NEI

NUCLEAR ENERGY INSTITUTE

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Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: Steam Generator Degradation Specific Management Database, Request for Additional Information

PROJECT NUMBER: 689

References:

1. Letter From S. Magruder (NRC) to D. Modeen (NEI), "Request for Additional Information Regarding NP 7480-L, Addendum 1, 'Steam Generator Tubing Outside Diameter Stress Corrosion Cracking at Tube support Plates, Database for Alternate Repair Limits,' 1996 Database Update, November 1996," dated January 24, 1997

2. Letter from D. Modeen (NEI) to S. Magruder (NRC), "Phase 1 Response to NRC RAI dated January 27, 1997," dated April 2, 1997

3. Letter from D. Modeen (NEI) to NRC Document Control Desk, "Steam Generator Degradation Specific Database, Addendum 2 and Responses to NRC Requests for Additional Information (RAI)," dated June 5, 1998

Reference 1 forwarded a Request for Additional Information (RAI) regarding NP 7480-L, *"Addendum 1 Steam Generator Tubing Outside Diameter Stress Corrosion Cracking at Tube Support Plates, Database Alternate Repair Limits"*. References 2 and 3 responded to all of the NRC questions except for parts 1 and 3 of question 9. The responses to these parts are included in Enclosure 1. This letter completes the response to Reference 1.

As has been the past practice, we believe any NRC staff review of the enclosed information is exempt from the fee recovery provision contained in 10 CFR Part 170. This submittal provides information that might be helpful to NRC staff when evaluating licensee submittals provided in response to Generic Letter 95-05. Such reviews are exempted under §170.21, Schedule of Facility Fees. Footnote 4 to the

D046

Special Projects provision of §170.21 states, "Fees will not be assessed for requests/reports submitted to the NRC... [a]s means of exchanging information between industry organizations and the NRC for the purpose of supporting generic regulatory improvements or efforts."

We would be pleased to meet with you or provide any support necessary to expedite acceptance and approval of the outstanding issues regarding the database. If you have any questions regarding the technical content of this letter, please contact Dr. Govinda Srikantiah of EPRI at (650) 855-2091.

Sincerely,

J H Riley for

David J. Modeen

JHR/edb
Enclosure

c: Mr. Ted Sullivan, U.S. Nuclear Regulatory Commission
Mr. Jim Anderson, U.S. Nuclear Regulatory Commission
Mr. Stewart L. Magruder, Jr., U.S. Nuclear Regulatory Commission
Mr. David Goetcheus, TVA
Ms. Helen Cothron, TVA
Mr. Greg Kammerdeiner, Duquesne Light
Mr. Richard Pearson, NSP
Mr. Rick Mullins, Southern Co
Mr. Ron Baker, South Texas
Mr. Bob Exner, PG&E
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Mr. Bob Keating, Westinghouse
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Mr. David Steininger, EPRI
NEI Steam Generator Program Task Force

Staff Comment:

(1) Discuss if indications not detected with the bobbin coil and which would be detected with the rotating pancake coil (RPC), if they were inspected, could be considered significant flaws. Discuss whether the pulled tube data support the statement that significant indications (in terms of leakage or burst probability) can be expected to be detected by the bobbin coil and confirmed by RPC inspection. In addition, discuss whether the pulled tube data support the observation that indications detected by the bobbin coil and not confirmed through RPC inspection are insignificant. For example, discuss whether the population of bobbin indications confirmed through RPC inspection is different from the population of bobbin indications not confirmed by RPC in terms of their leakage and burst potential.

Response

To support assessments of bobbin and RPC detectability for ODSCC at TSP intersections, Section 5.5 and Table 5-5 were included in the Addendum 1 report (1996 ODSCC Database Update). This section identifies pulled tube destructive examination results for indications that were NDD (No Detectable Degradation) in the field. An update of Table 5-5 that includes recent pulled tube results from Plants Y-1 and A-1 is attached as Table 9-1. There are a total of 252 field bobbin NDD indications, including 190 from one European plant, with destructive examination results. The maximum crack depth of any bobbin NDD indication is 62%. Burst pressures were obtained for 33 NDD indications with the lowest burst pressure of 9,063 psi.

The substantial database of Table 9-1 strongly supports the conclusion that indications not detected with the bobbin coil, whether detected by RPC or not, are not structurally significant flaws. The maximum depth indication of 62% not detected by bobbin and was only 0.13 inch long, which is not structurally significant by either length or depth. For more significant > 0.5" lengths, the maximum depth found for a bobbin NDD indication was 53% with a burst pressure of 9,800 psi. Based on these data, bobbin NDD indications would not contribute to leakage or burst at the time of inspection or over the prior cycle. Therefore, for POPCD development, indications not detected at the end of the cycle are not important "missed" indications and EOC detectability provides an adequate database for defining the POD at the prior inspection.

