

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

July 26, 1988

NRC BULLETIN NO. 88-09: THIMBLE TUBE THINNING IN WESTINGHOUSE REACTORS

Addressees:

All holders of operating licenses or construction permits for Westinghouse (W)-designed nuclear power reactors that utilize bottom mounted instrumentation.

Purpose:

The purpose of this bulletin is to request that addressees establish and implement an inspection program to periodically confirm incore neutron monitoring system thimble tube integrity.

Description of Circumstances:

The incore neutron monitoring system thimble tubes extend from a 10-path transfer device, through the seal table, through the bottom of the reactor vessel, and into selected fuel assemblies. The thimble tubes are sealed at the leading (reactor) end, but are open at the 10-path transfer device to allow insertion of an incore neutron detector during flux mapping. By design, the thimble tubes, over most of their length, serve as a portion of the reactor coolant system (RCS) pressure boundary. (A description of a typical incore neutron monitoring system is contained in NRC Information Notice No. 87-44, "Thimble Tube Thinning in Westinghouse Reactors," dated September 16, 1987.) Thus, wear of the thimble tubes results in degradation of the RCS pressure boundary and can also create a potentially non-isolable leak of reactor coolant. Furthermore, thimble tube thinning could result in multiple thimble tube failures beyond a facility's design basis during flux mapping operations or a transient event.

As discussed in NRC Information Notice No. 87-44, Supplement 1, "Thimble Tube Thinning in Westinghouse Reactors," dated March 28, 1988, thimble tubes are experiencing thinning as a result of flow-induced vibration. Thimble tube wear has generally been detected at locations associated with geometric discontinuities or area changes along the flow path (such as areas near the lower core plate, the core support forging, the lower tie plate, the upper tie plate, and the vessel penetration). Many licensees have detected thimble wear.

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There have also been several instances (both foreign and domestic) of thimble tubes experiencing leaks. In addition, a review of the available data indicates that most leaks have occurred during flux mapping (while either inserting or retracting the probe).

Discussion:

The amount of vibration the thimble tubes experience is determined by such plant-specific factors as the gap distance from the lower core plate to the fuel assembly instrument tube, the amount of clearance between the thimble tube and the guide or instrument tube, the axial component of the local fluid velocity, the thickness of the thimble tube, and the moment of inertia of the thimble tube. A review of the available data indicates that it is not possible to accurately predict thimble wear rates. Thus, it appears that the only effective method for determining thimble tube integrity is through plant-specific inspections and periodic monitoring.

There are currently no inservice inspection or testing requirements for thimble tubes. The NRC staff believes that this may have resulted in significant thimble tube degradation having gone undetected, creating a condition that may be adverse to safety. To ensure that addressees are in compliance with General Design Criteria 14 "Reactor Coolant Pressure Boundary" of 10 CFR 50, Appendix A and to minimize (through early detection of thimble tube thinning) the likelihood of a potentially non-isolable leak of reactor coolant, the NRC staff requests that addressees perform the actions described below.

Actions Requested:

1. Each addressee is requested to establish an inspection program to monitor thimble tube performance. This inspection program should include:
 - ° the establishment, with technical justification, of an appropriate thimble tube wear acceptance criterion (for example, percent through-wall loss). This acceptance criterion should include allowances for such items as inspection methodology and wear scar geometry uncertainties.
 - ° the establishment, with technical justification, of an appropriate inspection frequency (for example, every refueling outage).
 - ° the establishment of an inspection methodology that is capable of adequately detecting wear of the thimble tubes (such as eddy current testing).
2. Addressees are requested to implement the inspection program in accordance with the following schedule, as applicable. In addition, addressees are requested to take appropriate corrective actions (such as isolation or replacement) should a thimble tube fail to meet the acceptance criterion established in Item 1 above.

- a. All holders of operating licenses which are in their first fuel cycle and all holders of construction permits - at their first refueling outage.
- b. All holders of operating licenses that (prior to receipt of this bulletin) had already established an inspection program to monitor thimble tube integrity consistent with that requested in Item 1 above and, based upon the results of the last inspection, took appropriate corrective actions for thimble tubes that failed to satisfy the established acceptance criterion - in accordance with their established inspection frequency.
- c. All holders of operating licenses that (upon receipt of this bulletin) are in a cold shutdown that is expected to be of sufficient duration to allow inspections of the thimble tubes to be performed - prior to restart.
- d. All others - prior to restart from the next cold shutdown that is of sufficient duration to allow inspections of the thimble tubes to be performed (but no later than restart from the next refueling outage scheduled to commence after receipt of this bulletin).

