UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 10, 2009

Mr. David A. Heacock
President and Chief Nuclear Officer
Virginia Electric and Power Company
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

SUBJECT: NORTH ANNA POWER STATION, UNIT NO. 1, FOURTH 10-YEAR INSERVICE INSPECTION AND TESTING INTERVAL FOR SNUBBER VISUAL EXAMINATION AND FUNCTIONAL TESTING, RELIEF CS-001 (TAC NO. MD9957)

Dear Mr. Heacock:

By letter dated October 7, 2008, Virginia Electric and Power Company (the licensee) requested relief from certain requirements of Section XI of the American Society of Mechanical Engineers, *Boiler and Pressure Vessel Code* (ASME Code), under the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a for the fourth 10-year inservice inspection (ISI) interval for North Anna Power Station, Unit No. 1 (NAPS 1). The licensee provided supplemental information, Revision 1 to CS-001, by letter dated February 18, 2009. Specifically, the licensee proposed an alternative in relief request CS-001 for snubber visual examination and functional testing requirements.

The Nuclear Regulatory Commission (NRC) staff finds that the proposed alternative to use Technical Requirements Manual (TRM), Section 3.7.5, "Snubbers," for snubber visual inspection and functional testing provides an acceptable level of quality and safety. Therefore, the NRC staff authorizes the requested relief pursuant to 10 CFR 50.55a(a)(3)(i) for the fourth 10-year ISI interval scheduled to commence on May 1, 2009, and completed by April 30, 2019.

All other requirements of the ASME Code, Section XI for which relief has not been specifically requested remain applicable, including a third-party review by the Authorized Nuclear Inservice Inspector. If you have any questions concerning this matter, please contact John F. Stang, at (301) 415-1345.

Sincerely,

Melanie C. Wong, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-338

Enclosure: Safety Evaluation

cc w/encl: Distribution via Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

FOURTH 10-YEAR INSERVICE INSPECTION INTERVAL PROGRAM

RELIEF CS-001 FOR

SNUBBER VISUAL EXAMINATION AND FUNCTIONAL TESTING

NORTH ANNA POWER STATION, UNIT NO. 1

VIRGINIA ELECTRIC AND POWER COMPANY

DOCKET NO. 50-338

1.0 INTRODUCTION

By letter dated October 7, 2008, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML082880160) Virginia Electric and Power Company (the licensee), submitted Relief Request CS-001 for its fourth 10-year inservice inspection (ISI) interval for snubber visual examination and functional testing at North Anna Power Station Unit 1 (NAPS 1). In response to the Nuclear Regulatory Commission (NRC) staff's request for additional information (RAI), the licensee revised the relief request, as submitted in its letter dated February 18, 2009 (ADAMS Accession No. ML090490761). The licensee requested relief from certain ISI and examination requirements of the American Society of Mechanical Engineers, *Boiler and Pressure Vessel Code* (ASME Code), Section XI, Code 2004 Edition, Article IWF-5000, which references ASME/American Nuclear Standards Institute (ANSI),*Operation and Maintenance of Nuclear Power Plants* (OM), Part 4 (OM-4), 1987 Edition with OMa-1988 Addenda.

The NRC staff has evaluated the licensee's Relief Request CS-001 and determined that the proposed alternative to use Technical Requirements Manual (TRM), Section 3.7.5, "Snubbers," for snubber visual inspection and functional testing provides an acceptable level of quality and safety. Therefore, the NRC staff authorizes the requested relief pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a(a)(3)(i) for the fourth 10-year ISI interval scheduled to commence on May 1, 2009, and completed by April 30, 2019.

2.0 REGULATORY REQUIREMENTS

Section 50.55a(g) of 10 CFR requires that an inservice inspection (ISI) of ASME Code Class 1, 2, and 3 components be performed in accordance with Section XI of the ASME Code and applicable addenda, except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). According to 10 CFR 50.55a(a)(3), alternatives to the requirements of paragraph 50.55a(g) may be used, when authorized by the NRC, if an applicant

Enclosure

demonstrates that the proposed alternatives would provide an acceptable level of quality and safety or if the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection (ISI) of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that ISI of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval subject to the limitations and modifications listed in paragraph (b) of this section. The ISI Code of Record for the fourth 10-year inservice inspection interval of NAPS 1 is the 2004 Edition of the ASME Code, Section XI.

3.0 TECHNICAL EVALUATION

3.1 Relief Request CS-001, Revision 1

3.1.1 Component for Which Relief is Requested

All NAPS 1 safety-related ASME Code Class 1, 2 and 3 snubbers.

3.1.2 Code Requirements

The ASME Code Section XI, paragraph IWF-1220, Snubber Inspection Requirements, requires that the inservice inspection requirements for snubbers be in accordance with the requirements of Article IWF-5000.

The Article IWF-5000 provides inservice inspection requirements for snubbers.

Paragraphs IWF-5200(a) and IWF-5300(a) require that snubber preservice and inservice examinations be performed in accordance with OM-4, using the VT-3 visual examination method described in IWA-2213.

Paragraphs IWF-5200(b) and IWF-5300(b) require that snubber preservice and inservice tests be performed in accordance with OM-4.

3.1.3 Licensee's Proposed Alternative

The licensee proposes to use NAPS 1, TRM Section 3.7.5, "Snubbers," to perform visual examinations and functional testing of ASME Code Class 1, 2 and 3 snubbers in lieu of meeting ASME Code, Section XI requirements.

