



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

May 9, 1989

Docket

Docket No. 50-498

LICENSEE: Houston Lighting & Power Company
FACILITY: South Texas Project, Unit 1
SUBJECT: RESULTS OF BOTTOM-MOUNTED INSTRUMENTATION (BMI)
THIMBLE TUBE INSPECTION

Enclosure 1 is a list of the meeting attendees. The presentation material handout is proprietary so it is not included with this meeting summary. A copy is retained in the project manager's files.

Wear of BMI thimble tubes has been observed in a number of plants, the most severe being in several European plants. In order to monitor wear, the licensee committed to inspect the tubes after 16 weeks of three or four reactor coolant pump (RCP) operation. The first inspection was performed during May 4-7, 1988. A non-proprietary copy of the tests results is enclosed (Enclosure 2). The inspections showed wear indications on 19 of the 58 thimbles with no obvious correlation of wear with thimble location in the core. In the majority of cases, wear occurred at the location of the flow limiter.

Thimble wear data was available from Tihange (Belgium) which has characteristics similar to South Texas and was analysed by Westinghouse. The analysis indicated that wear rates are high initially and then approach zero asymptotically. Also, repositioning the tubes to present a fresh surface resulted in the same wear-time histories as before repositioning. Westinghouse and the licensee believe that the South Texas thimble tubes will perform similarly to those at Tihange.

Immediate actions proposed for South Texas were to: 1) reposition and cap tubes showing 40% wear or greater; and 2) reposition those thimble tubes with greater than 20% wear. Long-term corrective actions proposed included, investigation of heavier wall thimble tubes, examination of thimbles and flow limiters from Tihange to determine wear mechanism, and installation of isolation valves at the seal table. The licensee indicated that the correction deemed appropriate for Unit 1 would be applied to Unit 2 prior to fuel load.

At the end of the meeting, the staff concluded that there was reasonable assurance that after the proposed short term actions were taken, South Texas, Unit 1 could operate for additional 16 weeks. At the end of the operating period, another inspection of the thimbles would be conducted. Following that

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inspection, the staff requested that the licensee inform the staff of the inspection results as well as any new information regarding thimble wear that was available.

Original Signed By
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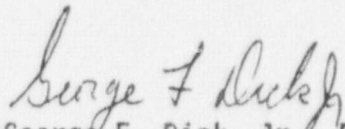
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Enclosure 1

South Texas Project, Unit 1

Thimble Tube Meeting

May 17, 1988

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May 12, 1988
ST-HL-AE-2655
PFN: G4.2
10CFR50

U. S. Nuclear Regulatory Commission
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South Texas Project Electric Generating Station
Units 1 and 2
Docket Nos. STN 50-498, STN 50-499
Bottom Mounted Instrumentation (BMI) Thimble Inspection

- Reference: (1) ST-HL-AE-2458 dated January 5, 1988
(2) ST-HL-AE-2490 dated February 3, 1988

On May 4-7, 1988, Houston Lighting & Power Company (HL&P) performed eddy current inspection of all 58 BMI thimbles at the South Texas Project (STP) Unit 1 following approximately 11 weeks of 4 pump operation at RCS normal operating temperature (above 560 degrees F.). The thimbles have been subjected to approximately 16 weeks total operating time including lower temperature reactor coolant pump (RCP) operation.

The eddy current inspection was performed with the thimbles inserted into the reactor vessel. The entire length of each thimble was inspected except for the top 40 inches which was the same as for the baseline inspection in December 1987. As previously discussed in Reference 1, this 40 in. spacing is the top portion of the thimble inserted in the fuel assembly and is in an area where thimble tube wear has not been experienced. Additional inspection was done on four thimbles which were temporarily retracted about 2 ft. in order to better measure and confirm indications which had been partially masked by interference from metal structures adjacent to the thimble. The eddy current inspection utilized a multifrequency data acquisition system. The test frequencies used were 62, 140, and 300 KHZ. The sensitivity of the inspection process had a threshold of 10% wall loss which corresponds to 0.0052 in. or 0.13 mm. Wear below this level is insignificant and indistinguishable from normal surface markings. A calibration standard was used for each data taking run. The data for each thimble was reviewed and compared with the results obtained from the baseline inspection.

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The following summarizes the results of eddy current testing, short term and long term corrective action, and how it compares to the European data and action plan.

A. Eddy Current Results

Data obtained from eddy current testing is shown in Attachment 1. The wear was found to be primarily in the region of the flow limiter nozzle and to be approximately 3/4" in length. Some wear was identified at locations other than the flow limiter (primarily in the vessel penetration region) on 7 thimbles, but was determined to be minimal and have no adverse affect on thimble integrity.

