

April 22, 1997

**FOR:** The Commissioners

**FROM:** L. Joseph Callan /s/  
Executive Director for Operations

**SUBJECT:** NRC STAFF'S POSITION ON AUGMENTED EXAMINATION REQUIREMENTS FOR BOILING WATER REACTOR PRESSURE VESSELS PURSUANT TO 10 CFR 50.55a(g)(6)(ii)(A)

**PURPOSE:**

To inform the Commission of the NRC staff's position regarding the extent to which boiling water reactor (BWR) licensees shall inspect their reactor pressure vessels (RPVs) in accordance with the requirements of Section 50.55a(g)(6)(ii)(A) to Chapter 10 of the *Code of Federal Regulations*, "Augmented examination of reactor vessel."

**SUMMARY:**

Section 50.55a(g)(6)(ii)(A) to Chapter 10 of the *Code of Federal Regulations* [10 CFR 50.55a(g)(6)(ii)(A) or the Rule], promulgated in August 1992 required that licensees perform an inspection of RPV welds in accordance with Section XI of the ASME Code on an expedited schedule, and revoked all previously granted reliefs for RPV weld examinations. The BWR Vessel and Internals Project (BWRVIP), a technical committee of the BWR Owners Group (BWROG), has stated its intent to pursue relief from this section of 10 CFR 50.55a through rulemaking and/or a request for the NRC staff to grant an alternative pursuant to the provisions of 10 CFR 50.55a(a)(3)(i). The NRC staff has concluded that no alternative to the expedited inspection requirements of 10 CFR 50.55a(g)(6)(ii)(A) (or the routine inspection requirements as established elsewhere in 10 CFR 50.55a) should be authorized for BWR licensees until they have completed at least one examination of essentially 100 percent of their RPV shell welds and have shown that the examination performed provides an acceptable level of quality and safety. The NRC staff intends to issue the attached letter to the BWRVIP to clarify the NRC staff's position regarding this policy matter. However, it should be noted that the BWRVIP has requested, by letter dated April 18, 1997, a meeting with the Commission in the near future.

**REGULATORY BACKGROUND:**

In January 1991, the NRC published in the Federal Register a proposed Rule to amend 10 CFR 50.55a, "Codes and Standards" (56 FR 3796). One purpose of this amendment was to incorporate by reference a later edition and addenda to Section XI of the ASME Code. This included the 1989 Edition of the ASME Section XI, Division 1, and addenda through 1988. In addition, the Rule proposed to create Section 50.55a(g)(6)(ii)(A) to 10 CFR 50.55a [10 CFR 50.55a(g)(6)(ii)(A)], "Augmented examination of reactor vessel."

As noted in the Statement of Considerations for the Rule, the primary reason for the augmented examination rule was that few examinations had been performed up to that time on BWR and PWR reactor vessel shell welds. Therefore, there was a concern on the part of the NRC staff regarding the existence of manufacturing flaws in the RPV welds, and the initiation and propagation of flaws during service. The NRC staff had no assurance that ASME Section XI flaw acceptance criteria were being satisfied in the RPV shell welds which had never been completely examined as part of a Section XI inservice inspection program. The augmented examination was needed for BWRs because of evidence demonstrating a viable mechanism for initiating environmentally-assisted cracks in the RPV cladding; evidence that the cladding cracks can propagate into the ferritic steel of the RPV base plate; and, evidence that BWR reactor vessels may be embrittled more by neutron irradiation than would be predicted by Regulatory Guide 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials."

The intent of 10 CFR 50.55a(g)(6)(ii)(A) was to require that licensees perform an expanded RPV shell weld examination, as specified in the 1989 Edition of ASME Section XI, on an "expedited" basis. "Expedited," in this context, effectively meant during the inspection interval when the Rule was approved or the first period of the next inspection interval. The final Rule was published in the *Federal Register* on August 6, 1992 (57 FR 34666).

