U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REGULATORY RESEARCH

DRAFT REGULATORY GUIDE AND VALUE/IMPACT STATEMENT

November 1981
Division 1
Task MS 901-4

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IDENTIFICATION OF VALVES FOR INCLUSION IN INSERVICE TESTING PROGRAMS

A. INTRODUCTION

Paragraph 50.55a(g) of 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," requires that certain valves be designed and provided with access to enable inservice testing to assess operational readiness in accordance with the requirements of ASME Boiler and Pressure Vessel Code, Section XI. Paragraph 50.55a(g) further requires that ASME Section III Code Class 1, 2, and 3 valves meet the requirements of subsequent Code editions and addenda of Section XI to the extent practical within the limitations of design, geometry, and materials of construction.

General design criterion 32, "Inspection of Reactor Coolant Pressure Boundary," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50 requires, in part, that components that are part of the reactor coolant pressure boundary be designed to permit periodic inspection and testing of important areas and features to assess their structural and leaktight integrity. Criteria 37, 40, 43, and 46 require that specified systems be designed to permit appropriate periodic pressure and functional testing to ensure (1) the structural and leak-tight integrity of its components and (2) the operability and performance of active components of the system.

If the licensee determines that conformance with certain Code requirements is impractical or if conformance to the code would cause unreasonable hardship without a compensating increase in safety, paragraph 50.55a(g)

This regulatory guide and the associated value/impact statement are being issued in draft form to involve the public in the early stages of the development of a regulatory position in this area. They have not received complete staff review and do not represent an official NRC staff position.

Public comments are being solicited on both drafts, the guide (including any implementation schedule) and the value/impact statement. Comments on the value/impact statement should be accompanied by supporting data. Comments on both drafts should be sent to the Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Docketing and Service Branch, by FEB 2 3 1982

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requires the licensee to notify the Commission and submit information to support this determination. Following the evaluation of this information, the Commission may grant relief.

This regulatory guide provides guidance on the staff's practice in identifying valves for inclusion in the licensee's inservice testing program and the information needed by the staff for its review of the program and on the information needed to evaluate requests for relief from any of the Code provisions.

B. DISCUSSION

In the Summer 1973 Addenda, the ASME Boiler and Pressure Vessel Code, Section XI, first published the requirements for inservice testing of valves. The scope of the testing program and the owner's responsibility to submit a listing of valves to be tested are given in Article IWV 1000 of the Code. To bring the scope of testing programs into agreement with current NRC staff practice, the Winter 1977 Edition of the Code limited the scope of the testing program to valves that are required to perform a specific function in shutting down the reactor to a hot or cold shutdown condition or to mitigate the consequences of an an accident. Previously the Code was less specific and merely referred to operational readiness of certain Code Class 1, 2, and 3 valves. Some licensees have interpreted the Code and § 50.55a of the regulations to require testing of all Code Class 1, 2, and 3 valves and no others. After reviewing a number of inservice testing programs, the staff has developed guidelines for the implementation of the inservice testing requirements and informed licensees as to which valves are to be included in the program.

1. Valves to be Considered for Inclusion in the Testing Program

The NRC staff recognizes that, since many of the plants were built prior to the issuance of Section XI, fundamental differences will exist between the submittals of the various plants. In reviewing the various licensee testing programs, the staff has been limiting the scope to valves that are required to:

a. Mitigate the consequences of an accident,

b. Shut down the reactor to the cold shutdown condition, or

c. Maintain the reactor in a safe shutdown condition.

Typically, these valves would be classified by the licensee in the safety analysis report as ASME Section III Code Class 1, 2, and 3 for plants granted construction permits after January 1, 1971. For plants with construction permits issued prior to that date, however, the systems performing functions that are important to safety could be classified as non-Code. Moreover, some systems that may be needed to keep the reactor in a safe shutdown condition following a loss-of-coolant accident may also be classified as non-Code, or as Quality Group D in Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants." These systems, as viewed by the staff, are important to safety and are subject to the testing provisions of ASME Section XI within the limitations of design, geometry, and materials of construction.

Examples of systems that the staff has considered for inclusion in an inservice testing program are listed in Appendix A to this guide. This appendix, in conjunction with the licensee's safety analysis report, can be used as the basis for developing a comprehensive inservice testing program for valves.

