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

January 21, 2016

Mr. Richard L. Anderson
Vice President
Duane Arnold Energy Center
3277 DAEC Road
Palo, IA 52324-9785

SUBJECT: DUANE ARNOLD ENERGY CENTER – RELIEF REQUEST NO. PR-01, PR-02, VR-01, VR-02, AND VR-03 RELATED TO THE INSERVICE TESTING PROGRAM FOR THE FIFTH 10-YEAR INVERVAL (CAC NO. MF5674)

Dear Mr. Anderson:

By letter dated January 30, 2015 (Agencywide Documents Access Management System (ADAMS) Accession No. ML15033A372), NextEra Energy Duane Arnold, LLC, the licensee, submitted alternative requests PR-01, PR-02, VR-01, VR-02, and VR-03 for the fifth 10-year inservice testing (IST) program at Duane Arnold Energy Center (DAEC). The submitted alternative requests propose to perform alternate tests in lieu of the requirements specified in the American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(1), the licensee requested to use the proposed alternatives in requests PR-01, PR-02, VR-01, and VR-02 on the basis that the alternatives provide an acceptable level of quality and safety. Pursuant to 10 CFR 50.55a(z)(2), the licensee requested to use the proposed alternative in request VR-03 on the basis that compliance with the OM Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

As set forth in the enclosed safety evaluation, the NRC staff determines that the alternatives proposed in requests PR-01, PR-02, VR-01, and VR-02 provide an acceptable level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(1). Therefore, the NRC staff authorizes alternative requests PR-01, PR-02, VR-01, and VR-02 at DAEC until the end of the fifth 10-year IST interval.

Also, as set forth in the enclosed safety evaluation, the NRC staff determines that the alternative proposed in request VR-03 provides reasonable assurance that the components are operationally ready. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Therefore, the NRC staff authorizes alternative request VR-03 at DAEC until the end of the fifth 10-year IST interval.

All other ASME OM Code requirements for which alternatives or relief was not specifically requested and approved in the subject request remain applicable.

If you have any questions, please contact the Project Manager, Mahesh Chawla at 301-415-8371 or via e-mail at Mahesh.Chawla@nrc.gov.

Sincerely,

David J. Wrona, Chief
Plant Licensing Branch III-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-331

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

INSERVICE TESTING PROGRAM RELIEF REQUESTS PR-01, PR-02, VR-01, VR-02, VR-03

FIFTH 10-YEAR INTERVAL

NEXTERA ENERGY DUANE ARNOLD, LLC

DUANE ARNOLD ENERGY CENTER

DOCKET NO. 50-331

## 1.0 INTRODUCTION

By letter dated January 30, 2015 (Agencywide Documents Access Management System (ADAMS) Accession No. ML15033A372), NextEra Energy Duane Arnold, LLC, the licensee, submitted alternative requests PR-01, PR-02, VR-01, VR-02, and VR-03 for the fifth 10-year inservice testing (IST) program at Duane Arnold Energy Center (DAEC). The submitted alternative requests propose to perform alternate tests in lieu of the requirements specified in the American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(1), the licensee requested to use the proposed alternatives in requests PR-01, PR-02, VR-01, and VR-02 on the basis that the alternatives provide an acceptable level of quality and safety. Pursuant to 10 CFR 50.55a(z)(2), the licensee requested to use the proposed alternative in request VR-03 on the basis that compliance with the OM Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

*(Note that the licensee actually requested the use of alternatives pursuant to 10 CFR 50.55a(a)(3)(i) and (a)(3)(ii). Subsequent to the licensee's submittal, a change to the regulations became effective wherein the regulations at 10 CFR 50.55a(a)(3)(i) and (a)(3)(ii) were relocated to new regulations at 10 CFR 50.55a(z)(1) and (z)(2), respectively. The new regulations at (z)(1) and (z)(2) are equivalent to the former regulations at (a)(3)(i) and (a)(3)(ii). The remainder of this evaluation will, therefore, reference the new regulations.)*

## 2.0 REGULATORY EVALUATION

Title 10 CFR 50.55a(f), *Inservice Testing Requirements*, requires, in part, that IST of certain ASME Code Class 1, 2, and 3 pumps and valves be performed in accordance with the specified ASME OM Code and applicable addenda incorporated by reference in the regulations. Exceptions are allowed where alternatives have been authorized by the U.S. Nuclear

Regulatory Commission (NRC) pursuant to paragraphs (z)(1) or (z)(2) of 10 CFR 50.55a. In proposing alternatives, the licensee must demonstrate that: (1) the proposed alternatives provide an acceptable level of quality and safety (10 CFR 50.55[a(z)(1)], or (2) compliance would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety (10 CFR 50.55a(z)(2)). Section 50.55a allows the NRC to authorize alternatives from ASME OM Code requirements upon making the necessary findings.

Based on the above, and subject to the following technical evaluation, the NRC staff finds that regulatory authority exists for the licensee to request and the Commission to authorize the alternatives requested by the licensee.

## 3.0 TECHNICAL EVALUATION

### 3.0.1 Applicable ASME OM Code Edition and Addenda

The DAEC fifth 10-year IST program interval begins on February 1, 2016, and is scheduled to end on January 31, 2026. The applicable ASME OM Code edition and addenda for the DAEC fifth 10-year IST program interval is the 2004 Edition through the 2006 Addenda.

## 3.1 Relief Request PR-01

### 3.1.1 OM Code Requirements

Per paragraph ISTB 3510(e), "General, Frequency Response Range," the frequency response range of the vibration measuring transducers and their readout system shall be from one-third minimum pump shaft rotational speed to at least 1000 Hz.

### 3.1.2 Component Identification

Relief is requested for the following standby liquid control (SBLC) pumps:

1P230A
1P230B

These are two 100 percent capacity positive displacement pumps designed to inject sodium pentaborate solution into the reactor at a minimum rate of 26.2 gallons per minute (gpm) at a discharge pressure greater than or equal to 1150 pounds per square inch gage (psig) as backup capability for reactivity control independent of normal reactivity control provided by the control rods.

### 3.1.3 Licensee's Basis for Requesting Relief

The licensee stated:

> The nominal shaft rotational speed of these pumps is 242 [revolutions per minute] rpm, which is equivalent to approximately 4 [hertz] Hz. Based on this frequency and ISTB-3510(e), the required frequency response range of instruments used for measuring pump vibration is 1.33 to 1000 Hz. Procurement

and calibration of instruments to cover this range to the lower extreme (1.33 Hz) is impractical due to the limited number of vendors supplying such equipment and the level and sophistication and cost of the equipment.

These pumps are of a simplified reciprocating (piston) positive displacement design with rolling element bearings, Model Number TD-60, manufactured by Union Pump Corporation. Union Pump Corporation has performed an evaluation of the pump design and has determined that there are no probable sub-synchronous failure modes associated with these pumps under normal operating conditions. Furthermore, there are no known failure mechanisms that would be revealed by vibration at frequencies below that related to shaft speed (4 Hz); thus no useful information is obtained below this frequency nor will indication of pump degradation be masked by instrumentation unable to collect data below this frequency to within tolerance prescribed by IST.

