



UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION REPORT BY THE OFFICE OF NUCLEAR REACTOR REGULATION
OF THE SECOND TEN-YEAR INTERVAL INSERVICE INSPECTION
REQUESTS FOR RELIEF FOR
COMMONWEALTH EDISON COMPANY
ZION NUCLEAR POWER STATION, UNITS 1 AND 2
DOCKET NOS. 50-295 AND 50-304

1.0 INTRODUCTION

The Technical Specifications for Zion Nuclear Station, Units 1 and 2, 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). 10 CFR 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) may be used, when authorized by the staff, 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 applicable edition of Section XI of the ASME Code for the Zion Nuclear Power Station, Units 1 and 2, second 10-year inservice inspection (ISI) Interval is the 1980 Edition, through winter 1981 Addenda. 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 impractical for its facility, information shall be submitted to the Commission in support

Code requirements are impractical. The Commission may grant such relief and may impose such alternative requirements that it determines 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 June 15, 1993, Commonwealth Edison Company (CECo or the licensee) submitted Request for Relief No. IWB-13, Technical Approach and Position 10, and Hydro Request for Relief Nos. 9 and 10.

2.0 EVALUATION AND CONCLUSIONS

The staff, with technical assistance from its contractor, the Idaho National Engineering Laboratory (INEL), has evaluated the information provided by the licensee in support of its Request for Relief No. IWB-13, Technical Approach and Position 10, and Hydro Request for Relief Nos. 9 and 10. Based on the information submitted, the staff adopts the contractor's conclusions and recommendations presented in the Technical Evaluation Summary. The alternative contained in Request for Relief IWB-13 is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) due to the hardship that would be encountered without a compensating increase in the level of quality and safety if the licensee performed the Code-required volumetric examinations. However, this alternative is authorized provided the licensee performs the proposed visual examination of the Code required area from inside the vessel. Request for Relief No. 9 is denied because the licensee's proposed alternative is not a logical extension of Code Case N-498 and does not provide an acceptable level of quality and safety. Request for Relief No. 10 is denied because simultaneous use of Code Cases N-498 and N-416 has not been approved and does not provide an acceptable level of quality and safety. Technical Approach and Position 10 documents the licensee's intent to use Code Case N-498 for Class 1 and 2 pressure tests. The staff concluded that this was acceptable, because Code Case N-498 is acceptable for generic use by reference in Regulatory Guide 1.147, Revision 10.

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IDAHO NATIONAL ENGINEERING LABORATORY
TECHNICAL EVALUATION SUMMARY OF THE
SECOND TEN-YEAR INTERVAL INSERVICE INSPECTION
REQUESTS FOR RELIEF FOR
COMMONWEALTH EDISON COMPANY
ZION NUCLEAR POWER STATION, UNITS 1 AND 2
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1.0 INTRODUCTION

The licensee, Commonwealth Edison Company (CECo), submitted Relief Request IWB-13, Technical Approach and Position 10, and Hydro Request for Relief Nos. 9 and 10, in a letter dated June 15, 1993, for the second 10-year ISI intervals which ends in December 1993 for Unit 1 and September 1994 for Unit 2. The Idaho National Engineering Laboratory (INEL) has evaluated the subject requests for relief in the following sections.

2.0 EVALUATION

The Code of record for Zion Nuclear Station, Units 1 and 2, second 10-year ISI interval is ASME Section XI, 1980 Edition through winter 1981 Addenda. The information provided by the licensee in support of the requests for relief from Code requirements has been evaluated and is documented below.

A. Request for Relief No. IWB-13, Examination Category B-D, Item B3.120, Pressurizer Surge Nozzle Inside Radius Examination

Code Requirement: Table IWB-2500-1, Examination Category B-D, Item B3.120 requires a volumetric examination of pressurizer nozzle inside radius sections, as defined by Figure IWB-2500-7.

Licensee's Code Relief Request: The licensee requested relief from performing the Code-required volumetric examinations of the inner radius sections for pressurizer surge nozzle welds at Zion Nuclear Power Station, Units 1 and 2.

Licensee's Basis for Requesting Relief: The licensee stated:

"Insulation on the lower head of the pressurizer prohibits access needed to perform the examination of the surge nozzle inside radius section. The removal of the insulation covering the lower pressurizer head will result in high radiation exposure to plant personnel.

A 1987 radiological survey performed in the area of the Unit 2 lower pressurizer head found dose rates of 2.25 R/hr on contact with the surge

nozzle, 1.2 R/hr at 18", and 700 mR/hr in the general area. The dose would increase if the mirror insulation was removed.