2. Reactor Coolant Pressure Isolation

There are locations in existing light water reactors where high-pressure reactor coolant is isolated from a system having a lower operating or design pressure. Generally, two or more normally closed valves are required to isolate high-pressure systems from low-pressure systems. A postulated failure of these valves would result in a loss-of-coolant accident (LOCA), and in some configurations, the LOCA may be outside the containment. An event leading to the latter in PWRs was found to be a significant contributor to postulated core melt accidents.

Valves whose only function is to perform pressure isolation between high- and low-pressure systems and that are not part of the containment boundary have been required to show operational readiness and leak tightness in accordance with ASME Section XI. Where check valves are used to perform the function of pressure isolation, as is generally the case in the low-, intermediate-, and high-pressure safety injection systems, it must be ascertained that the valve discs are actually in place and capable of seating to confirm the pressure protection offered by these valves as well as their capability to deliver full injection flows.

3. Containment Isolation Valves

Where systems penetrate the containment boundary and communicate with either the primary reactor coolant system or the containment atmosphere, Regulatory Guide 1.141, "Containment Isolation Provisions for Fluid Systems," recommends and the staff has been requiring that such systems be provided with sufficient redundancy to ensure leak-tight containment isolation. Those valves that are required to perform only a containment isolation function under any postulated accident condition and that are not required for primary reactor coolant system isolation may meet the requirements stipulated in the Type C tests of Appendix J to 10 CFR Part 50 and need not be further leak-tested to Section XI. In such cases, it would be desirable, when performing the Type C tests of Appendix J, to individually leak-test each valve. Appendix J requires that a combined leakage rate for all penetrations and valves meet the Type C test acceptance criteria and does not specify an individual leakage limit for each valve.

Total integrated containment leakage measurements do not necessarily reflect the potential for incipient failure for each valve or provide assurance that each valve will perform its isolation function during an accident. These valves could be important in limiting radiation release to the environment, and the staff has required them to be tested for leak-tight integrity and operability. Therefore, they should be included in the inservice testing program.

4. Valves Performing Both Pressure Isolation and Containment Isolation Functions

There are cases where valves that communicate with the primary coolant system perform a containment isolation function as well as a pressure isolation function. These valves are required to be leak-tested at system functional differential pressure to verify their pressure isolation capability. Exceptions to this requirement are outlined in IWV-3420 of the ASME Boiler and Pressure Vessel Code, Section XI. The Code indicates that testing at lower pressures, such as the Appendix J Type C tests, is acceptable provided correlations between the leakage limits at functional differential pressure and the leak rates at lower pressures are performed. The staff agrees with this philosophy. However, the Appendix J Type C tests are normally performed with low-pressure air or nitrogen, while pressure isolation valve tests are generally performed with high-pressure water. Therefore, these correlations may be difficult to obtain. The option of performing this type of analysis with certain verifications is left to the applicant or licensee with approval by the staff.

5. <u>ASME Section XI Convenience Valves</u>

Although IWV-1300 of the 1974 Edition and IWV 1200 of the 1977 Edition of Section XI of the ASME Boiler and Pressure Vessel Code exclude valves used for operating convenience and maintenance from testing requirements, it is the NRC staff's position that any such valve that is in the normal or alternative flow path of cooling water for engineered safety systems must be included in the valve testing program. For those plants that must comply with the 1975 Addenda to ASME XI, valves that are normally locked open or closed should be categorized E in the program and their positions verified during inservice testing. This recommendation has also been applied to engineered safety systems that are designed to remove decay heat from the reactor core following a LOCA.

6. <u>Conditions Under Which Valves Should Be Excluded from Tests</u>

There are valves that, when exercised under certain conditions, could put the plant in an unsafe condition. In almost all such cases, the unsafe condition would involve failure in a redundant system or in the valve itself. One example is a valve whose failure to close during cycling tests would result in a loss of containment integrity. If one of the redundant valves has failed open, exercising the remaining valve during plant operation would breach the containment. Another example is a valve whose undetected failure in a nonconservative position during cycling tests would cause a loss-of-system function. Included in this category would be nonredundant valves such as those in a single discharge line from the refueling water tank or in accumulator discharge lines. Other valves may fall into this category under certain conditions. For example, when one train of a redundant system such as the emergency core cooling system (ECCS) is inoperative, the valves in the remaining system become nonredundant, and their failure or their isolation to perform the required tests would render the entire ECCS system inoperative.

