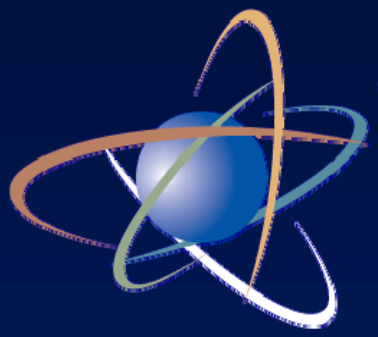

Issues – Use of ASME OM Codes and Code Cases
&
OEs- Steam Generator Snubbers

December 9-10, 2019

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Division of Engineering and External Hazards

Office of Nuclear Reactor Regulation

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Topics for Discussion

- Use of ASME Code Cases and Alternative Request
- Inservice Examination and Testing of Snubbers - ASME BPV Code, Section XI or ASME OM Code
- Use of OM Code Case OMN-13
- Compensating Struts - ASME OM Code
- Comanche Peak Nuclear Power Plant – Steam Generator (SG) Snubber Leakage
- Armenian Nuclear Power Plant (NPP) Unit 2, Hydraulic SG Snubber Leakage

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Use of OM Code Cases and Alternative Request

Background

- NRC staff observed that various ASME OM Code Cases, applicability (edition and addenda) do not match with the various Editions or Addenda of the ASME OM Code in which they are published.

- NRC staff also observed that some of the plants, while updating snubber program with 10-year ISI or IST update, do not update their OM Code Cases, as required by 10 CFR 50.55a(b)(6)(i).

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Use of OM Code Cases and Alternative Request (cont.)

Regulation

- Regulatory Guide (RG) 1,192, Revision 2 approves OM Code Cases for use without or with conditions.
- 10 CFR 50.55a(b)(6) states that licensees may apply the ASME OM Code Cases listed in NRC RG 1.192 as incorporated by reference in 10 CFR 50.55a(a)(3)(iii), without prior NRC approval.
- Currently, 10 CFR 50.55a endorses RG 1.192, Rev.2.

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Use of OM Code Cases and Alternative Request (cont.)

Description:

- RG 1.192, Rev. 2 approved OM Code Cases, where their applicability in the ASME OM Code editions and addenda do not match with the ASME OM Code -2012 incorporated by reference in 10 CFR 50.55a, are listed in table (next slide).

- The table (next slide) is only applicable when licensee is using listed Code Cases with the OM Code-2012.

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Use of OM Code Cases and Alternative Request (cont.)

ASME OM Code Case	Code Case Applicability ASME/ANSI or ASME OM Code	OM Code Edition	Code Case Approved in RG 1.192, Rev-2 (Yes/No)	Relief or Alternative Request required to Use Code Case with OM-2012 (Yes/No)
OMN-6 (Pump)	ASME OM Code-1990 through OMa-2005 Addenda,	2012	Yes	Yes
OMN-8 (POV)	ASME/ANSI OMa-1988, Part 10, para. 4.2 through ISTC-5100, 5100, OM-2004	2012	Yes	Yes
OMN-16, Rev-1 (Pump)	ASME OM Code-1998 through OMa-2011 Addenda	2012	Yes with condition	Yes
OMN-17, (PRV)	ASME OM Code-1995 through OMa-2006 Addenda	2012	Yes	Yes

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Use of OM Code Cases and Alternative Request (cont.)

ASME OM Code Case	Code Case Applicability ASME/ANSI or ASME OM Code	OM Code Edition	Code Case Approved in RG 1.192, Rev-2 (Yes/No)	Relief or Alternative Request Required to Use Code Case with OM-2012 (Yes/No)
OMN-19, (Pump)	ASME OM Code-1994 through OM Code -2009	2012	Yes with condition	Yes
OMN-13, Rev-2 (Snubber)	ASME OM Code-1995 through OMa-2011 Addenda	2012	Yes	Yes
OMN-15, Rev-2 (Snubber)	ASME OM Code-1998 through OMa-2011 Addenda	2012	Yes	Yes

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Use of ASME OM Code Cases and Alternative Request (cont.)