The second part of this question relates to the structural significance of indications detected by the bobbin coil and not confirmed by RPC inspection. The database Tables 5-1 and 5-2 of Addendum 1 provide data for this assessment. There are a total of 82 pulled tube and 79 model boiler specimens that were inspected by both bobbin and RPC probes. Later pulled tubes add 3 indications to this total. Out of the 164 total indications inspected by bobbin and RPC, 10 indications were detected by bobbin but not by RPC (pancake coils). The maximum depths of the RPC NDD indications ranged from 26% to 60% based on destructive examination results. The lowest measured burst pressure of the RPC NDD indications was 9,500 psi. This substantial database supports the conclusion that indications detected by bobbin and not confirmed by RPC are structurally insignificant for both burst and leakage considerations.

The population of bobbin indications confirmed by RPC is different from the population of bobbin indications not confirmed by RPC in that all structurally significant bobbin indications are confirmed by RPC inspection. Based on the data described above from Tables 5-1 and 5-2, all bobbin indications with maximum depths > 60% have been confirmed by RPC which includes all leakers in the ARC database and indications with burst pressures less than about 9,000 psi. Thus, the ARC database of 154 bobbin indications confirmed by RPC inspection demonstrates that structurally significant indications are detected by both bobbin and RPC probes.

It can be noted that the use of RPC confirmed indications in developing POPCD is based on the use of RPC inspection to eliminate potential false bobbin calls from the evaluation. Residual bobbin signals may be identified as potential indications and the RPC inspection aids exclusion of these signals from the flaw population. For conservatism in the POPCD development, bobbin indications not inspected by RPC are assumed to be confirmed indications. Since most of the indications not inspected by RPC are lower voltage indications below the lower voltage repair limit, it would be expected based on general inspection trends that a large fraction of the bobbin indications would not be confirmed by RPC.

Staff Comment

(3) If the POPCD approach were to be implemented, discuss any assessment that would be performed at the end of each plant outage to confirm the adequacy of the POPCD approach. Discuss any reporting criteria to be implemented based on the assumptions in the proposed POPCD methodology.

Response

If the POPCD approach is approved and implemented, the GL 95-05 90-day reports documenting the ARC analyses would include a POPCD assessment for the prior cycle of operation. Completed POPCD assessments have been included in many prior 90-day reports that were collected to develop the integrated data POPCD evaluation given in Addendum 1. These existing assessments form a model for future POPCD analyses if approved and implemented. When the ODSCC ARC database is updated as anticipated on about an annual basis, the database update will include an update to POPCD based on integrating the latest inspection results into the recommended POPCD.

The 90-day reports typically include comparisons of ARC projections with the inspection results. Included are comparisons of predicted with actual voltage distributions and projected SLB leak rate/burst probability with that calculated from the measured voltage distribution. When the projections significantly underestimate the leak rate and/or burst probability calculated from the measured distribution, the causative factors for the underestimate will be assessed including a potential POD underestimate based on the use of POPCD. It can be noted that the influence of POPCD changes on the prior cycle projections can be directly assessed since the 90-day POPCD assessment applies to the prior EOC inspection. A reanalysis of the projections using the cycle dependent POPCD provides a direct determination of the influence of POPCD changes. When the projections underestimate that found from the actuals, the assessment of POPCD as a potential contributor to the underestimates will be included in the 90-day report.

Table 9-1.
Pulled Tubes with Field Bobbin NDD Indications

Plant	Tube	TSP	Field RPC	Field Reevaluation		Destructive Examination			Leak Rate (l/hr)	Burst Press. (psi)
				Bobbin Volts	RPC Volts	Max. Depth %	Ave. Depth %	Crack Length in.		
7/8" Tubes										
P-1	R11C48	3H	NDD	0.2	-	17	-	-	-	-
	R16C60	2H	NDD	0.9	0.22	52	36	0.74	0.0	10,200
		3H	NDD	NDD	-	< 20	-	-	-	-
	R28C42	3H	NDD	NDD	0.2	34	17%	0.718	-	11,792
	R10C48	1	NDD	0.28	NDD	47	36%	0.346	-	11,968
		2	NDD	NDD	NDD	22	11%	0.068	-	12,891
D-1	R18C21	2H	NDD	NDD	NDD	38	-	0.62	-	11,200
D-2	R7C38	2H	-	0.19	-	34	23	0.65	0.0	9,450
		3H	-	0.26	-	26	8	0.71	0.0	10,000
	R18C77	3H	-	0.21	-	35	-	-	-	-
		4H	-	0.27	-	41	-	-	-	-
	R11C25	3H	-	0.28	-	30	-	-	-	-
	R6C40	1H	-	0.35	-	~0	-	-	-	-
	R12C42	3H	-	0.59	-	21	-	-	-	-
A-1	R20C26	1H	-	0.2	-	62	-	0.13	-	-
	R28C35	3H	NDD	NDD	NDD	45	31	0.375	-	10,620
A-2	R16C50	1H	-	0.16	-	14	-	< 0.05	-	-
		2H	-	0.08	-	3	-	0.06	-	-
		3H	-	0.30	-	0	-	-	-	-
	R16C53	1H	-	NDD	-	12	-	-	-	-
		2H	-	NDD	-	22	-	-	-	-
		3H	-	NDD	-	13	-	-	-	-