By incorporating into the regulations the 1989 Edition of the ASME Code, the NRC staff was requiring that licensees perform volumetric examinations of "essentially 100 percent" of the RPV pressure-retaining shell welds during all inspection intervals. This represented an expansion by the ASME of the requirements from previous editions of Section XI of the ASME Code which, as far back as the Winter 1975 Addenda, had required examination of 100 percent of the RPV pressure-retaining welds during the first inspection interval, then limited examinations in the intervals thereafter. Requiring every licensee to perform an extensive volumetric examination of every RPV shell weld at least once during the service life of the RPV was therefore consistent with the philosophy that had been expressed in the ASME Code for more than 20 years. In those 20 years, however, BWR licensees had requested and been granted extensive relief from performing RPV shell weld examinations. As a result, only a small percentage of the beltline welds in BWR RPVs had been examined, and no BWR licensee had completed an examination which would satisfy the philosophy and requirements of the NRC and the ASME Code. Recognizing the small percentage of RPV welds that were being examined, the conflict between this small percentage of examinations and the ASME Code requirements, and the fact that inspection technology had evolved such that commercial systems were available to support the ASME-specified scope of RPV inspections, the previously granted reliefs were revoked in 1992 with the issuance of the Rule.

**DISCUSSION:**

During original promulgation of the Rule, the only exception the BWROG took to the proposed rule was to the accelerated implementation schedule for RPV examinations. The NRC staff addressed this concern in the final Rule by allowing licensees who were within 40 months of the end of their current

inspection interval to defer the augmented examination until the first period of the subsequent inspection interval.

More recently, by letter dated September 28, 1995, the BWRVIP submitted the proprietary report, "BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations (BWRVIP-05)," for NRC staff review. This report compared the Rule's inspection requirements for RPV shell welds in BWRs to the BWRVIP's proposed alternative (inspection of 50% of RPV shell longitudinal seam welds and 0% of RPV shell circumferential seam welds) by performing enhanced probabilistic fracture mechanics (PFM) analyses. The BWRVIP's results stated that its proposed inspection scope resulted in only a modest increase in the low probability of a BWR RPV failure. The NRC staff has stated to the BWRVIP that the recommendations contained in BWRVIP-05 are insufficient for those licensees who had never conducted an examination equivalent to that required by the Rule.

The NRC staff acknowledges that the BWRVIP has provided, in the original BWRVIP-05 report and in their response to NRC staff RAIs, substantial technical arguments for reducing the scope of BWR RPV shell weld examinations. The BWRVIP maintains that BWR RPVs were constructed to high quality standards, that the shell welds received volumetric and surface examinations in accordance with the edition of the Section III of the ASME Code to which they were constructed, and that the design considerations of many BWRs did not anticipate the need for extensive inservice examinations. They argue also that operational characteristics of the BWR system mitigate the severity of the transients which would be expected to challenge RPV integrity, while the environment and material properties of the RPVs limit the amount of degradation (via stress corrosion cracking (SCC), fatigue, etc.) expected during the vessel's service life. Finally, when the BWRVIP considers all of these factors in a probabilistic failure assessment, they state that their significant proposed reduction in examination scope leads to a modest increase in the already low vessel failure probability while reducing the economic burden placed upon the BWR licensees.

Notwithstanding these arguments, the NRC staff maintains that the policy of the NRC should not be modified from that expressed in 10 CFR 50.55a(g)(6)(ii)(A). The NRC staff maintains that, while the condition of the RPV materials may be expected to be as described by the BWRVIP, the NRC staff has noted other instances in which the industry has not been able to accurately predict in-service degradation, such as internals cracking (e.g., shroud, core spray piping, etc.). Therefore, the NRC staff would require confirmation of the industry's expectations under actual service conditions through the performance of at least one comprehensive baseline examination of all BWR RPV welds. These examinations could, for example, support the BWRVIP's assertion that limited degradation of RPV materials (due to SCC, fatigue, preservice flaws, and interactions between these three) occurs during the vessel's service life. The NRC staff has concluded that these examinations are necessary to maintain a level of defense-in-depth which is appropriate given the importance of ensuring RPV integrity. Defense-in-depth (by RPV inspection, conservative operational limits, etc.) is necessary since no physical redundancy exists for the RPV. Again, since this NRC staff position does not conflict with the philosophy captured in Section XI of the ASME Code for the last 20 years, the NRC staff finds no compelling reason to modify NRC policy at this time.

