AUG 7 1984

Docket No. 50-354

APPLICANT: Public Service Electric & Gas Company (PSE&G)

FACILITY: Hope Creek Generating Station

SUBJECT: SUMMARY OF MATERIALS ENGINEERING BRANCH (MATERIALS APPLICATIONS SECTION) DRAFT SER OPEN ITEM MEETING

On July 17, 1984, a meeting was held in the Bethesda, Maryland offices of the NRC to discuss Draft SER Open Items identified by the Materials Engineering Branch in Draft SER Sections 5.3.1.2, 5.3.1.3 and 5.3.4. A list of attendees is included as Enclosure 1 to this meeting summary.

The open items discussed and their status are indicated in Enclosure 2. In addition to providing responses as identified in Enclosure 2, PSE&G will submit for staff review additional information on the vessel "discontinuity limits" identified in FSAR Figure 5.3-1. PSE&G will formally respond to the items discussed at the meeting by July 31, 1984.

David H. Wagner, Project Manager
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Division of Licensing

Enclosures: As stated

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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Hope Creek

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Ms. Mary Henderson, Clerk
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U.S. Environmental Protection Agency
ATTN: EIS Coordinator
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26 Federal Place
New York, New York 10007

Enclosure 1

MEETING TITLE: Material Engineering Branch DSER Open Item Meeting (Mat'ls Applications Section)

APPLICANT: PSE&G

FACILITY: Hope Creek Generating Station

DATE: July 17, 1984

NAME	AFFILIATION
Dave Wagner	NRC
William Gailey	PSE&G
Bruce Preston	PSE&G
Steve Carter	G.E.
Joseph E. Rogozenski	PSE&G
Dean B. James	G.E.
James M. Ashley	PSE&G
Barry J. Elliot	NRC

ENCLOSURE 2

DSER Section 5.3.1.2 /5.3.4

To demonstrate that the GE Procedure Y 1006A006 is applicable to Hitachi fabricated vessel, provide:

a. GE Procedure Y 1006A006

b. Test results and analysis of Hitachi fabricated materials and its supplier which shows the GE Procedure will conservatively predict the RT_{NDT} for the Hitachi forgings, plates, and welds.

The plate/forge materials which forms the data base for the analysis, must be melted, cross-rolled or forged and heat treated to an equivalent condition as the Hitachi plate/forge material.

The weld materials, which form the data base for the analysis must be fabricated using equivalent wire flux and heat treatment as the Hitachi weld materials.

STATUS

The applicant provided a proposed response at the meeting (attached). The response is under staff review pending formal submittal of the response by July 31, 1984.

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QUESTION 251.2

To demonstrate that the GE Procedure Y 1006A006 is applicable to Hitachi fabricated vessel, provide:

a. GE Procedure Y 1006A006

b. Test results and analysis of Hitachi fabricated materials and its supplier which shows the GE Procedure will conservatively predict the RT_{NDT} for the Hitachi forgings, plates, and welds.

The plate/forge materials which forms the data base for the analysis, must be melted, cross-rolled or forged and heat treated to an equivalent condition as the Hitachi plate/forge material.

The weld material, which form the data base for the analysis must be fabricated using equivalent wire flux and heat treatment as the Hitachi weld materials.

RESPONSE

The applicability of General Electric Procedure Y 1006A006, revision 1 (attached) to the Hitachi-fabricated Hope Creek Unit 1 reactor pressure vessel (RPV) is demonstrated by Tables 251.2-1 and 251.2-2. These tables compare the chemistries, heat treatments, and mechanical properties of the materials that form the data base for the application of Y1006A006 with the properties of the HCGS RPV materials. Table 251.2-1 provides data for plate materials, and Table 251.2-2 provides data for forgings. The comparisons indicate that for both plates and forgings there are no significant differences in these properties between the Y1006A006 materials and the HCGS RPV materials.