3.1.4 Licensee's Basis for Requesting Relief (as stated)

NAPS 1, TRM Section 3.7.5, "Snubbers," contains specifically developed and approved visual inspection and functional testing requirements for the snubbers at NAPS 1.

Currently, the snubber examination and testing program is contained in the NAPS 1 TRM. The existing TRM test and examination requirements meet the intent of the OM-4 Code and provide an acceptable level of quality and safety. Integration of ASME Code Section XI and OM-4 into an effective coherent examination and testing program along with associated required changes to the TRM would require a significant amount of administrative activity (e.g., administrative procedure changes, reconciliation of ASME Code requirement differences, technical procedure changes, etc.). These actions are considered a hardship given there is no commensurate increase in safety due to such integration.

A second alternative approach to implement these requirements for examination and testing would be to revise the TRM to reference the appropriate paragraphs of OM-4. Many of the requirements that would require revision to the existing TRM are very similar to OM-4. However, this results in a significant amount of administrative activity, without enhancement in quality and safety. A third approach, which is proposed, is to implement the existing TRM snubber program, which provides a means to accomplish the examination and testing intended by the ASME Code and regulation with a minimum of burden. The significant technical differences are discussed herein. Administrative controls currently in place are sufficient and accomplish the same purpose.

General

The current safety-related snubber testing requirements of TRM Section 3.7.5 form the basis of the NAPS 1 ISI and testing program for snubbers. There are 326 small bore snubbers (capacities ≤ 50 Kips) and 12 large bore snubbers (capacities ≥ 50 Kips) installed in NAPS 1. All the snubbers at NAPS 1 are hydraulic snubbers.

Snubber maintenance and repair are controlled at NAPS 1 by written maintenance procedures that are based on manufacturers' recommendations and good industry practices. These procedural requirements are similar to the requirements of OM-4, paragraph 1.5.6. Changing snubber maintenance procedures requires review and approval of the snubber engineer. Design engineering approval is required for any changes that could affect the snubber's ability to meet the functional (operability) test acceptance criteria or affect the snubber's ability to support the design load. Following maintenance and repair, snubbers are required to be functionally tested to demonstrate that they meet the acceptance criteria. Snubbers that are modified or replaced due to visual or functional testing deficiencies are subject to the requirements of IWA-4000 and must be evaluated for suitability as required by OM-4, paragraph 1.5.7. Replacement snubbers are functionally tested prior to installation and visually inspected following installation in accordance with the snubber visual inspection criteria.

Visual Inspections

For visual inspections, the TRM states that snubbers are categorized as accessible or inaccessible during reactor operation and may be examined independently. This is the same requirement as OM-4, paragraph 1.6.

The TRM does not address snubber preservice examinations. However, snubbers are rotated from service in accordance with ASME Code Case N-508-3 (approved by Regulatory Guide (RG) 1.147) and following replacement a visual examination is required to be performed in accordance with maintenance procedures and the post maintenance testing program. This

visual examination is similar to the preservice examination requirements described in OM-4, paragraph 2.1.1. Additional preservice operability testing proposed by Dominion is described later in this section. Repair/Replacement activities will be performed as required by ASME Code Case N-508-3 and IWA-4000. Replacement snubbers are functionally tested prior to installation to demonstrate that they meet engineering acceptance criteria.

The intervals for snubber visual inspections are conducted in accordance with the TRM visual examination table which meets Generic Letter (GL) 90-09. The inspection interval is based on the snubber population and the number of unacceptable snubbers. Historically, the number of unacceptable visual snubber inspections at NAPS 1 is one or less. The OM-4, paragraph 2.3.2.2 bases the inspection frequency on the number of unacceptable snubbers but does not take into consideration the snubber population. GL 90-09 acknowledges that the visual inspection schedule as contained in OM-4 is excessively restrictive and that plants with large snubber populations have spent a significant amount of resources and subjected plant personnel to unnecessary radiological exposure to comply with the visual examination requirements of OM-4. GL 90-09 states that its alternative schedule for visual inspection provides the same confidence level as that provided in OM-4.

TRM requirements in conjunction with procedural inservice visual inspection requirements are similar to OM-4, paragraphs 2.3.1.1 and 2.3.1.2 and examinations are conducted with VT-3 Level II or III visually qualified examiners. Visual examinations encompass as a minimum the following inspection items:

> Fluid level, cylinder body defects, tie rod defects, valve block defects, hydraulic leaks, wiper seal deterioration/damage, snubber orientation, snubber misalignment, interferences, freedom of rotational movement, boric acid, bent piston rod, scored piston rod, painted piston rod and structural attachment defects.

The small bore snubbers at NAPS 1 are manufactured by ITT Grinnell and are of similar design. Large bore snubbers are manufactured by Lisega and are also of similar design. Snubbers which fail visual inspections are evaluated and a root-cause analysis is completed in accordance with administrative procedures and the corrective action program. Snubber failures are not specifically characterized into failure mode groups as defined in OM-4, paragraph 2.3.4.3. However, failures are evaluated to determine if the failure mechanism has the potential to affect other snubbers and whether the cause of the failure is from the application, maintenance practices, manufacturing defect, and isolated or unexplained failures. Snubbers that may be subject to similar failure mechanisms are evaluated for continued service and operability in accordance with the corrective action program.