The NRC staff has also concluded that its rejection of the BWRVIP's probabilistic arguments to support authorization of inspection alternatives or granting of relief requests is consistent with Commission policy on the use of probabilistic risk assessment (PRA). On August 19, 1995, the Commission published its "Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities; Final Policy Statement," in the *Federal Register* (60 FR 42622). In this, the Commission notes, "...the NRC would use the safety goals in making regulatory decisions regarding backfitting new generic requirements but not to make specific licensing decisions including granting relief from unnecessary requirements," and, "Appropriate procedures for including PRA in the process for changing regulatory requirements should be developed and followed. It is, of course, understood that the intent of this policy is that existing rules and regulations shall be complied with unless these rules and regulations are revised." While the NRC staff acknowledges that the analysis in the BWRVIP-05 report may not be carried all the way through to a comparison with NRC safety goals, the use of PFM to determine vessel failure probabilities based on different examination programs is certainly similar to performing PRA. Therefore, at a July 11, 1996 meeting, NRC management informed the BWRVIP that the appropriate use of such PFM-based arguments, in keeping with Commission policy, is not to request alternative inspections or relief requests but to effect changes to the Rule. In support of this, by letter dated September 20, 1996, the BWRVIP indicated its intent to petition for rulemaking. During a meeting on October 15, 1996, the NRC staff informed industry representatives that even if the proposed relaxation in examination scope were found acceptable, the time required to process a rule change may not eliminate the need to perform the presently required inspections.

Subsequently, in an October 29, 1996 letter, the BWRVIP also indicated that they would pursue with the NRC staff a technical alternative (examination of 100 percent of the longitudinal and zero percent of the circumferential RPV shell welds) per the provisions of 10 CFR 50.55a(a)(3)(i). 10 CFR 50.55a(a)(3)(i) permits alternatives to the requirements to be authorized when the alternative would "provide an acceptable level of quality and safety." The NRC staff's view is that authorizing the technical alternative proposed by the BWRVIP under 10 CFR 50.55a(a)(3)(i) *en masse*, would circumvent the intent of 10 CFR 50.55a(g)(6)(ii)(A).

The provision for an "alternative to the examination requirements" in 10 CFR 50.55a(g)(6)(ii)(A)(5) was intended to address "limited" alternatives to the required examination scope based on material interferences discovered during the examinations. As such, the provisions of 10 CFR 50.55a(g)(6)(ii)(A)(5) are much more limited than the provisions of 10 CFR 50.55a(a)(3)(i) mentioned above and do not circumvent the intent of 10 CFR 50.55a(g)(6)(ii)(A). While the NRC staff will consider authorizing "limited" alternatives provided (1) that an attempt is made to comply with the regulations and (2) that this attempt provides an acceptable level of quality and safety, the NRC staff's position is that extensive, *a priori* reductions in the examination scope are not consistent with NRC policy, and therefore cannot be justified under 10 CFR 50.55a(g)(6)(ii)(A)(5). In summary, while there may be no legal objection to preclude authorizing alternatives to the Rule under 10 CFR 50.55a(a)(3)(i), the staff considers only those alternatives which can be authorized per the provisions of 10 CFR 50.55a(g)(6)(ii)(A)(5) to be consistent with NRC policy. Therefore, until at least one examination has been completed, 10 CFR 50.55a(g)(6)(ii)(A)(5) will effectively be the only paragraph under which inspection alternatives providing an acceptable level of quality and safety will be authorized.

#### **CONCLUSION:**

The NRC staff has concluded that no modification to the requirements of 10 CFR 50.55a(g)(6)(ii)(A) (or the routine inspection requirements as

established elsewhere in 10 CFR 50.55a) should be granted for BWR licensees until they have completed at least one examination of essentially 100 percent of their RPV shell welds. As licensees make attempts to comply with the regulations, the NRC staff plans to grant limited alternatives to the requirements of 10 CFR 50.55a(g)(6)(ii)(A) provided that the conditions of 10 CFR 50.55a(g)(6)(ii)(A)(5) are met. A reduction in subsequent examination requirements will also be considered depending upon the results of the augmented inspections, future ASME Code developments, and changes to the Rule which may be supported by the BWRVIP's PFM-based arguments.

The NRC staff intends to issue the attached letter to the BWRVIP to clarify this issue within 10 working days from the issuance of this paper unless guidance to the contrary is received from the Commission. Further, the BWRVIP has requested, by letter dated April 18, 1997, a meeting with the Commission in the near future on the subject of this Commission Paper.

**COORDINATION:**

The Office of the General Counsel has been consulted on this issue and has no legal objection to the NRC staff's position or the attached letter.

