

TECHNICAL EVALUATION REPORT
PILGRIM NUCLEAR POWER STATION
UNIT 1
INSERVICE INSPECTION PROGRAM

Submitted to:

U.S. Nuclear Regulatory Commission
Contract No. 03-82-096

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TECHNICAL EVALUATION REPORT
PILGRIM NUCLEAR POWER STATION UNIT 1
INSERVICE INSPECTION PROGRAM

INTRODUCTION

The revision to 10 CFR 50.55a, published in February 1976, required that Inservice Inspection (ISI) Programs be updated to meet the requirements (to the extent practical) of the Edition and Addenda of Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code* incorporated in the Regulation by reference in paragraph (b). This updating of the programs was required to be done every 40 months to reflect the new requirements of the later editions of Section XI.

As specified in the February 1976 revision, for plants with Operating Licenses issued prior to March 1, 1976, the Regulations became effective after September 1, 1976, at the start of the next regular 40-month inspection period. The initial inservice examinations conducted during the first 40-month period were to comply with the requirements in editions of Section XI and addenda in effect no more than six months prior to the date of start of facility commercial operation.

The regulation recognized that the requirements of the later editions and addenda of the Section XI might not be practical to implement at facilities because of limitations of design, geometry, and materials of construction of components and systems. It therefore permitted determinations of impractical examination or testing requirements to be evaluated. Relief from these requirements could be granted provided health and safety of the public were not endangered, giving due consideration to the burden placed on the licensee if the requirements were imposed. This report provides evaluations of the various requests for relief by the licensee, Boston Edison Company (BEC), of the Pilgrim Nuclear Power Station, Unit 1. It deals only with inservice examinations of components and with system pressure tests. Inservice tests of pumps and valves (IST programs) are being evaluated separately.

*Hereinafter referred to as Section XI or Code.



The revision to 10 CFR 50.55a, effective November 1, 1979, modified the time interval for updating ISI programs and incorporated by reference a later edition and addenda of Section XI. The updating intervals were extended from 40 months to 120 months to be consistent with intervals as defined in Section XI.

For plants with Operating Licenses issued prior to March 1, 1976, the provisions of the November 1, 1979, revision are effective after September 1, 1976, at the start of the next one-third of the 120-month interval. During the one-third of an interval and throughout the remainder of the interval, inservice examinations shall comply with the latest edition and addenda of Section XI, incorporated by reference in the Regulation, on the date 12 months prior to the start of that one-third of an interval. For Pilgrim Nuclear Power Station Unit 1, the ISI program and the relief requests evaluated in this report cover the last 40 months of the current 120-month inspection interval, i.e., from August 9, 1979, to December 9, 1982. The applicable version of Section XI is the 1974 Edition with Addenda through the Summer of 1975.

The November 1979 revision of the Regulation also provides that ISI programs may meet the requirements of subsequent code editions and addenda, incorporated by reference in Paragraph (b) and subject to Nuclear Regulatory Commission (NRC) approval. Portions of such editions or addenda may be used provided that all related requirements of the respective editions or addenda are met. These instances are addressed on a case-by-case basis in the body of this report.

Finally, Section XI of the Code provides for certain components and systems to be exempted from its requirements. In some instances, these exemptions are not acceptable to NRC or are only acceptable with restrictions. As appropriate, these instances are also discussed in this report.

References (1) to (11) listed at the end of this report pertain to previous transmittals on ISI between the licensee and the Commission. By letters of April 28 and November 24, 1976,^(1,4) the Commission provided general ISI guidance to all licensees. Submittal in response to that guidance was made by the licensee on May 19, 1976,⁽²⁾ and the Commission commented on that response in the letter of June 25, 1976.⁽³⁾ The licensee submitted proposed technical specification changes March 15, 1979,⁽⁵⁾ and on May 8, 1979,⁽⁶⁾ requested an extension for the submittal of the weld and hydrostatic testing



program. This program was subsequently submitted to the Commission on July 24, 1979.⁽⁷⁾ By letter of August 15, 1979,⁽⁸⁾ the Commission granted interim approval of the ISI program submitted by Pilgrim 1. On January 31, 1980,⁽⁹⁾ a submittal was made by the licensee, informing the Commission that BECo intends to perform ultrasonic examinations in accordance with the 1977 Edition, Summer 1978 Addenda. By letter of February 24, 1982,⁽¹⁰⁾ the Commission requested additional information to complete the review of the ISI program. This information was furnished by the licensee on May 5, 1982.⁽¹¹⁾

From these submittals, a total of 12 requests (a) for relief from Code requirements, (b) for updating to a later code, and (c) for exemptions not necessarily acceptable to the Commission were identified. These requests are evaluated in the following sections of this report. A request for relief relative to using an unclad calibration block for ultrasonic examination was withdrawn by the licensee in Reference 11.



I. CLASS 1 COMPONENTS

A. Reactor Vessel

1. Relief Request 9, Class 1 and 2 Bolting, Categories B-G-1, B-G-2, and C-D, Items B1.7 through B1.11, B3.4 through B3.6, B3.10, B4.2 through B4.4, B4.12, B5.1 through B5.3, B5.9, B6.1 through B6.3, B6.9, C1.4, C2.4, C3.2 and C4.2

Code Requirement

Category B-G-1: Pressure Retaining Bolting, 2-Inches and Larger in Diameter

The areas shall include bolts, studs, nuts, bushings, washers, and threads in base material and flange ligaments between threaded stud holes.

The examination performed during each inspection interval shall cover 100% of the bolts, studs, nuts, bushings, and threads in base material and flange ligaments between threaded stud holes.

Bushings, threads, and ligaments in base material of flanges are required to be examined only when the connection is disassembled.

