AREVAEPRDCPEm Resource

From: WELLS Russell D (AREVA NP INC) [Russell.Wells@areva.com]
Sent: Thursday, June 11, 2009 1:33 PM
To: Tesfaye, Getachew
Cc: Pederson Ronda M (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 49, FSAR Ch 3, Supplement 2
Attachments: RAI 49 Supplement 2 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. provided responses to 10 of the 13 questions of RAI No. 49 on September 18, 2008. AREVA NP submitted Supplement 1 to the response on November 17, 2008 to address the remaining 3 questions.

Based on discussions with the NRC on March 4, 2009 at the U.S. EPR Design Centered Working Group meeting related to the U.S. EPR inservice testing (IST) program description and conference calls on April 14, 2009 and May 21, 2009, the attached file, “RAI 49 Supplement 2 Response US EPR DC.pdf” supersedes our previous responses to RAI 49, with the exception of the responses to Questions 03.09.06-4, 03.09.06-9, 03.09.06-12 and 03.09.06-13, included in the original response to RAI 49.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 49, Questions 03.09.06-1, 03.09.06-5, 03.09.06-6, 03.09.06-7, 03.09.06-8, 03.09.06-10, and 03.09.06-11.

The following table indicates the respective pages in the response document, “RAI 49 Supplement 1 Response US EPR DC.pdf” that contain AREVA NP’s response to the subject questions.

Question #	Start Page	End Page
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This concludes the formal AREVA NP response to RAI 49, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

(Russ Wells on behalf of)
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From: Pederson Ronda M (AREVA NP INC)
Sent: Monday, November 17, 2008 5:40 PM
To: 'Getachew Tesfaye'
Cc: 'John Rycyna'; WELLS Russell D (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); SLIVA Dana (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 49, FSAR Ch 3, Supplement 1

Getachew,

AREVA NP Inc. provided responses to 10 of the 13 questions of RAI No. 49 on September 18, 2008. The attached file, "RAI 49 Supplement 1 Response US EPR DC.pdf" provides a technically correct and complete response to the remaining three questions, as committed

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 49, Question 03.09.06-5.

The following table provides the page(s) in the response document, "RAI 49 Supplement 1 Response US EPR DC.pdf" containing the response to each question.

Question #	Start Page	End Page
RAI 49 — 03.09.06-5	2	3
RAI 49 — 03.09.06-6	4	4
RAI 49 — 03.09.06-7	5	5

This concludes the formal AREVA NP response to RAI 49, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

Ronda Pederson

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From: WELLS Russell D (AREVA NP INC)
Sent: Thursday, September 18, 2008 4:38 PM
To: 'Getachew Tesfaye'
Cc: 'John Rycyna'; Pederson Ronda M (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 49, FSAR Ch 3

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 49 Response US EPR DC.pdf" provides technically correct and complete responses to 9 of the 12 questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 49 Question 03.09.06-13.

The following table provides the page(s) in the response document, "RAI 49 Response US EPR DC.pdf" containing the response to each question.

Question #	Start Page	End Page
RAI 49 — 03.09.06-1	2	3
RAI 49 — 03.09.06-3	4	6
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RAI 49 — 03.09.06-11	15	15
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A complete answer is not provided for 3 of the 12 questions. The schedule for a technically correct and complete response to this question is provided below.

Question #	Response Date
RAI 49 — 03.09.06-5	November 19, 2008
RAI 49 — 03.09.06-6	November 19, 2008
RAI 49 — 03.09.06-7	November 19, 2008

Sincerely,

(Russ Wells on behalf of)
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From: Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Thursday, August 21, 2008 4:38 PM
To: ZZ-DL-A-USEPR-DL
Cc: Charles Hammer; David Terao; Tarun Roy; Joseph Colaccino; John Rycyna
Subject: U.S. EPR Design Certification Application RAI No. 49 (873), FSAR Ch3

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on August 7, 2008, and discussed with your staff on August 21, 2008. Draft RAI Question 03.09.06-2 was deleted and Draft RAI Questions 03.09.06-8 and 03.09.06-9 were modified as a result of that discussion. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Thanks,
Getachew Tesfaye
Sr. Project Manager
NRO/DNRL/NARP
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 561

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Response to

Request for Additional Information No. 49 (873), Supplement 2, Revision 0

8/21/2008

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 03.09.06 - Functional Design Qualification and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints
Application Section: 3.9.6
CIB1 Branch

Question 03.09.06-1:

General Design Criterion 1 requires that structure, systems and components (SSCs) important to safety be designed to quality standards commensurate with the importance of the safety functions to be performed. Where generally recognized codes and standards are used, they shall be identified and evaluated to determine their applicability, adequacy, and sufficiency as necessary to assure a quality product in keeping with the required safety function.

ASME QME-1-2007, Qualification of Active Mechanical Equipment Used in Nuclear Power Plants (Revision of ASME QME-1-2002), provides acceptable measures and guidelines to ensure that pumps, valves, and dynamic restraints are functionally designed and qualified to perform their safety functions during accident conditions. This Standard was approved as an American National Standard on June 25, 2007.

FSAR Tier 2, Section 3.9.6.1 does not provide a discussion of whether or not all or portions of this Code will be used to functionally qualify safety-related pumps, valves, and dynamic restraints for the U.S. EPR. FSAR Tier 2, Section 3.11.2.2 states that the U.S. EPR's approach to qualification of mechanical equipment is based on methods developed and accepted by the NRC for operating reactors as described in South Texas Project docketed correspondence regarding the elimination of equipment qualification (EQ) of mechanical components. The applicant states in Section 3.11.2.2 that the need to maintain a separate mechanical equipment qualification (MEQ) program for the U.S. EPR was determined to be redundant, considering engineering design programs.

Considering the above, please address the following:

1. FSAR Tier 2 Section 3.9.6.1 does not address ASME QME-1-2007. Will the design and qualification requirements with respect to safety-related pumps, valves, and dynamic restraints adhere to the requirements of this standard? If not all, will portions of this standard be applied to the U.S. EPR?
2. If this standard is not being utilized, provide the bases for how what is being proposed in FSAR Tier 2 Sections 3.9.6.1 and 3.11.2.2 is the equivalent of what is required by this standard. Provide descriptions and examples of how:

a) Thermal and radiation aging for both normal and accident conditions and the resulting qualified lives of non-metallic components used in pumps, valves and dynamic restraints are determined, documented and then incorporated into procurement and design specifications of SSCs.

b) How will qualified lives for non-metallic components be established?

c) What type of qualification testing will be performed for these components? Will they be qualified by analyses, testing, or some combination of analysis and testing?

d) Describe how the specific environmental effects resulting from both normal operation and design basis accident conditions are accounted for in the proposed qualification program for pumps, valves, and dynamic restraints?

e) Identify the differences between the proposed functional qualification program and the ASME QME-1-2007 requirements for dynamic restraints as provided in Section QDR, for pumps as provided in Section QDP, and for valves as provided in Section QV. Provide a discussion regarding how what is proposed is the equivalent of the standard and define any differences.

Response to Question 03.09.06-1:

1. U.S. EPR FSAR Tier 2, Section 3.9.6.1 does not address ASME QME-1-2007 since it is not addressed in either RG 1.206 or Standard Review Plan (SRP) 3.9.6. Although NRC has not yet formally endorsed ASME QME-1-2007[1], AREVA NP intends to use ASME QME-1-2007 as guidance for qualifying active mechanical equipment with the exception that a separate mechanical equipment qualification (MEQ) program for the U.S. EPR will not be maintained as noted in U.S. EPR FSAR Tier 2, Section 3.11.2.2.

   Based on discussions with the NRC on March 4, 2009 at the U.S. EPR Design Centered Working Group meeting related to the U.S. EPR inservice testing (IST) program description (Accession Number ML090430197), and during a conference call on April 14, 2009, U.S. EPR FSAR Tier 2, Section 3.9.6.1 will be revised to provide additional information related to the functional design and qualification of pumps, valves, and dynamic restraints in accordance with the guidance of SRP 3.9.6. Additionally, U.S. EPR FSAR Tier 2, Section 3.9.6 will be revised to identify those U.S. EPR FSAR Tier 2 sections that also interface with Section 3.9.6.

2. A response to item 2 of Question 03.09.06-1 is not required based on the response to item 1 above.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 3.9.6.and Section 3.9.6.1 will be revised as described in the response and indicated on the enclosed markup.

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[1] In May 2008, NRC issued draft Regulatory Guide DG-1175 (Proposed Revision 3 of Regulatory Guide 1.100) which proposes to endorse ASME QME-1-2007 with exceptions.

Question 03.09.06-3:

GDCs 37, 40, 43, and 46 specify that safety-related systems be designed to permit periodic functional testing. NUREG-0800 Section 3.9.6 states that an acceptable means of meeting these GDC requirements for new plant applications, is that safety related pump, valve, and piping designs include provisions to allow testing of pumps and valves at the maximum flow specified in the plant accident analyses. It also states that the design and qualification should be accomplished such that each pump and valve is capable of performing its intended function for a full range of system differential pressure and flow, ambient temperatures, and available voltages.

FSAR Tier 2 Section 3.9.6.1 states that the IST program requires pump and valve testing over the full range of system differential pressures, flowrates, temperatures and available voltages. It also states that system design includes alternate flow paths and required instrumentation, to allow full flow testing of pumps under the IST program. Considering the above, please answer the following:

3. Flow diagrams containing safety-related pumps and valves in the application did not typically show the layout of full-flow test lines and/or other provisions (instrument taps, DP gauges) necessary to fully assess the ability to test these components. Are all safety-related pumps provided with full-flow test lines such that IST testing will be performed at accident assumed flow-rates?
4. If there are any exceptions to the answer to item 1 above, please list them and describe why they cannot be full flow tested.
5. Will all safety-related valves be IST tested at accident assumed flowrates? If there are any exceptions please list them and describe why they cannot be full flow tested.
6. Provide, if available, flow diagrams for safety-related pumps and valves in sufficient detail (e.g. line sizes and flowpaths) such that the full-flow test capacity can be determined. If unavailable, provide a reason why, or provide alternative information such that the review can make this determination.

Response to Question 03.09.06-3:

1. Safety related pumps are capable of being tested at the accident assumed flow rates as described below:

   <u>Component Cooling Water (CCW) System</u>

   Full flow testing of the CCW system at power can be achieved by aligning one pump from each division to both of the common headers at the same time (Train 1 or 2 aligned to Common 1a and 1b and Train 3 or 4 aligned to Common 2a and 2b). The pumps that are not aligned to the common headers can then be aligned to that train’s safety injection users (inactive during normal operations) to allow for full flow testing.

   <u>Spent Fuel Pool Cooling (SFPC) System</u>

   The SPFC pumps are in operation during normal plant operation and can be tested in their normal operating configuration.

Emergency Feedwater (EFW) System

Full flow testing capability is provided to the EFW Storage Pool as shown in U.S. EPR FSAR Tier 2, Figure 10.4.9-1, sheets 2 and 3.

