ENCLOSURE

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 5, 1995

Mr. Roger A. Newton
Westinghouse Owners Group Chairman
Wisconsin Electric Power Company
231 West Michigan Street
Milwaukee, WI 53201

SUBJECT: REVIEW OF WESTINGHOUSE ELECTRIC CORPORATION TOPICAL REPORT WCAP-13632, REVISION 2, "ELIMINATION OF PRESSURE SENSOR RESPONSE TIME TESTING REQUIREMENTS," DATED AUGUST 1995 - WESTINGHOUSE OWNERS GROUP PROGRAM MUHP-3040, REVISION 1

Dear Mr. Newton:

The NRC staff has completed its review of the subject topical report prepared by Westinghouse Electric Corporation dated August 1995. The enclosure provides the staff's Safety Evaluation Report. The topical report describes Westinghouse Owners Group Program MUHP-3040, Revision 1, which was completed as an industry effort to demonstrate that periodic response time testing (RTT) requirements for selected pressure and differential pressure sensors in Reactor Trip System (RTS) and Engineered Safety Features Actuation System (ESFAS) channels could be eliminated. Upon eliminating sensor RTT requirements, the total RTS or ESFAS channel response time would be verified by summing an allocated sensor response time with the measured response time of the remainder of the channel.

Based on its review of the information presented in WCAP-13632, Revision 2, the staff has concluded that any sensor failure that significantly degrades sensor response time can be detected during the performance of other surveillance tests, principally calibration. Accordingly, the staff concludes that the performance of periodic RTT for the selected pressure and differential pressure sensors identified in the topical report can be eliminated from Technical Specifications (TS) and that allocated sensor response times may be used to verify acceptable RTS and ESFAS channel response times. Therefore, the staff accepts WCAP-13632, Revision 2, for reference in license amendment applications for all Westinghouse pressurized water reactors with the conditions discussed below.

When submitting plant-specific license amendment (TS change) requests, licensees must confirm the applicability of the generic analysis of WCAP-13632, Revision 2, to their plant, and in addition to the request as shown in Appendix B of the WCAP report and the TS markup tables as shown in Appendix A, licensees must take the following actions:

(a) Perform a hydraulic RTT prior to installation of a new transmitter/switch or following refurbishment of the transmitter/switch (e.g., sensor cell or variable damping components) to determine an initial sensor-specific response time value.

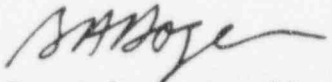
(b) For transmitters and switches that use capillary tubes, perform a RTT after initial installation and after any maintenance or modification activity that could damage the capillary tubes.

(c) If variable damping is used, implement a method to assure that the potentiometer is at the required setting and cannot be inadvertently changed or perform hydraulic RTT of the sensor following each calibration.

(d) Perform periodic drift monitoring of all Model 1151, 1152, 1153, and 1154 Rosemount pressure and differential pressure transmitters, for which RTT elimination is proposed, in accordance with the guidance contained in Rosemount Technical Bulletin No. 4 and continue to remain in full compliance with any prior commitments to Bulletin 90-01, Supplement 1, "Loss of Fill-Oil in Transmitters Manufactured by Rosemount." As an alternative to performing periodic drift monitoring of Rosemount transmitters, licensees may complete the following actions: (1) ensure that operators and technicians are aware of the Rosemount transmitter loss of fill-oil issue and make provisions to ensure that technicians monitor for sensor response time degradation during the performance of calibrations and functional tests of these transmitters, and (2) review and revise surveillance testing procedures, if necessary, to ensure that calibrations are being performed using equipment designed to provide a step function or fast ramp in the process variable and that calibrations and functional tests are being performed in a manner that allows simultaneous monitoring of both the input and output response of the transmitter under test, thus allowing, with reasonable assurance, the recognition of significant response time degradation.

Should you have any questions or wish further clarification, please call me at (301) 415-1004, or John Ganiere at (301) 415-2921.