Functional Testing

For the purposes of functional testing, the TRM identifies small bore snubbers (capacities ≤ 50 Kips) and large bore snubbers (capacities ≥ 50 Kips). This separation of snubbers is based on NRC GL 84-13, "Technical Specification for Snubbers." OM-4 does not separate snubbers into small and large bore groups.

Functional Testing of Small Bore Snubbers

Functional testing of small bore snubbers is defined in the TRM as follows:

> "At least once per 18 months during shutdown, an initial representative sample of small bore snubbers shall be functionally tested either in-place or in a bench test. The size of the initial sample shall follow the expression:
>
> $Ni = 35[1 + C/2]$
>
> > Where
> > Ni is the initial number of snubbers to be tested; and
> > C (C = 1) is the allowable number of small bore snubbers not meeting the acceptance criteria selected by the operator from the initial sample of Ni snubbers.
>
> For each number of small bore snubbers above "C" which does not meet the functional test criteria, the sample to be functionally tested is expanded according to the expression:
>
> $N = 35(1 + C/2)\,[2/(C + 1)]^2\,(A-C)$
>
> > Where
> > N is the total number of snubbers to be tested in the expanded sample;
> > A is the total number of small bore snubbers found inoperable during functional testing of the representative sample; and
> >
> > C (C = 1) is the allowable number of small bore snubbers not meeting the acceptance criteria selected by the operator from the initial sample of Ni snubbers.
>
> C = 1 is currently the value used in NAPS 1 TRM and was previously approved for use by the NRC in the third interval. This value was selected to take advantage of the historical performance experienced at NAPS 1 where the number of failures has not exceeded 1 failure per refueling outage surveillance cycle since 1992."

When C exceeds 1, the TRM requires that the snubber functional test sample size be increased in accordance with the equation above.

Comparison of TRM sample size to OM-4 for Small Bore Snubbers

OM-4 uses different formulas for establishing the number of snubbers to be initially functionally tested. These formulas are referred to as the 10% plan, the 37 testing sample plan, and the 55 testing sample plans. The determination of which plan to use is determined by the number of snubbers installed in the station. If the number of snubbers is less than 370, the 10% plan is the preferred plan. When the snubber population is over 370, the 37 testing sample plan is used and if the snubber population is over 550 the 55 testing sample plan is used. The total number of snubbers at NAPS 1 is 326; therefore, the 10% plan will be used for comparison to the TRM formula.

OM-4 states that for the initial sample lot tested, 10% of the snubbers in the general population shall be selected. The additional sample size shall be at least one-half the size of the original sample. So the total number of snubbers to be tested, including initial test group, is

$$N \geq 0.1n + C(0.1n/2)$$

Where
N is the total number of snubbers to be tested;
n is total number of snubbers in defined test group plan; and
C is the number of unacceptable snubbers found through functional testing.

Reviewing the OM- 4 formula, it can be seen that OM-4 does not pre-define a set number of allowable failures as in the TRM. OM-4 only requires that a minimum number of snubbers be tested, based on the population (the 0.1n factor), and an additional number of snubbers be tested for scope expansion based on the number found inoperable by testing (the C(0.1 n/2) factor). Substituting the number of small bore snubbers (326) for NAPS 1, this formula reduces to:

$$N \geq 32.6 + 16.3C$$

The initial sizes and expanded sample sizes, once a functional test failure is found, are provided in the comparison table below. (Note: In the table, the value "A" or functional test failures as defined by the TRM would be equivalent to the value "C" in the OM-4 formula.)

Small Bore Snubbers	Small Bore Snubbers Initial Sample Size plus Additional Sampling	
Functional Test Failures (number of snubbers)	TRM formula with C=1 (C = allowable test failures before expansion) (number of snubbers)	OM-4 Code (number of snubbers) (Note 3)
A = 0	53 (Note 1)	33
A = 1	53 (Note 1)	49
A = 2	106 (Note 2)	66
A = 3	158 (Note 2)	82
Note 1: TRM formula is $Ni = 35[1 + C/2]$ Note 2: TRM formula is $N = 35(1 + C/2)[2/(C + 1)]^2 (A-C)$ Note 3: OM-4 formula is $N = 32.6 + 16.3C$ and $C = A$		

From the above table, it can be seen that the TRM formula with C = 1 will test more of the snubbers than OM-4. This demonstrates that the existing value of "C" in the TRM formula will provide an adequate degree of testing when compared to the OM-4. Thus, the proposed TRM Section 3.7.5 (C=1) functional testing requirements provides an acceptable level of quality and safety for inservice testing of small bore snubbers.

Functional Testing of Large Bore Snubbers

At least once per 18 months during shutdown, the TRM requires that 10% or 2 out of 12 large bore snubbers be functionally tested. For each large bore snubber that does not meet the functional test criteria, an engineering evaluation is required to determine the failure mode. If the failure is determined to be generic, an additional 10% or 2 snubbers will be tested. If the failure is determined to be non-generic, an additional 10% or 2 snubbers will be tested the next refueling outage. A non-generic failure has the same meaning as an isolated failure as defined in OM-4, paragraph 1.4. A generic failure is any failure that is not determined to be non-generic. A comparison of the TRM requirements for large bore snubbers to the OM-4 10% sample plan is as follows:

Large Bore Snubbers	Large Bore Snubbers Initial Sample Size plus Additional Sampling	
Generic functional test failures (number of snubbers)	TRM (number of snubbers)	OM-4 Code (number of snubbers)
A = 0	2	2
A = 1	4	2
A = 2	6	3
A = 3	8	3

From the above table, it can be seen that the TRM formula with generic failures will test a greater number of large bore snubbers than OM-4. The OM Code paragraph 3.2.5.1 (b) does not count isolated (non-generic) for the purpose of determining the number of additional sample lots. This demonstrates that the existing TRM formula will provide an adequate degree of testing when compared to OM-4.