Essential Service Water (ESW)

The ESW system has a single mode of operation with two trains normally operating. The standby train(s) can be aligned to perform pump testing using normal flow paths.

Extra Borating System (EBS)

Full flow testing for the EBS pumps is accomplished through the EBS test line (30JDH10 BR008 on U.S. EPR FSAR Tier 2, Figure 6.8-1). This line allows the EBS pump to circulate back to its suction tank. The EBS pump is a positive displacement pump so there is no pump curve. The flow restrictor in the test line enables the EBS pump to be pressure tested at the maximum required EBS injection pressure.

Low Head Safety Injection (LHSI) and Medium Head Safety Injection (MHSI)

The LHSI and MHSI pumps have full flow test capability utilizing existing recirculation lines.

Safety Chilled Water (SCW)

The SCW system is a closed loop operation. The standby train(s) can be aligned to perform pump testing using normal flow paths.

Emergency Diesel Fuel Transfer Pumps and Auxiliary Fuel Pump

The emergency diesel fuel transfer pumps and auxiliary fuel pump are positive displacement pumps; therefore, they do not have pump curves. The pumps are flow tested to provide the consumption rate of the emergency diesel generator at its continuous rating as described in U.S. EPR FSAR Tier 2, Section 9.5.4.2.2.

2. There are no exceptions to item 1 above.

3. As noted in U.S. EPR FSAR Tier 2, Section 3.9.6.3, testing of safety-related valves is performed in accordance with ASME OM Code, Subsection ISTC which complies with the SRP 3.9.6 subsection II.3 acceptance criteria for valves. As noted in SRP 3.9.6, “the valve test procedures, acceptance criteria, and corrective actions are acceptable if the provisions of Subsection ISTC of the OM Code, as incorporated by reference in 10 CFR 50.55a, are met with regard to preservice and periodic inservice valve testing.” This is also further satisfied through the combined license (COL) information item in U.S. EPR FSAR Tier 2, Section 3.9.6 which states: “A COL applicant that references the U.S. EPR design certification will submit the PST program and IST program for pumps, valves, and snubbers as required by 10 CFR 50.55a.”

4. Full flow test capabilities for the safety-related pumps are described in response to question 1. With respect to valves, the line sizes and flowpath are described in the piping and instrumentation diagrams (P&IDs) for their respective systems. Due to the extensive nature

and proprietary content of the P&IDs, they can be made available for NRC inspection at the AREVA NP Rockville, MD office.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

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Question 03.09.06-5:

In the IST program for valves, please address the following additional requirements:

1. As required by ISTC-5220, air release and vacuum breaker valves (identified as 30PEB10AA190, 30PEB10AA191, 30XJG10AC001, 30PEB20AP001, SAQ20AC001, 30XJG20AC001, 30XJG30AC001, PEB30AP001, SAQ30AC001, 30XJG40AC001, PEB40AP001, and SAQ40AC001) should have a stroke testing frequency of 2-years.
2. The IST valve table needs to show valve sizes and associated P&ID drawing numbers.
3. Since the main steam isolation valves are single inline components and are required to isolate flow in the forward and reverse direction, address the need for leak testing in each direction.
4. On the safety injection system P&ID (Figure 6.3-3), there are shown 3-port power -operated valves (30JNK10AA001, 30JNK20AA001, 30JNK30AA001, and 30JNK40AA001) that should be added to the IST program.
5. There are valves in the IST table (30JMQ41AA002, 30JMQ42AA002, 30JMQ43AA002, 30JNG10AA010, 30JNG20AA010, 30JNG30AA010, 30JNG40AA010) that have a passive designation which is inconsistent with having both open and closed safety positions.
6. The IST table should indicate that all power-operated valves requiring an exercise test should also require a stroke time test (ISTC-5113).
7. In accordance with ISTC-3560, required fail-safe testing should be indicated in the IST table.

Response to Question 03.09.06-5:

1. The NRC question states that as required by ISTC-5220, air release and vacuum breaker valves should have a stroke testing frequency of two years. ISTC-5220 only applies to check valves. Inservice testing (IST) requirements for vacuum breaker and air release valves are provided in ISTC-5230 (vacuum breaker valves) and ISTC-5240 (safety and relief valves), as noted in ASME Operation and Maintenance (OM) Code Table ISTC-3500-1, Inservice Test Requirements. ASME OM Code Table ISTC-3500-1 also lists valve exercise test procedure and frequency requirements for Category C (safety and relief) valves per ISTC-5230 and ISTC-5240. Both ISTC-5230 and ISTC-5240 refer to ASME OM Code Mandatory Appendix I for test requirements. ASME OM Code Mandatory Appendix I, I-1350 requires a ten year test interval for Class 2 and 3 pressure relief valves (except main steam safety valves), and I-1380 requires a two year test interval for Class 2 and 3 vacuum relief valves (except primary containment vacuum relief valves).

   Of the components listed in the question, only two are vacuum breakers (i.e., 30PEB10AA190 and 30PEB10AA191). As noted in U.S. EPR FSAR Tier 2, Table 3.9.6-2, valve 30PEB10AA190 currently has a two year test frequency. U.S. EPR FSAR Tier 2, Table 3.9.6-2, will be revised to indicate a two year test frequency for valve 30PEB10AA191 and corresponding valves 30PEB20AA191, 30PEB30AA191, and 30PEB40AA191 (Note: the numbers for these have been corrected to 30PEB11AA191, 30PEB21AA191, 30PEB310AA191, and 30PEB410AA191, respectively). The remaining items listed are pumps and heat exchangers that are supported by air release and vacuum breaker valves. The pumps in question are listed in U.S. EPR FSAR Tier 2, Table 3.9.6-1. IST requirements do not apply to heat exchangers.

2. AREVA NP does not understand the regulatory basis for this question, since neither RG 1.206 nor SRP 3.9.6 require valve sizes and associated piping and instrumentation diagram (P&ID) drawing numbers to be identified in U.S. EPR FSAR Tier 2, Table 3.9.6-2 . The valve sizes and associated P&ID drawing numbers for the valves listed in U.S. EPR FSAR Tier 2, Table 3.9.6-2 are available for NRC inspection.
3. As stated in U.S. EPR FSAR Tier 2, Section 10.3, the main steam isolation valves (MSIV) are required to isolate (in the forward flow direction) the main steam lines in the event of excessive steam flow. This prevents over-cooling of the reactor coolant and retains activity by steam-side isolation in the event of a steam generator tube rupture. Failure of the MSIVs to isolate in the reverse flow direction does not result in, or increase the severity of, a credible event. Since the MSIVs are not required to isolate in the reverse flow direction, they are leak tested only in the forward flow direction.
4. The valves in question, along with other valves from this system, will be added to U.S. EPR FSAR Tier 2, Table 3.9.6-2.
5. Valves 30JNG10AA010, 30JNG20AA010, 30JNG30AA010, and 30JNG40AA010 are cross-connect isolation valves. They are classified as passive because they are only open when maintenance of a train is required; otherwise, they are closed. When the valves are open, electrical breakers are racked-out, to prevent single failure. The valves do not receive a safety injection (SI) signal with open or closed positions, which is why they have a passive designation. U.S. EPR FSAR Tier 2, Table 3.9.6-2 will be revised to change the designation of valves 30JMQ41AA002, 30JMQ42AA002, and 30JMQ43AA002 as active.
6. Stroke-time testing for power-operated valves is specified in U.S. EPR FSAR Tier 2, Section 3.9.6.3. The IST requirement for measuring the stroke time for valves is performed in conjunction with a valve exercise inservice test. The stroke time test is not identified as a separate IST. Based on discussions with the NRC on March 4, 2009, at the U.S. EPR Design Centered Working Group meeting related to the U.S. EPR IST program description (Accession Number ML090430197), the response to this question will be added to U.S. EPR FSAR Tier 2, Section 3.9.6.3. Additionally, U.S. EPR FSAR Tier 2, Section 3.9.6.3, will be revised to delete "to the extent practical" in reference to compliance with Subsection ISTC of the ASME OM Code.
7. The switch for a fail-safe valve functions by interrupting (de-energizing) the electrical or pneumatic actuating force for the valve whenever the switch is moved to the fail-safe position. Therefore, this normal valve operation demonstrates the valve’s fail-safe capability, which is verified during valve exercise testing by remote position indication. Since a successful exercise test satisfies a valve’s fail-safe testing requirements, a separate test for fail-safe capability is not required and is not specified in U.S. EPR FSAR Tier 2, Table 3.9.6-2. This information will be added to U.S. EPR FSAR Tier 2, Table 3.9.6-2.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 3.9.6.3 and Table 3.9.6-2 will be revised as described in the response and indicated on the enclosed markup.

Question 03.09.06-6:

In discussing inservice operability testing of power-operated valves, the applicant states that this testing includes testing in static system conditions with diagnostic measurements or dynamic system conditions that include flow and differential pressure. Although the lessons learned from operating experience have proven that static tests are ineffective for assessing the design-basis capability of MOVs, the applicant should clarify the use of static tests for operability determinations of POVs.

Response to Question 03.09.06-6:

As stated in U.S. EPR FSAR Tier 2, Section 3.9.6.3.2, the power operated valve (POV) inservice testing (IST) program incorporates industry and regulatory experience (including Generic Letters 89-10 and 96-05, and INPO operating experience) and information gained through analysis, design, maintenance, and testing of the valves within specific safety-related systems. The IST program for POVs includes programmatic features similar to the Joint Owners Group (JOG) Program in response to Generic Letter 96-05. Operability tests for POVs are conducted in either static or dynamic conditions in accordance with MPR-2524-A (Reference 1). When the margin between component capability and design-basis requirements have not been previously determined due to different valve design features, materials, or operating parameters, dynamic testing is performed to determine these margins.

Based on discussions with the NRC on March 4, 2009, at the U.S. EPR Design Centered Working Group meeting related to the U.S. EPR IST program description (Accession Number ML090430197), and during a conference call on April 14, 2009, U.S. EPR FSAR Tier 2, Section 3.9.6.3.1, Section 3.9.6.3.2, and Section 3.9.6.6 will be revised to add additional information related to the testing and periodic verification of POVs. U.S. EPR FSAR Tier 2, Section 3.9.6.3.1 and Table 5.2-1 will also be revised to add a reference to NRC-accepted Code Case OMN-1 (see RG 1.192) regarding motor-operated valves.

References for Question 03.09.06-6:

1. MPR-2524-A, Joint Owners' Operated Valve Group (JOG) Motor Periodic Verification Program Summary, MPR Associates, November 2006.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 3.9.6.3.1, Section 3.9.6.3.2, Section 3.9.6.6, and Table 5.2-1 will be revised as described in the response and indicated on the enclosed markup.