Sincerely,



Bruce A. Boger, Director
Division of Reactor Controls
and Human Factors
Office of Nuclear Reactor Regulation

Enclosure: As stated

cc: D. Miller, Westinghouse Electric
R. C. Howard, Westinghouse Electric

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EVALUATION OF WESTINGHOUSE ELECTRIC CORPORATION TOPICAL REPORT WCAP-13632, REVISION 2, "ELIMINATION OF PRESSURE SENSOR RESPONSE TIME TESTING REQUIREMENTS"

1.0 INTRODUCTION AND BACKGROUND

The requirement for periodic testing of reactor trip systems is established in 10 CFR Part 50.55a paragraph (h), "Protection systems," which states, in part, that "protective systems must meet the requirements set forth in editions or revisions of the Institute of Electrical and Electronics Engineering (IEEE) Standard: 'Criteria for Protective Systems for Nuclear Power Generating Stations,' (IEEE-279)." In addition, 10 CFR 50.36 paragraph (c)(1)(ii)(A) requires limiting safety systems settings to be included in the Technical Specifications (TS) and to be "so chosen that automatic protective action will correct the abnormal situation before a safety limit is exceeded." Also, 10 CFR 50.36 paragraph (c)(3), "Surveillance requirements," states "Surveillance requirements are requirements related to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within the safety limits, and that the limiting conditions of operation will be met."

ENCLOSURE

requirements were included in the Westinghouse Standard TSs and were required for all Westinghouse plants licensed after that date. IEEE Standard 338-1975, "Criteria for the Periodic Surveillance Testing of Class 1E Power and Protection Systems," and its later version IEEE Std. 338-1977, "Criteria for the Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems," (Reference 1) provided generic guidance on the conduct of response time verification tests. The NRC staff endorsed IEEE Standard 338-1977 in Regulatory Guide 1.118, Revision 2, "Periodic Testing of Electric Power and Protection Systems," dated June 1978 (Reference 2). Guidance on the performance of RTT is also provided in the Instrument Society of America (ISA) Standard ISA-S67.06-1986, "Response Time Testing of Nuclear Safety-Related Instrument Channels in Nuclear Power Plants," dated August 29, 1986 (Reference 3). ISA-S67.06-1986 has not been endorsed by the NRC staff, but its methodology is widely used in plant specific RTT procedures.

New guidance on the scope of TS requirements under 10 CFR 50.36 was promulgated by the NRC with the publication of the Commission's Final Policy Statement on TS Improvements in July 1993. RTT is not specifically required by this policy because the essential instrumentation providing indication and actuation functions to mitigate design basis accidents for which RTT elimination has been proposed will continue to be incorporated in plant TSs and, as such, will receive other surveillances to verify operability.

Westinghouse Electric Corporation (Westinghouse) issued WCAP-13632, Revision 2, "Elimination of Pressure Sensor Response Time Testing Requirements," (Reference 4) in August 1995. Revision 2 of WCAP-13632 superseded the

original submittal, WCAP-13632, Revision 1, dated December 1993. The WCAP report provides a description of Westinghouse Owners Group (WOG) Program MUHP-3040, Revision 1, which was completed as an industry effort to demonstrate that TS requirements to perform periodic RTT of the following pressure and differential pressure sensors typically used in Reactor Trip System (RTS) and Engineered Safety Features Actuation System (ESFAS) instrumentation loops at Westinghouse plants could be eliminated:

