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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO THE INSERVICE TESTING PROGRAM'S THIRD TEN-YEAR INTERVAL

OMAHA PUBLIC POWER DISTRICT

FORT CALHOUN, UNIT 1

DOCKET NO. 50-285

1.0 INTRODUCTION

The Code of Federal Regulations, 10 CFR 50.55a, requires that inservice testing (IST) of certain ASME Code Class 1, 2, and 3 pumps and valves be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code (the Code) and applicable addenda, except where relief has been granted or proposed alternatives have been authorized or granted by the Commission pursuant to 10 CFR 50.55a(a)(3)(i), (a)(3)(ii), or (f)(6)(i). In order to obtain authorization or relief, the licensee must demonstrate that (1) the proposed alternatives provide an acceptable level of quality and safety; (2) compliance would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety; or (3) conformance is impractical for its facility. NRC guidance contained in Generic Letter (GL) 89-04, "Guidance on Developing Acceptable Inservice Testing Programs," provides alternatives to the Code requirements determined acceptable to the staff. Alternatives that conform with the guidance in GL 89-04 may be implemented without additional NRC approval. Relief requests that conform with GL 89-04 are not evaluated in the Technical Evaluation Report (TER), though they have been reviewed to determine conformance and any concerns identified by such reviews are discussed in Appendix A, "IST Program Anomalies." Relief Request PE-2 and portions of Relief Requests VE-1, VE-2, and VE-3 are approved pursuant to GL 89-04 as they conform to the guidance delineated in Position 9 (PE-2) and Position 2 of Attachment 1 of GL 89-04.

Section 50.55a authorizes the Commission to grant relief from ASME Code requirements or to approve proposed alternatives upon making the necessary findings. The NRC staff's findings with respect to granting the relief requested or authorizing the proposed alternatives as part of the licensee's IST program are contained in this safety evaluation (SE).

The 1989 Edition of the Code, Section XI, Subsections IWP and IWV, provide that the rules for IST of pumps and valves shall meet the requirements set forth in ASME Operations and Maintenance Standards Part 6 (OM-6), "Inservice Testing of Pumps in Light-Water Reactor Power Plants," and Part 10 (OM-10), "Inservice Testing of Valves in Light-Water Reactor Power Plants." The Fort Calhoun IST Program is based on the requirements in the 1989 Edition of the Code.

The Fort Calhoun IST program covers the third ten-year interval for the Fort Calhoun Station, Unit 1. The third ten-year interval began September 26, 1993, and ends September 26, 2003.

2.0 EVALUATION

The staff, with technical assistance from the Idaho National Engineering Laboratory (INEL), has reviewed the letters from Omaha Public Power District (OPPD), dated November 13, 1992, and March 25, 1994 concerning IST program requests for relief submitted for the third ten-year interval for the Fort Calhoun Station, Unit 1. The staff adopts the evaluations and recommendations for granting relief or authorizing alternatives contained in the attached TER prepared by INEL. Table 1 lists each relief request and the status of approval. The test deferrals of valves, as allowed by OM-10, were also reviewed. Results of the review are provided in Table 4.1 of the TER with recommendations for further review by the licensee for specific deferrals.

2.1 Relief Request Pump E4

In its letter dated March 25, 1994, the licensee submitted an additional relief request for two sets of pumps, the raw water pumps and the component cooling water pumps, to use pump curves to accomplish the inservice testing and define the acceptance criteria for the testing. The relief request was not submitted with the previous revision of the program as the licensee believed that the testing complied with OM-6. Following its review of draft NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants," issued November 1993, the licensee determined that relief was necessary. Section 5.2 of OM-6 requires that the system resistance be varied until either the measured differential pressure or measured flow rate equals the corresponding reference value. The quantities listed in Table 2 of OM-6 are then measured or observed and compared to the corresponding reference value. Rather than set the applicable pumps at a reference value, the licensee proposes to establish a range of values (pump curves) and test the pumps in the as-found operating condition.

2.1.1 Licensee's Basis for Relief

The licensee stated:

"(1) The Raw Water (RW) and Component Cooling Water (CCW) systems at Fort Calhoun Station (FCS) are designed such that the total pump flow cannot be adjusted to one specific value for the purpose of testing

without adversely affecting the system flow balance and technical specification operability requirements. Therefore, the RW and CCW pumps must be tested in a manner that the RW and CCW loops remain properly flow balanced during and after the testing. In addition, certain supplied loads (e.g., cooling of Control Element Drive Mechanisms) must remain fully operable per Technical Specifications to maintain the required level of plant safety during power operation.

