and the data sheet number where more detailed seismic qualification information is provided. The data sheets are included in this section. They follow the format of Attachment 2 of the NRC letter. A brief discussion of the qualification of the selected equipment follows.

2. Electrical Components (Table VI-1 Items 13-18 and 20-21)

2.1 All safety related electrical equipment has been qualified either by test or analysis on the basis of the appropriate floor response spectra generated by the 0.15g SSE. Reference to Table VI-1 indicates the method of qualification.

2.2 The revised floor response spectra have been used to determine the margin available for the 0.20g acceleration SSE.

2.3 For the components which were qualified for the 0.15g SSE by testing, the test method was either sine beat or sine dwell, with highly conservative input levels. In some cases, equipment was subjected to as many as 75 sine beat tests and to sine dwells as long as 45 seconds.

Based on the high input levels and the conservative nature of sine beat and sine dwell testing at resonance and integer frequencies, it is concluded that the margin for each component is sufficient to qualify it to the revised seismic requirements.

2.3.1 As an example of the above, the 5 KV metal clad switchgear (Item 13 of Table VI-1) is discussed here. In this case, damping was first determined using sine sweep and the relation

$$\xi = \frac{1}{2Q}$$

Where ξ = damping (percent of critical damping)
Q = amplification

Quasi-resonance magnification curves were used to compare floor response spectra curves to maximum equipment buildup at resonance. The amplification was determined to be 5.5 times the peak value of the sine beat input acceleration. The required test input was determined to be 0.21g. However, the actual test input excitation was 0.8g, approximately four (4) times the required level.

The revised floor response spectra, based on the 0.20g zero period acceleration (ZPA) SSE using 3 percent damping, normalized to 5 percent damping (consistent with the component damping), indicates a peak floor response at the equipment mounting location of 2.16g in the peak range of 5-7 hertz. The required test input is determined to be 0.39g. Since the actual test input was 0.8g, the required input for the 0.20g SSE is exceeded by a factor of two (2).

2.3.2 The other components which were qualified by sine beat or sine dwell testing were evaluated for margin, and in all cases, there was sufficient margin to qualify the components for the revised (0.20g) SSE requirements.

2.4 Items 16 and 18 of Table VI-1 were qualified by analysis. Their respective data sheets indicate the stresses calculated for the 0.15g SSE on the critical structural elements. The seismic factor (defined in Section IV, Paragraph 1.1) is also calculated for these components.

2.4.1 The seismic factor for the critical structural elements of the unit substation transformers are quite large, indicating a large available stress reserve. Obviously, the transformers would function under the imposition of a 0.20g SSE.

2.4.2 The seismic factor for the critical elements of the battery racks for the 0.15g SSE are not as high, but still provide margin for a higher SSE. To ensure that these critical elements would not be overstressed due to a 0.20g SSE, the stresses and the seismic factor for such an SSE have been calculated and are reported below:

Identification	(a) Seismic Stress	(b) Total Stress	(c) Stress Allowable	(c) - (b) / (a)
Unistrut P-1000 (pc. 3)	23643	27592	28800	0.05
Side and End Stringers (pcs. 12 & 13)	*	26064	28800	0.11
Tubing (pc. 10)	*	22820	28800	0.26
Brace	*	6025	7390	0.23
Angle Iron Frame Support (pc. 1)	14064	22980	28800	0.41
Anchor Bolts	*	27952	38800	0.388
Tube Connection to Bottom Support	*	15918	28800	0.809
Channel Connection to Bottom Support	*	18695	22000	0.177

* assume seismic stress is total stress

2.4.3 In the cases noted above where qualification was demonstrated by analysis, it is concluded that stresses were below the allowables for both the 0.15g and 0.20g SSE cases. Therefore, there is sufficient margin to qualify the components for the revised (0.20g) SSE requirements.

3. <u>Control Panels and Instruments</u> (Table VI-1 Item 19)

3.1 The auxiliary shutdown panel was evaluated as representative of a control panel with instruments required for shutdown. The panel was qualified by analysis, while the instruments were qualified by testing, for the 0.15g SSE.

3.2 The revised floor response spectra have been used to determine the acceptability of the installation for the 0.20g SSE.

3.3 The data sheet for the panel indicates the stresses calculated on the side of the panel and on the anchor bolts. The seismic factor (defined in Section IV, paragraph 1.1) is also calculated. To ensure that the panel would withstand the loads due to a 0.20g SSE, the stresses and seismic factors for such an SSE have been calculated and are reported below:

Identification	(a) Seismic Stress	(b) Total Stress	(c) Stress Allowable	$\frac{(c) - (b)}{(a)}$
Panel	780 psi	780 psi	1610 psi	1.1
Anchor Bolts	9 ksi	9 ksi	20 ksi	1.2

The maximum deflection is calculated to be 0.0049 inch. This will not adversely affect functional operability.

The natural frequencies of vibration are greater than 33 Hz for the structural system and various panel sections including the instrument package panels. Dynamic amplification of the flat spectra response of seismic acceleration is found to be a maximum of 0.87g in the structural system in the horizontal direction and 0.47g in the vertical direction. Use of these amplified dynamic loads as well as static loads with both horizontal and vertical effects show the bending, tensile and shear stresses in the various structural members and connections to be much lower than the maximum allowable stresses. Stresses in the anchor bolts are quite low and load capacity in the welds are quite high. Displacements in the instrument package panel sections are quite small and will not cause loss of function of the equipment. Loading of the panel plate sections and panel frame has been found to be much less than that required for buckling. The analysis methods used subjected the structural elements to more critical conditions than would be encountered by the structural system in a prototype environment. It is concluded that the panel is structurally adequate to function properly when subjected to loadings associated with a 0.20g SSE.

3.4 The seismic test reports for the instruments mounted on the auxiliary shutdown panel have been reviewed. The data sheets summarize the pertinent information. The qualification testing envelops the revised response spectra, ensuring that the instruments will be operable for the 0.20g SSE.

4.0 Mechanical Components (Table VI-1 Items 1-12 and 21-24)

4.1 Mechanical components required to accomplish safe hot shutdown after a seismic event and continued shutdown heat removal were originally qualified by analysis on the basis of the appropriate floor response spectra generated by a 0.15g SSE. A review and/or reanalysis has been performed for Items 1-12 and 21-24 to determine the margins available for a 0.020g acceleration SSE. In some cases, 1
the original seismic analysis (0.15g SSE) used acceleration values which envelope the acceleration values generated by a 0.20g SSE floor response spectra. In these cases, a reanalysis was not required. In most cases, however, a new seismic analysis was performed on the basis of the appropriate floor response spectra generated by a 0.20g SSE. The mechanical components are listed in Table VI-1, Items 1-12 and Items 21-24.

4.2 A summary of the reanalysis for each of the mechanical components listed in Table VI-1 is described below. Items 21, 22, 23, and 24 were added to the Table by Toledo Edison after a review of the equipment required to accomplish safe hot shutdown after a seismic event and continued shutdown heat removal.

4.2.1 Auxiliary Feedwater Pumps

The original seismic analysis performed by the pump vendor (Byron Jackson) showed that the equipment is qualified for a 0.15g SSE. Byron Jackson revised their original seismic analysis to incorporate the required accelerations for a 0.20g SSE. This revised analysis showed the equipment had adequate margins when subjected to a 0.20g SSE. See Data Sheet 1. All stresses and deflections were within the allowable values.

4.2.2 Component Cooling Water Heat Exchangers

The original seismic analysis performed by the vendor (Structhers Wells) showed that the equipment is qualified for the 0.15g SSE. The vendor performed a new seismic analysis incorporating the required accelerations for a 0.20g SSE. The new analysis used current state-of-the-art techniques for modeling the heat exchanger and resulted in the determination of lower natural frequencies. These lower natural frequencies and the current 1
state-of-the-art modeling techniques resulted in the analysis showing insufficient margin for the anchor bolts and the base of the fixed support.

The original analysis was then reviewed using the current analytical techniques. This review indicated that for 0.15g SSE the anchor bolts and base of the fixed support did not meet their original design margin. Therefore, it was decided to modify the saddle supports during the spring 1980 refueling outage to meet their original design margins for a 0.15g SSE. These modifications also provide margin when the heat exchanger is subjected to a 0.20g SSE. It should be emphasized that this modification was made due to a change in analytical methodology and not inadequate margin for a 0.20g SSE. The calculated stress values shown in Data Sheet 2 reflect the modified saddle supports.

