Duane Arnold Energy Center
3277 DAEC Road
Palo, IA 52324
Telephone 319 851 7611
Fax 319 851 7611

IES UTILITIES

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Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station P1-37
Washington, DC 20555-0001

Subject: Duane Arnold Energy Center
Docket No: 50-331
Op. License No: DPR-49
Response to NRC Action Items on Duane Arnold Energy Center Inservice Testing Program

References: 1) Letter from J. Franz (IES) to W. Russell (NRC), dated January 30, 1995, Subject: Third Ten-Year Inservice Testing Program
2) Letter from G. Marcus (NRC) to L. Liu (IES), dated November 21, 1995, Subject: Safety Evaluation of Relief Requests for Duane Arnold Energy Center Inservice Testing Program

File: A-101b, A-286e

Dear Sirs:

In Reference 1, IES Utilities submitted Revision 13 of the Duane Arnold Energy Center (DAEC) Inservice Testing (IST) Program and associated relief requests for NRC review and approval. This revision of the DAEC IST Program adopted ASME/ANSI OM-6 and 10 for inservice testing during the third ten-year IST interval which began on February 1, 1995.

Reference 2 provided the Staff's Safety Evaluation (SE) and Technical Evaluation Report (TER) of the IST Program. The SE stated that the relief requests are acceptable for implementation provided that action items identified in the TER are addressed. IES Utilities' responses to these action items are provided in the attachment. An additional relief request, PR-008, is also included for NRC review and approval.

A047/1

This submittal contains the following new NRC commitment:

> The IST Program will be updated to incorporate the resolution of the TER action items. This includes the development of deferral justifications for check valves subject to disassembly not currently covered by relief requests (action item 5.17).

Should you have any questions regarding this matter, please contact this office.

Sincerely,

Kenneth E. Peveler
Manager, Regulatory Performance

Attachment

cc: C. Rushworth
L. Liu
L. Root
J. Franz
G. Kelly (NRC-NRR)
A. B. Beach (Region III)
NRC Resident Office
Docu

IES UTILITIES INC. RESPONSE TO NRC ACTION ITEMS CONCERNING THE DUANE ARNOLD ENERGY CENTER INSERVICE TESTING PROGRAM

The Technical Evaluation Report (TER) identified nineteen inconsistencies, omissions, and required licensee actions associated with the Duane Arnold Energy Center (DAEC) Third Ten-Year Interval Inservice Testing (IST) Program. Each action item, as described in the TER, is reproduced along with the IES Utilities response. The TER contains two action items designated 5.15.

NRC Action Item 5.1

Relief is recommended for the licensee to calculate the river water, core spray, and RHR pumps' differential pressure at the reference flow rate, and for the licensee to utilize a reference curve for the HPCI pump, provided the licensee reviews the procedures and documents the impracticality of measuring the differential pressure after achieving the reference flowrate ±2%, and proceduralizes the ΔP calculation. (TER Sections 2.1 and 2.2.2).

IES Utilities Response:

The use of linear interpolation to establish pump differential pressure at reference conditions (flow rate) based on two dP readings, one above and one below the reference flow rate, is described in "Proceedings of the Third NRC/ASME Symposium on Valve and Pump Testing," Volume 1, page 485.

The test method of Relief Request PR-02 is superior to that endorsed in Part 5.3 of NUREG-1482. Interpolating test measurements back to a reference flow rate addresses the combined effect of setting tolerance and instrument accuracy on data repeatability. The test procedures establish the test flow rates above and below the reference flow rate in regions where the manufacturer's curves represent "straight-line" operation, for which linear interpolation is valid. The test procedures also provide the necessary equations to convert inservice test data to the corresponding dP at reference conditions. The reference flow rate and allowed measurement bands for differential pressure at flow rates above and below reference flow rate are tabulated below.

SYSTEM	REFERENCE FLOW	TOLERANCE
River Water	6250 gpm	± 100
Core Spray	3034 gpm	± 50
Residual Heat Removal (RHR)	5200 gpm	± 200

For similar reasons, continued use of a pump curve for High Pressure Coolant Injection (HPCI) pump testing is proposed. Data need only be compared to the reference curve to assess pump degradation. The variation from reference of ± 2% will introduce data scatter to test results. The test curve is set to span from the Technical Specification flow requirement of 3000 gpm to 3400 gpm, as read off a digital multimeter installed behind the main control room panel to meet instrument accuracy requirements. Establishing a single reference flow rate would require allotting additional dedicated test personnel to establish reference conditions. Under the current test method, these personnel monitor general plant status.

NUREG-1482, Section 5.2, element 6 states "If vibration levels vary significantly over the range of pump conditions, prepare a method for assigning appropriate vibration acceptance criteria for regions of the pump curve." The variation of vibration over the 400 gpm flow range is addressed in IES Utilities response to Action Item 5.2. As the HPCI pump test method addresses the elements of NUREG-1482 Section 5.2, approval of Relief Request PR-04 is requested fo. continued use.

NRC Action Item 5.2

The licensee must provide additional information justifying the burden of running the HPCI pump for two minutes at each of the points on the reference curve (i.e., the suppression pool increase experienced during this test period and the limiting suppression pool temperature). (TER Section 2.2.2)

IES Utilities Response:

Relief Request PR-04 describes the use of a pump curve to trend HPCI pump performance in lieu of OM-6 methods which require setting flow (or pressure) at a single reference value. The use of a pump curve for inservice testing is described in NUREG-1482, Section 5.2.

By necessity, PR-04 likewise described a process for establishing a new reference curve if maintenance impacting pump hydraulic characteristics was performed. The reference curve is derived from five measurements of differential pressure within the allowed flow range for HPCI IST surveillance testing. The use of five points is in accordance with NUREG-1482 guidance.