- Barton 288 and 289 Differential Pressure Indicating Switches
- Barton 332 Differential Pressure Transmitter
- Barton 351 Sealed Sensor
- Barton 752 Differential Pressure Transmitter
- Barton 763 Gauge Pressure Transmitter
- Barton 763A Gauge Pressure Transmitter
- Barton 764 Differential Pressure Transmitter
- Foxboro N-E11AH Absolute Pressure Transmitter
- Foxboro N-E11DM Differential Pressure Transmitter
- Foxboro N-E11GH Gauge Pressure Transmitter
- Foxboro N-E11GM Gauge Pressure Transmitter
- Foxboro E11GM Gauge Pressure Transmitter
- Foxboro N-E13DM Differential Pressure Transmitter
- Foxboro N-E13DH Differential Pressure Transmitter
- Foxboro E13DH Differential Pressure Transmitter
- Tobar 32PA1 Absolute Pressure Transmitter
- Tobar 32PA2 Absolute Pressure Transmitter
- Tobar 32PG1 Gauge Pressure Transmitter
- Tobar 32DP1 Differential Pressure Transmitter
- Tobar 32DP2 Differential Pressure Transmitter
- Rosemount Pressure and Differential Pressure Transmitters Models 1151, 1152, 1153, and 1154
- Veritrak 76PH2 Absolute Pressure Transmitter
- Veritrak 76PG1 Gauge Pressure Transmitter
- Veritrak 76DP1 Differential Pressure Transmitter

WCAP-13632, Revision 2, utilizes the sensor failure modes and effects analyses (FMEA) contained in Electric Power Research Institute (EPRI) Report NP-7243, "Investigation of Response Time Testing Requirements," dated May 1991 (Reference 5) and EPRI Report NP-7243, Revision 1, dated March 1994 (Reference 6) to justify the elimination of RTT surveillance requirements for several of

the pressure sensors identified above. However, not all of the pressure sensors identified above were evaluated in the EPRI report. To justify the elimination of RTT for these additional pressure sensors, the WOG completed similarity analyses that compared the sensors to those evaluated in the EPRI report. Where similarity could not be shown, FMEA or testing was used to justify the elimination of RTT requirements.

The information presented in WCAP-13632, Revision 2, shows that, in general, failure modes associated with the pressure sensors analyzed by EPRI and the WOG would not affect sensor response time independently of sensor output. Therefore, sensor failure modes that have the potential to affect sensor response time would be detected during the performance of other TS surveillance requirements, principally sensor calibration.

Revision 2 of WCAP-13632 provides a methodology for verifying the total RTS or ESFAS channel response time by using an allocated sensor response time, rather than a measured sensor response time, summed with the measured response time of the remainder of the channel. Allocations for the pressure and differential pressure sensor response times would be obtained from: 1) historical records based on acceptable RTT (hydraulic, noise, or power interrupt tests), 2) inplace, onsite, or offsite (e.g., vendor) test measurements, or 3) utilizing vendor engineering specifications.

WCAP-13632, Revision 2, also includes TS markup tables (Appendix A) and a No Significant Hazards Evaluation (Appendix B) to be used by licensees when submitting plant-specific license amendment requests to eliminate pressure and differential pressure sensor RTT requirements.

2.0 DISCUSSION

Current Westinghouse Standard TSs require nuclear power plants to periodically perform RTT for instrument channels in the RTS and the ESFAS. The response time may be measured by any series of sequential, overlapping, or total steps provided that the test measures the total channel response time. Due to the complexity of testing an entire instrument channel from the sensor to the final device, plant surveillance procedures typically test a channel in two or more overlapping steps. Usually, instrument sensors are tested in one individual step because they require specialized test equipment and outside vendors are typically used.

The intent of RTT is to ensure that changes in response time of instrumentation beyond the limits assumed in the plant safety analyses are detected, and combined with instrument calibration, to ensure that the instrumentation is operating correctly. The response time tests do not demonstrate that a specific pressure sensor response time design value is met, but rather that the specified performance TS requirements for the entire RTS or ESFAS channel are satisfied.

