

# CATEGORY 1

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SUBJECT: Forwards calculation that supports util position that  
 measured thickness of main steam sys pipe elbow meets  
 requirements of ASME/ANSI B31.1 code.

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April 17, 1997

AEP:NRC:1098A

Docket No: 50-315

U. S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, D.C. 20555

Gentlemen:

Donald C. Cook Nuclear Plant Unit 1  
MAIN STEAM SYSTEM - PIPE WALL THINNING

Pursuant to an April 14, 1997, conversation with members of your staff, this letter forwards our position paper on the acceptability of a calculational methodology to meet the requirements of the ASME/ANSI B31.1 code.

It is our position that the measured thickness of a main steam system pipe elbow, .843 inches, meets the requirements of the B31.1 code. The B31.1 code allows the use of the actual material ultimate tensile strength in lieu of the minimum specified tensile strength when using the formula given in code paragraph 104.1.2(a). A calculation using the actual ultimate tensile strength demonstrates that we are in conformance with the B31.1 code.

The calculation which forms the basis for our conclusion that we are in conformance with the B31.1 code is provided as attachment 2. Attachment 1 provides background information, as well as a synopsis of our technical justification for reaching our conclusion that we meet the B31.1 code requirements and that the current pipe condition is acceptable.

This main steam system piping elbow is currently included in our erosion/corrosion program, and wall thickness measurements are scheduled to be taken during the next refueling outage. Any changes in wall thickness will be processed in accordance with our erosion/corrosion program and ASME Section XI repair and replacement program.

Sincerely,

A handwritten signature in dark ink, appearing to read 'E. E. Fitzpatrick'.

E. E. Fitzpatrick  
Vice President

vlb

Attachment

c: A. A. Blind  
A. B. Beach  
MDEQ - DW & RPD  
NRC Resident Inspector  
J. R. Padgett

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ATTACHMENT 1 TO AEP:NRC:1098A

USAS B31.1 MINIMUM WALL THICKNESS POSITION



### MINIMUM WALL THICKNESS POSITION

#### Summary

During the 1995 unit 1 refueling outage, the erosion-corrosion program identified that the wall thickness of the main steam piping in the extrados of the bend (1-MS-1) was less than the primary calculation (equation 3) in the ASME B31.1 code, 1967 Edition. It was determined that this piping was acceptable for another cycle with the condition that thickness measurements be taken again during the next refueling outage (U1R97). Wall thickness measurements were again performed in 1997. The results were comparable with the 1995 results indicating that erosion-corrosion is not active in this piping. Since the measured wall thickness was determined to be less than the code allowable primary calculation (equation 3, B31.1), a condition report was generated. We performed an alternate code acceptable calculation (see attachment 2) using the actual ultimate tensile strength from the certified material test report (CMTR) (attachment 2), to compute the allowable stress. The alternate code-acceptable minimum wall thickness calculation, based on the computed allowable stress using the lowest value ultimate tensile strength of seven lots of material listed on the CMTR, is 0.828". The minimum measured wall thickness in the pipe was 0.843". The main steam piping (1-MS-1) meets the requirements of the ASME B31.1 code, 1967 Edition.

#### Code Requirements and Code Calculations

The ASME/ANSI B31.1, 1967 edition, Paragraph 102.3.1(b)1 states that for ferrous materials at temperatures below the creep range, the basis for establishing allowable stress values are 25% of the specified minimum tensile strength at room temperature, or 25% of the minimum expected tensile strength at temperature, or 62-1/2% minimum expected yield strength for 0.2% offset at temperature.

Paragraph 104.1.2(a) states that the minimum thickness of the pipe required for design pressures and temperatures is given by:

$$t(\text{min}) = (PD)/2(SE+Py) \quad (\text{equation 3 in B31.1})$$

Where SE is the maximum allowable stress:

- t (min) is the minimum wall thickness
- P is the internal design pressure
- D is the outside diameter
- y is 0.4 for ferritic materials

The 1997 t(min) calculation provided in attachment 2 for the main steam piping is derived from paragraph 104.1.2(a). The t(min) calculation using the allowable stress (minimum values listed in appendix A tables) is 0.907", whereas the alternate code acceptable calculation we used employs 25% of the lowest value ultimate tensile strength property listed in the CMTR, resulting in a calculated allowable stress of 19200 psi and a minimum wall thickness of 0.828".

#### Technical Justification

The code allows the user of ASME/ANSI B31.1 to substitute the actual ultimate tensile strength for the minimum specified tensile strength for the material in the calculation of the allowable stress values. The method of determining allowable stresses by



using actual ultimate tensile strength values has been included in paragraph 102.3.1(a). The as-constructed "actual" values are not normally known at the time the design is performed and, therefore, the designer must use the specified allowable stress values listed in the tables of Appendix A of B31.1. In the case of the unit 1 main steam line, we conservatively chose the lowest ultimate tensile strength of seven lots of material in the CMTR (see attachment 2). If we were to use the actual ultimate tensile value for 1-MS-1, instead of the lowest value, the minimum wall thickness is calculated at 0.819". The difference between 0.843" and 0.819" is 0.024". The B31.1 code provides for ample design margins based on using 25% of the ultimate tensile strength of the material. The tensile strength of the material is not expected to change during the life of the component and this application of piping is not subjected to external influences such as radiation damage which would reduce the tensile properties of the material.

We requested that the current chairman of the B31 design committee, acting as a independent consultant, provide Cook Nuclear Plant with an independent evaluation of our calculation package to determine if our calculation in attachment 2 meets the B31.1 code requirements. This independent evaluation concurred with our position that the piping meets the requirements of B31.1.

The erosion/corrosion susceptibility of this section of pipe is low to non-existent based on the low moisture content of the steam during normal operation. The inclusion of this piping in the erosion/corrosion program in 1995 is an example of our conservative thinking in regard to the erosion/corrosion of piping. The wall thickness measurements taken in 1997 support the conclusion that erosion/corrosion does not play a role in the degradation of this piping. However, due to the short time interval between wall thickness measurements, we plan to monitor the wall thickness of this piping until we are confident that the influence of erosion/corrosion will not cause this pipe to be outside the requirements of B31.1.

Wall thickness measurements were taken on all other unit 1 main steam piping runs in the extrados areas with the result being that no areas were found that approach the minimum wall thickness.

We have scheduled wall thickness measurements on 1-MS-1 in the extrados area to be taken again during the next refueling outage. Appropriate action will be taken consistent with the purview of our erosion/corrosion program and ASME Section XI repair and replacement program. We also have scheduled activities to take thickness measurements in the extrados areas on selected piping for unit 2 during the 1997 refueling outage.

#### Conclusion

This piping meets the requirements of B31.1 by using the actual material properties of the piping to determine allowable stresses and minimum wall thickness. Planned activities to monitor this condition are adequate to maintain it at an acceptable level of safety.







ATTACHMENT 2 TO AEP:NRC:1098A

MINIMUM PIPE WALL THICKNESS CALCULATION