Reporting Requirements:

1. Records generated during the development of the inspection program requested by Item 1 of Actions Requested, as well as the results of the inspections requested in Item 2 of Actions Requested, shall be documented and maintained in accordance with plant procedures.
2. Addressees who cannot meet the schedule described in Item 2 of Actions Requested are required to submit to the NRC an alternative schedule with justification for the requested deviation.
3. Addressees are required to, in accordance with the following schedule, as applicable, submit a writer response that a) confirms that an inspection program consistent with that requested in Item 1 of Actions Requested has been established and b) confirms that inspections of the thimble tubes have been performed and that appropriate corrective actions were taken.
 - a. Addressees implementing the inspection program in accordance with Parts a, c, or d of Item 2 of Actions Requested - within 30 days of completion of the thimble tube inspections.
 - b. Addressees implementing the inspection program in accordance with Part b of Item 2 of Actions Requested - within 90 days of the receipt of this bulletin.

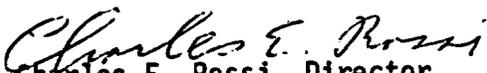
4. Regarding thimble tube degradation that is detected, addressees are reminded of the reporting requirements of 10 CFR 50.72 and 10 CFR 50.73. For example, 10 CFR 50.72 requires a report for "... any event, found while the reactor is shut down, that, had it been found while the reactor was in operation, would have resulted in the nuclear power plant, including its principal safety barriers, being seriously degraded or being in an unanalyzed condition that significantly compromises plant safety" and 10 CFR 50.73 requires a report for "... any event or condition that resulted in the condition of the nuclear power plant, including its principal safety barriers, being seriously degraded..."

Although not required by this bulletin, addressees are encouraged to work collectively to address technical concerns associated with this issue (such as development of an appropriate thimble tube acceptance criterion and an appropriate inspection frequency), as well as to share thimble tube operational experience and inspection results.

The written reports required above shall be addressed to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555, under oath or affirmation under the provisions of Section 182a, Atomic Energy Act of 1954, as amended. In addition, a copy shall be submitted to the appropriate Regional Administrator.

This request is covered by Office of Management and Budget Clearance Number 3150-0011 which expires December 31, 1989. The estimated average burden as defined in 5 CFR 1320.7 is approximately 3000 man-hours per licensee response. Comments on the accuracy of this estimate and suggestions to reduce the burden may be directed to the Office of Management and Budget, Room 3208, New Executive Office Building, Washington, D.C. 20503, and to the U.S. Nuclear Regulatory Commission, Records and Reports Management Branch, Office of Administration and Resources Management, Washington, D.C. 20555.

If you have any questions about this matter, please contact one of the technical contacts listed below or the Regional Administrator of the appropriate regional office.


Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

Technical Contacts: Jack Ramsey, NRR
(301) 492-1167

Shou-Nien Hou, NRR
(301) 492-0904

Attachment: List of Recently Issued NRC Bulletins

LIST OF RECENTLY ISSUED
 NRC BULLETINS

Bulletin No.	Subject	Date of Issuance	Issued to
88-08, Supplement 1	Thermal Stresses in Piping Connected to Reactor Coolant Systems	6/24/88	All holders of OLs or CPs for light-water-cooled nuclear power reactors.
88-08	Thermal Stresses in Piping Connected to Reactor Coolant Systems	6/22/88	All holders of OLs or CPs for light-water-cooled nuclear power reactors.
88-05, Supplement 1	Nonconforming Materials Supplied by Piping Supplies, Inc. at Folsom, New Jersey and West Jersey Manufacturing Company at Williamstown, New Jersey	6/15/88	All holders of OLs or CPs for nuclear power reactors.
88-07	Power Oscillations in Boiling Water Reactors (BWRs)	6/15/88	All holders of OLs or CPs for BWRs.
88-06	Actions to be Taken for the Transportation of Model No. Spec 2-T Radiographic Exposure Device	6/14/88	All NRC licensees authorized to manufacture, distribute, or operate radiographic exposure devices or source changers.
87-02, Supplement 2	Fastener Testing to Determine Conformance with Applicable Material Specifications	6/10/88	All holders of OLs or CPs for nuclear power reactors.
88-05	Nonconforming Materials Supplied by Piping Supplies, Inc. at Folsom, New Jersey and West Jersey Manufacturing Company at Williamstown, New Jersey	5/6/88	All holders of OLs or CPs for nuclear power reactors.
88-04	Potential Safety-Related Pump Loss	5/5/88	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
 CP = Construction Permit