As indicated in WCAP-13632, Revision 2, the basic premise for the elimination of periodic RTT of pressure and differential pressure sensors installed in RTS and ESFAS channels is that pressure sensor component failures that can cause response time degradation will also affect sensor output and, therefore, can be detected by other TS surveillance tests. As a result, RTT is considered redundant to other TS surveillance requirements. Westinghouse noted that IEEE Standard 338-1977 defines a basis for eliminating RTT. Section 6.3.4 states in part:

> "Response time testing of all safety-related equipment, per se, is not required if, in lieu of response time testing, the response time of the safety system equipment is verified by functional testing, calibration check, or other tests, or both. This is acceptable if it can be demonstrated that changes in response time beyond acceptable limits are accompanied by changes in performance characteristics which are detectable during routine periodic tests."

The program described in WCAP-13632, Revision 2, refers to work documented in EPRI Report NP-7243, Revision 1, to support the elimination of periodic RTT surveillance requirements of selected pressure and differential pressure sensors in RTS and ESFAS instrumentation loops. The EPRI program was devised to determine: 1) how RTT performs as a unique indicator of pressure and differential pressure sensor response time degradation; 2) sensor failure modes, if any exist, which result in response time degradation that would not

be detected by other periodic (non-RTT) testing methods; 3) the level of redundancy between RTT and other periodic tests; and, 4) the RTT methods best suited to detect, where necessary, response time degradation.

EPRI evaluated approximately 4200 RTT data measurements from 39 plants to determine sensor types that have failed RTT and to determine if response time degradation was the key indicator of the failure. EPRI also completed FMEAs of the principle design components of numerous pressure and differential pressure sensors typically employed in RTS and ESFAS instrumentation loops in order to determine which, if any, potential sensor failure modes could affect sensor response time and not be detectable by other periodic surveillance tests. EPRI completed FMEAs for the following sensors typically installed in Westinghouse plants:

- Barton 288 and 289 Differential Pressure Indicating Switches
- Barton 763 Gauge Electronic Pressure Transmitter
- Barton 764 Differential Pressure Electronic Transmitter
- Foxboro N-E11GH Gauge Pressure Transmitter
- Foxboro N-E11GM Gauge Pressure Transmitter
- Foxboro N-E11DM Differential Pressure Transmitter
- Foxboro N-E13DM Differential Pressure Transmitter
- Foxboro N-E13DH Differential Pressure Transmitter
- Tobar 32PA1 Absolute Pressure Transmitter
- Tobar 32PG1 Gauge Pressure Transmitter
- Tobar 32DP1 Differential Pressure Transmitter
- Rosemount Pressure and Differential Pressure Transmitters Models 1151, 1152, 1153, and 1154

The EPRI review found that RTT has not identified any pressure or differential pressure sensors that have failed response time requirements. This is due in large part to the fact that pressure sensor component failures that affect sensor response time also affect sensor accuracy and, therefore, are detected during other periodic surveillance tests, such as calibrations and channel

checks, which are performed more frequently than RTT. The EPRI report concluded that the current RTT program for pressure and differential pressure sensors adds very little to the identification of failed sensors and verification of loop response times and that, in general, other TS surveillance requirements have proven effective in identifying failed sensors in a timely manner.

The WOG identified the following additional pressure and differential pressure sensors currently installed in RTS and ESFAS instrumentation loops at Westinghouse plants but not analyzed in the EPRI report:

- Barton 332 Differential Pressure Transmitter
- Barton 351 Sealed Sensor
- Barton 752 Differential Pressure Transmitter
- Barton 763A Gauge Pressure Transmitter
- Foxboro N-E11AH Absolute Pressure Transmitter
- Foxboro E11GM Gauge Pressure Transmitter
- Foxboro E13DH Differential Pressure Transmitter
- Tobar 32PA2 Absolute Pressure Transmitter
- Tobar 32DP2 Differential Pressure Transmitter
- Veritrak 76PH2 Absolute Pressure Transmitter
- Veritrak 76PG1 Gauge Pressure Transmitter
- Veritrak 76DP1 Differential Pressure Transmitter