4.2.3 Diesel Fuel Oil Day Tanks

The vendor (Richmond Engineering Company) revised the original seismic analysis to incorporate the required accelerations for a 0.20g SSE. The new analysis showed that the expansion anchors did not have a factor of safety of at least 4.0 in accordance with the bolt manufacturer's recommendation. A review of the as-built anchoring condition for the tank revealed that the anchor bolts did not have a factor of safety of 4.0 for a 0.15g SSE. However, the installed factor of safety was greater than 2.0. Modifications to the tank saddle supports are presently being made during the Spring 1980 refueling outage so that the installed factor of safety will be greater than 4.0 for a 0.15g SSE. This will also provide adequate margin for a 0.20g SSE. It should be emphasized that these modifications were necessitated by as-built conditions and not an increase in SSE accelerations from 0.15g to 0.20g.

The vendor's new seismic analysis for a 0.20g SSE shows that the circumferential bending stress at the horn of the saddle is greater than the allowable stress.

Based on a review of the conservatisms in the code and the vendors conservative analytical techniques, we believe that there is still sufficient margin in the design against failure.

4.2.4 Service Water Pumps and Motors

The original seismic analysis performed by the pump vendor (Goulds Pumps) showed that the equipment is qualified for a 0.15g SSE. Goulds Pump revised their original seismic analysis to incorporate the required accelerations for a 0.20g SSE. This revised analysis showed the equipment had adequate margins when subjected to a 0.20g SSE. See Data Sheet 4. The original seismic analysis which was done for the motors used seismic accelerations which are higher than the accelerations required by either a 0.15g SSE or a 0.20g SSE. The seismic accelerations used for the motor analysis are shown on Data Sheet 4. All stresses and deflections for the pumps and motors were within the allowable values.

4.2.5 Auxiliary Feedwater Pump Turbine

The original seismic analysis which was done for the auxiliary 1
feedwater pump turbine used seismic accelerations which are higher than the accelerations required by either a 0.15g SSE of a 0.20g SSE. The seismic accelerations used for the analysis are shown on Data Sheet 5. All stresses and deflections were within the allowable values.

4.2.6 Borated Water Storage Tank

The seismic loads for a 0.20g SSE were calculated by Bechtel Power Corporation. These calculations showed that the loads for a 0.20g SSE are lower than the seismic loads used for the original tank design based on a 0.15g SSE. Stress checks indicate that all stresses calculated for a 0.20g SSE were well below allowable values. Reference Data Sheet 6.

4.2.7 Emergency Diesel and Generator

The original seismic analysis performed by the vendor (Bruce GM Diesel, now Power Systems) showed that this equipment is qualified for a 0.15g SSE. The vendor is presently in the process of preparing a new seismic analysis report incorporating the required accelerations for a 0.20g SSE. The preliminary results of the new analysis will be completed by June 6, 1980 and will be reported by June 12, 1980. The equipment supplier, Power Systems, has stated that, based on 0.15g SSE analysis, the margins for all items analyzed were high and that a significantly higher seismic load could be carried before exceeding allowable stresses. Therefore, we anticipate that the new seismic analysis will verify the equipment to have adequate margin to withstand a 0.20g SSE.

4.2.8 Emergency Diesel Cooling Water Heat Exchanger

This equipment is included in the analysis of the emergency diesel and generator. Refer to Paragraph 4.2.7.

4.2.9 Decay Heat Removal Cooler

The original seismic analysis performed by the equipment supplier (Atlas, a supplier to Babcock and Wilcox) showed that the coolers are qualified for a 0.15g SSE. Babcock and Wilcox evaluated the new seismic response curves to determine the applicable loads for a 0.20g SSE. The new loads were considerably less than those used by Atlas in the design of the coolers. Therefore, the coolers have sufficient margin to withstand a 0.20g SSE. Refer to Data Sheet 9.

4.2.10 Decay Heat Removal Pump and Motor

The original seismic analysis performed by the vendor (B&W) showed that the equipment is qualified for a 0.15g SSE. B&W reevaluated the critical structural components based on the peak accelerations of the applicable 0.20g SSE response spectra, and showed that all stresses for the pump and motor were within allowable values. Refer to Data Sheet 10. 1

4.2.11 Decay Heat Removal Suction Valves HV-DH11 and HV-DH12 and Motor Operators

The original seismic analysis which was done for these valves and motor operators used seismic accelerations which are higher than the accelerations acting on the valves during either a 0.15g SSE or a 0.20g SSE. The accelerations used in the seismic analysis are shown on Data Sheet 11. All stresses were within allowable values.

4.2.12 Auxiliary Feedwater Pump Steam Inlet Valve MS-106

The original seismic analysis which was done for this valve and motor operator used seismic accelerations which are higher than the accelerations acting on the valve during either a 0.15g SSE or a 02.0g SSE. The accelerations used in the seismic analysis are shown on Data Sheet 12. All stresses were within allowable values.

4.2.13 Component Cooling Water Pumps and Motors

The original seismic analysis performed by the pump vendor (Goulds Pumps) showed that the equipment is qualified for a 0.15g SSE. The vendor performed a new seismic analysis to incorporate the required accelerations for a 0.20g SSE. The new analysis showed the equipment had adequate margins when subjected to a 0.20g SSE. See Data Sheet 21. The original seismic analysis which was done for the motors used seismic accelerations which are a higher than the accelerations required by either a 0.15g SSE or a 0.20g SSE. The seismic accelerations used for the motor analysis are shown on Data Sheet 21. All stresses and deflections for the pumps and motors were within the allowable values.

4.2.14 Component Cooling Water Surge Tank

The original seismic analysis performed by the tank vendor (Brown-Minneapolis) showed that the equipment is qualified for a 0.15g SSE. A new seismic analysis was done by Bechtel Power Corporation to incorporate the required accelerations for a 0.20g SSE. All stresses and deflections for the tank were within the allowable values. Refer to Data Sheet 22.

4.2.15 Diesel Fuel Oil Storage Tank

The original seismic analysis performed by the tank vendor (Rich-
mond Engineering Company) showed that the equipment is qualified
for a 0.15g SSE. The vendor reanalyzed the equipment based on
the 0.20g SSE response spectra, and the reanalysis showed no 1
appreciable difference (0.26 percent increase) in seismic accelera-
tion response of the vessel from that used in the original anal-
ysis. Therefore, it is concluded that the vessels have adequate
margins to withstand a 0.20g SSE. See Data Sheet 23.

4.2.16 Diesel Fuel Oil Storage Tank Transfer Pumps and Motors

The original seismic analysis which was done for this equipment used seismic accelerations which are higher than the accelerations required by either a 0.15g SSE or a 0.20g SSE. All stresses and deflections were within the allowable values. The analysis used accelerations of 1.2g horizontal and 0.8g vertical, and considered the horizontal and vertical loads to act simultaneously. The peak acceleration values applicable for these pumps are 0.75g horizontal and 0.72g vertical as shown in Figure II-1 and II-2 (using 3 percent damping per Table II-1). A Data Sheet has not been included for these components because additional data from the equipment supplier is not available.

5.0 Summary

5.1 The components selected and evaluated have been shown to have
sufficient margin to perform their function when subjected to an
0.20g SSE. Modifications are being made to two mechanical com-
ponents, component cooling water heat exchangers and diesel fuel 1
oil day tanks. However, these modifications are not a result of
an increase in SSE acceleration from 0.15g to 0.20g, but are the
result of reevaluating the 0.15g analysis in light of current
analytical techniques and as-built field conditions. When these
modifications are complete these components will have sufficient
margin to withstand a 0.20g SSE.