Sub-synchronous peaks are usually associated with sleeved bearing components. These frequencies detect shaft to sleeve rub and oil whirl. The IST requirement for detection to 1/3 running speed is to detect these failure mode types. However, this Union pump design utilizes roller bearings which do not have the same failure modes. For a roller bearing design, typical failure is ball or race related and occurs at frequencies greater than turning speed, classified as non-synchronous. As a roller bearing fails, a corresponding change in 1-times turning speed and harmonics indicating excessive looseness and random impacting, not sub-synchronous frequencies, will be seen.

Per the manufacturer, there is no internal gearing in this pump model, therefore the input shaft rpm is also the crank rpm. The instrumentation for measuring vibration must be adequate for accurately assimilating information at this rpm. The significant modes of vibration with respect to equipment monitoring are as follows:

<u>1-Times Crankshaft Speed</u> - An increase in vibration at this frequency may be an indication of rubbing between a single crankshaft cheek and rod end, cavitation at a single valve, or coupling misalignment.

<u>2-Times Crankshaft Speed</u> - An increase in vibration at this frequency may be an indication of looseness at a single rod bearing or crosshead pin, a loose valve seat in the fluid cylinder, a loose plunger/crosshead stub connection, or coupling misalignment.

<u>Other Multiple of Shaft Speed or Non-synchronous peaks</u> - An increase in vibration at other frequencies may be an indications of cavitation at several valves, looseness at multiple locations or bearing degradation.

Per the manufacturer, all failure modes that cause vibration in the pump will be at multiples greater than the crank rpm.

Based on the forgoing discussion, it is clear that monitoring pump vibration within the frequency range of 4 to 1000 Hz will provide adequate information for evaluating pump condition and ensuring continued reliability with respect to the pumps' function.

Relief is requested pursuant to 10 CFR 50.55a[(z)(1)] on the basis that the alternative testing will provide an acceptable level of quality and safety.

3.1.4 Licensee's Proposed Alternative Testing

The licensee proposed:

Vibration levels of Standby Liquid Control Pumps will be measured in accordance with the applicable portions of ISTB 3500 with the exception of the lower frequency response limit for the instrumentation (ISTB 3510(e)). In this case the lower response limit of the vibration measuring equipment will be 4.00 Hz.

In addition to the normal SBLC pump IST vibration peak overall result, DAEC engineering department personnel will routinely perform post spectral/waveform analysis of the vibration data to ensure no adverse trends toward mechanical degradation go undetected. This lower limit restriction will not affect the operational readiness of the Standby Liquid Control Pumps, and the OM Code maximum allowable vibration limits for the required action range are being maintained.

The proposed alternative will result in corrective action on a pump prior to the occurrence of significant degradation.

3.1.5 Staff Evaluation

The licensee requests relief from the frequency response range requirements for the SBLC pumps 1P230A and 1P230B. The ASME OM Code in paragraph ISTB 3510(e) requires that the frequency response range for vibration measuring transducers and their readout system shall be from one-third of the minimum pump shaft rotational speed (1.33 Hz) to at least 1,000 Hz. The licensee proposes to use its existing instrumentation with a range of 4.00 Hz to 1,000 Hz.

These pumps are piston, positive-displacement pumps with rolling-element bearings. The pump manufacturer informed the licensee that this type of pump has no sub-synchronous failure modes. Furthermore, there are no known failure mechanisms that would be revealed by vibration at frequencies below those related to shaft speed (4 Hz). The licensee states that, based upon the absence of a credible failure mode, no useful information will be obtained by testing below the 4 Hz frequency nor will any indication of pump degradation be masked by instrumentation unable to collect data below frequency.

The licensee identified the frequencies where high vibration would provide an indication of pump degradation as a one time (1X) pump running speed, (2X) pump running speed, and multiples of pump running speed. The types of problems that could be encountered at these frequencies were also identified. The frequency spectrum of the signals generated is characteristic of each pump and constitutes a unique pattern. Analysis of the pattern allows identification of vibration sources, and monitoring of change over time permits evaluation of the mechanical condition of the pump.

Consistent with the NRC staff position in Section 5.4 of NUREG-1482 Revision 2, "Guidelines for Inservice Testing at Nuclear Power Plants," and based on the forgoing discussion, the staff finds that monitoring pump vibration within the frequency range of 4 to 1,000 Hz will provide adequate information for evaluating pump condition and ensuring continued reliability with respect to the pumps' function, and that the information gained at the low frequency response (i.e., less than 4 Hz) does not apply for the bearing design of these pumps.

3.2 Relief Request PR-02

3.2.1 OM Code Requirements

Per paragraph ISTB-3550, "Flow Rate," when measuring flow rate, a rate or quantity meter shall be installed in the pump test circuit.

Per paragraph ISTB-5300(a)(1), "Duration of Tests," for the Group A test and the comprehensive test, after pump conditions are as stable as the system permits, each pump shall be run at least 2 minutes. At the end of this time at least one measurement or determination of each of the quantities required by Table ISTB-3000-1 shall be made and recorded.

3.2.2 Component Identification

Relief is requested for the following standby liquid control (SBLC) pumps:

1P230A
1P230B

These are two 100 percent capacity positive displacement pumps designed to inject sodium pentaborate solution into the reactor at a minimum rate of 26.2 gpm at a discharge pressure greater than or equal to 1150 psig as backup capability for reactivity control independent of normal reactivity control provided by the control rods.

3.2.3 Licensee's Basis for Requesting Relief

The licensee stated:

> The positive displacement SBLC pumps are designed to pump a constant flow rate regardless of system resistance. The SBLC system was not designed with a flow meter in the flow loop. The system was designed with a test tank, where the change in the level can be measured over time and a flow rate calculated. As part of the modifications made to the SBLC system for the [anticipated transient without scram] ATWS Rule (10 CFR 50.62), DAEC installed instrumentation to measure the SBLC flow. The ultrasonic flow meter that was installed, however, was not intended to meet the accuracy requirements of the ASME OM Code, and

has not proven to be capable of meeting Code accuracy requirements. The accuracy performance of the flow meter is attributed to the lack of adequate straight length of pipe to establish fully developed flow.

In March, 2006, portable ultrasonic flow meters were installed on the common SBLC pump discharge piping to determine the practicality of using ultrasonic flow meters to measure flow per ASME OM Code requirements. The flow meter transducers were installed at three different locations on the discharge piping. A vendor representative was on-site to facilitate proper installation and setup of the transducers and flow meters. Each location produced significantly different measured flow rates compared to the other locations and the test tank level method.

NUREG 1482, Revision 2 recognizes that plants may have difficulties with flow instrumentation. In Section 2.5.1, "Justifications for Relief or Alternatives," the NUREG states that compliance with the Code may be impractical because of design limitations. Section 2.5.1.(2) states, "Imposition of the Code requirements would require significant system redesign and modifications. For example, a flow meter does not meet the accuracy requirements of ISTB 3510 and Table ISTB 3510-1 because the present system configuration does not have a straight section of pipe of sufficient length in which to measure flow accurately (see Section 5.5)." In that respect, flow measurement cannot be achieved to the required accuracy using a flow meter. In addition, the SBLC test tank is not large enough to provide two minutes of flow prior to recording flow data. As discussed in NUREG-1482, Revision 2, Section 5.5.2, "Use of Tank Level to Calculate Flow Rate for Positive Displacement Pumps," states, "Requiring licensees to install a flow meter to measure the flow rate and to guarantee the test tank size, such that the pump flow rate will stabilize in 2 minutes before recording data would be a burden because of the design and installation changes to be made to the existing system. Therefore, compliance with the Code requirements would be a hardship."