If one of the check valves isolating a low-pressure system from a high-pressure system has failed open, e.g., the isolation valves of the residual heat removal/shutdown cooling systems and certain ECCS valves, exercising the other valve could subject the low-pressure system to pressures above its design pressure. The staff's position has been that routine exercising of such a valve should not be performed unless a reliable method exists to detect the position of, or leakage past, the check valves (i.e., pressure indication monitored in the control room). If practical, exercising of this valve should be performed at the next cold shutdown.

7. Exceptions to Section XI Testing Intervals

The ASME Code recognizes the need for flexibility in the required valve testing frequency. For example, IWV 3410 of the Code permits valves that cannot be exercised every 3 months to the position required to fulfill their function to be partly stroked during normal operation of the reactor and fully stroked at cold shutdown. It may not be practical to de-inert a containment to test or inspect the movement of a valve at the stated valve test period or to measure stroking times.

The practice of the staff has been not to require reactor down time for the express purpose of routine valve testing. However, it is necessary to avoid the situation in which tests are postponed to the refueling outage merely to avoid the inconvenience of testing systems at the temperature/pressure conditions that prevail during plant operation.

8. Requests for Relief from Code Requirements

In the past, many requests for relief have not included adequate technical information for the staff to review. Detailed technical information is needed for the staff to evaluate the request for relief based on the burden imposed on the licensee in complying with the Code and the compensating increase in safety. The information would include items such as accessibility, radiation level (including estimated man-rems for work involved), or the capability to withstand valve leakage without impacting on the ability to mitigate the consequences of an accident or achieve a cold shutdown condition. If all necessary information is provided with the program submittal, subsequent requests by the staff for additional information will be reduced or eliminated, and the review of such programs can be expedited.

Relief from full-stroke testing of valves is generally not granted by the staff. However, the following methods have been considered acceptable:

a. Verification of maximum required accident flow rate,

b. Disassembly and manual operation of the swing arm/disc of a check valve,

c. Reduced pressure operation (must be accompanied by sufficient manufacturer's data).

C. REGULATORY POSITION

1. Valves that are required for safe plant shutdown, required to maintain the plant in a safe shutdown condition, or required to mitigate the consequences of an accident are considered by the staff as important to safety. Such valves should be included in a comprehensive inservice testing program regardless of whether they were constructed to the requirements of ASME Section III or not. Typical systems that fall into this category are presented in Appendix A to this guide.

2. Valves that perform a pressure isolation function between high- and low-pressure systems should be classified as Category A or AC if they are leak-tested to ascertain that the pressure protection offered by these valves is adequate for system safety. Active valves[1] in this group should be exercised in accordance with ASME Section XI (IWV-3400).

3. Valves that perform only a containment isolation function are subject to the provisions of Appendix J to 10 CFR Part 50 and need not meet Section XI leak-test requirements.

4. Valves that perform both a pressure isolation function and a containment isolation function, although not necessarily at the same times, should be tested to verify both operational readiness in accordance with ASME Section XI and leak-tight integrity in accordance with Appendix J to 10 CFR Part 50 and ASME Section XI (IWV-3420).

[1]Active valves are defined in ASME Section XI, Subarticle IWV-2100.

5. Certain valves that are used for operating convenience and maintenance have been excluded from testing by ASME Section XI Some of these valves are in systems important to safety and are in a normal or alternative flow path of engineered safety feature systems and should be included in the inservice test program to the extent that their positions are verified quarterly or each time the valve is cycled.

6. If the exercise of a valve as required by Section XI could result in an unsafe plant condition under certain conditions of plant operation, that valve should be tested at some other condition of the plant.

7. The testing of valves should be performed at a frequency as near to the Code-required intervals as practical with due consideration to plant safety.

