

Regulatory Perspectives on ASME OM Code, Mandatory Appendix IV, Revision 0, “Inservice Testing of Air-Operated Valves in Light-Water Reactor Nuclear Power Plants”

Jason Carneal*

Component Performance, NDE & Testing Branch
Division of Engineering
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission

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Abstract

The American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code) establishes the requirements for preservice and inservice testing and examination of certain components to assess their operational readiness in light-water reactor nuclear power plants. The Code of Federal Regulations (CFR) endorses and mandates the use of the ASME OM Code for testing air-operated valves in 10 CFR 50.55a(b)(3)(ii) and 10 CFR 50.55a(f)(4), respectively.

ASME has recently approved Mandatory Appendix IV, Revision 0. NRC currently anticipates that Mandatory Appendix IV will first appear in the 2014 Edition of the ASME OM Code. Publication of the 2014 Edition of the ASME OM Code begins the NRC rulemaking process to modify 10 CFR 50.55a to incorporate the 2014 Edition of the ASME OM Code by reference. NRC staff has actively participated in the development of Mandatory Appendix IV, Revision 0, through participation in the ASME OM Code Subgroup on Air-Operated Valves (SG-AOV). The purpose of this paper is to provide NRC staff perspectives on the contents and implementation of Mandatory Appendix IV, Revision 0. This paper specifically discusses Mandatory Appendix IV, Sections IV-3100, “Design Review,” IV-3300, “Preservice Test,” IV-3400, “Inservice Test,” IV-3600, “Grouping of AOVs for Inservice Diagnostic Testing,” and IV-3800, “Risk Informed AOV Inservice Testing.” These topics were selected based on input received during NRC staff participation in the SG-AOV and other industry meetings. The goal of this paper is to provide NRC staff perspectives on the topics of most interest to NRC staff and members of the SG-AOV.

Background

The NRC has been studying the problems associated with air operated valves (AOVs) for a number of years. NRC concerns with the operability of air operated valves originally considered common cause failures of AOVs. In particular, instrument air systems that supply multiple valves were identified as a potential common cause failure mechanism that could adversely impact the operability of multiple valves. In response to this concern, NRC staff issued Generic Letter 88-14, "Instrument Air Supply System Problems Affecting Safety-Related Equipment," the NRC required that licensees perform a design and operations verification of the instrument air system. This verification included verification by test that actual instrument air quality is consistent with the manufacturer's recommendations for individual components, verification that maintenance practices, emergency procedures, and training are adequate to ensure that safety-related equipment will function as intended on loss of instrument air, and verification that the design of the entire instrument air system (including verification by test) to show that safety-related components will perform as expected in accordance with all design-basis events. Although it required a design basis verification of air system capability to support component operability, GL 88-14 did not require periodic verification of component function.

In the 1990's, NRC took many actions associated with motor-operated valves (MOVs), including issuance of GL-89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance" and GL 96-05, "Periodic Verification of Design-Basis Capability of Safety-Related Motor-Operated Valves." The major lessons learned from experience with MOV programs was incorporated into the approach for dealing with issues associated with other power-operated valves (POVs), including AOVs. The major lessons learned were (1) the need for a design review to establish the design basis for each valve and (2) the need for periodic verification to demonstrate that each valve can continue to meet their intended function and to monitor potential degradation while in service.

AOVs were included in Generic Safety Issue (GSI) 158, "Performance of Safety-Related Power-Operated Valves under Design Basis Conditions." The use of power-operated valves in safety systems was sufficiently widespread to raise concerns similar to those on MOVs addressed in the implementation of Generic Letter No. 89-10.