Bolting may be examined either in place under tension when the connection is disassembled, or when the bolting is removed.

| <u>Item No.</u> | <u>Components and Parts to be Examined</u> | <u>Examination Method</u> |
|-----------------|--|---------------------------|
| B1.7 | Reactor Vessel Closure Studs, in place | Volumetric |
| B1.8 | Reactor Vessel Closure Studs and Nuts when removed | Surface and Volumetric |
| B1.9 | Reactor Vessel Ligaments between Threaded Stud Holes | Volumetric |
| B1.10 | Reactor Vessel Closure Washers, Bushings | Visual |
| B3.4 | Heat Exchangers Pressure Retaining Bolting, in place | Volumetric |
| B3.5 | Heat Exchangers Pressure Retaining Bolting, when removed | Volumetric and Surface |
| B3.6 | Heat Exchangers Pressure Retaining Bolting | Visual |
| B4.2 | Piping Pressure Retaining Bolting, in place | Volumetric |
| B4.3 | Piping Pressure Retaining Bolting, when removed | Volumetric and Surface |
| B4.4 | Piping Pressure Retaining Bolting | Visual |
| B5.1 | Pump Pressure Retaining Bolting, in place | Volumetric |
| B5.2 | Pump Pressure Retaining Bolting, when removed | Volumetric and Surface |
| B5.3 | Pump Pressure Retaining Bolting | Visual |



| <u>Item No.</u> | <u>Components and Parts to be Examined</u> | <u>Examination Method</u> |
|-----------------|--|---------------------------|
| B6.1 | Valve Pressure Retaining Bolting, in place | Volumetric |
| B6.2 | Valve Pressure Retaining Bolting, when removed | Volumetric and Surface |
| B6.3 | Valve Pressure Retaining Bolting | Visual |

Category B-G-2: Pressure Retaining Bolting, Smaller Than 2-Inches in Diameter

The areas shall include bolts, studs, and nuts.

The examinations performed during each inspection interval shall cover 100% of the bolts, studs, and nuts.

Bolting may be examined either in place under tension when the connection is disassembled, or when the bolting is removed.

| <u>Item No.</u> | <u>Components and Parts to be Examined</u> | <u>Examination Method</u> |
|-----------------|--|---------------------------|
| B1.11 | Reactor Vessel Pressure Retaining Bolting | Visual |
| B3.10 | Heat Exchangers Pressure Retaining Bolting | Visual |
| B4.12 | Piping Pressure Retaining Bolting | Visual |
| B5.9 | Pump Pressure Retaining Bolting | Visual |
| B6.9 | Valve Pressure Retaining Bolting | Visual |

Category C-D: Pressure Retaining Bolting Exceeding 1-Inch in Diameter

The areas shall include bolts, studs, nuts, bushings, washers and threads in base material and flange ligaments between threaded stud holes.

Visual examinations performed during each inspection interval shall cover 100% of the bolts, studs, nuts, bushings and threads in base material and flange ligaments between threaded stud holes.

Nondestructive examinations shall be performed on 10% of the bolting in each joint, but not less than two bolts or studs per joint.

Bushings, threads and ligaments in base material of flanges are required to be examined only when the connection is disassembled.



Bolting may be examined either in place under tension, when the connection is disassembled, or when the bolting is removed.

| <u>Item No.</u> | <u>Components and Parts to be Examined</u> | <u>Examination Method</u> |
|-----------------|---|--|
| C1.4 | Pressure Vessels Pressure Retaining Bolting | Visual and either Surface or Volumetric Visual and either Surface or Volumetric Visual and either Surface or Volumetric Visual and either Surface or Volumetric |
| C2.4 | Piping Pressure Retaining Bolting | |
| C3.2 | Pumps Pressure Retaining Bolting | |
| C4.2 | Valves Pressure Retaining Bolting | |

Code Relief Request

Licensee requests permission to update to the 1977 Edition Summer 1978 Addenda of the Code for Categories B-G-1, B-G-2 and C-D.

Proposed Alternative Examination

None.

Licensee's Basis for Requesting Relief

This relief request addresses the Section XI Examination Categories B-G-1 and B-G-2 for Class 1 bolting, and C-D for Class 2 bolting. Category B-G-1 in the 1974 Edition of the ASME Code, Summer 1975 Addenda covers bolting two-inches and greater in diameter and B-G-2 covers bolting less than two-inches in diameter. Category C-D covers bolting that exceeds one-inch in diameter.

However, in later editions of the Code, Class 1 bolting exactly two-inches in diameter is shifted from Category B-G-1 to B-G-2 by revision of the category definition. Similarly, Class 2 bolting between one and two-inch diameter is eliminated from Category C-D of the later editions of the Code.

Boston Edison concurs with the Category definitions of later editions of Section XI for Examination Categories B-G-1, B-G-2, and C-D and accordingly requests permission to adopt these definitions.

These portions of the later Code are adopted pursuant to paragraph (g) of 10 CFR 50.55a as revised in the proposed rule



published in the Federal Register, Volume 44 - No. 12 on January 18, 1979. This rule change approves for use of the 1977 Edition, Summer 1978 Addenda, of the Code. Paragraph (g)(4)(iv) of the rule change allows the adoption of portions of later approved editions and addenda to the Code provided that all related requirements of the respective editions and addenda are met. It is felt that the above stated adoptions are in compliance with the regulations.

Evaluation

The 1977 Edition of Section XI has been referenced in 10 CFR 50.55a and inservice examinations may meet the requirements of this edition in lieu of those from previous editions with the following provisions:

- (a) Commission approval is required to update to the more recent edition (10 CFR 50.55a (g)(4)(iv)).
- (b) When applying the 1977 Edition, all of the addenda through Summer 1978 Addenda must be used.
- (c) Any requirement of the more recent edition which is related to the one(s) under consideration must also be met.