TABLE VI-1

SUMMARY OF QUALIFICATION OF SELECTED COMPONENTS

Component	Location Bldg.	Location Area	Location Elevation	Response Spectra Figure No.	Qualification Method	Data Sheet No.
1. Auxiliary feedwater pump	Aux.	7	567	II-31A, B, C	Analysis	1
2. Component cooling water heat exchanger	Aux.	7	585	II-32A, B, C	Analysis	2
3. Diesel fuel oil day tank	Aux.	6	595	II-30A, B, C	Analysis	3
4. Service water pumps	INTS.	-	576	II-34A, B, C	Analysis	4
5. Auxiliary feedwater pump turbine	Aux.	7	567	II-31A, B, C	Analysis	5
6. Borated water storage tank	Outside	-	585	II-1, II-2	Analysis	6
7. Emergency diesel and generator	Aux.	6	585	Later	Analysis	7 (Later)
8. Emergency diesel cooling water heat exchanger	Aux.	6	585	Later	Analysis	Included with Sheet No. 7
9. Decay heat removal cooler	Aux.	7	545	II-1, II-2	Analysis	9
10. Decay heat removal pump and motor	Aux.	7	545	II-1, II-2	Analysis	10
11. Decay heat removal suction valves HV DH11 and 12 and motor operators	CIS.	9	560	None See Data Sheet	Analysis	11

1

TABLE VI-1 (Continued)

Component	Location			Response Spectra Figure No.	Qualification Method	Data Sheet No.	
	Bldg.	Area	Elevation				
12. Auxiliary feedwater pump steam inlet valve MS-106	Aux.	7	624.5	None See Data Sheet	Analysis	12	1
13. 5 KV switchgear	Aux.	6	585	II-27A, B, C	Test	13	
14. Motor control center (typical of AC and DC)	Aux.	6	603	II-28A, B, C	Test	14	
15. 125 V battery and battery racks	Aux.	6	603	II-28A, B, C	Test (batteries) and analysis (racks)	15	
16. 125 V battery charger	Aux.	6	603	II-28A, B, C	Test	16	
17. 480 V unit substation transformers	Aux.	6	603	II-28A, B, C	Analysis	17	
18. Auxiliary shutdown panel and instruments	Aux.	6	585	II-27A, B, C	Analysis (panel) and test (instruments)	18A- 18F	
19. SFAS cabinets	Aux.	7	623	II-29A, B, C	Test	19	
20. SFRCS cabinets	Aux.	7	623	II-29A, B, C	Test	20	
21. Component cooling Water pumps & motors	Aux.	7	585	II-32A, B, C	Analysis	21	
22. Component cooling Water surge tank	Aux.	7	623	II-33A, B, C	Analysis	22	1
23. Diesel fuel oil Storage tank	Outside	-	585	II-I, II-2	Analysis	23	

TABLE VI-1 (Continued)

	Component	Location			Response Spectra	Qualification	Data Sheet	
		Bldg.	Area	Elevation	Figure No.	Method	No.	
24.	Diesel fuel oil storage tank transfer pumps & motors	Located inside the Diesel fuel oil storage tank		585	II-1, II-1	Analysis	Not available, see Section 4.2.16	1

NOTES:

Aux. - auxiliary building
CIS. - containment internal structures
INTS. - intake structure

Data Sheet 1

Qualification Summary of Equipment

I. Plant Name: Davis-Besse 1 — Type:

1. Utility: Toledo Edison — PWR √

2. NSSS: B & W 3. A/E: Bechtel — BWR

II. Component Name: Auxiliary Feedwater Pumps

1. Scope: [ ] NSSS [X] BOP

2. Model Number: 4x6x9D-7 Stage DVMX Quantity: 2

3. Vendor: Byron Jackson Pump Division

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance Horizontal centrifugal turbine-driven pump

   b. Dimensions 12'-3" L x 3'-7" W x 4'-7" H

   c. Weight Approx. 5,000 lbs.

6. Location: Building Auxiliary Building, Area '

   Elevation 565 Feet

7. Field Mounting Conditions [X] Bolt (No. 8, Size 1½")
   [ ] Weld (Length ____)
   [ ] ____

8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   ALL: 152 Hz. F/B: 162 Hz. V: 336 Hz

9. a. Functional Description: Provide emergency feedwater to the steam generators to remove heat from the primary system.

   b. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

   [X] Both assuming non-seismic equipment is not available

10. Pertinent Reference Design Specifications: 7749-M-36, 7749-C-41A

Data Sheet 1

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method: Test: ____________

Analysis: X

Combination of Test and Analysis: ____________

Test and/or Analysis by Byron Jackson Report No. TCF-1021-SEI, Rev. 2
(name of Company or Laboratory & Report No.)

V. Vibration Input:

1. "Revised" Required Response Spectra (attach the graphs): Figures II-31A,B,C

2. Required Acceleration in Each Direction: (based on 0.2g)

S/S = 0.229g F/B = 0.212g V = 0.198g

VI. If Qualification by Test, then Complete: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ____

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE ____ SSE ____ Other ____ (specify)

4. Frequency Range: ____________

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs) [ ] No

6. Input g-level Test at S/S = ____ F/B = ____ V = ____

7. Laboratory Mounting:

1. [ ] Bolt (No.____, Size____) [ ] Weld (Length____) [ ] ____

8. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

9. Test Results including modifications made: ____________

10. Other tests performed (such as fragility test, including results): ____

Data Sheet 1

VII. If Qualification by Analysis or by the Combination of Test and Analysis, then Complete:

1. Description of Test including Results: Analysis: All frequencies greater than 33 Hz. Therefore, the ZPA was applied to pump weights and a static analysis was performed.

2. Method of Analysis

[X] Static Analysis   [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History
[ ] Response Spectrum

3. Model Type: [X] 3D   [ ] 2D   [ ] 1D

[ ] Finite Element   [ ] Beam   [ ] Closed Form solution

4. [X] Computer Codes: Byron Jackson Program CRTSPD

Frequency Range and No. of modes considered: N/A

[ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
[ ] Other: N/A (specify)

6. Damping: 3% Basis for the damping used: Table II-1

7. Support Considerations in the model: Fixed at foundation

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	(a) Seismic Stress	(b) Total Stress	(c) Stress Allowable	(c) - (b) / (a)
Hold down bolts	Pump to Baseplate	*	797	27,000	*
Hold down dowels	Pump to Baseplate	*	6,477	75,600	*

* Not available from the analysis

B.

Max. Deflection	Location	Effect Upon Functional Operability
Pump Shaft	.00232"	None, since running clearances are greater than deflection.

Data Sheet 2

Qualification Summary of Equipment

I. Plant Name: Davis-Besse 1 Type:

1. Utility: Toledo Edison PWR √

2. NSSS: B & W 3. A/E: Bechtel BWR ______

II. Component Name Component Cooling Water Heat Exchangers

1. Scope: [ ] NSSS [X] BOP

2. Model Number: Type 61-31N11-5H Quantity: 3

3. Vendor: Struthers Wells Corporation

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance Shell & tube, TEMA R Heat Exchanger

b. Dimensions 37'-4" L x 67" Ø

c. Weight 101,932 lbs. flooded

6. Location: Building Auxiliary Building, Area 7

Elevation 585 Feet

7. Field Mounting Conditions [X] Bolt (No. 4 , Size 1") 2 bolts in fixed support, 2 bolts in sliding suppor
[ ] Weld (Length______)
[ ] ______

8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

ALL: 25.3 Hz F/B: 19.9 Hz V: 19.9 Hz

9. a. Functional Description: Provide heat removal capability for reactor auxiliary equipment, including the Decay Heat Coolers.

b. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

[X] Both

10. Pertinent Reference Design Specifications: 7749-M-23, 7749-C-41A

Data Sheet 2

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method: Test: ____

Analysis: X

Combination of Test and Analysis: ____

Test and/or Analysis by Struthers Wells Corporation
(name of Company or Laboratory & Report No.)

V. Vibration Input:

1. "Revised" Required Response Spectra (attach the graphs): Figures II 32A,B,C

2. Required Acceleration in Each Direction: (based on 0.20 g)

S/S = 0.30g F/B = 1.60g V = 0.90g

VI. If Qualification by Test, then Complete: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ____

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE____ SSE____ Other____ (specify)

4. Frequency Range: ____

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs) [ ] No

6. Input g-level Test at S/S = ____ F/B = ____ V = ____

7. Laboratory Mounting:

1. [ ] Bolt (No.____, Size____) [ ] Weld (Length____) [ ] ____

8. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

9. Test Results including modifications made: ____

10. Other tests performed (such as fragility test, including results): ____

Data Sheet 2

VII. If Qualification by Analysis or by the Combination of Test and Analysis, then Complete:

1. Description of Test including Results: N/A

2. Method of Analysis

[ ] Static Analysis [ ] Equivalent Static Analysis

[X] Dynamic Analysis: [ ] Time-History
[ ] Response Spectrum

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[X] Finite Element [ ] Beam [ ] Closed Form solution

4. [X] Computer Codes: ANSYS

Frequency Range and No. of modes considered: 0 to 102 Hz., No. Modes 9

[X] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [X] SRSS
[ ] Other: ______ (specify)

6. Damping: 3% Basis for the damping used: Table II-1

7. Support Considerations in the model: Supports modeled as beams with correct section properties

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	(a) Seismic Stress	(b) Total Stress	(c) Stress Allowable	(c) - (b) / (a)
Anchor bolts shear	stress	*	10,350	13,300	*
Base of support bearing	stress	*	10,840	27,000	*

* Not available from the analysis

B.