Question 03.09.06-7:

The design of the U.S. EPR system should incorporate provisions to permit all safety-related check valves to be tested for performance in both the forward and reverse flow directions. The ASME OM Code (2004 Edition) includes this requirement for bi-directional testing of check valves (as does the 1995 Edition of the ASME Code through the 2003 Addenda as is currently incorporated by reference in 10 CFR 50.55a(b)(3)). Specifically, the Code states that the necessary valve obturator movement during exercise testing shall be demonstrated by performing both an open and close test. Does the U.S. EPR system design incorporate provisions, including alternate flow paths and required instrumentation, to allow for bi-directional flow testing of check valves? For which check valves is bi-directional flow testing impractical? What alternative testing is proposed by the applicant for these check valves?

Response to Question 03.09.06-7:

As stated in U.S. EPR FSAR Tier 2, Section 3.9.6.1, the U.S. EPR design provides access to structures, systems, and components (SSC) to facilitate comprehensive testing. The U.S. EPR design also incorporates provisions to permit safety-related check valves to be tested for performance in both the forward and reverse flow directions.

Based on discussions with the NRC on March 4, 2009, at the U.S. EPR Design Centered Working Group meeting related to the U.S. EPR IST program description (Accession Number ML090430197), and during a conference call on April 14, 2009, U.S. EPR FSAR Tier 2, Section 3.9.6.3.3 will be revised to reflect the information in the response to this question.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 3.9.6.3.3 will be revised as described in the response and indicated on the enclosed markup.

Question 03.09.06-8:

In SECY-90-016, the staff recommended that check valve testing for ALWR designs should incorporate the use of nonintrusive diagnostic techniques to address degradation and performance characteristics. In its SRM to SECY-90-016, dated June 26, 1990, the Commission approved the staff's recommendations. Discuss the extent to which the U.S. EPR certified design use advanced nonintrusive techniques to periodically assess degradation and performance characteristics of the check valves.

Response to Question 03.09.06-8:

In accordance with SRP 3.9.6, Acceptance Criteria 3.C.iii, "Inservice Testing Program for Check Valves," U.S. EPR FSAR Tier 2, Section 3.9.6.3 states: "The IST program incorporates nonintrusive techniques to periodically assess the degradation and performance of selected valves." Further information on the nonintrusive techniques used to detect degradation of check valves is provided in U.S. EPR FSAR Tier 2, Section 3.9.6.3.3.

Based on discussions with the NRC on March 4, 2009, at the U.S. EPR Design Centered Working Group meeting related to the U.S. EPR IST program description (Accession Number ML090430197), U.S. EPR FSAR Tier 2, Section 3.9.6.3 will be revised to state that the nonintrusive techniques to periodically assess degradation and performance apply specifically to check valves (see U.S. EPR FSAR Tier 2, Section 3.9.6.3.3).

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 3.9.6.3 will be revised as described in the response and indicated on the enclosed markup.

Question 03.09.06-10:

The sample disassembly examination program proposed by the DC applicant groups check valves by similar design, application, and service condition. Will the sample disassembly examination program further group check valves by valve manufacturer, design, service, size, materials of construction, and orientation as required by the ASME OM Code (reference ISTC-5221(c)(1))?

Response to Question 03.09.06-10:

As noted in the NRC question, ASME OM Code Section ISTC-5221(c)(1) requires that "Grouping of check valves for the sample disassembly examination program shall be technically justified and shall consider, as a minimum, valve manufacturer, design, service, size, materials of construction, and orientation." Thus, the sample disassembly program will comply with the OM Code. However, the specific details of the sample disassembly program will be the responsibility of the COL applicant since this information will not be available until a specific design and valve manufacturer is selected. This is addressed through Combined License (COL) information items 3.9-7 and 3.9-13 in U.S EPR FSAR Tier 2, Table 1.8-2.

Based on discussions with the NRC on March 4, 2009, at the U.S. EPR Design Centered Working Group meeting related to the U.S. EPR IST program description (Accession Number ML090430197), U.S. EPR FSAR Tier 2, Section 3.9.6.3.3 will be revised to add a reference to ASME OM Code Section ISTC-5221 regarding the sample disassembly examination program.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 3.9.6.3.3 will be revised as described in the response and indicated on the enclosed markup.

Question 03.09.06-11:

Per FSAR Tier 2, Chapter 3, Section 3.9.6.4.1, snubber selection is based on reconciling restraint stiffness values used in the piping analysis. However, no mention of clearances, lost motion or mismatch snubber criteria is given in the FSAR description or topical report. As stated in NUREG 0800 Section 3.9.3, Acceptance Criteria 3.B.(ii):

"The snubber end fitting clearance, mismatch of end fitting clearances, mismatch of activation and release rates, and lost motion should be minimized and should be considered when calculating snubber reaction loads and stress which are based on a linear analysis of the system or component. This is especially important in multiple snubber applications where mismatch of end fitting clearance has a greater effect on the load sharing of these snubbers than does the mismatch of activation level or release rate. Equal load sharing of multiple snubber supports should not be assumed if mismatch in end fitting clearance exists."

How are clearances and different snubber activation and release rates addressed in U.S. EPR snubber design process?

Response to Question 03.09.06-11:

The criteria for design of snubbers, including clearances, is described in Section 6.6 of AREVA NP topical report ANP-10264NP-A, "U.S. EPR Piping Analysis and Pipe Support Design," (Reference 6 of U.S. EPR FSAR Tier 2, Section 3.9.6.6), which has been approved by the NRC. Snubbers are modeled in a linear analysis as dynamic restraints with a stiffness that is rigid compared to the piping in the dynamic analysis model. The snubbers on the reactor coolant system (RCS) are modeled as explained below.

For the snubbers supporting Class 1, 2 and 3 piping, as long as the deflection criteria for the total support design meets the requirements in the above referenced topical report, no further analysis is required. When these deflection criteria are not met, the stiffness is calculated considering the localized stiffnesses of the inline structural components, including the snubber. If one support in a piping analysis boundary does not meet the deflection criteria, stiffnesses for all supports within the boundary must be calculated and the piping analysis performed again. Inline structural components for the snubber supports are carefully selected to minimize differences in clearances, stiffnesses, activation rates, release rates and lost motion due to "deadband." Additionally, snubbers are certified by the manufacturer to meet the functional requirements of the snubber purchase specification. Snubbers are included in the inservice testing (IST) program to confirm operability and correct installation.

For the RCS main coolant loop piping analysis, the support stiffness is determined using localized stiffnesses of the inline structural components, including the snubber. Re-analysis is required if the snubber manufacturer cannot confirm to the specified stiffness values. The snubber selection and IST criteria discussed above is also applicable to the RCS piping analysis.

Based on discussions with the NRC on March 4, 2009, at the U.S. EPR Design Centered Working Group meeting related to the U.S. EPR IST program description (Accession Number ML090430197), during a conference call on April 14, 2009, U.S. EPR FSAR Tier 2, Section 3.9.6.1 will be revised to add a reference to Section 6.6 of AREVA NP topical report ANP-10264NP-A. U.S. EPR FSAR Tier 2, Section 3.9.6.4.2 and Table 5.2-1 will be revised to add a reference to NRC-accepted Code Case OMN-13 (see RG 1.192) regarding the intervals for visual examination of snubbers.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 3.9.6.1, Section 3.9.6.4.2, and Table 5.2-1 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

3.9.6 Functional Design, Qualification, and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints

This section describes the functional design and qualification provisions and inservice testing (IST) programs for safety-related pumps, valves, and dynamic restraints (snubbers). This includes both ASME Code, Section III, Class 1, 2, or 3 (Reference 1), and non-ASME Code safety-related pumps, valves, and snubbers. The provisions and programs described here verify that these components are in a state of operational readiness to perform their safety functions throughout the life of the plant.

The following GDC apply to this section:

- GDC 1 and 10 CFR 50.55a require, in part, that structures, systems, and components (SSC), which include pumps, valves, and dynamic restraints important to safety, be designed, fabricated, erected, constructed, and inspected to quality standards commensurate with the importance of the safety functions they perform. As noted in Section 3.1.1, the U.S. EPR Quality Assurance (QA) Program, which has been approved by the NRC (refer to Section 17.5), describes the recognized codes, standards, and design criteria that govern safety-related SSC. This program also confirms that these SSC are designed to quality standards commensurate with the safety functions they perform. Where applicable, design is in accordance with the codes required in 10 CFR 50.55a.

- GDC 2 requires, in part, that components important to safety be designed to withstand the effects of severe natural phenomena, combined with appropriate effects of normal and accident conditions, without a loss of capability to perform their safety functions. As noted in Section 3.1.1, safety-related SSC are designed either to withstand the effects of natural phenomena without loss of the capability to perform their safety functions, or to fail in a safe condition. Additional information on the seismic classifications of safety-related SSC is provided in Section 3.2.

- GDC 4 requires, in part, that components important to safety be designed to accommodate the effects of, and be compatible with, the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents. As noted in Section 3.1.1, safety-related SSC are designed to accommodate the effects of, and be compatible with, the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, which includes loss-of-coolant accidents. Additionally, the U.S. EPR design applies the leak-before-break methodology, as described in Section 3.6.3, to eliminate the dynamic effects of pipe rupture.

- GDC 14 requires that the reactor coolant pressure boundary (RCPB) be designed with an extremely low probability of abnormal leakage, rapidly propagating failure, and gross rupture. As noted in Section 3.1.2, the RCPB is designed to accommodate the system pressures and temperatures attained under the expected modes of plant operation, including anticipated transients, with stresses within applicable limits.

- GDC 15 requires that the reactor coolant system (RCS) be designed with sufficient margin of safety so that the design conditions of the RCPB are not exceeded during conditions of normal operation, including anticipated operational occurrences (AOO). As noted in Section 3.1.2, steady-state and transient analyses are performed to verify that the design conditions of the RCS and its associated auxiliary systems are not exceeded. These analyses address normal operations, including AOOs. Additionally, RCPB components have a sufficient margin of safety through the use of proven materials and design codes, proven fabrication techniques, nondestructive shop examination, and integrated hydrostatic testing of assembled components. Chapter 5 describes the RCS design.

- GDC 37 requires that the emergency core cooling system be designed to permit appropriate periodic pressure and functional testing to confirm the structural and leak-tight integrity of its components, as well as the operability and performance of the active components of the system. ISTs required by the ASME OM Code (Reference 2), as well as other preservice tests (PST) and ISTs for pumps and valves, demonstrate leak-tight integrity, operability, and performance. This testing specifically applies to safety-related pumps and valves in the emergency core cooling system and meets the requirements of GDC 37.

- GDC 40 requires that the containment heat removal system be designed to permit appropriate periodic pressure and functional testing to confirm the structural and leak-tight integrity of its components, as well as the operability and performance of the active components of the system. ISTs required by Reference 2, as well as other PSTs and ISTs for pumps and valves, demonstrate leak-tight integrity, operability, and performance. This testing specifically applies to safety-related pumps and valves in the containment heat removal system and meets the requirements of GDC 40.

