

RAS 5658

72-22-ISFSI - State Exhibit 196 - Rec'd 6/3/02

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION TITLE PAGE

*SEE INSTRUCTIONS ON REVERSE SIDE

▲ 5010 64 (FRONT)

CLIENT & PROJECT Private Fuel Storage Facility, LLC Private Fuel Storage Facility, Skull Valley, UT				PAGE 1 OF 34 35		
CALCULATION TITLE (Indicative of the Objective): Development of Time Histories for 2,000-Year Return Period Design Spectra				QA CATEGORY (✓) <input checked="" type="checkbox"/> I - NUCLEAR SAFETY RELATED <input type="checkbox"/> II <input type="checkbox"/> III <input type="checkbox"/> OTHER		
CALCULATION IDENTIFICATION NUMBER				OPTIONAL WORK PACKAGE NO.		
J.O. OR W.O. NO.	DIVISION & GROUP	CURRENT CALC. NO.	OPTIONAL TASK CODE			
05996 02	Geotechnical	G(PO18)-3	N/A	N/A		
* APPROVALS - SIGNATURE & DATE				REV. NO. OR NEW CALC. NO.	SUPERSEDES * CALC. NO. OR REV. NO.	CONFIRMATION * REQUIRED (✓)
PREPARER(S)/DATE(S)	REVIEWER(S)/DATE(S)	INDEPENDENT REVIEWER(S)/DATE(S)	YES			NO
 Robert R. Youngs 8/24/99	 Chin Man Mok 8/24/99	 Chin Man Mok 8/24/99	0	N/A		X
 Robert R. Youngs 3/21/01	 Chin Man Mok 3/21/01	 Chin Man Mok 3/21/01	1	05996.02 -G(PO18)-3 Rev 0		
DISTRIBUTION *						
GROUP	NAME & LOCATION	COPY SENT (✓)	GROUP	NAME & LOCATION	COPY SENT (✓)	
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NUCLEAR REGULATORY COMMISSION

Docket No. _____ Official Exh. No. 196
In the matter of PFS
Staff _____ IDENTIFIED ☒
Applicant _____ RECEIVED ☒
Intervenor ☒ REJECTED _____
Other _____ WITHDRAWN _____
DATE 6/3/02 Witness _____
Clerk V. McDaniel

CALCULATION SUMMARY

▲ 5010 62

J.O./W.O./CALCULATION NO.
05996 02

REVISION
1

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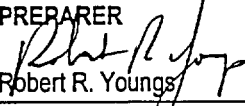
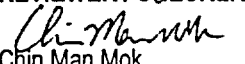
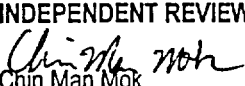
CLIENT / PROJECT	Private Fuel Storage Facility, LLC Private Fuel Storage Facility, Skull Valley, Utah	QA CATEGORY / CODE CLASS I
SUBJECT / TITLE Development of Time Histories for 2,000-Year Return Period Design Spectra		
OBJECTIVE OF CALCULATION Develop a 3-component set of time histories that are compatible with the 2,000-year return period design response spectra and satisfy US NRC Standard Review Plan 3.7.1 (1989).		
CALCULATION METHOD / ASSUMPTIONS 1. Select natural recordings consistent with controlling design event. - 2. Scale motions to match design spectra at 5% damping and estimated spectra at 2% and 10% damping 3. Develop target PSD using standard Review Plan Appendix A and ratio of design spectra to REGGUIDE 1.60 4. Adjust time histories to meet envelop requirements for 5% response spectra and PSD of Standard Review Plan.		
SOURCES OF DATA / EQUATIONS See list of references on Page 11 of 34. Computer Programs: SPECTRA: A computer program to compute response spectra. Verification in project files		
CONCLUSIONS A 3-component set of time histories were developed for the 2,000-year Design spectra that satisfy requirements of US NRC Standard Review Plan 3.7.1 (1989). Time histories are on attached disk		
REVIEWER (S) COMMENTS	PREPARER  Robert R. Youngs	DATE 3/21/01
	REVIEWER / CHECKER  Chin Man Mok	DATE 3/21/01
	INDEPENDENT REVIEWER  Chin Man Mok	DATE 3/21/01

