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October 2, 1978

Mr. John F. Stolz, Chief
Light Water Reactors Branch No. 1
Division of Project Management
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Re: Docket No. 50-275-OL
Docket No. 50-323-OL
Diablo Canyon Units 1 & 2

Dear Mr. Stolz:

Attached are 40 copies of responses to your letter dated July 28, 1978 regarding reactor vessel material properties non-compliance with 10 CFR 50, Appendix G-fracture toughness requirements, and 10 CFR 50, Appendix H-reactor vessel material surveillance program requirements.

Five copies of these reports have been sent directly to Mr. Dennis Allison.

Kindly acknowledge receipt of the above material on the enclosed copy of this letter and return it to me in the enclosed addressed envelope.

Very truly yours,

Philip A. Crane, Jr.

Enclosures
CC w/enc.: Mr. Dennis Allison
Service List

Areas of Non-Compliance with 10CFR50 - Appendix G

The ferritic materials in the Diablo Canyon Units 1 and 2 reactor vessels were not all tested to meet the later ASME Section III Boiler and Pressure Vessel Code required by 10CFR50 Appendix G since these vessels were fabricated to the 1966 and 1968 Editions of the Code, respectively. Therefore, Charpy impact test orientation was parallel to the working or rolling direction of the base materials rather than normal to the working or rolling direction as required by Appendix G. Westinghouse did, however, perform additional impact tests on the intermediate and lower shell course plates of both vessels which surround the effective height of the fuel assemblies. Full Charpy test curves were obtained on these plates from specimens oriented normal to the principal rolling direction. A summary of these results is presented in Tables 5.2-21A & B. Full Charpy curves for all the base material on the vessels have been obtained by the fabricator on impact specimens oriented parallel to the principal working or rolling direction. RT_{NDT} for materials not in the beltline region were estimated using methods identified in the NRC Standard Review Plan 5.3.2.

Weld metal test specimens were removed from a separate weldment using excess material from the beltline region plates.

Reactor vessel bolting material toughness tests were not performed to meet a minimum requirement of 25 mils lateral expansion and 45 ft-lb energy at the preload temperature or at the lowest service temperature.

Tests were performed to meet 35 ft-lbs at $10^{o}F$. The results of the tests are shown in the attached tables. These results show that some of the bolting material did not meet the 45 ft-lb requirement of Appendix G at $10^{o}F$. It is expected that these materials would exhibit at least 45 ft-lbs if tested at $50^{o}F$ which is considered to be the lowest pre-load or service temperature. Although lateral expansion measurements were not performed in most cases, it is also expected that these materials would exhibit at least 25 mils lateral expansion if tested at $50^{o}F$ based on test results on other bolting materials where both impact energy and lateral expansion were obtained.

Stress intensity factors for various vessel locations were not calculated to determine if they are lower than the reference stress intensity factors specified in ASME Section III Code Appendix G. Westinghouse has performed these calculations for many vessels and has shown that the calculated stress intensity factors are always lower than the reference stress intensity. Westinghouse is confident that if calculated stress intensity factors for the Units 1 and 2 vessels were obtained, the values would fall below the reference stress intensity factors.

Pressure-temperature limits for the reactor vessels have been established using the methods identified in NRC Standard Review Plan 5.3.2. The assumptions and sample calculation identified in the Standard Review Plan are similar to those used by Westinghouse. Drop weight specimens were machined parallel to the rolling direction. Charpy impact test specimens were oriented as identified earlier.