"(2) The RW and CCW systems loops are not designed with full flow test lines with single throttle valves. Therefore, the flow cannot be throttled to a fixed reference value every time a pump test is performed. Total pump flow rate can only be measured using the total flow indication as installed and read on the supply headers. There are no valves available in any of the loops, on either the supply or return lines, for the purpose of throttling total RW or CCW system flows. Only the flow of the served components are able to be individually throttled. The main loops of RW and CCW are piped in parallel with each other. Many loads are throttled to flow ranges specified in the FCS Design Basis Documents (DBD). All loads are aligned in parallel, and receive RW/CCW flow when the RW/CCW pumps are running regardless of which served components are in service. During power operation, certain loops of RW/CCW are required to be operable per Technical Specifications. Specific loops/components of RW/CCW cannot be taken out of service for testing without entering an action statement for a Limiting Condition for Operation (LCO). Also, exceeding certain individual component flows/temperatures (e.g., reactor coolant pump seals) can require plant shutdown in two hours, depending on the load in question.

"(3) Certain RW/CCW loops are flow balanced during each refueling outage (at a nominal 18-month frequency) to ensure that all loads are adequately supplied. Flow ranges are specified for these loads in order to balance flows against each other. Once properly flow balanced, minimal flow adjustment can be made for any one particular load without adversely impacting the operability of the remaining loads (i.e., increasing flow for one load reduces flow for all of the others). Each time the system is flow balanced, proper individual component flows are produced, but this in turn does not necessarily result in one specific value for total flow. Because certain loads have an acceptable flow range, overall system full flow (the sum of the individual component flows) also has a range. Consequently, the Code requirements to quarterly adjust RW/CCW loop flow to one specific flow value for the performance of inservice testing conflicts with FCS system design and component operability requirements (i.e., flow balance) as required by the Technical Specifications."

2.1.2 Alternative Testing

The licensee proposed "As discussed above in the Basis for Relief section, it is extremely difficult to return to a specific value of flow rate or differential pressure for testing of these pumps. Multiple reference points

could be established according to the Code, but obtaining reference values at every possible point, even over a small range is not feasible. An alternative to the testing requirements of OM Part 6, Section 5.2, is to base the acceptance criteria on a reference pump curve. Flow rate and differential pressure are measured/calculated during inservice testing and compared to an established baseline reference curve. In addition, trending is accomplished by taking the ratio of the reference curve differential pressure versus flow and the actual differential pressure versus flow.

The following elements are used in developing and implementing the reference pump curves:

1. A reference pump curve (differential pressure vs. flow) has been established for RW pumps AC-10A, AC-10B, AC-10C, and AC-10D, and for CCW pumps AC-3A, AC-3B, and AC-3C from data taken on these pumps when they were known to be operating acceptably. These pump curves represent pump performance close to the original manufacturer's pump test data.

2. Pump curves are based on four or more test points whenever possible. Rated capacities of these pumps are 6,000 - 7,000 gpm for the RW pumps and 4,500 - 5,500 gpm for the CCW pumps.

3. To reduce the uncertainty associated with the pump curves and to ensure the adequacy of the acceptance criteria, all instruments used in establishing the baseline reference pump curves either meet or exceed the Code required accuracy.

4. The reference baseline pump curves are compared to the manufacturer's pump curves which were validated during plant preoperational testing.

5. Review of the pump hydraulic data trend plots indicates close correlation with established pump reference curves, thus validating the accuracy of the pump curves to assess the pumps' operational readiness.

6. The reference pump curves are based on differential pressure vs. flow. See the attached sample AC-3A and AC-10A pump acceptance criteria sheets [see Figures 1 and 2]. Areas for Required Action are as shown for AC-3A in [Figure 1]. Areas for Acceptable, Alert, and Required Action are as shown for AC-10A in [Figure 2]. These acceptance criteria limits do not conflict with operability criteria (minimum operability) as shown on [Figures 1 and 2].

7. Only a small portion of the established reference curve is being used to accommodate flow rate variance due to flow balancing of various system loads.

8. Review of recent vibration data trend plots indicates that the change in vibration readings over the range of the pump curves being used is insignificant; therefore, only one fixed reference value has been assigned for each vibration measurement location.

9. After maintenance or repair that may affect the existing baseline reference pump curves, a new reference pump curve is determined or the existing pump curve revalidated by an inservice test."