GSI-158 was closed in RIS-2000-03, "Resolution of Generic Safety Issue 158: Performance of Safety-Related Power-Operated Valves Under Design Basis Conditions", which stated that after detailed review, the NRC had closed GSI-158 on the basis that current regulations provide adequate requirements to ensure verification of the design-basis capability of POVs and that no new regulatory requirements were needed. RIS-2000-03 further stated that NRC staff would continue to work with industry groups on an industry-wide approach to the POV issue and to provide timely, effective, and efficient resolution of the concerns regarding POV performance. Furthermore, RIS-

2000-03 stated that NRC staff would continue to monitor licensees' activities to ensure that POVs are capable of performing their specified safety-related functions under design-basis conditions.

The National Technology Transfer and Advancement Act of 1995 (Public Law 104-113) requires that if agencies establish technical standards, they must use technical standards developed or adapted by voluntary consensus standards bodies unless the use of such standards is inconsistent with applicable law or is otherwise impractical. However, Public Law 104-113 does not require that agencies endorse a standard in its entirety. As a result of the commitment to continue working with industry on issues associated with POVs, NRC staff has pursued use of the ASME OM Code, a national consensus standard, to resolve remaining concerns with AOV performance. NRC staff has actively engaged in the development of Mandatory Appendix IV through participation in the ASME OM SG-AOV. The ASME OM SG-AOV is comprised of members from industry, vendors, and NRC staff.

Mandatory Appendix IV, Revision 0 was approved by ASME in 2013. The ASME OM SG-AOV is currently developing Revision 1 of Mandatory Appendix IV. Mandatory Appendix IV will be included in the 2014 Edition of the ASME OM Code. Publication of Mandatory Appendix IV in the ASME OM Code begins the official NRC review process for incorporation by reference in 10 CFR 50.55a. Any NRC conditions on the use of Mandatory Appendix IV will be determined during the NRC rulemaking process.

Requirements of Mandatory Appendix IV and NRC Staff Perspective

Mandatory Appendix IV contains new requirements for preservice and inservice testing of active AOVs in light-water reactor power plants. The following sections highlight some of the new requirements present in Mandatory Appendix IV, and provide NRC staff perspectives on the requirements. The information being provided by this perspective must not be confused with interpretation of the ASME OM Code requirements. End users with interpretation questions must follow the process of submitting their inquiries to the ASME OM Code Committee.

Design Review Requirements in Mandatory Appendix IV

Mandatory Appendix IV, Section IV-3100 requires that a design review be performed for each AOV to ensure that the AOV can meet its intended function. The design review establishes the required loads, output capability, limits, margin, and other pertinent attributes of each AOV. Section IV-3100(g) also requires that licensees use one of the following methods to verify the design basis capability of the valve:

- Test at or near design basis conditions
- Analytical techniques

- Data from other valves if justified by an engineering evaluation
- Grouping at plant with similar valves

NRC Staff Perspective on Design Review Requirements in Mandatory Appendix IV

During the development of Mandatory Appendix IV, several discussions were held on the order in which the above methods are listed in Section IV-3100. The bullets above are arranged in the order in which they appear in Mandatory Appendix IV, Revision 0. NRC staff were the major proponents of listing testing at or near design basis conditions as first in the list. The method with the least uncertainty is typically performing a test on the valve at or near design basis conditions, whether in the plant or at a prototype facility. The NRC staff position on the acceptability of various techniques to demonstrate design basis capability of valves is documented in Information Notice (IN) 2012-14, "Motor-Operated Valve Inoperable Due to Stem-Disc Separation." From an NRC staff perspective, the techniques listed in Section IV-3100 of Mandatory Appendix IV are generally listed in increasing order of uncertainty, and therefore decreasing order of acceptability.

NRC staff also note that the language in Mandatory Appendix IV does not specify that testing is required to verify the design basis capability of the valve. As written, the licensee is able to select any of the listed techniques in Section IV-3100 of Mandatory Appendix IV. Therefore, the requirements of Mandatory Appendix IV are flexible in that they allow a licensee to select a method that is appropriate for each AOV. NRC staff notes that each of the methods listed in Section IV-3100 of Mandatory Appendix IV are acceptable for use as long as they are supported by appropriate technical evidence.