Relief is requested pursuant to 10 CFR 50.55a[(z)(1)] on the basis that the alternative testing will provide an acceptable level of quality and safety.

3.2.4 Licensee's Proposed Alternative Testing

The licensee proposed:

Flow rate for the SBLC pumps will be determined by measuring the change in test tank level over time. The pump will be started with suction from the test tank and will discharge to storage barrels. The test tank level will be approximately the same at the beginning of each test to ensure repeatability. After at least two minutes of pump operation and a change of tank level of at least 20 inches, the time and level are recorded and the pump stopped. The change in level over the measured time will be converted to flow rate by the following formula:

$$Q\ (GPM) = \psi\ \Delta L\ (inch) / \Delta t\ (Second)$$

*Where:* *Q is flow rate*
*$\psi$ is a constant which reflects tank dimensions and unit conversions*
*$\Delta L$ is the measured change in level in the tank in time $\Delta t$*

Pump discharge pressure will match system pressure up to the shutoff head of the positive displacement pump. Because of the characteristics of a positive displacement pump, there should be virtually no change in pump discharge flow rate as a result of the rising level in the temporary storage barrels. Therefore, increasing level will not have an impact on test results. By having approximately the same level in the tank at the beginning of each test, repeatable results can be achieved.

Per NUREG-1482, Revision 2, Section 5.5.2 states, "when flow meters are not installed in the flow loop of a system with a positive displacement pump, it is impractical to directly measure flow rate for the pump. The staff has determined that, if the licensee uses the tank level to calculate the flow rate as described in Subsection ISTB-3550, the implementing procedure must include the calculational method and any test conditions needed to achieve the required accuracy. Specifically, the licensee must verify that the reading scale for measuring the tank level and the calculational method yield an accuracy within ±2 percent for Group A and B tests, and Preservice and Comprehensive Tests. If the meter does not directly indicate the flow rate, the record of the test shall identify the method used to reduce the flow data."

The test tank level will be measured in accordance with the accuracy requirements of OM Table ISTB-3510-1. The calculation method and test conditions required to achieve this accuracy are documented in the implementing procedures.

### 3.2.5 Staff Evaluation

The ASME OM Code requires that pump flow rate be measured in order to determine the extent of any pump degradation. A 2-minute run time is required by the ASME OM Code in order to achieve stable pump performance parameters before data are recorded during the test.

The positive displacement SBLC pumps utilized at DAEC are designed to pump a constant flow rate regardless of system resistance. The SBLC system was not initially designed with flow meter instrumentation in the flow loop and uses a test tank to determine flow rate by measuring the change in tank level over a period of time. As part of the modifications made to the SBLC system to meet 10 CFR 50.62 requirements, DAEC installed an ultrasonic flow meter to measure SBLC flow. However, the ultrasonic flow meter was not intended to meet the accuracy requirements of the ASME OM Code and has not proven to be capable of meeting OM Code accuracy requirements due to the lack of an adequate straight length of pipe which is necessary to establish fully developed flow.

In March 2006, DAEC installed portable ultrasonic flow meters to determine the practicality of using later technology instrumentation to measure flow per ASME OM Code requirements. The portable ultrasonic flow meters failed to produce consistent results as compared to using tank level to calculate flow rate. However, the test tank is not large enough to provide 2 minutes of flow prior to recording flow data. Requiring DAEC to install a larger test tank to facilitate pump testing would require significant modifications to the plant due to the design, fabrication, and installation changes that would have to be made.

As an alternative to the ASME OM Code requirements, the licensee is proposing to measure the flow rate by determining the change in source tank level over a period of time and calculating an average flow rate from the tank. The change in flow resistance due to the rising level of temporary storage barrels, will be small in comparison with the pump discharge pressure, thereby having no significant effect on the test results. Provided that the tank level at the beginning of each test is approximately the same, repeatable results can be achieved. This method is consistent with the NRC staff's recommendation in NUREG-1482, Revision 2, and therefore provides reasonable assurance of the pump's operational readiness when the test tank level is measured in accordance with the accuracy requirements of Table ISTB-3500-1. Implementing procedures include the calculation method and any test conditions required to achieve this accuracy.

3.3 Relief Request VR-01

3.3.1 OM Code Requirements

Per paragraph ISTC-3510, *Exercising Test Frequency*, Active Category A, Category B, and Category C check valves shall be exercised nominally every 3 months except as provided by ISTC-3520, ISTC-3540, ISTC-3550, ISTC-3570, ISTC-5221 and ISTC-5222. Power-operated relief valves shall be exercise tested once per fuel cycle.

3.3.2 Component Identification

Relief is requested for the following excess flow check valves (EFCVs):

| | | | | |
|---|---|---|---|---|
| XFV2119 | XFV4457B | XFV4513 | XFV4589 | XFV4665 |
| XFV2139 | XFV4458A | XFV4514 | XFV4590 | XFV4666 |
| XFV2246A | XFV4458B | XFV4515 | XFV4591 | XFV4667 |
| XFV2246B | XFV4459A | XFV4516 | XFV4607 | XFV4668 |
| XFV2246C | XFV4459B | XFV4518 | XFV4608 | XFV4669 |
| XFV2246D | XFV4460A | XFV4519 | XFV4611 | XFV4670 |
| XFV2443A | XFV4460B | XFV4528 | XFV4612 | XFV4671 |
| XFV2443B | XFV4501A | XFV4562 | XFV4637 | XFV4672 |
| XFV2443C | XFV4501B | XFV4578 | XFV4638 | XFV4673 |
| XFV2443D | XFV4503 | XFV4579 | XFV4641A | XFV4674 |
| XFV4453A | XFV4504 | XFV4580 | XFV4641B | XFV4675 |

| | | | | |
|---|---|---|---|---|
| XFV4453B | XFV4505 | XFV4581 | XFV4642A | XFV4676 |
| XFV4454A | XFV4506 | XFV4582 | XFV4642B | XFV4677 |
| XFV4454B | XFV4507 | XFV4583 | XFV4643A | XFV4678 |
| XFV4455A | XFV4508 | XFV4584 | XFV4643B | XFV4679 |
| XFV4455B | XFV4510A | XFV4585 | XFV4644A | XFV4680 |
| XFV4456A | XFV4510B | XFV4586 | XFV4644B | XFV4681 |
| XFV4456B | XFV4511 | XFV4587 | XFV4663 | XFV4682 |
| XFV4457A | XFV4512 | XFV4588 | XFV4664 | |

The licensee stated:

> Excess flow check valves (EFCVs) specifically designed by Marotta Scientific Controls Inc. for the DAEC are provided in each instrument process line that penetrates the drywell and connects to the reactor coolant pressure boundary. The EFCV is designed so that it will not close accidently during normal operation, will close if a rupture of the instrument line is indicated downstream of the valve, can be reopened when appropriate, and has its status indicated in the control room.
>
> An orifice is installed just inside the drywell on each of these instrument lines. The orifice limits leakage to a level where the integrity and functional performance of secondary containment and associated safety systems are maintained, the coolant loss is within the capability of the reactor coolant makeup system, and the potential offsite exposure is substantially below the guidelines of 10 CFR 50.67. Regulatory Guide 1.11 requested that an additional isolation valve capable of automatic operation be located outside containment on these instrument process lines. At the DAEC, these are the excess flow check valves.