8. Requests for relief from Code requirements or from frequency of testing should be accompanied by sufficient detailed information for the NRC staff to fully evaluate the impact on plant safety of granting such relief. Information in support of requests for relief from the requirements of the ASME Code, Section XI, should include, as a minimum, the following details:

a. Identity of Component:

(1) Name and number as given in the FSAR,

(2) Function of component within the system and its coordinate location in the P&I diagram,

(3) ASME Section III Code Class,

(4) Specific ASME Section XI valve category (see IWV 2000).

b. Identification of the applicable ASME Code Editions and Addenda and those specific requirements from which relief is requested.

c. Information to justify a determination that testing is impractical or unnecessary (i.e., the basis for requesting relief).

d. An alternative inservice testing proposal if not in accordance with Section XI (at cold shutdown and refueling in that order). It should be demonstrated that the proposed inservice testing will provide an acceptable level of quality and safety and not endanger the public health and safety.

e. The schedule for implementing the alternative procedures.

f. The alternative testing frequency if the Code-required shortest test frequency is not applied in testing any valve assembly. The reasons for not doing so should be provided and supported by test results and a trend analysis.

The trend analysis should be presented in tabular or plotted form for easy and consistent interpretation.

D. IMPLEMENTATION

This draft regulatory guide has been published to encourage public participation in its development. Except in those cases in which an applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method to be described in the active guide reflecting public comments will be used in evaluating the applicant's inservice testing (IST) program for valves.

In addition, the NRC staff intends to use this guide to evaluate the IST program for valves in all plants beginning 3 months after issuance of the active guide. For operating plants, the licensee should submit an IST program consistent with this guide 6 months prior to the start of the next 120-month interval.

If the IST program for the initial 120-month interval for plants under construction has not yet been submitted, an IST program based on this guide should be submitted within 3 months after the issuance of the active guide or at the time the application for an operating license is submitted, whichever is later. If the IST program for the initial 120-month interval has been submitted but is not consistent with this guide, a revised program based on this guide should be submitted within 3 months after the issuance of the active guide.

APPENDIX A

The valves in the following systems and components in systems important to safety should be considered for inclusion in a comprehensive inservice testing program. The list is not intended to be all inclusive. Key components in instrumentation and auxiliary systems that are required to directly support plant shutdown or safety system function should also be considered.

1. Pressurized Water Reactors
   1.1 Reactor Coolant System (RCS) and any proposed flow path for establishing natural circulation
   1.2 Portions of Main Steam System
   1.3 High-Pressure Injection System (HPCI)
   1.4 Low-Pressure Injection System (LPCI)
   1.5 Accumulator Systems
   1.6 Containment Spray System
   1.7 Primary and Secondary System Safety and Relief Valves and Atmospheric Relief Valves
   1.8 Portions of Main Feedwater System
   1.9 Auxiliary Feedwater Systems
   1.10 Residual Heat Removal System (Shutdown Cooling)
   1.11 Component Cooling Water Systems
   1.12 Service Water Systems
   1.13 Containment Isolation Valves required to change position on a containment isolation signal
   1.14 Chemical Volume and Control System
   1.15 Emergency Diesel Engine Fuel Oil Storage and Transfer System
   1.16 Ventilation Systems that perform a safety function
   1.17 Instrument Air Systems that are required to support safety system functions

2. Boiling Water Reactors
   2.1 Reactor Coolant Recirculation System (RCS)
   2.2 Portions of Main Steam Supply
   2.3 High-Pressure Injection System (HPCI)
   2.4 Low-Pressure Injection System (LPCI)

2.5 Residual Heat Removal System (Steam Condensing, Shutdown Cooling, Suppression Pool Cooling)

2.6 Low Pressure Core Spray System

2.7 Safety, Relief, and Safety/Relief Valves of RCS and secondary systems

2.8 Reactor Core Isolation Cooling System

2.9 Containment Cooling System (Spray)

2.10 Containment Isolation Valves Required to Change Position on a Containment Isolation Signal

2.11 Standby Liquid Control System

2.12 Automatic Depressurization System

2.13 Control Rod Drive Hydraulic System

2.14 Active Valves in Service and Backup Water, Closed Cooling Water, Firewater, or Well Water Systems.

2.15 Emergency Diesel Engine Fuel Oil Storage and Transfer System

2.16 Portions of Main Feedwater System

2.17 Instrument Air Systems that are required to support safety system functions

Note: The terminology for various systems such as Accumulator Systems and others may vary depending on the preference of the individual nuclear steam system supplier.