Thus, the proposed TRM Section 3.7.5 functional testing requirements provide an acceptable level of quality and safety for inservice testing of large bore snubbers. Additionally, the continued implementation of a program based on the TRM requires minimal administrative program change or TRM changes.

Preserve Operability Testing

To comply with the preservice testing requirements of OM-4, Section 3.1 verbatim, additional testing activity is required beyond the above proposal for inservice activities. Therefore, the licensee proposes the inclusion of the preservice operability testing requirements into the current snubber surveillance as follows:

> "**General**, Preservice Operational readiness testing shall be performed on all snubbers. Testing may be performed at the manufacturer's facility.

Test Parameters, Tests shall verify the following:

(a) Activation is within the specified range of velocity or acceleration in tension and in compression.
(b) Release rate, when applicable, is within the specified range in tension and in compression. For units specifically required not to displace under continuous load, ability of the snubber to withstand load without displacement.
(c) For mechanical snubbers, drag force is within specified limits in tension and compression.
(d) For hydraulic snubbers, if required to verify proper assembly drag force is within specified limits in tension and in compression.

Test Failure Evaluations, Snubbers that fail the preservice operational readiness test shall be evaluated for the cause(s) of failures(s).

Design Deficiency, If a design deficiency in a snubber is found, it shall be corrected by changing the design or specification, or by other appropriate means.

Other Deficiencies, Other deficiencies shall be resolved by adjustment, modification, repair, replacement, or other appropriate means.

Retest Requirements, Adjusted, modified, repaired, or replacement snubbers shall be tested to meet the requirements of the Test Parameters stated above."

The inclusion of these requirements into the current snubber surveillance program provides an alternative to OM-4, Section 3.1 with an acceptable level of safety and quality for the preservice testing requirements with only small administrative impact.

3.1.5 NRC Staff's Technical Evaluation

The licensee requested relief from the requirements of ASME Code, Section XI, paragraphs IWF-5200(a) and (b), and IWF-5300(a) and (b). The licensee proposed that the inservice visual examinations and functional testing of ASME Code Class 1, 2 and 3 snubbers be performed in accordance with the requirements of the NAPS 1, TRM Section 3.7.5, "Snubbers," in lieu of meeting the requirements in the ASME Code, Section XI, paragraphs IWF-5200(a) and (b), and IWF-5300(a) and (b).

The applicable edition of Section XI of the ASME Code for the NAPS 1 fourth 10-year ISI interval is the 2004 Edition. The ASME Code, Section XI, paragraphs IWF-5200(a) and (b), and IWF-5300(a) and (b), references OM-4, 1987 Edition with OMa-1988 Addenda.

ASME Code, Section XI, paragraphs IWF-5200(a) and IWF-5300(a) require that snubber preservice and inservice examinations be performed in accordance with OM-4, using the VT-3 visual examination method described in IWA-2213. Paragraphs IWF-5200(b) and IWF-5300(b) require that snubber preservice and inservice tests be performed in accordance with OM-4.

ASME Code, Section XI, Table IWA-1600-1 requires that OM-4 shall be Edition 1987 with OMa-1988 Addenda. OM-4 specifies the requirements for visual examination (paragraph 2.3) and

functional testing (paragraph 3.2). The licensee proposes to use NAPS 1 TRM Section 3.7.5 for inservice visual examination and functional testing of all safety-related snubbers. A visual inspection is the observation of the condition of installed snubbers to identify those that are damaged, degraded, or inoperable as caused by physical means, leakage, corrosion, or environmental exposure. To verify that a snubber can operate within specific performance limits, the licensee performs functional testing that typically involves removing the snubber and testing it on a specially designed stand or bench. The performance of visual examinations is a separate process that complements the functional testing program and provides additional confidence in snubber operability.

NAPS 1, TRM Section 3.7.5 incorporates GL 90-09, "Alternative Requirements for Snubber Visual Inspection Intervals and Corrective Actions." GL 90-09 acknowledges that the visual inspection schedule (as contained in OM-4) is excessively restrictive and that licensees with large snubber populations have spent a significant amount of resources and have subjected plant personnel to unnecessary radiological exposure to comply with the visual examination requirements. GL 90-09 states that its alternative schedule for visual inspection provides the same confidence level as that provided by OM-4.

TRM Section 3.7.5 defines,

> Inservice examination requirements: 1. visual examination, 2. visual examination interval frequency, 3. method of visual examination, 4. subsequent examination intervals, and 5. inservice examination failure evaluation.
>
> Inservice operability testing requirements: 1. Inservice operability or functional test; 2. initial snubber sample size and additional sampling; 3. failure evaluation; 4. test failure mode groups; and 5. corrective actions for the 10% plan, 37 sample, and the 55 sample plans that are similar to those provided by OM-4.