Attachment 2 provides a comparison of the eddy current data at Tihange 3, STP, and Doel 4. Doel 4, unlike Tihange 3 and STP, had larger, heavier walled .339 in. OD thimbles and operated for a full fuel cycle with no intermediate inspections. Consequently, the data is less meaningful when trying to provide a comparison. Tihange 3 experienced a thimble leak after approximately 16 weeks of operation. STP thimbles were also exposed to the equivalent of 16 weeks of operation with the worst wall loss indicated at 60%. Inspection of the 49 intact thimbles at Tihange 3, after 16 weeks of operation, revealed that all but 7 thimbles had indicated wall loss. By comparison, STP Unit 1 had no indication of wall loss in the flow limiter region on 39 thimbles.

B. Short Term Corrective Action

As discussed in References 1 and 2, HL&P will reposition and cap thimbles as necessary in order to operate for 20 weeks before the next eddy current inspection. The thimbles to be capped and/or repositioned and the basis for that disposition is shown in Attachments 3 and 4. Thimbles to be capped will also be repositioned in order to preclude wear through thereby minimizing ALARA concerns when thimbles are removed during the first refueling outage. All thimbles requiring repositioning will be retracted 2 inches which will relocate the defect area of the thimble out of the wear region. After not more than 20 weeks of 3 or 4 pump operation, HL&P will again perform eddy current inspection and take action based on the results to reposition and/or cap as necessary to preclude thimble leakage during subsequent power operation.

Tihange 3 repositioned and/or capped thimbles in October 1987 when they performed their first eddy current inspection and then again in January 1988 after performing their second inspection. Their intention is to remove flow limiters and the .313 in. OD thimbles in their May outage and replace them with .339 in. OD thimbles. Doel 4 operated for a full cycle without eddy current inspection. As a result of the significant wear on their thimbles, they will be removing their flow limiters and replacing their existing thimbles with like .339 in. OD thimbles during their refueling outage. Flow limiters will not be reinstalled at either plant.


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C. Long Term Corrective Action

HL&P intends to correct the existing thimble wear problem in Unit 2 prior to fuel load and by the first refueling in Unit 1. Heavier thimbles are still being investigated by HL&P and Westinghouse. Test results from Waltz Mill shows that a .385 in. OD thimble is very resistant to flow induced vibration. The thimbles have been tested for insertion/retraction in Unit 2 using a dummy fuel assembly and performed satisfactorily. In late May at the hot cell in Mons, Belgium, limiters and thimbles from Tihange 3 will be analyzed to determine the mechanism for wear. By July 1, 1988, Westinghouse will provide a recommendation to HL&P regarding the long term solution.

Doel 4 and Tihange 3 are also waiting for Westinghouse to provide a recommendation regarding the long term solution.

If you should have any questions on this matter, please contact me or M. A. McBurnett at 512-972-8530.



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Attachments: Summary of Thimble Wear
Comparison of Tihange 3/STP/Doel 4 Eddy Current Results
Thimble Recommendations
B&W Thimble Wear Recommended Action Plan

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SUMMARY OF THIMBLE WEAR
SOUTH TEXAS 1 - 5/9/88

QUANTITY	PERCENT WALL LOSS (FLOW LIMITER)	CORE LOCATION
1 EACH	60 %	B-8
2 EACH	40 %	K-6, C-8
1 EACH	36 %	C-7
1 EACH	28 %	F-14
1 EACH	25 %	E-11
5 EACH	20 %	J-7, D-8, G-12, K-2, N-4
1 EACH	16 %	D-3
2 EACH	15 %	H-15, N-8
5 EACH	12 %	L-13, H-11, J-1, J-8, L-15

WEAR AT LOCATION OTHER THAN FLOW LIMITER
(ALL BELOW LIMITER)

QUANTITY	PERCENT WALL LOSS	CORE LOCATION
1 EACH	20 %	K-2*
1 EACH	16 %	B-8*
1 EACH	15 %	H-15*
1 EACH	12 %	D-3*
3 EACH	10 %	D-12, F-1, P-4