The pressurizer has a single surge nozzle in the lower vessel head. In order to perform exams on the pressurizer surge nozzle inside radius, the "blend region" (reference Zion figure B13), which is the optimal scanning surface, must be accessible for proper surface penetration [preparation] and ultrasonic scanning.

The blend region is not accessible since it is covered by the lower pressurizer head insulation that was not designed for removal. Zion Station investigated the impact of removing the lower head insulation, as well as the possibility of conducting a limited exam by removing the surge nozzle insulation and scanning on the nozzle surface. The results of these investigations are presented below.

The lower head of the pressurizer is covered by four-inch thick, multi-layered stainless steel mirror insulation which was not designed for removal. In order to remove the insulation, the 78 pressurizer cables would have to be disconnected (reference Zion figures B12 and B13). In addition, each of the 78 convection stops which are riveted to the insulation would have to be cut and removed so that the insulation could be removed over the pressurizer heaters (reference Zion figure B14). The radiation exposure to plant personnel for insulation removal, surface preparation, and inspection is estimated to be 53 person-rem (based on a dose rate of 1.2 R/hr).

Insulation covering the pressurizer surge nozzle can be removed. However, the "blend region" will still not be accessible to allow for adequate surface preparation and inspection. A limited exam is possible if ultrasonic scanning is conducted from the nozzle. However, due to the complex geometry of the nozzle, the resulting coverage would provide very limited data from which to assess the condition of the pressurizer surge nozzle inside radius. The estimated radiation exposure for insulation removal, surface preparation, and to perform the scan from the nozzle would be 2.5 person-rem (based on a dose rate of 1.2 R/hr). The limited data obtained from this inspection does not provide a compensatory increase in quality and safety to justify the hazards of personnel radiation exposure received to obtain the data.

The radiological conditions for the required surge nozzle inspections would result in significant individual and cumulative radiation exposure conflicts with Zion Station's ALARA objectives."

Licensee's Proposed Alternative Examination: The licensee proposed to perform ASME VT-2 visual examinations of the surge nozzles after each refueling outage. (This VT-2 examination is required by Table IWB-2500-1, Examination Category B-P, Item B15.20.) In addition, the licensee has investigated the possibility of performing a remote visual (VT-3) examination of the nozzle inside radius section from the inside

of the pressurizer. Zion Station has determined that a debris screen exists that covers the surge nozzle orifice and inner surface of the nozzle including the nozzle inside radius section. It is unknown to what extent the debris screen may limit the VT-3 examination. The licensee stated:

"An attempt will be made to conduct a remote visual inspection (VT-3) on the surge nozzle inside radius from the inside of the pressurizer. Since it is not known if the inspection surface is visible, a best effort will be made to conduct a visual exam on accessible portions of the inside radius. Examination limitations will be noted on the examiner's data sheet and in the outage summary report."

Evaluation: INEL reviewed additional information provided by the licensee concerning the geometrical configuration of the nozzle-to-vessel welds and inside radius sections for the pressurizer surge nozzles at Zion Station, Units 1 and 2. INEL concurs with the licensee that limited useful volumetric information would be obtained by ultrasonically scanning the inside radius section from the nozzle side.

It should be noted that the licensee was previously granted relief from volumetric examination of the pressurizer surge nozzle-to-vessel welds, for the current 10-year inspection interval, based on the unusual difficulties that would be encountered to access and examine the welds from the "blend area" of the vessel, as described above. Similar hardship and difficulties would be experienced if the licensee was required to perform the Code examination of the inside radius section from the vessel side.

As an alternative, the licensee has proposed to perform ASME VT-2 visual examinations of the surge nozzles after each refueling outage (as stated above, this is a Code requirement). In addition, Zion Station will conduct a remote VT-3 visual examination of the Code-required area from the inside of the vessel. It is understood that this examination may be limited by a debris screen that may preclude direct observation of the inner surface of the inside radius section. However, a visual examination of the debris screen and adjacent inner vessel surface(s) could provide meaningful information regarding the general condition of materials in this area of the pressurizer.

Pursuant to 10 CFR 50.55a(a)(3)(ii), it is recommended that the proposed alternative be authorized, provided that a thorough VT-3 visual examination of the debris screen and surrounding inner surfaces of the pressurizer surge nozzle is performed. The presence of degradation or other anomalies should be immediately reported to the NRC. The licensee should consider using a color-sensitive remote visual system for the VT-3 examination, as it would enhance the detection of flaws that penetrate the cladding by providing greater contrast for carbon steel corrosion products. Considering the hardships involved, the visual examinations provide reasonable assurance of continued integrity for the

pressurizer surge nozzle weld inside radius section and adjacent vessel materials.