Further evidence of the compatibility of the HCGS RPV material is presented in Tables 251.2-3 and 251.2-4, which compare Charpy V-notch test results. As shown in Table 251.2-3, the plates fabricated by Japan Steel/Hitachi have toughness properties equivalent to the Y1006A006 data-base materials, although they were evaluated at test temperatures 10°F lower. Similarly, as shown in Table 251.2-4, the Japan Steel/Hitachi forgings demonstrate a -10°F notch toughness comparable to results for the Y1006A006 forgings, which were tested at +50°F.

Evidence of the equivalence of the Y1006A006 and Hitachi weld materials is given in Table 251.2-5, which compares their respective chemistries, tensile properties, and thermal treatments. Except for the Ni content, these materials are very similar, although the Hitachi weld metals are generally lower in phosphorus and sulfur content.

Table 251.2-6 compares the Charpy V-notch impact-test results for Y1006A006 and Hitachi weld materials. The Hitachi materials correspond well with the notch toughness values for the Y1006A006 materials and, in fact, are generally superior. The submerged-arc weld materials used for

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fabrication of the HCGS RPV are not presented in this response because their toughness properties are suitable to meet the requirements of Appendix G of 10 CFR 50 for establishing reference temperatures, and it was not necessary to apply procedure Y1006A006.

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Table 251.2-1

Comparison of SA 533 Plate Material
Used as the Data Base for GE Procedure Y1006A006 Versus SA533 Material Manufactured by Japan Steel Works for Hope Creek Unit 1 Reactor Pressure Vessel

Grade	Thickness (in.)	Source	No.[1]	C	Mn	P	S	Si	Ni	Cr	Mo	Heat Treatment	Orient.	Yield Strength (Ksi)	Ultimate Tensile Strength (Ksi)	% El.
				Average Composition of Materials (wt %)												
A533	6-6.5	GE	5	0.21	1.32	0.009	0.014	0.18	0.51	—	0.48	1625F-6Hr.-Agitated Brine-Q+1200F-6Hr.-	Long.	69.2	90.4	27.9
												Brine-Q+1125F-30Hr.-FC to 600F	Tran.	66.0	88.4	25.6
A533	7-7.5	Comb.	6	0.22	1.36	0.011	0.014	0.19	0.53	—	0.49	1675F-4Hr.-AC+1600F-4Hr.-Agitated WQ+	—	—	—	—
												1225F-4Hr.-FC+1150F-40Hr.-FC				
A533	8-8.5	GE	4	0.22	1.39	0.011	0.018	0.20	0.54	0.11	0.49	1775F-8.5Hr.-Agitated Brine-Q+1200F-8Hr.-	—	—	—	—
												Brine-Q+1125F-30Hr.-FC				
A533	8.5-9	Comb.	1	0.22	1.38	0.011	0.013	0.21	0.44	—	0.49	1675F-4Hr.-AC+1600F-4Hr.-Agitated WQ+	Tran.	68.3	88.6	25.4
												1225F-4Hr.-FC+1150F-40Hr.-FC				
A533	9.5-10	West.	6	0.21	1.31	0.011	0.017	0.22	0.57	0.14	0.47	1600F-4Hr.-Agitated WQ-1225F-4Hr.-AC+	Tran.	66.4	86.3	24.3
												1150F-40Hr.-FC	Long.	66.2	87.4	26.0
A533	11.5-12	Comb.	3	0.23	1.31	0.010	0.015	0.19	0.55	—	0.58	1675F-4Hr.-AC+1600F-4Hr.-Agitated WQ+	Tran.	64.4	86.7	26.5
												1225F-4Hr.-FC+1150F-40Hr.-FC				
A533	11.5-12	West.	4	0.21	1.35	0.013	0.022	0.24	0.51	—	0.48	1600F-4Hr.-Agitated WQ+1225F-4Hr.-AC+	Long.	66.7	87.3	26.2
												1150F-27Hr.-FC	Tran.	67.8	86.9	26.0
A533[2]	6-6.5	Japan Steel		0.20	1.45	0.012	0.008	0.31	0.63	—	0.56	(1580F-1634F)-3.4Hr.-Q+(1202F-1238F)-	—	70.2	92.5	26.5
												3.3Hr.+(1112F-1130F)-40.5Hr.				
A533	6-6.5	Japan Steel		0.20	1.43	0.010	0.008	0.30	0.56	—	0.54	"	—	70.8	92.3	25.1
A533	6-6.5	Japan Steel		0.22	1.43	0.009	0.008	0.29	0.58	—	0.59	"	—	69.3	91.8	25.0
A533	6-6.5	Japan Steel		0.19	1.44	0.010	0.012	0.30	0.56	—	0.50	"	—	62.7	87.5	27.5
A533	6-6.5	Japan Steel		0.20	1.46	0.010	0.011	0.27	0.54	—	0.51	"	—	66.2	89.4	24.6
A533	6-6.5	Japan Steel		0.018	1.49	0.008	0.010	0.31	0.57	—	0.50	"	—	68.6	90.5	25.6

