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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

September 27, 2007

NRC REGULATORY ISSUE SUMMARY 2007-24
NRC STAFF POSITION ON USE OF THE WESTINGHOUSE CROSSFLOW ULTRASONIC FLOW METER FOR POWER UPRATE OR POWER RECOVERY

ADDRESSEES

All holders of operating licenses for nuclear power reactors, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

INTENT

The U.S. Nuclear Regulatory Commission (NRC) is issuing this regulatory issue summary (RIS) to inform addressees that NRC has written a letter to Westinghouse Electric Corporation (WEC) suspending NRC's approval of WEC's topical report on the CROSSFLOW ultrasonic flow meter (UFM) for new and future use until the staff's concerns are resolved. This RIS does not transmit any new requirements and does not require any specific action or written response. However, the information provided in the letter to WEC, including the Safety Evaluation attached to the letter, may have applicability to current users of the CROSSFLOW UFM.

BACKGROUND INFORMATION

Licensees use UFMs to provide better accuracy than the venturis that have typically been used for measuring feedwater flow rate in nuclear power plants. Feedwater flow rate is an important input parameter in establishing the plant's operating power level. The operating power limit is defined in the plant's operating license.

UFMs are used (a) to compensate for fouling in venturis that could lead to operation at less than the licensed thermal power limit and (b) in conjunction with measurement uncertainty recapture (MUR) power uprate license amendments to operate at higher power levels. The former application, generally known as power recovery, is implemented under Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.59 and does not require NRC staff review. The latter application, referred to as a MUR power uprate, requires a license amendment request (LAR) under 10 CFR 50.90 since the licensed thermal power will increase.

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Since 2002 there have been a number of instances, at some plants that have implemented UFMs under 10 CFR 50.59, where use of UFM instrumentation has led to operation up to a few percent above the licensed power level. This occurs when UFM instrumentation does not provide the improved or decreased flow rate uncertainty that is claimed by the vendor. However, the staff's experience with reviewing postulated loss-of-coolant accident (LOCA) and non-LOCA events at these higher power levels, is that the consequences of these events are only slightly affected by the small variations in power level that could result from the increase in feedwater flow rate uncertainty. The small effect on the consequences and, therefore, low safety significance are due to the margins between the results of the analyses and the acceptance criteria, and conservatisms assumed in the licensing basis accident and transient analyses. Nevertheless, to preclude recurrence, the NRC staff conducted a generic re-evaluation of the thermal-hydraulic and fluid dynamic aspects of UFMs.

Two vendors, Caldon[1] and WEC, currently supply UFMs to nuclear power plants for improving feedwater flow rate measurement accuracy. In a letter dated July 5, 2006 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML061700222), the NRC staff informed Caldon that it completed its re-evaluation of the Caldon UFM. The staff concluded that the performance of the Caldon Check and CheckPlus UFMs are consistent with the Caldon Topical Reports ER-80P, Revision 0, and ER-157P, Revision 5, previously approved by NRC, subject to satisfying a confirmatory item related to transducer replacement that was expected to introduce a very small uncertainty that would not significantly change claimed total uncertainty, and that there was a sound thermal-hydraulic and fluid dynamic basis for using the Caldon UFMs.

However, in a letter dated September 26, 2007 (ADAMS Accession No. ML071650263) the NRC staff informed WEC that it completed its re-evaluation of the CROSSFLOW UFM, as described in WEC's Topical Report CENPD-397-P, Revision-01-P, "Improved Flow Measurement Accuracy Using Crossflow Ultrasonic Flow Measurement Technology," and as described in NRC's approval of the topical report. The staff has concluded, based on information received subsequent to the staff's initial approval of the topical report, that its approval of that report should be suspended. Accordingly, the staff is suspending its March 20, 2000 (ADAMS Accession No. ML003694197), approval of CENPD-397-P, Revision-01-P, for new and future use until the staff's concerns are resolved. The basis for the action is in the staff's Safety Evaluation attached to its letter to WEC.

Regulations

Nuclear power plants are licensed to operate up to a specified reactor core thermal power limit. 10 CFR Part 50, Appendix K, requires licensees to assume that the reactor has been operating continuously at a power level at least 1.02 times the licensed power level when performing LOCA and emergency core cooling system performance analyses. This requirement is included to ensure that instrumentation uncertainties are adequately accounted for in the analyses. Appendix K to 10 CFR Part 50 allows licensees to assume a power level less than 1.02 times the licensed power level, but not less than the licensed power level, provided the licensee has

[1]Caldon is now a part of the Measurement Systems Division of Cameron International Corporation ("Cameron"). The name "Caldon" continues to be used in describing their UFMs.

demonstrated that the proposed value adequately accounts for instrumentation uncertainties.