4. Regarding thimble tube degradation that is detected, addressees are reminded of the reporting requirements of 10 CFR 50.72 and 10 CFR 50.73. For example, 10 CFR 50.72 requires a report for "... any event, found while the reactor is shut down, that, had it been found while the reactor was in operation, would have resulted in the nuclear power plant, including its principal safety barriers, being seriously degraded or being in an unanalyzed condition that significantly compromises plant safety" and 10 CFR 50.73 requires a report for "... any event or condition that resulted in the condition of the nuclear power plant, including its principal safety barriers, being seriously degraded..."

Although not required by this bulletin, addressees are encouraged to work collectively to address technical concerns associated with this issue (such as development of an appropriate thimble tube acceptance criterion and an appropriate inspection frequency), as well as to share thimble tube operational experience and inspection results.

The written reports required above shall be addressed to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555, under oath or affirmation under the provisions of Section 182a, Atomic Energy Act of 1954, as amended. In addition, a copy shall be submitted to the appropriate Regional Administrator.

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In a telephone conversation with Jim Conran on 7/20/88, Mr. Conran indicated that CRGR comments from the CRGR meeting on 7/14/88 had been satisfactorily included in this bulletin.
John E. Ramsey
7/21/88

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*SEE PREVIOUS CONCURRENCES
OGCB:DOEA:NRR *D/DEST:NRR
JERamsey LCShao
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*PPMB:ARM
TechEd
06/08/88

*C/OGCB:DOEA:NRR
CHBerlinger
07/06/88

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07/21/88

this bulletin. In addition, addressees are requested to identify appropriate corrective actions (such as isolation or replacement) to be taken should a thimble tube fail to meet the acceptance criterion established in Item 1) above.

- 3) Records generated during the development of the inspection program requested by Item 1) above, as well as the results of the inspections requested in Item 2) above, shall be documented and maintained in accordance with plant procedures.
- 4) Addressees are required to, within 30 days of the completion of the next (or first) refueling outage that begins 90 days after the receipt of this bulletin, provide a written response that a) confirms that the inspection program requested in Item 1) above has been established and b) confirms that inspections requested in Item 2) above have been performed.

Although not required by this bulletin, addressees are encouraged to work collectively to address this issue.

The written reports requested above, shall be addressed to the U. S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555, under oath or affirmation under the provisions of Section 182a, Atomic Energy Act of 1954, as amended. In addition, a copy shall be submitted to the appropriate Regional Administrator.

This requirement for information was approved by the Office of Management and Budget under blanket clearance number 3150-0011. Comments on burden and duplications should be directed to the Office of Management and Budget, Reports Management, Room 3208, New Executive Office Building, Washington, D.C. 20503.

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- ° implementation of an inspection methodology that is capable of adequately detecting wear of the thimble tubes (such as eddy current testing).
- 2) Addressees are requested to implement the inspection program established by Item 1) above by performing inspections of the thimble tubes at the next (or first) refueling outage that begins 90 days after the receipt of this bulletin. In addition, addressees are requested to identify appropriate corrective actions (such as isolation or replacement) to be taken should a thimble tube fail to meet the acceptance criterion established in Item 1) above.
- 3) Records generated during the development of the inspection program requested by Item 1) above, as well as the results of the inspections requested in Item 2) above, shall be documented and maintained in accordance with plant procedures.
- 4) Addressees are required to, within 30 days of the completion of the next (or first) refueling outage that begins 90 days after the receipt of this bulletin, provide a written response that a) confirms that the inspection program requested in Item 1) above has been established and b) confirms that inspections requested in Item 2) above have been performed.

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