To address these sensors, the WOG completed similarity analyses that compared the design and the functionality of the principle components of each of these pressure and differential pressure units to sensors previously evaluated in the EPRI report. Where similarity could not be shown, other techniques such as FMEA or circuit testing were completed in order to show that the response time would not be significantly affected by degradation of components or that such changes would be detectable by normal calibration procedures. The analyses results for each of these sensors did not identify any credible

failure modes that would affect sensor response time independently of other system performance parameters and, consequently, would not be detected by other periodic surveillance tests. All of the WOG analyses documented in WCAP-13632, Revision 2, were reviewed and approved by the respective sensor manufacturers.

Westinghouse has proposed using allocated sensor response times in accordance with the methodology described in Section 9 of WCAP-13632, Revision 2, to verify total RTS or ESFAS response time. Allocations for sensor response times would be obtained from: 1) historical records based on acceptable RTT (hydraulic, noise, or power interrupt tests), 2) inplace, onsite, or offsite (e.g., vendor) test measurements, or 3) utilizing vendor engineering specifications. There is no specific recommendation in determining which of these methods to use, although the value will be increasingly more conservative progressing through these methods. Available manufacturer supplied and Westinghouse engineering specification response time values for the subject pressure sensors are shown in Table 9-1 of WCAP-13632, Revision 2. If the sensor response time is not provided in the table, then neither the manufacturer or Westinghouse currently provide this information. For these sensors, the most conservative value for sensor response time based on historical records of acceptable RTT should be used. Pressure sensor response time allocations would be verified by the performance of appropriate RTT prior to placing the sensor in service and re-verified following maintenance that may adversely affect response time, such as replacing the sensor assembly of a

pressure transmitter. The total channel response time is obtained by summing the allocated sensor response time with the measured response time of the remainder of the channel.

The WCAP indicated that the elimination of sensor RTT does not affect the total system response time assumed in the safety analysis. The use of allocated sensor response times will still provide assurance that the total system response time is within that defined in the safety analysis, since calibrations will detect any degradation which might significantly affect sensor response time.

Although not part of the justification for deleting the TS requirements to perform periodic RTT of the pressure and differential pressure sensors identified above, the WOG evaluated the effect of significant degradation of response time on the ability of the instrument loop to perform its safety function. Specifically, the WOG completed a safety assessment assuming increased response times. The maximum incredible response time for each reactor trip function was calculated by increasing the sensor, signal conditioning, and logic equipment response time allowances by a factor of five and calculating the root mean square. In all cases, the response time was still below the TS limit. However, it is noted that based on the analyses documented in the EPRI report and WCAP-13632, Revision 2, it is not anticipated that such response time degradation would occur or go undetected.

3.0 EVALUATION

To meet the guidance of Regulatory Guide 1.118, Revision 2, and IEEE 338-1977, Section 6.3.4, RTT is needed unless it has been shown that changes in the response time of a sensor will be accompanied by changes in performance characteristics which are detectable during routine periodic tests. The sensor analysis results contained in EPRI Report NP-7243, Revision 1, concluded that, in general, RTT is redundant to other periodic surveillance tests, such as channel checks and calibrations, because these other surveillance tests will detect sensor component failures that cause response time degradation. Furthermore, these other surveillance tests are performed more frequently than current response time tests. The staff agrees with this determination. However, the EPRI FMEAs identified two failure modes that could potentially affect response time without concurrently affecting sensor output. The report indicated that these two potential failure modes, slow sensor fill fluid leak during pressurized operation in Rosemount transmitters and variable damping potentiometer misadjustment in Rosemount transmitters, may not be detected by calibration.

