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February 9, 2010

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

SUBJECT: Duke Energy Carolinas, LLC (Duke)
McGuire Nuclear Station Unit 1
Docket Number 50-369
Relief Request 09-MN-007
Response to Request for Additional Information

On September 15, 2009, Duke submitted Relief Request 09-MN-007 pursuant to 10 CFR 50.55a(a)(3)(i) requesting NRC approval for an alternative to the examination requirements of ASME Code, Section XI. This request supports the examination of reactor vessel cold leg nozzle-to-safe end and safe end-to-pipe welds performed from the inside surface during the upcoming McGuire Unit 1 spring 2010 refueling outage.

During a telephone call on January 28, 2010, the NRC requested additional information regarding the materials for the affected ASME Code components in this relief request and a copy of EPRI Policy/Procedure Directive 03-01 "Criteria For Issuing Documentation of Depth Sizing Errors That Exceed the 0.125-Inch RMS Appendix VIII Criteria." Attached is Duke's response.

If you have any questions or require additional information, please contact P. T. Vu at (980) 875-4302.

Sincerely,

Regis T. Repko

Attachments

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NRR

xc:

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ATTACHMENT 1

ASME CODE COMPONENT MATERIALS

RR 09-MN-007

AFFECTED ASME CODE COMPONENT MATERIALS

Materials used in the construction of the McGuire Unit 1 reactor vessel cold leg nozzles are listed as follows:

- Nozzle Forging: SA-508, Class 2
- Safe End: SA-182, F316
- Piping Elbow: SA-351, CF8A

The Nozzle to Safe End weld material is Alloy 82/182 (F-43).

ATTACHMENT 2

EPRI POLICY/PROCEDURE DIRECTIVE 03-01

RR 09-MN-007

EPRI POLICY/PROCEDURE 03-01

EPRI Policy/Procedure 03-01 describes the criteria for issuing documentation of depth sizing errors that exceed the 0.125-inch RMS Appendix VIII criteria. Procedure 03-01 is a Performance Demonstration Initiative Standing Sub-committee (PDISS) operating policy and procedure. PDISS operating policies and procedures describe the conduct of PDISS activities. They function as an appendix to the PDISS Rules of Conduct to assure that activities are conducted in a consistent manner. Each policy or procedure must be approved by the PDISS. The approval date is listed at the end of the document.

EPRI Policy/Procedure 03-01 begins on page 2 of this attachment.

03-01 Title: Criteria For Issuing Documentation of Depth Sizing Errors That Exceed the 0.125-Inch RMS Appendix VIII Criteria

BACKGROUND

RMS error is used as the criterion for acceptable depth sizing performance in Appendix VIII and is calculated according to the following equation:

Equation 1:

$$RMS = \left[\frac{\sum_{i=1}^{n} (m_i - t_i)^2}{n} \right]^{1/2}$$

where

m_i=measured flaw size

t_i = true size of a flaw

n=number of flaws measured

Appendix VIII requires that the RMS error for depth sizing be less than or equal to 0.125". For dissimilar metal weld applications (Supplement 10), the NRC has issued RIS-2003-01 that allows use of procedures that do not meet all of the Supplement 10 criteria provided that the best available technology is applied. In cases where the required level of accuracy is not achieved, there is interest in knowing the sizing error associated with particular procedures so that the error can be considered in evaluation of indications.

The PDI sample sets and demonstration process used for Supplement 10 (Inside and Outside Surfaces) and Supplement 2 (Inside Surface) demonstrations are fully capable of assessing depth-sizing error provided that the sizing error does not approach a substantial fraction of the wall thickness of the samples. This is a practical consideration because sizing measurements are truncated at the high end (i.e., flaws cannot be oversized by candidates to the point that they are reported to be greater

than the wall thickness). Therefore, from a measurement process point-of-view, the sample sets and process cannot reliably assess large sizing errors.

This proposal describes the processes to be used to determine if sizing errors larger than the acceptance criterion of 0.125" RMS have been measured with sufficient reliability to issue documentation of the error.

CRITERIA

The following process and criteria are proposed:

Process. Calculate RMS according to Equation 1.

