

January 22, 2001

Gary Van Middlesworth  
Site General Manager  
Duane Arnold Energy Center  
Nuclear Management Company, LLC  
3277 DAEC Road  
Palo, Iowa 52324-9785

SUBJECT: SAFETY EVALUATION FOR PROPOSED ALTERNATIVES TO ASME  
SECTION XI INSERVICE INSPECTION PROGRAM RELATED TO LENGTH  
SIZING QUALIFICATION CRITERION AND TRAINING FOR ULTRASONIC  
TESTING PERSONNEL FOR THE DUANE ARNOLD ENERGY CENTER  
(TAC NO. MA8914)

Dear Mr. Van Middlesworth:

By letter dated April 14, 2000, IES Utilities, Inc., the licensee, submitted Relief Requests NDE-R037, NDE-R038, NDE-R039, and NDE-R040 for the Inservice Inspection (ISI) Program at the Duane Arnold Energy Center (DAEC). By letter dated November 14, 2000, IES Utilities, Inc., supplemented its April 14<sup>th</sup> letter and withdrew Relief Requests NDE-R039 and NDE-R040. By Relief Request NDE-R037, the licensee proposed to use a length sizing qualification criterion of 0.75 inch root mean square (RMS) in lieu of the requirement contained in Appendix VIII, Supplement 4, Subparagraph 3.2(b), of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (the Code) to use true length  $-\frac{1}{4}$  inch  $+1$  inch. Also by Relief Request NDE-R037, the licensee proposed to use the depth sizing requirement of 0.15 inch RMS consistent with 10 CFR 50.55a(b)(2)(xv)(C)(1) in lieu of the requirements contained in Appendix VIII, Supplement 4, Subparagraph 3.2(c), of the Code. By Relief Request NDE-R038, the licensee proposed to conduct annual ultrasonic testing training in accordance with 10 CFR 50.55a(b)(2)(xiv) requirements in lieu of Subarticle VII-4240 to Appendix VII of Section XI of the Code. The Nuclear Regulatory Commission (NRC) staff has reviewed the alternatives proposed in Relief Requests NDE-R037 and NDE-R038.

IES Utilities, Inc., was subsequently succeeded by Nuclear Management Company, LLC (NMC), as the licensed operator of DAEC. By letter dated October 5, 2000, NMC requested that the NRC staff continue to process and disposition licensing actions previously docketed and requested by IES Utilities, Inc.

Based on the information provided in the relief requests, the NRC staff concludes that the alternatives proposed by Relief Requests NDE-R037 and NDE-R038 for the third ISI 10-year internal will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the ISI program alternatives proposed in Relief

G. Van Middlesworth

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Requests NDE-R037 and NDE-R038 for the third ISI 10-year interval. The NRC staff's safety evaluation (SE) is enclosed.

If you have any questions regarding this issue or SE, please contact your Project Manager, Brenda L. Mozafari at 301-415-2020.

Sincerely,

***/RA/***

Claudia M. Craig, Chief, Section 1  
Project Directorate III  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket No. 50-331

Enclosure: Safety Evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

THIRD TEN-YEAR INTERVAL INSERVICE INSPECTION PROGRAM PLAN

REQUEST FOR RELIEF NOS.: NDE-R037, R038, R039, AND R040

IES UTILITIES INC.

DUANE ARNOLD ENERGY CENTER

DOCKET NO. 50-331

1.0 INTRODUCTION

The inservice inspection of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Class 1, Class 2, and Class 3 components shall be performed in accordance with Section XI of the ASME Code and applicable editions and 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, in part, that alternatives to the requirements of paragraph (g) may be used, when authorized by the Nuclear Regulatory Commission (NRC), if the licensee demonstrates that: (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 difficulty 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 twelve months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The inservice inspection Code of record for Duane Arnold Energy Center for the third 10-year interval is the 1989 Edition of the ASME Code. 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.

The NRC staff has reviewed the information submitted by IES Utilities Inc., the licensee, in a letter dated April 14, 2000, and supplemented November 14, 2000, requesting relief from certain Code-required ultrasonic testing (UT) criteria. The licensee's proposed alternatives to the Code requirements are contained in Relief Requests NDE-R037 and NDE-R038 for the third 10-year inservice inspection interval at the Duane Arnold Energy Center.

ENCLOSURE

Specifically, Relief Request NDE-R037 proposed using statistical length sizing tolerances for personnel qualifications of reactor pressure vessels (RPVs) in place of prescriptive tolerances. Relief Request NDE-R038 proposed changes to the annual training criteria for UT personnel. The licensee withdrew Relief Requests NDE-R039 and NDE-R040.