The requirements for examining Class 2 bolting 2-inches in diameter and under are deleted from the 1977 Edition with addenda through Summer 1978, but volumetric examination is substituted for visual examination of bolts and studs of larger diameters. Class 1 bolting exactly 2-inches in diameter is shifted from Category B-G-1 to Category B-G-2. This shift substitutes visual for volumetric (and in some instances, surface) examinations in most instances.

Recommendations

Pursuant to 10 CFR 50.55a(g)(4)(iv), approval should be granted to update to the requirements of the Summer 1978 Addenda for Category B-G-1, B-G-2, and C-D items. This approval would delete the requirement to examine Class 2 bolting 2-inches in diameter and under and would shift Class 1 bolting exactly 2-inches in diameter from Category B-G-1 to B-G-2.

References

Reference 7.



Science Applications, Inc.

2. Relief Request 1, Reactor Vessel Closure Bushings, Category B-G-1, Item B1.10

Code Requirement

The areas shall include bolts, studs, nuts, bushings, washers, and threads in base material and flange ligaments between threaded stud holes.

Examinations shall be performed during each inspection interval and shall cover 100% of the bolts, studs, nuts, bushings, and threads in base material and flange ligaments between threaded stud holes.

Bushings are required to be visually examined only when the connection is disassembled.

Code Relief Request

Relief is requested from the requirement to visually examine all closure stud bushings each inspection interval.

Proposed Alternative Examination

Boston Edison Company will continue to inspect the bushings of reactor vessel closure studs removed during refueling outages.

Licensee's Basis for Requesting Relief

The requirements to visually examine all closure stud bushings each inspection interval is deemed impractical because the closure studs would have to be removed to allow for this inspection.

Performing the required examination constitutes needless radiation exposure to personnel with no compensatory increase in safety.

Evaluation

Relief Request 1 applies to Category B-G-1, Item B1.10, not Item B1.7 as listed in the licensee's program.

The Code requirements for bushings require a visual examination only when the connection is disassembled. Therefore, this relief request is not necessary.



Under I.A.1 of this report, the licensee's request to update Category B-G-1 to a later version of the Code is discussed. This updating does not affect the requirements to visually inspect the reactor vessel closure bushings.

Conclusions and Recommendations

The licensee meets the intent of the Code, so relief is not required and should not be granted.

References

Reference 7.



3. Relief Request 3, Interior Clad Surfaces of Reactor Vessels,
Category B-X-1, Items B1.13 and B1.14

Code Requirement

The examinations performed during each inspection interval shall cover 100% of the patch areas. The areas shall include at least six patches (each 36 sq. in.) evenly distributed in the closure head, and six patches (each 36 sq. in.) evenly distributed in accessible sections of the vessel shell. The examination shall be (1) visual and surface or (2) volumetric for the closure head cladding, and visual for the vessel cladding.

Code Relief Request

Relief is requested from performing examinations of the closure head and vessel cladding patches.

Proposed Alternative Examination

None.

Licensee's Basis for Requesting Relief

Analysis has shown that flaws which initiate in the reactor vessel cladding, at locations other than nozzles, do not propagate through the clad-base metal interface. Therefore, their existence poses no threat to reactor vessel integrity. The nozzle areas are covered by the requirement to inspect the inner radii volumetrically to detect the presence of flaws which may have propagated into base metal. Accordingly, the ASME has completely eliminated the B-I-1 and B-I-2 examination categories from later editions of Section XI.

Performing these examinations only constitutes a needless exposure of personnel to radiation with no compensatory increase in safety. Boston Edison, therefore, will not perform the above mentioned examinations for the remainder of the present inspection interval. The examinations will not be required for subsequent intervals since the requirements have been deleted from the Code.

Evaluation

The 1977 Edition of Section XI has been referenced in 10 CFR 50.55a and inservice examinations may meet the requirements of this edition in lieu of those from previous editions with the following provisions:



- (a) Commission approval is required to update to the more recent edition (10 CFR 50.55a(g)(4)(iv)).
- (b) When applying the 1977 Edition, all of the addenda through Summer 1978 Addenda must be used.
- (c) Any requirement of the more recent edition which is related to the one(s) under consideration must also be met.

The requirements for examining closure-head cladding and vessel cladding are deleted from the 1977 edition with addenda through Summer 1978.

Recommendations

Based on the above evaluation, Code relief should not be granted. Instead, pursuant to 10 CFR 50.55a(g)(4)(iv), approval should be granted to update to the requirements of the 1977 Edition, Summer 1978 Addenda, for Category B-I-1 items. This approval would delete the requirement to examine these items.

References

Reference 7.



B. Pressurizer

Does not apply to BWRs.

C. Heat Exchangers

1. Class 1 Bolting, Category B-G-1, Items B3.4 through B3.6

The request to update to the 1977 Edition, Summer 1978 Addenda (see I.A.1 of this report) applies here. Therefore, the following is recommended:

Pursuant to 10 CFR 50.55a(g)(4)(iv), approval should be granted to update to the requirements of the Summer 1978 Addenda for Category B-G-1 items. This approval would shift Class 1 bolting exactly 2-in. in diameter from Category B-G-1 to B-G-2.

D. Piping Pressure Boundary

1. Class 1 Bolting, Category B-G-1, Items B4.2 through B4.4

The request to update to the 1977 Edition, Summer 1978 Addenda (see I.A.1 of this report) applies here. Therefore, the following is recommended:

Pursuant to 10 CFR 50.55a(g)(4)(iv), approval should be granted to update to the requirements of the Summer 1978 Addenda for Category B-G-1 items. This approval would shift Class 1 bolting exactly 2-in. in diameter from Category B-G-1 to B-G-2.