- GDC 43 requires that the containment atmospheric cleanup system be designed to permit appropriate periodic pressure and functional testing to confirm the structural and leak-tight integrity of its components, as well as the operability and performance of the active components of the system, including pumps and valves. ISTs required by Reference 2, as well as other PSTs and ISTs for pumps and valves, demonstrate leak-tight integrity, operability, and performance. This testing specifically applies to safety-related pumps and valves in the containment atmospheric cleanup system and meets the requirements of GDC 43.

- GDC 46 requires that the cooling water system be designed to permit appropriate periodic pressure and functional testing to confirm the structural and leak tight integrity of its components, as well as the operability and performance of the active components of the system. ISTs required by Reference 2, as well as other PSTs and ISTs for pumps and valves, demonstrate leak-tight integrity, operability, and performance. This testing specifically applies to safety-related pumps and valves in the cooling water system and meets the requirements of GDC 46.

- GDC 54 requires that piping systems penetrating the primary reactor containment be provided with leak detection and isolation capabilities. These piping systems are designed with a capability to test the operability of the isolation valves periodically to determine if valve leakage is within acceptable limits. ISTs required by Reference 2, as well as other PSTs and ISTs for pumps and valves, demonstrate leak-tight integrity, operability, and performance. This testing specifically applies to safety-related valves in systems that penetrate the primary containment and meets the requirements of GDC 54.

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Other FSAR sections that interface with this section are:

- Section 3.2.2 addresses the classification system and quality group for pumps and valves.
- Section 3.9.2 addresses dynamic testing and analysis of safety-related pumps, valves, and snubbers.
- Section 3.9.3 addresses the structural design of safety-related pumps, valves, and snubbers.
- Section 3.10 addresses the seismic and dynamic qualification of safety-related pumps and valves.
- Section 3.11 addresses the environmental qualification of safety-related pumps and valves.
- Section 3.12 addresses the design and leak testing provisions of pressure retaining systems and components that interface with the reactor coolant system as part of the primary review responsibility for intersystem loss-of-coolant accidents.
- Section 3.13 addresses programs for ensuring bolting and threaded fastener adequacy and integrity.
- Section 5.2.2 addresses the valves specified for overpressure protection of the reactor coolant pressure boundary.
- Section 5.4.7 and Section 6.3 address residual heat remove and emergency core cooling systems piping, respectively that is connected to the reactor coolant system and is subject to thermally stratified flow, thermal striping, and/or thermal cyclic effects.
- Section 6.2.1.2 addresses the analyses of subcompartment differential pressures resulting from postulated pipe breaks.
- Section 6.2.4 and Section 6.2.6 address the containment isolation system and the overall containment leakage testing program, respectively.
- Section 9.2.1 addresses surveillance, testing, inspection, and maintenance programs of service water systems.
- Section 10.3 addresses the number and size of valves specified for the main steam supply system.

A COL applicant that references the U.S. EPR design certification will submit the PST program and IST program for pumps, valves, and snubbers as required by 10 CFR 50.55a.

A COL applicant that references the U.S. EPR design certification will identify the implementation milestones and applicable ASME OM Code for the preservice and inservice examination and testing programs. These programs will be consistent with the requirements in the latest edition and addenda of the OM Code incorporated by reference in 10 CFR 50.55a on the date 12 months before the date for initial fuel load.

3.9.6.1 Functional Design and Qualification of Pumps, Valves, and Dynamic Restraints

IST of safety-related pumps, valves, and snubbers is performed in accordance with Reference 2 and applicable addenda, as required by 10 CFR 50.55a(f), and the guidance provided in RG 1.192 and NUREG-1482, Revision 1 (Reference 3). The ASME OM Code is incorporated by reference in 10 CFR 50.55a(b)(3). ASME OM Code Subsection ISTB defines the functional testing requirements for pumps. Subsection ISTC defines the functional testing requirements for valves, and Subsection ISTD defines the functional testing requirements for snubbers. As described in Section 3.9.6.3, the IST program also incorporates operating experience—for example, GL 96-05 (Reference 4), GL 89-10 (Reference 5), Regulatory Issue Summary 2000-03 (Reference 10).

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In accordance with RG 1.206 and the acceptance criteria of SRP 3.9.6, functional design and qualification of pumps, valves, and snubbers includes the following:

- Safety-related pump, valve, and piping designs include provisions to allow testing of pumps and valves at the maximum flow specified in the plant accident analyses.

  Pumps and valves are tested within the IST program requirements to confirm that the required components are capable of performing their intended safety function. The safety analysis includes information concerning the design limitations and functional requirements for the performance of pumps and valves, including operation at the maximum flowrate. The IST pump functional design and pump qualification include an assessment for degraded flow conditions. The IST program requires pump and valve testing over the full range of system differential pressures, flowrates, temperatures, and available voltages (as applicable), from normal operating to design-basis conditions and considers degraded flow. IST testing is also performed on RCPB valves to demonstrate that they will not experience leakage, or increased leakage, from their loading. Additional information on the dynamic testing and analysis of systems, components, and equipment is provided in Section 3.9.2.

- Functional design and qualification of each safety-related pump and valve is performed such that each pump and valve is capable of performing its intended function for a full range of system differential pressure and flow, ambient temperatures, and available voltage (as applicable) under conditions ranging from normal operating to design-basis accident conditions.

The U.S. EPR design provides ready access to SSC to facilitate comprehensive testing using currently available equipment and techniques. Accessibility incorporated into the design complies with the requirements of Reference 2 and 10 CFR 50.55a(f). System design incorporates provisions, including alternate flow paths and required instrumentation, to allow full flow testing of pumps under the IST program. The Chapter 15 safety analyses describe bounding design-basis requirements for safety-related pump and valve performance, including assumed design basis accident (DBA) flowrates and margin for degraded flow conditions. Degraded flow conditions are those caused by post-accident circumstances, such as debris that may collect on the Reactor Building sump strainers and cause reduced flow in accident mitigation systems.

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Valves within the reactor coolant system and safety-related valves in connected systems are designed, manufactured, and tested to meet the requirements of the ASME Code, Section III (See Section 3.9.6.3, Section 5.2, and Section 5.4 for additional information). Design basis and required operating conditions for safety-related check valves are established based on design conditions including the required system operating cycles to be experienced by the valve, environmental conditions under which the valve is required to function, and severe transient loadings expected during the life of the valve (See Section 3.9.6.3.3 for additional information on testing of check valves).

Safety-related power-operated valves are qualified to perform their design basis functions either before installation or as part of preservice tests. Power operated valves have a functional qualification performed to demonstrate by test, by analysis or by a combination thereof, the ability to operate over a range up to the design conditions. This functional qualification demonstrates the motor-operated valve capability during and after loads representative of the maximum seismic or vibratory event (as required to perform their intended function), demonstrate the valve sealing capability, demonstrate capability under cold and hot operating conditions, demonstrate capability under maximum pipe end loads and demonstrate flow interruption and functional capability. The motor-operated valve (MOV) testing program requires either in-plant valve operation or prototype valve testing at system flow and pressure or system differential pressure to verify correct MOV actuator sizing and control settings.

Solenoid-operated valves are verified to perform their safety-related design requirements over a range of electrical power supply conditions including minimum and maximum voltage. Solenoid-operated valves are qualified for minimum and maximum voltage and amperage during factory acceptance testing, which also includes maintaining the valve in its energized position.

Additional information on MOVs is provided in Section 3.9.6.3.1 and information on power-operated valves other than MOVs is provided in Section 3.9.6.3.2.

Design basis and required operating conditions for safety-related check valves are established based on design conditions including the required system operating

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cycles to be experienced by the valve, environmental conditions under which the valve is required to function, and severe transient loadings expected during the life of the valve. Qualification testing provides for the adequacy of the safety-related check valves under design conditions. Additional information on check valves is provided in Section 3.9.6.3.3.

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- The provisions for the design and qualification of snubbers are provided in Section 3.9.3, Section 3.9.6.4, and the U.S. EPR Piping Analysis and Pipe Support Design Topical Report, Section 6.6 (Reference 6). Snubbers in safety-related systems include provisions to allow access for IST program activities (Section 3.9.6.4).

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- The design and installation of safety and relief valves is described in Section 3.9.3.
- The seismic and dynamic qualification of mechanical and electrical is described in Section 3.10.
- Section 3.11 addresses the environmental qualification of safety-related pumps and valves.
- As required by GDC 14, safety-related valves that are part of the RCPB are designed and tested such that these valves will not experience any abnormal leakage, or increase in leakage, from their loading, as addressed in Section 3.10.
- As required by GDC 15 and in accordance with SRP 3.9.6, pumps, valves, and snubbers are designed with sufficient margin to demonstrate that the design conditions are not exceeded in accordance with Reference 2. Pump motors are designed to tolerate anticipated frequency and voltage variations due to degraded electrical power supply line conditions.

Reference 2 defines the IST scope by establishing the PST, IST, and examination of components to assess their operational readiness. The ASME OM Code identifies components subject to test examination, as well as testing responsibilities, methods, intervals, parameters to be measured and evaluated, criteria for evaluating results, corrective action, personnel qualification, and record keeping. These requirements apply to:

- Pumps and valves that are required to perform a specific function in bringing the reactor to a safe shutdown condition, maintaining the reactor in safe shutdown condition, or mitigating the consequences of an accident.
- Pressure relief devices that protect systems, or portions of systems, that perform one or more of the three functions described above.
- Dynamic restraints used in systems that perform one or more of these three functions, or that protect the integrity of the RCPB.

The initial testing program (ITP) is described in Section 14.2 and envelopes the PST program. Detailed test procedures are developed and conducted as a part of the initial plant startup program. These tests include parameters and acceptance criteria that can

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be used to establish and measure reference values for components in the IST program. These tests also include requirements for instrumentation range and accuracy. The IST program will evaluate results of preoperational testing to establish IST baseline values.

The IST program for pumps is addressed in Section 3.9.6.2, for valves in Section 3.9.6.3, and for snubbers in Section 3.9.6.4. The IST program also includes provisions for relief requests and requests for alternate testing methods, which are addressed in Section 3.9.6.5.