3.3.3 Licensee's Basis for Requesting Relief

The licensee stated:

> The excess flow check valve is a simple device: the major components are a poppet and spring. The spring holds the poppet open under static conditions. The valve will close upon sufficient differential pressure across the poppet. Functional testing of the valve is accomplished by venting the instrument side of the tube. The resultant increase in flow imposes a differential pressure across the poppet, which compresses the spring and decreases flow through the valve.
>
> Excess flow check valves have been extremely reliable throughout the industry. In the first 40 years of operation at the DAEC, no excess flow check valve has failed to close due to actual valve failure (i.e., not related to test methodology). The DAEC Technical Specifications (TS) detail what frequency is required to maintain a high degree of reliability and availability, and provide an acceptable level of quality and safety. In the NRC's safety evaluation, which is associated

with TS Amendment No. 230, the Staff concluded, "Based on the acceptability of the methods applied to estimate the release frequency, a relatively low release frequency estimate in conjunction with unlikely limit on core damage and negligible consequence of a release in the reactor building, we conclude that the increase in risk associated with the licensee's request for relaxation of EFCV surveillance testing to be sufficiently low and acceptable." DAEC requested this relief pursuant to 10 CFR 50.55a[(z)(1)] to exercise excess flow check valves at the frequency specified in amended DAEC TS Surveillance Requirement (SR) 3.6.1.3.7.

The NRC's Safety Evaluation also states that the radiological consequences of an unisolable rupture of an instrument line were previously evaluated in response to Regulatory Guide 1.11, as documented in DAEC [updated final safety analysis report] (UFSAR) Section 1.8.11. This evaluation assumed a continuous discharge of reactor water through an instrument line with a 1/4 inch orifice for the duration of the detection and cooldown sequence. The assumptions for the accident evaluation do not change as a result of the proposed change in test frequency, and the evaluation in the DAEC UFSAR Section 1.8.11 remains acceptable.

General Electric NEDO-32977-A (Boiling Water Reactor Owner's Group (BWRTOG) Topical Report B21-00658-01), Excess Flow Check Valve Testing Relaxation, dated November 1998, (revised through June 2000) was approved by the staff on March 14, 2000. NEDO-32977-A provides additional bases for this relief request. The report concludes that the change in the test frequency had insignificant impact on valve reliability, and that the demonstrated reliability of EFCVs coupled with low consequences of EFCV failure provided adequate justification for extending the test interval up to once every 120 months.

3.3.4 Licensee's Proposed Alternative Testing

The licensee proposed:

Excess flow check valves will be exercised at the frequency specified in the amended DAEC TS Surveillance Requirement (SR) 3.6.1.3.7. The surveillance requirement is to test a representative sample of Excess Flow Check Valves so that each Excess Flow Check Valve is tested at least once every 10 years.

The Excess Flow Check Valves have position indication in the control room. Check valve remote position indication is excluded from Regulatory Guide 1.97 as a required parameter for evaluating containment isolation. The remote position indication will be verified in the closed direction at the same frequency as the exercise test, which will be performed at the frequency prescribed in the amended DAEC TS Surveillance Requirement (SR) 3.6.1.3.7. After the close position test, the valves will be reset, and the remote open position indication will be verified. Although inadvertent actuation of an EFCV during operation is highly unlikely due to the spring-poppet design, the DAEC will verify the EFCVs indicate open in the control room at a frequency greater than once every 2 years.

The failure of an EFCV to isolate would be evaluated per the DAEC corrective action program. The DAEC 10 CFR 50.65 Maintenance Rule Program specifies a performance criteria of less than or equal to 1 maintenance preventable failure to isolate per year on a 3-year rolling average for the combined total of identified automatic isolation Primary Containment valves.

Relief is requested pursuant to 10 CFR 50.55a[(z)(1)]; [on the basis that] the alternative testing will provide an acceptable level of quality and safety.

3.3.5 Staff Evaluation

An EFCV is provided in each instrument process line that penetrates the drywell and is connected to the reactor coolant pressure boundary. The EFCV is designed so that it will not close accidently during normal operation, will close if a rupture of the instrument line is indicated downstream of the valve, can be reopened when appropriate, and has its status indicated in the control room. Because of the unique design, testing of these ECVs and verifying their closure indication require a simulated instrument line break. Therefore, the licensee proposes to perform the exercise tests on a sampling basis, i.e., approximately equal number of EFCVs are tested every 24 months and each EFCV is tested at least once every 10 years.

The proposed alternative described in the relief request is identical to the technical specification (TS) amendment request for SR 3.6.1.3.7 that was submitted by letter dated April 12, 1999. The NRC staff safety evaluation (SE) regarding the proposed amendment was issued on December 29, 1999 (ADAMS Accession Nos. ML003672708 and ML003672720), and concluded that the increase in risk associated with the licensee's request for relaxation of EFCV testing is sufficiently low and acceptable. Additionally, an orifice is installed just inside the drywell in each of these instrument lines. The orifice limits leakage to a level where the integrity and functional performance of secondary containment and associated safety systems are maintained, and the coolant loss is within the capability of the reactor coolant makeup system.

The initial submittal of relief request VR-01 for the fourth DAEC IST Program 10-year interval in 2005 referenced the DAEC TS Amendment No. 230 and referenced the Boiling-Water Reactor (BWR) Owners Group Topical report B21-00658-01, "Excess Flow Check Valve Testing Relaxation" as a basis for the relaxation. By letter dated March 14, 2000, the NRC submitted comments concerning generic application of EFCV testing relaxation to the BWR Owner's Group on this Topical Report and requested that the report be revised accordingly. The General Electric NEDO-32977-A Report, dated June 2000, which was submitted in response to the NRC comments, concluded that individual licensees will develop their own EFCV performance criteria. This conclusion considered that DAEC has included the EFCVs as a subset within the Maintenance Rule. As identified in the March 14, 2000, letter to the BWR Owners Group, the EFCV performance criteria should be based on sound reliability modeling that is consistent with generally expected performance of the EFCVs. Further, the corrective action program must evaluate equipment failures and establish appropriate corrective actions to comply with the performance criteria. NEDO-32977-A also identifies that such performance criteria and the basis, once developed, will be subject to staff review.

In response to staff questions, the licensee submitted a revised VR-01 relief request by letter dated January 4, 2006. This revised relief request correctly referenced NEDO-32977-A dated

June 2000, as additional bases for the relief request. This report concludes that the change in the test frequency had insignificant impact on valve reliability, and that the demonstrated reliability of EFCVs coupled with low consequences of EFCV failure provided adequate justification for extending the interval up to once every 120 months.