* INDICATES THIMBLES THAT HAVE WEAR AT THE FLOW LIMITER
AND A SECOND ELEVATION

R P N M L K J H G F E D C B A

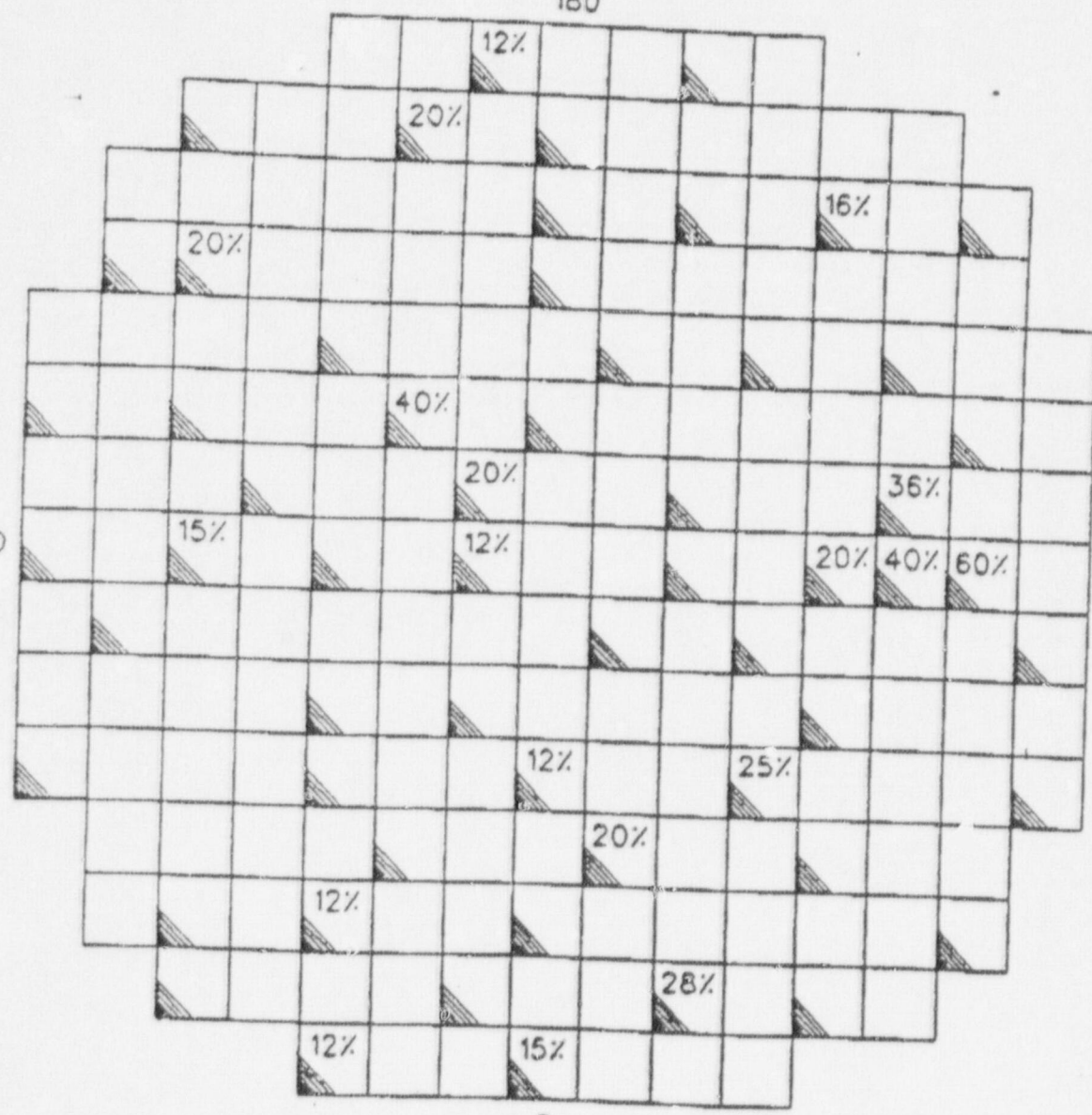
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15

90

270

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 - THIMBLE LOCATIONS

COMPARISON OF TIHANGE 3/STP/DOEL 4

EDDY CURRENT RESULTS

PERCENT WALL LOSS	NO. OF TIHANGE 3 WORN THIMBLES	NO. OF SOUTH TEXAS WORN THIMBLES	NO. OF DOEL 4 WORN THIMBLES
GREATER THAN 90%	1	0	28
80% TO 90%	0	0	16
70% TO 80%	0	0	1
60% TO 70%	7	1	1
50% TO 60%	15	0	1
40% TO 50%	12	2	0
30% TO 40%	7	1	0
20% TO 30%	0	7	1
10% TO 20%	1	8	0
0% TO 10%	7	39	1

ONE THIMBLE
NOT INSPECTED

THIMBLE RECOMMENDATIONS

THIMBLE NO.	WEAR (%)	EST. WEAR RATE/WK. (BASED ON 16 WKS)	20 WKS WORTH OF WEAR	MARGIN TO 60% WEAR ALLOWABLE	RECOMMENDED DISPOSITION
B-8	60	4.375 /WK	87.5%	-27.5%	REPOSITION & CAP
K-6	40	3.125 /WK	62.5%	-2.5%	REPOSITION & CAP
C-8	40	3.125 /WK	62.5%	-2.5%	REPOSITION & CAP
C-7	36	2.875 /WK	57.5%	2.5%	REPOSITION
F-14	28	2.375 /WK	47.5%	12.5%	REPOSITION
E-11	25	2.1875 /WK	43.75%	16.25%	REPOSITION
G-12	20	1.875 /WK	37.5%	22.5%	REPOSITION
K-2	20	1.875 /WK	37.5%	22.5%	REPOSITION
N-4	20	1.875 /WK	37.5%	22.5%	REPOSITION
O-3	20	1.875 /WK	37.5%	22.5%	REPOSITION
J-7	20	1.875 /WK	37.5%	22.5%	REPOSITION

BM THIMBLE WEAR RECOMMENDED ACTION PLAN

REPOSITION AND CAP:

B-B = 60%

K-6, C-8 = 40%

REPOSITION:

C-7 = 36%

F-14 = 28%

E-11 = 25%

G-12, K-2, N-4, D-8, J-7 = 20%