DIABLO CANYON UNIT NO. 1 CLOSURE HEAD
BOLTING MATERIAL PROPERTIES

CLOSURE HEAD STUDS

HEAT NO.	MAT'L SPEC. NO	BAR NO.	0.2% YS KSI	UTS KSI	ELONG. %	RA %	BHN	ENERGY AT 10°F FT-LBS	LATERAL EXPANSION MILS
46500	SA540 GR24	134	158.0	173.0	16.0	55.7	363	42, 44, 45	—
		134-1	155.0	167.5	17.0	57.7	341	50, 52, 50	—
		142	153.0	167.0	17.0	56.1	341	48, 50, 47	—
		142-1	162.0	175.0	16.0	55.0	363	44, 44, 41	—
		133	154.5	168.5	17.0	57.8	341	47, 48, 47	—
		133-1	158.7	172.5	16.5	56.8	341	47, 47, 47	—
		141	153.2	169.0	17.0	55.7	352	45, 46, 46	—
		141-1	150.0	165.0	16.0	55.2	341	52, 53, 54	—
		139	161.0	175.0	16.5	53.4	363	40, 42, 40	—
		139-1	164.5	178.5	15.0	53.3	363	40, 44, 42	—
		121	152.5	167.0	17.0	56.8	341	54, 52, 50	—
		121-1	147.5	163.0	16.5	55.5	363	50, 50, 50	—
		116	147.0	163.5	16.0	53.6	341	50, 50, 53	—
		116-1	145.0	162.0	17.0	55.2	352	53, 53, 55	—
37075		130	141.5	161.0	17.0	56.0	352	50, 45, 47	—
		130-1	148.5	164.5	17.0	56.9	363	46, 47, 46	—
		127	149.0	164.5	17.0	57.5	341	54, 51, 52	—
		127-1	146.0	162.0	17.5	56.1	341	54, 54, 53.	—
		113	146.5	162.0	17.5	58.1	331	52, 52, 53	—
		113-1	140.0	158.0	17.0	56.5	341	51, 46, 53	—
		122	150.0	164.0	17.0	56.5	341	54, 52, 52	—
		122-1	147.5	162.5	17.5	57.3	352	55, 55, 52	—

DIABLO CANYON UNIT NO. 1 CLOSURE HEAD BOLTING MATERIAL PROPERTIES

CLOSURE HEAD NUTS & WASHERS

HEAT NO.	MAT'L SPEC. NO	TUBE NO	0.2% YS KSI	UTS KSI	ELONG %	RA %	BHN.	ENERGY AT 10°F FT-LBS	LATERAL EXPANSION MILS
46251	SA540 B23	5	157.5	170.0	16.0	54.7	363	42, 46, 46	—
		5-1	149.5	163.0	17.9	55.8	341	50, 54, 53	—
		8	152.5	164.0	16.5	55.3	341	50, 50, 49	—
		8-1	151.5	162.2	17.0	56.0	341	50, 50, 54	—
		11	151.0	163.5	17.0	55.8	341	50, 50, 50	—
		11-1	151.0	164.0	17.0	56.5	341	52, 54, 50	—
		10	150.5	161.0	17.0	56.0	341	50, 50, 53	—
		10-1	148.5	161.0	17.0	56.8	341	50, 55, 48	—
		13	153.0	164.0	17.0	57.3	331	54, 50, 53	—
		13-1	147.2	159.0	17.0	56.5	341	56, 50, 51	—
		17	148.7	161.5	17.0	56.5	341	52, 50, 55	—
		17-1	155.5	167.5	16.0	54.2	341	51, 51, 50	—
		21	155.5	168.0	16.5	55.5	352	46, 50, 48	—
		21-1	150.5	162.0	16.5	56.2	341	54, 54, 54	—
		22	150.2	162.5	16.0	56.0	341	54, 52, 50	—
		22-1	147.0	160.0	17.0	57.3	341	54, 56, 54	—
46715		26	158.5	172.0	16.0	54.1	363	44, 45, 44	—
		26-1	156.0	170.0	17.0	56.0	352	48, 44, 48	—
		28	144.7	160.5	17.5	57.3	352	50, 56, 50	—
		28-1	154.7	167.5	17.0	54.7	363	45, 42, 40	—
		31	149.0	164.0	17.5	57.1	363	46, 48, 48	—
		31-1	156.0	169.0	16.5	54.9	363	44, 44, 44	—