Section 4.1 of NEDO-32977-A speculates that most EFCVs fail to close due to sticking, and Attachment A testing data identifies 21 failures on Browns Ferry Nuclear (BFN) Plant, Unit 2, and 5 failures on BFN, Unit 3, due to crud buildup and sticking after extended outages. Table 4-1 of NEDO-32977-A shows that both BFN and DAEC use the same make of EFCV. Considering that NEDO-32977-A indicates DAEC has included EFCVs as a subset of the Maintenance Rule, the staff questioned if adequate maintenance would be performed on the EFCVs. The licensee was requested to indicate if there is any preventive maintenance performed on the EFCVs to prevent sticking and if no preventive maintenance is performed, to explain why such failures reported with similar valves are not expected when the valves are not exercised as frequently. The licensee's response by letter dated May 8, 2006, stated that the EFCV vendor manual states that, under normal operating conditions, the valve does not require maintenance of any kind and DAEC concurs with the vendor that preventive maintenance is not needed. Although the licensee did not address valve failures at BFN, it appears that these failures may have resulted from the plant-specific layup conditions during the extended outage, rather than defective valves.

Attachment B to NEDO-32977-A includes a radiological analysis of the consequences of an unisolable instrument line break. The NRC staff was concerned that the consequences of a common-mode failure caused by sticking in the event of a postulated high-energy line break outside containment, should be considered in evaluating the reliability of the valves to close. By letter dated May 19, 2006, the licensee responded that instrument lines containing EFCVs would not be impacted by postulated high-energy line breaks outside containment.

On the basis of information submitted by the licensee and the topical report submitted by the BWR Owner's Group, there is reasonable assurance that the proposed alternative testing approach provides an acceptable level of quality and safety. The sampling approach that is consistent with the TSs will reduce radiation exposure during testing and provides a 95-percent confidence level for reliability based on current testing experience. Preventive maintenance is not required for these valves and the specified DAEC Maintenance Rule performance criteria should ensure continued reliability through effective corrective actions. The consequences of a rupture in an instrument line combined with a single-failure of an EFCV have been analyzed and are shown to be acceptable. Therefore, the NRC staff finds that, due to the high reliability of the EFCVs and the acceptable consequences of a failure of an EFCV to isolate and trending of any EFCV test failures, the proposed alternative provides an acceptable level of quality and safety.

3.4 Relief Request VR-02

3.4.1 OM Code Requirements

Per Appendix I Section I-1320(a), Test Frequencies, Class 1 Pressure Relief Valves

5-Year Test Interval. Class 1 pressure relief valves shall be tested at least once every 5 years, starting with initial electric power generation. No maximum limit is specified for the number of valves to be tested within each interval; however, a minimum of 20 percent of the valves from each valve group shall be tested within any 24-month interval. This 20 percent shall consist of valves that have not been tested during the current 5-year interval, if they exist. The test interval for any individual valve shall not exceed 5 years.

Per Appendix I Section I-3410(d), Class 1 Main Steam Pressure Relief Valves with Auxiliary Actuating Devices

Each valve that has been maintained or refurbished in place, removed for maintenance and testing, or both, and reinstalled shall be remotely actuated at reduced or normal system pressure to verify open and close capability of the valve before resumption of electric power generation. Set-pressure verification is not required.

Per Section ISTC-5113, Valve Stroke Testing

(a) Active valves shall have their stroke times measured when exercised in accordance with ISTC-3500.
(b) The limiting value(s) of full-stroke time of each valve shall be specified by the Owner.
(c) The stroke time of all valves shall be measured to at least the nearest second.
(d) Any abnormality or erratic action shall be recorded (see ISTC-9120) and an evaluation shall be made regarding need for corrective action.
(e) Stroke testing shall be performed during normal operating conditions for temperature and pressure if practicable.

Per Section ISTC-5114, Stroke Test Acceptance Criteria

Test results shall be compared to the reference values established in accordance with ISTC-3300, ISTC-3310, or ISTC-3320.

(a) Valves with reference stroke times of greater than 10 sec shall exhibit no more than 125% percent change in stroke time when compared to the reference value.
(b) Valves with reference stroke times of less than or equal to 10 sec shall exhibit no more than 150% percent change in stroke time when compared to the reference value.
(c) Valves that stroke in less than 2 sec may be exempted from ISTC-5114(b). In such cases the maximum limiting stroke time shall be 2 sec.

3.4.2 Component Identification

Relief is requested for the following Main Steam Safety/Relief Valves (SRVs):

| | | | | | |
|---|---|---|---|---|---|
| PSV4400 | PSV4401 | PSV4402 | PSV4405 | PSV4406 | PSV4407 |

The main steam relief valves are dual function safety/relief valves that operate as both a pilot operated relief valve (overpressure protection mode) and a power-operated relief valve (manual/Automatic Depressurization System(ADS)/Low-Low Set (LLS) mode). The SRVs are categorized as Category B and Category C valves in the Inservice Testing Program. The Category of C is consistent with the pilot operated relief valve function and is tested per

Appendix I of the ASME OM Code. Category B is consistent with a power-operated relief valve and is tested per Section ISTC-5100 of the ASME OM Code.

3.4.3 Licensee's Basis for Requesting Relief

For Appendix I Section I-1320(a) and Appendix I Section I-3410(d)

The licensee stated:

> This Fifth 10-year IST Interval request for relief is based on Appendix I, ASME OM Code-2004 Edition through the 2006 Addenda. Exercising of the SRV after reinstallation could only be performed during reactor startup when there is sufficient steam pressure to actuate the main disk. Past history indicates that the main disks may not re-seat properly after being exercised during reactor startup resulting in steam leakage into the suppression pool. This leakage results in a decrease in plant performance and the potential for increased suppression pool temperatures and level, which could force a plant shutdown to repair a leaking SRV. Past operating history indicates that the exercising performed during reactor startup is of no significant benefit in ensuring the proper operation of the individual SRV subassemblies.
>
> This request for relief also proposes to implement Code Case OMN-17, "Alternate Rules for Testing ASME Class 1 Pressure Relief/Safety Valves." OMN-17 states in Section (a) that safety valves shall be tested at least once every 72 months (6 years) with a minimum of 20 [percent] of the SRV group being tested within any 24-month interval. This 20 [percent] shall consist of valves that have not been tested during the current 72-month interval, if they exist. The test interval for any individual valve that is in service shall not exceed 72 months except that a 6-month grace period is allowed to coincide with refueling outages to accommodate extended shutdown periods.
>
> Leaking SRVs create operational problems associated with the suppression pool. SRV leakage increases both pool temperature and level, requiring more frequent use of the Residual Heat Removal (RHR) System to maintain the corresponding limits for the suppression pool in the plant's Technical Specifications (TS).
>
> The SRV pilot assemblies removed during a refueling outage are tested at an offsite facility. The as-found testing is performed prior to the resumption of power operation from that refueling outage, meeting the OM code requirements. The valves are refurbished, as necessary, to meet the acceptance criteria of zero leakage, and are certified in writing as being leak free. The valves are then reinstalled in the plant in a subsequent refueling outage and proper pilot operation is confirmed through leak rate testing of the pilot air operators and associated accumulator piping followed by manual lift at reactor power.
>
> Several aspects of SRV design and operation can contribute to valve leakage. As mentioned earlier, these include test pressure, pilot valve disc and rod configuration, and overall system and valve cleanliness. Actuation of the SRVs

after laboratory testing by any means allows these contributors to impact the ability of the valve to re-close completely. DAEC has made significant efforts to minimize the effects of these contributors. In 1999 the DAEC Technical Specifications were changed to permit an as-found tolerance of ± 3% and ± 1% as-left tolerance on the SRV opening setpoints. Since that time, DAEC has not had any SRV setpoint failures and had only one instance of seat leakage during testing at the offsite facility in 2009. There have been two instances of valve leakage during power operation; a pilot valve leak in 2004 and a second stage leak in 2010. This recent event occurred shortly after performance of the in-situ test at reduced system pressure and is believed to be a contributing cause of the valve failure.