The requirement to perform a reference curve test is infrequent. The current pump is estimated to require at least one overhaul over the rest of plant life. Therefore, imposing the two-minute duration hold (OM-6, Part 5.6) at each of five points used to develop the test curve is not especially burdensome. The request for relief from Section 5.6 of OM-6

regarding two-minute operation at test points has been deleted from PR-04. (See pages 24 and 25 of this attachment.)

PR-04 has also been modified to reflect changes in HPCI pump vibration testing resulting from the elimination of Relief Request PR-07. PR-07 had been proposed to allow the use of spectral alert limits and analysis in lieu of the OM-6 Table 3a vibration alert cap of 0.325 in/sec. This relief request has since been eliminated and vibration limits in units of Mils (from Table 3 of OMb-1989, Part 6) will be used. (See letter from G. Kelly (NRC) to L. Liu (IES) dated April 30, 1996).

NUREG-1482, Section 5.2 notes that when a pump curve is used for inservice testing, the licensee must address the variation of pump vibration across the range of allowable test flow rates. In correspondence dated March 4, 1994 (J. Hannon (NRC) to L. Liu (IES)), the NRC issued an SE on inservice testing at the DAEC applicable to testing during the second ten-year IST interval. As discussed in the attachment to the SE, HPCI vibration levels in Mils do not vary significantly over the range of flow rates used for inservice testing.

Vibration alert and action criteria, in units of Mils, is derived from Table 3 of OMb-1989, Part 6. Alert and action limits are dependent on pump speed and not derived from multiples of reference vibration as calculated when using units of in/sec. Therefore, the variation of vibration with flow is not an issue when Mils are used.

NRC Action Item 5.3

The licensee must verify that for all excess flow check valves tested in accordance with Relief Request VR-02, isolating the associated instrumentation has the potential for causing a plant trip or transient. If isolating the valves will not jeopardize continued plant operation, the licensee should perform testing quarterly or revise the relief request. (TER Section 3.1.2)

IES Utilities Response:

Excess Flow Check Valve testing is discussed in NUREG/CR-6396, "Examples, Clarifications, and Guidance on Preparing Requests for Relief from Pump and Valve Inservice Testing Requirements." As described in NUREG/CR-6396, relief is no longer required to defer testing of excess flow check valves until refueling outages under OM-10, Paragraph 4.3.2.2(e).

Relief Request VR-02 also requested relief from the biennial frequency requirement to perform leak testing (OM-10 Part 4.2.2.3(a)) and position indication testing (OM-10 Part 4.1). As stated in the TER, relief is not required from the biennial requirement of OM-10

Parts 4.1 and 4.2.2.3(a) for testing performed on an eighteen-month refuel cycle. Per the guidance of NUREG/CR-6396, a Refuel Justification (RRJ-03) has been prepared which addresses the impracticality of performing the subject testing quarterly or during cold shutdown. RRJ-03 is provided on pages 16 and 17 of this attachment.

NRC Action Item 5.4

The licensee should review the code classification and safety function of the CRD rupture disks. If the disks are within the scope of the regulations and Code, the licensee must provide additional information concerning the hardship of replacing these disks every five years, before relief can be recommended. Additionally, the licensee should provide an alternate means or schedule for monitoring degradation commensurate with their safety significance. (TER Section 3.2)

IES Utilities Response:

The inservice inspection (ISI) classification of the subject rupture disks was evaluated in conjunction with the preparation of the ISI program update for the third ten-year ISI interval which began on November 1, 1996. The Class 2 boundary terminates at the internal accumulator piston which separates nitrogen and charging water. Therefore, the disks are outside the scope of the program and Relief Request VR-04 is hereby withdrawn.

NRC Action Item 5.5

The licensee has proposed an exception to the requirements of ¶4.2.1.8(d) for four emergency service water valves based on the variance of stroke times. The licensee has not provided the normal range of stroke times nor the maximum limiting stroke time that will be applied. Additional information on the burden of complying with the Code and assurance that the proposed alternate will provide an adequate means for detecting valve degradation prior to failure is necessary before relief can be recommended. The licensee should revise and resubmit the request. (TER Section 3.6)

IES Utilities Response:

The nominal opening time for CV-1956A and CV-1956B is 2 seconds. The nominal opening time for CV-2080 and CV-2081 is 2.5 seconds. Based on these nominal times, the acceptance criteria of OM Part 10, Paragraph 4.2.1.8(d) is impractical to apply given the method of measurement.

The limiting value of stroke time for these valves is currently established at 5 seconds. Due to the fact that nominal valve stroke times can be influenced by maintenance, the

limiting value of stroke time is subject to revision. Accordingly, this information which is subject to modification is inappropriate to include in Relief Request VR-23 on a permanent basis.

The 5-second maximum stroke-time limit represents a reasonable deviation from current nominal valve performance for the assessment of operability. The number also represents a conservative philosophy for establishing limiting stroke times. Though subject to change as a result of maintenance, the acceptance criteria is subject to site inspection.

NRC Action Item 5.6

The licensee has proposed to exercise the HPCI and RCIC to feedwater valves (V-14-001 and 3) with feedwater flow quarterly, when practical (i.e., when operating above 90 percent power and pressure instruments are available). Based on the request (VR-03), it is not apparent how pressure instrumentation will be used to verify the full-stroke of the valves, and why the unavailability of pressure instruments and power levels less than 90% make testing impractical. The licensee should provide additional information why testing quarterly is impractical.