~~Pumps and valves are tested within the IST program requirements to confirm that the required components are capable of performing their intended safety function. The safety analysis includes information concerning the design limitations and functional requirements for the performance of pumps and valves, including operation at the maximum flowrate. The IST pump functional design and pump qualification include an assessment for degraded flow conditions. The IST program requires pump and valve testing over the full range of system differential pressures, flowrates, temperatures, and available voltages (as applicable), from normal operating to design basis conditions and considers degraded flow that may occur during post-accident conditions. IST testing is also performed on RCPB valves to demonstrate that they will not experience leakage, or increased leakage, from their loading.~~

~~The U.S. EPR design provides ready access to SSC to facilitate comprehensive testing using currently available equipment and techniques. Accessibility incorporated into the design complies with the requirements of Reference 2 and 10 CFR 50.55a(f). System design incorporates provisions, including alternate flow paths and required instrumentation, to allow full flow testing of pumps under the IST program. The design also incorporates provisions to permit the IST program testing of valves at the maximum flow specified in the plant accident analysis. The Chapter 15 safety analyses describe bounding design-basis requirements for safety-related pump and valve performance, including assumed design basis accident (DBA) flowrates and margin for degraded flow conditions. Degraded flow conditions are those caused by post-accident circumstances, such as debris that may collect on the Reactor Building sump strainers and cause reduced flow in accident mitigation systems.~~

~~As required by GDC 15 and in accordance with SRP 3.9.6, pumps, valves, and snubbers are designed with sufficient margin to demonstrate that the design conditions are not exceeded in accordance with Reference 2. Pump motors are designed to tolerate anticipated frequency and voltage variations due to degraded electrical power supply line conditions.~~

~~Reference 2 defines the IST scope by establishing the PST, IST, and examination of components to assess their operational readiness. The ASME OM Code identifies components subject to test examination, as well as testing responsibilities, methods,~~

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intervals, parameters to be measured and evaluated, criteria for evaluating results, corrective action, personnel qualification, and record keeping. These requirements apply to:

- Pumps and valves that are required to perform a specific function in bringing the reactor to a safe shutdown condition, maintaining the reactor in safe shutdown condition, or mitigating the consequences of an accident.
- Pressure relief devices that protect systems, or portions of systems, that perform one or more of the three functions described above.
- Dynamic restraints used in systems that perform one or more of these three functions, or that protect the integrity of the RCPB.

The initial testing program (ITP) is described in Section 14.2 and envelopes the PST program. Detailed test procedures are developed and conducted as a part of the initial plant startup program. These tests include parameters and acceptance criteria that can be used to establish and measure reference values for components in the IST program. These tests also include requirements for instrumentation range and accuracy. The IST program will evaluate results of preoperational testing to establish IST baseline values.

Other design information that interfaces with this section is provided in the following sections:

- Section 3.2.2 addresses the classification system and quality group for pumps and valves.
- Section 3.9.2 addresses dynamic testing and analysis of safety-related pumps, valves, and dynamic restraints.
- Section 3.9.3 addresses the structural design of safety-related pumps, valves, and dynamic restraints and also pump and valve operability assurance.
- Section 3.10 addresses the seismic and dynamic qualification of safety-related pumps and valves.
- Section 3.11 addresses the environmental qualification of safety-related pumps and valves.

The IST program for pumps is addressed in Section 3.9.6.2, for valves in Section 3.9.6.3, and for snubbers in Section 3.9.6.4. The IST program also includes provisions for relief requests and requests for alternate testing methods, which are addressed in Section 3.9.6.5.

3.9.6.2 Inservice Testing Program for Pumps

This section describes the IST of pumps to assess their operational readiness, in compliance with ASME OM Code Subsections ISTA and ISTB. The program applies to pumps that are required to perform a specific function of bringing the reactor to the safe shutdown condition, in maintaining the safe shutdown condition, or in mitigating the consequences of a DBA. Pumps that are designated as Class 1, 2, and 3, and non-class pumps that perform a safety-related function are included in the IST program.

Associated systems that contain pumps in the IST program include the necessary valving, instrumentation, test loops, fluid inventory, or other provisions to perform the required testing. Each pump is categorized as either a Group A or Group B pump. A pump that meets both Group A and Group B pump definitions is categorized as a Group A pump. Group A pumps are operated continuously or routinely during normal operation, cold shutdown, or refueling operations. Group B pumps are in standby systems that are not operated routinely, except for testing. When a Group A test is required, a comprehensive test may be substituted. When a Group B test is required, a Group A or comprehensive test may be substituted. A PST may be substituted for an inservice test.

IST testing conforms to the following:

- IST frequency is established in accordance with requirements set forth by Reference 2, Subsections ISTA and ISTB.
- IST interval is determined by calendar years following placement of the unit into commercial service.
- IST intervals are established in compliance with the following:
  - Initial test interval is the 10 years following commencement of unit commercial service.
  - Successive test intervals are 10 years following the previous test interval.
- Each IST interval may be extended or decreased by as much as one year. Adjustments will not cause successive intervals to be altered by more than one year from the original pattern of intervals.
- For units that are out of service continuously for six months or more, the IST interval during which the outage occurred may be extended for a period equivalent to the outage, and the original pattern of intervals extended accordingly for successive intervals.

An initial set of reference values are established for each pump during the PST period or before implementing IST. Reference values are to be determined only when the equipment being tested is known to be operating acceptably. Following the PST, the

IST commences when the pump is required to be operable to fulfill the required function. When a pump has been replaced, repaired, or has undergone maintenance that could affect the pump's performance, a new reference value will be determined or the previous value reconfirmed by an inservice test performed before the time it is returned to service or immediately if not removed from service.

A list of pumps included in the IST program is provided in Table 3.9.6-1—Inservice Pump Testing Program Requirements. Parameters to be measured during IST program testing include pump speed (if required), discharge and differential pressures, flowrate, and vibration at IST conditions, as required by ISTB-3000 for each specific pump category. Range and accuracy requirements for instruments used to measure pressure, flowrate, speed, vibration, and differential pressure are provided in Reference 2, Table ISTB-3510-1. Instrument accuracy, range, location, fluctuations, and frequency response range requirements are established in accordance with ISTB-3510. The specific testing requirements and acceptance criteria are identified in ISTB-5000. A COL applicant that references the U.S. EPR design certification will identify any additional site-specific pumps in Table 3.9.6-1 to be included within the scope of the IST program.

3.9.6.3 Inservice Testing Program for Valves

This section describes the IST of valves to assess their operational readiness, in compliance with Reference 2, Subsections ISTA and ISTC. The program applies to valves classified as ASME Code Class 1, 2, or 3 valves and non-ASME valves that perform a safety-related function. Additional information on MOVs, power-operated valves, and check valves is provided in Section 3.9.6.3.1, Section 3.9.6.3.2, and Section 3.9.6.3.3, respectively.

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Valve testing requirements include exercise, leakage, and position verification. Other specific testing requirements for power-operated valves require stroke-time testing and may require diagnostic testing to determine valve operating conditions to verify operability under design-basis conditions. The IST requirement for measuring the stroke time for valves is performed in conjunction with a valve exercise inservice test. The stroke time test is not identified as a separate IST. IST program valves are classified as either active or passive. Active valves change obturator position to accomplish a specific function in shutting down a reactor to the safe-shutdown condition, maintaining the safe shutdown condition, or mitigating the consequences of an accident. Passive valves maintain obturator position and do not change the obturator position to accomplish the required safety functions. Passive valves are not included in the valve exercise testing.

Pre-conditioning of valves or their associated actuators or controls prior to IST testing undermines the purpose of IST testing and is not allowed. Pre-conditioning includes manipulation, pre-testing, maintenance, lubrication, cleaning, exercising, stroking,

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operating, or disturbing the valve to be tested in any way except as may occur in an unscheduled, unplanned, and unanticipated manner during normal operation.

The IST program complies with the requirements of Reference 2, Subsection ISTC ~~to the extent practical~~. If a valve cannot be tested during normal operation, justification for testing during cold shutdown or a refueling outage is included in the test plan. The IST program incorporates nonintrusive techniques to periodically assess the degradation and performance of ~~selected valves~~check valves (see Section 3.9.6.3.3)..

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Valves within the scope of the IST program are categorized as follows:

- Category A valves, for which seat leakage in the closed position is limited to a specific maximum amount to fulfill their required functions.
- Category B valves, for which seat leakage in the closed position is inconsequential to fulfill their required functions.
- Category C valves, which are self-actuating in response to some system characteristic to fulfill their required functions, such as pressure for relief valves or flow direction for check valves. Category C valves are addressed in Section 3.9.6.3.3 (check valves) and Section 3.9.6.3.6 (safety and relief valves).
- Category D valves, which are actuated by an energy source capable of only one operation, such as rupture disks or explosively actuated valves.

Category A and Category B valves are tested as follows:

- Valves are tested by full-stroke exercising during operation at power to the positions required to fulfill their functions. If full-stroke testing is not practical, testing may be limited to part-stroke exercising of the valves during operation at power and full-stroke exercising during cold shutdowns.
- If valve exercising is not practical during operation at power then the testing may be limited to full-stroke exercising of the valves during cold shutdowns. Valve exercising may be limited to part-stroke during cold shutdowns and full-stroke during refueling outages.
- Valve exercising is not required if the time period since the previous full-stroke exercise is less than three months and no activities that could change operating parameters have been performed. During extended shutdowns, valves that are required to be operable must remain capable of performing their intended safety function.
- Exercising valves during cold shutdown commences within 48 hours of achieving cold shutdown and continues until testing is complete or the plant is ready to return to operation at power.
- Valve testing required to be performed during a refueling outage is completed before returning the plant to operation at power.

Valve testing uses reference values determined from the results of PST or IST. These tests are performed under conditions as near as practical to those expected during the IST. Reference values are established only when the valve is known to be operating acceptably. When a valve or its control system has been replaced, repaired, or has undergone maintenance that could affect valve performance, a new reference value is determined or the previous value is reconfirmed by an inservice test. This test is performed before the valve is returned to service or immediately if the valve is not removed from service. Deviations between the previous and new reference values are identified and analyzed. Verification that the new values represent acceptable operation is documented. The plant corrective action program documents valve failures.

A list of valves included in the IST program is provided in Table 3.9.6-2—Inservice Valve Testing Program Requirements. A COL applicant that references the U.S. EPR design certification will identify any additional site-specific valves in Table 3.9.6-2 to be included within the scope of the IST program. Valve test procedures and schedules are included in the test plan which is provided by the COL applicant.

3.9.6.3.1 Inservice Testing Program for Motor-Operated Valves

3.9.6.3.1.1 MOV Program Requirements and Guidance

In addition to the IST program requirements in the ASME OM Code incorporated by reference in 10 CFR 50.55a(f), 10 CFR 50.55(b)(3)(ii) requires establishment of a program to ensure that the safety-related MOVs continue to be capable of performing their design-basis safety functions. Accordingly, IST of ASME Section III Class 1, 2, and 3, and safety-related MOVs is performed in accordance with ISTC of Reference 2 and applicable addenda, as required by 10 CFR 50.55 a(f). Furthermore, ASME Code Case OMN-1, as accepted by the NRC staff with conditions in RG 1.192, is also used which provides an alternative method to MOV stroke-time testing that also satisfies
03.09.06-6 the requirement in 10 CFR 50.55a to supplement the OM Code IST provisions with a program to ensure that safety-related MOVs continue to be capable of performing their safety functions.