Step A. If RMS $\leq$ 0.125", this is acceptable to Appendix VIII criteria, and the PDQS can be issued

Step B. If RMS > 0.125" and $\leq$ 0.187", this does not meet appendix VIII criteria, but the sizing error can be documented in a separate letter to PDI members upon request

Step C. If RMS > 0.187", then calculate Root Mean Square Percentage (RMSP) according to equation 2

$$RMS = \left[\frac{\sum_{i=1}^{n} \frac{(m_i - t_i)}{t_{wall}}}{n} \right]^{1/2}$$

Equation 2

where

m_i=measured flaw size

t_i = true size of a flaw

n=number of flaws measured

t_{wall}= wall thickness of the sample containing each flaw

Thus, RMSP expresses the RMS error in terms related to the wall thickness. If RMSP $\leq$0.10 the sizing error can be documented in a separate letter to PDI members upon request

Documenting sizing errors in this way is for the sole purpose of providing information to PDI members on the sizing performance of procedures and personnel for their use in evaluating indications. The proposed process is imposed, as a way of ensuring that documented sizing errors are meaningful and reliable. Documentation of sizing errors that exceed Appendix VIII criteria does not imply that the procedures or personnel are qualified to Appendix VIII or PDI criteria.

BASIS

The RMS error was selected as the sizing accuracy criterion in Appendix VIII to replace the previous criteria as it was judged to be a better measurement of sizing performance. The previous criteria were based on regression analysis with the addition of a limit on the undersizing of any one flaw. The critical undercall criterion led some candidates to intentionally oversize flaws, and thus defeated the purpose of assessing sizing error. The RMS criterion selected was 0.125" since it produced similar pass rates as the previous criteria for a large set of candidates taking the IGSCC qualifications and achieved the objective of measuring sizing error more effectively. It is important to note that the wall thickness for the IGSCC pipe samples were approximately 0.8". Thus, the 0.125 RMS error represents an error of about 14% of wall thickness. In comparison, the criterion proposed for documenting sizing errors that exceed 0.125" is 10% of wall thickness.

Step B of the process consists of a straightforward test that addresses RMS $\leq$ 0.187". This amounts to a 50% larger error allowance than the 0.125" limit in Appendix VIII. This is judged to be a reasonable increment that allows sizing error to be measured reliably within the limitations of the existing sample set without further analysis as described in Step C.

When applying the RMS error criterion, it is important to realize that the piping wall thickness of samples used in test sets in supplements 10 and 2 spans a wide range, typically from less than 0.5" to over 4". This range of thickness and the very thick samples at the upper end add complexity to the sizing error assessment. For example, if the original 14% error acceptable for the 0.8" thick IGSCC samples were applied to thick PWR RCS piping, the corresponding RMS error criterion would be significantly greater.

To assess the reliability of applying the proposed 10% RMSP criterion, several sets of Supplement 10 and 2 data sets were analyzed as well as several artificially created sets. The artificial

test sets were constructed to contain a range of sizing performance ranging from poor to excellent correlating. The artificial test sets were constructed to cover cases where test sets contained a wide range of pipe thickness (from 0.5" to 4") as well those with narrow ranges of thick pipes (3"-4"). This was done to evaluate whether the 10% RMSP approach would properly screen out poor sizing performance while allowing good sizing performance to be documented even though it exceeded the qualification limit of 0.125".

The results of these analyses shows that the 10% RMSP criterion requires that sizing data, even those that do not meet the Appendix VIII 0.125" criterion, must be well correlated- typically with correlation coefficient exceeding 90%. Data less well correlated fails to attain an RMSP of 10% or less. Conversely, data with RMSP exceeding 10% tends to be less well correlated and allows one of two large errors to be accepted. Finally, the 10% RMSP limit is conservative relative to the 14% used as the basis for the current Appendix VIII criterion.

In summary, the process provides confidence that sizing errors are measured reliably with the existing samples sets. Therefore, the process described above is well suited for issuing documentation of sizing errors that do not meet the established 0.125" RMS specified in Appendix VIII. The current requirement for depth sizing of flaws is that an average sizing error not exceed 0.125", computed using an RMS equation. This is a reasonable error for many thicknesses of material but can be difficult to achieve in very thick material or unusual configurations. In cases where the examination procedure cannot meet the 0.125" criteria, but is consistent in the average error, it is acceptable to publish the results of the qualification and use those results for engineering analysis of the flaw. To control this within reasonable bounds, only average errors of 0.187" or less, or errors that do not exceed 10% of the material wall thickness will be published by the PDI and may be used by the utility for flaw analysis.

Approved: 5/14/03