2. Relief Request 2, Pressure Retaining Welds in Piping, Category B-J, Item B4.5

Code Requirement

Volumetric weld examinations shall be performed during each inspection interval and shall cover all of the area of 25% of the circumferential joints including the adjoining 1-ft sections of longitudinal joints and 25% of the pipe branch connection joints.

Code Relief Request

Relief is requested from the volumetric examination of one pressure retaining piping weld in each primary containment penetration assembly, which are as follows:



| | |
|-------------------------------|----------|
| RCIC Steam Supply to Turbine | - 3 in. |
| HPCI Steam Supply to Turbine | - 10 in. |
| A&B Core Spray Injection | - 10 in. |
| Reactor Water Cleanup Suction | - 6 in. |
| RHR Head Spray | - 4 in. |
| RHR A&B Return | - 18 in. |
| RHR Supply | - 20 in. |
| A&B Feedwater | - 18 in. |
| A, B, C, & D Main Steam | - 20 in. |
| Drain, Main Steam | - 3 in. |

RCIC - Reactor Core Isolation Coolant
HPCI - High Pressure Coolant Injection
RHR - Residual Heat Removal

Proposed Alternative Examination

The examinations required by IWB-5000 will be conducted in accordance with the Code.

Licensee's Basis for Requesting Relief

As stated in 10 CFR 50.55a(g)(1) for plants whose construction permits were issued prior to January 1, 1971, components shall meet Section XI requirements to the extent practical. Since examination requirements for these welds did not exist at the time Pilgrim Unit 1 was designed, accessibility for their inspection was not considered. The design constraints make it extremely impractical to examine the subject welds by volumetric or surface techniques. Boston Edison feels that this constitutes a basis for relief from the volumetric examination requirements of Section XI.

The safety implications of this exemption are minimal due to the fact that the safety margins in the subject welds are typical of those in all welds in the applicable systems. Since the exempted welds represent only small fraction of the total number of welds in these systems (15 out of 496), and all of the other welds are inspected as part of the ISI program, loss in statistical significance of the inspection sampling program, due to exempting these welds is expected to be negligible.

Evaluation

The identified welds are completely inaccessible for volumetric or surface examination because the welds are located inside a containment penetration. Each primary containment penetration assembly, due to its design, leaves one pressure retaining piping weld inaccessible for examination by either surface or volumetric means. The welds can only be examined by inspecting for evidence of leakage during system hydrotests.



The initial design of the assemblies did not provide for accessibility for inservice examinations. If it is assumed, though, that the workmanship and quality assurance of the welding as well as the preservice examinations were adequate, then an examination of the first pressure boundary weld outside the containment should reflect service induced failures for that particular piping section. Thus, the first pressure boundary weld outside the containment on each of these process pipes could be volumetrically examined, where practical, over 100% of its length during each inspection interval. Such an examination would maintain sample size. Also, the licensee could conduct visual examinations at these penetrations as proposed.

Conclusions and Recommendations

Based on the above evaluation, it is concluded that for the welds discussed above, the code requirements are impractical. It is further concluded that the alternative examination discussed above will provide necessary added assurance of structural reliability. Therefore, the following is recommended:

Relief should be granted from the volumetric examination of the identified welds with the following provisions:

- (a) The first pressure boundary weld outside the containment on each of these process pipes should be volumetrically examined, where practical, over 100% of its length during each inspection interval.
- (b) The proposed visual examinations should be performed on the containment penetration assemblies when leakage and hydrostatic tests are conducted in accordance with IWB-1220(c).

References

References 7, 10 and 11.



E. Pump Pressure Boundary

1. Class 1 Bolting, Category B-G-1, Items B5.1 through B5.3

The request to update to the 1977 Edition, Summer 1978 Addenda (see I.A.1 of this report) applies here. Therefore, the following is recommended:

Pursuant to 10 CFR 50.55a(g)(4)(iv), approval should be granted to update to the requirements of the Summer 1978 Addenda for Category B-G-1 items. This approval would shift Class 1 bolting exactly 2-in. in diameter from Category B-G-1 to B-G-2.

2. Relief Request 10, Pressure Retaining Welds in Pump Casing, Category B-L-1, Item B5.6

Code Requirement

The areas shall include the weld metal and the base metal for one wall thickness beyond the edge of the weld.

Volumetric examinations shall be performed during each inspection interval and shall include 100% of the pressure-retaining welds in at least one pump in each group of pumps performing similar functions in system (e.g., recirculating coolant pumps).

The examinations may be performed at or near the end of the inspection interval.

Code Relief Request

Relief is requested from the volumetric examination of one pressure-retaining weld in the recirculation pump casings.

Proposed Alternative Examination

Boston Edison will keep abreast of any improvements in state-of-the-art nondestructive examination (NDE) techniques that would permit a viable examination of these welds. It is expected that practical techniques will be perfected in the near future.

In the interim, a close visual examination of these welds will be performed during the system hydrostatic test required by IWB-5000 to provide an adequate level of assurance that the integrity of these components is maintained.



Licensee's Basis for Requesting Relief

Each of the two main recirculation pump casings contain one pressure retaining weld. The weld is between the cast stainless steel casing and the flange to which the motor is bolted.

This relief request is primarily based upon the fact that, currently, no reliable technique for the inspection of these welds is available. Ultrasonic techniques are not adequate because the heavy wall, cast structure of the pump casing inhibits uniform penetration of the ultrasonic beam. High background radiation levels external and internal to the pump casing prohibit use of radiographic techniques from the standpoint of both film resolution and excessive exposure that would be required to disassemble, inspect, and reassemble a pump.