There is no flow instrumentation installed to measure flow through each of these valves. The installed flow instrumentation on these lines is upstream of piping that cross-connects the two feedwater trains. The licensee has referred to calculation M93-12 which will be used to verify that the valves will full-stroke open. Specific details of the test method have not been provided in the request. Therefore, no determination of the acceptability of the test method has been made. As discussed in Generic Letter 89-04, Position 1 and in NUREG-1482, Appendix A, Group Question 2 Current Considerations, knowledge of total flow through multiple paths does not provide verification of flowrates through the individual valves and is not a valid full-stroke exercise. The licensee is referred to the January 24, 1992 Safety Evaluation on the Beaver Valley Inservice Testing Program, referenced in Appendix A of NUREG-1482. The licensee should review these documents and ensure that the test method is both sufficient to indicate that the check valves are full-stroke exercised, and repeatable.

IES Utilities Response:

As described, feedwater system configuration precludes the use of normal operating feedwater flow measurements to confirm full-stroke open capability of V-14-1 and V-14-3. Calculation M93-12, "Increase in ΔP due to Unbalanced Feedwater Flow," derived quantitative criteria for verification of feedwater check valve ability to meet HPCI/RCIC injection requirements independent of flow measurements. This "alternate test method" to full-flow measurement for verification of a check valve's ability to open was prepared and developed in accordance with GL 89-04, Attachment 1, Position 1 guidance.

Calculation M93-12 was submitted to the Staff by letter dated April 12, 1995 (K. Young (IES) to W. Russell (NRC)). This calculation expresses the expected pressure difference between feedwater header and reactor pressure that would be observed if feedwater check valve V-14-3 were partially open, passing the equivalent of HPCI injection requirements of 3000 gpm. Performing the calculation utilizing the HPCI model encompasses RCIC injection with its lower requirement of 400 gpm.

With V-14-3 partially open, more flow is directed through V-14-1. The parallel feedwater headers are crosstied downstream of installed flow instrumentation and upstream of system check valves.

The increase in flow through V-14-1 requires an increase in feedwater header pressure above balanced feedwater flow conditions to overcome the increased system resistance. M93-12 derived differential pressures for various reactor power levels, indicative of balanced and abnormal flow conditions by application of Bernoulli's Equation.

During reactor power operations, recording feedwater header pressure and reactor pressure can be used to assess check valve condition. The two readings are subtracted and compared to a limiting value, dependent on power level. M93-12 addressed the accuracy of the available pressure instruments. Below 90 percent reactor power, the instrument inaccuracy makes application of calculation M93-12 inconclusive.

Application of calculation M93-12 to demonstrate the ability of V-14-1 and V-14-3 to meet flow requirements is accordingly dependent on power level and availability of pressure instrumentation. The test has advantages over disassembly. Radiation exposure is reduced and the status of both check valves can be verified periodically during plant operation.

NRC Action Item 5.7

It is not apparent from the information detailed in the justification why cycling each of the two reactor vessel head vent valves in series would cause a reactor transient. The licensee should clarify why quarterly testing is impractical and review the safety function of these valves. Per the deferral justification (CSJ-01), the safety function is to only provide reactor coolant pressure boundary. The licensee should evaluate whether these valves have an active safety function.

IES Utilities Response:

The safety function of these valves has been reviewed and it has been determined that exercising per ASME/ANSI OM-10 is not required; accordingly, deferral justification

CSJ-01 has been deleted. These normally-closed valves constitute the Class 1 reactor coolant pressure boundary, a passive function. The valves are opened to provide a vent during cold shutdown operations (non-safety function) and repositioned during startup.

NRC Action Item 5.8

The licensee states that the testing of the recirculation pump discharge bypass valves cannot be performed because of consequences if the valve failed during testing (CSJ-05). The licensee should not base the justification simply on an assumed failure, unless the failure could cause a loss of a safety system function or the probability and risk associated with a test induced failure warrants it. For example, the NRC staff has concluded that quarterly testing of PORVs in PWRs is impractical because PORVs have shown a high probability of causing a small LOCA by sticking open. Typical valves, whose failure in a non-conservative position during exercising would cause a loss of system function, include the RHR pump discharge crossover valves for plants whose licensing bases assumes that all four cold legs are being supplied by water from at least one pump (Reference NRC Information Notice 87-01). Other valves may fall into this category under certain system configurations or plant operating modes, e.g., when one train of a redundant ECCS system is inoperable, non-redundant valves in the remaining train should not be cycled because their failure would cause a total loss of system function. The licensee is referred to NUREG-1482, Sections 2.4.5 and 3.1.1 for the staff's guidance on impractical conditions.

IES Utilities Response:

MO-4629/4630, Reactor Recirculation Pump 1P-201A/B Discharge Bypass Valves were included in Revision 13 of the DAEC IST Program on the basis that they are closed during Shutdown Cooling (SDC) operation for proper flow orientation through the core. The SDC cooling mode of RHR operation is "non-safety" related for the DAEC. NUREG-1482 discusses the testing of components required for cold-shutdown when this operating mode is non-safety related (Part 2.2). Based on this clarification, these valves are being removed entirely from the IST Program. As normally open valves during reactor operation, they do not perform a passive closed function which would subject them to position indication testing.

The subject valves also receive closure signals on Low Pressure Coolant Injection (LPCI) Loop Selection. Closure of these valves has been determined not to be necessary to satisfy post Loss-of Coolant-Accident (LOCA) core cooling requirements.

NRC Action Item 5.9

As discussed in NUREG-1482, Section 3.1.2, entering a LCO is not sufficient justification alone for deferring testing. The licensee should provide additional justification in CSJ-09, 10 and 11, or perform testing of the subject valves quarterly.