Description of Code Cases listed in Table:

- Code Case OMN-6, "Alternate Rules for Digital Instruments."
- Code Case OMN-8, "Alternative Rules for Preservice and Inservice Testing of Power-Operated Valves That Are Used for System Control and Have a Safety Function Per OM-10, ISTC-1.1, or ISTA-1100."
- Code Case OMN-13, Revision 2, "Performance-Based Requirements for Extending Snubber Inservice Visual Examination Interval at LWR Power Plants."
- Code Case OMN-15, Revision 2, "Performance-Based Requirements for Extending the Snubber Operational Readiness Testing Interval at LWR Power Plants."
- Code Case OMN-16, Revision 1, "Use of a Pump Curve for Testing."
- Code Case OMN-17, "Alternative Rules for Testing ASME Class 1 Pressure Relief/Safety Valves."
- Code Case OMN-19, "Alternative Upper Limit for the Comprehensive Pump Test."

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Use of ASME OM Code Cases and Alternative Request

NRC Recommendation:

- Relief or Alternative Request (related to OM Code or Code Case) approved for the current 10-year ISI or IST interval, cannot be used for the subsequent ISI or IST 10-year interval. The licensee must submit new relief or alternative request for NRC approval.
- If the applicable edition and addenda of an OM Code Case approved by RG 1.192 as incorporated by reference in 10 CFR 50.55a and addenda of the snubber program or IST/ISI Program, the licensee must submit relief or alternative request to use the Code Case.
- While updating snubber program with 10-year ISI or IST Interval, the licensee must also update the OM Code Cases (if continue to use Code Cases) as required by 10 CFR 50.55a(b)(6)(i).

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Inservice Examination and Testing of Snubbers – ASME BPV Code, Section XI or ASME OM Code

Background

- ASME BPV Code, Section XI, 2005 Addenda and earlier Editions contained the snubber inservice examination and testing requirements.
- ASME BPV Code, Section XI, 2006 addenda through the latest editions do not contain the snubber inservice and testing requirements.
- ASME OM Code, 1995 Edition through the latest Editions contain the snubber inservice and testing requirements.