OM-4 requirements and TRM 3.7.5 criteria are compared and summarized in the following table and followed by a detailed review:

Criteria	ASME/ANSI OM Part 4 -1987 through OMa-1988 Addenda	North Anna Power station, Unit 1 TRM Section 3.7.5
Inservice Examination Requirements		
1. Visual Examination	Paragraph 2.3.1.1, Visual Examination, states that snubber visual examinations shall identify impaired functional ability due to physical damage, leakage, corrosion, or degradation.	TRM Table 3.7.5-1, Section (c), states that visual inspections shall verify that there are (1) no indications of damage or impaired operability; (2) attachments to the foundations or supporting structure are secure and (3) fasteners for attachment of the snubber to the component and to the snubber anchorage are functional.

2. Visual Examination Interval Frequency	Paragraph 2.3.2.2 provides visual examination interval frequency.	TRM Table 3.7.5-1, Section (a) provides snubber visual inspection interval frequency. These visual inspection interval frequency requirements are similar to those contained in NRC GL 90-09.
3. Method of Visual Examination	IWF-5200(a) and IWF-5300(a) require use of the VT-3 visual examination method described in IWA-2213.	The licensee states that TRM requirements in conjunction with procedural inservice visual inspection requirements are similar to OM-4, paragraphs 2.3.1.1 and 2.3.1.2 and examinations are conducted with VT-3 Level II or III visually qualified examiners.
4. Subsequent Examination Intervals	Paragraph 2.3.2 provides guidance for inservice examination intervals based on the number of unacceptable snubbers discovered.	TRM Table 3.7.5-1, Section (a) establishes subsequent snubber visual inspection intervals based on the number of unacceptable snubbers discovered. These requirements are similar to those contained in NRC GL 90-09.
5. Inservice Examination Failure Evaluation	Paragraph 2.3.4 states that snubbers not meeting examination and acceptance criteria shall be evaluated to determine the cause of unacceptability.	TRM Table 3.7.5-1, Section (a), states that snubbers which appear inoperable as a result of visual inspections shall be classified as unacceptable and may be reclassified acceptable for the purpose of establishing the next visual inspection interval, provided that: (1) the cause of the rejection is clearly established and remedied for that particular snubber and for other generically susceptible snubbers, and (2) the affected snubber is functionally tested in the as found condition and determined operable per the acceptable criteria of Table 3.7.5-1, Sections (d) and (e).

Inservice Examination Requirements

1. Visual Examination

TRM Table 3.7.5-1, Section (c), states that visual inspections shall verify that (1) there are no indications of damage or impaired operability; (2) attachments to the foundations or supporting structure are secure; (3) fasteners for attachment of the snubber to the component and to the snubber anchorage are functional; and (4) in those locations where snubber movement which can be manually induced without disconnecting the snubber, that the snubber has freedom of movement and is not frozen up. The visual examination per Table 3.7.5-1 verifies visible indication of damage or impaired operability of snubbers as well as its attachments and anchorages. OM-4, paragraph 2.3.1.1, requires snubber visual examinations to identify impaired functional ability due to physical damage, leakage, corrosion, or degradation. TRM 3.7.5 snubber visual examination requirements are considered to be equivalent to snubber visual examination requirements of OM-4 paragraphs 2.3.1.1. Therefore, this alternative provides an acceptable level of quality and safety.

2. Visual Examination Interval Frequency

TRM Table 3.7.5-1, Section (a) provides snubber visual inspection interval frequency requirements which are different than the OM-4 visual inspection interval requirements. Table 3.7.5-1 incorporates the visual inspection interval frequency as specified in GL 90-09, "Alternative Requirements for Snubber Visual Inspection Intervals and Corrective Actions." GL 90-09 acknowledges that the visual inspection interval frequency (as contained in OM-4) is excessively restrictive and that licensees with large snubber populations have spent a significant amount of resources and have subjected plant personnel to unnecessary radiological exposure to comply with the visual examination requirements. GL 90-09 states that its alternative schedule (interval frequency) for visual inspection provides the same confidence level as that provided by OM-4. Therefore, this alternative provides an acceptable level of quality and safety.

3. Method of Visual Examination

TRM Table 3.7.5-1, Section (b), requires that visual inspections shall verify that (a) the snubber has no visible indications of damage or impaired operability; (b) attachments to the foundation or supporting structure are secure and functional; and (c) fasteners for the attachment of the snubber to the component and to the snubber anchorage are secure and functional.

The licensee states that TRM requirements, in conjunction with procedural inservice visual inspection requirements, are similar to OM-4, paragraphs 2.3.1.1 and 2.3.1.2, and examinations are conducted with VT-3 Level II or III visually qualified examiners. Visual examinations encompass as a minimum the following inspection items:

> Fluid level, cylinder body defects, tie rod defects, valve block defects, hydraulic leaks, wiper seal deterioration/damage, snubber orientation, snubber misalignment, interferences, freedom of rotational movement, boric acid, bent piston rod, scored piston rod, painted piston rod and structural attachment defects.

The intent and scope of NAPS 1 TRM visual examination requirements are equivalent to the

OM-4 VT-3 examination requirements. Therefore, the NRC staff finds the licensee's method of snubber visual inspection provides an acceptable level of quality and safety and is acceptable.

4. Subsequent Examination Intervals

TRM Table 3.7.5-1, Section (a), establishes subsequent snubber visual inspection intervals based on the number of unacceptable snubbers discovered, in lieu of the OM-4, paragraph 2.3.2 requirements. These requirements are equivalent to the guidance provided in GL 90-09, which has been approved for use by the NRC. Therefore, the NRC staff finds that the subsequent examination intervals contained in TRM Table 3.7.5-1 provide an acceptable level of quality and safety and is acceptable.