Boston Edison feels that this exemption is justified considering the safety margin provided by the materials of construction. The pump casing is a high strength cast stainless steel (ASTM-A351-CF8) which is highly immune to stress corrosion cracking. The flange is manufactured from forged stainless steel. These materials do not exhibit unstable crack growth and therefore, will provide adequate leak before break margin.

Evaluation

Ultrasonic examination of these welds is impractical because of the heavy wall and cast stainless material of the pump casing. Other licensees have made successful volumetric examinations by taking multiple shots using the miniature linear accelerator (MINAC) of the weld area and one-half inch on each side. An evaluation of the applicability of this examination technique at Pilgrim Unit 1 should be made. The 1974 Code calls for an examination for a distance of one wall thickness on each side of the weld. With the MINAC technique this is impractical and examination of one-half inch on each side of the weld is inadequate. This is in compliance with the 1977 Edition through Summer 1978 Addenda of Section XI.

Conclusions and Recommendations*

Not enough information has been supplied to show that this request is impractical, and relief should be denied. If the licensee determines that the MINAC technique is not practical and a suitable alternative volumetric examination cannot be found, the licensee should make another relief request.

References

References 7 and 10.

*The licensee may withdraw this relief request. In a telephone conversation with K. Eggleston, the NRC Project Manager, on September 3, 1982, the licensee stated the belief that this is not a pressure retaining weld. The licensee is investigating further.



3. Relief Request 8, Internal Surfaces of Pumps, Category B-L-2,
Item B5.7

Code Requirement

Visual examination of pump internal pressure boundary surfaces.

One pump in each of the group of pumps performing similar functions in the system shall be examined during each inspection interval. The examinations may be performed at or near the end of the inspection interval.

Code Relief Request

Relief is requested from the visual examination of the internal surfaces of the reactor recirculation pump at the pressure boundary.

Proposed Alternative Examination

The internal surfaces of the recirculation pump casing will be visually examined whenever the surfaces are made accessible when a pump is disassembled for maintenance purposes.

Licensee's Basis for Requesting Relief

The basis for this relief request is predicated on the following two points:

- (1) to complete the subject examination, large expenditures of man-hours and man-rem are required with essentially no compensating increase in plant safety, and
- (2) the structural integrity afforded by pump casing material utilized will not significantly degrade over the lifetime of the pump.

Based on data compiled from a plant similar in age and design to Pilgrim Unit 1, it is expected that approximately 1000 man-hours and 50 man-rem exposure would be required to disassemble, inspect, and reassemble one pump. Performing this visual examination under such adverse conditions as high dose rates (30-40 R/hr) and poor as-cast surface condition, realistically, provides little additional information as to the pump casing integrity.

The recirculation pump casing material, cast stainless



steel (ASTM A351-CF8), is widely used in the nuclear industry and has performed extremely well. The presence of some delta ferrite (typically 5% or more) imparts substantially increased resistance to intergranular stress corrosion cracking. The delta ferrite also results in improved pitting corrosion resistance in chloride containing environments.

Boston Edison feels that adequate safety margins are inherent in the basic pump design and that the health and safety of the public will not be adversely effected by not performing the visual examination of the pump internal pressure boundary surfaces.

Evaluation

The visual examination is to determine whether unanticipated severe degradation of the casing is occurring due to phenomena such as erosion, corrosion, or cracking. However, previous experience during examinations of pumps at other plants has not shown any significant degradation of casings.

The disassembly of the reactor recirculation pumps to the degree necessary to inspect the internal pressure retaining surfaces is a major effort, involving large personnel exposures and the generation of large amounts of radioactive waste. In view of the effort required to disassemble a pump, the information returned from visual examination of its internal surfaces would be marginal.

The licensee has committed to the concept of visual examination if the pump is disassembled for maintenance. Meanwhile, pressure and flow are monitored during pump operation to assess performance.

As discussed in I.E.2 of this report, the licensee should determine the practicality of using the MINAC technique for examining the pump casing weld. Thus, if a pump will be disassembled for weld examination, the examination of interior surfaces should be done at the same time.

The visual examination of the internal pressure boundary may be performed at or near the end of the 10-year inspection interval. The Code committee and the Electric Power Research Institute (EPRI) are undertaking a program to assemble and evaluate results of visual examinations of pump casing surfaces. Within the next two years, this program should provide a more definitive basis for the Code committee and NRC for upholding or modifying this Code requirement. Since so many licensees consider this requirement impractical and an undue burden, it is reasonable to postpone a decision to grant relief until at least preliminary results from that program become available. Since the end of the current inspection interval for Pilgrim



Unit 1 is December 9, 1982, this may require extending the inspection interval by one year as permitted by IWA-2400(a).

Visual examination of the externals of the pump casings could be conducted for evidence of leakage when pressure tests are performed as required by IWB-5000.

Conclusions and Recommendations

Based on the above evaluation, it is concluded that for the visual examination discussed above, a more definitive technical basis is needed. Therefore, the following is recommended:

- (1) Relief should not be granted at this time from the visual examination of the internal surfaces of the reactor recirculation pump at the pressure boundary.
- (2) The licensee's proposal to perform a visual examination whenever the surfaces are made accessible because a pump is disassembled for maintenance purposes should be accepted. The licensee should determine whether such disassembly will be necessary to meet the requirements for Item B5.6 (see I.E.2 of this report).
- (3) Visual examination of the externals of the pump casings should be conducted for evidence of leakage when pressure tests are performed as required by IWB-5000.

References

Reference 7.



F. Valve Pressure Boundary

1. Class 1 Bolting, Category B-G-1, Items B6.1 through B6.3

The request to update to the 1977 Edition, Summer 1978 Addenda (see I.A.1 of this report) applies here. Therefore, the following is recommended:

Pursuant to 10 CFR 50.55a(g)(4)(iv), approval should be granted to update to the requirements of the Summer 1978 Addenda for Category B-G-1 items. This approval would shift Class 1 bolting exactly 2-in. in diameter from Category B-G-1 to B-G-2.