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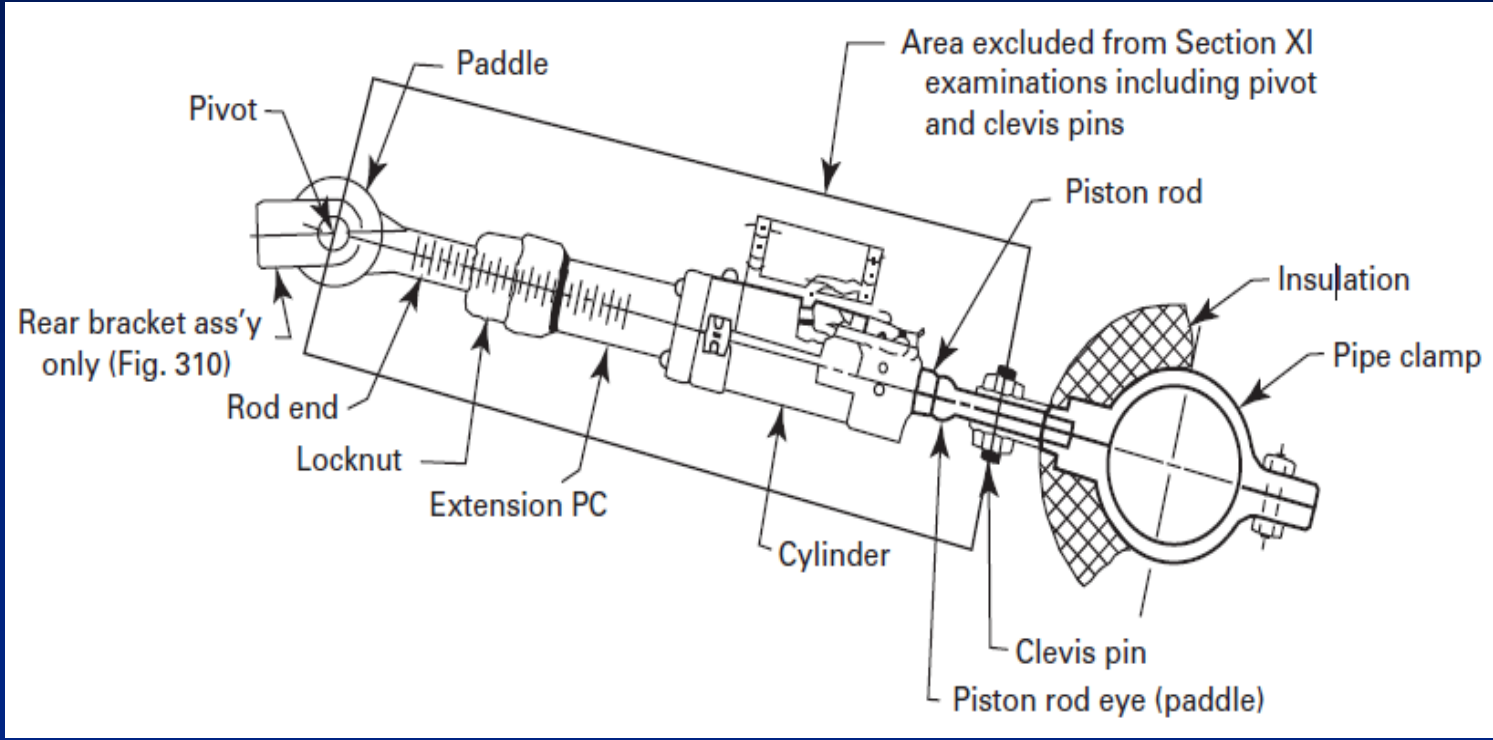
Boundary between Snubber (pin-to-pin) and support structure Figure 1300-1(f), ASME Section XI, 2006 Addenda and later Edition



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Inservice Examination and Testing of Snubbers - ASME BPV Code, Section XI or ASME OM Code

Regulation:

- 10 CFR 50.55a(g) states, in part, that ISI of components (including supports) which are classified as ASME Code Class 1, Class 2, and Class 3 must meet the requirements, set forth in Section XI of editions and addenda of the ASME BPV Code (or ASME OM Code for snubbers).
- 10 CFR 50.55a(b)(3)(v)(A) for snubber states, in part, that licensees may use ASME OM Code, 1995 Editions through the latest edition incorporated by reference in place of the requirements for snubbers in the editions and addenda up to the 2005 addenda of the ASME BPV Code Section XI.
- 10 CFR 50.55a(b)(3)(v)(B) for snubber states, in part, that licensees must comply with the provisions for examining and testing snubbers in Subsection ISTD of the ASME OM Code when using the 2006 Addenda and later editions of Section XI of the ASME BPV Code.

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Inservice Examination and Testing of Snubbers – ASME BPV Code, Section XI or ASME OM Code

NRC Recommendation

- If plant's "Code of Record" for ISI interval is ASME Section XI, 2006 Addenda or later, the licensee must use the applicable edition of the ASME OM Code for developing its snubber program.
- The regulation requires that snubber program should be updated and aligned with the plant's 10-year ISI interval.
- While using ASME OM Code, many licensees have aligned their snubber program with 10-year IST program. NUREG-1482 describes method to align the snubber program with IST program.
-
- Snubber program alignment with ISI or IST 10-year interval should be clearly specified in the snubber program, along with start and end dates.