## 2.0 RELIEF REQUEST NDE-R037, UT LENGTH SIZING TOLERANCE FOR REACTOR PRESSURE VESSEL PERFORMANCE DEMONSTRATIONS

### 2.1 Code Requirements for which Relief is Requested

10 CFR 50.55a(g)(6)(ii)(C) imposes implementation of Appendix VIII to the 1995 Edition with 1996 Addenda of Section XI of the Code. The imposed implementation schedule for Supplement 4 to Appendix VIII is November 22, 2000. Supplement 4, Subparagraph 3.2(b), length sizing qualification criterion requires that flaw lengths estimated by UT be the true length  $-1/4$  inch  $+1$  inch. However, 10 CFR 50.55a(b)(2)(xv)(C)(1) modifies the length sizing qualification criterion to a depth sizing acceptance criterion of 0.15 inch root mean square (RMS) and specifies that this be used in lieu of the requirements of Subparagraph 3.2(b).

Supplement 4, Subparagraph 3.2(c), requires that the UT performance demonstration results be plotted on a two-dimensional plot with the measured depth plotted along the ordinate axis and the true depth plotted along the abscissa axis. For qualification, the plot must satisfy the following statistical parameters: (1) slope of the linear regression line is not less than 0.7; (2) the mean deviation of flaw depth is less than 0.25 inches; and (3) correlation coefficient is not less than 0.70.

### 2.2 Licensee's Proposed Alternative to Code

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee proposed using a length sizing qualification criterion of 0.75 inch RMS in lieu of Appendix VIII, Supplement 4, Subparagraph 3.2(b), and to use the RMS value of 10 CFR 50.55a(b)(2)(xv)(C)(1) which modifies the depth sizing criterion of Appendix VIII, Supplement 4, Subparagraph 3.2(a), in lieu of Subparagraph 3.2(c).

### 2.3 Evaluation

The U.S. nuclear utilities created the Performance Demonstration Initiative (PDI) to implement performance demonstration requirements contained in Appendix VIII of Section XI of the Code. To this end, PDI has developed a performance demonstration program for qualifying UT equipment, procedures, and personnel. During the development of the performance demonstration for Supplement 4, PDI determined that the Code criteria for flaw sizing was unworkable. The length sizing tolerance of  $-1/4$  inch  $+1.0$  inch in Supplement 4, Subparagraph 3.2(b) encouraged examiners to bias their results on the plus side. To discourage testmanship (passing the test based on manipulation of results rather than skill), PDI adopted a length sizing tolerance of 0.75 inch RMS which has been in use since 1994. As early as 1995, the staff has recognized and accepted PDI's use of 0.75 inch RMS for depth sizing. PDI formalized their use of 0.75 inch RMS as the criterion for Supplement 4, Subparagraph 3.2(b), in Code Case N-622, "Ultrasonic Examination of RPV and Piping and Bolts and Stubs, Section XI, Division 1." The

NRC representatives to ASME Code meetings participated in the process leading up to the publishing of Code Case N-622.

The NRC staff intended to formalize the acceptability of the 0.75 inch RMS length sizing criterion in 10 CFR 50.55a(b)(2)(xv)(C)(1), but mistakenly published the value of 0.15 inch RMS for depth sizing tolerance in place of the existing length sizing tolerance. The omission of the length sizing tolerance of 0.75 inch RMS in the rule was an oversight, and the inclusion of the depth sizing tolerance in Subparagraph 3.2(b) was an error. The NRC staff considers that the proposed alternative to use a length sizing tolerance of 0.75 inch RMS in lieu of the requirements in Supplement 4, Subparagraph 3.2(b) will provide an acceptable level of quality and safety.

In the second part of the alternative, the licensee proposed eliminating the use of Supplement 4, Subparagraph 3.2(c), which imposes three statistical parameters for depth sizing. The first parameter, 3.2(c)(1), pertains to the slope of a linear regression line. The linear regression line is the difference between actual versus true value plotted along a through-wall thickness. For Supplement 4 performance demonstrations, a linear regression line of the data is not applicable because the performance demonstrations are performed on test specimens with flaws located in the inner 15 percent through-wall. The differences between actual versus true value produce a tight grouping of results which resemble a shot gun pattern. The slope of a regression line from such data is extremely sensitive to small variations, thus, making the parameter of Subparagraph 3.2(c)(1) a poor and inappropriate acceptance criterion. The second parameter, 3.2(c)(2), pertains to the mean deviation of flaw depth. The value used in the code is too lax with respect to evaluating flaw depths within the inner 15 percent of wall thickness. Therefore, the licensee proposed to use the more appropriate criterion of 0.15 inch RMS of 10 CFR 50.55a(b)(2)(xv)(C)(1), which modifies Subparagraph 3.2(a), as the acceptance criterion. The third parameter, 3.2(c)(3), pertains to a correlation coefficient. The value of the correlation coefficient in Subparagraph 3.2(c)(3) is inappropriate for this application since it is based on the linear regression from Subparagraph 3.2(c)(1).