The loss of fill oil in Model 1153, Series B and D, and Model 1154 Rosemount pressure and differential pressure transmitters manufactured before July 11, 1989 is the subject of NRC Bulletin 90-01, Supplement 1, "Loss of Fill-Oil in Transmitters Manufactured by Rosemount," dated December 22, 1992. EPRI Report NP-7243, Revision 1, concluded that periodic drift monitoring of Rosemount pressure and differential pressure transmitters in accordance with Bulletin 90-01, Supplement 1, and Rosemount Technical Bulletin No. 4 is effective for

detecting potential loss of fill fluid failures in these particular Rosemount transmitters. However, the staff notes that loss of fill oil is a credible failure mode in all Rosemount pressure and differential pressure transmitters including Model 1151, 1152, and 1153, Series A, Rosemount transmitters as well as post-July 11, 1989 manufactured Model 1153, Series B and D, and 1154 Rosemount transmitters. Therefore, licensees should perform perindic drift monitoring of all Model 1151, 1152, 1153, and 1154 Rosemount pressure and differential pressure transmitters, for which RTT elimination is proposed, in accordance with the guidance contained in Rosemount Technical Bulletin No. 4. In addition, licensees shall continue to remain in full compliance with any prior commitments to Bulletin 90-01, Supplement 1. As an alternative to performing periodic drift monitoring of Rosemount transmitters, licensees may complete the following actions: (1) ensure that operators and technicians are aware of the Rosemount transmitter loss of fill-oil issue and make provisions to ensure that technicians monitor for sensor response time degradation during the performance of calibrations and functional tests of these transmitters, and (2) review and revise surveillance testing procedures, if necessary, to ensure that calibrations are being performed using equipment designed to provide a step function or fast ramp in the process variable and that calibrations and functional tests are being performed in a manner that allows simultaneous monitoring of both the input and output response of the transmitter under test, thus allowing, with reasonable assurance, the recognition of significant response time degradation.

Misadjustment of variable damping potentiometers during calibration can affect response time without affecting sensor output and may not be detectable during normal calibration. As a result, EPRI Report NP-7243, Revision 1, recommended implementing a method to assure that the potentiometer is at the required setting and cannot be inadvertently changed or as an alternative, perform hydraulic RTT of the sensor following each calibration. Therefore, the staff agrees that licensees proposing to eliminate RTT of sensors where variable damping is used should follow this recommendation.

The FMEAs also identified a manufacturing/handling defect with the potential to affect response time involving crimped capillaries as a result of the manufacturing process, improper handling by the manufacturer, or in the field during maintenance or plant modifications. As a result, EPRI Report NP-7243, Revision 1, concluded that for transmitters and switches that use capillary tubes, RTT should be performed after initial installation and after any maintenance or modification activity that could damage the capillary tubes. The staff supports this conclusion and believes that performing an initial RTT at the time of installation is sufficient to detect the occurrence of crimped capillary tubing or other problems with instrument performance. Degradation in capillaries over time generally can be detected with the proper calibration methods. However, in some cases, capillary tubing is not included in calibration testing. For those cases, the staff agrees that it will be necessary to perform capillary tube testing after any maintenance that might damage the capillary tube.

EPRI Report NP-7243, Revision 1, also recommended performing a hydraulic RTT prior to installation of a new transmitter/switch or following refurbishment of the transmitter/switch (e.g., sensor cell or variable damping components) to determine an initial sensor-specific response time value. Based on this recommendation, the TS markups as shown in Appendix A of WCAP-13632, Revision 2, state that allocations for sensor response times must be verified prior to placing the sensor in operational service and re-verified following maintenance that may adversely affect response time such as replacing the sensing assembly of a transmitter. The staff agrees that the approach indicated in the Appendix A TS markups is consistent with the EPRI recommendation, and is therefore acceptable.

The staff's review of EPRI Report NP-7243, Revision 1, determined that the FMEAs and other accumulated RTT data were generally useful in showing that the great majority of sensor component failure modes which can affect sensor response times will also affect sensor output, with the exception of the specific pressure sensor failure modes described above. In addition, the staff finds that there are no sensor failure modes associated with the sensors analyzed by the WOG that would affect response time without also affecting calibration or functional test results. The staff also notes that the manufacturers of the subject pressure and differential pressure sensors for which the elimination of RTT is proposed do not recommend or require periodic RTT in order to ensure correct function of the transmitter.