Table 1
Comparison of Time History and Design Response Spectra

	Period (sec)	Frequency (Hz)	5% Damping			Fault-parallel Time			Vertical Time		
			Design Basis (g)	Fault-normal History (g)	Mismatch (%)	Design Basis (g)	Fault-parallel History (g)	Mismatch (%)	Design Basis (g)	History (g)	Mismatch (%)
	0.01	100.0	0.711			0.711			0.695		
	0.02	50.0							0.695		
1	0.0294	34.0	0.711	0.76927	8.2	0.711	0.78683	10.7	0.9025	0.99628	10.4
2	0.0323	31.0	0.7526	0.77982	3.6	0.7526	0.80991	7.6	0.9609	1.00017	4.1
3	0.0357	28.0	0.8010	0.84131	5.0	0.8010	0.86948	8.5	1.0293	1.04885	1.9
4	0.0400	25.0	0.8588	0.9047	5.3	0.8588	0.93079	8.4	1.1116	1.19269	7.3
5	0.0455	22.0	0.9291	0.98317	5.8	0.9291	1.02187	10.0	1.2122	1.35589	11.8
6	0.0500	20.0	0.985	1.03022	4.6	0.985	1.08005	9.6	1.293	1.44014	11.4
7	0.0556	18.0	1.0471	1.06662	1.9	1.0471	1.1203	7.0	1.3750	1.50653	9.6
8	0.0588	17.0	1.0823	1.12944	4.4	1.0823	1.18812	9.8	1.4215	1.51701	6.7
9	0.0625	16.0	1.1210	1.2124	8.2	1.1210	1.21054	8.0	1.4727	1.55963	5.9
10	0.0667	15.0	1.1638	1.29985	11.7	1.1638	1.23824	6.4	1.5293	1.61816	5.8
11	0.0690	14.5	1.1869	1.27762	7.6	1.1869	1.22454	3.2	1.5598	1.59245	2.1
12	0.0714	14.0	1.2113	1.27619	5.4	1.2113	1.2691	4.8	1.5921	1.70303	7.0
13	0.0741	13.5	1.2370	1.27427	3.0	1.2370	1.34037	8.4	1.6261	1.78858	10.0
	0.0750		1.246			1.246			1.638		
14	0.0769	13.0	1.2695	1.31321	3.4	1.2695	1.38925	9.4	1.6485	1.69913	3.1
15	0.0800	12.5	1.3068	1.36309	4.3	1.3068	1.36613	4.5	1.6648	1.86983	12.3
16	0.0833	12.0	1.3468	1.42453	5.8	1.3468	1.33278	-1.0	1.6820	1.81249	7.8
17	0.0870	11.5	1.3899	1.44809	4.2	1.3899	1.48302	6.7	1.7001	1.77089	4.2
18	0.0909	11.0	1.4363	1.44918	0.9	1.4363	1.56928	9.3	1.7193	1.84069	7.1
19	0.0952	10.5	1.4865	1.58465	6.6	1.4865	1.5737	5.9	1.7395	1.96952	13.2
20	0.100	10.0	1.541	1.58448	2.8	1.541	1.60646	4.2	1.761	2.00011	13.6
21	0.105	9.5	1.5812	1.69622	7.3	1.5812	1.72729	9.2	1.7445	1.74355	-0.1
22	0.111	9.0	1.6247	1.74391	7.3	1.6247	1.79984	10.8	1.7274	1.94131	12.4
23	0.118	8.5	1.6721	1.71854	2.8	1.6721	1.69923	1.6	1.7094	1.72835	1.1
24	0.125	8.0	1.7237	1.84728	7.2	1.7237	1.86824	8.4	1.6905	1.79545	6.2
25	0.129	7.8	1.7514	1.83035	4.5	1.7514	1.88174	7.4	1.6807	1.76637	5.1
26	0.133	7.5	1.7805	1.77161	-0.5	1.7805	1.90084	6.8	1.6707	1.79384	7.4
27	0.138	7.3	1.8111	1.80989	-0.1	1.8111	1.9507	7.7	1.6603	1.85589	11.8
28	0.143	7.0	1.8433	1.89042	2.6	1.8433	1.88747	2.4	1.6497	1.73188	5.0
29	0.148	6.7	1.8773	2.01524	7.3	1.8773	1.95493	4.1	1.6387	1.57356	-4.0
	0.150		1.889			1.889			1.635		
30	0.154	6.5	1.8994	1.9722	3.8	1.8994	1.89939	-0.0	1.6154	1.56433	-3.2
31	0.160	6.3	1.9157	2.04385	6.7	1.9157	2.05623	7.3	1.5856	1.79473	13.2
32	0.167	6.0	1.9328	2.08635	7.9	1.9328	2.10562	8.9	1.5551	1.61986	4.2