IES Utilities Response:

The check valves of cold shutdown justification CSJ-09, 10, and 11 are included in the DAEC Appendix J Program, which is the basis for the closed exercise requirement. The subject check valves do not have local or remote position indication that can be used for determining obturator position. Obturator closure also cannot be determined from system pressure response. The only practical method of verifying check valve closure on dP reversal is by test volume pressurization and venting upstream of the valve in test.

The test method is analogous to performing a leak test without quantifying makeup flow to determine seat leakage. NUREG-1482, Section 4.1.4, "Extension of Test Interval to Refueling Outage for Check Valves Verified Closed by Leak Testing," discusses the general extension of closure verification exercising of Appendix J valves to refuelings. This section states that "If no other practical means is available, it is acceptable to verify that check valves are capable of closing by performing leak-rate testing, such as local leak rate testing in accord with Appendix J to 10 CFR Part 50, at each reactor refueling outage. Recognizing that the setup and performance limitations may render leak testing impractical during power operation and cold shutdown outages, the staff has determined that implementation of an extension of the test frequency for such valves is acceptable in accord with 10 CFR 50.55a(f)(4)(iv)."

In addition to the fact that safety systems are rendered inoperable to perform the desired testing, the need to set up test equipment (NUREG-1482, 4.1.4) has been added to CSJ-9, 10, and 11 as the basis for not performing testing quarterly.

V-22-22 has been deleted from CSJ-09. This manual stop-check valve's closure capability is confirmed by disassembly in accordance with GL 89-04, Attachment 1, Position 2.

NRC Action Item 5.10

It is impractical to exercise the LPCI injection check valves quarterly due to the insufficient discharge head of the RHR pumps. It is also impractical to full-stroke exercise these valves during cold shutdown because access to the inerted containment is required. The licensee has proposed to part-stroke exercise only one valve each cold shutdown based on the burden of realigning the RHR system to allow testing of the other

valve. Although it may be impractical to exercise both valves every cold shutdown, there may be shutdown periods of sufficient length to allow realignment of the system. If the licensee can only exercise one valve at a cold shutdown period, they should ensure that the other valve is exercised at the next cold shutdown. (RRJ-15)

IES Utilities Response:

RRJ-15 has been modified to reflect NUREG-1482, Section 3.1.1.3 guidance regarding de-inerting containment for inservice testing. Confusing wording regarding multiple train testing has been deleted. RRJ-15 has also been modified to note requirements for partial stroke-testing during cold shutdowns. These expectations are described in NUREG-1482, 3.1.1.1 and will be implemented to the extent practical for these particular valves.

NRC Action Item 5.11

It is impractical to exercise the core spray injection valves quarterly due to the insufficient discharge head of the core spray pumps. It is also impractical to full-stroke exercise these valves during cold shutdown periods because of operational constraints with the RPV water level. The licensee has not specifically described the impracticality of partial-stroke exercising the valves at cold shutdown, but has stated that preparations to inject water via the core spray pumps are excessive and burdensome. The core spray pumps are tested quarterly. It is not apparent why a partial-stroke exercise is so burdensome. The licensee should partial-stroke exercise the valves at cold shutdown, or revise the deferral justification accordingly. (RRJ-17)

IES Utilities Response:

Performance of a partial-stroke exercise of the core spray injection check valves at a cold-shutdown frequency is impractical. For the quarterly test, the core spray pump takes suction from the suppression pool and recirculates flow back to the suppression pool via a test line. Performance of a partial stroke exercise and injection to the vessel would require realignment of the pump suction to the Condensate Storage Tank. This would result in the transfer of high-conductivity suppression pool water to the reactor from the residual suppression pool water in the system piping. The deferral justification has been revised accordingly.

NRC Action Item 5.12

Full-stroke exercising of the SBLC injection check valves during operation or cold shutdowns is impractical due to the extensive test set up and system restoration. The licensee should evaluate the practicality of partial-stroke exercising these valves at cold shutdowns utilizing test connections. Other BWRs, such as Quad Cities, perform testing

in this manner. The licensee should either partial-exercise these valves at cold shutdown or revise the justification. Additionally, the licensee should correct the justification to reflect the correct valve number, i.e., V-26-009. (RRJ-21)

IES Utilities Response:

The DAEC Standby Liquid Control (SBLC) System does not have installed flow instrumentation downstream of the system explosively actuated valves as used by Commonwealth Edison's Quad Cities Plant during cold shutdowns for partial exercising.

To perform a conclusive partial exercise of both V-26-8 and V-26-9, Drywell access is necessary to close normally locked open manual isolation V-26-32. Isolating the test piping from the reactor is necessary to develop a conclusive flow rate through the check valves. The DAEC Drywell is inerted during normal reactor operation. De-inerting BWR containments for the purpose of performing cold-shutdown testing is discussed in NUREG-1482, Section 3.1.1.3. This section states that "The NRC staff does not consider that containment de-inerting solely for the purpose of valve testing is warranted and approves the test deferral...."

RRJ-21 has been amended to reflect the guidance of NUREG-1482, Section 3.1.1.3, regarding de-inerting containment for inservice testing. The typographical error has also been corrected.

NRC Action Item 5.13

The licensee has not provided adequate justification for not exercising the CRD scram discharge header vent and drain valves at cold shutdown. The licensee should discuss if fail-safe testing can be performed without testing the RPS and why the normal exercising of these valves quarterly does not fulfill the requirements of ¶ 4.2.1.6. Other BWRs, such as Oyster Creek perform this testing at cold shutdowns. (RRJ-29)

IES Utilities Response:

The quarterly exercise of the CRD SCRAM discharge header vent and drain valves does verify the valves will close on a loss of air pressure. Test solenoids exist to allow cycling the valves without input of the reactor protection system. These solenoids are used during quarterly surveillance.