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Inservice Examination and Testing of Snubbers – ASME BPV Code, Section XI or ASME OM Code

- Snubber Program alignment with IST 10-year interval in lieu of the ISI 10-year interval should be carefully evaluated, and any extension beyond the requirements of ISTA-3120 or IWA-2430, must be submitted as relief request to NRC for approval before implementation.
- Snubber Program plan and its 10-year update must be submitted to NRC as required by ISTA-3200.
- While using ASME OM Code for inservice examination and testing of snubber (pin-to-pin), the examination of support structure, and attachments must be performed by use of ASME BPV Code, Section XI as described in Figure 1300-1(f).

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Use of Code Case OMN-13

Background:

- NRC staff learned that while implementing Code Case OMN-13, some plants are not keeping records of their failures of snubbers examination and failures (maintenance, snubber replacement, water hammer event, reservoir fluid level low, and service life monitoring) during the 10 year extension.
- NRC staff also learned that some plants are continuing to use OMN-13 in the subsequent interval without updating to the OMN-13 (current applicable Revision), and without any document or record showing that they meet the failure requirements of the Table ISTD-4252-1 specified in Section 2(b).

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Use of Code Case OMN-13 (cont.)

Discussion:

- OMN-13, Revision 0 and Revision 2, Section 2(b), states that the requirements of this Code Case shall be implemented after the requirements of paragraphs. ISTD-4251 and ISTD-4252 have been satisfied and the previous examination per Table ISTD-4252-1 was performed at a maximum interval of two fuel cycles.
- OMN-13, Revision 0 and 2, Section 3.7(a) states that all snubbers within the scope of Subsection ISTD shall be examined and evaluated per this Code Case at least once every 10 years.

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Use of Code Case OMN-13 (cont.)

Discussion (cont.):

- OMN-13, Revision 2 , Section 3.7(b), states, in part, that
  - If at any time during an examination interval the cumulative number of unacceptable snubbers exceeds the applicable value from Column B in Table ISTD-4252-1, the current examination interval shall end, and all remaining examinations must be completed within the current fuel cycle.

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Use of Code Case OMN-13 (cont.)

Discussion (cont.):

- Example of Cumulative number of unacceptable failures during 10 years extension:
  - Examination Failures = A
  - Failures during Maintenance = B
  - Failures during SLM =C
  - Failures during Walkdown =D
  - Failures due to low fluid level =E
- If total number of cumulative of unacceptable snubbers (A+B+C+D+E) exceeds the applicable value from Column B in Table ISTD-4252-1, the current examination interval shall end.

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Use of Code Case OMN-13 (cont.)

NRC Recommendation:

- While using OMN-13, if any at time during the 10 year extension, the cumulative number of examination failures exceed the number of failures are specified in Table ISTD-4252-1, the use of the Code Case must end.

- While using OMN-13, the General Requirements Section 2(b) must be meet for two fuel cycles (48 months) and continue to meet the examination failures requirements as specified in Table ISTD-4252-1.

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Use of Code Case OMN-13 (cont.)

NRC Recommendation (cont.):

- While using OMN-13, and after completing extension 10 years allowed by OMN-13, if licensee wants to continue to use Code Case in the subsequent 10-year ISI/IST interval, the plant must document that all cumulative examination failures (in previous 10 year extension) satisfy the total number failures requirement of Table ISTD-4252-1.

- To clarify the above details, ASME OM Code, Subcommittee ISTD, should add clarification in the Code Case OMN-13 or develop a OMN-13, Non-mandatory Appendix containing "Example Scenarios."

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Compensating Struts – ASME OM Code

Background:

- The term “Compensating Strut” is a proprietary trade name which is often used generically to address a type of snubber that locks completely and does not allow displacement under load.
- Compensating struts are being used to support the piping systems and equipment during earthquake and various abnormal dynamic or transient loads at some nuclear power plants.
- ASME OM Code, Subsection ISTD does not address compensating struts as a separate devices since ASME considers that compensating struts are a category of mechanical snubbers without defining it in the OM Code or any other ASME Code.