L. Joseph Callan  
Executive Director for Operations

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Attachment: As stated

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ATTACHMENT

Carl Terry, BWRVIP Chair  
Niagara Mohawk Power Company  
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SUBJECT: BWR VESSEL AND INTERNALS PROJECT, BWR REACTOR PRESSURE VESSEL SHELL WELD INSPECTION RECOMMENDATIONS  
(BWRVIP-05)

Dear Mr. Terry:

By letter dated September 28, 1995, as supplemented by letter dated June 24, 1996, the Boiling Water Reactor Vessel and Internals Project (BWRVIP) submitted the proprietary Electric Power Research Institute (EPRI) report TR-105697, "BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations (BWRVIP-05)," dated September 1995, for U.S. Nuclear Regulatory Commission (NRC) staff review. This report evaluates the current inspection requirements for boiling water reactor pressure vessel (RPV) shell welds in BWRs, proposes alternative inspection requirements for BWR shell welds, and presents results from performing probabilistic fracture mechanics (PFM) analyses based on an enhanced PFM code, VIPER, to justify a proposed alternative scope of inspections. Under the existing augmented inspection requirements in Section 50.55a to Title 10 of the *Code of Federal Regulations* [10 CFR 50.55a(g)(6)(ii)(A)], all licensees must perform expedited examinations of "essentially 100%" of the circumferential and longitudinal reactor vessel shell welds. Among its other recommendations, BWRVIP-05 would revise these requirements in 10 CFR 50.55a(g)(6)(ii)(A) to inspect 50 percent of RPV shell longitudinal seam welds, and zero percent of RPV shell circumferential seam welds.

To aid the NRC staff's review of this document, the NRC staff issued two Requests for Additional Information (RAIs), the first on April 2, 1996, and the second on May 20, 1996. By letter dated June 24, 1996, the BWRVIP responded to the two RAIs with supplemental information. Further, in response to the request from the BWRVIP Executive Oversight Committee (EOC), NRC managerial and technical staff met with the BWRVIP EOC management and technical staff in a public meeting held at the NRC offices in Rockville, Maryland, on July 11, 1996. A subsequent public meeting was held at the NRC offices in Rockville, Maryland, on October 15, 1996, where the NRC discussed with you your plans to Petition for Rulemaking.

Subsequently, in a letter dated September 20, 1996, you proposed to Petition for Rulemaking to amend 10 CFR 50.55(a)(g)(6)(ii)(A) and, in a letter

dated October 28, 1996, to pursue with the NRC staff a technical alternative (examination of 100 percent of the longitudinal weld lengths and zero percent of the circumferential weld lengths) under the provisions of 10 CFR 50.55a(a)(3)(i).

The NRC staff has examined the BWRVIP-05 report, your proposed technical alternative, and your proposal of a Petition for Rulemaking. The NRC staff has concluded that a one-time baseline examination of the RPV shell welds, as presently required by 10 CFR 50.55a(g)(6)(ii)(A), is appropriate, and that no modification of the requirements of 10 CFR 50.55a(g)(6)(ii)(A) should be granted for BWR licensees until they have completed at least one "best effort" examination of essentially 100 percent of their RPV shell welds. The NRC staff will consider limited modifications in examination scope on a case-by-case basis (when material interferences can be demonstrated to exist) as licensees make "best effort" attempts to comply with the regulations. The staff's view is that authorizing the technical alternative proposed by the BWRVIP would not be permissible under 10 CFR 50.55a(g)(6)(ii)(A)(5), and authorizing the alternative under 10 CFR 50.55a(a)(3)(i) would circumvent the intent of 10 CFR 50.55a(g)(6)(ii)(A).

During the October 15, 1996, meeting (see Meeting Summary dated December 10, 1996) between the NRC staff and members of the BWRVIP, in which your intention to Petition for rulemaking was discussed, the time necessary to process a rule change, assuming such changes were found acceptable or warranted, along with demands on NRC staff resources for higher priority activities, may not support a rule change in time to eliminate the need to perform the presently required inspections. It should be noted that, until such time as changes are made to the regulations, licensees must continue to perform augmented examinations in accordance with 10 CFR 50.55a(g)(6)(ii)(A).

Please contact Keith R. Wichman, of my staff, at (301) 415-2757 if you have any further questions on this subject.

Sincerely,  
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