



September 27, 2006

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ET 06-0042

U. S. Nuclear Regulatory Commission
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Reference: 1) Letter ET 06-0031, dated August 4, 2006, from T. J. Garrett, WCNOC, to USNRC

2) Letter ET 06-0021, dated May 19, 2006, from T. J. Garrett, WCNOC, to USNRC

Subject: Docket 50-482: Wolf Creek Nuclear Operating Corporation's Response to the September 20, 2006 NRC Request for Additional Information Regarding 10 CFR 50.55a Request I3R-05

Gentlemen:

Reference 2 provided Wolf Creek Nuclear Operating Corporation's (WCNOC) 10 CFR 50.55a Request I3R-05, which requested alternatives to the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (BPV) Code, Section XI for the installation and examination of full structural weld overlays for repairing/mitigating Pressurizer nozzle-to-safe end dissimilar metal (DM) and safe end-to-piping stainless steel (SS) butt welds. Reference 1 provided WCNOC's responses to a July 6, 2006 Nuclear Regulatory Commission (NRC) request for additional information (RAI) regarding the WCNOC 10 CFR 50.55a Request I3R-05 and provided Revision 1 to I3R-05 to address two WCNOC responses to the RAI.

During the NRC review of industry requests regarding weld overlays, the NRC sent out a generic RAI. This generic RAI was received by WCNOC on September 20, 2006 by electronic mail.

Attachment 1 to this letter provides WCNOC's responses to the RAI. It lists each NRC RAI followed by WCNOC's response.

In accordance with request 2 of the RAI, WCNOG is committing to provide the details of the ultrasonic examination results of the full structural weld overlays of the Wolf Creek Generating Station (WCGS) Pressurizer safety, relief, spray and surge line nozzle welds to the NRC within 14 days of the completion of the final weld overlay ultrasonic examination. WCNOG will notify the NRC Project Manager for WCGS when the ultrasonic examination of the final full structural weld overlay is complete.

In addition, a correction to section 2 of 10 CFR 50.55a Request I3R-05, Revision 1 submitted in Reference 1 is provided as follows. The last bullet in Section 2 of the Request incorrectly identified the ASME Section III Original Code of Construction applicable for the bottom Pressurizer piping (surge line) as the 1974 Edition though Summer 1975 Addenda. The correct ASME Section III edition and addenda for the surge line Original Code of Construction is the 1974 Edition through Winter 1975 Addenda with fatigue analysis in accordance with the Summer 1979 Addenda. Request I3R-05, Revision 1 is changed by this correction.

Attachment 2 contains a list of commitments.

If you have any questions, please contact me at (620) 364-4084 or Mr. Kevin Moles at (620) 364-4126.

Sincerely,



Terry J. Garrett

TJG/rlt

Attachment 1: Response to the September 20, 2006 NRC Request for Additional Information
Regarding 10 CFR 50.55a Request I3R-05

Attachment 2: List of Commitments

cc: J. N. Donohew (NRC), w/a
G. E. Werner (NRC), w/a
B. S. Mallett (NRC), w/a
Senior Resident Inspector (NRC), w/a

**Response to the September 20, 2006 NRC Request for Additional Information
Regarding 10 CFR 50.55a Request I3R-05**

1.0 Request for Additional Information:

Identify the UT acceptance criteria that will be used for the complete full structural weld overlay and heat affected zone beneath the weld overlay. If the acceptance criteria to be used is not consistent with the respective positions stated in Regulatory Guide 1.147, Rev. 14, for the applicable code cases, provide the technical bases for its use.