33	0.174	5.8	1.9508	2.0622	5.7	1.9508	1.99702	2 4	1 5240	1.71253	12 4
34	0.182	5.5	1.9697	2.11064	7.2	1.9697	1.9581	-0.6	1.4921	1.60323	7.4
35	0.190	5.2	1.9898	2.05929	3.5	1.9898	2.13389	7.2	1.4594	1.51181	3.6
36	0.200	5.0	2.011	2.14129	6.5	2.011	2.18846	8 8	1.426	1.47945	3 7
37	0.208	4.8	1.9772	2.1528	8 9	1.9772	2.07742	5 1	1.3702	1.55493	13 5
38	0 217	4.6	1.9425	2 11203	8.7	1.9425	2.09823	8 0	1.3143	1.38905	5 7
39	0.227	4.4	1.9069	2.01372	5.6	1.9069	2.08812	9.5	1.2584	1 38993	10.5
40	0.238	4 2	1 8704	2.04416	9.3	1.8704	1.95396	4 5	1.2023	1.31668	9 5
41	0 250	4.0	1.8328	1.83278	-0 0	1.8328	1.91029	4.2	1.1463	1.26114	10 0
42	0 263	3 8	1.7941	1.9148	6.7	1.7941	1.90854	6.4	1.0902	1.15981	6 4
43	0.278	3 6	1.7542	1.86855	6.5	1.7542	1.85945	6.0	1.0340	1.11098	7.4
44	0 290	3 4	1.7235	1.87361	8.7	1.7235	1.81318	5 2	0.9918	1.13626	14 6
	0.300		1.699			1.699			0.959		
45	0 303	3.3	1.6828	1.80503	7.3	1.6828	1.77131	5.3	0.9467	1.04903	10 8
46	0.317	3.2	1.6097	1.64734	2.3	1.6097	1.74337	8 3	0.8919	0.96341	8 0
47	0 333	3 0	1.5364	1.61059	4 8	1.5364	1.67163	8 8	0.8377	0.93903	12.1
48	0 345	2.9	1.4875	1.6184	8 8	1.4875	1.64246	10 4	0.8021	0 88341	10.1
49	0.357	2.8	1.4385	1.59768	11.1	1.4385	1.61483	12.3	0.7668	0.75297	-1.8
50	0.370	2.7	1.3894	1.53479	10.5	1.3894	1.56713	12.8	0.7318	0.80264	9.7
51	0.385	2.6	1.3402	1.43771	7.3	1.3402	1.47974	10 4	0.6972	0.80324	15.2
52	0.400	2.5	1.291	1.29745	0.5	1.291	1.33766	3.6	0.663	0.76616	15.6
53	0 417	2.4	1.2431	1.32383	6.5	1.2431	1.36554	9.8	0 6317	0.66191	4.8
54	0 435	2.3	1.1951	1.29492	8.4	1.1951	1.31723	10.2	0 6006	0.644	7.2
55	0 455	2.2	1.1469	1.17245	2.2	1.1469	1.29691	13.1	0.5698	0.60888	6 9
56	0.476	2.1	1.0985	1.14662	4.4	1.0985	1.24187	13 0	0 5393	0.59974	11.2
57	0.500	2.0	1.050	1 07825	2.7	1.050	1.17603	12.0	0.509	0.56712	11 4
58	0 526	1.9	0.9962	1.05154	5.6	0.9962	1.16298	16.7	0 4807	0.53385	11.1
59	0.556	1.8	0.9425	0 8856	-6.0	0.9425	1.12603	19.5	0.4526	0.47324	4.6
60	0 588	1.7	0 8889	0.9198	3.5	0.8889	1.03206	16.1	0 4247	0 45997	8.3
61	0 625	1.6	0 8354	0.88903	6.4	0.8354	0.92933	11.2	0.3970	0 42693	7.5
62	0 667	1.5	0.7819	0 73934	-5.4	0.7819	0.94301	20.6	0.3694	0 39032	5.7
63	0.714	1.4	0.7285	0.78578	7.9	0.7285	0.85834	17.8	0 3421	0.38997	14.0
	0.750		0.693			0.693			0.324		
64	0.769	1.3	0.6763	0.75236	11.3	0.6706	0.77482	15 5	0.3152	0 30952	-1.8
65	0 833	1.2	0.6260	0.64803	3.5	0.6044	0.71335	18 0	0 2889	0.33617	16.3
66	0 909	1.1	0.5756	0.5838	1.4	0.5398	0.63656	17.9	0 2629	0.28059	6.7
67	1.00	1.0	0.525	0.58508	11.4	0.477	0.56703	18 9	0.237	0.26506	11.8
68	1.11	0.9	0.4594	0.44851	-2.4	0.4074	0.50923	25.0	0 2086	0 23842	14.3
69	1.25	0.8	0.3956	0 4175	5.5	0.3416	0.44719	30.9	0.1808	0.20408	12.8
70	1.43	0.7	0.3340	0.3604	7.9	0.2797	0 3794	35.6	0.1538	0.18618	21.0
	1.50		0.314			0.260			0.145		
71	1.67	0.6	0 2770	0.30842	11.3	0.2244	0.28255	25 9	0.1284	0.14389	12.1
72	2.00	0 5	0.223	0.25	12.1	0.174	0.20892	20 1	0.104	0.12739	22.5
73	2 50	0 4	0 1773	0 20195	13.9	0.1281	0.14228	11.1	0.0815	0.09851	20.9
	3.00		0.147			0.0997			0.0668		

74	3.33	0.3	0.1290	0.14663	13.6	0.0848	0.09173	8.2	0.0586	0.07144	21.8
	4.00		0.103			0.0640			0.0468		
75	5.00	0.2	0.0811	0.08607	6.1	0.0457	0.05354	17.2	0.0367	0.04509	22.9
				Minimum	-6.0		Minimum	-1.0		Minimum	-4.0

Bold values indicate control points in design ground response spectrum, intermediate values obtained by log(period)-log(SA) interpolation

Shaded values indicate negative mismatch between time history spectrum and design response spectrum