B. Request for Relief No. 9, Examination Categories D-A, D-B, and D-C, Items D1.10, D2.10, and D3.10, Alternative Rules for Hydrostatic Testing of Class 3 Components

Code Requirement: Table IWD-2500-1, Examination Categories D-A, D-B, and D-C, Items D1.10, D2.10, and D3.10 require various system pressure tests to be performed in accordance with IWD-5000 during each 10-year inspection interval. IWD-5000 specifies the type, frequency, pressure, examination, and other essential parameters required for these system pressure tests.

Licensee's Code Relief Request: The licensee requested relief from performing the system pressure tests within the parameters listed in IWD-5000.

Licensee's Basis for Requesting Relief: The licensee stated: "Recent ASME Code Committee activities have included the development of Code Case N-498 "Alternative Rules for 10-Year Hydrostatic Pressure Testing for Class 1 and Class 2 Systems", which allows a system pressure test at operating pressure to be performed in lieu of the Section XI required hydrostatic test, which is performed at higher pressures. It has demonstrated by research conducted by the ASME Special Working Group on Pressure Testing that an elevated pressure test, as required by ASME Section XI, will neither challenge the structural integrity of the system or increase the chances of detecting leakage. Leaking signaling potential component defects were readily noticed at the operating system pressure. Code Case N-498 has been approved for use in ISI Programs in Regulatory Guide 1.147.

The ASME Boiler and Pressure Vessel Code is currently developing Code Case N-498-1 to provide alternative rules for pressure testing for Class 3 systems as a logical extension of Code Case N-498. Zion Station proposes the following alternative rules, based upon proposed Code Case N-498-1, as stated below.

These requirements will provide reasonable assurance that the safety and integrity of Class 3 components will be maintained."

Licensee's Proposed Alternative: The licensee has proposed the following alternative rules to be implemented in lieu of the 10-year system hydrostatic pressure test requirements specified in ASME Code Section XI:

1. A system pressure test shall be conducted at or near the end of each 10-year inspection interval or during the same inspection period of each 10-year inspection interval of Inspection Program

2. The boundary subject to pressurization during the system pressure test shall extend up to and including the first normally closed valve capable of automatic closure as required to perform the system safety function.
3. The system shall be pressurized to nominal operating pressure for at least four hours for insulated systems and 10 minutes for noninsulated systems. The system shall be maintained at normal operating pressure during the performance of the VT-2 examination.
4. The VT-2 examination shall include all components within the boundary identified in (2) above.
5. Test instrumentation requirements for system hydrostatic pressure test are not required."

Evaluation: The licensee states that proposed Code Case N-498-1 for Class 3 systems is a logical extension of N-498 for Class 1 and 2 components. It should be noted, however, that system hydrostatic pressure tests are the only 10-year ISI requirements currently stipulated for Class 3 components, whereas Class 1 and 2 systems receive volumetric and/or surface examinations in addition to these pressure tests. Because of this difference, INEL concludes that the licensee's proposed alternative is not a logical extension of Code Case N-498 and does not provide an acceptable level of quality and safety. Therefore, the licensee's proposed alternative to Code requirements for system hydrostatic pressure tests of Class 3 components should not be authorized.

C. Request for Relief No. 10, IWA-4400, -4600, and -5214, System Pressure Tests After Component Repairs or Replacements

Code Requirement: IWA-4400(a) requires that a system hydrostatic test be performed, in accordance with IWA-5000, after repairs are made by welding on the pressure-retaining boundary for all Class 1, 2, and 3 components. Additionally, IWA-5214 requires that, after repair or replacement, components shall be pressure tested prior to resumption of service if stipulated by IWA-4400 and IWA-4600. The test pressures and temperatures for system hydrostatic tests are specified in IWB-5222, IWC-5222, and IWD-5223 for Class 1, 2, and 3 components.

Licensee's Code Relief Request: The licensee has requested relief from performing the post-repair or replacement hydrostatic pressure tests within the parameters listed in IWA-4400, IWA-4600, and IWA-5000.

Licensee's Basis for Requesting Relief: The licensee stated:

"Recent ASME Boiler and Pressure Vessel Code Committee activities have included the development of Code Case N-498, "Alternative Rules for 10-year Hydrostatic Pressure Testing for Class 1 and 2 Systems", which

allows a system leakage test (IWB-5221) for Class 1 systems and a system pressure test (IWC-5210) for Class 2 components at operating pressure to be performed in lieu of the Section XI hydrostatic test. It has been demonstrated by research conducted by the ASME Special Working Group on Pressure Testing that an elevated pressure test, as required by Section XI, will neither challenge the structural integrity of the system or increase the chances of detecting leakage. Leakage signaling potential component defects were readily noticed at the operating system pressure. Code Case N-498 has been approved for use in ISI Programs by Regulatory Guide 1.147.