In reference to the OM Code 2004 Edition through 2006 Addenda, Section 1-1320, "Test Frequencies, Class I Pressure Relief Valves," states that there is a five year frequency for SRV testing. DAEC proposes to use Code Case OMN-17, "Alternate Rules for Testing ASME Class 1 Pressure Relief/Safety Valves," to change the frequency to six years, including a 6 month grace period, to coincide with the 24-month refueling cycle at DAEC.

Additionally, reducing challenges to the SRVs is a recommendation of NUREG-0737, "TMI Action Plan Requirements," Item II.K.3.16. This recommendation is based on a stuck-open SRV being a possible Loss of Coolant Accident (LOCA). This relief request is consistent with that NRC recommendation.

For ISTC-5113 and ISTC-5114

The licensee stated:

> The proposed alternatives provide adequate assurance that valve stroke time in the power-actuated mode will be acceptable. Stroke timing of the SRVs will be performed at the offsite test facility as described above. Currently, as-found stroke time testing is performed prior to and after performing maintenance at the offsite test facility. After completion of maintenance, plant surveillance tests with steam at reduced pressure are performed in order to detect gross failures of the SRVs to change position. The tests performed at DAEC are not as refined as the valve response time test performed at the offsite test facility. The design requirement for the valve stroke time is 0.45 seconds from signal initiation to valve full open in the power-actuated mode (0.40 seconds from signal initiation to start of valve motion and 0.050 seconds (50 milliseconds) for valve stroke to full open). Measuring valve stroke times to this level of accuracy in-situ at the power plant is not practical and only possible under the controlled conditions of the offsite facility. Per ISTC-5114(c), the maximum permissible valve stroke time can be up to 2 seconds. Consequently, the in-situ test acceptance criterion becomes essentially a "failure to open" criterion. Therefore, the tests performed at DAEC can only detect gross failures to change position and cannot monitor for valve performance degradation between tests.

> In-situ stroke timing is not useful for identifying valve degradation over several operating cycles. Rather, an in-situ exercise test will be used to ensure that the valve will function in the power-actuated mode. This test will be performed at the frequency prescribed in ISTC-3510 for power-operated relief valves. Stroke time at the offsite test facility will demonstrate that the valve performs acceptably compared to the stroke times of known good performing valves. Since the offsite test facility cannot duplicate the electrical control system at the plant, actuation of the valve at the test facility is accomplished through a simplified electrical actuation. Observation of the end of the operating stroke at the offsite test facility is indirect, based on evidence of steam flow and pressure, as it is at the nuclear facility, since the relief valves have no positive open indication. Although these differences may result in minor differences in measured stroke time compared to those measured when installed in the plant, the stroke times measured at the test facility will be comparable to each other and thus can be used to detect any abnormality in valve performance.

Relief is requested pursuant to 10 CFR 50.55a(z)(1) on the basis that the alternative testing will provide an acceptable level of quality and safety.

3.4.4 Licensee's Proposed Alternative Testing

<u>For Appendix I Section I-1320(a) and Appendix I Section I-3410(d)</u>

The licensee proposed:

> As an alternative to the testing required by ASME OM Code-2004, Appendix I, paragraph I-3410(d), DAEC proposes to actuate the SRVs in the relief mode at the certified test facility. A test solenoid valve will be energized, the actuator will stroke, and the 2$^{nd}$ stage rod movement will be verified. This test will verify that, given a signal to energize the solenoid valve, the 2$^{nd}$ stage disc rod will travel to unseat the 2$^{nd}$ stage disc. The 2nd stage function will be recorded in the test documentation package for future reference, as needed. Alternate testing is justified since the remaining segments of the SRV relief mode of operation are verified by other tests. The ability of the pilot disc to open is demonstrated in the safety mode actuation bench test. The integrity of the pneumatic and solenoid system for the SRVs is verified by performance of post maintenance leak rate testing, continuity testing, and a functional testing of the solenoid valve while detached from the SRV.
>
> Automatic valve actuation is proven by Logic System Functional Tests which include verification that the [solenoid-operated valve] SOV is energized by the automatic signal. The actuator to main body joint is inspected during ISI VT-2 exam performed prior to startup. The above proposed surveillance and testing of the SRVs and associated components provide reasonable assurance of adequate valve operation and readiness.
>
> Following reinstallation, the electrical and pneumatic connections will be verified by energizing the SOVs using the respective control switches and inspecting the

pneumatic actuator for movement and leakage (so-called dry lift test). While this test will actuate the SRV second stage, operating experience at other plants indicates that it does not initiate second stage leakage or otherwise damage the valve when performed with no steam pressure; thus, making it a better alternative test to an in-situ steam test during reactor startup.

As an alternative to the testing required by Appendix I, paragraph I-1320(a), the licensee proposed:

> DAEC proposes to implement Code Case OMN-17 that requires in section (a) a 72-month test interval for Class 1 pressure relief valves with a minimum of 20% of the SRV group being tested within any 24- month interval. This 20% shall consist of valves that have not been tested during the current 72-month interval, if they exist. The test interval for any individual valve that is in service shall not exceed 72 months except that a six month grace period is allowed to coincide with refueling outages to accommodate extended shutdown periods. The removed main steam relief valves will be sent for as-found testing to the offsite test facility. Each main steam relief valve will then be disassembled and inspected for abnormal wear and the specific concerns documented in General Electric Company Service Information Letters No. 196, Supplement 17 and No. 646, References 5 and 6 respectively. The post-maintenance tests required by Appendix I, Section I-3310 will be conducted at the offsite testing facility. As part of implementation of this relief request, DAEC will institute measures to assure that each main steam relief valve will be disassembled and inspected prior to being placed on the new 72-month interval.

<u>For ISTC-5113 and ISTC-5114</u>

The licensee proposed:

> Stroke times will be measured at the offsite test facility. Stroke times will be measured following valve rebuild. The timing will begin with the actuating electrical signal and end with the indirect indication of the end of the operating stroke. Stroke time acceptance criteria will use a pre-established reference value that represents good performance for the valve type.
>
> An in-situ exercise test of the valve in the power-actuated mode will be performed at the frequency prescribed in ISTC-3510. The in-situ exercise test will be performed prior to the resumption of electric power generation. Main disc movement and set-pressure verification are not required.