Max. Deflection	Location	Effect Upon Functional Operability
N/A		

Data Sheet 3

Qualification Summary of Equipment

I. Plant Name: Davis-Besse 1 — Type:

1. Utility: Toledo Edison — PWR √

2. NSSS: B & W — 3. A/E: Bechtel — BWR ______

II. Component Name: Emergency Diesel Generator Fuel Oil Day Tanks

1. Scope: [ ] NSSS [X] BOP

2. Model Number: N/A — Quantity: 2

3. Vendor: Richmond Engineering Company

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance Horizontal cylindrical tank

   b. Dimensions 15'L x 8.5' Dia

   c. Weight 11,500 lbs. empty, 59,500 lbs. full

6. Location: Building Auxiliary Building, Area 6

   Elevation 595 Feet

7. Field Mounting Conditions [X] Bolt (No. 16, Size 3/4")
   [ ] Weld (Length ______)
   [ ] ______

8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   ALL: 423.5 Hz — F/B: 28.6 Hz — V: 224.7 Hz

9. a. Functional Description: Provides one day supply of diesel fuel oil for Emergency Diesel Generator

   b. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

   [X] Both assuming offsite power is not available

10. Pertinent Reference Design Specifications: 7749-M-129, 7749-C-41A

Data Sheet 3

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method: Test: ______

Analysis: X

Combination of Test and Analysis: ______

Test and/or Analysis by Richmond Engineering Company
(name of Company or Laboratory & Report No.)

V. Vibration Input:

1. "Revised" Required Response Spectra (attach the graphs): Figures II-30A,B,C

2. Required Acceleration in Each Direction: (based on 0.2g)
S/S = 0.528g N-S (TK.2) 0.5095g E-W (TK.1) F/B = 0.66g N-S (TK.1) 0.63g E-W (TK.2) V = 0.49g

VI. If Qualification by Test, then Complete: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ______

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE ______ SSE ______ Other ______ (specify)

4. Frequency Range: ______

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs) [ ] No

6. Input g-level Test at S/S = ______ F/B = ______ V = ______

7. Laboratory Mounting:

1. [ ] Bolt (No. ____, Size ____) [ ] Weld (Length ____) [ ] ______

8. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

9. Test Results including modifications made: ______

10. Other tests performed (such as fragility test, including results): ______

Data Sheet 3

VII. If Qualification by Analysis or by the Combination of Test and Analysis, then Complete:

1. Description of Test including Results: N/A

2. Method of Analysis

[X] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History
[ ] Response Spectrum

3. Model Type: [ ] 3D [ ] 2D [X] 1D

[ ] Finite Element [ ] Beam [ ] Closed Form solution

4. [ ] Computer Codes: ______

Frequency Range and No. of modes considered: Static Analysis used.

[X] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [X] SRSS
[ ] Other: ______ (specify)

6. Damping: 3% Basis for the damping used: Table II-1

7. Support Considerations in the model: Free end cantilever using saddle properties

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	(a) Seismic Stress	(b) Total Stress	(c) Stress Allowable	(c) - (b) / (a)
Circumferential Saddle Bending Stress at Horn of Saddle	Loads on Shell Portion in Saddle	**	31,639*	26,757	**
Foundation Bolts Shear	Seismic	6977	6977	62,456	7.95
Foundation Bolts Tension	Seismic	9326	9326	58,232	5.24

*See discussion in report SEction VI, aragraph 4.2.3
**Not available from the analysis

B. Max. Deflection Location Effect Upon Functional Operability
None

Data Sheet 4

Qualification Summary of Equipment

I. Plant Name: Davis-Besse 1 — Type:

1. Utility: Toledo Edison — PWR √

2. NSSS: B & W 3. A/E: Bechtel — BWR

II. Component Name: Service Water Pumps & Motors

1. Scope: [ ] NSSS [X] BOP

2. Model Number: VITX-SD-20X28BHC Quantity: 3

3. Vendor: Goulds Pumps, Vertical Pump Division

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance Vertical Centrifugal Two-Stage Pump

b. Dimensions 29' Column; 66" High, Discharge Head; 72" High, Motor

c. Weight Pump 7800 lbs.; Motor 8650 lbs.

6. Location: Building Intake Structure

Elevation 576 Feet

7. Field Mounting Conditions [X] Bolt (No. 12, Size 1 3/8")
[ ] Weld (Length ____)
[ ] ____

8. Natural Frequencies in Each Direction (Horizontal, Vertical):
H: Pump: 2.27, 18.04, 56.7, 117.5, 196.3, (sym. in each direction) Motor&Head (N-S):11.96,213.5,711.3 Motor&Head (E-W):12.50,224.9,733.0
V: Pump: 77.5 Hz; Motor: 35.0 Hz

9. a. Functional Description: Provide cooling water to the Component Cooling Water Heat Exchangers, and provide backup water supply to the Auxiliary Feedwater Pumps.

b. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
[X] Both

10. Pertinent Reference Design Specifications: 7749-M-45, 7749-C-41A

Data Sheet 4

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method: Test: ______

Analysis: X ______

Combination of Test and Analysis: ______

Test and/or Analysis by Perry H. Brown, Consulting Engineer
(name of Company or Laboratory & Report No.)

V. Vibration Input:

1. "Revised" Required Response Spectra (attach the graphs): Figures II-34A,B,C

2. Required Acceleration in Each Direction: (based on 0.2g)

S/S = .82, .70, .241,.251 F/B = .82, 1.56, .364, .364 V = .205
Motor analyzed using 4.0g Horizontal and 3.0g Vertical

VI. If Qualification by Test, then Complete: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ______

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE ______ SSE ______ Other ______ (specify)

4. Frequency Range: ______

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs)
[ ] No

6. Input g-level Test at S/S = ______ F/B = ______ V = ______

7. Laboratory Mounting:

1. [ ] Bolt (No.____, Size____) [ ] Weld (Length____) [ ] ______

8. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

9. Test Results including modifications made: ______

______

10. Other tests performed (such as fragility test, including results): ______

______

Data Sheet 4

VII. If Qualification by Analysis or by the Combination of Test and Analysis, then Complete:

1. Description of Test including Results: N/A

2. Method of Analysis

[ ] Static Analysis   [ ] Equivalent Static Analysis

[X] Dynamic Analysis: [ ] Time-History
[ ] Response Spectrum

3. Model Type: [X] 3D   [ ] 2D   [ ] 1D

[ ] Finite Element   [ ] Beam   [ ] Closed Form solution

4. [X] Computer Codes: Goulds' Programs, equivalent to "STRESS"

Frequency Range and No. of modes considered: 4 Modes Min.

[ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [X] SRSS
[ ] Other: ____________ (specify)

6. Damping: 3% Basis for the damping used: Table II-1

7. Support Considerations in the model: Base mounted-evaluated spring constant

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	(a) Seismic Stress	(b) Total Stress	(c) Stress Allowable	(c) - (b) / (a)
Anchor Bolts	Base to Floor		*	24,025	28,728	*
Pump Base	Floor Level		*	23,518	29,700	*

All other components have calculated stresses which are under the allowables by a wider margin.
*Not available from the analysis

B.

Max. Deflection	Location	Effect Upon Functional Operability
Shaft	Packing Area	None

Data Sheet 5

Qualification Summary of Equipment

I. Plant Name: Davis-Besse 1 — Type:

1. Utility: Toledo Edison — PWR √

2. NSSS: B & W 3. A/E: Bechtel — BWR ______

II. Component Name: Auxiliary Feedwater Pump Turbines

1. Scope: [ ] NSSS [X] BOP

2. Model Number: GS-2 Quantity: 2

3. Vendor: Terry Steam Turbine Company

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance Single-Stage Split casing steam turbine

   b. Dimensions 5'-7"L x 5'-2"W x 3'6"H

   c. Weight Turbine 2,800 lbs., Trip & Throttle Valve 962 lbs.