[1] No. = Number of plates tested
[2] = SA 533, Gr.B, Cl.1

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Table 251.2-2

Comparison of SA 508 Forging Material
Used as the Data Base for GE Procedure Y1006A006 Versus SA508 Material Manufactured by Japan Steel Works for Hope Creek Unit 1 Reactor Pressure Vessel

Grade	Thickness (in.)	Source	No.[1]	Average Composition of Materials (wt %) C	Mn	P	S	Si	Ni	Cr	Mo	V	Heat Treatment	Orient.	Yield Strength [redacted](ksi)	Ultimate Tensile Strength [redacted](Ksi)	Reduction of Area (%)
A508 Cl.2	5-8.5	West.	1	0.19	0.65	0.010	0.007	0.23	0.69	0.33	0.60	0.02	1550F-9Hr.-WQ+1210F-12Hr.-AC+1125F-11Hr.-FC	Tang.	72.1	91.3	69.
A508 Cl.2	9-9.5	West.	1	0.22	0.63	0.009	0.011	0.24	0.68	0.34	0.59	0.02	1585F-11Hr.-Double WQ-1220F-22Hr.-AC+1110F-6Hr.+50°/Hr. to 600F	Tang.	58.9	82.1	70.
A508 Cl.2	15-20	GE	1	0.21	0.60	0.010	0.007	0.24	0.67	0.33	0.58	0.04	1615F-9Hr.-Agitated WQ+1230F-20Hr.-WQ+1125F-30Hr.-100°/Hr. to 600F-AC	Tang.	60.0	82.1	73.
A508 Cl.2	20-25	Ladish	4	0.23	0.63	0.009	0.010	0.26	0.78	0.35	0.63	0.045	1650F-8Hr.-AC+1650F-8Hr.-WQ+1275F-24Hr.-WQ+1150F-30Hr.-FC to 600F-AC	Tang.	62.5	87.0	66.
A508 Cl.2	6.7	Japan Steel		0.16	0.72	0.010	0.009	0.32	0.84	0.39	0.62	—	(1634F-1643F)Austenitize-9.1Hr.+(1211F-1220F)Temper-16Hr.+1144F-PWHT-40Hr.	—	71.0	88.4	70.
A508 Cl.2	6.7	Japan Steel		0.15	0.70	0.011	0.011	0.32	0.81	0.38	0.63	Tr.	(1652-1670F)Austenitize-11Hr.+(1220-1230F)-Temper-16.5Hr.+1156F-PWHT-40Hr.	—	65.1	82.5	72.