5. Inservice Examination Failure Evaluation

OM-4, paragraph 2.3.4.1 requires that snubbers not meeting examination criteria be evaluated to determine the cause of unacceptability. Paragraph 2.3.4.2 states that snubbers found unacceptable may be tested in accordance with the requirements of paragraph 3.2. TRM Table 3.7.5-1, Section (a), states that snubbers which appear inoperable as a result of visual inspections shall be classified as unacceptable and may be reclassified acceptable for the purpose of establishing the next visual inspection interval, provided that: (1) the cause of the rejection is clearly established and remedied for that particular snubber and for other generically susceptible snubbers, and (2) the affected snubber is functionally tested in the as-found condition and determined operable per the acceptable criteria of Table 3.7.5-1, Sections (d) and (e). The licensee's program is considered to be equivalent to the requirements of OM-4. Therefore, the NRC staff finds that the TRM's inservice examination failure evaluation requirements provide an acceptable level of quality and safety.

Criteria	ASME/ANSI OM Part 4 -1987 through OMa-1988 Addenda	North Anna Power station, Unit 1 TRM Section 3.7.5
Inservice Operability Testing Requirements		
1. Inservice Operability or Functional Test	Paragraph 3.2.1.1, Operability Test, states that snubber operational readiness tests shall verify activation, release rate, and breakaway force or drag force by either an in-place or bench test.	TRM Table 3.7.5-1, Sections (d) and (e), state that the snubber functional test is to verify (1) activation (restraining action) achieved within specified range of velocity or acceleration in both tension and compression; (2) snubber bleed rate, or release rate where required, is present in both tension and compression, within the specified range; (3) for snubbers specifically required not to displace under continuous load, the ability to withstand load without displacement; and (4) for mechanical snubbers, the force that initiates free movement of the snubber rod in either tension or compression is less than the specified maximum drag force, and (5) the drag force shall not increase more than 50% since the last functional test. The licensee states that generally snubbers shall be functionally tested either in-place or in a bench test.
2. Initial Snubber Sample Size and Additional Sampling	Paragraph 3.2.3 states that each defined test plan group shall use either a 10% sampling plan, a "37 testing sample plan," or a "55 testing sample plan," during each refueling outage. A. <u>10% Testing Sample Plan</u> Paragraph 3.2.3.1(b) states that for any snubber(s) determined to be unacceptable as a result of testing, an additional sample of at least one-half the size of the initial sample lot shall be tested.	Relief Request and TRM Table 3.7.5-1, Section (c), state that snubbers shall be functionally tested using one of the following sample plans: (A) <u>10% Sampling Plan for large bore snubbers</u> (capacities≥ 50 Kips) The large bore snubber population will use a 10% sample or 2 snubbers out of 12 snubbers. For each failure, an additional 10% or 2 of that type of snubber shall be functionally tested.

	B. <u>37 or 55 Testing Sample Plans</u> Paragraph 3.2.3.2(b) states that for any snubber(s) determined to be unacceptable as a result of testing, an additional random sample of at least one-half the size of the initial sample lot shall be tested until the total number tested is equal to the initial sample size multiplied by the factor (1 + C/2), where C is the total number of snubbers found to be unacceptable. If the 37 plan is selected, initial and any additional testing shall be in accordance with Figure 1 of the OM-4.	(B) <u>Small Bore Snubbers</u> (capacities ≤50 Kips) An initial representative sample of the small bore snubber population shall follow the expression Ni = 35 [1+ C/2], where Ni is initial number of snubbers to be tested, and C (C=1) is the number of snubbers not meeting the acceptance criteria. For each number of small bore snubbers which does not meet the functional test acceptance criteria for Sections (d) and (e) of this table, an additional sample selected according to the expression $N = 35(1 + C/2)\,[2/(C + 1)]^2\,(A-C)$ shall be functionally tested, where "A" is the total number of small bore snubbers found inoperable during the functional testing of the representative sample.
3. Failure Evaluation	Paragraph 3.2.4.1 states that snubbers not meeting the operability testing acceptance criteria in paragraph 3.2.1 shall be evaluated to determine the cause of the failure.	TRM Table 3.7.5-1, Section (c) requires that if any snubber selected for functional testing either fails to lockup or fails to move, i.e., is frozen in place, the cause will be evaluated and, if caused by manufacturer or design deficiency, all snubbers of the same design subject to the same defect shall be functionally tested.
4. Test Failure Mode Groups	Paragraph 3.2.4.2 states that unacceptable snubber(s) shall be categorized into failure mode group(s). A test failure mode group(s) shall include all unacceptable snubbers that have a given failure mode, and all other snubbers subject to the same failure mode.	The licensee states that the failure mode grouping is a method to determine the extent of condition of failure, and the population or grouping for sample expansion. Failure mode grouping is not incorporated into the TRM; however, plant procedures do address determining the extent of condition and determining failure grouping for sample expansion.

5. Corrective Actions for 10% Sample, 37 Sample and 55 Sample Plan	Paragraphs 3.2.5.1 and 3.2.5.2 states that unacceptable snubbers shall be repaired, modified, or replaced.	The licensee states that all the snubbers that are considered unsatisfactory for functional testing shall be repaired or replaced, as required by Code Case N-508-3 and IWA-4000. The replacement snubbers and repaired snubbers shall be functionally tested prior to installation.