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Compensating Struts – ASME OM Code (cont.)

Following are commonly understood definitions of mechanical snubbers and compensating struts for clarification (not provided in ASME OM Code):

- Mechanical Snubber – An acceleration sensitive device which provides restraint to a component or system during a sudden application of abnormal forces but allows free motion during normal thermal movement. Acceleration is maintained at the design threshold without locking, hence the mechanical snubber will not become locked in a fixed position by a sustained, uninterrupted force.

- Compensating Strut – An acceleration sensitive device which provides restraint to a component or system during a sudden application of abnormal forces but allows free motion during normal thermal movement. When the predetermined threshold acceleration is exceeded, the compensating strut locks up becoming a rigid restraint and allows no further free motion until the applied force drops to or near zero.

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Compensating Struts – ASME OM Code (cont.)

NRC Recommendations:

- All the regulatory requirements of 10 CFR 50.55a and ASME OM Code are applicable to the inservice examination and testing of compensating struts.

- Licensees shall include inservice examination and testing of plants' compensating struts in their snubber program.

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Comanche Peak – Non-Cited Violation Unit 2 SG Snubber Leakage

Reference:

- NRC – Inspection Report - Non-Cited violation related to steam generator snubbers leaking and their Operability Determination and Functionality Assessments at Comanche Peak Nuclear Power Plant (ADAMS Accession No. ML17300B401).

Background:

- Comanche Peak Nuclear Power Plant (Comanche Peak) Unit 2 committed to ASME OM Code Subsection ISTD for snubber inservice examination and testing.

- During NRC Inspection activities between July 1 and September 30, 2017, One of the findings was repetitive and related to Comanche Peak Unit 2 loop 3 steam generator hydraulic snubber's low level fluid in its reservoir.

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Comanche Peak – Non-Cited Violation
Unit 2 SG Snubber Leakage (cont.)

Findings:

- NRC inspector identified a finding of low safety significant and associated Non-Cited Violation (NCV) of 10 CFR Part 50, Appendix B, Criteria XVI, “Corrective Action,” associated with the licensee’s failure to take timely corrective actions for a condition adverse to quality.
- Licensee failed to take corrective actions multiple times for a repetitive leak in the hydraulic snubbers for the Unit 2, loop 3 steam generator, resulting in level in the hydraulic fluid reservoir going below the minimum level in the slight glass on multiple occasions.

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Comanche Peak – Non-Cited Violation
Unit 2 SG Snubber Leakage (cont.)

Description:

- On March 9, 2017, the licensee discovered that Unit 2 steam generator 2-03 upper hydraulic snubber oil reservoir oil level was low.
- The licensee documented this deficiency in CR-2017-003019 and closed this CR after completion of a work order to fill reservoir.
- The licensee continue operation that the Unit 2 loop 3 steam generator snubber was no longer required. The licensee referenced a letter issued by Westinghouse in 2007 following a leak from Unit 2 loop 4 steam generator snubbers.

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Comanche Peak – Non-Cited Violation
Unit 2 SG Snubber Leakage (cont.)

Description (cont.):

- The Westinghouse 2007 letter stated that Unit 2 could be operated for the remainder of the cycle but the licensee needed to perform a detailed analysis to support this. The letter also stated that an analysis could likely be performed to justify removal of the Unit 2 snubbers, based on an analysis that was performed for the replacement of Unit 1 steam generators.
- Although the Westinghouse letter had only documented acceptability for the existing cycle (2007), the licensee began using this letter as a justification for operability for snubber oil leaks well past that time frame, and did not perform an analysis to justify continued operation with degraded SG snubbers.

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Comanche Peak – Non-Cited Violation
Unit 2 SG Snubber Leakage (cont.)