The primary goal of the design review is to establish reasonable assurance that each AOV will perform its safety function under design basis conditions, based on sound engineering practices. Section IV-3100(g) requires verification of the results of the design basis review using one of the following methods: testing, analysis, data from other valves, or grouping at the plant with similar valves. Each of these methods are considered equivalent from a Code perspective. During the development of Mandatory Appendix IV, NRC staff advocated that testing be listed first in Section IV-3100(g) because testing provides the highest technical fidelity to demonstrate that a valve will perform under design basis conditions. However, NRC staff notes that testing of every AOV is neither necessary nor feasible. Mandatory Appendix IV, as written, provides sufficient flexibility to verify the design basis capability of AOVs using methods other than testing each AOV. NRC staff perspectives on the use of each method provided in Section IV-3100(g) are discussed below.

NRC Staff Perspectives on Mandatory Appendix IV, Section IV-3100(g)(1): Testing at or Near Design Basis Conditions

The first method listed in Mandatory Appendix IV, Section IV-3100(g) is testing at or near design-basis conditions. NRC staff would accept either in-situ testing of a valve or testing in a prototype facility. If a prototype facility is used for testing a valve, an engineering analysis should be performed to demonstrate that the tested conditions are applicable to the valve's installed configuration. For instance, the analysis should ensure that key valve parameters tested in the prototype facility, such as valve packing to stem coefficient of friction, bound the values of the as-installed valve. The analysis should also consider the effects of differences in the test environment and the environment to which the valve is exposed in the plant, such as ambient operating temperature, chemistry of the process fluid, and radiation exposure.

If testing is utilized for valves already installed in a plant, there may be cases where it is not possible to achieve design basis conditions during the test. Valves dynamically tested at less than design-basis conditions may be extrapolated with proper justification, which should include a calculation to demonstrate that sufficient margin exists between actuator capability and required torque or thrust at design basis conditions.

NRC Staff Perspectives on Mandatory Appendix IV, Section IV-3100(g)(2): Analytical Techniques

Mandatory Appendix IV, Section IV-3100(g) also allows analytical techniques to be used to verify the design basis capability of an AOV. If this method is selected, thrust and torque methods similar to those used in Generic Letter 89-10 programs can be used for AOVs if the applicability of the method to the specific AOV is confirmed. The licensee should review the technical basis of the selected method and the range of conditions, such as valve and system parameters, to justify use of the selected analytical method. To determine actuator output capability, first principle methods should be used. Vendor methods may be used if they are determined to be appropriate by the licensee. The actuator output capability should be adjusted to account for uncertainties and degradation.

Once available actuator output capability and thrust/torque requirements are calculated, the AOV margin can be established and evaluated. The licensee's analytical methods should conclude that sufficient margin exists to ensure that the AOV can operate under design basis conditions.

NRC Staff Perspectives on Mandatory Appendix IV, Section IV-3100(g)(3): Data from Other Valves

Mandatory Appendix IV, Section IV-3100(g)(3) allows the use of valve test data from other valves, obtained either through industry operating experience or research programs, to justify the design basis capability of an AOV. NRC staff note that this approach requires the most margin because of the uncertainty associated with applying data from valves that have a different operation and maintenance history to a particular AOV. In these cases, the licensee should perform a detailed available capability evaluation of the AOV to provide confidence that the AOV has significant capability margin to operate under design basis conditions. NRC staff note that the acceptable margin defined in this process should be significantly higher than those used in evaluations of design basis capability under Section IV-3100(g)(2) and (g)(3).

NRC Staff Perspectives on Mandatory Appendix IV, Section IV-3100(g)(4): Grouping of Similar Valves

Mandatory Appendix IV, Section IV-3100(g)(4) allows grouping of similar valves to verify the design basis capability of an AOV. Where valve-specific dynamic testing is not performed and analytical techniques are not used, NRC staff will accept grouping of valves that are dynamic tested at the plant to apply the plant-specific test information to an AOV in the group. This option is intended for use when several valves of similar design exist in similar systems throughout the plant. Specifically, system parameters (process fluid, environmental conditions, operating temperatures and pressures) and valve parameters (actuator design and configuration, maintenance history, valve setup parameters) should be similar when utilizing this technique.