The IST program also incorporates the guidance of NUREG-1482, Revision 1 (Reference 3). Periodic verification of safety-related MOVs incorporates the guidance of Generic Letter 96-05 (Reference 4) which supersedes Generic Letter 89-10 (Reference 5) and its supplements with regard to MOV periodic performance verification. The MOV testing program also incorporates the recommendations from the Joint Owners Group (JOG) MOV Periodic Verification (Reference 9).

The PST program for MOVs is conducted in accordance with ISTC 3100 under conditions as near as practical to those expected during subsequent IST.

3.9.6.3.1.2 Description of MOV Testing Program

Code Testing of MOVs

IST of an MOV relies on diagnostic techniques that assess valve performance under actual loading. Periodic testing per Reference 2, Subsection ISTC, and Reference 4 is conducted under adequate differential pressure and flow conditions to demonstrate that the MOV continues to perform its safety function to open and close, as applicable, during design-basis conditions. MOVs that fail to meet their respective acceptance criteria are declared inoperable.

Safety-related MOV functions are used to determine the type of required IST and PST. These functions include:

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- Active or active-to-fail for fulfillment of a safety-related function.
- RCPB isolation function.
- Containment isolation function.
- Maximum seat leakage (in the closed position) for fulfillment of a safety-related function.
- Safety-related remote-position-indication function.

Retesting MOVs to verify functionality is required after valve or valve-actuator maintenance. The extent of retesting depends upon the type of maintenance performed. MOV testing is incorporated into the initial plant startup test program (refer to Section 14.2). Containment isolation valve (CIV) leak rate test frequency is addressed in Section 6.2.6.

MOVs are tested in accordance with the Reference 2 and the guidance of Reference 3, including the following:

- Remote position-indication tests: Valves with position indicators that are included in the IST program are observed locally during valve exercising to verify that the indicators are operating correctly. Where local observation is not practical, other methods are used to verify correct valve position indicator operation.
- Leakage tests: Safety-related valves with seat leakage limits are tested to verify that leakage does not exceed allowable limits. This testing includes valves that isolate piping and lines that penetrate containment; these valves are tested in accordance with 10 CFR 50, Appendix J. Most valves are tested individually as a part of the Type C testing, depending on the valve function and configuration.
- Exercise tests: Safety-related MOVs are exercised periodically, and generally undergo full-stoke exercise testing quarterly. Measuring stroke time is not a separate inservice test, but is done as part of periodic testing. If it is impractical to

exercise a valve during plant operation, the valve may be full-stroke tested during cold shutdowns. Valves that operate during normal plant operation and at a frequency that satisfies exercising requirements need not be additionally exercised, provided that IST-required observations are made at intervals no greater than that specified in the IST plan.

A list of MOVs included in the IST program is provided in Table 3.9.6-2.

Non-Code Testing of MOVs

The MOV testing program incorporates the Joint Owners' Group (JOG) Motor-Operated Valve (MOV) Periodic Verification (PV) Program (Reference 9) to address Generic Letter 96-05, (Reference 4).

Operability testing relies on non-intrusive diagnostic techniques. These tests are conducted in either static or dynamic conditions in accordance with Reference 9.

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Testing is performed to confirm that an adequate margin exists in MOV capabilities. These tests include verification that the MOV achieves maximum required torque or thrust, as applicable. The tests include consideration of diagnostic equipment inaccuracies, degraded voltages, control switch repeatability, load-sensitive MOV behavior, and the margin for degradation. These tests also indicate hard seat-contact and verify that the tests performed do not exceed the allowable structural and under-voltage motor capability limits for the individual parts of the MOV.

3.9.6.3.1.3 Testing Frequency

The interval between testing to demonstrate continued design basis capability does not exceed five years or three refueling outages, whichever is longer. Longer design-basis verification intervals may be justified through implementation of ASME Code Case OMN-1, as accepted in RG 1.192.

3.9.6.3.1.4 Acceptance Criteria

Acceptance criteria for successful completion of the PST and IST of MOVs includes the following:

- Consistent with the safety function, the valve fully opens and/or the valve fully closes or both. Diagnostic equipment indicates hard seat contact.
- The testing demonstrates adequate margin with respect to the design basis, including consideration of diagnostic equipment inaccuracies, degraded voltage, control switch repeatability, load sensitive MOV behavior, and margin for degradation.
- The maximum torque and/or thrust (as applicable) achieved by the MOV, allowing sufficient margin for diagnostic equipment inaccuracies and control switch

repeatability, does not exceed the allowable structural and undervoltage motor capability limits for the individual parts of the MOV.

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IST of ASME Section III Class 1, 2, and 3, and safety-related motor-operated valves (MOV) is performed in accordance with the Reference 2 and applicable addenda, as required by 10 CFR 50.55 a(f). Testing is required except where specific relief has been granted by the NRC. The IST program incorporates the guidance of RG 1.192 and Reference 3. NRC-accepted Code Case OMN-1 (RG 1.192) is also used for PST and IST to assess the operational readiness of MOVs.

Periodic verification of safety-related MOVs is performed in accordance with Generic Letter 96-05 (Reference 4) which supersedes Generic Letter 89-10 (Reference 5) and its supplements with regard to MOV periodic performance verification. The MOV testing program also incorporates the recommendations from the Joint Owners Group (JOG) MOV Periodic Verification (Reference 9).

The MOV testing program requires either in-plant valve operation or prototype valve testing at system flow and pressure or system differential pressure to verify correct MOV actuator sizing and control settings. The PST program for MOVs is conducted in accordance with 10 CFR 50.55a(b)(3)(ii) and Reference 2, ISTC 3100 under conditions as near as practical to those expected during subsequent IST. The interval between testing to demonstrate continued design basis capability does not exceed five years or three refueling outages, whichever is longer.

IST of an MOV relies on diagnostic techniques that assess valve performance under actual loading. Periodic testing per Reference 2, Subsection ISTC and Reference 4 is conducted under adequate differential pressure and flow conditions to demonstrate that the MOV continues to perform its safety function to open and close, as applicable, during design-basis conditions. MOVs that fail to meet their respective acceptance criteria are declared inoperable.

Safety-related MOV functions are used to determine the type of required IST and PST. These functions include:

- Active or active-to-fail for fulfillment of a safety-related function.
- RCPB isolation function.
- Containment isolation function.
- Maximum seat leakage (in the closed position) for fulfillment of a safety-related function.
- Safety-related remote-position-indication function.

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~~Retesting MOVs to verify functionality is required after valve or valve actuator maintenance. The extent of retesting depends upon the type of maintenance performed. MOV testing is incorporated into the initial plant startup test program (refer to Section 14.2). Containment isolation valve (CIV) leak rate test frequency is addressed in Section 6.2.6.~~

~~MOVs are tested in accordance with the Reference 2 and the guidance of Reference 4, including the following:~~

- ~~Remote position-indication tests: Valves with position indicators that are included in the IST program are observed locally during valve exercising to verify that the indicators are operating correctly. Where local observation is not practical, other methods are used to verify correct valve position indicator operation.~~
- ~~Leakage tests: Safety-related valves with seat leakage limits are tested to verify that leakage does not exceed allowable limits. This testing includes valves that isolate piping and lines that penetrate containment; these valves are tested in accordance with 10 CFR 50, Appendix J. Most valves are tested individually as a part of the Type C testing, depending on the valve function and configuration.~~
- ~~Exercise tests: Safety-related MOVs are exercised periodically, and generally undergo full-stoke exercise testing quarterly. Measuring stroke time is not a separate inservice test, but is done as part of periodic testing. If it is impractical to exercise a valve during plant operation, the valve may be full-stroke tested during cold shutdowns. Valves that operate during normal plant operation and at a frequency that satisfies exercising requirements need not be additionally exercised, provided that IST-required observations are made at intervals no greater than that specified in the IST plan.~~
- ~~Operability tests: Inservice operability testing of power-operated valves, including MOVs, relies on nonintrusive diagnostic techniques. These tests are conducted in either static or dynamic conditions in accordance with Reference 9.~~
- ~~Additional tests: Testing is performed to confirm that an adequate margin exists in MOV capabilities. These tests include verification that the MOV achieves maximum required torque or thrust, as applicable. The tests include consideration of diagnostic equipment inaccuracies, degraded voltages, control switch repeatability, load-sensitive MOV behavior, and the margin for degradation. These tests also indicate hard seat-contact and verify that the tests performed do not exceed the allowable structural and under-voltage motor capability limits for the individual parts of the MOV.~~

~~A list of MOVs included in the IST program is provided in Table 3.9.6-2.~~

3.9.6.3.2 Inservice Testing Program for Power-Operated Valves Other Than MOVs

3.9.6.3.2.1 Power-Operated Valves, Other Than MOV, Program Requirements and Guidance

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Power-operated valves, other than MOVs, include valves actuated by solenoid, hydraulic, or pneumatic operators. In accordance with the IST program requirements in the ASME OM Code incorporated by reference in 10 CFR 50.55a(f), IST of ASME Code, Section III, Class 1, 2 and 3 safety-related power-operated valves is performed in accordance with ISTC of Reference 2 and applicable addenda, as required by 10 CFR 50.55 a(f). The power-operated valve IST program incorporates industry and regulatory experience and INPO operating experience and information gained through analysis, design, maintenance, and testing of the valves within specific safety-related systems. Specifically, the power-operated valve test program incorporates the guidance of Regulatory Issue Summary 2000-03 (Reference 10) that incorporates the lessons learned from MOV analysis and tests in response to GL 96-05 (Reference 4), GL 89-10 (Reference 5), and the JOG air-operated valve program (Reference 11).

3.9.6.3.2.2 Description of Power-Operated Valve, Other Than MOV, Testing Program

Code Testing of Power-Operated Valves, Other Than MOVS

Safety-related power-operated valves are subject to operational readiness testing in accordance with the requirements stated in the ASME OM Code. IST of valves assesses operational readiness including actuating, stroke timing, fail safe, and verification of position indicating systems. The ability of power-operated valves to perform their design-basis functions is verified either before installation or as part of preoperational testing performed during the initial plant startup test program, as described in Section 14.2.

When the margin between component capability and design-basis requirements have not been previously determined due to different valve design features, materials, or operating parameters, then dynamic testing will be performed to determine these margins. This includes verification that solenoid-operated valves continue to be capable of performing their design-basis safety functions.

Installed solenoid-operated valves are tested using Class 1E electrical power supply voltage and current to verify they remain capable of performing their required safety function during design-basis accident conditions. Solenoid-operated valves are also tested to confirm the valve moves to its energized position and is maintained in that position, and to confirm that the valve moves to the appropriate fail position when de-energized.

A list of power-operated valves included in the IST program is provided in Table 3.9.6-2.