[1]No. = Number of forgings tested

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Table 251.2-3

Comparison of Notch Toughness Information for Japan Steel and Y1006A006 Plate Material

				1/4T Charpy V-Notch Test Results			
Grade	Thickness (in.)	Source	Orientation	No.[1]	Test Temperature (°F)	Average Absorbed Energy (ft-lb)	Average Lateral Expansio (mils)
A533	6-6.5	GE	Transverse	5	+ 50	60	44
	7-7.5	Comb.		6		56	45
	8-8.5	GE		4		60	40
	8.5-9	Comb		1		53	40
	11.5-12	Comb.		3		47	36
	11.5-12	West.		4		44	40
SA533, Gr.B, Cl.1	6.2-6.8	Japan Steel		See Below[2]	+ 40	44	34
						50	38
						81	57
						64	50
						54	40
						52	41

[1] No = Number of plates tested

[2] Each row of data represents a heat of material used in the beltline region of the Hope Creek Unit 1 RPV.

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Table 251.2-4

Comparison of Notch Toughness Information for Japan Steel and Y1006A006 Forgings

Grade	Thickness (in.)	Source	Orientation	No.[1]	Test Temperature (°F)	Average Absorbed Energy (ft-lb)	Average Lateral Expansion (mils)
				1/4T Charpy V-Notch Test Results			
A508 Class 2	8-8.5	West.	Tang.	1	+ 50	81	60
↓	9-9.5	West.	Tang.	1	↓	96	64
↓	15-20	GE	Long.	1	↓	96	55
↓	20-25	Ladish	N.R.	4	↓	48	NR
ASME SA508, Class 2	6.7	Japan Steel/ Katsuta Works, Hitachi Ltd.	Long.	See Below[2]	- 10	80	66
ASME SA508, Class 2	6.7	Japan Steel/ Katsuta Works, Hitachi Ltd.	Long.		- 10	77	62

[1] No. - Number of forgings tested

[2] Each row of data represents a heat of material used in the fabrication of the low pressure core injection nozzles for Hope Creek Unit 1 RPV

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Table 251.2-5

Comparisons of Y1006A006 and Hitachi Shielded Metal Arc Weld Material

Heat/Lot	Chemical Composition (wt. %) C	Ni	Mn	Si	P	S	Mo	V	Cu	Yield Strength (Ksi)	Ultimate Tensile Strength (Ksi)	Reduction of Area (%)	Heat Treatment
Y1006A006 DATA BASE:													
402P3162/H426B27AE	0.066	0.83	1.06	0.46	0.02	0.018	0.49	0.019	0.03	78.7	90.7	42.8	1150°F ± 20° for 50 hours
401P2871/H430B27AF	0.06	0.98	1.09	0.36	0.013	0.017	0.52	0.02	0.03	73.5	83.5	71.2	"
03L048/B525B27AF	0.04	0.96	1.23	0.40	0.014	0.014	0.53	0.02	0.09	78.0	91.0	64.7	"
L83978/J414B27AD	0.08	1.06	1.15	0.51	0.017	0.014	0.54	0.02	0.02	83.7	94.5	69.5	"
401S0371/B504B27AE	0.05	1.04	1.18	0.37	0.012	0.012	0.56	0.02	0.03	84.2	94.4	68.2	"
492L4871/A421B27AE	0.07	0.95	1.06	0.37	0.018	0.025	0.50	0.02	0.04	72.0	84.5	72.7	"
422K8511/G313A27AD	0.06	1.00	1.21	0.31	0.016	0.013	0.54	0.02	0.01	81.3	91.5	74.5	"
640892/J424B27AE	0.08	1.00	1.20	0.44	0.015	0.018	0.55	0.02	0.09	76.5	90.0	71.0	"
07R458/S[illegible]03B27AG	0.06	0.97	1.14	0.35	0.020	0.021	0.51	0.02	0.04	68.0	80.5	71.4	"
HITACHI:													
510-01205	0.072	0.54	1.20	0.42	0.016	0.011	0.45	—	0.09	85.6	94.6	67.9	1112–1170°F 40 hours
519-01205	0.08	0.56	1.10	0.40	0.011	0.012	0.46	—	—	73.0	85.5	71.7	"
504-01205	0.07	0.48	1.01	0.42	0.011	0.008	0.44	—	—	69.8	83.3	68.[illegible]	"