3.4.5 Staff Evaluation

<u>For Appendix I Section I-1320(a) and Appendix I Section I-3410(d)</u>

Mandatory Appendix I, Paragraph I-1320(a) requires that Class 1 pressure relief valves shall be tested at least once every 5 years. Mandatory Appendix I, Paragraph I-3410(d) requires that each valve that has been maintained or refurbished in place, removed for maintenance and testing, or both, and reinstalled shall be remotely actuated at reduced or normal system pressure to verify open and close capability of the valve before resumption of electric power generation. In lieu of the 5-year test interval required by Paragraph I-1320(a), the licensee proposes to implement Code Case OMN-17, which allows a test interval of 6 years plus a 6-month grace period. In lieu of testing the SRVs as required by Paragraph I-3410(d), the licensee proposes to test the main valve and pilot valve at a test facility and verify the actuator by separate surveillance tests.

The NRC staff reviewed the licensee's request and finds that the functional capability of the valves is adequately verified with the proposed alternative testing of the SRVs. In lieu of the current ASME OM Code required test, a manual actuation and valve leakage test will be performed at a steam test facility using test conditions similar to those for the installed valves in the plant, including valve orientation, ambient temperature, and steam conditions. Following SRV installation, the licensee's proposed testing includes verifying proper electrical connections and actuator performance. Although the tests of the SRVs at the steam test facility are not performed with the actual valve solenoids installed in the plant, the solenoid actuators are adequately tested and verified by separate surveillance tests.

A major difference between the current tests required by Mandatory Appendix I, Paragraph I-3410(d) and the proposed alternative is that the proposed alternative allows a series of overlapping tests to individually test SRV components. However, with the proposed alternative, all of the components necessary to manually actuate the SRVs will continue to be tested to demonstrate the functional capability of the valves, without the need to stroke test the valves on-line with system steam pressure. The NRC staff notes that the current testing requirements could result in seat leakage of the SRVs during power operation. Excessive seat leakage could result in excessive suppression pool temperature and level or unidentified drywell leakage. In addition, the staff notes that the proposed alternative is consistent with later editions of the code which no longer require in situ SRV testing. Therefore, the NRC staff finds that the proposed alternative to Paragraph I-3410(d) is acceptable.

Another difference between the current testing required by Paragraph I-1320(a) and the proposed alternative is that the alternative results in less frequent testing of the SRV components. Instead of testing each SRV every 5 years, the proposed alternative of Code Case OMN-17 allows extension of the test frequency from 60 months to 72 months plus a 6-month grace period. The code case imposes a special maintenance requirement to disassemble and inspect each valve to verify that parts are free from defects resulting from time-related degradation or service-induced wear prior to the start of the extended test frequency. The purpose of this maintenance requirement is to reduce the potential for set pressure drift. Code Case OMN-17 has not yet been added to Regulatory Guide 1.192, "Operation and Maintenance Code Case Acceptability, ASME OM Code," nor included in 10 CFR 50.55a by reference. However, the NRC has allowed licensees to use OMN-17 provided all requirements in the code case are met. Consistent with the special maintenance requirement in Code Case OMN-17, each SRV will be refurbished to a like-new condition prior to the start of each 6.5-year test interval. Critical components will be inspected for wear and defects, and the critical dimensions will be measured during the inspection. Components will be reworked to within the specified tolerance or replaced if found to be worn or outside of specified tolerances. Furthermore, Code Case OMN-17 is performance based in that it requires SRVs be tested more frequently, if test failures occur. For example, the OMN-17 requires that two additional valves be tested when a valve in the initial test group exceeds the set pressure acceptance criteria. All remaining valves in the group are required to be tested if one of the additional valves tested exceeds its set pressure acceptance criteria. Therefore, the SRV test frequency would be equivalent to the current test frequency, if test failures occur. In addition, the licensee has had no setpoint failures of the valves to stroke open since 1999. Therefore, the NRC staff finds that the proposed testing frequency, with additional OMN-17 requirements, provides adequate periodic verification of valve operation.

For ISTC-5113 and ISTC-5114

In lieu of the ASME OM Code requirements, the licensee proposed to test the SRVs at an off-site steam test facility, and compare the test results to a pre-established reference value of known good performing valves. The NRC staff reviewed the licensee's request and finds that the main valve stroke time is adequately measured and compared to a comparable pre-established reference value of known good performing valves in the proposed alternative. As noted in the licensee's submittal, the proposed alternative will allow testing of main valves and pilot valves at an offsite facility. A representative solenoid actuator used at the plant will be installed at the test facility for testing the main valve and pilot valve. The test conditions at the test facility are similar to those at normal operating conditions in the plant. Since the test facility cannot duplicate the electrical control system at the plant, actuation of the valve at the test facility is accomplished through a simplified electrical actuation. Observation of the end of the operating stroke at the test facility is indirect based on evidence of steam flow and pressure as it is at the plant. Although these observations may result in minor differences in measured stroke time compared to those measured in the plant, the stroke times measured at the test facility, when compared to a pre-established reference value of known good performing valves, will provide indirect but comparable test results to detect changes or any abnormality in valve performance. Therefore, the NRC staff finds that the proposed alternative captures the valve stroke testing and the stroke time test data required by ISTC-5113 and ISTC-5114 of ASME OM Code, and therefore is acceptable.

3.5 Relief Request VR-03

3.5.1 OM Code Requirements

This request applies to the various frequency specifications of the ASME OM Code. The frequencies for tests given in the ASME OM Code do not include a tolerance band.

| Code Paragraph | Description |
|---|---|
| ISTA-3120(a) | "The frequency for the inservice testing shall be in accordance with the requirements of Section IST." |
| ISTB-3400 | Frequency of Inservice Tests |
| ISTC-3510 | Exercising Test Frequency |
| ISTC-3540 | Manual Valves |

| Code Paragraph | Description |
|---|---|
| ISTC-3630(a) | Frequency |
| ISTC-3700 | Position Verification Testing |
| ISTC-5221(c)(3) | "At least one valve from each group shall be disassembled and examined at each refueling outage; all valves in a group shall be disassembled and examined at least once every 8 years." |
| Appendix I, I-1320 | Test Frequencies - Class 1 Pressure Relief Valves |
| Appendix I, I-1330 | Test Frequencies - Class 1 Nonreclosing Pressure Relief Devices |
| Appendix I, I-1340 | Test Frequencies - Class 1 Pressure Relief Valves that are used for Thermal Relief Application |
| Appendix I, I-1350 | Test Frequencies - Class 2 and 3 Pressure Relief Valves |
| Appendix I, I-1360 | Test Frequencies - Class 2 and 3 Nonreclosing Pressure Relief Devices |
| Appendix I, I-1370 | Test Frequencies - Class 2 and 3 Primary Containment Vacuum Relief Valves |
| Appendix I, I-1380 | Test Frequencies - Class 2 and 3 Vacuum Relief Valves Except for Primary Containment Vacuum Relief Valves |
| Appendix I, I-1390 | Test Frequencies - Class 1 Pressure Relief Valves that are used for Thermal Relief Application |
| Appendix II, II-4000(a)(1) | Performance Improvement Activities Interval |
| Appendix II, II-4000(b)(1)(e) | Optimization of Condition Monitoring Activities Interval |

3.5.2 Component Identification

Various components for which ASME OM Code specifies test frequencies, but not including dynamic restraints (snubbers).