Actuating the CRD scram discharge header vent and drain valves utilizing the solenoids tied to the RPS requires initiation of a full SCRAM signal. The solenoids de-energize and air is vented from the valve actuators. Utilizing the RPS solenoids to actuate the

CRD SCRAM discharge header vent and drain valves is the appropriate method for performing fail-safe testing, utilizing the safety-related control logic and solenoids.

The DAEC IST Program has been modified to reflect that fail-safe testing of the CRD SCRAM discharge header vent and drain valves will be performed on a cold shutdown frequency, in accordance with OM-10, Part 4.2.1.2.f. RRJ-29 has been deleted and a cold-shutdown justification added for fail-safe testing on a cold-shutdown frequency.

NRC Action Item 5.14

The licensee in Section 5.4 of the IST Program states that an extension of +25% may be applied to the test intervals, as allowed by the Technical Specifications. The Technical Specifications do not however address the test intervals for relief valves, and as discussed in NUREG-1482, Section 3.1.3, the extension should not be applied to valves tested in accordance with OM Part 1.

IES Utilities Response:

Section 5.4, "Testing Intervals," of the DAEC Inservice Testing Program has been modified to note that the TS surveillance frequency tolerance may not be applied to relief valve testing performed to OM-1 requirements. The clarification guidance of NUREG-1482, Section 3.1.3 has been referenced.

NRC Action Item 5.15

The licensee in Section 5.6 of the IST Program states that when quarterly testing is "undesirable," Part 10 allows deferral to cold shutdowns or refueling periods. Part 10, ¶4.2 and 4.3, allow testing to be deferred only when quarterly testing is impractical. If testing is practical, but undesirable, the licensee is required to submit a relief request. The licensee is requested to review the IST Program and revise the deferral justifications as necessary based on this clarification.

IES Utilities Response:

The TER addressed various deferral justifications. The justifications have been revised or deleted, as appropriate: CSJ-01 is discussed in the IES response to action item 5.7. CSJ-05 is discussed in item 5.8. CSJ-09, CSJ-10 and CSJ-11 are discussed in item 5.9. RRJ-15 is discussed in item 5.10. RRJ-17 is discussed in item 5.11. RRJ-21 is discussed in item 5.12. RRJ-29 is discussed in item 5.13.

NRC Action Item 5.15

Note 2 to Table A states that the pump suction pressure will be derived indirectly from level. As discussed in Section 5.5.3 of NUREG-1482, the calculation must be included in the implementing procedure and the accuracy must comply with the Code requirements, i.e., ±2%. The licensee should verify that the Code requirements are met, or submit a relief request. Additionally, Note 4 discusses test frequency, however, this note is not applied to any of the pumps in the table.

IES Utilities Response:

The River Water, Emergency Service Water (ESW), and RHR Service Water (SW) pumps are Code classed components subject to inservice testing in accordance with 10 CFR 50.55a. Suction pressure during inservice testing is calculated from the height of water measured above the suction inlet of these vertical line shaft pumps. The test procedures contain the necessary conversion equations for calculation of suction pressure.

Stilling Basin level is used to calculate ESW and RHR SW pump suction pressure. The instrument loop used satisfies OM-6 range (4.6.1.2.a) and Table 1 accuracy requirements.

River Water Level is used to calculate River Water pump suction pressure. The instrument used has a 40′ span. The normal level during testing is less than one third of span. The Code accuracy requirements are satisfied over the range of river levels expected during testing. As the instrument provides measurement accuracy equivalent to Code requirements, relief is not required per Section 5.5.3 of NUREG-1482. This section states "Therefore, the licensee may implement a calculational method without obtaining relief because the ASME Code allows for the determination of differential pressure from the discharge pressure and the pressure in the pump inlet. To implement this guidance, the method of determining the inlet pressure using a calculational method must meet quality assurance requirements and be included in a procedure."

The diesel fuel oil pumps are submerged in oil and the oil height above its suction inlet is used to calculate suction pressure. This pump is not within the ISI boundary and accordingly need not satisfy OM-6 accuracy requirements.

NRC Action Item 5.16

Relief Requests VR-07 and 8 discuss rupture disks and state that there is no history of failure of these disks. Although these requests concern disks that are not ASME Code classified and staff approval is not required, the licensee is referred to NRC Information Notice 93-067 (Ref. 19), NUREG/CR-6014 (Ref. 20), and AEOD Report E402 (Ref. 21) for documentation of failures of these components.

IES Utilities Response:

NRC Information Notice 93-067 has been reviewed by DAEC Engineering for site-specific applicability. The record of this review is available on site. Based on the ISI classification of these rupture disks, Relief Requests VR-07 and VR-08 have been deleted.

NRC Action Item 5.17

The review performed for this TER did not include verification that all pumps and valves within the scope of 10 CFR 50.55a and Section XI are contained in the IST Program, and did not ensure that all applicable testing requirements have been identified. The IST Program's scope was, however, reviewed for selected systems. The pumps and valves in the residual heat removal and service water-pumphouse systems were reviewed against OMa-1988, Part 6 and 10 requirements. The review results showed compliance with the Code, except for the following items. The licensee should review these items and make changes to the IST Program, where appropriate. The licensee should also consider generically the types of omissions noted here and where necessary, review and revise the IST Program for other systems, as well.