Table 9-1.
Pulled Tubes with Field Bobbin NDD Indications

Plant	Tube	TSP	Field RPC	Field Reevaluation		Destructive Examination			Leak Rate (l/hr)	Burst Press. (psi)
				Bobbin Volts	RPC Volts	Max. Depth %	Ave. Depth %	Crack Length in.		
	R27C54	2H	NDD	NDD	NDD	36	20	0.376	-	10,910
		3H	NDD	0.31	NDD	34	20	0.250	-	11,190
	R34C53	2H	NDD	NDD	NDD	33	18	0.228	-	11,490
		3H	NDD	NDD	NDD	37	19	0.308	-	11,670
W-1	R9C55	2H	NDD	NDD	NDD	24	13	0.240	-	10,459
	R11C61	1H	0.5 v	1.06	0.5	46	30	0.689	0.0	10,063
		2H	-	NDD	-	42	30	0.37	-	10,620
Y-1	R10C22	1H	NDD	NDD	NDD	4	-	-	-	12,437
		2H	-	0.56	-	26	-	-	-	12,085
	R12C32	2H	NDD	NDD	NDD	20	6	0.20	-	13,081
	R21C43	2H	NDD	NDD	NDD	32	13	0.255	-	14,063
3/4" Tubes										
AA-1	R37C34	1H	NDD	NDD	NDD	~ 0	-	-	-	10,660
	R16C42	1H	NDD	NDD	NDD	15	8	0.29	-	10,720
		5H	NDD	0.28	NDD	26	12	0.33	0.0	10,640
	R27C43	1H	NDD	NDD	NDD	~ 0	-	-	-	12,640
	R42C44	7H	NDD	0.21	0.11	42	25	0.68	0.0	10,120
AB-1	R20C7	1H	NDD	NDD	NDD	~ 0	-	-	-	11,300
		5H	NDD	0.23	NDD	38	20	0.56	0.0	10,200
		7H	NDD	0.38	NDD	26	12	0.44	0.0	11,300
	R3C107	5H	NDD	0.25	NDD	53	32	0.55	0.0	9,800
		7H	NDD	0.26	NDD	45	21	0.59	0.0	10,300

Table 9-1.
Pulled Tubes with Field Bobbin NDD Indications

Plant	Tube	TSP	Field RPC	Field Reevaluation		Destructive Examination			Leak Rate (l/hr)	Burst Press. (psi)
				Bobbin Volts	RPC Volts	Max. Depth %	Ave. Depth %	Crack Length in.		
AC-1	R25C58	2H	NDD	NDD	-	0	-	-	-	-
		3H	NDD	NDD	-	3	-	-	-	-
		4H	NDD	NDD	-	0	-	-	-	-
	R2C37	2H	NDD	NDD	-	1	-	-	-	11,300
		3H	NDD	NDD	-	0	-	-	-	-
		4H	NDD	NDD	-	0	-	-	-	-
	R39C37	3H	NDD	0.13	-	2	-	-	-	-
		4H	NDD	NDD	-	0	-	-	-	-
	R20C100	3H	NDD	NDD	-	0	-	-	-	-
		4H	NDD	NDD	-	0	-	-	-	-
	R26C63	3H	NDD	0.12	-	5	-	-	-	
		4H	NDD	0.26	-	0	-	-	-	11,300
	R15C25	2H	NDD	NDD	-	2	-	-	-	-
		3H	NDD	NDD	-	2	-	-	-	-
		4H	NDD	NDD	-	0	-	-	-	-
R-1	R10C69	2H	NDD	NDD	NDD	~ 0	-	-	-	-
	R5C112	2H	-	0.48	NDD	0	-	-	0.0	-
E-4	R16C31	7H	-	-	-	-	-	-	-	9,425
	R40C47	4H	-	-	-	-	-	-	-	9,063
V-3, 4	96 Specimens 1989	Var.	NDD	NDD	NDD	0-10	-	-	-	-
	87 Specimens 1990	Var.	NDD	NDD	NDD	0-10	-	-	-	-

Table 9-1.
Pulled Tubes with Field Bobbin NDD Indications

Plant	Tube	TSP	Field RPC	Field Reevaluation		Destructive Examination			Leak Rate (l/hr)	Burst Press. (psi)
				Bobbin Volts	RPC Volts	Max. Depth %	Ave. Depth %	Crack Length in.		
	1990	-	NDD	NDD	NDD	15	-	-	-	
	1990	(2)	NDD	NDD	NDD	25-26	-	-	-	-
	1990	-	NDD	NDD	NDD	33	-	-	-	-
	1990	-	NDD	NDD	NDD	45	-	-	-	-
	1990	(2)	NDD	NDD	NDD	55,58	-	-	-	-
	R23C26	2H	NDD	NDD	NDD	0	-	-	-	-
	R11C75	5H	NDD	NDD	NDD	0	-	-	-	-