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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION REQUEST FOR

REQUEST FOR AUTHORIZATION OF ALTERNATIVE

NORTHEAST NUCLEAR ENERGY COMPANY

MILLSTONE NUCLEAR POWER STATION, UNIT NO. 2

DOCKET NO: 50-336

1.0 INTRODUCTION

In 1992 the Nuclear Regulatory Commission issued 10 CFR 50.55a(g)(6)(ii)(A) which contains new requirements for an augmented examination of reactor vessels. This section requires licensees to implement an augmented examination of "essentially 100%" of the reactor pressure vessel shell welds. The shell welds are specified in the 1989 Edition of the American Society of Mechanical Engineers (ASME) Code, Section XI, Table IWB-2500-1, Examination Category B-A, "Pressure Retaining Welds in Reactor Vessel," Item B1.10. This ASME classification includes Item B1.11, circumferential shell welds, and Item B1.12, longitudinal shell welds. 10 CFR 50.55a(g)(6)(ii)(A)(2) defines "essentially 100%" examination as "more than 90% of the examination volume of each weld" [emphasis added]. The schedule for implementation of the augmented inspection is dependent upon the number of months remaining in the 10-year inservice inspection (ISI) interval that was in effect on September 8, 1992. 10 CFR 50.55a(g)(6)(ii)(A)(5) requires licensees unable to completely satisfy the requirements of the augmented reactor vessel examination to propose an alternative that would provide an acceptable level of quality and safety. A licensee may use their proposed alternative when authorized by the Office of Nuclear Reactor Regulation.

In a letter dated June 9, 1995, Northeast Nuclear Energy Company (NNECO), the licensee, presented the results of the augmented reactor pressure vessel (RPV) examinations for Millstone Unit 2. The weld examination coverage obtained on two of three circumferential RPV shell welds, specifically HS-1 (89%) and SC-2 (89%), and three of nine longitudinal RPV shell welds, specifically LSL-1 (77%), MSL-1 (55%), and USL-3 (88%), did not meet the augmented examination requirements for "essentially 100%" coverage. The remaining seven RPV shell welds received "essentially 100%" examinations ranging from 93% to 100% coverage. NNECO requested authorization to not perform any additional or alternative RPV examinations.

2.0 EVALUATION

2.1 Examination

The augmented RPV examination required by 10 CFR 50.55a(g)(6)(ii)(A) at Millstone Unit 2 was conducted together with other ASME Code-required ISI examinations in 1994. NNECO's examinations were performed from the inside diameter (ID) of the RPV utilizing remote, automated ultrasonic (UT) inspections. The examination procedures were written to meet the requirements of Section V and Section XI of the ASME Code and NRC Regulatory Guide 1.150, "Ultrasonic Testing of Reactor Vessel Welds During Preservice and Inservice Examinations," Rev. 1, Appendix A. The licensee conducted outside diameter (OD) UT pre-service examinations on the entire RPV in 1975, before commercial service and resultant irradiation of the vessel.

Scanning the weld volume with the automated UT inspection process was done with several transducers, including 50/70° bi-modal, 45° and 60° shear wave, and 0° longitudinal wave, to meet the requirements of the ASME Code, Section V. The results of these inspections are summarized in Table 1, "Results of Millstone 2 Augmented Reactor Pressure Vessel Examinations." The augmented RPV examination at Millstone Unit 2 included 12 welds, 3 circumferential (ASME Item B1.11) and 9 longitudinal (ASME Item B1.12), and resulted in "essentially 100%" coverage for 7 of these welds. Examination coverage for welds HS-1 and SC-2 (circumferential) and USL-3 (longitudinal) was 89%, 89%, and 88%, respectively; just below the required value. Longitudinal welds LSL-1 and MSL-1 received only 77% and 55% examination coverage due to geometrical limitations. Although not directly applicable to meeting the "essentially 100%" examination requirement for <u>each</u> weld stated in 10 CFR 50.55a(g)(6)(ii)(A)(2), the licensee stated that, overall, 90.8% of the cumulative total volume of RPV shell welds was examined during the 1994 inspection. (NNECO's submittal indicated 91.5% overall average coverage, which was not consistent with the individual weld coverages reported. In response to a staff inquiry, on September 19, 1995, the licensee indicated they inadvertently included another weld in the overall average calculation. The correct percentage is 90.8%.)