NRC staff note that when using plant-specific data for analyzing similar valves, the licensee knows the performance and maintenance history of a particular AOV. This provides confidence that the valve's performance is predictable. Using information from the valves performance and maintenance history, the licensee should ensure that sufficient margin exists between actuator capability and required torque or thrust at design basis conditions. The licensee should consider any effects on actuator output capability that may stem from maintenance activities or operational history of a particular AOV.

Testing Requirements in Mandatory Appendix IV

Preservice and Inservice Testing Requirements

Mandatory Appendix IV, Section IV-3300, "Preservice Test," defines the requirements for preservice testing of active AOVs. Section IV-3300 requires that each of the following tests be performed for each AOV during the preservice period: diagnostic test (unless exempted by IV-3410(d)), stroke test, fail safe test, valve seat leakage testing in

accordance with ISTC-3600 and ISTC-5000, and position verification in accordance with ISTC-3700.

Mandatory Appendix IV, Section IV-3400, "Inservice Test," defines the requirements for inservice testing of active AOVs. Section IV-3400 requires that each of the following tests be performed for each AOV during the inservice period: diagnostic test (unless exempted by IV-3410(d)), stroke test, fail safe test, valve seat leakage testing in accordance with ISTC-3600 and ISTC-5000, and position verification in accordance with ISTC-3700.

Diagnostic Testing Requirements

Mandatory Appendix IV, Section IV-3410, "Diagnostic Test," defines the requirements for diagnostic testing of active AOVs. Section IV-3410(a) states that if insufficient test data exists from an applicable AOV or AOV group to determine the diagnostic test interval in accordance with para. IV-6400, then AOV diagnostic testing shall be conducted every 3 refueling cycles or 6 years, whichever is longer.

Mandatory Appendix IV, Section IV-3410(b) allows AOVs to be grouped for diagnostic testing in accordance with IV-3600. Section IV- 3410(c) states that if maintenance activities are scheduled concurrent with an AOV's Diagnostic Test, then the Diagnostic Test shall be conducted in the as-found condition, prior to the maintenance activity. Mandatory Appendix IV, Section IV-3520 requires that new inservice test values shall be determined or the previously established inservice test values shall be confirmed or the activities performed shall be evaluated along with the results of post replacement, repair, modification, or maintenance testing to determine if new inservice test values are warranted before the AOV is returned to service.

Mandatory Appendix IV, Section IV-3410(d) provides an exemption from diagnostic testing when normal plant operation provides adequate demonstration of AOV capability via periodic cycling, provided that the periodic cycling conditions meet or exceed the design basis conditions. Section IV-3410(d) also requires that the basis for exemption be documented by engineering evaluation.

Mandatory Appendix IV, Section IV-3410(e) requires that licensees consider more frequent diagnostic testing for AOVs with severe service conditions, AOVs with any abnormal characteristics, or AOVs with low margin.

Mandatory Appendix IV, Section IV-3410(f) states that alternative risk informed diagnostic test intervals may be applied. Mandatory Appendix IV, Section IV-3800 states that "risk informed AOV Inservice Testing that incorporates risk insights in conjunction with functional margin to establish AOV grouping, acceptance criteria, exercising requirements and testing intervals may be implemented."

Mandatory Appendix IV, Section IV-3410(g) requires that the inservice diagnostic test interval shall not exceed 10 years. Mandatory Appendix IV, Section IV-3410(g) states that the diagnostic test interval may be extended up to 6 months to coincide with a refueling outage.

Stroke Testing Requirements

Mandatory Appendix IV, Section IV-3420(a) requires that all AOVs within the scope of this Mandatory Appendix have a stroke test performed at least once per refueling cycle or by cold shutdown justification, not to exceed 24 months. If Stroke Testing of an AOV is not practical during plant operation, Section IV-3420(a) requires the test to be performed during cold shutdown or a plant refueling outage.