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Non-Code Testing of Power-Operated Valves, Other Than MOVs

Although the design basis capability of active, safety-related power-operated valves is verified as part of the design and qualification process, power-operated valves that perform an active safety function are tested again after installation in the plant, as required, to ensure valve setup is acceptable to perform their required functions, consistent with valve qualification. These tests, which are typically performed under static (no flow or pressure) conditions, also document the baseline performance of the valves to support maintenance and trending programs. During the testing, critical parameters needed to ensure proper valve setup are measured. Depending on the valve and actuator type, these parameters include seat load, running torque or thrust, valve travel, actuator spring rate, bench set and regulator supply pressure. Uncertainties associated with performance of these tests and use of the test results (including those associated with measurement equipment and potential degradation mechanisms) are addressed appropriately. Uncertainties are considered in the specification of acceptable valve setup parameters or in the interpretation of the test results (or a combination of both). Uncertainties affecting both valve function and structural limits are addressed.

Additional testing is performed as part of the air-operated valve program, which includes the elements for an air-operated valve program as identified in Reference 11. The air-operated valve program incorporates the attributes for a successful power-operated valve long-term periodic verification program, as discussed in Reference 10 by incorporating lessons learned from previous nuclear power plant operations and research programs as they apply to the periodic testing of air-operated valves and other power-operated valves included in the IST program. For example, lessons learned addressed in the air-operated valve program include:

- Setpoints for air-operated valves are defined based on current vendor information or valve qualification diagnostic testing, such that the valve is capable of performing its design-basis function(s).
- Periodic static testing is performed to identify potential degradation, unless those valves are periodically cycled during normal plant operation under conditions that meet or exceed the worst case operating conditions within the licensing basis of the plant for the valve, which would provide adequate periodic demonstration of air-operated valve capability. If required based on valve qualification or operating experience, periodic dynamic testing is performed to re-verify the capability of the valve to perform its required functions.
- Sufficient diagnostics are used to collect relevant data (e.g., valve stem thrust and torque, fluid pressure and temperature, stroke time, operating and/or control air pressure, etc.) to verify the valve meets the functional requirements of the qualification specification.

- Test frequency is specified, and is evaluated each refueling outage based on data trends as a result of testing. Frequency for periodic testing is in accordance with Reference 11.

Power-operated valves (POV), other than MOVs, include valves actuated by solenoid, hydraulic, or pneumatic operators. The ability of POVs to perform their design-basis functions is verified either before installation or as part of preoperational testing performed during the initial plant startup test program, as described in Section 14.2. This includes verification that solenoid-operated valves (SOV) continue to be capable of performing their design-basis safety functions.

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The POV IST program incorporates industry and regulatory experience (including Generic Letters 89-10 and 96-05 (Reference 4 and Reference 5) and INPO operating experience) and information gained through analysis, design, maintenance, and testing of the valves within specific safety-related systems. The IST program for POVs includes programmatic features of the Joint Owners Group (JOG) Program in response to Reference 4. When the margin between component capability and design-basis requirements have not been previously determined due to different valve design features, materials, or operating parameters, dynamic testing will be performed to determine these margins. The POV test program also incorporates the guidance of NRC Regulatory Issue Summary 2000-03 (Reference 10) that incorporates the lessons learned from MOV analysis and tests in response to GL 96-05 (Reference 4), GL 89-10 (Reference 5), and the JOG air-operated valve (AOV) program (Reference 11).

SOVs are qualified for minimum and maximum voltage and amperage during factory acceptance testing, which also includes maintaining the valve in its energized position. Installed SOVs are tested using Class 1E electrical power supply voltage and current to verify they remain capable of performing their required safety function during design basis accident conditions. SOVs are also tested to confirm the valve moves to its energized position and is maintained in that position, and to confirm that the valve moves to the appropriate fail position when de-energized.

A list of POVs included in the IST program is provided in Table 3.9.6-2.

3.9.6.3.3 Inservice Testing Program for Check Valves

Check valve testing requires verification that obturator movement is in the direction required for the valve to perform its safety function. For check valves that perform a safety function in the open and closed directions, the valve is tested by initiating flow and observing whether or not the obturator moves to the full-open position. During flow conditions, the obturator moves to and maintains contact with the backseat without fluctuating, while allowing the flowrate and maximum differential pressure across the valve to remain within acceptable design limits for the system. When flow ceases or reverses, the obturator moves to the valve seat to fulfill the test requirements.

For valves that have a safety function in only the open direction, the valve is exercised by initiating flow and observing whether or not the obturator moves to the full-open position. Check valves that have a safety function in only the closed direction are exercised by initiating flow and observing whether or not the obturator moves to at least the partially open position. When flow ceases or reverses, the obturator moves to the valve seat.

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The U.S. EPR design incorporates provisions to permit safety-related check valves to be tested for performance in both the forward and reverse flow directions. Check valve testing includes observations of a direct indicator or other positive means, such as changes in system pressure, flowrate, level, temperature, seat leakage, testing, or nonintrusive testing results. Acceptance criteria for this testing consider the specific system design and valve application. For example, a valve's safety function may require obturator movement in both open and closed directions. A mechanical exerciser may be used to operate a check valve for testing. Where a mechanical exerciser is used, acceptance criteria are provided for the force or torque required to move the check valve's obturator. Exercise tests also detect missing, sticking, or binding obturators.

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As noted in Subsection ISTC-5221 of Reference 2, iIf these test methods are impractical ~~for certain check valves~~, or if sufficient flow cannot be achieved or verified, a sample disassembly examination program verifies valve obturator movement. In accordance with Subsection ISTC-5221 of Reference 2 and the guidance of Reference 3, tThe sample disassembly examination program groups check valves by category of similar design (manufacturer, size, model number and materials), application, and service condition, including valve orientation, and requires a periodic examination of one valve from each group.

During the disassembly process, the full-stroke motion of the obturator is verified and verification is performed that the internals of the valve are structurally sound (i.e., no loose or corroded parts). Also, if the disassembly is to verify the full-stroke capability of the valve, the disk is manually exercised. While the valve is in a partially disassembled condition the valve internals are inspected and the condition of the moving parts evaluated. Nondestructive examination is performed on the hinge pin to assess wear, and seat contact surfaces are examined to verify adequate contact. Full-stroke motion of the obturator is re-verified immediately prior to completing reassembly. At least one valve from each group is disassembled and examined at each refueling outage, and the valves in each group are disassembled and examined at least once every eight years. A condition monitoring program may be established to modify testing or disassembly inspection periods when sufficient operating data have been collected for a valve type. The condition monitoring program is prescribed by post-maintenance program or ASME OM Code Appendix II requirements for each equipment type. Before returning to service, valves disassembled for examination or valves that received maintenance that could affect their performance are exercised with a full or part stroke. Details and bases of the sampling program are documented and recorded in the test plan.

When operating conditions, valve design, valve location, or other considerations prevent direct observation or measurements by use of conventional methods to determine adequate check valve function, diagnostic equipment and nonintrusive techniques are used to monitor internal conditions. Nonintrusive techniques include acoustic, ultrasonic, magnetic, and x-ray technologies, that are used to measure valve-operating parameters (e.g., fluid flow, disk position, disk movement, and disk impact forces). Nonintrusive techniques also detect valve degradation. Diagnostic equipment and techniques used for valve operability determinations are verified as effective and accurate under the PST program. Testing is performed, to the extent practical, under normal operation, cold shutdown, or refueling conditions applicable to each check valve. Testing includes effects created by sudden starting and stopping of pumps, if applicable, or other conditions, such as flow reversal. When maintenance that could affect valve performance is performed on a valve in the IST program, post-maintenance testing is conducted prior to returning the valve to service.

Preoperational testing is performed during the ITP (refer to Section 14.2) to verify that valves are installed in a configuration that allows correct operation, testing, and maintenance. Preoperational testing verifies that piping design features accommodate check valve testing requirements. Tests also verify disk movement to and from the seat and determine, without disassembly, that the valve disk positions correctly, fully opens or fully closes as expected, and remains stable in the open position under the full spectrum of system design-basis fluid flow conditions. Additional information on leak rate testing is provided in Section 6.2.6.

A list of check valves included in the IST program is provided in Table 3.9.6-2.

3.9.6.3.4 Pressure Isolation Valve Leak Testing

Pressure isolation valves (PIV) are the two normally closed valves, in series, within the RCPB that isolate the RCS from an attached low-pressure system. PIVs are classified as A or A/C in accordance with the provisions of Subsection ISTC-1300 of Reference 2. PIV seat leakage rate tests are conducted in accordance with Subsection ISTC-3630, which specifies a PIV leakage limit of 0.5 gpm per inch of nominal valve diameter up to 5 gpm maximum for each PIV. PIV leakage tests are described further in the Technical Specifications.

A list of PIVs included in the IST program is provided in Table 3.9.6-2.

3.9.6.3.5 Containment Isolation Valve Leak Testing

CIVs are leak tested in accordance with 10 CFR 50, Appendix J. Additional information on CIVs is provided in Sections 6.2.4 and 6.2.6.

A list of CIVs included in the IST program is provided in Table 3.9.6-2. Section 6.2.4 also contains a list of CIVs.

3.9.6.3.6 Inservice Testing Program for Safety and Relief Valves

Safety and relief valves protect systems that are required to provide a safety function. Stroke tests are performed for dual-function safety and relief valves. Safety and relief valve tests are conducted in accordance with Appendix I to Reference 2. Power-operated relief valves subject to the IST program are tested in accordance with Subsection ISTC-5100 for Category B valves and Subsection ISTC-5240 for Category C valves. Using test equipment, including gages, transducers, load cells, and calibration standards, to determine valve set-pressure is acceptable if the overall combined accuracy does not exceed ±one percent of the indicated (measured) set pressure.

A list of safety and relief valves included in the IST program is provided in Table 3.9.6-2.

3.9.6.3.7 Inservice Testing Program for Manually Operated Valves

Manual valves are exercised at least every two years. Exercise of a manual valve includes a complete cycle from fully open to fully closed.

A list of manual valves included in the IST program is provided in Table 3.9.6-2.

3.9.6.3.8 Inservice Testing Program for Explosively Actuated Valves

The U.S. EPR does not use explosively actuated valves.

3.9.6.4 Inservice Testing Program for Dynamic Restraints

Safety-related systems inside and outside of containment may experience dynamic effects under various accident conditions, including seismic events and DBAs. Snubbers are attached to these systems to reduce these dynamic effects in areas where rigid supports are unacceptable. As noted in Section 6.6 of Reference 6, snubber supports for piping systems allow free thermal movements, while restraining movements due to dynamic loadings.

Snubbers are designed to meet the requirements of Reference 2. The criteria for the size and location of the snubbers are further described in Section 6.6 of Reference 6, which also identifies the type of information to be provided in the design specification, as well as the design and analysis considerations that enable the snubbers to activate correctly for their design loadings. For example, snubber lockup velocity is designed so that the snubber does not lock up under routine static and thermal loading. Section 3.9.2 addresses dynamic testing and analysis of safety-related pumps, valves, and dynamic restraints. The IST program for snubbers complies with all these provisions, including the guidance provided by RG 1.192.

and dynamic restraints. The IST program for snubbers complies with all these provisions, including the guidance provided by RG 1.192.