6. Location: Building Auxiliary Building, Area 7

   Elevation 565 Feet

7. Field Mounting Conditions [ ] Bolt (No.______, Size______)
   [ ] Weld (Length______)
   [X] Bolted to Aux. Feed. Pump baseplate, see Data Sheet 1B

8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   ALL: >100 Hz F/B: >100 Hz V: >100 Hz

9. a. Functional Description: Steam turbine drive for Auxiliary Feedwater Pump (see Data Sheet 1B)

   b. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
   [X] Both assuming non-seismic equipment is not available.

10. Pertinent Reference Design Specifications: 7749-M-36, 7749-C-41

Data Sheet 5

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method: Test: ____________

Analysis: X

Combination of Test and Analysis: ____________

Test and/or Analysis by Keith, Feibusch Associates
(name of Company or Laboratory & Report No.)

V. Vibration Input:

1. "Revised" Required Response Spectra (attach the graphs): Figures II-31A,B,C

2. Required Acceleration in Each Direction: (based on 0.2g)
S/S = 0.229g required 1.50g used F/B = 0.212g required 1.50g used V = 0.198g required 0.48g used

VI. If Qualification by Test, then Complete: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ____________

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE ____________ SSE ____________ Other ____________ (specify)

4. Frequency Range: ____________

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs)
[ ] No

6. Input g-level Test at S/S = ____________ F/B = ____________ V = ____________

7. Laboratory Mounting:

1. [ ] Bolt (No._____, Size_____) [ ] Weld (Length_____) [ ]__________

8. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

9. Test Results including modifications made: ____________

____

10. Other tests performed (such as fragility test, including results): ____________

____

Data Sheet 5

VII. If Qualification by Analysis or by the Combination of Test and Analysis, then Complete:

1. Description of Test including Results: N/A

2. Method of Analysis

[X] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History
[ ] Response Spectrum

3. Model Type: [ ] 3D [ ] 2D [X] 1D

[ ] Finite Element [ ] Beam [ ] Closed Form solution

4. [ ] Computer Codes: ______

Frequency Range and No. of modes considered: Rigid

[X] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
[ ] Other: N/A - Rigid (specify)

6. Damping: N/A Basis for the damping used: Rigid

7. Support Considerations in the model: Anchor bolts in concrete, no credit for concrete shear resistance capability

8. Critical Structural Elements:

A. Identification	Location	Governing Load or Response Combination	(a) Seismic Stress	(b) Total Stress	(c) Stress Allowable	(c) - (b) / (a)
Thrust Bearings	Turbine Shaft		0.489 Kips	1.173 Kips	1.550 Kips	0.771

All other components have calculated stresses which have higher margins of safety.

B. Max. Deflection	Location	Effect Upon Functional Operability
Turbine Shaft	.005"	No effect.

Data Sheet 6

Qualification Summary of Equipment

I. Plant Name: Davis-Besse 1 Type:

1. Utility: Toledo Edison PWR √

2. NSSS: B & W 3. A/E: Bechtel BWR

II. Component Name Borated Water Storage Tank

1. Scope: [ ] NSSS [X] BOP

2. Model Number: - Quantity: 1

3. Vendor: Chicago Bridge & Iron Co.

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance Field-fabricated, vertical right cylindrical tank

b. Dimensions 47' Dia. x 44' Straight height

c. Weight 550,000 Gal. capacity storage tank

6. Location: Building Yard, west of Aux Bldg

Elevation 585 Feet

7. Field Mounting Conditions [X] Bolt (No. 48 , Size 2½")
[ ] Weld (Length)
[ ]

8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

ALL: 6.58 Hz. F/B: 6.58 Hz V: 13.06 Hz.

9. a. Functional Description: Provides source of borated water for makeup to primary system, refueling water storage, safety injection, containment spray and spent fuel pool cooling.

b. Is the equipment required for [ ] Hot Standby [X] Cold Shutdown, assuming non-seismic equipment is not available.
[ ] Both

10. Pertinent Reference Design Specifications: 7749-C-34, 7749-C-41

Data Sheet 6

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method: Test: ____________

Analysis: X

Combination of Test and Analysis: ____

Test and/or Analysis by Chicago Bridge & Iron Co. and Bechtel Power Corporation
(name of Company or Laboratory & Report No.)

V. Vibration Input:

1. "Revised" Required Response Spectra (attach the graphs): Figures II-1 & II-2

2. Required Acceleration in Each Direction: (based on 0.2g)

S/S = 0.21g F/B = 0.21g V = 0.22g

VI. If Qualification by Test, then Complete: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ____

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE____ SSE____ Other____ (specify)

4. Frequency Range: ____________

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs)
[ ] No

6. Input g-level Test at S/S = ____ F/B = ____ V = ____

7. Laboratory Mounting:

1. [ ] Bolt (No.____, Size____) [ ] Weld (Length____) [ ]____

8. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

9. Test Results including modifications made: ____________

10. Other tests performed (such as fragility test, including results): ____

Data Sheet 6

VII. If Qualification by Analysis or by the Combination of Test and Analysis, then Complete:

1. Description of Analysis including Results: Design loads due to 0.20g SSE calculated and compared to original design and code allowables substantiating adequacy of tank design.

2. Method of Analysis

[ ] Static Analysis [ ] Equivalent Static Analysis

[X] Dynamic Analysis: [X] Time-History
[X] Response Spectrum

3. Model Type: [ ] 3D [X] 2D [ ] 1D

[ ] Finite Element [X] Beam [ ] Closed Form solution

4. [X] Computer Codes: Bechtel Standard Programs: Model Analysis (CE-917), spectral Analysis (CE-918), Time-History Analysis (CE-920), and Response Spectra Analysis (CE-921).

Frequency Range and No. of modes considered: to 33 Hz. (6 Degrees of Freedom)

[ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [X] SRSS
[ ] Other: ______ (specify)

6. Damping: 5% Basis for the damping used: Bolted steel structure

7. Support Considerations in the model: Soil structure interaction

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	(a) Seismic Stress	(b) Total Stress	(c) Stress Allowable	(c) - (b) / (a)
Axial (Longitudinal) Stress	Ring #1	3523	3637	18,500	4.22
Circumferential (Lateral) Stress	Ring #3	3076	12,972	18,500	1.80

B.

Max. Deflection	Location	Effect Upon Functional Operability
0.139" Lateral	Top of Tank	None

Data Sheet 9

Qualification Summary of Equipment

I. Plant Name: Davis-Besse 1 — Type:

1. Utility: Toledo Edison — PWR ✓

2. NSSS: B & W 3. A/E: Bechtel — BWR ______

II. Component Name Decay Heat Removal Cooler

1. Scope: [X] NSSS [ ] BOP

2. Model Number: TEMA Type B-E-U Quantity: 2

3. Vendor: Atlas Industrial Mfg. Co.

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance U-Tube, Shell & Tube HX

b. Dimensions Overall 64" x 19'-0"

c. Weight Empty 17,500 lbs., Full of Water 28,800 lbs.

6. Location: Building Auxiliary Building, Area 7

Elevation 545 Feet

7. Field Mounting Conditions [X] Bolt (No. 8, Size 1"Ø)
[ ] Weld (Length ______)
[ ] ______

8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

ALL: >33 Hz F/B: >33 Hz V: >33 Hz

9. a. Functional Description: Remove Decay Heat from Reactor Coolant System

b. Is the equipment required for [ ] Hot Standby [X] Cold Shutdown

[ ] Both ______

10. Pertinent Reference Design Specifications: Seismic-1107/NSS-14/0470, Mfg. Specs. - 1024/0769, CS-3-106, 1152/1069, CS-5-95

Data Sheet 9

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method: Test: ______

Analysis: X

Combination of Test and Analysis: ______

Test and/or Analysis by Atlas and B&W
(name of Company or Laboratory & Report No.)

V. Vibration Input:

1. "Revised" Required Response Spectra (attach the graphs): Figures II-1 & II-2

2. Required Acceleration in Each Direction: (based on 0.2g)
S/S = 0.20g required 0.255g used F/B = 0.20g required 0.264g used V = 0.20g required 0.222g used

VI. If Qualification by Test, then Complete: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ______

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE ______ SSE ______ Other ______ (specify)

4. Frequency Range: ______

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs)
[ ] No

6. Input g-level Test at S/S = ______ F/B = ______ V = ______

7. Laboratory Mounting:

1. [ ] Bolt (No. ____, Size ____) [ ] Weld (Length ____) [ ] ______

8. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

9. Test Results including modifications made: ______

______

10. Other tests performed (such as fragility test, including results): ______

______

Data Sheet 9

VII. If Qualification by Analysis or by the Combination of Test and Analysis, then Complete:

1. Description of Test including Results: N/A

2. Method of Analysis

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History
[X] Response Spectrum

3. Model Type: [X] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam [ ] Closed Form solution

4. [X] Computer Codes: STALUM

Frequency Range and No. of modes considered: 1 to 100, 100 Modes

[ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [X] SRSS
[ ] Other: ______ (specify)

6. Damping: 3% Basis for the damping used: Table II-1

7. Support Considerations in the model: Yes

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	(a) Seismic Stress	(b) Total Stress	(c) Stress Allowable	(c) - (b) / (a)

B&W evaluated the new response curves to determine applicable loads. The new loads were considerably less than those used by Atlas, and the Atlas original calculations were not altered.