WCNOC Response to 1.0:

Table 5, page 26 of 28 of Wolf Creek Nuclear Operating Corporation (WCNOC) 10 CFR 50.55a Request I3R-05, Rev. 1, clearly identifies the ultrasonic testing (UT) acceptance criteria for the completed weld overlay, noting that the UT acceptance standards for bonding and welding flaws are per Section XI Nonmandatory Appendix Q, paragraph Q-4100(c). In order to examine the completed weld overlay for bonding and welding flaws, the interface between the weld overlay and the underlying base materials must also be examined, which will adequately examine the heat affected zone beneath the weld overlay. Q-4100(c) requires that planar flaws (as characterized by Section XI Article IWA-3000) shall meet the preservice examination standards of Table IWB-3514-2. Q-4100(c) also requires that laminar flaws (as characterized by Section XI Article IWA-3000) shall meet the acceptance standards specified in Q-4100(c)(1) through (4). Pages 27 and 28 of I3R-05 clearly identify that the UT acceptance standards for preservice and inservice examinations for full structural repair weld overlays are per Section XI Nonmandatory Appendix Q, paragraphs Q-4200 and Q-4300. For preemptive full structural weld overlays not covered by Case N-504-3, page 28 identifies the examination requirements and acceptance standards that will be used, consistent with the applicable portions of Appendix Q.

On page 2 of 28 in 10 CFR 50.55a Request I3R-05, Rev. 1, it was noted that alternative requirements were being requested for the installation and examination of full structural weld overlays. It was noted that the requested alternative requirements used methodologies and requirements similar to those in ASME Code Cases N-504-3 and N-638-1, but noted that these Cases could not be used without modifications. On page 3 of 28 of I3R-05, it was noted that Case N-504-3 and Nonmandatory Appendix Q from the 2005 Addenda of Section XI would be used along with the modifications detailed in Table 2. Therefore, the acceptance criteria for examinations are consistent with the Regulatory Guide (RG) 1.147 condition on use of Case N-504-2. On page 7 of 28 of I3R-05, in 5.0 B) for the proposed alternative to use modified Code Case N-638-1, it was noted that modifications to Case N-638-1 were detailed in Table 3. It further noted that the modifications included in Table 3 address performance of the ultrasonic examinations of Code Case N-504-3 (and Section XI Nonmandatory Appendix Q) applicable to weld overlays, as noted in Tables 2 and 5, in lieu of the Code Case N-638-1 ultrasonic examination applicable to base metal/weld metal excavations and rewelding. Therefore, as discussed in Table 3, the NRC condition on use of N-638-

1 requiring use of Section III NB-5330 acceptance criteria is not applicable to this Request and will not be applied.

The RG 1.147, Rev. 14, condition on Case N-638-1 states:

UT examinations shall be demonstrated for the repaired volume using representative samples which contain construction type flaws. The acceptance criteria of NB-5330 of Section III edition and addenda approved in 10 CFR 50.55a apply to all flaws identified within the repaired volume.

If used, this condition would apply only to the limited portion of the weld overlay where Code Case N-638-1 ambient temperature temper bead welding is required. The remaining portion of the weld overlay does not need to use Code Case N-638-1, because temper bead welding is not required for welding on austenitic materials. Case N-504-3, Appendix Q, and the modifications specified in I3R-05 are applicable for the remaining portion of the weld overlay. For this remaining portion of the weld overlay, the condition applied to the use of Case N-638-1 is not applicable.

The technical basis for not applying the RG 1.147 condition on Case N-638-1 is further discussed in the following paragraphs. The basis will reiterate the basis included in 10 CFR 50.55a Request I3R-05, will compare the Section III and Section XI UT acceptance standards, discuss the inconsistency of applying more limiting Section III acceptance standards to more sensitive Section XI examination requirements, and will note that the imposition of Section III UT acceptance standards to weld overlays is inconsistent with years of NRC precedents and without evidence of the inadequacy of the past NRC approvals.

A) Code Case N-504-3 and Nonmandatory Appendix Q Adequately Examine the Weld Overlays

Table 3, page 14 of 28 in WCNOG Request I3R-05 Rev. 1, identifies modifications to Case N-638-1 and provides the basis for the modifications. The second modification to Case N-638-1 states that in lieu of the ultrasonic examination requirement of paragraph 4.0(b), ultrasonic examinations of the final weld overlay will be performed in accordance with the requirements of Code Case N-504-3 and Nonmandatory Appendix Q as indicated in Table 5. The basis for this modification includes the following with regard to the use of Case N-638-1 UT examinations and the NRC condition applied to those N-638-1 UT examinations.