2.1.3 Quality/Safety Impact

The licensee stated "The design of the FCS RW and CCW systems and the Technical Specification requirements make it impractical to adjust system flows to a fixed reference value for inservice testing without adversely affecting the system flow balance and Technical Specification operability requirements. Proposed alternate testing using a reference pump curve for each pump provides adequate assurance and accuracy in monitoring pump condition to assess pump operational readiness and will adequately detect pump degradation. The proposed alternate testing will have no adverse impact on plant or public safety."

2.1.4 Evaluation

Where it is not practical to return to the same flow configuration for each subsequent inservice pump test, it is necessary for the licensee to establish a method for evaluating the operational readiness of pumps in variable flow systems such as the RW and CCW pumps. During quarterly pump testing, the licensee is not able to manually control each of these local stations and duplicate the overall system reference condition, as required by the Code. Imposing the Code requirements would require (1) modifications to the system to add new test lines or (2) operation in a condition that does not provide adequate cooling to the heat loads for the period of time necessary to perform testing.

Using the pump-specific curves for flow and differential pressure, the licensee is able to evaluate the pump in as-found system conditions. The vibration acceptance criteria has been reviewed and the licensee has determined that no changes, such as developing variable ranges for vibration levels, are required and a single reference value for vibration will be used. This testing will ensure that the monitoring would indicate a severely degraded pump, hydraulically or mechanically, and that the pump will be declared inoperable and repaired following inservice testing when the test data exceeds the acceptance criteria. Therefore, based on the impracticality of performing testing at a single reference value, with an acceptable alternative method that assesses the operational readiness of the subject pumps, relief can be granted. The burden of imposition of the Code requirements has been considered.

2.1.5 Conclusion

Relief to use pump curves for testing the RW and CCW pumps is granted pursuant to 10 CFR 50.55a(f)(6)(i) based on the impracticality of performing testing in accordance with the Code requirements to test pumps at a reference value of either differential pressure and measure flow, or flow and measure differential pressure. The granting of relief is in consideration of the adequacy of an alternative method of testing and the burden if the Code requirements were imposed.

2.2 Program Scope Review

INEL, using system drawings, reviewed the scope for the following systems against the requirements of Section XI and the regulations: containment spray, chemical and volume control, steam generator feedwater, and safety injection. The review revealed no concerns (see Section 1.3 of the TER). This review does not constitute a comprehensive system review or endorsement of the scope of the IST program.

2.3 General

For the Fort Calhoun Station IST program, relief is granted from, or alternatives are authorized to, the testing requirements which have been determined to be impractical to perform, where an alternative provides an acceptable level of quality and safety, or where compliance would result in a hardship or unusual difficulty without a compensating increase in quality or safety. Four relief requests were granted provisionally or on an interim basis and require additional action by the licensee as discussed in Appendix A of the TER. Two relief requests were denied: (1) relief request VG1 for controlling the testing of thermal relief valves on safety-related systems in the preventive maintenance program rather than the IST program, and (2) relief request PE3 for not using an alert range for the charging pumps. The licensee should take action prior to performing the next regularly scheduled IST, or within 90 days for tests performed quarterly, to ensure that the testing of these components complies with the Code or to develop additional justification for not complying with the Code (reference GL 91-18 for guidance on nonconforming conditions).

The IST program relief requests which are granted or authorized are acceptable for implementation provided the action items identified in Appendix A of the TER are addressed within one year of the date of the SE or by the end of the next refueling outage, whichever is later. Additionally, the granting of relief is based upon the fulfillment of any commitments made by the licensee in its basis for each relief request and the alternatives proposed.

Program changes involving new or revised relief requests should be submitted to the NRC for review. New or revised relief requests that meet the positions stated in GL 89-04, Attachment 1, should be submitted to the NRC, but may be implemented provided the guidance in GL 89-04, Section D, is followed. Program changes that add or delete components from the IST program should be submitted periodically to the NRC.

3.0 CONCLUSION

The Fort Calhoun Station IST program requests for relief from the Code requirements have been reviewed by the staff with the assistance of its contractor, INEL. The TER provides INEL's evaluation of these relief requests. The staff has reviewed the TER and concurs with the evaluations and recommendations for granting relief or authorizing alternatives. A summary of the relief request determinations is presented in Table 1. The authorizing of alternatives or granting of relief is based upon the fulfillment of any

commitments made by the licensee in its basis for each relief request and the alternatives proposed. The implementation of IST program and relief requests is subject to inspection by NRC.