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Table 4251.2-6
Comparison of CVN Test Results for Y1006A006 and Hitachi Weld Materials

Source	Heat/Flux	Process	Test Temp (°F)	Absorbed Energy (ft.lb)	Lateral Expansion (mils)	Shear (%)
Y1006A006	03L048/B525B27AF	SMAW	0	61, 75, 79	44, 58, 59	50, 60, 60
			+ 40	104, 108	75, 77	80, 80
			+130	122, 123, 126	89, 83, 91	100, 100, 100
	02R486/J404B27AG		- 10	52, 64, 66	39, 45, 46	40, 40, 40
			+ 40	84, 87	63, 68	60, 60
			+130	121, 124, 129	91, 96, 95	100, 100, 100
	L83978/J414B27AD		- 20	51, 52, 81	37, 40, 63	35, 50, 40
			+ 40	120, 123	72, 73	80, 80
			+ 72	128, 140	78, 81	90, 90
	401S0371/B504B27AE		0	80, 85, 82	53, 62, 60	35, 50, 35
			+ 40	95, 97	71, 76	40, 75
			+ 70	111, 107, 109	87, 85, 77	80, 90, 80
	402P3162/H426B27AE		- 10	60, 54, 68	44, 37, 53	40, 30, 30
			+ 40	96, 99	57, 68	60, 60
			+212	119, 122, 124	93, 90, 68	100, 100, 100
	492LA871/A421B27AE		0	50, 51, 57	36, 38, 40	30, 40, 45
			+ 40	135, 137	84, 80	90, 80
	422K8511/G313A27AD		- 20	65, 74, 127	44, 48, 76	40, 50, 60
			+ 25	107, 108	74, 80	80, 70
	640892/J424B27AE		0	55, 62, 62	38, 44, 48	35, 40, 40
			+ 40	56, 75	42, 55	50, 60
			+130	118, 122, 130	87, 89, 92	100, 100, 100
	401P2871/H430B27AE		0	27, 50, 56	25, 42, 46	40, 45, 45
			+ 10	75, 76, 107	60, 62, 74	60, 50, 80
			+ 40	90, 100	71, 76	70, 80
	07R458/S403B27AG		0	59, 61, 70	51, 52, 58	50, 50, 60
			+ 40	99, 101	77, 78	80, 75
		↓	+ 72	106, 110	85, 87	80, 80

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351.2-6

Table 6A (continued)

Comparison of CVN Test Results for Y1006A006 and Hitachi Weld Materials

Source	Heat/Flux	Process	Test Temp (°F)	Absorbed Energy (ft-lb)	Lateral Expansion (mils)	Shear (%)
Hitachi	510-01205	SMAW	+ 10	90, 73, 48	70, 64, 38	60, 40, 30
				98, 87, 92	65, 66, 65	50, 50, 50
	519-01205	↓	+ 10	110, 110, 107	87, 78, 70	75, 75, 80
	504-01205	↓	+ 10	130, 120, 123	89, 84, 92	75, 80, 75

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DSER Section 5.3.1.2 | 5.3.4

To demonstrate compliance with the qualification and calibration requirements of NB 2360 of the Summer 72 Addenda to the 1971 edition of the ASME Code, indicate the qualification and calibration program requirements, which were used for the RCPB materials and indicate how these requirements satisfy the calibration and qualification requirements of NB 2360 of the Summer 72 Addenda to the ASME Code.

STATUS

Based on the proposed response presented at the meeting (attached),

The response provided at the meeting (attached) appears to be acceptable. This response will be formally submitted for staff review by July 31, 1984.