DIABLO CANYON UNIT NO. 2 CLOSURE HEAD
BOLTING MATERIAL PROPERTIES

CLOSURE HEAD STUDS

HEAT NO.	MAT'L SPEC. NO.	BAR NO.	0.2% YS KSI	UTS. KSI	ELONG. %	RA %	BHN	ENERGY AT 10°F FT-LBS	LATERAL EXPANSION MILS
15966	SA540 B24	101	142.5	156.0	18.0	58.6	341	60, 62, 63	31, 34, 37
		101-1	139.0	153.0	18.0	57.8	341	62, 62, 63	40, 40, 31
		102	141.7	155.0	18.5	58.3	331	60, 63, 61	36, 39, 37
		102-1	140.2	154.5	18.5	58.6	331	61, 59, 63	32, 35, 37
		104	141.5	155.0	18.0	51.8	341	62, 60, 62	38, 38, 35
		104-1	140.0	154.7	18.5	58.8	331	63, 65, 61	44, 38, 33
		108	144.5	157.0	19.0	58.3	341	59, 58, 61	31, 28, 35
		108-1	142.2	155.0	18.0	58.1	341	60, 55, 59	36, 32, 32
15026		428	145.0	160.0	16.0	54.7	363	50, 50, 48	—
		428-1	155.2	169.0	15.0	48.4	388	43, 45, 40	—
		431	144.0	161.0	17.0	55.5	363	46, 48, 46	—
		431-1	152.0	166.5	16.5	55.7	375	44, 44, 40	—
		436	152.5	166.0	16.0	53.3	375	46, 47, 46	—
		436-1	159.5	171.0	16.0	52.3	375	46, 47, 46	—
		435	153.0	167.0	16.0	53.2	352	50, 46, 45	—
		435-1	152.5	167.0	16.0	54.5	363	47, 47, 48	—
		440	150.0	165.5	17.0	52.5	363	46, 48, 47	—
		440-1	154.0	170.0	16.0	50.8	375	40, 44, 46	—
		465	152.5	168.0	16.5	53.0	341	46, 47, 45	—
		465-1	156.0	170.5	17.0	55.6	363	46, 45, 46	—

DIABLO CANYON UNIT NO. 2. CLOSURE HEAD
BOLTING MATERIAL PROPERTIES
CLOSURE HEAD NUTS & WASHERS

HEAT NO.	MAT'L SPEC. NO	TUBE NO	0.2% YS KSI	UTS KSI	ELONG %	RA %	BHN	ENERGY AT 10°F FT-LBS	LATERAL EXPANSION MILS
46251	SA540 B23	5	157.5	170.0	16.0	54.7	363	42, 46, 46	—
		5-1	149.5	163.0	17.9	55.8	341	50, 54, 53	—
		8	152.5	164.0	16.5	55.3	341	50, 50, 49	—
		8-1	151.5	162.2	17.0	56.0	341	50, 50, 54	—
		11	151.0	163.5	17.0	55.8	341	50, 50, 50	—
		11-1	151.0	164.0	17.0	56.5	341	52, 54, 50	—
		10	150.5	161.0	17.0	56.0	341	50, 50, 53	—
		10-1	146.5	161.0	17.0	56.8	341	50, 55, 48	—
		13	153.0	164.0	17.0	57.3	331	54, 50, 53	—
		13-1	147.2	159.0	17.0	56.5	341	56, 50, 51	—
		17	148.7	161.5	17.0	56.5	341	52, 50, 55	—
		17-1	155.5	167.5	16.0	54.2	341	51, 51, 50	—
		21	155.5	168.0	16.5	55.5	352	48, 50, 48	—
		21-1	150.5	162.0	16.5	56.2	341	54, 54, 54	—
		22	150.2	162.5	16.0	56.0	341	54, 52, 50	—
Y	Y	22-1	147.0	160.0	17.0	57.3	341	54, 56, 54	—

Areas of Non-Compliance With 10CFR50 - Appendix H

The surveillance program for Unit No. 1 does not comply with ASTM E-185-73. This program was designed to conform with ASTM E-185-70; therefore the number of test specimens and their orientation is not in agreement with ASTM E-185-73. The surveillance weld material is representative but not identical to that used in the beltline region of the vessels.

Four of the six capsules in Unit No. 2 will receive a neutron flux 3.6 times as high as that received by the vessel inner surface and therefore are not in agreement with the requirement of Appendix H which requires that the neutron flux received by the specimens is not more than three times as high as that received by the vessel inner surface.