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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

ON ASME CODE CASE N-498-1

UNION ELECTRIC COMPANY

CALLAWAY PLANT, UNIT 1

DOCKET NO. 50-483

1.0 INTRODUCTION

The Technical Specifications for Callaway Plant state that the inservice inspection and testing of the American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 components shall be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code and applicable Addenda as required by 10 CFR 50.55a(g), except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). Section 50.55a(a)(3) of 10 CFR states that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulties without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) on the date 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The 1980 Edition through winter 1981 Addenda of Section XI is the applicable edition of the ASME Code for the Callaway first 10-year inservice inspection (ISI) interval. The components (including supports) may meet the requirements set forth in subsequent editions and addenda of the ASME Code incorporated by reference in 10 CFR 50.55a(b), subject to the limitations and modifications listed therein and subject to Commission approval.

Pursuant to 10 CFR 50.55a(g)(5), if the licensee determines that conformance with an examination requirement of Section XI of the ASME Code is not practical for its facility, information shall be submitted to the Commission in support of that determination and a request made for relief from the ASME

Code requirement. After evaluation of the determination, pursuant to 10 CFR 50.55a(g)(6)(i), the Commission may grant relief and may impose alternative requirements that are determined to be authorized by law; will not endanger life, property, or the common defense and security; and are otherwise in the public interest, giving due consideration to the burden upon the licensee that could result, if the requirements were imposed.

In a letter dated July 8, 1994, the licensee, Union Electric (UE), proposed an alternative examination to the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI. UE submitted additional information in a letter dated December 6, 1994, as requested by the NRC staff. UE requested approval for the implementation of the alternative rules of ASME Section XI Code Case N-498-1, dated May 11, 1994, "Alternative Rules for 10-Year System Hydrostatic Testing for Class 1, 2, and 3 Systems" pursuant to 10 CFR 50.55a(a)(3) for 10-year hydrostatic testing on Class 1, 2, and 3 systems.

2.0 EVALUATION

2.1 Licensee's Request

Approval of N-498-1 is hereby requested in order to permit exemption of all ASME systems and components for 10-year ISI hydrostatic test requirements.

2.2 Licensee's Component Identification

Class 1, 2, and 3 systems subject to hydrostatic testing.

2.3 ASME Code, Section XI, Requirements

Section XI, Table IWB-2500-1, Category B-P (for Class 1), Table IWC-2500-1, Category C-H (for Class 2), and Table IWD-2500-1, Categories D-A, D-B, and D-C (for Class 3) contain the requirements for system hydrostatic and leakage testing. The Code requires system hydrostatic testing once per 10-year interval at or near the end of the interval.

2.4 Licensee's Proposed Alternative Testing

The licensee proposed to use the alternative contained in Code Case N-498-1, a system leakage test, in lieu of hydrostatic testing, for Class 1, 2, and 3 Systems.

2.5 Licensee's Basis for Relief

UE submitted the following information by letter dated July 8, 1994:

> The American Society of Mechanical Engineers has endorsed and submitted Code Case N-498-1 to the Nuclear Regulatory Commission for review and approval. Code Case N-498-1 is entitled "Alternative Rule for 10-Year System Hydrostatic Testing for Class 1, 2, and 3 Systems." This revision to Code Case N-498 was developed to exempt ASME Class 3 systems

and components from 10-year ISI hydrostatic test requirements. Code Case N-498, which has been approved by the NRC, provided only for exemption of ASME Class 1 and 2 systems and components.

UE supplemented their Relief Request by letter dated December 6, 1994:

Code Case N-498-0 provides for exemption of ASME Class 1 and Class 2 systems from the 10-year ISI hydrostatic testing requirements of Section XI of the ASME Code. This Code Case has been endorsed by the NRC, and is currently listed in Regulatory Guide 1.147. NRC approval of N-498-0 indicates NRC concurrence with several of the precepts which form the bases for N-498-0, including:

- Hydrostatic testing subjects piping and components to a pressure only slightly above design pressure. This small increase in pressure does not present a meaningful test of structural integrity.

- Due to the relatively low pressures used, hydrostatic testing serves primarily as a means of leakage detection.

- Industry experience has shown that leakage is more likely to be detected during normal system operation than during a hydrostatic test. Most leaks are detected while the system is at normal operating pressure.

- Ten-year ISI hydrostatic tests are performed only once each 10-year interval. System leakage tests at nominal operating pressure are conducted a minimum of once each refueling cycle for Class 1 systems, and once each 40-month period for Class 2 and Class 3 systems.

- Hydrostatic testing imposes significant hardships on owners, due to the efforts required to set up and perform the tests.

- Hydrostatic testing imposes considerable costs on owners (including increases in critical path activities) without a commensurate increase in plant safety.

Revision 1 to Code Case N-498 exempts ASME Class 3 systems from 10-year ISI hydrostatic tests, in addition to maintaining the currently approved exemptions for ASME Class 1 and 2 systems. The philosophy which formed the basis for approval of N-498-0 is equally applicable to N-498-1.

Cost impacts associated with ASME Class 3 systems are frequently significant, while hydrostatic tests on these systems do not provide a meaningful contribution to plant safety. As examples of these increased costs, 65 ASME Class 3 ISI hydrostatic tests are required at the Callaway Plant each 10-year interval. The cost of these tests is conservatively estimated at $253,760.00 per interval. This estimate does not include costs associated with potential increases in refueling outage work scope, nor does it consider potential increased outage critical path.