Code Case N-638-1 and the temper bead welding techniques in IWA-4600 are written to address repair welds where a defect is excavated and the resulting cavity is filled using a temper bead technique. However, an excavated cavity configuration differs significantly from the weld overlay configuration addressed in Code Case N-504-3 and Appendix Q. For an excavated cavity, the fusion line between the weld and the cavity is more critically oriented for hydrogen cracking than the fusion line between a weld overlay and the underlying base metal/original welds. For weld overlays, potential hydrogen

cracking associated with the Pressurizer weld overlays would be limited to the heat affected zone in the P-No. 3 nozzle material at the weld overlay to nozzle interface. Potential hydrogen cracking in the heat-affected zone in the weld overlay to nozzle interface under the weld overlay is best identified by a UT examination. These potential causes of cracking are addressed by the WCNOG Request I3R-05 proposed modification to N-638-1, which examines the adjacent band and the weld with a surface examination, as required by N-638-1, and examines the weld overlay by UT examination in accordance with Code Case N-504-3 and Appendix Q with demonstrated Performance Demonstration Initiative (PDI) UT procedures for examination of weld overlays. This eliminates the Case N-638-1 UT examination of the adjacent band and weld overlay. With this modification, the NRC Regulatory Guide 1.147, Revision 14, condition on use of N-638-1 is not applicable to these weld overlays and will not be applied.

To summarize, Code Case N-504-3, Nonmandatory Appendix Q, and the PDI UT-8 UT procedure are written specifically to address weld overlays and not only adequately examine the weld overlays but also provide more appropriate UT examinations and acceptance criteria than the UT examinations specified in Code Case N-638-1.

B) Comparison of the Section III and Section XI Acceptance Standards

The Construction Codes, in particular ASME Section III, utilize nondestructive examination procedures and techniques that have flaw detection capabilities that are well within the practical limits of workmanship and quality level for welds. The acceptance standards for these procedures are written for a range of fabrication flaws. Typical fabrication flaws in welds include lack of fusion, incomplete penetration, cracking, slag inclusions, porosity, and concavity. It should be noted that Construction Code NDE acceptance standards are established to detect weld fabrication flaws as a means of measuring the quality of workmanship. However, experience and fracture mechanics have demonstrated that many of the flaws that are rejected using Construction Code acceptance standards do not have a significant effect on the structural integrity of the component. In fact, if characterized and evaluated using Section XI methods and acceptance standards, some if not many of these fabrication flaws (e.g. rounded indications such as porosity and small planar flaws such as cracks) would be acceptable.

Section XI has adopted the very conservative assumption that all observed indications – crack-like defects, slag inclusions, porosity, lack of weld fusion, laminations, and any combinations thereof - should be treated as planar flaws. In addition, irregularly shaped flaws are conservatively represented as simple geometric shapes to simplify their analysis. These provisions are implemented in the flaw characterization rules of IWA-3000. Using these provisions, flaw acceptance standards are simplified to facilitate assessment using the principles of fracture mechanics. Pages E-3 and E-4 of EPRI Report NP-1406-SR, Nondestructive Examination Acceptance Standards, states the following:

The flaw characterization rules of ASME Code - Section XI were based on the assumption that indications which derived from crack-like defects, slag inclusions, porosity, lack of penetration or fusion, laminations, and any combinations thereof, would be resolved into simple geometrically defined planar defects. The principles of fracture mechanics could then be applied to evaluate the significance of these planar indications and to determine the interrelationships among the surface flaws, subsurface flaws, and laminar flaws, with different aspect ratios (i.e. flaw depth and length).

The treatment of all indications as planar flaws was intentionally adopted to assure a high degree of conservatism although defects, other than cracks, were recognized as relatively unimportant, particularly in the size range of the allowable indication standards. The resolution of all flaw configurations into simple geometries would not only facilitate flaw evaluation analysis but also assure the conservatism.

