XI.M24 COMPRESSED AIR MONITORING

Program Description

The purpose of the compressed air monitoring program is to provide reasonable assurance of the integrity of the compressed air system. The program consists of monitoring moisture content, corrosion, and performance of the compressed air system. This includes (a) preventive monitoring of water (moisture) and other potential contaminants to keep within the specified limits; and (b) inspection of components for indications of loss of material due to corrosion.

The compressed air monitoring aging management program (AMP) is based on results of the plant owner's response to Nuclear Regulatory Commission (NRC) Generic Letter (GL) 88-14 (as applicable to license renewal) and reported in previous NRC Information Notices (IN) 81-38; IN 87-28; IN 87-28, Supplement 1; and by the Institute of Nuclear Power Operations Significant Operating Experience Report (INPO SOER) 88-01. NRC GL 88-14, issued after several years of study of problems and failures of instrument air systems, recommends that each holder of an operating license perform an extensive design and operations review and verification of its instrument air system. NRC GL 88-14 also recommends that the licensees describe their program for maintaining proper instrument air quality. This AMP does not include all aspects of NRC GL 88-14 because many of the issues in the GL are not relevant to license renewal.

This AMP does not change the applicant's docketed response to NRC GL 88-14 for the rest of its operations. The program utilizes the aging management aspects of the applicant's response to NRC GL 88-14 for license renewal with regard to preventative measures, inspections of components, and testing to ensure that the compressed air system will be able to perform its intended function for the period of extended operation. The AMP also incorporates the air quality provisions provided in the guidance of the Electric Power Research Institute (EPRI) NP-7079. EPRI NP-7079 was issued in 1990 to assist utilities in identifying and correcting system problems in the instrument air system and to enable them to maintain required industry safety standards. The American Society of Mechanical Engineers (ASME) operations and maintenance standards and guides (ASME OM-S/G-1998, Part 17) provides additional guidance for maintenance of the instrument air system by offering recommended test methods, test intervals, parameters to be measured and evaluated, acceptance criteria, corrective actions, and records requirements.

Evaluation and Technical Basis

1. ***Scope of Program:*** The program manages the aging effects of loss of material due to corrosion in compressed air systems.

2. ***Preventive Actions:*** For the purposes of aging management, moisture and other corrosive contaminants in the system's air are maintained below specified limits to ensure that the system and components maintain their intended functions. These limits are prepared from consideration of manufacturer's recommendations for individual components and guidelines based on ASME OM-S/G-1998, Part 17; American National Standards Institute (ANSI)/ISA-S7.0.01-1996; EPRI NP-7079; and EPRI TR-108147.

3. ***Parameters Monitored/Inspected:*** Maintaining moisture and other corrosive contaminants below acceptable limits mitigates loss of material due to corrosion. Periodic air samples are taken and analyzed for moisture and other corrosives. Periodic and opportunistic

inspections of accessible internal surfaces are performed for signs of corrosion and abnormal corrosion products that might indicate a loss of material within the system.

4. ***Detection of Aging Effects:*** Moisture and other corrosives increase the potential for loss of material due to corrosion. The program periodically samples and tests the air quality in the compressed system for moisture in accordance with industry standards, such as ANSI/ISA-S7.0.01-1996. Typically, compressed systems have in-line dew point instrumentation that either checks continuously using an automatic alarm system or is checked at least daily to ensure that moisture content is within specifications. Additionally, periodic visual inspections of critical component internal surfaces (compressors, dryers, after-coolers, and filters) are performed for signs of loss of material due to corrosion. ASME O/M-S/G-1998, Part 17 provides guidance for inspection frequency and inspection methods of these components.

5. ***Monitoring and Trending:*** Daily readings of system dew point are recorded and trended. Air quality analysis results are reviewed to determine if alert levels or limits have been reached or exceeded. This review also checks for unusual trends. ASME O/M-S/G-1998, Part 17, provides guidance for monitoring and trending data. Visual inspection results are compared to previous results to ascertain if adverse long-term trends exist. The effects of corrosion are monitored by visual inspection. Test data are analyzed and compared to data from previous tests to provide for the timely detection of aging effects on passive components.