A COL applicant that references the U.S. EPR design certification will provide a table identifying the safety-related systems and components that use snubbers in their support systems, including the number of snubbers, type (hydraulic or mechanical), applicable standard, and function (shock, vibration, or dual-purpose snubber). For snubbers identified as either a dual-purpose or vibration arrester type, the COL applicant shall indicate whether the snubber or component was evaluated for fatigue strength. Per the ASME Code, Section III, Subsection NF, fatigue evaluation is not required for shock snubbers.

Snubbers are procured components and specific snubber suppliers are selected in accordance with the COL applicant's approved quality assurance program, established in accordance with 10 CFR 50, Appendix B. Records of supplier information are maintained in the COL applicant's record management system.

3.9.6.4.1 Snubber Installation

The snubber supplier provides manufacturer recommendations for snubber installation. These recommendations include operating requirements (e.g., operation in compression or retraction modes), accommodation of vertical movement, and the designated first natural frequency (a specific Hertz value). Snubbers are installed using the manufacturer recommendations and installation instructions, which provide guidance on the storage, handling, installation, and adjustments of each of the required snubbers. The installation instructions contain the snubber settings for hot and cold conditions, as well as additional location-specific information that may be needed for the installation. Installation drawings provide the location of the snubber and the orientation on the pipe, or the relationship to an associated component. The pipe support design specification requires that hydraulic snubbers be equipped with a level indicator for observation of fluid level in the snubber.

The final installation of the snubber is an iterative process. The snubber's spring constant specified by the snubber supplier for a given load capacity is compared against the spring constant from the piping system model. Other pipe support components (e.g., pipe clamp, pipe extensions) and the auxiliary structural steel stiffness values are considered in the model and structural analysis. If the snubber location and support direction are confirmed and the spring constants are the same, then installation can proceed. If the spring constants do not agree, additional analysis is required to confirm the snubber load requirements. This iteration continues until the snubber load capacities and spring constants are reconciled.

The U.S. EPR design incorporates provisions that allow ready access for maintenance, inspection, and testing of components. The correct installation and operation of

3.9.6.4.2 Snubber Examination and Testing Program

Snubber PST and IST are performed in accordance with the ASME OM Code Subsection ISTD (Reference 2). The overall PST and IST intervals are as defined in the administrative requirements (in Subsection ISTA) of the code. The specific examination and testing intervals are in accordance with Subsection ISTD, as described below.

Visual Examination

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Snubbers are visually examined to identify impaired function caused by physical damage, leakage, corrosion, or degradation from environmental exposure or operating conditions. External features that may affect operability are also examined. Visual inspections are conducted in accordance with the requirements of the ASME Code, Section XI (Reference 7) for VT-3 examinations. A maintenance inspection checklist is used to describe the examination requirements. The intervals for visual examination are in accordance with NRC-accepted Code Case OMN-13 (RG 1.192).

Snubber examination requirements include the following:

- The snubber load, rating, location, orientation, position setting, and configuration (e.g., attachments and extensions) are in accordance with design drawings and specifications.
- Installation records (based on physical examinations) provide verification that the snubbers are installed according to the design drawings and their specifications meet the requirements.
- Adequate swing clearance is provided to allow snubber movement.
- Testing systems used for functional testing of snubbers determine compression loads and spring/hydraulic conditions.

Functional Testing

Preservice functional testing is performed on snubbers prior to initial plant operation. This testing may be performed at the manufacturer's facility. Inservice functional testing is performed over the test plan intervals specified in Reference 2. Snubbers are tested in their installed location or removed and bench tested. Snubbers are tested in their as-found condition and the test parameters are selected so that the snubbers are tested to the fullest extent practicable.

Functional tests for snubbers are performed to verify the following:

- Activation is within the specified range of velocity or acceleration in tension and in compression.

- Activation is within the specified range of velocity or acceleration in tension and in compression.
- Release rate, when applicable, is within the specified range in tension and in compression. Snubbers specifically required not to displace under continuous load withstand load without displacement.
- For mechanical snubbers, the drag force is within specified limits in tension and in compression.
- For hydraulic snubbers, the drag force is within specified limits in tension and in compression (if required to verify correct assembly).

Unacceptable Snubbers

Generic Letter 90-09 (Reference 8) states that a snubber is considered unacceptable if it fails the acceptance criteria of the visual inspection. For an unacceptable snubber, an engineering evaluation determines if the snubber has adversely affected components in the system to which it is attached. Unacceptable snubbers will be adjusted, repaired, modified, or replaced and then retested.

Repair or Replacement of Snubbers

Snubbers that are maintained or repaired by removing or adjusting a snubber part that can affect the results of tests are examined and tested in accordance with the applicable code requirements before being returned to service.

Service Life Monitoring

The service of snubbers is evaluated at least once each fuel cycle, and increased or decreased if warranted. This evaluation is based on technical data from representative snubbers that have been in service in the plant or on other information related to service life. If the evaluation indicates that service life will be exceeded before the next scheduled system or plant outage, then one of the following actions occurs:

- The snubber is replaced.
- The snubber is reconditioned.
- A technical justification is documented for extending the service life.

3.9.6.5 Relief Requests and Alternative Authorizations to the OM Code

If it is determined that compliance with the requirements of the ASME OM Code (Reference 2) is impractical, relief is requested from the code in accordance with 10 CFR 50.55a. These relief requests identify the applicable code requirements, justify the relief request, and provide alternate testing methods.

3.9.6.6 References

1. ASME Boiler and Pressure Vessel Code, Section III, "Rules for Construction of Nuclear Power Plant Components," The American Society of Mechanical Engineers, 2004 edition.

2. ASME OM Code, "Code for Operation and Maintenance of Nuclear Power Plants," The American Society of Mechanical Engineers, 2004 edition.

3. NUREG-1482, Revision 1, "Guidelines for Inservice Testing at Nuclear Power Plants," U.S. Nuclear Regulatory Commission, January 2005.

4. Generic Letter 96-05, "Periodic Verification of Design Basis Capability of Safety-Related Motor-Operated Valves," U.S. Nuclear Regulatory Commission, September 18, 1996.

5. Generic Letter 89-10, "Safety-Related Motor-Operated Valve testing and Surveillance," U.S. Nuclear Regulatory Commission, June 28, 1989.

6. ANP-10264NP-A, Revision 0, "U.S. EPR Piping Analysis and Pipe Support Design Topical Report," AREVA NP Inc., November 2008.

7. ASME Boiler and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," The American Society of Mechanical Engineers, 2004 edition.

8. Generic Letter 90-09, "Alternative Requirements for Snubber Visual Inspection Intervals and Corrective Actions," U.S. Nuclear Regulatory Commission, May 14, 1990.

9. MPR-2524-A, "Joint Owners Group (JOG) Motor Operated Valve Periodic Verification Program Summary," MPR Associates, November 2006.

10. Regulatory Issue Summary 2000-03, "Resolution of Generic Safety Issue 158: Performance of Safety-Related Power-Operated Valves Under Design Basis Conditions," March 15, 2000.

11. Joint Owners Group Air Operated Valve Program Document, Revision 1, December 13, 2000.

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Table 3.9.6-2—Inservice Valve Testing Program Requirements
Sheet 1 of 91

Valve Identification Number[1]	Description/ Valve Function	Valve Type[2]	Valve Actuator[3]	ASME Code Class[4]	ASME OM Code Category[5]	Active / Passive[6]	Safety Position[7]	Test Required[8,10]	Test Frequency[9]	Comments
30FAK10AA001	FPC to SFP Isolation	GT	MO	3	B	A	O/C	ET ST PI	Q Q 2Y	
30FAK10AA004	FPC to SFP Isolation Bypass	GB	MA	3	B	A	O/C	ET PI	Q 2Y	
30FAK11AA001	FPC Pump, 30FAK11AP001, suction isolation	GT	MA	3	B	P	O	PI	2Y	
30FAK12AA001	FPC Pump, 30FAK12AP001, suction isolation	GT	MA	3	B	P	O	PI	2Y	
30FAK11AA002	FPC Pump, 30FAK11AP001 discharge check	CK	SA	3	C	A	O	ET	Q	
30FAK11AA003	FPC Pump, 30FAK11AP001 discharge isolation	GT	MA	3	B	P	O	PI	2Y	
30FAK12AA002	FPC Pump, 30FAK12AP001 discharge check	CK	SA	3	C	A	O	ET	Q	
30FAK12AA003	FPC Pump, 30FAK12AP001 discharge isolation	GT	MA	3	B	P	O	PI	2Y	

8. Required tests per ASME OM Code 2004, Subsection ISTC-3000:

   A. LT – Leakage test per Table ISTC-3500-1 and ISTC-3600.

   B. ET – Exercise test per Table ISTC-3500-1 and ISTC-3510, nominally every three months.

   C. PI – Position indication verification per Table ISTC-3500-1 and ISTC-3700.

   D. ST – Stroke time test per ISTC-5000 (in conjunction with exercise test).

9. Test frequencies abbreviations per NUREG-1482, Revision 1:

   A. Q – Test performed once every 92 days.

   B. CS – Test performed during cold shutdown, but not more frequently than once every 92 days.

   C. RF – Test performed each refueling outage.

   D. 2Y – Test performed once every two years.

   E. 5Y – Test performed once every five years (per ASME OM, ISTC-3540).

   F. RV – Test relief valve at OM schedule.

10. The switch for a fail-safe valve functions by interrupting (de-energizing) the electrical or pneumatic actuating force for the valve whenever the switch is moved to the fail-safe position. Therefore, this normal valve operation demonstrates the valve's fail-safe capability, which is verified during valve exercise testing by remote position indication. Since a successful exercise test satisfies a valve's fail-safe testing requirements, a separate test for fail-safe capability is not required and is not specified in this table.

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Next File

Table 5.2-1—ASME Code Cases

Code Case Number	Title
N-60-5	Material for Core Support Structures Section III, Division 1
N-71-18	Additional Materials for Subsection NF, Class 1, 2, 3, and MC Supports Fabricated by Welding, Section III, Division 1
N-284-1 [1]	Metal Containment Shell Buckling Design Methods, Section III, Division 1, Class MC
N-319-3	Alternate Procedure for Evaluation of Stresses in Butt Welding Elbows in Class 1 Piping, Section III, Division 1
N-729-1	Alternative Examination Requirements for PWR Reactor Vessel Upper Heads with Nozzles Having Pressure-Retaining, Partial-Penetration Welds
OMN-1, Revision 0 [2]	Alternative Rules for Preservice and Inservice Testing of Active Electric Motor-Operated Valve Assemblies in Light-Water Reactor Power Plants
OMN-13, Revision 0 [2]	Requirements for Extending Snubber Inservice Visual Examination Interval at LWR Power Plants

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03.09.06-11

NOTES:

1. See Section 3.8 for use.
2. See Section 3.9.6 for use.

03.09.06-6 and 03.09.06-11