The Section XI preservice acceptance standards for austenitic piping welds containing planar, laminar, and linear flaws are specified in IWB-3514. The acceptance standards are conservative and are based on quantitative fracture mechanics analysis rather than Construction Code workmanship standards. For example, Section III allows no lack of fusion, but Section XI has specific acceptance standards for accepting some lack of fusion in overlays, which is in fact a lamination. If the Section XI preservice acceptance standards are met, the detected flaw is acceptable and no additional evaluations are required. However, if the preservice acceptance standards are not met, then the weld must be repaired.

These Section XI acceptance standards were specifically prepared for evaluation of flaws in operating nuclear power plants on Class 1 components and are best suited to address weld overlay work. Section XI Nonmandatory Appendix Q, Subarticles Q-4100 and Q-4200 for weld overlay examinations invoke the IWB-3514 acceptance standards for austenitic piping welds. These requirements are utilized in the WCNOG Request I3R-05, consistent with the RG 1.147 condition on use of Case N-504-2.

C) Interrelationship of Examination Requirements and Acceptance Standards

Both Section III and Section XI have developed examination requirements and acceptance standards as an interrelated set of requirements to provide a high level of quality and degree of acceptability. The degree of acceptability does differ between the two Codes because of the different conditions to which the Codes apply, i.e., operating nuclear power plants vs. shop fabrication or new plant construction. Radiological exposure, accessibility restrictions, personnel safety, difficulty in repair or replacement, and differing costs for repair are all conditions that drive different levels of flaw acceptability for the Section XI applicability for operating nuclear power plants vs. the Section III applicability for new construction. Although Section XI has a different degree of acceptability for flaws, the acceptable flaw sizes have been established to

provide safety margins consistent with Section III, thus providing an equivalent level of safety.

Because the Section III and Section XI examination requirements and acceptance standards have been developed as an interrelated set of requirements, a consistent set of requirements needs to be applied when performing examinations and evaluating the results. If Section III UT acceptance standards are to be used, then use of Section III UT examination requirements should also be used. Although Section III UT examination requirements are not as sensitive as the Section XI Appendix VIII UT performance demonstration requirements, it must be recognized that use of Section III UT examination requirements were not intended to identify many of the small indications identified with Section XI UT performed in accordance with Section XI and PDI qualified procedures, equipment and personnel. This is because Section III's examinations are aimed at finding workmanship flaws while Section XI's examinations are aimed at finding service-induced flaws, which are typically tighter and harder to detect. If Section XI PDI qualified UT is to be performed, the Section XI acceptance standards should be used to provide a consistent set of requirements. This is because the Section XI acceptance standards were developed in recognition of the need for more sensitive examination requirements and are based on acceptable flaw sizes determined by fracture mechanics. It should also be noted that using the Section XI flaw characterization rules of IWA-3000 with the Section III NB-5330 UT acceptance standards makes it very difficult for any indications in weld overlays to be acceptable because the Section III criteria does not allow crack-like indications while the IWA-3000 rules resolve all indications into planar (crack-like) flaws.

D) Historical Weld Overlay Approvals and Experience:

Weld overlays have long been used for repair and mitigation of cracking in Boiling Water Reactors (BWR). Over 1000 weld overlays ranging in size from 4 inches to 28 inches in diameter have been installed in Class 1 BWR piping with some of these in service for over 20 years. The NRC had extensive research performed regarding these weld overlays (NUREG 0313 Rev. 2) and documented established positions for acceptability in Generic Letter 88-01. In Generic Letter 88-01, the NRC approved the use of Section XI acceptance standards for determining the acceptability of installed weld overlays.