6. ***Acceptance Criteria:*** Acceptance criteria for air quality moisture limits are established based on accepted industry standards, such as ANSI/ISA-S7.0.01-1996. Internal surfaces should not show signs of corrosion (general, pitting, and crevice) that could indicate the potential loss of function of the component. Manufacturers' certifications can be used to demonstrate that the bottled air meets acceptable quality standards.

7. ***Corrective Actions:*** Corrective actions are taken if any parameters are out of acceptable ranges, such as moisture content in the system air. As discussed in the Appendix for GALL, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address the corrective actions.

8. ***Confirmation Process:*** The site corrective actions program, quality assurance (QA) procedures, site review and approval process, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. As discussed in the Appendix for GALL, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address the confirmation process and administrative controls.

9. ***Administrative Controls:*** Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. As discussed in the Appendix for GALL, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address administrative controls.

10. ***Operating Experience:*** Potentially significant safety-related problems pertaining to air systems have been documented in NRC IN 81-38; IN 87-28; IN 87-28, Supplement 1; and License Event Report 50-237/94-005-3. Some of the systems that have been significantly degraded or that have failed due to the problems in the air system include the decay heat removal, auxiliary feedwater, main steam isolation, containment isolation, and fuel pool seal systems. In 2008, one plant incurred an unplanned reactor trip from a failure of a mechanical joint in the instrument air system (NRC IN 2008-06). Nevertheless, as a result of

NRC GL 88-14 and in consideration of INPO SOER 88-01, EPRI NP-7079, and EPRI TR-108147, performance of air systems has improved significantly.

References

10 CFR Part 50, Appendix B, *Quality Assurance Criteria for Nuclear Power Plants*, Office of the Federal Register, National Archives and Records Administration, 2009.

ANSI/ISA-S7.0.01-1996, *Quality Standard for Instrument Air*, American National Standards Institute (ANSI), 1996.

ASME OM-S/G-1998, Part 17, *Performance Testing of Instrument Air Systems Information Notice Light-Water Reactor Power Plants*, 1ISA-S7.0.1-1996, "Quality Standard for Instrument Air," American Society of Mechanical Engineers, New York, NY, 1998.

EPRI NP-7079, *Instrument Air System: A Guide for Power Plant Maintenance Personnel*, Electric Power Research Institute, Palo Alto, CA, December 1990.

EPRI/NMAC TR-108147, *Compressor and Instrument Air System Maintenance Guide: Revision to NP-7079*, Electric Power Research Institute, Nuclear Maintenance Application Center, Palo Alto, CA, March 1998.

INPO Significant Operating Experience Report 88-01, *Instrument Air System Failures*, Institute of Nuclear Power Operations, May 18, 1988.

NRC Generic Letter 88-14, *Instrument Air Supply Problems Affecting Safety-Related Components*, U.S. Nuclear Regulatory Commission, August 8, 1988.

NRC Information Notice 81-38, *Potentially Significant Components Failures Resulting from Contamination of Air-Operated Systems*, U.S. Nuclear Regulatory Commission, December 17, 1981.

NRC Information Notice 87-28, *Air Systems Problems at U.S. Light Water Reactors*, U.S. Nuclear Regulatory Commission, June 22, 1987.

NRC Information Notice 87-28, Supplement 1, *Air Systems Problems at U.S. Light Water Reactors*, U.S. Nuclear Regulatory Commission, December 28, 1987.

NRC Information Notice 2008-06, *Instrument Air System Failure Resulting In Manual Reactor Trip*, U.S. Nuclear Regulatory Commission, April 10, 2008.

NRC Licensee Event Report 50-237/94-005-3, *Manual Reactor Scram due to Loss of Instrument Air Resulting from Air Receiver Pipe Failure Caused by Improper Installation of Threaded Pipe during Initial Construction*, U.S. Nuclear Regulatory Commission, April 23, 1997.