Inservice Operability Testing Requirements

1. Inservice Operability or Functional Test

The licensee states that generally snubbers shall be functionally tested either in-place or in a bench test. TRM Table 3.7.5-1, Sections (d) and (e), state that the snubber functional test is to verify (1) activation (restraining action) achieved within specified range of velocity or acceleration in both tension and compression; (2) snubber bleed rate, or release rate where required, is present in both tension and compression, within the specified range; (3) for snubbers specifically required not to displace under continuous load, the ability to withstand load without displacement; and (4) for mechanical snubbers, the force that initiates free movement of the snubber rod in either tension or compression is less than the specified maximum drag force; and (5) the drag force shall not increase more than 50% since the last functional test. The staff finds that the TRM requirements are considered to be equivalent to the snubber operability test requirements of OM-4, paragraph 3.2.1. Therefore, the TRM functional test requirements provide an acceptable level of quality and safety.

2. Snubber Initial Sample Size and Additional Sampling

There are 12 large bore snubbers (capacities ≥ 50 KIPS) and 326 small bore snubbers (capacities ≤ 50 Kips) installed in NAPS 1. All the snubbers at NAPS 1 are hydraulic snubbers. OM-4, paragraph 3.2.3 states that each defined test plan group shall use either a 10% sampling plan, a "37 testing sample plan," or a "55 testing sample plan," during each refueling outage. TRM Table 3.7.5-1, Section (c) states that snubbers shall be functionally tested using one of the following sample plans:

(A) 10% Sample Plan for Large Bore Snubbers:

TRM Table 3.7.5-1, Section (c) requires that 10% of the large bore snubbers be functionally tested. This sample plan is similar to the OM-4 defined 10% sample plan. The TRM requires that for each large bore snubber generic failure an additional 10% or 2 snubbers will be tested. A generic failure is any failure that is not considered to be an isolated failure. OM-4, paragraph 3.2.3.1(b) requires that an additional sample size must be at least one-half the size of the initial sample size of the "defined test plan group" of snubbers. A comparison of the TRM test requirements for large bore snubbers to the OM-4, 10% sample plan plus additional sample is as follows:

Large Bore Snubbers	Large Bore Snubbers Initial plus Additional Sampling	
Generic functional test failures (number of snubbers)	TRM Table 3.7.5 (number of snubbers)	OM-4 Code (number of snubbers)
A = 0	2	2
A = 1	4	2
A = 2	6	3
A = 3	8	3
Note: A is the number of snubbers failed in generic functional test.		

The sample sizes shown in the above table conclude that the number of large bore snubbers tested by use of the TRM formula with generic failures will be greater than or equal to the number required by OM-4. Therefore, the TRM requirements for large bore snubbers sample size and additional sampling provide an acceptable level of quality and safety.

(B) Sample Plan for Small Bore Snubbers

TRM Table 3.7.5-1, Section (c) states that an initial representative sample of the small bore snubber population shall follow the expression, Ni = 35 [1+ C/2], where Ni is initial number of snubbers to be tested; and C (C=1) is the number of snubbers not meeting the acceptance criteria. The TRM will use C=1 in all cases, even before initial sample testing, whereas OM-4 does not specify any assumed number of snubber failures.

The TRM Table 3.7.5-1 sample method is similar to the OM-4, 37 snubbers sample plan. OM-4, Appendix C, Section C1.2 states that the 37 plan has an accept line criteria approximately represented by $N \geq 0.1n + C\ (0.1n/2)$, where N is the total number of snubbers to be tested; n is the total number of snubbers in the defined test plan group; and C is the number of unacceptable snubbers found through functional testing. OM-4 does not define a pre-set number of allowable failures for snubbers as required by the TRM for small bore snubbers. OM-4 only requires that a minimum number of snubbers be tested, based on the population (the 0.1n factor), and an additional number of snubbers be tested for scope expansion based on the number of failures found by testing (the C(0.1 n/2) factor). Substituting the number of small bore snubbers (326) for NAPS 1, this formula reduces to:

$$N \geq 32.6 + 16.3C$$

The initial sizes and expanded sample sizes, once a functional test failure is found, are provided in the comparison between TRM and OM-4 methods below:

Small Bore Snubbers	Small Bore Snubbers Initial plus Additional Sampling	
Functional test failures (number of snubbers)	TRM formula with C=1 (C = allowable test failures before expansion) (number of snubbers)	OM-4 Code (number of snubbers) (Notes 3 and 4)
A = 0	53 (Note 1)	33
A = 1	53 (Note 1)	49
A = 2	106 (Note 2)	66
A = 3	158 (Note 2)	82
Note 1: TRM formula is Ni = 35[1 + C/2] Note 2: TRM formula is $N = 35(1 + C/2)[2/(C + 1)]^2(A-C)$ Note 3: OM-4 formula is N = 32.6 + 16.3C Note 4: The value "A" or functional test failures as defined by the TRM would be equivalent to the value "C" in the OM-4 formula.		

This table shows that the numbers of snubbers tested by the use of the TRM formula is greater than the number tested using the OM-4 formula. This demonstrates that the value of C = 1 in the TRM formula will provide an adequate degree of testing when compared to the OM-4 requirements. The licensee's TRM Table 3.7.5-1 testing sample plans and additional sampling requirements are considered to be equivalent to the OM-4 requirements and provide an acceptable level of quality and safety for inservice testing of small bore snubbers. Therefore, TRM requirements for additional sampling when using the 37 testing sample plan is considered acceptable and provide an acceptable level of quality and safety and is acceptable.

