INNOVATING NUCLEAR TECHNOLOGY
ANALYSIS AND MEASUREMENT SERVICES CORPORATION

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June 4, 2021

U.S. Nuclear Regulatory Commission
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Document Control Desk
Attention: Mr. Joseph Holonich, Project Manager
Washington, DC 20555-0001

Subject: Response to Request for Additional Information for Analysis and Measurement Services Corporation Topical Report AMS-TR-0720R1, "Online Monitoring Technology to Extend Calibration Intervals of Nuclear Plant Pressure Transmitters" (Docket No. 99902075)

References:

(1) AMS letter dated October 9, 2020, *Submittal of Analysis and Measurement Services Corporation Topical Report AMS-TR-0720R1, "Online Monitoring Technology to Extend Calibration Intervals of Nuclear Plant Pressure Transmitters"* (ADAMS Accession No. ML20317A111)

(2) NRC Email to AMS dated March 5, 2021, *Final RAIs for AMS re Topical Report AMS-TR-0720R1.pdf* (ADAMS Accession No. ML21067A674)

(3) AMS letter dated May 7, 2021, *RAI Response #2 AMS-0521-RAI2* (ADAMS Accession No. ML21130A109)

(4) AMS letter dated May 19, 2021, *Response to Request for Additional Information for Analysis and Measurement Services Corporation Topical Report AMS-TR-0720R1, "Online Monitoring Technology to Extend Calibration Intervals of Nuclear Plant Pressure Transmitters*" (ADAMS Accension No. ML21140A000)

Dear Mr. Joseph Holonich:

Analysis and Measurement Services Corporation (AMS) submitted Topical Report AMS-TR-0720R1 by Reference 1. NRC issued seven Request for Additional Information (RAI) by Reference 2. AMS provided a response to RAI-2 by Reference 3. AMS provided a response to all seven by Reference 4, followed by a virtual call between AMS and NRC on June 1, 2021 to describe the content of Reference 4 and provide any necessary clarification. The following changes are submitted hereby in this letter to accommodate the NRC issues raised during the virtual call of June 1, 2021.

1. Section 11.1.2 Step 18 was edited.
2. The first bullet of Section 11.4 was simplified.
3. Material was added to Step 4 of Section 13.1 to describe the method for calculating the Average Calibration Interval.
4. Material was added to Step 4 of Section 13.1 to clarify that if the calculated backstop is less than the existing calibration frequency, then the existing calibration frequency is to be used as the backstop.

5. A new chapter (Chapter 15) was added to describe a process to determine the minimum data acquisition sampling rate required for OLM data collection for drift monitoring. The existing Chapter 15 was moved as is and numbered as Chapter 16.
6. Material was added to Step 6 of Section 11.1.1 to indicate that a new chapter (Chapter 15) has been added to describe a process to determine the minimum data acquisition sampling rate required for OLM data collection for drift monitoring.

The TR pages affected by the above changes are attached to this letter.

AMS requests that the attached information marked as proprietary be withheld from public disclosure. In accordance with 10 CFR 2.390, "Public inspections, exemptions, requests for withholding," an affidavit is enclosed identifying the specific portions of the above documents that are proprietary and the basis for making that determination. Non-proprietary versions of the documents are also provided with the proprietary information redacted.

Please contact me at (865) 691-1756 ext. 128 or by email at hash@ams-corp.com with any questions.

Best regards,

H.M. Hashemian

H.M. Hashemian, Ph.D.
President and CEO
AMS Corporation

Attachments:
1) TR pages changed: AMS-0521-RAIs1-7-R2-NON-PROPRIETARY
2) TR pages changed: AMS-0521-RAIs1-7-R2-PROPRIETARY
3) Affidavit identifying proprietary information

1. **Determine if Transmitters are Amenable to OLM.**

   Chapter 12 includes a table of nuclear grade transmitter models that are amenable to OLM. Any transmitter model that is not listed in this table should only be added to the OLM program if it can be shown by similarity analysis that its failure modes are the same as the listed transmitter models or otherwise detectable by OLM.