B.

Max. Deflection	Location	Effect Upon Functional Operability
N/A		N/A

Data Sheet 10

Qualification Summary of Equipment

I. Plant Name: Davis-Besse 1 — Type:

1. Utility: Toledo Edison — PWR √

2. NSSS: B & W   3. A/E: Bechtel — BWR ______

II. Component Name: Decay Heat Removal Pump & Motor

1. Scope: [X] NSSS   [ ] BOP

2. Model Number: 10 x 12 x 21 "KSM"   Quantity: 2

3. Vendor: B&W Canada Ltd./Westinghouse

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance: Horizontal Centrifugal

   b. Dimensions: 48" x 116" x 55" High

   c. Weight: 8270 lbs.

6. Location: Building: Auxiliary Building, Area 7

   Elevation: 545 Feet

7. Field Mounting Conditions [X] Bolt (No. 8, Size 3/4" Ø)
   [ ] Weld (Length ______)
   [ ] ______

8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   (Not calculated, see Para. VII.1 on Sheet 3)
   ALL: ______ F/B: ______ V: ______

9. a. Functional Description: Removes Decay Heat during cooldown and accident conditions

   b. Is the equipment required for [ ] Hot Standby [X] Cold Shutdown
   [ ] Both ______

10. Pertinent Reference Design Specifications: Seismic - 1107/0469, Mfg. Specs. - 1130/0369, CS-3-106, 1152/1069, CS-5-95

Data Sheet 10

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method: Test: ____________

Analysis: X

Combination of Test and Analysis: ____________

Test and/or Analysis by Babcock & Wilcox Co.
(name of Company or Laboratory & Report No.)

V. Vibration Input:

1. "Revised" Required Response Spectra (attach the graphs): Figures II-1 & II-2

2. Required Acceleration in Each Direction: See Para. VII.i
Used 1.6g Horizontal and 0.8g Vertical
S/S = ____________ F/B = ____________ V = ____________

VI. If Qualification by Test, then Complete: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random
[ ] sine beat
[ ] ________

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE ________ SSE ________ Other ________ (specify)

4. Frequency Range: ____________

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs)
[ ] No

6. Input g-level Test at S/S = ________ F/B = ________ V = ________

7. Laboratory Mounting:

1. [ ] Bolt (No. ____, Size ____) [ ] Weld (Length ____) [ ] ________

8. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

9. Test Results including modifications made: ____________

____

10. Other tests performed (such as fragility test, including results): ____________

____

Data Sheet 10

VII. If Qualification by Analysis or by the Combination of Test and Analysis, then Complete:

1. Description of Test including Results: N/A

The attachment bolts for the pump & motor assembly were analyzed using the peak of the response spectra curves as statically applied loads at the C.G. of each component (pump, motor and base). 1.6G Horizontal & 0.8G Vertical used.

2. Method of Analysis

[ ] Static Analysis   [X] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History
[ ] Response Spectrum

3. Model Type: [ ] 3D   [ ] 2D   [ ] 1D

[ ] Finite Element   [X] Beam   [ ] Closed Form solution

4. [ ] Computer Codes: ________

Frequency Range and No. of modes considered: ________

[X] Hand Calculations

5. Method of Combining Dynamic Responses: [X] Absolute Sum   [ ] SRSS
[ ] Other: ________ (specify)

6. Damping: 3%   Basis for the damping used: Table II-1

7. Support Considerations in the model: Simple Support

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	(a) Seismic Stress	(b) Total Stress	(c) Stress Allowable	(c) - (b) / (a)
Bolt Stress	Pump to Base	Nozzle Loads Plus SSE	3600	6300	25,000	5.19
Bolt Stress	Base to Foundation	Nozzle Loads Plus SSE	13,200	21,100	36,000	1.13
Bolt Stress	Motor to Frame	SSE	9,400	9,400	25,000	1.66

B.

Max. Deflection	Location	Effect Upon Functional Operability
N/A		

Data Sheet 11

Qualification Summary of Equipment

I. Plant Name: Davis-Besse 1 Type:

1. Utility: Toledo Edison PWR √

2. NSSS: B & W 3. A/E: Bechtel BWR

II. Component Name Decay Heat Removal Suction valves HV-DH11 and HV-DH12

1. Scope: [X] NSSS [ ] BOP

2. Model Number: Velan No. P-35216 Quantity: 2

3. Vendor: Velan (Valve Co.) Engineering Co.

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance Motor-operated Gate Valve

   b. Dimensions 12" diameter valve

   c. Weight 4555 lbs. (Approx.)

6. Location: Building Containment, Area 9

   Elevation 560 Feet

7. Field Mounting Conditions [ ] Bolt (No. _____, Size _____)
   [X] Weld (Length 40 in.)
   [ ] _____

8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical): (Not calculated, conservative accelerations used, see Para. VII.A)
   ALL: F/B: V:

9. a. Functional Description: Two valves in series, from Reactor Coolant System to Decay Heat Removal System

   b. Is the equipment required for [ ] Hot Standby [X] Cold Shutdown

   [ ] Both

10. Pertinent Reference Design Specifications:

Data Sheet 11

III. Is Equipment Available for Inspection in the Plant: [ ] Yes [ ] No Inside Containment

IV. Equipment Qualification Method: Test: ____________

Analysis: X

Combination of Test and Analysis: ____________

Test and/or Analysis by Velan Engineering Co.
(name of Company or Laboratory & Report No.)

V. Vibration Input:

1. "Revised" Required Response Spectra (attach the graphs): Used 3.0g Horiz. & Vert.

2. Required Acceleration in Each Direction: See Para. VII.8A

S/S = ____________ F/B = ____________ ____________ V = ____________

VI. If Qualification by Test, then Complete: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random
[ ] sine beat
[ ] ____________

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE ____________ SSE ____________ Other ____________ (specify)

4. Frequency Range: ____________

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs)
[ ] No

6. Input g-level Test at S/S = ____________ F/B = ____________ V = ____________

7. Laboratory Mounting:

1. [ ] Bolt (No.____, Size____) [ ] Weld (Length____) [ ] ____________

8. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

9. Test Results including modifications made: ____________

____

10. Other tests performed (such as fragility test, including results): ____________

____

Data Sheet 11

VII. If Qualification by Analysis or by the Combination of Test and Analysis, then Complete:

1. Description of Test including Results: N/A

2. Method of Analysis

[X] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History
[ ] Response Spectrum

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam [ ] Closed Form solution

4. [ ] Computer Codes: ______

Frequency Range and No. of modes considered: ______

[X] Hand Calculations

5 Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
[ ] Other: N/A (specify)

6. Damping: ______ Basis for the damping used: ______

7. Support Considerations in the model: ______

8. Critical Structural Elements:

A. Identification	Location	Governing Load or Response Combination	(a) Seismic Stress	(b) Total Stress	(c) Stress Allowable	(c) - (b) / (a)

Valve and operator were analyzed to withstand 3.0g horizontally and vertically acting simultaneously, in addition to normal operating load. Analysis shows that stresses are all within allowables.

B. Max. Deflection	Location	Effect Upon Functional Operability

Data Sheet 12

Qualification Summary of Equipment

I. Plant Name: Davis-Besse 1 — Type:

1. Utility: Toledo Edison — PWR ✓

2. NSSS: B & W — 3. A/E: Bechtel — BWR ____

II. Component Name: Auxiliary Feedwater Pump Steam Inlet Valve HV-MS106

1. Scope: [ ] NSSS [X] BOP

2. Model Number: Velan No. B14-254B-2TS Quantity: 1

3. Vendor: Velan (Valve Co.) Engineering Co.

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance: Motor-operated Gate Valve

   b. Dimensions: 6" diameter valve

   c. Weight: 1200 lbs. (Approx.)