2. Relief Request 7, Valve Bodies, Category B-M-2, Item B6.7

Code Requirement

Visual inspection shall be performed of the internal pressure boundary surfaces, on valves exceeding 4-in. nominal pipe size.

One valve in each group of valves of the same constructional design, e. g., globe, gate, or check valve, manufacturing method and manufacturer that performs similar functions in the system shall be examined during each inspection interval.

The examinations may be performed at or near the end of the inspection interval.

Code Relief Request

Relief is requested from the visual examination of the internal surfaces at the pressure boundary of the Class 1 valves exceeding 4-inch diameter nominal pipe size.

Proposed Alternative Examination

An examination of the internal pressure boundary surfaces will be performed, to the extent practical, each time a valve is disassembled for maintenance purposes.

Licensee's Basis for Requesting Relief

The requirement to disassemble primary system valves for the sole purpose of performing a visual examination of the internal pressure boundary surfaces has only a very small potential of increasing plant safety margins and a very disproportionate impact on expenditures of plant manpower and radiation exposure.



Performing these visual examinations, in some cases, under such adverse conditions as high dose rates (10 R/hr) and poor as-cast surface conditions, realistically provides little additional information as to the valve casing integrity.

For approximately 20 percent of these valves the reactor vessel core must be completely unloaded and the vessel drained to permit disassembly for inspection.

The performance of both carbon and stainless cast valve bodies has been excellent in all BWR applications. Based on this experience and both industry and regulatory acceptance of these alloys, continued excellent service performance is anticipated.

A more practical approach that would essentially provide an equivalent sampling program and significantly reduce radiation exposure to plant personnel is to inspect the internal pressure boundary of only those valves that require disassembly for maintenance purposes. This would still provide a reasonable sampling of primary system valves and give adequate assurance that the integrity of these components is being maintained.

Evaluation

The disassembly of large valves to the degree necessary to inspect the internal pressure retaining surfaces (bodies) is a major effort in terms of exposure of personnel. To do this disassembly solely to perform a visual examination of the internal body is impractical.

The licensee has committed to the concept of visual examination if the valve is disassembled for maintenance. The visual examination specified is to determine whether unanticipated severe degradation of the casing is occurring due to phenomena such as erosion or corrosion. The visual examination of the internal pressure boundary may be performed at or near the end of the 10-year inspection interval. The end of the first interval for Pilgrim Unit 1 is December 1982. Therefore, the licensee will be in compliance with the regulation up to that time. Now that the end of the interval is approaching, the licensee should submit a new relief request for each valve classification for which a valve has not been disassembled and examined. To minimize delays and outage time, it is recommended that relief requests be submitted as soon as possible.

For those valve classifications that require examination and for which valve maintenance has not occurred in an inspection interval, visual examinations should be performed on one valve in each such classification when the system pressure tests (IWA-5000) are conducted in accordance with the requirements for Category B-P.



Conclusions and Recommendations*

Based on the above evaluation, it is concluded that for the valves discussed above, there is not presently enough justification for granting relief from impractical Code requirements. Therefore, the following is recommended:

- (a) Relief should not be granted at this time from visual examination of the internal pressure boundary surfaces on valves exceeding 4-in. nominal pipe size.
- (b) The licensee's proposal to perform the Code required examinations whenever the valves are opened because of maintenance should be accepted.
- (c) During other inspection periods, the licensee should perform visual examinations for leakage when the system pressure tests (IWA-5000) are conducted in accordance with the requirements for Category B-P.
- (d) Now that the end of the inspection interval approaches, the licensee should submit specific relief requests for each valve classification for which a valve has not been disassembled and examined.

References

Reference 7.

*Since the licensee is so close to the end of his interval, he has been asked to submit a more specific relief request on these valves. This subject was discussed with the licensee in a telephone conversation with K. Eggleston, the NRC Project Manager, on September 3, 1982. The licensee intends to reply on about October 1, 1982.



II. CLASS 2 COMPONENTS

A. Pressure Vessels

1. Class 2 Bolting, Category C-D, Item C1.4

The request to update to the 1977 Edition, Summer 1978 Addenda (see I.A.1 of this report) applies here. Therefore, the following is recommended:

Pursuant to 10 CFR 50.55a(g)(4)(iv), approval should be granted to update to the requirements of the Summer 1978 Addenda for Category C-D items. This approval would delete the requirement to examine Class 2 bolting 2-in. in diameter and under.

B. Piping

1. Class 2 Bolting, Category C-D, Item C2.4

The request to update to the 1977 Edition, Summer 1978 Addenda (see I.A.1 of this report) applies here. Therefore, the following is recommended:

Pursuant to 10 CFR 50.55a(g)(4)(iv), approval should be granted to update to the requirements of the Summer 1978 Addenda for Category C-D items. This approval would delete the requirement to examine Class 2 bolting 2-in. in diameter and under.

C. Pumps

1. Class 2 Bolting, Category C-D, Item C3.2

The request to update to the 1977 Edition, Summer 1978 Addenda (see I.A.1 of this report) applies here. Therefore, the following is recommended:

Pursuant to 10 CFR 50.55a(g)(4)(iv), approval should be granted to update to the requirements of the Summer 1978 Addenda for Category C-D items. This approval would delete the requirement to examine Class 2 bolting 2-in. in diameter and under.