2. **List Transmitters in Each Redundant Group.**

   [[ ]]a,b,f

3. **Determine if OLM Data Covers Applicable Setpoints.**

   [[ ]]a,b,f

4. **Calculate Backstops.**

   A backstop, as described in Chapter 13, must be established for each group of redundant transmitters amenable to OLM as a defense against common mode drift. The backstop identifies the maximum period between calibrations without calibrating at least one transmitter in a redundant group.

5. **Establish Method of Data Acquisition.**

   OLM data is normally available in the plant computer or an associated data historian. If data is not available from the plant computer or historian, a custom data acquisition system including hardware and software must be employed to acquire the data.

6. **Specify Data Collection Duration and Sampling Rate.**

   OLM data must be collected during startup, normal operation, and shutdown periods at the highest sampling rate by which the plant computer takes data. Chapter 15 describes a process to determine the minimum sampling rate for OLM data acquisition to monitor for transmitter drift. **[[ ]]a,b,f** Chapter 8 describes a process to help determine the optimal sampling rate and minimum duration of OLM data collection.

   [[ ]]a,b,f

]]a,b,f

16. Address Uncertainties in the Unexercised Portion of Transmitter Range.

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]]a,b,f

17. Select Transmitters to Be Checked for Calibration as a Backstop.

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]]a,b,f

18. Perform Dynamic Failure Mode Assessment.

[[

]]a,b,f This step must be performed using the noise analysis technique described in Section 11.3 to cover dynamic failure modes that are not detectable by the OLM process for transmitter drift monitoring (see Chapter 3).

19. Produce a Report of Transmitters Scheduled for Calibration Check.

The results of OLM analysis must be compiled in a report and independently reviewed. The transmitters that have been flagged must be scheduled for a calibration check at the next opportunity.

11.2 EXAMPLE OF THE OLM DATA ANALYSIS PROCESS

This section presents an example of the OLM data analysis process to illustrate the steps that were outlined in Section 11.1.2. This example comes from analysis performed for a complete operating cycle of about 18 months using the Sizewell B nuclear plant data collected from the beginning of startup in May 2013 to end of shutdown in October 2014.

The OLM data sampled during plant startup is first partitioned and then analyzed partition-by-partition. An example using four redundant transmitters is illustrated in Figure 11.1. The partitioning windows are selected by the OLM analyst based on experience and characteristics of the OLM data (Figure 11.1a). The process estimate is calculated using simple averaging or parity space technique for each partition (Figure 11.1b). This value is then subtracted from the reading of each redundant transmitter to arrive at the deviation of each transmitter from the process estimate for the redundant group. The deviation results are then plotted versus time for the redundant transmitters (Figure 11.1c).

11.4 TRAINING OF OLM ANALYST

The OLM analyst must be trained in both static and dynamic performance verification of transmitters. A great deal of research has been performed worldwide to automate the reading and interpretation of OLM data and results, but none can yet replace the need for a human analyst. The human analyst must have knowledge of the OLM fundamentals and skills in the OLM implementation details. As a minimum, the analyst must have education or experience in process measurement, instrumentation and control, system analysis, and training to perform the following tasks. **[[**

]][a,b,f]

11.5 REQUIRED TECHNICAL SPECIFICATIONS CHANGES

The plant Technical Specification must be modified as shown in Appendix B to implement OLM. The typical Technical Specification changes must include the addition of a definition for ONLINE MONITORING. A new ONLINE MONITORING Program to Extend Transmitter Calibration Intervals must be added. A new Surveillance Requirement option to use the ONLINE MONITORING Program to Extend Transmitter Calibration Intervals to determine the frequency of transmitter CHANNEL CALIBRATION must be adopted. The new SURVEILLANCE REQUIREMENT option is added as an “OR” option to the existing requirement.