The NRC has identified a number of generic deficiencies that affect plant safety and have frequently appeared as IST programmatic weaknesses. These are addressed by Generic Letter 89-04. In that letter, the staff delineated positions that describe deficiencies and explained alternatives to the ASME Code that the staff considers acceptable. If alternatives are implemented in accordance with the relevant position in the generic letter, the staff has determined that relief should be granted pursuant to 10 CFR 50.55a(g)(6)(i) (now (f)(6)(i) for IST) on the grounds that it is authorized by law, will not endanger life or property or the common defense and security, and is otherwise in the public interest. In making this determination, the staff has considered the burden on the licensee that would result if the requirements were imposed.

For any relief granted pursuant to Generic Letter 89-04 the staff (with technical assistance from INEL) has reviewed the information submitted by the licensee to determine whether the proposed alternative follows the relevant position in the generic letter. If an alternative conforms to a position of the generic letter, it is listed as having been approved pursuant to Generic Letter 89-04 in Table 1 of the safety evaluation. Any anomalies in the relief request are addressed in the TER and identified in Table 1.

The licensee should refer to the TER, Appendix A, for a discussion of anomalies identified during the review. The licensee should address each anomaly in accordance with the guidance therein. The IST program relief requests are acceptable for implementation provided the action items identified in Appendix A of the TER are addressed within one year of the date of this SE or by the end of the next refueling outage, whichever is later. The licensee should respond to the NRC within one year of the date of this SE describing actions taken, actions in progress, or actions to be taken, to address each of these items.

The staff concludes that the relief requests as evaluated and modified by this SE will provide reasonable assurance of the operational readiness of the pumps and valves to perform their safety-related functions. The staff has determined that granting relief pursuant to 10 CFR 50.55a(f)(6)(i) and authorizing alternatives pursuant to 10 CFR 50.55a(a)(3)(i) or (a)(3)(ii) is authorized by law and will not endanger life or property, or the common defense and security and is otherwise in the public interest. In making this determination, the staff has considered the impracticality of performing the required testing and the burden on the licensee if the requirements were imposed.