In addition, for a number of years the NRC has accepted various versions of Code Case N-504 in RG 1.147 with no conditions regarding the use of Section XI acceptance standards for determining the acceptability of weld overlays. Code Case N-504 (and its later versions) was developed to codify the BWR weld overlay experience and NRC approval is consistent with the NRC acceptability of BWR weld overlays. Similarly, Code Case N-638 was acceptable for use in RG 1.147 Rev. 13 with no conditions and has been approved by the NRC for use in PWR weld overlay installations using the Section XI acceptance standards.

There is no known operating experience with weld overlays where use of the Section XI UT acceptance standards has resulted in a weld overlay being inadequate to meet the design or service conditions or resulted in non-conservative acceptance that negatively affected the weld overlay function.

Code Case N-638-1 was not prepared for weld overlay applications. The WCNOG 10 CFR 50.55a Request I3R-05 requested alternative requirements that used methodologies and requirements similar to those in ASME Code Cases N-504-3 and N-638-1, but noted that these Cases could not be used without modifications. Request I3R-05 presented these modifications and the basis for the modifications and concluded that the NRC condition on use of N-638-1 requiring use of Section III NB-5330 acceptance criteria is not applicable to this Request and will not be applied. Using Section XI acceptance standards without the current Case N-638-1 NRC condition is consistent with previous criteria approved by the NRC for weld overlay installations. Conversely, the imposition of Section III UT acceptance standards to weld overlays is inconsistent with years of NRC precedents and without justification given the evidence of past NRC approvals and operating experience.

Conclusions:

As discussed above, performing weld overlay examinations using Section XI and PDI qualified UT requirements with Section III UT acceptance standards for acceptance of weld overlays imposes an unnecessary and unjustified level of conservatism. This conservatism may result in the rejection of indications that would otherwise meet all design and service conditions and would maintain safety margins consistent with Section III. Rejection of indications because of this conservatism could result in repairs that increase worker radiation exposure and may extend outage duration and cost, without any compensating increase in safety. The above information provides the technical basis for use of Section XI UT acceptance standards as presented in 10 CFR 50.55a Request I3R-05 rather than the Section III UT acceptance standards contained in the RG 1.147 condition on use of Case N-638-1.

2.0 Request for Additional Information:

Provide a commitment to submit within 14 days from completion of UT examination of the weld overlays, a report that summarizes the results of the examinations, consistent with the September 14, 2006 letter from Exelon to NRC regarding Byron Station, Unit 1 Relief Request 13R-03.

WCNOC Response to 2.0:

WCNOC commits to provide the details of the ultrasonic examination results of the full structural weld overlays of the Wolf Creek Generating Station (WCGS) Pressurizer safety, relief, spray and surge line nozzle welds to the NRC within 14 days of the completion of the final weld overlay ultrasonic examination. WCNOC will notify the NRC Project Manager for WCGS when the ultrasonic examination of the final full structural weld overlay is complete. This commitment is contained in Attachment 2.

LIST OF COMMITMENTS

The following table identifies those actions committed to by Wolf Creek Nuclear Operating Corporation (WCNOC) in this document. Any other statements in this submittal are provided for information purposes and are not considered to be commitments. Please direct questions regarding these commitments to Mr. Kevin Moles at (620) 364-4126.

COMMITMENT	Due Date/Event
WCNOC will notify the NRC Project Manager for Wolf Creek Generating Station (WCGS) when the ultrasonic (UT) examination of the final full structural weld overlay is complete.	When the final UT examination of the weld overlays during WCNOC's Fall 2006 Refueling Outage is completed.
<p>WCNOC will provide the results of the UT examinations of the full structural weld overlays of the WCGS Pressurizer safety, relief, spray and surge line nozzle welds to the NRC.</p> <p>The results will include:</p> <ul style="list-style-type: none">• A listing of indications detected;• The disposition of all indications using the standards of ASME Section XI, Table IWB-3514-2 and/or Table IWB-3514-3; and, if possible,• The type and nature of the indications. <p>Also included in the results will be a discussion of any repairs to the overlay material and/or base metal and the reason for the repair.</p>	Within 14 days of completion of the final UT examination of the weld overlays during WCNOC's Fall 2006 Refueling Outage.