Mandatory Appendix IV, Section IV-3420(b) requires that stroke testing include stroke time measurement. The limiting value(s) of full-stroke time for each valve are determined by the Owner. Mandatory Appendix IV requires that the stroke time of all valves is to be measured to at least the nearest second, any abnormality or erratic action is to be recorded, and an evaluation shall be made regarding need for corrective action. Where periodic cycling is used to validate valve function per para. IV-3410 (d), a stroke time test shall be performed quarterly. Section IV-3420(b) also stipulates that if testing is not practicable during plant operation, testing shall be performed during cold shutdown or refueling outage in accordance with para. IV-3420(a).

Mandatory Appendix IV, Section IV-3420(c) requires that licensees consider more frequent stroke testing for AOVs with severe service conditions (temperature, radiation, fluid process), or AOVs with any abnormal characteristics. Section IV-3420 specifies that HSSC AOVs that can be operated during plant operation must be exercised quarterly unless the potential increase in core damage frequency (CDF), large early release (LER) and risk associated with the extension is small and consistent with the NRC's safety goal policy statement.

Fail Safe Testing Requirements

Mandatory Appendix IV, Section IV-3430 requires that all AOVs with fail-safe actuators have a fail safe test performed at least once per refueling cycle, not to exceed 24 months. In addition, the fail safe test is performed by observing the operation of the actuator upon loss of valve actuating power to verify it repositions to its fail safe position or remains in the last position depending on the required characteristic.

NRC Staff Perspective on Testing Requirements of Mandatory Appendix IV

NRC staff notes that Mandatory Appendix IV requires a preservice and inservice diagnostic testing, unless exempted by Section IV-3410(d). The exemption in Section

IV-3410(d) is intended to allow licensees to credit operational tests in which an AOV is demonstrated to operate in conditions that meet or exceed the design basis conditions of the AOV as identified in the design review. Section IV-3410(d) clearly states that the exemption must be documented with an engineering evaluation. NRC staff note that while an inservice test would not be necessary in cases where the exemption in IV-3410(d) applies, Mandatory Appendix IV does require documentation to show that the operating conditions adequately demonstrate the capability of the AOV to operate under design basis conditions. Documentation of the use of this exemption should be described in the plant's IST program, and the basis for this determination should be documented in plant records associated with the testing of valves to which this exemption is applicable.

Mandatory Appendix IV, Section IV-3420(c) requires that licensees consider more frequent diagnostic testing for AOVs with severe service conditions, AOVs with any abnormal characteristics, or AOVs with low margin. NRC staff considers severe service conditions to mean valves installed in highly radioactive or corrosive environments or process fluids, or other factors associated with the operating environment that could affect valve performance. Abnormal characteristics include AOVs that have a history of performance issues, require extensive maintenance, or are installed in an unusual configuration (either external or internal). AOVs with low margin are those AOVs that are determined by the licensee to have a margin that is close to the acceptable actuator capability margin for the particular AOV. NRC staff note that the acceptable actuator capability margin can vary widely based on the method used to justify the design basis capability of the AOV under Mandatory Appendix IV, Section IV-3100(g). These AOVs may require more frequent testing until modifications are performed on the valve and demonstrated to address the issue.

Mandatory Appendix IV also requires that the licensee consider more frequent testing for HSSC AOVs, those valves operating in severe service conditions or AOVs with abnormal characteristics. These requirements are directly related to requirements on ASME Code Case OMN-1, "Alternative Rules for Preservice and Inservice Testing of Certain Motor-Operated Valve Assemblies in Light-Water Reactor Power Plants," and conditions placed on the use of OMN-1 as documented in Regulatory Guide (RG) 1.192, "Operation and Maintenance Code Case Acceptability, ASME OM Code." The second condition on the use of ASME Code Case OMN-1, as documented in RG 1.192, stated that:

"When extending exercise test intervals for high risk MOVs beyond a quarterly frequency, licensees must ensure that the potential increase in Core Damage Frequency (CDF) and risk associated with the extension is small and consistent with the intent of the Commission's Safety Goal Policy Statement."