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QUESTION 251.3

To demonstrate compliance with the qualification and calibration requirements of NB 2360 of the Summer 72 Addenda to the 1971 edition of the ASME Code, indicate the qualification and calibration program requirements, which were used for the RCPB materials and indicate how these requirements satisfy the calibration and qualification requirements of NB 2360 of the Summer 72 Addenda to the ASME Code.

RESPONSE

As indicated in Section 5A.3:

a. The main steam piping material was tested in accordance with the Summer, 1972 Addenda to the 1971 Edition of Section III of the ASME B&PV Code.

b. The flued-head fitting material was tested in accordance with the Winter, 1973 Addenda to the 1971 Edition of Section III of the ASME B&PV Code.

c. The safety/relief valves were exempted from testing because of their 6-inch size.

d. The main steam isolation valves were also exempted from testing at the time of purchase.

The reactor pressure vessel was procured to the Winter, 1969 Addenda to the 1968 Edition of Section III of the ASME B&PV Code. Information from GETSCO, Tokyo, indicates that Hitachi impact tested the RPV material in accordance with paragraph NB 2360 of the Summer, 1972 Addenda of the 1971 Edition of the ASME B&PV Code.

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DSER Section 5.3.4

Provide drop weight test and Charpy V-notch test results from the closure flange region materials to demonstrate compliance with the closure flange requirements of Appendix G, 10 CFR 50.

STATUS

The applicant provided the attached proposed response at the meeting. The staff commented that limiting material (highest nil-ductility transition temperature material) should be identified. PSE&G will formally submit a revised response by July 31, 1984.

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QUESTION 251.4:

Provide drop weight test and Charpy V-notch test results from the closure flange region materials to demonstrate compliance with the closure flange requirements of Appendix G, 10 CFR 50.

RESPONSE

Available drop-weight and Charpy V-notch test results for the Hope Creek Unit 1 closure flange materials are provided below:

Material	Orientation	NDT Temp. (°F)	Test Temp. (°F)	Absorbed Energy (Ft-lbs)	Lateral Expansion (Mils)
SA508, C1.2 (Head Flange)	Longitudinal	-20/	-40	64.1,70.6,20.8,77.1	48,51,11,58,
		-10	-10	93.1,114.7,106.6, 87.8,97.1,71.9	64,78,62,55, 64,49
		@180° AWAY	10	81.1,108,133.6, 137.6,165.1	49,68,78,95, 68,74
			40	157.4,121.5,137.6, 134.9,144.3,137.6	89,73,77,86, 79,85
			60	199.9,154.8,159.9, 195.4,144.3,170.1	77,69,88,87, 82,73
SA508,C1.2 (Shell Flange)	Longitudinal	-10	10	120.1,122.8,130.9, 130.9,132.3,116.1	77,81,83,81, 77,64
			-10	120.1,95.8,128.2, 109.3,101.2,87.8	72,58,80,75, 59.57
			+40	141.6,134.9,141.6, 145.6,167.6,182.4	81,77,84,82, 85,89
			-40	13.4,69.3,59.0,55.2, 74.5,101.2	7,48,41,38, 54,68

DRAFT

DSER Section 5.3.1.2 /5.3.4

Provide Charpy V-notch data and analysis from base materials, which are similar to the base materials used in fabrication of shell course No. 3, to demonstrate that the upper shelf energy properties of the plates in shell course No. 3 exceed the requirements of Paragraph IV.A.1 of Appendix G, 10 CFR 50.

STATUS

A proposed response was provided at the meeting (attached). The staff will review this response pending formal submittal of the attached response by July 31, 1984.

DRAFT

QUESTION 251.5

Provide Charpy V-notch data and analysis from base materials, which are similar to the base materials used in fabrication of shell course No. 3, to demonstrate that the upper shelf energy properties of the plates in shell course No. 3 exceed the requirements of Paragraph IV.A.1 of Appendix G, 10 CFR 50.

