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MEMORANDUM:
To: Mr. M. Bender, ACRS Ad Hoc Metal Components Subgroup.
Subject: NRC Staff's Draft Report on Pressurized Thermal Shock.
Date: September 28, 1982.

The following comments are based on a review of the Staff's draft report and of some of the appendices, with special attention to Sections 4, 5, 9, and 10.

General: The report proposes a basis for selection of a generic screening criterion to use for selection of those plants which should conduct more detailed plant-specific evaluation for effects of PTS events on plant safety and modifications that may be necessary. The report also proposes some generic guidelines to be followed by all plants in consideration of PTS and recommends ongoing programs.

Shortcomings of the report include non-destructive examination and operating procedures and training needs. Both of these subjects are treated more thoroughly in the appendices. Non-destructive examination detection of small, near surface flaws is discussed in Appendix L, and the sensitivity of the analyses to flaw sizes and flaw size detection are discussed in Appendix H.3.4. A summary of those discussions should be in the body of the report.

Operating procedures and training are discussed in Appendix C, but are treated lightly in the report, perhaps because "NRC does not consider operator action an acceptable long-term "solution" to the PTS issue". However, the importance of operator actions should not be overlooked, and it may be one of the principal short-term measures to be taken.

Proposed Screening Criterion: The fracture mechanics analysis used for derivation of the charts in Section 4, which apparently form the basis for selection of the screening value of RT_{NDT}, is based on the assumption of existence of a longitudinal surface crack of infinite length. The computer program selects the minimum depth flaw for which crack initiation can occur. The report does not adequately explain this, and does not show how the critical flaw sizes vary for various conditions. The assumption of infinite crack length seems to be extremely conservative. Short cracks may grow in length before they become deeper, because of lower toughness near the surface; but the toughness of the material increases with axial distance from the core midplane, so that crack arrest may occur in the longitudinal direction, and shorter cracks are more likely to be arrested in the depth direction than those of unlimited length. It is also unlikely that such long cracks could pre-exist across a circumferential weld joint, or that a shallow crack would propagate across a weld joint.

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Determination of RT_{NDT}: Section 5 of the report presents a proposed method for determination of RT_{NDT} of each reactor vessel in service, to compare with the screening criterion. Appendix E gives the back-up information in support of the method. Included is a proposed revision of the curves in Regulatory Guide 1.99. I support the proposed revision, but I suggest that the first paragraph under C. REGULATORY POSITION, in the guide be retained as it is.

The use of generic data to establish RT_{NDTo} and ΔRT_{NDT} seems to be unnecessary for those plants for which the results of Charpy V-notch tests on weld deposits in accordance with the ASME Code prior to 1972 are available. The value of RT_{NDTo} should be lower than the temperature at which the Charpy tests yield 30 ft-lbs.

In evaluating the shift in RT_{NDT}, for use in comparison with the screening criterion, consideration should be given to allowing the use of the shift determined from the surveillance specimens exposed in the particular reactor vessel. Although the Cu and Ni contents of the weld materials used throughout the vessel are not known, upper limits of those elements can be established for the types of materials used, and from analyses of the broken surveillance specimens the corrections could be made. The results should be more representative of the specific vessel than an estimate based on all the surveillance specimens in the country plus twice the standard deviation of all those specimens.

Probability of Vessel Failure; The uncertainties in probabilistic analysis methods is illustrated by the differences between the WOG and NRC results shown in Figures 8-2 and 8-3 of the report. The trends could have been anticipated from intuitive reasoning.

The report reflects an extensive study of the problem. In general I feel that the conclusions are conservative, and in some instances perhaps unnecessarily so.

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