As an example, in a MUR power uprate license amendment application, a licensee may propose to use a power measurement uncertainty of 0.5 percent. To achieve this level of accuracy, the licensee proposes to use a UFM for measuring main feedwater flow rate to provide a more accurate measurement of feedwater flow rate than (a) the feedwater flow rate measurement accuracy assumed during the development of the original 10 CFR Part 50, Appendix K requirements and (b) the current method of feedwater flow rate measurement used to calculate reactor thermal output. In this example, the licensee substantiates that the UFM will measure feedwater mass flow rate consistent with a total power measurement uncertainty of 0.5 percent. On this basis, a licensee will then propose to reduce the power measurement uncertainty to 0.5 percent. The improved power measurement uncertainty would obviate the need for the 2 percent power margin originally required by Appendix K to 10 CFR Part 50, thereby allowing an increase in the licensed reactor thermal power limit by 1.5 percent.

For those licensees who use UFMs for power recovery, an increase in the licensed reactor thermal power limit is not requested and the 2 percent power margin required by Appendix K to 10 CFR Part 50 is maintained. However, with the use of an NRC-approved UFM, a licensee may adjust the feedwater flow rate measurement reading obtained from a venturi to account for the fouling of the venturi that may occur during operation. Since UFMs are not subject to fouling like a venturi, the licensee can take advantage of an NRC-approved UFM's increased accuracy to develop a correction factor that can be applied to the venturi to determine feedwater flow rate, allowing the licensee to operate the reactor closer to its licensed limit. This is allowed by 10 CFR 50.59(c)(2)(viii) since the change would not result in a departure from a method of evaluation described in a licensee's Final Safety Analysis Report (FSAR) used in establishing the design bases or in the safety analyses. Specifically, 10 CFR 50.59(a)(2)(ii) indicates that changing from a method described in the FSAR to another method that has been approved by the NRC for the intended application is not a departure from a method of evaluation described in the FSAR.

SUMMARY OF THE ISSUE

The NRC staff has suspended its approval of WEC's topical report on the CROSSFLOW UFM for new and future use until the staff's concerns are resolved. Accordingly, the staff will not approve any LARs for MUR power uprates using the CROSSFLOW UFM that rely on NRC's previous approval of WEC's topical report without additional justification that is acceptable to the staff. The staff will inform individual licensees that have submitted LARs for MUR power uprates using the CROSSFLOW UFM of the status of their submittals given that NRC's approval of WEC's topical report has been suspended. Additionally, licensees should no longer consider the topical report "approved by NRC for the intended application" under 10 CFR 50.59(a)(2)(ii) in future 10 CFR 50.59 evaluations of changes to support power recovery.

The staff has provided its reasons for suspending approval of the WEC topical report for new and future use, until the staff's concerns are resolved, in NRC's letter to WEC dated September 26, 2007. The specific weaknesses are summarized as follows:

1. The assumption that laboratory calibration results are transferrable to an in-plant configuration without additional in-plant calibration, without a complete uncertainty

evaluation, and without traceability to a national standard. Alternatively, if in-plant calibration is used to eliminate this assumption, the weaknesses of in-plant calibration without a complete uncertainty evaluation and without traceability to a national standard may remain.

2. The treatment of the impact of acoustic noise on CROSSFLOW and the ability to detect and remove the effects, including determination of residual uncertainty.

3. The lack of periodic in-plant calibration using an instrument traceable to a national standard and lack of assurance that CROSSFLOW operation remains within the claimed uncertainty.

4. The lack of specific restrictions over a range of flows and plant configurations that define where the CROSSFLOW calibration can be considered valid.

5. Inadequate description of the installation and use of CROSSFLOW consistent with the actual calibration and commissioning practices.

Regarding licensees of plants that rely on the topical report for a MUR power uprate or power recovery, the NRC is not requesting a written response from these licensees due primarily to the small effect on the consequences of postulated licensing basis accident and transient analyses, and low safety significance of the issue. However, it is expected that licensees will review this new information for applicability to their facilities and consider actions, as appropriate, to assure that their plants operate in accordance with their licensing bases. Licensees that currently rely on the topical report are expected to ensure that CROSSFLOW continues to function consistent with all requirements and the plant's licensing bases (e.g., 10 CFR 50.46, Appendix K to 10 CFR Part 50, and the plant's licensed maximum rated thermal power). Additionally, the NRC staff expects licensees to address and, if necessary, correct identified deficiencies at their plants and comply with applicable reporting requirements.

BACKFIT DISCUSSION

This RIS informs addresses that the NRC staff has written a letter to WEC suspending its approval of WEC's topical report on the CROSSFLOW UFM for new and future use until the staff's concerns are resolved. This RIS requires no action or written response and, therefore, is not a backfit under 10 CFR 50.109. Consequently, the NRC staff did not perform a backfit analysis.

***FEDERAL REGISTER* NOTIFICATION**

A notice of opportunity for public comment on this RIS was not published in the *Federal Register* because it is informational.

CONGRESSIONAL REVIEW ACT

The NRC has determined that this RIS is not a rule as designated by the Congressional Review Act (5 U.S.C. §§801-808) and, therefore, is not subject to the Act.

PAPERWORK REDUCTION ACT STATEMENT

This RIS does not contain information collection requirements that are subject to the requirements of the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.).

CONTACT

Please direct any questions about this matter to the technical contact listed below.

/RA/

Michael J. Case, Director
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Technical Contact: Warren C. Lyon, NRR
301-415-2897
Email: wcl@nrc.gov

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