- Valves AV-4926E and F, and 4929C and D, in the service water system are only tested closed. These valves generally have a function to open to allow the air to be vented, thereby preventing air binding. The licensee should review the function for these valves, and revise the IST Program as necessary.
- Air-operated strainer bypass valves CV-4939A & B and 4940A & B in the service water system fail closed. These valves are not, however, included in the IST Program. The licensee should review the function for these valves, and revise the IST Program as necessary.
- The licensee has not included the RHR/Core Spray fill pump in the IST Program, nor has specified exercising the associated check valves open (they are only exercised closed). The licensee should review the function of this pump that maintains these systems full of water to prevent a water hammer, and revise the IST Program as necessary.
- Appendix C indicates that valve MO-2010 will be exercised at cold shutdown. However, there is no justification referenced or contained in Appendix E. This valve should be tested quarterly or a justification must be prepared.
- Appendix C indicates that valve V-20-008 will be disassembled and inspected at refueling outages. However, no relief request or deferral justification is noted. It

appears that VR-05 also applies to this valve. Appendix C and D should be revised as appropriate.

- Valve V-20-010 is only exercised closed per the IST Program. This valve must open to allow service water to be injected into the reactor vessel, via the RHR system. The licensee should review the safety analysis report and evaluate whether this valve has a safety function in the open direction, and revise the IST Program accordingly.

IES Utilities Response:

- The air-vent valves are simple devices, consisting of a lever/fulcrum assembly and ball float. Operational problems with these valves, in the past, have been identified by excessive seat leakage. The inability to vent air does not appear to be a credible failure mechanism for these components based on past performance history.

- The backwash capability of the ESW and RHRSW strainers is classified as non-safety.

- The DAEC RHR/Core Spray keep-fill pump and associated "open" function of keep-fill check valves is beyond IST Program scope by plant design basis. As described in plant Technical Specification Bases, the prevention of water hammer is desirable, but it will not prevent the system from performing its design function (TS Bases 3.5.H). Discharge piping pressure is alarmed and compensatory measures are taken to preclude the possibility of water hammer. The "open" function of the keep-fill check valves and functional capability of the keep-fill pump is, in essence, continually in test.

- MO-2010 is a passive open valve for inservice testing purposes, cross-tying the LPCI trains to meet three pump design basis accident (DBA) injection requirements (two pumps per train, single failure of one pump). Periodically exercising the valve is beneficial on an augmented basis: OM-10 requirements, other than position indication testing, are not applicable.

- LPCI minimum flow recirculation line check valve V-20-8 is orientated vertically. Per GL 89-04, Attachment 1, Position 2, it cannot be grouped with its horizontally-orientated sister valves of Relief Request VR-05. Due to OM-10 endorsement of valve disassembly, it was unclear if deferral justifications were necessary. Deferral justifications for check valves subject to disassembly not currently covered by relief requests will be developed.

- While check valve V-20-10 does allow for the injection of RHRSW to the reactor vessel through the RHR system, this feature is not credited in the DAEC Emergency Core Cooling System (ECCS) analysis. The check valve's inclusion in the IST

Program is based on its passive function as the ISI boundary termination. A two-year seat leakage test is performed on the valve to confirm its integrity as a passive barrier.

NRC Action Item 5.18

The licensee has stated via Note 3 in Appendix A, that the RCIC, screenwash, diesel fuel oil, and standby liquid control pumps are located outside the ISI-code boundaries. The licensee has not discussed in Section 3 of the IST Program how the ISI-class boundaries were developed. The licensee should ensure that the code classification is consistent with the commitments contained in the plant's safety analysis report. The licensee is referred to NUREG-1482, Sections 2.2 and 2.3 for the staff's guidance concerning the scope of the IST Program.

IES Utilities Response:

The DAEC second ten-year ISI interval was extended one year as permitted by the ASME Code and 10CFR 50.55a. Accordingly, the third ten-year ISI interval began on November 1, 1996. The DAEC third ten-year IST interval began on February 1, 1995. In preparation for the third ten-year ISI interval, a thorough review of current ISI boundaries was performed. The ISI boundary review addresses the concerns of Action Item 5.18.

As a result of the ISI boundary review, several systems or portions of systems were reclassified. Consequently, several IST relief requests are being resubmitted for NRC approval. These reliefs will be implemented in parallel with NRC review and approval.

Relief Request PR-01 for the Standby Liquid Control Pumps is being resubmitted for the impracticality of complying with the vibration frequency response range of OM Part 6, ¶4.6.1.6. PR-01 is provided on pages 19 and 20 of this attachment. Relief Request VR-12 is being resubmitted for Containment Atmosphere Monitoring System Solenoid Valves which are not equipped with installed position indication. Utilizing non-intrusive test instrumentation, the stroke times of these valves will be measured cyclically. VR-12 is provided on pages 21 and 22 of this attachment.

Relief Request VR-10 for Pressure Suppression Chamber to Drywell Vacuum Breaker Valves has been deleted; the valves are being redesignated as Class 2 components. A Refueling Justification (RRJ-25) has been prepared for these valves. RRJ-25 is provided on page 18 of this attachment.

The components of Relief Requests VR-13 and VR-18 have also been redesignated as Class 2 components; the test methods for these components are in compliance with GL 89-04 Attachment 1 Positions. Accordingly, the requisite approval is granted under the Generic Letter.

NUMBER: RRJ-03

SYSTEM: Nuclear Boiler, Reactor Recirculation, Reactor Core Isolation Cooling, Core Spray, High Pressure Coolant Injection, and Reactor Vessel Instrumentation

COMPONENTS: XFV-xxxx, Excess Flow Check Valves

SAFETY FUNCTION: Excess Flow Check Valves are located in instrument process lines that penetrate the Drywell, performing a containment isolation function. These valves will close automatically if a rupture of downstream instrument tubing occurs.