The purpose of the OLM Topical Report is to provide a method to defer calibration of the transmitters included in the ONLINE MONITORING Program based on OLM results. The OLM methodology described in the Topical Report is not used to extend the calibration of any other elements in the safety signal path (e.g., signal converters or adjustable parameters in I&C rack equipment). The Surveillance Requirement frequency for these other components in the signal path remains in effect. The Surveillance Requirement frequency for these other components can be calendar-based by specifying a calendar interval, risk-based using a Surveillance Frequency Control Program, or defined based on self-testing features of a digital I&C platform-based system.

$$\frac{P_{MAX}}{P_{CM}} = \sqrt{\left(\frac{Max\ Interval}{Average\ Calibration\ Interval}\right)} \qquad \text{Eq. 13.5}$$

Or,

$$Max\ Interval\ = (Average\ Calibration\ Interval)\left(\frac{P_{MAX}}{P_{CM}}\right)^2 \qquad \text{Eq. 13.6}$$

where the Average Calibration Interval is calculated in two steps: calculate the average time interval between calibrations of each redundant transmitter for the installed history of the transmitter, and then average the results of this calculation.

The backstop is equal to the maximum interval identified but bounded on the low side by the average calibration interval and on the high side by the time span of plant calibration data. If the backstop is less than the existing calibration frequency, then the existing calibration frequency must be used as the backstop. For example, if the average calibration interval is 18 months and the time span of plant calibration data is 20 years, then the backstop that is calculated should have a value between 18 months and 20 years. In this case, if the backstop turns out to be less than 18 months, it will still be set at 18 months and if it turns out to be greater than 20 years, it will still be set at 20 years. Section 13.3 presents two tables of backstop values for a variety of services in two PWR plants that provided calibration history data for this project.

13.2 BACKSTOP PROVISIONS

The established backstop may be used as is or updated for the following cases.

1. The backstop calculated for existing transmitters can be used as is for any new transmitters of the same make and model.
2. The backstop calculated for existing transmitters can be used for other transmitters of a different make or model for which an objective similarity analysis has verified that these other transmitters are equivalent to existing transmitters.
3. Backstops must be recalculated as more calibration data becomes available. This may result in longer or shorter backstops. Any recalculation of backstops must be verified and documented.

15 MINIMUM DATA ACQUISITION SAMPLE RATE FOR DRIFT MONITORING

OLM uses the deviation of each transmitter from the average of the redundant transmitters in a group (see Section 11.1.2 Step 12b and Section 11.2 Figure 11.1c) to identify transmitters that must be flagged for a calibration check. Therefore, it is important that the average deviation of each redundant transmitter in each group is accurate (see Figure 11.1d).

The accuracy of the average deviation of each transmitter is dependent on **[[**

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This section describes a process to determine the minimum rate at which the output of transmitters in an OLM program must be sampled to provide accurate average deviations.

15.1 Distribution of OLM Data

During normal operation of a nuclear power plant, **[[**

]][a,b,f] to determine the minimum sample rate that must be used to acquire OLM data for drift monitoring.

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Figure 15.1. Example Histogram of Deviations from the Redundant Group Average for a Steam Generator Level Transmitter

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]]^{a,b,f} Eq. 15.1

[[

]]^{a,b,f} Eq. 15.2

[[

]]^{a,b,f} Eq. 15.3

[[

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[[ ]]^{a,b,f}

Figure 15.2. Minimum Sample Rate [[ ]]^{a,b,f}

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]][a,b,f]

15.2 Process To Establish Minimum Sample Rate

The example above shows how to **[[**

]][a,b,f] Following are the steps that must be taken to arrive at the minimum sample rate for collection of OLM data to monitor for drift. **[[**

]][a,b,f]

Table 15.1. Minimum Sample Rate Example for PWR Plant #1

Service	XMTR ID	Std. Dev (% span)	Minimum samples, n	Minimum Sample Rate	Maximum Sample Period

a,b,f

Table 15.2. Minimum Sample Rate Example for PWR Plant #2

Service	XMTR ID	Std. Dev (% span)	Minimum samples, n	Minimum Sample Rate	Maximum Sample Period

a,b,f