PDI was aware of the inappropriateness of Subparagraph 3.2(c) early in the development of their program. They brought the issue before the appropriate ASME committee which formalized eliminating the use of Supplement 4, Subparagraph 3.2(c) in Code Case N-622. NRC staff representatives participated in the discussions and consensus process of the code case. Based on the above, the NRC staff believes that the use of the Subparagraph 3.2(c) requirements in this context is inappropriate and that the proposed alternative to use the RMS value of 10 CFR 50.55a(b)(2)(xv)(C)(1), which modifies the criterion of Appendix VIII, Supplement 4, Subparagraph 3.2(a), in lieu of Subparagraph 3.2(c) will provide an acceptable level of quality and safety<sup>1</sup>.

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1. The information which would have been required for Appendix VIII, Supplement 4, Subparagraph 3.2(c)(1) is still required and valid for the sizing qualification of Appendix VIII, Supplement 6.

## 2.4 Conclusion

Based on the discussion above, the staff has concluded that the alternative proposed in Relief Request NDE-R037 for the third 10-year interval will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the proposed alternative for the third 10-year interval.

## 3.0 RELIEF REQUEST NDE-R038, SUBARTICLE VII-4240 SUPPLEMENTAL TRAINING FOR UT PERSONNEL

### 3.1 Code Requirements for which Relief is Requested

The licensee is requesting relief from the 1995 Edition with 1996 Addenda, Appendix VII to Section XI of the Code, Subarticle VII-4240 for Appendix VIII qualified UT personnel and the 1989 Edition of Appendix VII to Section XI, Subarticle VII-4240 for non-Appendix VIII qualified UT personnel. Subarticle VII-4240 requires a minimum of 10 hours of annual UT training.

### 3.2 Licensee's Proposed Alternative to Code

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee proposed conducting annual UT training in accordance with 10 CFR 50.55a(b)(2)(xiv) requirements in lieu of Subarticle VII-4240 to Appendix VII of Section XI of the Code.

### 3.3 Evaluation

Subarticle VII-4240, Appendix VII of Section XI of the Code requires 10 hours of annual training to impart knowledge of new developments, material failure modes, and any pertinent technical topics as determined by the licensee. No hands-on training or practice is required to be included in the 10 hours of training. This training is required of all UT personnel qualified to perform examinations of ASME Code Class 1, 2, and 3 systems. Independent of the ASME Code, 10 CFR 50.55a(b)(2)(xiv) imposes the requirement that eight hours of hands-on training with flawed specimens containing cracks be performed no earlier than six months prior to performing examinations at a licensee's facility. The licensee contends that maintaining two separate UT annual training programs create confusion, redundancies, and extra paper work.

As part of the staff's rulemaking effort to revise 10 CFR 50.55a(b)(2), the issue of UT annual training requirements was reviewed. This review was included in the summary of comments to the rule 64 *FR* 51370. In the review, the staff determined that the 10 hours of annual training requirement specified in the ASME Code was inadequate for two reasons. The first reason is that the training does not require practice with flawed specimens. Practice with flaws is necessary because signals can be difficult to interpret. The second reason is related to the length of training and its frequency. Studies have shown that an examiner's capability begins to diminish within six months if skills are not maintained. Therefore, examiners must practice on a frequent basis to maintain their capability for proper interpretation of flaws.



Based on resolution of public comments for the above rulemaking, the staff accepted an industry initiative advanced by the Electric Power Research Institute (EPRI), which proposed eight hours of hands-on practice with flawed specimens containing cracks. The practice would occur no earlier than 6 months prior to performing examinations at a licensee's facility. The initiative was adopted in 10 CFR 50.55a(b)(2)(xiv) for personnel maintaining their Appendix VIII qualifications. The staff believes that the proposed alternative to use 10 CFR 50.55a(b)(2)(xiv) in lieu of Subarticle VII-4240 will maintain the skill and proficiency of UT personnel at or above the level provided in the Code for annual UT training, thereby providing an acceptable level of quality and safety.

### 3.4 Conclusion

Based on the discussion above, the staff concludes that the alternative proposed in Relief Request NDE-R038 for the third 10-year interval will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the proposed alternative for the third 10-year interval.

Principal Contributor: D. Naujock, DE/EMCB

Date: January 22, 2001