BASIS: Excess flow check valves are installed on instrument lines penetrating containment to minimize leakage in event of an instrument-line failure outside containment per Regulatory Guide 1.11. The excess 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 with 10 psid 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 closes off flow through the valve. These devices are highly reliable.

The testing above requires the removal of the associated instrument or instruments from service. These instruments monitor reactor performance parameters (core flow, core and jet pump differential pressure) or provide inputs to various systems. Many of the inputs are associated with the initiation of a safety system and testing is impractical quarterly due to concerns of creating a plant transient or trip. For those excess flow check valves that are associated with instruments that monitor reactor performance, quarterly testing is likewise impractical: personnel safety concerns must be considered since the process-side of these valves is high pressure and contaminated reactor coolant. The performance history of these devices does not warrant incurring these risks. These valves are likewise impractical to exercise on a cold shutdown frequency: there are 94 excess flow check valves. Performance of testing would delay reactor shut-down or start-up, creating a negative impact on outage time and

plant availability. In summary, due to plant and personnel safety concerns and plant availability in light of the highly reliable performance of these devices, testing will be performed at a refueling frequency.

NUMBER: RRJ-25

SYSTEM: Containment Atmosphere Monitoring System

COMPONENTS: CV-4327A, CV-4327B, CV-4327C, CV-4327D, CV-4327F, CV-4327G, CV-4327H - Suppression Chamber - Drywell Group Vacuum Breakers

SAFETY FUNCTION: These vacuum breakers are located on the vent header within the airspace of the suppression chamber. They relieve pressure from the suppression chamber through vent lines to the Drywell to prevent a significant pressure differential between the Drywell and suppression chamber.

BASIS: These vacuum breakers are located within the suppression chamber and are inaccessible during plant operation. The suppression chamber contains the pressure suppression pool, the heat sink for any postulated transient or accident. Access to the suppression chamber is provided through manways; these manways establish primary containment and access requires de-inerting primary containment. As described in NUREG-1482, de-inerting primary containment for the purpose of inservice testing is impractical during cold shutdowns.

Though inaccessible during plant operation and cold shutdowns, the valves are equipped with a pneumatic operator which allows remote operation. On a monthly basis, Technical Specifications functionally test these valves, verifying obturator freedom of movement. The valves are equipped with position indication lights in the Control Room. This test satisfies OM-1, Paragraph 1.3.4.3 requirements.

In order to test these valves for operability with respect to their non-powered operation and setpoints, test personnel must have access to each valve to allow mechanical exercising. Access to these valves is available during refueling outages. During each refueling outage, each valve will be mechanically exercised and the setpoint of each measured and valve operability evaluated.

RELIEF REQUEST NO. PR-01

PUMPS:

1P-230 A&B - Standby Liquid Control Injection (SBLC)

TEST REQUIREMENT:

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. (Part 6, Para. 4.6.1.6)

BASIS FOR RELIEF:

The nominal shaft rotational speed of these pumps is 242 RPM which is equivalent to approximately 4 Hz. Based on this frequency and Part 6, Para. 4.6.1.6, 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 of sophistication and cost of the equipment.

These are of a simplified reciprocating (piston) positive displacement design with rolling element bearings, Model Number TD-60, manufactured by Union Pump Corporation. Union Pump Corp. 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.

The requirement to measure vibration with instruments with response to 1/3 shaft speed stems from the need to detect oil whip or oil whirl associated with journal bearings. In the case of these pumps, there are no journal bearings to create these phenomena, thus satisfying the frequency response range criteria would serve no significant purpose. The significant modes of vibration with respect to equipment monitoring are as follows:

- 1-Times Crankshaft Speed - 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.

- 2-Times Crankshaft Speed - 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.
- Other Multiples of Shaft Speed - An increase in vibration at other frequencies may be indications of cavitation at several valves, looseness at multiple locations, or bearing degradation.

Based on the foregoing discussion, it is clear that monitoring pump vibration within the frequency range of 4 to 100 Hz will provide adequate information for evaluating pump condition and ensuring continued reliability with respect to the pumps' function. Compliance with the Code requirement would result in a significant hardship and cost without any compensating increase in pump performance or plant safety.

ALTERNATE TESTING:

Vibration levels of the Standby Liquid Control Pumps will be measured in accordance with the applicable portions of Part 6, Paragraph 4.6 with the exception of the lower frequency response limit for the instrumentation (Para. 4.6.1.6). In this case the lower response limit of the vibration measuring equipment will be 4.03 Hz or less.

RELIEF REQUEST NO. VR-12

SYSTEM:

Containment Atmosphere Monitoring System

COMPONENTS:

SV-8101A	SV-8106A
SV-8101B	SV-8106B
SV-8102A	SV-8107A
SV-8102B	SV-8107B
SV-8103A	SV-8108A
SV-8103B	SV-8108B
SV-8104A	SV-8109A
SV-8104B	SV-8109B
SV-8105A	SV-8110A
SV-8105B	SV-8110B

CATEGORY:

A

FUNCTION:

These valves provide containment isolation for the containment atmosphere monitoring system.

TEST REQUIREMENTS:

The stroke time of all power-operated valves shall be measured to at least the nearest second. Part 10, Para. 4.2.1.4. (b)

Exercising requirements of Part 10, Para. 4.2.1.2, the test frequencies are limited to quarterly (plant operation), cold shutdown or during refueling outages.

BASIS FOR RELIEF:

These valves are not provided with individual remote position indicators. The valve stems of these solenoid operated valves are enclosed, making local observation and stroke timing stem movement impractical. The advent of new

technologies allows the application of non-intrusive test instrumentation to measure valve stroke time.