From an NRC staff perspective, the inclusion of similar language in Mandatory Appendix IV, Revision 0, Section 3420(c)(1) was intended to address this condition. Therefore, an extension on the quarterly stroke testing requirement for HSSC AOVs is only allowed if a licensee can demonstrate that the potential increase in CDF and LERF is small and consistent with the guidance contained in RG 1.174 “An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis.”

NRC staff also note that Mandatory Appendix IV allows grouping of AOVs for inservice testing, but limits the inservice test interval for each AOV to 10 years in Section IV-3410(g). This is consistent with experience and lessons learned from the development of requirements for MOVs.

Requirements for Grouping of AOVs for Inservice Diagnostic Testing

Mandatory Appendix IV, Section IV-3600 states that AOVs may be grouped for inservice diagnostic testing, and requires that grouping of AOVs be justified by an engineering evaluation, alternative testing techniques, or both. Section IV-3600 also requires, when grouping AOVs, the following shall be satisfied:

- AOVs with identical or similar actuators and valves with similar plant service conditions may be grouped together based on the results of DBRs and/or Preservice Tests. Functionality of all groups of AOVs shall be validated by appropriate Inservice Diagnostic Testing of one or more representative valves.
- Test results shall be evaluated for all AOVs in the group.
- A single representative valve assembly shall not be selected for Inservice Diagnostic Testing consecutively. All testable valve assemblies in a group shall be Inservice Diagnostic Tested within the maximum test interval.
- The number of valve assemblies tested from each group shall be determined using appropriate statistical methodology.
- Position Verification Testing shall be performed on each AOV in the group and shall be verified in accordance with para. ISTC-3700.

NRC Staff Perspective on Grouping of AOVs for Inservice Diagnostic Testing

The NRC staff note that the Mandatory Appendix IV requirements for grouping of AOVs contain additional requirements to those listed in Mandatory Appendix III for MOVs. Specifically, the last three items in the above list do not appear in Mandatory Appendix III. The additional requirements ensure that when valves are grouped, a single AOV cannot be selected consecutively for inservice testing. For grouped valves, each

consecutive test is required to be performed on unique AOV assemblies. In addition, each AOV in the group must be tested at least once within the maximum test interval. The additional requirements also ensure that an appropriate statistical methodology is used to determine the number of valves selected for each group. Mandatory Appendix IV also requires that licensees perform position verification testing on each AOV in the group. NRC staff note that all AOVs in a group must be diagnostically tested at least once every 10 years. From an NRC staff perspective, the statement above that the “number of valve assemblies tested from each group shall be determined using appropriate statistical methodology” means that licensees will ensure that for each test, a sufficient number of valves will be selected from the group to complete the inservice diagnostic test for each valve in the group within the maximum test interval. For example, for a valve group of 10 valves, two different valves should be tested from the group every two years to complete the inservice diagnostic test on each valve in the group within the maximum test interval.

Requirements for Risk-Informed AOV Inservice Testing

Mandatory Appendix IV, Section IV-3800, “Risk Informed AOV Inservice Testing,” defines the requirements for using risk information in AOV inservice testing and provides test requirements for High and Low Safety Significant Component (HSSC/LSSC) categories of AOVs. Section IV-3820 states that ASME OM Code Section ISTE provides an acceptable method of risk ranking that may be used to categorize AOVs. Mandatory Appendix IV, Section IV-3821 stipulates that the testing requirements for HSSC AOVs are as follows:

- An initial Diagnostic Test shall be performed to assess functional margin except for AOVs that meet the requirements of tested per para. IV-3410 (d). The Preservice Diagnostic Test may be used to meet this requirement.
- Regular scheduled Diagnostic Testing, in accordance with para. IV-3410, is required for HSSC AOVs except for AOVs that meet the requirements of para. IV-3410 (d).
- Inservice Stroke Test shall be performed in accordance with para. IV-3420 and Fail Safe Testing (if required) in accordance with para. IV-3430.
- Requirements of para. IV-3520 shall be utilized for AOV replacement, repair, modification or maintenance.
- High Safety Significant Component (HSSC) AOVs that can be operated during plant operation shall be exercised quarterly, unless the potential increase in core damage frequency (CDF), large early release (LER) and risk associated with the extension is small and consistent with the regulator safety goal policy statement.

Mandatory Appendix IV, Section IV-3822 stipulates that the testing requirements for LSSC AOVs are as follows:

- An initial Diagnostic Test shall be performed to assess functional margin except for AOVs tested per para. IV-3410 (d). The Preservice Diagnostic Test may be used to meet this requirement.
- Regular scheduled Diagnostic Testing, in accordance with para. IV-3410, is not required for LSSC AOVs except for AOVs tested per para. IV-3410 (d).
- Inservice Stroke Test shall be performed in accordance with para. IV-3420 and Fail Safe Testing (if required) in accordance with para. IV-3430, except that the frequency shall be quarterly. If Stroke Testing is not practicable during plant operation, testing shall be performed during cold shutdown or refueling.
- Requirements of para. IV-3520 shall be utilized for AOV replacement, repair, modification or maintenance.

NRC Staff Perspectives on Risk-Informed AOV Inservice Testing

Mandatory Appendix IV, Revision 0, states that ASME OM Code Subsection ISTE is an acceptable method for risk ranking of AOVs. NRC staff note that this statement is from a Code perspective, and additional NRC staff review may be necessary for the risk ranking methodologies utilized by licensees. NRC staff are currently reviewing Subsection ISTE in the 2012 Edition of the ASME OM Code under the rulemaking process. During this rulemaking, any additional NRC limitations or conditions on the use of Subsection ISTE will be determined. NRC staff recommend that licensees review the draft and final rules that will be issued to change 10 CFR 50.55a to incorporate the 2012 ASME OM Code rule by reference in order to become familiar with any limitations and conditions on the use of Subsection ISTE. NRC staff note that ASME OM Code Case OMN-3, "Requirements for Safety Significance Categorization of Component Using Risk Insights for Inservice Testing of LWR Power Plants," is conditionally approved for use in RG 1.192. NRC staff recommend that licensees review the conditions placed on the use of ASME OM Code Case OMN-3.

Code Applicability and Relief Request Process

NRC staff understands that Mandatory Appendix IV has been developed using a national consensus standard. As such, it is unlikely that the requirements of Mandatory Appendix IV will be achievable for all active AOVs. Therefore, the NRC staff anticipate that alternatives to or relief from the requirements of Mandatory Appendix IV will be necessary in some cases.

Once the ASME Code Edition or Addenda containing Mandatory Appendix IV is incorporated by reference into the 10 CFR 50.55a, each provision of the code edition/addenda that 10 CFR 50.55a incorporates by reference and mandates constitutes a legally binding NRC requirement imposed by rule. When a licensee updates its 120 month IST interval, the ASME OM Code Edition incorporated by reference in 10 CFR 50.55a 12 months prior to the start date of the IST interval becomes a part of the plant's licensing basis. If a licensee determines that it is unable to meet these requirements, the licensee must request approval where the requirements will not be met through the relief or alternative process described in 10 CFR 50.55a.

Pursuant to 10 CFR 50.55a(a)(3)(i) and (ii), the Commission may authorize the licensee to implement an alternative to the ASME OM Code requirements, provided that the alternative ensures an acceptable level of quality and safety or the ASME OM Code requirement presents a hardship without a compensating increase in the level of quality and safety. In determining whether to grant relief from the ASME OM Code requirements or to authorize alternatives, the NRC staff considers the merits of the submitted technical information. In requesting relief or use of an alternative, the licensee would typically identify the specific ASME OM Code requirement and associated paragraph for which use of an alternative is requested, describe the proposed alternative(s), describe the basis for authorization of the proposed alternative(s), and clarify the burden that would result if the NRC enforced the specified requirements. Inconvenience or administrative burden is not, in and of themselves, adequate justification for deviating from the ASME OM Code requirements.