Fifty-two of the 65 Class 3 hydrostatic tests are complete. The remaining 13 are required to be completed during Callaway's seventh refueling outage, which is scheduled to begin in March 1995. Ten of these 13 affect Callaway's Diesel Generator oil systems. All 10 of these Diesel Generator hydrostatic tests will decrease Diesel Generator availability during the refueling outage. This potential safety reduction alone is considered sufficient to offset any perceived safety increase resulting from hydrostatic testing; however, 5 of these 10 hydrostatic tests will also increase outage critical path. The result is a considerable hardship without a commensurate safety increase.

The three remaining hydrostatic tests apply to Component Cooling Water systems. While all three will increase component unavailability, one involves the "A" RHR pump and heat exchanger. Performance of this hydrostatic test will increase safety system unavailability, with a corresponding decrease in plant shutdown safety.

Pursuant to 10 CFR 50.55(a)(3), approval for use of Code Case N-498-1 at the Callaway Station is hereby requested.

2.6 Evaluation

Information prepared in conjunction with ASME Code Case N-498-1 notes that the system hydrostatic test is not a test of the structural integrity of the system, but rather an enhanced leakage test. That this was the original intent is indicated in a paper by S. H. Bush and R. R. Maccary, *"Development of In-Service Inspection Safety Philosophy for U.S.A. Nuclear Power Plants,"* ASME, 1971. Piping components are designed for a number of loadings that would be postulated to occur under the various modes of plant operation. Hydrostatic testing only subjects the piping components to a small increase in pressure over the design pressure, and therefore, does not present a significant challenge to pressure boundary integrity since piping dead weight, thermal expansion, and seismic loads, which may present far greater challenge to the structural integrity of a system than fluid pressure, are not part of the loading imposed during a hydrostatic test. Accordingly, hydrostatic pressure testing is primarily regarded as a means to enhance leakage detection during the examination of components under pressure, rather than as a measure to determine the structural integrity of the components.

UE requested approval for the implementation of the alternative rules of ASME Section XI Code Case N-498-1, dated May 11, 1994, "Alternative Rules for 10-Year System Hydrostatic Testing for Class 1, 2, and 3 Systems" for 10-year hydrostatic testing of Class 1, 2, and 3 systems. The licensee indicated they already use N-498, "Alternative Rules for 10-Year System Hydrostatic Testing for Class 1, and 2 Systems" since use of Code Case N-498 for Class 1 and 2 systems was previously approved by the NRC in Regulatory Guide 1.147, Rev. 11. The rules for Code Class 1 and 2 in N-498-1 are unchanged from N-498. The staff found N-498 acceptable because the alternative provided adequate assurance and because compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore, this evaluation applies to Class 3 systems.

Revision N-498-1 encompasses Class 3 components and specifies requirements for Class 3 that are identical to those for Class 2 components. In lieu of 10-year hydrostatic pressure testing at or near the end of the 10-year interval, Code Case N-498-1 requires a visual examination (VT-2) be performed in conjunction with a system leakage testing, at nominal operating pressure and temperature.

Currently, licensees incur considerable time, radiation dose, and dollar resources carrying out hydrostatic test requirements. A significant amount of effort may be necessary (depending on system, plant configuration, Code class, etc.) to temporarily remove or disable Code safety and/or relief valves to meet test pressure requirements. The safety assurance provided by the enhanced leakage gained from a slight increase in system pressure during a hydrostatic test may be offset or negated by the following factors: having to gag or remove Code safety and/or relief valves, placing the system (and thus the plant) in an off-normal state, erecting temporary supports in steam lines, possible extension of refueling outages, and resource requirements to set up testing with special equipment and gages.

Class 3 systems do not normally receive the amount and/or type of Non-Destructive Examinations that Class 1 and 2 systems receive. While Class 1 and 2 system failures are relatively uncommon, Class 3 leaks occur more frequently and the failure mode typically differs. Based on a review of Class 3 system failures requiring repair for the last five years in Licensee Event Reports and the Nuclear Plant Reliability Data System databases, the most common causes of failures are erosion-corrosion (EC), microbiologically induced corrosion (MIC), and general corrosion. Licensees generally have programs in place for prevention, detection, and evaluation of EC and MIC. Leakage from general corrosion is readily apparent to inspectors when performing a VT-2 examination during system pressure tests. The industry indicates that experience has demonstrated that leaks are not being discovered as a result of hydrostatic test pressures propagating a preexisting flaw through wall. They indicate that leaks in most cases are being found when the system is at normal operating pressure.

Giving consideration to the minimal amount of increased assurance provided by the increased pressure associated with a hydrostatic test, versus the pressure for the system leakage test, and the hardship associated with performing the ASME Code required hydrostatic test, the staff finds that compliance with the Section XI hydrostatic testing requirements results in hardship and/or unusual difficulty for the licensees without a compensating increase in the level of quality and safety. Accordingly, the licensee's proposed alternative, use of Code Case N-498-1 for Code Class 1, 2, and 3, is authorized for Callaway Plant pursuant to 10 CFR 50.55a(a)(3)(ii). UE's alternative is authorized until such time as the Code Case is published in a future revision of Regulatory Guide 1.147. At that time, if the licensee intends to continue to implement this Code Case, the licensee is to follow all provisions in Code Case N-498-1, with limitations issued in Regulatory Guide 1.147, if any.

3.0 CONCLUSION

The staff evaluated the information provided by UE in support of its request for relief. Based on the information submitted, the alternative for hydrostatic testing contained in the licensee's proposal is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) as compliance with the specified hydrostatic testing requirements which would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

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