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SUBJECT: Provides results of independent review of util calculations performed to support disposition of flaws found in core shroud welds H2,H4,H5 & H6B during plant core shroud insps.

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**SUSQUEHANNA STEAM ELECTRIC STATION
UNIT 1 CORE SHROUD INDEPENDENT
REVIEW RESULTS
PLA-4316**

FILE R41-2

Docket No. 50-387

References: PLA-4314 from R.G. Byram to USNRC, "Generic Letter 94-03 Additional Inspection Information," dated May 1, 1995.

PLA-4310 from R.G. Byram to USNRC, "Generic Letter 94-03 Interim Inspection Report," dated April 21, 1995.

PLA-4233 from R.G. Byram to USNRC, "Interim Response to Generic Letter," dated December 19, 1994.

This letter provides the results of the independent review of PP&L's calculations performed to support disposition of flaws found in core shroud welds H2, H4, H5, and H6B during the Susquehanna Steam Electric Station (SSES) Unit 1 core shroud inspections. The results of this review show that the SSES Unit 1 core shroud meets the required safety factors for structural integrity for continued operation for a period of at least 18 months of operation (see Attachment 1 to this PLA for details).

Also included with this letter are revisions to Attachment 4 "Summary of SSES Unit 1 Shroud Defects" of the referenced PLA-4314. These revisions have been discussed with NRC's Mr. C. Poslusny and Mr. J. Medoff of NRC NRR. Please discard the original Attachment 4 to PLA-4314 and replace it with the enclosed revised table.

We plan to submit our 30 day report covering the final inspection results for the Unit 1 shroud during the week of May 22, 1995. Our scope and schedule for the inspection of the Unit 2 core shroud, currently scheduled for the upcoming Unit 2 7th Refueling and Inspection Outage beginning in September 1995, will be submitted to NRC during the week of June 5, 1995.

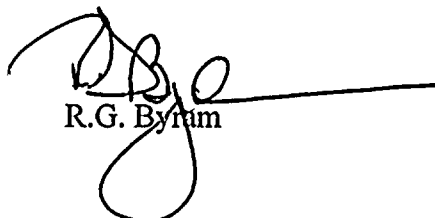
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If you have any questions, please call our Mr. James B. Wesner at 610-774-4023.

Very truly yours,

A handwritten signature in black ink, appearing to be 'R.G. Byram', written over a horizontal line. The signature is stylized and cursive.

Attachments

copy: NRC Region I
Ms. M. Banerjee - NRC Sr. Resident Inspector
Mr. C. Poslusny - NRR Sr. Project Manager

**Comparison of PP&L Results for Unit 1
Core Shroud Evaluations With Third Party Results**

During the analysis of the Unit 1 core shroud weld defects, PP&L retained the services of Structural Integrity Associates, Inc. (SIA) to perform an independent analysis of the weld defects. Both the PP&L and SIA calculations used the same input information from the stresses supplied by General Electric Company (GE) and the ISI data supplied by GE from the Unit 1 inspection. Both sets of calculations used limit load analysis for all welds that experienced operating neutron fluences below $3E+20$ n/cm². PP&L used the BWRVIP Distributed Ligament Length (DLL) computer program to calculate the safety factors for both the upset and the faulted conditions for the shroud loadings. SIA used their ANSC program which has been QA qualified and has verified that the DLL program gives the same results when given the same inputs.

SIA refined the inputs to their program to remove some of the conservatism built into the PP&L assumptions. SIA did not assume that all defects were through-wall as PP&L did, but "grew" the defects for 3 years mathematically before performing the limit load analysis. This left more good metal present for their analysis and, hence, produced slightly higher safety factors compared to PP&L's analysis. In addition, the ANSC program utilized all significant digit entries of the data, whereas the DLL program rounded out the data entries to the first significant number after the decimal point. This rounding off made the third and fourth digits in the output table slightly different. The table below compares the safety factors as calculated by PP&L and SIA for each of the welds for the limit load analysis.

Safety Factors for Limit Load Calculation Summary for SSES Unit 1

<u>WELD</u>	<u>UPSET</u>		<u>FAULTED</u>	
	<u>DLL</u>	<u>ANSC</u>	<u>DLL</u>	<u>ANSC</u>
H2	12.91	13.1	6.97	7.1
H5	2.92	3.0	1.87	1.9
H6A	10.42	10.6	6.74	6.9
H6B	5.38	5.5	3.56	3.7
H4	4.31	7.9	2.41	4.6
H4(LEFM)	N/A	3.1	N/A	1.8

Considering the H4 weld, the difference in safety factors can be understood in how the good metal and the defective metal were defined. PP&L applied the DLL program using only the good metal that was inspected, was not cracked, and was exposed to a fluence under $3E+20$ n/cm². The ANSC program assumes that all the metal was above the fluence limit of $3E+20$. Because of this assumption, SIA performed the Linear Elastic Fracture Mechanics (LEFM)

analysis to determine the applied stress intensity factor resulting from the bounding loading conditions for one cycle of operation. These results demonstrate that this weld still meets the safety factor requirements of 2.8 and 1.4 for the upset and faulted conditions respectively for one cycle of operation or 18 months.

PP&L has concluded, therefore, that our shroud will meet the required safety factors for structural integrity for continued operation for a period of at least 18 months of operation.

SUMMARY OF SSES UNIT 1 SHROUD DEFECTS

WELD ID	ISI TYPE	# DEFECTS	LONGEST(ANGLE/LENGTH)	DEEPEST INCHES	TOTAL LENGTH		LIMIT LOAD ANALYSIS	
					DEGREES	INCHES	UPSET	FAULTED
H1	UT	3	1.27DEGREES/2.42INCHES	0.2"	2.58	4.91	PASS	PASS
H2	UT	29	4.8/9.13	N/A	28.6	54.4	PASS	PASS
H3	UT	0	N/A	0"	0	0	N/A	N/A
H4	UT	28	28.19/50.46	0.7"	104.73	187.47	PASS	PASS
H5	UT	27	18.39/32.92	0.65"	105.84	189.45	PASS	PASS
H6A	UT	8	2.7/4.83	0.25"	6.66	11.92	PASS	PASS
H6B	UT	19	7.98/13.84	0.625"	38.08	66.05	PASS	PASS
H7	UT	0	N/A	0"	0	0	N/A	N/A
H8	VT-1	0	N/A	N/A	0	0	N/A	N/A
H9	VT-1	0	N/A	N/A	0	0	N/A	N/A
TO PASS UPSET CONDITION LIMIT LOAD ANALYSIS, THE SAFETY FACTOR CALCULATED WAS >2.8								
TO PASS FAULTED CONDITION LIMIT LOAD ANALYSIS, THE SAFETY FACTOR CALCULATED WAS >1.4								
MAX. FLUENCE TO THE END OF THE NEXT FUEL CYCLE, FALL 1996, WAS CALCULATED TO BE <3E20 n/cm^2 FOR ALL WELDS EXCEPT H4 WHICH WAS ABOVE THIS VALUE AT SOME PEAK LOCATIONS AROUND THE CIRCUMFERENCE.								

ATTACHMENT 4 TO PLA-4314
 Revision 1