Attachments:
1. Figures
2. Table
3. Technical Evaluation Report

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Date: June 21, 1994

Figure 1

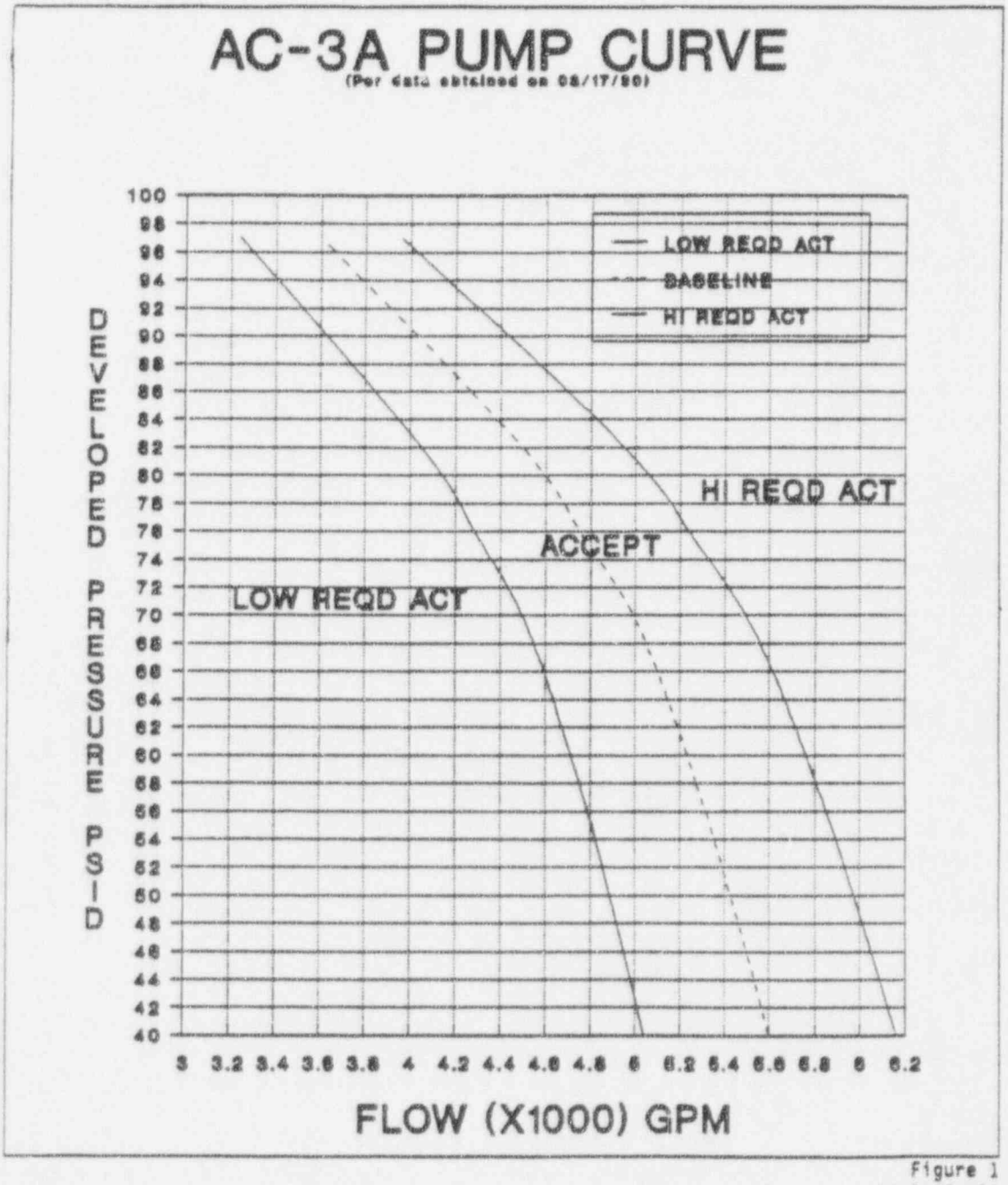
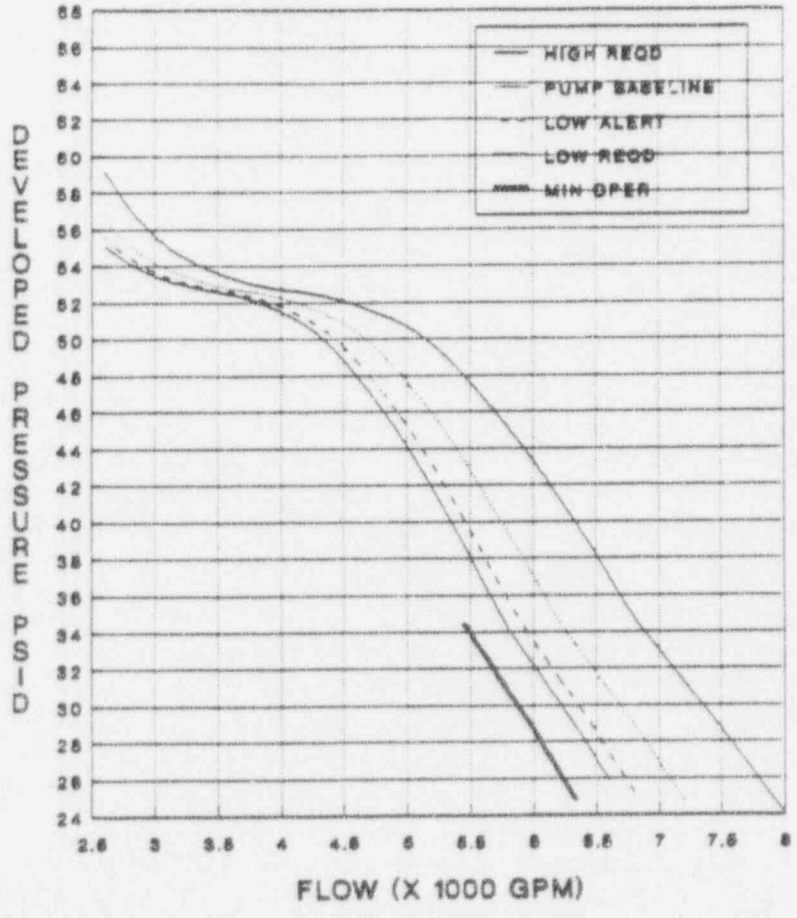


Figure 1
AC-3AQ2.WPG

Figure 2

AC-10A PUMP CURVE



SE-ST-RW-3002 performed 11/11/93

(AC-10AQ6.WPG)