3. Failure Evaluation

OM-4, paragraph 3.2.4.1 requires that snubbers not meeting the operability testing acceptance criteria in paragraph 3.2.1 shall be evaluated to determine the cause of the failure. The cause of failure evaluation requires a review of information related to other unacceptable snubbers and a determination of whether other snubbers of similar design would require further examination. TRM, Table 3.7.5-1, Section (c), states that if any snubber selected for functional testing either fails to lockup or fails to move, i.e., is frozen in place, the cause will be evaluated, and if caused by manufacturer or design deficiency, all snubbers of the same design subject to the same defect shall be functionally tested. This testing requirement is independent of the requirements stated above for snubbers not meeting the functional test acceptance criteria. Therefore, the NRC staff finds that the TRM requirements related to inservice operability failure evaluation considered to be equivalent to the OM-4 requirements provide an acceptable level of quality and safety and is acceptable.

4. Test Failure Mode Groups

OM-4, paragraph 3.2.4.2 requires that unacceptable snubber(s) be categorized into failure mode group(s). A test failure mode group shall include all unacceptable snubbers that have a given failure mode, and all other snubbers subject to the same failure mode. The licensee

states that the failure mode grouping is a method to determine the extent of condition of failure, and the population or grouping for sample expansion. Failure mode grouping is not incorporated into the TRM; however, plant procedures do address determining the extent of condition and determining failure grouping for sample expansion. The licensee states that snubber failures are evaluated and a root-cause analysis is completed in accordance with administrative procedures and the corrective action program. Snubber failures are not specifically characterized into failure mode groups as defined in OM-4, paragraph 2.3.4.3. However, failures are evaluated to determine if the failure mechanism has the potential to affect other snubbers and whether the cause of the failure is from the application, maintenance practices, manufacturing defect, isolated or unexplained failures. Snubbers that may be subject to similar failure mechanisms are evaluated for continued service and operability in accordance with the corrective action program.

The NAPS 1 TRM does not specifically address "Failure Mode Groups." However, the plant procedure accomplishes the same intent as "Failure Mode Grouping." Therefore, the TRM requirements with implementing procedures are considered to be equivalent to the OM-4 requirements and provide an acceptable level of quality and safety and is acceptable.

5. Corrective Actions for the 10% Sample, 37 Sample, and 55 Sample Plan

OM-4, paragraphs 3.2.5.1 and 3.2.5.2 require that unacceptable snubbers be adjusted, repaired, modified, or replaced. The licensee states that all the snubbers that are considered unsatisfactory for functional testing shall be repaired or replaced, as required by plant procedure. All snubber maintenance and repair activities are controlled at NAPS 1 by written procedures that are based on manufacturers' recommendations and industry good practices. These procedural requirements are similar to the requirements of OM-4, paragraph 1.5.6. Changing snubber maintenance procedures requires review and approval of the snubber engineer. Design engineering approval is required for any changes that could affect the snubber's ability to meet the functional (operability) test acceptance criteria or affect the snubber's ability to support the design load. Following maintenance and repair, snubbers are required to be functionally tested to demonstrate that they meet the acceptance criteria. The licensee states that snubbers that are modified or replaced due to visual or functional testing deficiencies are subject to the requirements of Code Case N-508-3 and IWA-4000 and must be evaluated for suitability as required by OM-4, paragraph 1.5.7. Replacement snubbers are functionally tested prior to installation and visually inspected following installation in accordance with the snubber visual inspection criteria. Therefore, the NRC staff finds that the TRM requirements, with implementing procedure corrective actions associated with unacceptable snubbers at NAPS 1, are considered to be equivalent to the OM-4 requirements, provide an acceptable level of quality and safety.

Based on the above discussions, the NRC staff finds that snubber inservice visual examinations and functional testing, conducted in accordance with NAPS 1, TRM, Section 3.7.5, provide reasonable assurance of snubber operability and provide a level of quality and safety equivalent to that of ASME Code, Section XI, Subarticles IWF-5200(a) and (b), and IWF-5300(a) and (b). Therefore, the NRC staff finds the licensee's proposed alternative provides an acceptable level of quality and safety with respect to snubber inservice visual inspection and functional testing. It should be noted that in authorizing Relief Request CS-001, Revision 1, NAPS 1, TRM, Section 3.7.5 becomes a regulatory requirement that may be used in lieu of ASME Code, Section XI requirements for performing ISI and testing of snubbers.

4.0 CONCLUSION

Based on the information provided, the NRC staff concludes that the proposed alternative to use TRM Section 3.7.5 for snubbers' inservice visual inspection and functional testing activities provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the licensee's proposed alternative is authorized for the NAPS 1 fourth 10-year ISI and testing interval. All other requirements of ASME Code, Section XI for which relief has not been specifically requested remain applicable, including a third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: Gurjendra S. Bedi, DCI/CPTB

Date: June 10, 2009

All other requirements of the ASME Code, Section XI for which relief has not been specifically requested remain applicable, including a third-party review by the Authorized Nuclear Inservice Inspector. If you have any questions concerning this matter, please contact John F. Stang, at (301) 415-1345.

Sincerely,

/RA/

Melanie C. Wong, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-338

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