2.2 Limitations to Examination

The licensee cited four specific items that reduced examination coverage: hot leg nozzle extensions, irradiation specimen tube holders, the flow skirt, and anti-rotation lugs. This is consistent with the experience of other licensees who have had limited ID examinations due to similar obstructions. The greatest limitation to "essentially 100%" coverage occurs at the Lower Shell Longitudinal @ 90° (LSL-1) and Middle Shell Longitudinal @ 90° (MSL-1) welds, where irradiation specimen tube holders limit coverage to 77% and 55%, respectively. Specific examination limitation(s) for each shell weld are listed in Table 1.

2.3 Detectable Indications in RPV Shell Welds

During analysis of the weld examinations, NNECO found recordable indications in five welds: SC-1, SC-2, USL-1, USL-2, and USL-3. The licensee concluded, based on the size of the indications, that all were acceptable to Section XI, Paragraph IWB-3500, "Acceptance Standards" as they met the dimensional requirement of the allowable flaw tables. No indications required analytical evaluation for acceptance.

2.4 Alternative or Additional Examinations

NNECO reviewed the results of the augmented RPV examination and concluded the examinations provided an acceptable level of quality and safety, and requested authorization to not perform any additional or alternative examinations. Their conclusion is based on three major factors: (1) the rough, irradiated OD surface of the vessel would not be conducive to automated UT examinations without significant surface preparation and resultant radiation dose to workers, (2) overall, 90.8% of the vessel shell weld volume was examined, and (3) all indications already found were acceptable without analytical evaluation. Examination from the OD surface would potentially allow Millstone 2 to meet the "essentially 100%" examination requirement for welds HS-1, SC-2, USL-3, LSL-1, and MSL-1. Geometrical obstructions which prevented full coverage from the ID may not interfere with an OD examination.

2.5 Analysis

NNECO's inspection results indicate that the automated UT examinations of the RPV were conducted to the extent practical. The ID examinations achieved "essentially 100%" coverage for 7 of the 12 RPV shell welds. Three of the remaining five welds (HS-1, SC-2, and USL-3) were within one or two percent of meeting the regulatory requirement for more than 90% of the examination volume of each weld. The remaining two longitudinal welds (LSL-1 and MSL-1) received 77% and 55% weld coverage due to the irradiation specimen tube holders obstructing the remote inspection tooling.

Although inspection from the OD of the vessel could increase the inspection coverage in the obstructed areas, NNECO states the OD surface would require extensive preparation for UT examination in a radiation field of 5 to 15 rads per hour. Preparation, inspection, and cleanup from this type of examination would result in significant accumulated personnel dose. The additional weld volume examined that may be obtained from examination from the OD would be small in comparison to the welds already examined from the ID. All indications detected with the ID examinations have been acceptable to ASME Section XI without analytical evaluation. The results from examination of a significant portion of the weld volume indicate that the vessel is not experiencing any safety-significant degradation.

3.0 CONCLUSION

Based on the information submitted, the staff concludes that, pursuant to 10 CFR 50.55a(g)(6)(ii)(A)(5), the licensee's proposed alternative, i.e., examination of the accessible volume from the ID surface, to the augmented RPV examination requirements of 10 CFR 50.55a(g)(6)(ii)(A) provides an acceptable level of quality and safety.

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Table 1. Results of Millstone 2 Augmented Reactor Pressure Vessel Examinations.

Weld	Item No.	Description	Coverage	Limitation
HS-1	B1.11	Lower Shell to Bottom Head Circumferential	89%	Flow skirt and anti-rotation lugs
SC-1	B1.11	Middle to Upper Shell Circumferential	99%	Outlet nozzle integral extension
SC-2	B1.11	Lower to Middle Shell Circumferential	89%	Irradiation specimen tube holders
LSL-1	B1.12	Lower Shell Longitudinal @ 90°	77%	Irradiation specimen tube holders
LSL-2	B1.12	Lower Shell Longitudinal @ 210°	100%	N/A
LSL-3	B1.12	Lower Shell Longitudinal @ 330°	100%	N/A
MSL-1	B1.12	Middle Shell Longitudinal @ 90°	55%	Irradiation specimen tube holders
MSL-2	B1.12	Middle Shell Longitudinal @ 210°	100%	N/A
MSL-3	B1.12	Middle Shell Longitudinal @ 330°	100%	N/A
USL-1	B1.12	Upper Shell Longitudinal @ 90°	100%	N/A
USL-2	B1.12	Upper Shell Longitudinal @ 210°	93%	Integral extension on outlet nozzle NS-4
USL-3	B1.12	Upper Shell Longitudinal @ 330°	88%	Integral extension on outlet nozzle NS-1