Description (cont.):

- In an operability evaluation prior to 2014, the licensee had only justified continued operation with a degraded snubber until the oil could be refilled.
- Starting 2014, the licensee began stating in their operability evaluations that the steam generators were operable because the snubbers were not required. Although 2007 Westinghouse letter only concluded that an analysis to justify removing the snubbers could be performed, the licensee considered the ability to potentially perform the analysis as equivalent to having an analysis, without performing the analysis.

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Comanche Peak – Non-Cited Violation
Unit 2 SG Snubber Leakage (cont.)

Description (cont.):

- On May 10, 2017, Unit 2 was restarted with low fluid level with no action taken to correct the condition.
- On May 30, 2017, the licensee discovered that the reservoir was empty, documented this in CR-2017-006871, and closed this CR with no additional action based on continuing assumption that the snubber was not required, and the low reservoir level was not required to be corrected.
- While closing CR-2017-006871, the licensee did not perform the detailed evaluation to support operating with the degraded snubber as required by Westinghouse in their 2007 letter.

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Comanche Peak – Non-Cited Violation
Unit 2 SG Snubber Leakage (cont.)

Description (cont.):

- NRC Inspector also discovered that a prior instance of an empty reservoir had existed in 2014, and had not been corrected until 2015. The inspectors discussed this issue with the licensee and questioned the operability of the steam generator with degraded snubbers.
- On June 17, 2017, following repeated questions from NRC inspector, the licensee completed the work order to fill the snubber reservoir, the licensee generated CR-2017-009071 documenting that snubbers were leaking and that it was a degraded condition and requiring corrective action.

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Comanche Peak – Non-Cited Violation
Unit 2 SG Snubber Leakage (cont.)

Analysis:

- The licensee failed to take corrective actions for a leak in the SG hydraulic snubbers, resulting in the fluid level reservoir going below the minimum level on multiple occasions.
- The licensee's failure to take timely and adequate corrective actions to correct a condition adverse to quality was a performance deficiency.
- The NRC Inspector also determined that the licensee did not perform the detailed evaluation to support operating with the degraded Unit 2 snubber as proposed by Westinghouse 2007 letter for Unit 1.

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Armenian NPP Unit 2- SG Snubber Leakage

Reference:

- Armenian Nuclear Power Plant (NPP) Unit 2, Leaking Hydraulic Steam Generator (SG) Snubber caused a plant shutdown – Presentation by Armenian NPP at International Atomic Energy Agency (IAEA), Vienna, Austria, October 08-11, 2018.

Background:

- On 3/25/2018, operators at Armenian NPP Unit 2 received an alarm for low oil level in the steam generator (SG) hydraulic snubber (HS-6/6) on the primary circuit.
- Initial inspection of SG snubber did not identify any visible damage and obvious leakage of oil from the SG snubber and its tank (reservoir), but oil was added into the snubber HS-6/6 tank (reservoir) .

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Armenian NPP Unit 2- SG Snubber Leakage

Background (cont.):

- Additional visual inspection of snubber HS-6/6, about an hour later, revealed oil leakage along the piston of the snubber at a rate of about one drop per 4 seconds (15 drops per minute).
- Unit 2 was shutdown for about 67 hours to complete the repair of SG snubber.

Findings:

- The cause of the hydraulic oil leak in HS-6/6 snubber was determined to be premature degradation of the O-ring installed in 2017.
- Degradation of O-ring appeared to be the result of poor quality of rubber material used in the O-ring provided by vendor.

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Armenian NPP Unit 2- SG Snubber Leakage (cont.)

Corrective Action:

- The licensee replaced all HS-6/6 SG hydraulic snubber rubber O-rings.
- The licensee checked selectively the condition of rubber O-rings in the rest of the 5 SG hydraulic snubbers which were repaired in 2017 outage.
- The licensee is working with the vendor to determine likely causes of the premature embrittlement of the O-ring material.

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Conclusions

- Licensees who believe that some of the items discussed are applicable to their facilities may wish to review their current snubber program and modify their program as appropriate.

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Questions?

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