3.5.3 Licensee's Basis for Requesting Relief

The licensee stated:

> Pursuant to 10 CFR 50.55a, "Codes and standards," paragraph [(z)(2)], relief is requested from the frequency specifications of the ASME OM Code. The basis of the relief request is that the Code requirement presents an undue hardship without a compensating increase in the level of quality or safety.

ASME OM Code Section Inservice Testing (IST) establishes the inservice test frequency for all components within the scope of the Code. The frequencies (e.g., quarterly) have always been interpreted as "nominal" frequencies and are defined in plant Technical Specifications (TS) Section 5.5.6, "Administrative Controls, Programs and Manuals - Inservice Testing Program." Licensees routinely applied the surveillance extension time period (i.e., grace period) contained in the plant TS Surveillance Requirements (SR) Applicability, specifically SR 3.0.2. This TS allows for a less than or equal to 25% extension of the surveillance test interval to accommodate plant conditions that may not be suitable for conducting the surveillance. However, regulatory issues have been raised concerning the applicability of the TS "grace period" to ASME OM Code required IST frequencies irrespective of allowances provided under TS SR 3.0.2.

The lack of a tolerance band on the ASME OM Code IST frequency restricts operational flexibility. There may be a conflict where a surveillance test could be required (i.e., its frequency could expire,) but where it is not possible or not desired that it be performed until sometime after a plant condition or associated Limiting Condition for Operation is within its applicability. Therefore, to avoid this conflict, the surveillance test should be performed when it can and should be performed.

The NRC recognized this potential issue in the TS by allowing a frequency tolerance as described in TS SR 3.0.2. The lack of a similar tolerance applied to OM Code testing places an unusual hardship on the plant to adequately schedule work tasks without operational flexibility.

Thus, just as with TS required surveillance testing, some tolerance is needed to allow adjusting OM Code testing intervals to suit the plant conditions and other maintenance and testing activities. This assures operational flexibility when scheduling surveillance tests that minimize the conflicts between the need to complete the surveillance and plant conditions.

3.5.4 Licensee's Proposed Alternative Testing

The licensee proposed:

Code Case OMN-20 is included in the ASME OM Code, 2012 Edition and will be used as the alternative to the frequencies specified in ASME OM Code.

The requirements of Code Case OMN-20 are described below.

ASME OM Division: 1 Section IST and earlier editions and addenda of ASME OM Code specify component test frequencies based either on elapsed time periods (e.g., quarterly, 2 years, etc.) or based on the occurrence of plant conditions or events (e.g., cold shutdown, refueling outage, upon detection of a sample failure, following maintenance, etc.).

a) Components whose test frequencies are based on elapsed time periods shall be tested at the frequencies specified in Section IST with a specified time period between tests as shown in the table below. The specified time period between tests may be reduced or extended as follows:
   1) For periods specified as less than 2 years, the period may be extended by up to 25% for any given test.

   2) For periods specified as greater than or equal to 2 years, the period may be extended by up to 6 months for any given test.

   3) All periods specified may be reduced at the discretion of the owner (i.e., there is no minimum period requirement).

Period extension is to facilitate test scheduling and considers plant operating conditions that may not be suitable for performance of the required testing (e.g., performance of the test would cause an unacceptable increase in the plant risk profile due to transient conditions or other ongoing surveillance, test or maintenance activities). Period extensions are not intended to be used repeatedly merely as an operational convenience to extend test intervals beyond those specified.

Period extensions may also be applied to accelerated test frequencies (e.g., pumps in Alert Range) and other less than two year test frequencies not specified in the table below.

Period extensions may not be applied to the test frequency requirements specified in Subsection ISTD, Preservice and Inservice Examination and Testing of Dynamic Restraints (Snubbers) in Light-water Reactor Nuclear Power Plants, as Subsection ISTD contains its own rules for period extensions.

| Frequency | Specified Time Period Between Tests |
|---|---|
| Quarterly (or every 3 months) | 92 days |
| Semiannually (or every 6 month) | 184 days |
| Annually (or every year) | 366 days |
| X years | X calendar years where 'X' is a whole number of years $\geq 2$ |

b) Components whose test frequencies are based on the occurrence of plant conditions or events may not have their period between tests extended except as allowed by ASME OM Division: 1 Section IST 2009 Edition through OMa-2011 Addenda and earlier editions and addenda of ASME OM Code.

### 3.5.5 Staff Evaluation

Historically, licensees have applied, and the NRC staff has accepted, the standard TS definitions for IST intervals (including allowable interval extensions) to ASME OM Code required testing. (Reference NUREG-1482 Revision 2, Section 3.1.3). Recently, the NRC staff reconsidered the allowance of using TS testing intervals and interval extensions for IST not associated with TS SRs. As noted in Regulatory Issue Summary 2012-10, "NRC Staff Position on Applying Surveillance Requirements 3.0.2 and 3.0.3 to Administrative Controls Program Tests," the NRC determined that programmatic test frequencies can't be extended in accordance with the TS SR 3.0.2. This includes all IST described in the ASME OM Code not specifically required by the TS SRs.

Following this development, the NRC staff sponsored and co-authored an ASME OM Code inquiry and code case to modify the ASME OM Code to include TS-like test interval definitions and interval extension criteria. The resultant ASME Code Case OMN-20, as shown above, was approved by the ASME Operation and Maintenance Standards Committee on February 15, 2012 with the NRC representative voting in the affirmative. ASME Code Case OMN-20 was subsequently published in conjunction with the ASME OM Code, 2012 Edition, and is applicable to all earlier editions and addenda. The licensee proposes to adopt ASME Code Case OMN-20.

Requiring the licensee to meet the ASME OM Code requirements, without an allowance for defined frequency and frequency extensions for IST of pumps and valves, results in a hardship without a compensating increase in the level of quality and safety. Based on the prior acceptance by the NRC staff of the similar TS test interval definitions and interval extension criteria, the staff finds that implementation of the test interval definitions and interval extension criteria contained in ASME OM Code Case OMN-20 is acceptable. Allowing usage of ASME Code Case OMN-20 provides reasonable assurance of operational readiness of pumps and valves subject to the ASME OM Code IST.

## 4.0 CONCLUSION

As set forth above, the NRC staff determines that the alternatives proposed in requests PR-01, PR-02, VR-01, and VR-02 provide an acceptable level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(1). Therefore, the NRC staff authorizes alternative requests PR-01, PR-02, VR-01, and VR-02 at DAEC until the end of the fifth 10-year IST interval.

As set forth above, the NRC staff determines that the alternative proposed in request VR-03 provides reasonable assurance that the components are operationally ready. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Therefore, the NRC staff authorizes alternative request VR-03 at DAEC until the end of the fifth 10-year IST interval.
All other ASME OM Code requirements for which relief was not specifically requested and approved remain applicable.

Principal Contributor: J. Billerbeck

If you have any questions, please contact the Project Manager, Mahesh Chawla at 301-415-8371 or via e-mail at Mahesh.Chawla@nrc.gov.

Sincerely,

*/RA/*

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Office of Nuclear Reactor Regulation

Docket No. 50-331

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