FORT CALHOUN STATION, UNIT 1
SAFETY EVALUATION TABLE 1
SUMMARY OF RELIEF REQUESTS

Relief Request Number	TER Section	Section XI Requirement	Equipment Identification	Proposed Alternate Method of Testing	NRC Action
Pump E1	2.1.1.1	ASME/ANSI OM-6, 4.6.2.2: Pressure measurement requirements	Raw water, low pressure safety injection (LPSI), high pressure safety injection (HPSI), containment spray (CS), and boric acid pumps	Determine pump inlet pressure and differential pressure by calculating the pressure due to the head of water above the pump inlet.	Alternate authorized pursuant to 10 CFR 50.55a, (a)(3)(ii)
Pump E2	N.A.	OM-6, 5.1: Measure pump flow rate quarterly	LPSI, HPSI, and CS pumps	Test pumps on mini-flow lines quarterly without measuring flow rate. Measure flow rate at cold shutdowns with pumps running in an instrumented path.	Approved by GL 89-04, Position 9, not evaluated in SE/TER.
Pump E3	2.2.1.1	OM-6, 6.1 and Table 3b: Acceptance criteria requirements	Charging pumps: CH-1A, -1B, and -1C	Do not use an Alert Range for these pumps and set the Required Action Range at <35 gpm and >40 gpm.	Relief denied
Pump E4	SE Section 2.1	OM-6, 5.2: Varying system resistance	Raw Water and Component Cooling Water Pumps AC-10A/B/C/D, AC-3A/B/C	Test pumps in an as-found operating condition and use pump curves to establish a baseline curve and the acceptance criteria curves.	Relief granted pursuant to 10 CFR 50.55a (f)(6)(i).
Valve G1	3.1.1.1	OM-1, 1.1: Scope of IST program for relief valves	All thermal relief valves on safety-related systems	Control the testing of these valves under their preventive maintenance program.	Relief denied
Valve E1	3.2.1.1	OM-10, 4.2.1.2: Exercising frequency requirements	Safety injection refueling water tank discharge check valves: SI-139 and -140	Disassemble and inspect these valves once every other refueling outage.	The test method is in accordance with OM-10. Sample disassembly and extension of the sample interval is approved by GL 89-04 provided that all provisions of GL 89-04, Position 2, are met.

FORT CALHOUN STATION, UNIT 1
SAFETY EVALUATION TABLE 1
SUMMARY OF RELIEF REQUESTS

Relief Request Number[1]	TER Section	Section XI Requirement	Equipment Identification	Proposed Alternate Method of Testing	NRC Action
Valve E2	3.2.2.1	OM-10, 4.2.1.2: Exercising frequency requirements	ECCS pump suction check valves from the containment sump: SI-159 and -160	Disassemble and inspect these valves once every other refueling outage.	The test method is in accordance with OM-10. Sample disassembly and extension of the sample interval is approved by GL 89-04 provided that all provisions of GL 89-04, Position 2, are met.
Valve E3	3.3.1.1	OM-10, 4.2.1.2: Exercising frequency requirements	Containment spray header check valves: SI-175 and -176	Disassemble and inspect these valves once every other refueling outage.	The test method is in accordance with OM-10. Sample disassembly and extension of the sample interval is approved by GL 89-04 provided that all provisions of GL 89-04, Position 2, are met.
Valve E4	N.A.	OM-10, 4.2.1.2: Exercising frequency requirements	Safety injection tank (SIT) discharge and combined injection header check valves: SI-207, -208, -211, -212, -215, -216, -219, and -220	Test these valves with flow during a low pressure SIT discharge and to verify satisfactory valve obturator movement by determining the valve flow coefficient.	This relief request was evaluated seperately in a safety evaluation (SE) issued on October 1, 1993.
Valve E5	3.1.2.1	OM-10, 4.2.2.2: Leak rate testing requirements	The CIVs listed in the relief request	Measure, record, and trend the leakage rate of these valves by penetration by pressurizing between the valves, which will apply pressure in the direction opposite to the design function for some of the valves.	Proposed alternative is in accordance with OM-10 and the rulemaking of 9-18-92, therefore, relief is not required.
Valve E6	3.4.1.1	OM-1, 1.3.5(b): Test frequency requirements	Auxiliary feedwater pump oil cooler relief valve: FW-1525	Test this valve every third refueling outage.	Alternate authorized pursuant to 10 CFR 50.55a, (a)(3)(i), for an interim period until OM-1 clarifies the single valve group issue.

[1] The Deferred Test Justifications (DTJs) submitted in the licensee's program are discussed in Section 4 of the attached Technical Evaluation Report. Each DTJ is listed and evaluated in Table 4.1.