6. Location: Building: Auxiliary Building, Area 7

   Elevation: 624.5 Feet

7. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [X] Weld (Length 21")
   [ ] ____

8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   32.7 Hz. for the valve & operator
   ALL: ____ F/B: ____ V: ____

9. a. Functional Description: Valve is in the line which supplies steam to the Auxiliary Feedwater Pump Turbine

   b. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
   [X] Both

10. Pertinent Reference Design Specifications: 7749-M-212

Data Sheet 12

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method: Test: ____________

Analysis: X

Combination of Test and Analysis: ____

Test and/or Analysis by Velan Engineering Co.
(name of Company or Laboratory & Report No.)

V. Vibration Input:

1. "Revised" Required Response Spectra (attach the graphs): Used 3.0g Horiz. & Vert.

2. Required Acceleration in Each Direction: See Para. VII.8.A

S/S = ________ F/B = ________ V = ________

VI. If Qualification by Test, then Complete: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ____

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE ____ SSE ____ Other ____ (specify)

4. Frequency Range: ____________

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs)
[ ] No

6. Input g-level Test at S/S = ____ F/B = ____ V = ____

7. Laboratory Mounting:

1. [ ] Bolt (No.____, Size____) [ ] Weld (Length____) [ ]____

8. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

9. Test Results including modifications made: ____________

10. Other tests performed (such as fragility test, including results): ____

Data Sheet 12

VII. If Qualification by Analysis or by the Combination of Test and Analysis, then Complete:

1. Description of Test including Results: N/A

2. Method of Analysis

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History
[ ] Response Spectrum

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam [ ] Closed Form solution

4. [ ] Computer Codes: ______

Frequency Range and No. of modes considered: ______

[ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
[ ] Other: N/A (specify)

6. Damping: ______ Basis for the damping used: ______

7. Support Considerations in the model: ______

8. Critical Structural Elements:

A. Identification	Location	Governing Load or Response Combination	(a) Seismic Stress	(b) Total Stress	(c) Stress Allowable	(c) - (b) / (a)

Valve and operator were analyzed to withstand 3.0g in any direction, in addition to normal operating load. Analysis shows that stresses are all within allowables. The maximum acceleration which the valve and operator will be subjected to in the installed piping system is less than 1.0g in any direction.

B. Max. Deflection	Location	Effect Upon Functional Operability

Data Sheet 21

Qualification Summary of Equipment

I. Plant Name: Davis-Besse 1 Type:

1. Utility: Toledo Edison PWR √

2. NSSS: B & W 3. A/E: Bechtel BWR

II. Component Name Component Cooling Water Pumps & Motors

1. Scope: [ ] NSSS [X] BOP

2. Model Number: 3415M, Size 14x16-22 Quantity: 3

3. Vendor: Goulds Pumps, Inc.

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance Horizontal centrifugal pump

b. Dimensions 111"L x 33"W x 63"H

c. Weight 11,404 lbs.

6. Location: Building Auxiliary Building, Area 7

Elevation 585 Feet

7. Field Mounting Conditions [X] Bolt (No. 8, Size 1")
[ ] Weld (Length ____)
[ ] ____

8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

ALL: 39.1 Hz. F/B: 24.4 Hz. V: higher than 39.1 Hz.

9. a. Functional Description: Provide cooling water for reactor auxiliary equipment, including the Decay Heat Coolers.

b. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
[X] Both

10. Pertinent Reference Design Specifications: 7749-M-46, 7749-C-41A

Data Sheet 21

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method: Test: ______

Analysis: X

Combination of Test and Analysis: ______

Test and/or Analysis by McDonald Engineering Analysis Compa Report No. ME-727
(name of Company or Laboratory & Report No.)

V. Vibration Input:

1. "Revised" Required Response Spectra (attach the graphs): Figures II-32A,B,C

2. Required Acceleration in Each Direction: (based on 0.2g)
   S/S = 0.264g required, 1.0g used   F/B = 0.70g required, 1.0g used   V = 0.35g required, 1.0g used
   Motor analyzed using 4.0g Horizontal and 3.0g Vertical

VI. If Qualification by Test, then Complete: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ______

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE ______ SSE ______ Other ______ (specify)

4. Frequency Range: ______

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs)
   [ ] No

6. Input g-level Test at S/S = ______ F/B = ______ V = ______

7. Laboratory Mounting:
   1. [ ] Bolt (No.____, Size____) [ ] Weld (Length____) [ ]______

8. Functional operability verified: [ ] Yes [ ] No [ ] Not Applic.

9. Test Results including modifications made: ______

10. Other tests performed (such as fragility test, including results): ______

Data Sheet 21

VII. If Qualification by Analysis or by the Combination of Test and Analysis, then Complete:

1. Description of Test including Results: N/A

2. Method of Analysis

[ ] Static Analysis   [ ] Equivalent Static Analysis

[X] Dynamic Analysis: to obtain frequencies   [ ] Time-History
[ ] Response Spectrum

3. Model Type: [ ] 3D   [ ] 2D   [ ] 1D

(X) Multi-degree of freedom beam connected model   [ ] Finite Element   [X] Beam   [ ] Closed Form solution

4. [X] Computer Codes: ICES-STRUDL

Frequency Range and No. of modes considered: 24 Hz. lowest, 39 Hz. second only 1 mode active in N-S dir., only 1 mode active in E-W dir.

[ ] Hand Calculations

5. Method of Combining Dynamic Responses: [X] Absolute Sum   [ ] SRSS
[ ] Other: ______________ (specify)

6. Damping: 3%   Basis for the damping used: Table II-1

7. Support Considerations in the model: Pump bedplate assumed to be bolted to foundation with pre-tightened bolts.

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	(a) Seismic Stress	(b) Total Stress	(c) Stress Allowable	(c) - (b) / (a)
Pump hold-down bolts, 1-1/8" diam.	End of pump casing/ pedestal junction	Seismic plus plus nozzle plus normal	12,130 2,683	28,432 2,747	32,000 16,000	0.294 tensile 4.940 shear

B.

Max. Deflection	Location	Effect Upon Functional Operability
0.009"	Impeller at centerline shaft & impeller intersection	No effect, since 0.011" clearance exceeds impeller deflection

Data Sheet 22

Qualification Summary of Equipment

I. Plant Name: Davis-Besse 1 — Type:

1. Utility: Toledo Edison — PWR √

2. NSSS: B & W 3. A/E: Bechtel — BWR ______

II. Component Name: Component Cooling Water Surge Tank

1. Scope: [ ] NSSS [X] BOP

2. Model Number: N/A Quantity: 1

3. Vendor: Brown Minneapolis

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance: Horizontal Cylindrical Tank

   b. Dimensions: 5'-6"O.D. x 15'-0" Long.

   c. Weight: 30,430 lbs. (approx.) full of water

6. Location: Building: Auxiliary Building, Area 7

   Elevation: 623 Feet

7. Field Mounting Conditions [X] Bolt (No. 8, Size 1")
   [ ] Weld (Length ______)
   [ ] ______

8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   ALL: 155 Hz. F/B: 21 Hz. V: 155 Hz.

9. a. Functional Description: Provides water reservoir, surge capability and static pressure for the Component Cooling Water System.

   b. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
   [X] Both

10. Pertinent Reference Design Specifications: 7749-M-103, 7749-C-41A

Data Sheet 22

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method: Test: ____________

Analysis: X

Combination of Test and Analysis: ____________

Test and/or Analysis by Bechtel Power Corporation
(name of Company or Laboratory & Report No.)

V. Vibration Input:

1. "Revised" Required Response Spectra (attach the graphs): Figures II-33A,B,C

2. Required Acceleration in Each Direction: (based on 0.3g)

S/S = 0.46g F/B = 0.60g V = 0.33g

VI. If Qualification by Test, then Complete: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ____________

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE ____________ SSE ____________ Other ____________ (specify)

4. Frequency Range: ____________

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs)
[ ] No

6. Input g-level Test at S/S = ____________ F/B = ____________ V = ____________

7. Laboratory Mounting:

1. [ ] Bolt (No.____, Size____) [ ] Weld (Length____) [ ]____________

8. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

9. Test Results including modifications made: ____________

____

10. Other tests performed (such as fragility test, including results): ____________

____

Data Sheet 22

VII. If Qualification by Analysis or by the Combination of Test and Analysis, then Complete:

1. Description of Test including Results: N/A

2. Method of Analysis

[ ] Static Analysis [X] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History
[ ] Response Spectrum

3. Model Type: [ ] 3D [ ] 2D [X] 1D

[ ] Finite Element [ ] Beam [ ] Closed Form solution

4. [ ] Computer Codes: N/A

Frequency Range and No. of modes considered: Up to 155 Hz.