Based on this information, the staff concurs that RTT is redundant to other periodic surveillance tests and that appropriate surveillance testing

alternatives to RTT are in place per the existing requirements of plant specific TSs. The staff concludes that calibration and other TS surveillance testing requirements will adequately ensure that the response time is verified for the sensors identified in WCAP-13632, Revision 2. The staff accepts the use of allocated sensor response times in accordance with the methodology described in Section 9 of WCAP-13632, Revision 2, when determining total channel response time and concludes that this method of response time verification still provides assurance that the total channel response time is within safety analysis limits. Therefore, the staff approves elimination of RTT TS requirements for the following pressure and differential pressure sensors in RTS and ESFAS channels, as identified in WCAP-13632, Revision 2:

- Barton 288 and 289 Differential Pressure Indicating Switches
- Barton 332 Differential Pressure Transmitter
- Barton 351 Sealed Sensor
- Barton 752 Differential Pressure Transmitter
- Barton 763 Gauge Pressure Transmitter
- Barton 763A Gauge Pressure Transmitter
- Barton 764 Differential Pressure Transmitter
- Foxboro N-E11AH Absolute Pressure Transmitter
- Foxboro N-E11DM Differential Pressure Transmitter
- Foxboro N-E11GH Gauge Pressure Transmitter
- Foxboro N-E11GM Gauge Pressure Transmitter
- Foxboro E11GM Gauge Pressure Transmitter
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- Foxboro N-E13DH Differential Pressure Transmitter
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- Tobar 32PA1 Absolute Pressure Transmitter
- Tobar 32PA2 Absolute Pressure Transmitter
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- Tobar 32DP2 Differential Pressure Transmitter
- Rosemount Pressure and Differential Pressure Transmitters Models 1151, 1152, 1153, and 1154
- Veritrak 76PH2 Absolute Pressure Transmitter
- Veritrak 76PG1 Gauge Pressure Transmitter
- Veritrak 76DP1 Differential Pressure Transmitter

The staff considers the elimination of RTT requirements for those sensors having potential failures modes that can affect the sensor response time independently of sensor output, as described in EPRI Report NP-7243, Revision 1, and summarized above, to be acceptable, subject to the additional actions identified in Section 4.0 conclusion of this evaluation.

The staff notes that the elimination of sensor RTT requirements in RTS and ESFAS channels is consistent with the Commission's Final Policy Statement on TS Improvements dated July 1993 in that the RTS and ESFAS instrumentation providing actuation functions to mitigate design basis accidents will continue to be incorporated in plant TSs and, as such, will receive other surveillances to verify operability and detect sensor response time degradation.

The staff accepts the use of the TS markup tables and the No Significant Hazards Evaluation as shown in Appendices A and B, respectively, of WCAP-13632, Revision 2, by licensee's when submitting plant-specific license amendment requests to eliminate sensor RTT requirements. As shown in Appendix A, the staff notes that future plant-specific license amendment requests will propose to revise RTS and ESFAS Instrumentation TS surveillance requirements to indicate that the total channel response time will be verified rather than tested and will propose to revise the associated Bases to indicate that response time may be verified by actual tests in any series of sequential, overlapping or total channel measurements, or by summation of allocated sensor response times with actual tests on the remainder of the channel in any series of sequential or overlapping measurements. The Bases will also be revised to indicate that WCAP-13632, Revision 2, provides the basis and methodology for

using allocated sensor response times and that allocations for sensor response times must be verified prior to placing a sensor in operational service and re-verified following maintenance that may adversely affect response time.