This instrumentation is expensive and delicate. Though non-intrusive, collecting the requisite data is time-consuming and, accordingly, impractical to perform during plant operation quarterly or during cold shutdowns. The reduced frequency of testing is offset by the quality of information gathered: Valve times can be measured in milliseconds and data are not influenced by human reaction time as typical for Rapid-Acting Valves.

Relief is requested to perform the requisite testing on a cyclic basis, once per operating cycle. This allows for more effective outage planning, as anomalies in performance can be identified during an on-line test due to the enhanced quality of test data and appropriate corrective action or further testing planned.

ALTERNATE TESTING:

These valves will be exercised and their positions locally verified every three months by direct observation of flow initiation/cessation through the valves. Stroke times will not be measured. Once per operating cycle the stroke times of these valves will be measured utilizing non-intrusive test instrumentation. For inservice test purposes, the valves will be designated Rapid Acting.

RELIEF REQUEST NO. PR-008

PUMPS:

1P-117A through 1P-117D River Water Pumps

TEST REQUIREMENT:

The full-scale range of each analog instrument shall be not greater than three times the reference value. (Part 6, Para. 4.6.1.2(a))

BASIS FOR RELIEF:

The installed pump discharge pressure gauge (PI-2909A, B, C, D) for each River Water Supply Pump has a 0-30 psig full-scale range. Surveillance tests performed per ASME Code are conducted at approximately 6250 gpm, with a corresponding pump discharge pressure of 5 to 9 psig. Attempts to permanently install gauges meeting the full-scale range requirements have resulted in gauge damage due to over-ranging. This over-ranging is caused by the higher discharge pressure observed during pump startup and system mode changes. Pump shutoff head is approximately 50 psid, which equates to a pump discharge pressure at the gauge location of 32 psig. The installed gauges are calibrated to 1% or better of full-scale. Currently, temporary test gauges meeting the OM Part 6 requirements are installed each time the pumps are tested. These 0-15 psig range gauges are then removed upon test completion. The use of a temporary test gauge is undesirable due to 1) wear associated with the breaking and reassembly of mechanical connections, 2) the additional calibration requirements associated with unnecessary instrumentation, and 3) the additional manhours required to install and remove the test gauges.

ALTERNATE TESTING:

Pump discharge pressure will be measured using installed instrumentation calibrated to 1% or better of full-scale, providing readings equivalent to Code-specified instrumentation. NUREG-1482, Section 5.5.1, discusses the range and accuracy requirements of analog instruments. NUREG-1482 notes that instruments that meet the intent of the Code requirement for the actual readings yield an acceptable level of quality and safety for testing.

RELIEF REQUEST NO. PR-04

PUMP:

1P-216 - High Pressure Coolant Injection Pump

TEST REQUIREMENT:

An inservice test shall be conducted with the pump operating at specified reference conditions. (Part 6, Para. 5.2)

The resistance of the system shall be varied until the flowrate equals the reference value. The pressure shall then be determined and compared to its reference value. Alternatively, the flow rate can be varied until the pressure equals the reference value and the flow rate shall be determined and compared to the reference flow rate value. (Part 6, Para. 5.2(b))

BASIS FOR RELIEF:

Operating experience has shown that flow rates (independent variables during inservice performance testing) for the HPCI pump cannot be readily duplicated with the present flow control systems. Efforts to exactly duplicate the reference values would require excessive valve manipulation which could ultimately result in damage to valves or operators. In order to perform accurate trending and data analysis, the use of an accurate reference value is very important. The complexities of the flow control systems found within these systems makes it extremely difficult to exactly duplicate the reference values.

Current NRC policy promulgated via NUREG-1482 allow using a "graphical" method of test result interpretation.

ALTERNATE TESTING:

Pump differential pressure and flow rate will be evaluated using a reference value test derived pump curve over a limited range of pump operation. This reference value test pump curve will be restricted to an operating regime that is representative of the pump operation under accident conditions or conditions that are the most sensitive indicator of pump degradation.

Based on the reference value test pump curve, acceptance criteria curves will be established for the upper and lower required action range limits.

Detailed Technical Description:

The reference value curve will be established by measuring a minimum of five (5) sets of differential pressure/flowrate data when the pump combination is known to be operating acceptably. The measurements will be distributed across the expected range of potential inservice test conditions. The two-minute test duration requirement of OM-6, Para. 5.6, will be imposed at each of the five (5) data points.

The equation for the reference value curve will then be computed using a third order polynomial regression technique that employs a least-squares fit of the data by successive polynomials of orders 1 through 3. The standard deviation about the regression line will be evaluated for each case. The resulting reference value curve is expressed as a third order polynomial in the general form:

$$y=a_3x^3+a_2x^2+a_1x+a_0 \text{ where}$$

y is the dependent variable and
x is the independent variable

The Required Action Range Curves will be scalar multiples of the reference value curve.

The measurements taken during inservice testing will be restricted to only those falling within the envelope of reference value test measurements. The inservice test differential pressure/flowrate test results will be plotted on a typical pump curve or evaluated by an equivalent tabular method and the results included in the permanent test records.

Finally, the combined differential pressure/flowrate test results will be evaluated for variation from test-to-test to identify any pump degradation. In addition, the results of all IST testing will be evaluated with respect to operability criteria for flowrate and differential pressure set forth in the DAEC Technical Specifications and UFSAR.

Pump vibration values will be measured in units of Mils. Vibration alert and action limits are dependent on pump speed and not derived from multiples of reference vibration as calculated when using units of in/sec. Therefore, the variation of vibration with flow is not an issue when Mils are used.

When the reference curve may have been affected by repair, replacement, or routine service, a new reference curve will be established or the previous curve will be revalidated by conducting an inservice test.