Proposed Code Case N-416-1 "Alternative Pressure Test Requirements for Welded Repairs or Installation of Replacement Items by Welding," is under consideration for publication in the ASME Boiler and Pressure Vessel Code. Code Case N-416-1 applies to Division 1, Class 1, 2, and 3 components. The basis for Code Case N-416-1 is similar to Code Case N-498.

Zion Station requests relief from the current Section XI rules for hydrostatic testing of Repairs, Replacements, and Modifications for Class 1, 2, and 3 components and proposes to apply the alternative requirements derived from Proposed Code Case N-416-1 as stated below.

"These alternative requirements are sufficient to assure the safety and reliability of ASME Code piping and vessels and will not adversely affect the safety or integrity of the plant."

Licensee's Proposed Alternative: The licensee has proposed the following alternative rules to be implemented in lieu of the post-repair or replacement system hydrostatic pressure test requirements specified in ASME Code Section XI:

1. NDE shall be performed in accordance with the Original Code of Construction.
2. Additional NDE shall be performed in accordance with the methods and acceptance criteria of the 1989 Edition of Section XI in instances where the 1989 Edition of Section III states methods and acceptance criteria beyond those stated in the Original Code of Construction. In addition, UT will be performed on Class 1 full penetration corner welded nozzles, branch, and piping connections.
3. Prior to or immediately upon return to service, a VT-2 examination shall be performed in conjunction with a system leakage test at nominal operating pressure. The system shall be pressurized at nominal operating pressure for at least four hours for insulated systems and 10 minutes for non-insulated systems.
4. The use of this relief request will be documented for specific repairs, replacements, or modifications on the Repair/Replacement

section of the NIS-1 form. In cases where the use of this relief request is not practical, Zion Station will perform hydrostatic exams per IWA-4000.

Evaluation: The licensee stated the intent to use approved Code Case N-498 as an alternative to the hydrostatic pressure tests required by the Code for Class 1 and 2 systems. It should be noted that while Code Cases N-498 and N-416 have been approved, we recommend that the NRC not authorize their simultaneous use since this alternative to Code requirements does not provide an acceptable level of quality and safety. Hydrostatic testing of components after repairs are made is always required, but may be deferred in accordance with N-416. Therefore, the licensee's proposed alternative to Code requirements for post-repair or replacement hydrostatic pressure tests of components should not be authorized.

D. Licensee's Technical Approach and Position 10, IWB-2500-1 and IWC-2500-1, Categories B-P and C-H, Requirements for Hydrostatic Pressure Tests

Code Requirement: Table IWB-2500-1, Category B-P and Table IWC-2500-1, Category C-H, require system hydrostatic pressure tests to be performed during each 10-year inspection interval for Class 1 and Class 2 components, respectively.

Licensee's Position: The licensee stated:

"It is the position of the station that the alternative rules stated in Code Case N-498, "Alternative Rules for 10 Year Hydrostatic Pressure Testing for Class 1 and 2 Systems, Section XI, Division 1," will be used in lieu of the 10-year hydrostatic pressure test requirements stated in Table IWB-2500-1 Category B-P, and Table IWC-2500-1 Category C-H.

Zion will also apply the alternative rules stated in Code Case N-498 for Interval 2, Class 1 and 2 relief requests which make reference to the 10- year hydrostatic test as an alternate examination. In these instances, VT-2 examinations will be conducted in accordance with Code Case N-498."

Staff Evaluation: Code Case N-498 is generically authorized for use by the NRC as referenced in Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Revision 10, dated July 1993.

3.0 CONCLUSION

Due to the extraordinary hardship that would be encountered if volumetric examination were required, the licensee's Request for Relief No. IWB-13 concerning the pressurizer surge nozzle inside radius sections, should be authorized per 10 CFR 50.55a(a)(3)(ii), provided that the licensee performs an

acceptable visual examination from the vessel inside diameter. Hydro Relief Nos. 9 and 10 are based on proposed Code cases which have not been approved by the NRC, therefore these alternative requirements should not be authorized. Finally, Technical Approach and Position 10 documents the licensee's intent to use approved Code Case N-498 for Class 1 and 2 pressure tests. Code Case N-498 is acceptable for generic use by reference in Regulatory Guide 1.147, Revision 10.