D. Valves

1. Class 2 Bolting, Category C-D, Item C4.2

The request to update to the 1977 Edition, Summer 1978 Addenda (see I.A.1 of this report) applies here. Therefore, the following is recommended:



Pursuant to 10 CFR 50.55a(g)(4)(iv), approval should be granted to update to the requirements of the Summer 1978 Addenda for Category C-D items. This approval would delete the requirement to examine Class 2 bolting 2-in. in diameter and under.

III. CLASS 3 COMPONENTS

No relief requests.



IV. PRESSURE TESTS

1. Relief Request 4, System Pressure Tests, Subsection 5000 Rules

Code Requirement

IWA-5210(a): The pressure retaining components shall be visually examined while the system is under the hydrostatic test pressure and temperature. The test pressure and temperature shall be maintained for at least four hours prior to the performance of the examinations.

Code Relief Request

Licensee requests permission to adopt Subsection 5000 rules in the 1977 Edition through Summer 1978 Addenda.

Proposed Alternative Examination

None.

Licensee's Basis for Requesting Relief

The pressure retaining components within each system boundary are subject to system pressure tests. These test requirements are not only an important part of Inservice Inspection but also demand clarity in their application. The hydrostatic test requirements in the 1974 Edition of Section XI are not as definitive as in the later Edition and Addenda of the Code and for this reason, misinterpretation and/or misapplication would occur.

In keeping with the present NRC thinking, Pilgrim Unit 1 is upgrading portions of its present ISI program to the most current requirements of ASME Section XI. Specifically, Pilgrim Unit 1 will be adopting Subsection 5000 rules in the 1977 Edition through Summer 1978 Addenda. By this adoption, application of Pilgrim Unit 1 inservice inspection program invokes a greater margin of safety by applying a clear and definitive Code.

Evaluation

The 1977 Edition of Section XI has been referenced in 10 CFR 50.55a and inservice examinations may meet the requirements of this edition in lieu of those from previous editions with the following provisions:

- (a) Commission approval is required to update to the more recent edition (10 CFR 50.55a(g)(4)(iv)).



- (b) When applying the 1977 Edition, all of the addenda through Summer 1978 Addenda must be used.
- (c) Any requirement of the more recent edition which is related to the one(s) under consideration must also be met.

The requirements for system pressure tests are clarified and simplified in the 1977 Edition with addenda through Summer 1978.

Recommendations

Pursuant to 10 CFR 50.55a(g)(4)(iv), approval should be granted to update to the requirements of the Summer 1978 Addenda for all Subsection 5000 rules. This approval would simplify the requirements for system pressure tests.

References

Reference 7.



Science Applications, Inc.

V. GENERAL

A. Ultrasonic Examination Techniques

1. Relief Request 6, Calibration Blocks

Code Requirement

Appendix I of ASME Section XI, Figure I-3131, requires that notches (2"L x 1/8" to 1/4" diameter) be machined into the calibration block.

Code Relief Request

Relief is requested from the requirement that notches be machined into the calibration block.

Proposed Alternative Examination

Continued use of blocks with side drilled holes.

Licensee's Basis for Requesting Relief

The baseline and subsequent inservice inspection of the vessel and nozzle welds were conducted with equipment that was calibrated on blocks which utilized side drilled holes only. The requirements to utilize notches does not increase the accuracy of the inspection.

Evaluation

The licensee has demonstrated a high degree of sensitivity can be achieved in the volumetric examination of vessels and piping, using calibration blocks with side drilled holes only. Two unacceptable planar flaws have been detected using these calibration blocks, both of which were verified by radiographic examination. Ultrasonic technicians performing manual ultrasonic examination of piping are given additional operator training on reference blocks at Pilgrim Nuclear Power Station. Ability to detect unacceptable conditions has been demonstrated at Pilgrim Nuclear Power Station.

An inservice inspection data base has been accumulated during the first interval for vessels and piping through use of calibration blocks that use side drilled holes only. With the end of the inspection interval in December 1982, it would be impractical to require converting the data from that based on calibration blocks with side drilled holes to that based on calibration blocks with notches. For the next inspection interval, the licensee may find that application of the 1980



Code is somewhat less restrictive than the 1974 Code and should investigate the possibility of converting the present calibration blocks to meet the new Code requirements. This could improve upon the current technique used by the licensee for detecting surface flaws.

Conclusions and Recommendations

Based on the above evaluation, it is concluded that for the calibration blocks discussed above, the Code requirements are impractical. Therefore, it is recommended that Code relief be granted for this inspection interval to continue use of existing calibration blocks with side drilled holes.

References

References 7, 10 and 11.

2. Reference 9, IWA-2232 Ultrasonic Examination

Code Requirement

IWA-2232 - Ultrasonic Examination: Ultrasonic examination shall be conducted in accordance with the provisions of Appendix I. Where Appendix I (I-1200) is not applicable, the provisions of Article 5 of Section V shall apply.

Code Relief Request

The licensee requests permission to update to Paragraph IWA-2232 of the 1977 Edition, Summer 1978 Addenda, of ASME Section XI for ultrasonic examinations.

Proposed Alternative Examination

Ultrasonic examinations would be performed in accordance with the 1977 Edition, Summer 1978 Addenda, of ASME Section XI.

Licensee's Basis for Requesting Relief

Although not included in the licensee's program, (7) the licensee has advised the Commission that it is their intention to perform ultrasonic examinations during the then current refueling outage (1980) in accordance with Paragraph IWA-2232 of the 1977 Edition, Summer 1978 Addenda, of ASME Section XI. The adoption of this section of the Code will be included in the licensee's revised program and the licensee feels that it will not decrease



the level of quality or safety of their inservice inspection and testing program. The licensee believes this would be the most practical method of presently meeting the ASME Code requirements for ultrasonic examinations at Pilgrim Station.