[X] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [X] SRSS
[ ] Other: ______ (specify)

6. Damping: 4% Basis for the damping used: Table II-1 (Welded Steel Structure)

7. Support Considerations in the model: As-built

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	(a) Seismic Stress	(b) Total Stress	(c) Stress Allowable	(c) - (b) / (a)
Compression	Saddle		*	697	15,000	*
Tension	Shell		*	13,794	23,100	*
Compression	Shell		*	592	14,227	*
Cross-bracing between Saddles			*	6,445	12,100	*
Tension	Foundation Bolts		*	6,972	22,000	*
Shear	Foundation Bolts		*	4,750	10,800	*

B.

Max. Deflection	Location	Effect Upon Functional Operability
Longitudinal		None

*Not available from the analysis

Data Sheet 23

Qualification Summary of Equipment

I. Plant Name: Davis-Besse 1 Type:

1. Utility: Toledo Edison PWR √

2. NSSS: B & W 3. A/E: Bechtel BWR

II. Component Name Emergency Diesel Generator Fuel Oil Storage Tanks

1. Scope: [ ] NSSS [X] BOP

2. Model Number: N/A Quantity: 2

3. Vendor: Richmond Engineering Company

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance Horizontal cylindrical tank (Buried)

b. Dimensions 50'L x 12' Dia.

c. Weight 62,750 lbs. empty

6. Location: Building Yard

Elevation Grade: 585 Feet

7. Field Mounting Conditions [ ] Bolt (No._______, Size_______)
[ ] Weld (Length_______)
[X] Buried underground

8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical): Not applicable since equivalent static analysis was used with peak values of acceleration (1.2g Horiz., 0.8g Vert. used).

9. a. Functional Description: Store diesel fuel oil for the Emergency Diesel Generators

b. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

[X] Both assuming offsite power is not available.

10. Pertinent Reference Design Specifications: 7749-M-129A, 7749-C-41

Data Sheet 23

III. Is Equipment Available for Inspection in the Plant: [ ] Yes [X] No

IV. Equipment Qualification Method: Test: ____________

Analysis: X

Combination of Test and Analysis: ____________

Test and/or Analysis by Richmond Engineering Company
(name of Company or Laboratory & Report No.)

V. Vibration Input:

1. "Revised" Required Response Spectra (attach the graphs): Figures II-1 & II-2

2. Required Acceleration in Each Direction: (based on 0.20g)
(used 1.2g Horizontal and 0.8g Vertical)
S/S = 0.73g F/B = 0.73g V = 0.70g

VI. If Qualification by Test, then Complete: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ____________

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE________ SSE________ Other________ (specify)

4. Frequency Range: ____________

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs)
[ ] No

6. Input g-level Test at S/S = ________ F/B = ________ V = ________

7. Laboratory Mounting:

1. [ ] Bolt (No.____, Size____) [ ] Weld (Length____) [ ]____________

8. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

9. Test Results including modifications made: ____________

10. Other tests performed (such as fragility test, including results): ____

Data Sheet 23

VII. If Qualification by Analysis or by the Combination of Test and Analysis, then Complete:

1. Description of Test including Results: N/A

2. Method of Analysis

   [ ] Static Analysis [X] Equivalent Static Analysis

   [ ] Dynamic Analysis: [ ] Time-History
   [ ] Response Spectrum

3. Model Type: [ ] 3D [ ] 2D [X] 1D

   [ ] Finite Element [ ] Beam [ ] Closed Form solution

4. [ ] Computer Codes: ______

   Frequency Range and No. of modes considered: N/A

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [X] SRSS
   [ ] Other: ______ (specify)

6. Damping: 3% Basis for the damping used: Table II-1

7. Support Considerations in the model: N/A

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	(a) Seismic Stress	(b) Total Stress	(c) Stress Allowable	(c) - (b) / (a)
Heads	Knuckle Region	SSE plus Pressure	6,828	10,767	12,056	0.189

B.

Max. Deflection	Location	Effect Upon Functional Operability
N/A		

VII. CONCLUSIONS

1. The previous sections of this report present the results of an intensive evaluation of the adequacy of systems required to accomplish safe shutdown of the reactor and continued shutdown heat removal in the event of an SSE with an acceleration of 0.20g.

2. This evaluation included an assessment of components, selected by the NRC Staff, representative of those necessary to achieve shutdown. It also included <u>all</u> stress problems for those piping systems required for shutdown. Further, it included randomly selected piping supports and ventilation ductwork supports.

3. In all cases, adequate margin was demonstrated such that the
accomplishment of safe shutdown and continued shutdown heat 1
removal is assured.

4. The factors of safety presented in this evaluation have additional inherent margins built-in as a result of either conservative analytical approaches or the use of allowable stresses (code or allowable) which have within themselves additional factors of safety. Examples of these inherent margins are discussed below for piping systems and piping and ventilation ductwork supports.

4.1 Piping Systems. Section IV, Paragraph 1.5 discusses how using a scale factor results in conservative seismic and total stress values. To show the conservatism of this approach three sets of stress cases were rerun using the complete computer reanalysis. These are:

a. Stress cases where the margin factor was not computed since by using the scale factor method it was obvious that an overstressed condition would result (i.e. margin factor >1.0) (31 of 50 cases).

b. Stress cases where the margin factor was computed using the 1
scale factor method but exceeded the allowable stress for
the revised response spectra (9 of 50 cases).

c. Stress cases where the margin factor computed by the scale factor method was between 0.9 and 1.0 (10 of 50 cases).

Table VII-1 shows the results of the comparisons for all fifty stress cases reviewed. For this evaluation, the average margin factors showed approximately a 50 percent reduction after computer reanalysis. On an average basis this indicates that the scale factor method of analysis has an inherent factor of safety of two.

4.2 Piping and Ventilation Supports. These are discussed in Section IV, Paragraph 2.0, and Section V, Paragraph 2.0, respectively. The margin factor or interaction values for the most stressed members (the latter being reported for anchor bolts) are conservative. For structural steel the allowable stresses were based on th AISC code which has built-in safety factors since they vary between 45 percent to 75 percent of the steel's yield stress, depending upon various parameters defining the configuration of structure and types of loads applied.

For standard catalog (non-engineered) items, i.e., pipe saddles, clamps, clevis, etc., the manufacturer's allowable capacity is based on a minimum factor of safety of five compared to the ultimate strength. For engineered components, i.e., sway struts, snubbers, etc., the applied loads are based upon a faulted loading condition while the manufacturer's allowable is based upon the
normal loading codition. This also provides an additional factor 1
of safety. In the case of anchor bolts, the manufacturer's allowables are one-fourth or one-fifth of the ultimate strength.

The twelve pipe supports identified in Table IV-5 were reanalyzed considering the above additional conservatisms to determine a revised margin or interaction value. This reanalysis has shown that considering these conservatisms results in a reduction of the margin factor or interaction value by 22 percent to 80 percent. Of the twelve problems reanalyzed the reduction for eight of them fell in the 75 percent to 80 percent range.

TABLE VII-1

PIPING SYSTEMS SAFETY MARGIN COMPARISON

Category of Stress Problem	Number of Problems	Average Margin Factor Using Scale Factor Method	Average Margin Factor Using Computer Analysis	Ratio of Avg. M.F. Scale Factor Method Computer Analysis	Ratio of Margin Factors* Scale Factor Method/Computer Analysis — Range and Number of Problems in Range: 1.0-1.5	1.5-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-7.69
Problems for which a margin factor was calculated using the scale factor method (Paragraphs 4.1.b and 4.1.c)	19	.866	.382	2.27	3 (Lowest 1.02)	3	7	6 (Highest 4.0)	–	–
Problems which did not have a margin factor calculated using the scale factor method, but in all cases it exceeds 1.0 (Paragraph 4.1.a)	31	>1.0	.508	1.97	8 (Lowest 1.14)	7	9	1	4	2 (Highest 7.69)
TOTAL	50	>.949	.465	2.04	11	10	16	7	4	2

*NOTE: For the 31 problems that did not have a margin factor calculated using the scale factor method, a conservative value of 1.0 was used in the calculation.