Where a test requirement of the ASME OM Code is determined to be impractical for a facility, 10 CFR 50.55a(f)(6)(i) allows a licensee to submit a request for relief from the given requirement, along with information to support the determination. Relief requests generally detail the reasons for deviating from the ASME OM Code requirements and propose alternative testing methods or frequencies. The Commission is authorized to evaluate licensees' relief requests, and may grant the requested relief or impose alternative requirements, considering the burden that the licensee might incur if the ASME OM Code requirements were enforced for the given facility. The basis for the determination of a required test being impractical must be submitted for NRC review and approval no later than 12 months after the expiration of the initial 120-month interval of operation from start of facility commercial operation and each subsequent 120-month interval of operation during which the test is determined to be impractical. However, experience has shown that licensees also identify impractical test provisions throughout the interval. In such cases, licensees may request relief as soon as they identify the condition. Because the requirements are impractical, the licensee would test the applicable components using the method proposed in the relief request in the period of time from the beginning of the new interval (or from the time of identification) until the NRC staff completes its evaluation.

NRC Oversight and Monitoring of Mandatory Appendix IV Effectiveness

Direct NRC oversight of IST programs is handled by regional NRC staff and resident inspectors, who review IST programs as part of the inspection program. The details of the NRC inspection procedure for inservice testing programs are documented in Inspection Procedure 73756, which is available through the NRC public website. NRC staff from the Office of Nuclear Reactor Regulation (NRR) serves as a technical point of contact for resident inspectors and regional NRC staff when IST program or operability questions arise in the field.

In addition to the inspection program, the NRC staff performs periodic reviews of operating experience to monitor the effectiveness of programs and policies. The NRC staff anticipates that implementation of Appendix IV will contribute to a continued downward trend of AOV failures in the field. Experience from implementation and oversight of the requirements of Mandatory Appendix IV will be included in continued NRC participation on the ASME OM SG-AOV. In addition, NRC staff intend to include guidance on the implementation of Mandatory Appendix IV in a future revision to NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants."

Additional Considerations

The NRC staff note that the baseline diagnostic test interval required by Mandatory Appendix IV, Revision 0, is 3 refueling cycles or 6 years, whichever is longer. NRC staff note that with the advent of small modular reactors that utilize a refueling cycle longer than 24 months, additional changes to Mandatory Appendix IV or limitations on its use may be necessary. The need for these changes will be analyzed in the future and addressed either in the NRC participation in ASME OM Code activities, or through the rulemaking process if necessary.

Recent operating experience, both AOVs and MOVs, has underscored the need for position verification testing to ensure that valves are operable. Therefore, NRC staff recommends that licensees carefully review the detailed requirements of Mandatory Appendix IV and Subsection ISTC, including any limitations and conditions placed on these requirements, during implementation of the 2014 Edition of the ASME OM Code.

Conclusions

ASME OM Code, Mandatory Appendix IV is expected to be published in the 2014 Edition of the ASME OM Code. Mandatory Appendix IV defines requirements for preservice and inservice testing of active AOVs to provide assurance that they are capable of performing their safety-related function. The development of Mandatory Appendix IV was based on resolution of GSI-158, and NRC initiatives to work with industry to resolve remaining concerns with the performance of AOVs. The NRC staff will evaluate whether any limitations or modifications are necessary for the

implementation of Mandatory Appendix IV during the rulemaking process to incorporate the 2014 Edition of the ASME OM Code into 10 CFR 50.55a. This paper provides the NRC staff perspective on some of the requirements contained in Mandatory Appendix IV, Revision 0.

References

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