Evaluation

The 1977 Edition of Section XI has been referenced in 10 CFR 50.55a and inservice examinations may meet the requirements of this edition in lieu of those from previous editions with the following provisions:

- (a) Commission approval is required to update to the more recent edition (pursuant to 10 CFR 50.55a(g)(4)(iv));
- (b) When applying the 1977 Edition, all the addenda through Summer 1978 Addenda must be used;
- (c) Any requirement of the more recent edition which is related to the one(s) under consideration must also be met.

Updating to the 1978 Edition, Summer 1978 Addenda, Paragraph IWA-2232 is acceptable with one additional requirement: Indications of 20% of reference level or greater which are interpreted to be a crack must be identified and evaluated according to the rules of Section XI.

Recommendations

Pursuant to 10 CFR 50.55a(g)(4)(iv), approval should be granted to update to the requirements of the 1977 Edition of Section XI, through Summer 1978 Addenda, for Paragraph IWA-2232, provided that indications 20% or greater of reference level that are interpreted to be a crack are identified and evaluated according to the rules of Section XI.

References

References 7 and 9



B. Exempted Components

1. Exemption 1, IWB-1220(b)(1), (Summer 1975 Addenda)

Code Requirement

IWB-1220(b)(1)(Summer 1975): Under the postulated conditions of loss of coolant from the component during normal reactor operation, the reactor operation, the reactor can be shut down and cooled down in an orderly manner, assuming makeup is provided by the reactor coolant makeup system only. However, in no instance may the size exemption be more than 3-in. nominal pipe size.

Exemption

Exemption from examination of piping welds in line sizes 3-in. in diameter and under is claimed.

Evaluation

Analysis shows that the reactor can be cooled down in an orderly manner using only the reactor coolant makeup system when there is a complete break in a 2.48-inch inside diameter water line. Therefore, the requirements of IWB-1220(b)(1) have been met and the Code requirements to exempt these components satisfied.

Conclusions and Recommendations

Based on the above evaluation, it is concluded that for piping welds in line sizes 3-in. in diameter and under, the justification for exemption from Code requirements has been demonstrated. Therefore, the following is recommended:

Exemption from volumetric examination of piping welds in line sizes 3-in. in diameter and under per IWB-1220(b)(1) should be allowed.

References

References 7, 10 and 11.



2. Exemption 3, IWC-1220(a), Components Exempted from Examination
Based on Pressure and Temperature

Code Requirement

1974 Edition Section XI - IWC-1220(a):

The following components may be exempted from the examination requirements of IWC-2520:

- (a) Components in systems where both the design pressure and temperature are equal to or less than 275 psig and 200°F respectively.

1977 Edition Section XI (Summer 1979 Addenda) - IWC-1220(b):

The following components shall be exempted from the inservice examination requirements of IWC-2500:

- (b) Components of systems or portions of systems, other than Residual Heat Removal Systems and Emergency Core Cooling Systems, that are not required to operate above a pressure of 275 psig (1900 kPa) or above a temperature of 200°F (93°C).

Exemption

Exemption from examination of piping welds in the Residual Heat Removal Systems (RHRS) and Emergency Core Cooling Systems (ECCS) is claimed according to IWC-1220(a), 1974 Edition of Section XI.

Evaluation

Paragraph IWC-1220(b) of Section XI, Summer 1978 Addenda, does not permit the exemption from examination of components in the ECCS and the RHRS that operate below 275 psig or below 200°F. Hence, low operating pressure and temperature is not an acceptable basis for exempting ECCS and RHRS components from inservice examination.

Components in the RHRS and the ECCS cannot be exempted under IWC-1220(a). It is required that a representative sample of welds on these components be examined.

Recommendations

Licensee should include a representative sample of welds on the RHRS and ECCS components in the Inservice Inspection Program.



References

Reference 7.

C. Other
None.



REFERENCES

1. D. L. Ziemann (NRC) to J. E. Larson (BEC), Pilgrim Nuclear Power Station Unit No. 1, Docket No. 50-293, April 28, 1976.
2. G. C. Andognini (BEC) to D. L. Ziemann (NRC), Letter #76-47, Inservice Inspection Requirements of 10 CFR 50.55a, May 19, 1976.
3. D. L. Ziemann (NRC) to J. E. Larson (BEC), Docket No. 50-293, June 25, 1976.
4. D. L. Ziemann (NRC) to J. E. Larson (BEC), Pilgrim Nuclear Power Station, License, DPR-35, Docket No. 50-293, November 24, 1976.
5. J. E. Howard (BEC) to T. A. Ippolito (NRC), Letter #79-64, Pilgrim Power Station Unit #1, Proposed Technical Specification Changes, DPR-35, Docket No. 50-293, March 15, 1979.
6. G. C. Andognini (BEC) to T. A. Ippolito (NRC), Letter #79-90, Request for Extension to the Weld and Hydrostatic Testing Program, DPR-35, Docket No. 50-293, May 8, 1979.
7. G. C. Andognini (BEC) to T. A. Ippolito (NRC), Letter #79-153, Pilgrim Nuclear Power Station Unit #1, Weld Inspection Program, DPR-35, Docket No. 50-293, July 24, 1979.
8. T. A. Ippolito (NRC) to G. C. Andognini (BEC), Docket No. 50-293, August 15, 1979.
9. G. C. Andognini (BEC) to T. A. Ippolito (NRC), Letter #80-18, ASME Section XI Codes, DPR-35, Docket No. 50-293, January 31, 1980.
10. D. B. Vassallo (NRC) to A. V. Morisi (BEC), Docket No. 50-293, February 22, 1982.
11. A. V. Morisi (BEC) to D. B. Vassallo (NRC), Letter #82-113, Request for Additional Information for Pilgrim Nuclear Power Station ISI Program, DPR-35, Docket No. 50-293, May 5, 1982.