RESPONSE

Table 5A-1 provides drop-weight NDT information and Charpy V-notch test results for the materials from shell courses 4 and 5 as well as information for the materials from shell course No. 3. Table 5A-3 compares the heat treatments, the chemistries, and the mechanical properties of these shell course materials and demonstrates that the materials from shell courses 4 and 5 should be considered equivalent to those from shell course No. 3. This equivalence and the suitable upper-shelf energies for the plates from shell courses 4 and 5, as presented in Appendix 5A, demonstrate that plates from shell course No. 3 should be considered to have upper-shelf energies that meet or exceed the requirements of Apppendix G of 10 CFR Part 50.

DRAFT

DSER Section 5.3.1.2/5.3.4

To demonstrate that the ferritic RCPB materials in the MSIV meet the requirements of Paragraph NB 2332 of the Winter 1972 Addenda of the ASME Code, provide:

a. Thickness of MSIV bodies and covers

b. Connecting pipe sizes

c. Lowest service metal temperature.

STATUS

The attached proposed response presented at the meeting appears to be acceptable. PSE&G will provide this response formally by July 31, 1984.

DRAFT

QUESTION 251.6

To demonstrate that the ferritic RCPB materials in the MSIV meet the requirements of Paragraph NB 2332 of the Winter 1972 Addenda of the ASME Code, provide:

a. Thickness of MSIV bodies and covers

b. Connecting pipe sizes

c. Lowest service metal temperature

RESPONSE

The thickness of MSIV bodies and covers are 1.925 and 5.095 inches, respectively; the connecting pipe size is 26 inches; and the lowest service metal temperature is ~~406°F.~~ 70°F

DRAFT

DSER Section 5.3.1.3 /5.3.4

Provide lead factors and predicted meutron fluence to be received by each surveillance capsule at the time of their withdrawal.

STATUS

The applicant provided the attached proposed response at the meeting. The staff indicated that the "time frame" for the calculated peak fluence should be indicated in the response. PSE&G will revise the response and submit it formally for staff review by July 31, 1984.

DRAFT

QUESTION 251.7:

Provide lead factors and predicted neutron fluence to be received by each surveillance capsule at the time of their withdrawal.

RESPONSE

Lead factors have been calculated using the base locations of the sample and nominal dimensions of the vessel. The lead factors are defined as the ratio of the neutron flux at the surveillance sample to the highest neutron flux at the wall of the vessel. The lead factor at the vessel inside diameter is 0.86 and the lead factor at one quarter of the vessel thickness is 1.20.

The calculated peak fluence at the inside diameter of the vessel is 1.7×10^{18} n/cm^2 and at one quarter of the vessel thickness is 1.1×10^{18} n/cm^2. The withdrawal of the capsules will be according to the following criteria:

a. The first set will be withdrawn when its exposure corresponds to the calculated exposure of the reactor vessel wall at 25% of the reactor design life.

b. The second set will be withdrawn when its exposure corresponds to the calculated exposure of the reactor vessel wall at 75% of the reactor design life.

c. The third set will be a spare to be withdrawn based on previously developed data.

Based on these criteria, the first specimens would be withdrawn after 11.6 years of operation with a fast neutron fluence of 4.2×10^{17} n/cm^2. The second set would be withdrawn with a fast neutron fluence of 1.3×10^{18} n/cm^2.

The construction tolerances on the reactor vessel required that the minimum (nominal) radius of the vessel be maintained. The applicable version of the ASME B&PV Code did allow for areas of the vessel to have larger radii. The measurement acceptance techniques for the vessel were either the use of a template to test the minimum diameter or a series of measurements to determine the diameter at various points. The measurement technique did not require the identification of the locations where the vessel diameter is longer than nominal. Hence the lead factors were calculated for the nominal dimension.

If an area of increased vessel diameter were to coincide with a location of the surveillance sample specimens, the correct fluence at the samples would be less than that predicted from measurements on the samples. If these data were used to predict the peak fluences, the values would be less than the calculated peak fluences. The calculated peak fluences using nominal dimensions will be conservative.

DRAFT