4.0 CONCLUSION

WOG Program MUHP-3040, Revision 1, was completed as an effort to eliminate TS RTT requirements for the above pressure and differential pressure sensors installed in RTS and ESFAS instrumentation loops. IEEE Standard 338-1977, as endorsed by Regulatory Guide 1.118, Revision 2, states that RTT is not required if in lieu of response time testing, the response time of the safety equipment is verified by functional testing, calibration checks or other tests, and if it can be demonstrated that changes in response time beyond acceptable limits are accompanied by changes in performance characteristics which are detectable during routine periodic tests.

Based on its review of the information presented in WCAP-13632, Revision 2, the staff agrees that, significant degradation of instrumentation response times can be detected during the performance of calibrations and other currently required surveillance tests. Thus, the staff concludes that the other existing TS surveillance requirements for the sensors described in WCAP-13632, Revision 2, provide confidence that the safety function of the plant instrumentation will be satisfied without the need for specific RTT.

Based on this information, the staff accepts WCAP-13632, Revision 2, "Elimination of Pressure Sensor Response Time Testing Requirements," dated

August 1995, as a basis for the elimination of RTT from TSs for the pressure sensors identified in WCAP-13632, Revision 2, with the conditions described below. The use of allocated sensor response times in accordance with the methodology contained in Section 9 of WCAP-13632, Revision 2, when verifying the total channel response time of the specific RTS and ESFAS channels containing the above sensors is considered to be acceptable.

When submitting plant-specific license amendment (TS change) requests, licensees must confirm the applicability of the generic analysis of WCAP-13632, Revision 2, to their plant, and in addition to the request as shown in Appendix B of the WCAP report and the TS markup tables as shown in Appendix A, licensees must commit to the following actions:

(a) Perform a hydraulic RTT prior to installation of a new transmitter/switch or following refurbishment of the transmitter/switch (e.g., sensor cell or variable damping components) to determine an initial sensor-specific response time value.

(b) For transmitters and switches that use capillary tubes, perform a RTT after initial installation and after any maintenance or modification activity that could damage the capillary tubes.

(c) If variable damping is used, implement a method to assure that the potentiometer is at the required setting and cannot be inadvertently changed or perform hydraulic RTT of the sensor following each calibration.

(d) Perform periodic drift monitoring of all Model 1151, 1152, 1153, and 1154 Rosemount pressure and differential pressure transmitters, for which RTT elimination is proposed, in accordance with the guidance contained in Rosemount Technical Bulletin No. 4 and continue to remain in full compliance with any prior commitments to Bulletin 90-01, Supplement 1. As an alternative to performing periodic drift monitoring of Rosemount transmitters, licensees may complete the following actions: (1) ensure that operators and technicians are aware of the Rosemount transmitter loss of fill-oil issue and make provisions to ensure that technicians monitor for sensor response time degradation during the performance of calibrations and functional tests of these transmitters, and (2) review and revise surveillance testing procedures, if necessary, to ensure that ca' 'ations are being performed using equipment designed to provide a step function or fast ramp in the process variable and that calibrations and functional tests are being performed in a manner that allows simultaneous monitoring of both the input and output response of the transmitter under test, thus allowing, with reasonable assurance, the recognition of significant response time degradation.

5.0 REFERENCES

1. IEEE Standard 338-1977, "Criteria for the Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems."

2. Regulatory Guide 1.118, Revision 2, "Periodic Testing of Electric Power and Protection Systems," dated June 1978.

3. ISA-S67.06-1986, "Response Time Testing of Nuclear Safety-Related Instrument Channels in Nuclear Power Plants," dated August 29, 1986.

4. WCAP-13632, Revision 2, "Elimination of Pressure Sensor Response Time Testing Requirements," WOG Program MUHP-3040, Revision 1, August 1995.

5. Electric Power Research Institute Report NP-7243, "Investigation of Response Time Testing Requirements," dated May 1991.

6. Electric Power Research Institute Report NP-7243, Revision 1, "Investigation of Response Time Testing Requirements," dated March 18, 1994.