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JUL 31 1981



MEMORANDUM FOR: Harold R. Denton, Director
Office of Nuclear Reactor Regulation

FROM: Roger J. Mattson, Director
Division of Systems Integration

SUBJECT: USE OF A RELIABILITY CRITERION IN THE SRP FOR THE
AUXILIARY FEEDWATER SYSTEM

Reference: Memorandum to Harold R. Denton from Thomas E. Murley,
"Use of a Reliability Criterion in the Standard Review
Plan for the Auxiliary Feedwater System," June 29, 1981

On July 17, 1981 you requested our comments on the referenced document. Specifically, you questioned the licensing practicalities of using a reliability criterion for the auxiliary feedwater system (AFWS), what plants it would apply to and whether the present staff is ready and trained to use such techniques. Also, you asked how the proposed unreliability of the AFWS would comport with unreliability or safety goals being discussed by the ACRS and others.

We have been using a preliminary version of the criterion specified in the Reference in recent reviews of the AFWS for new OLS. It was also used in the reviews of operating reactors conducted by the Bulletins and Orders Task Force. Although no numerical criteria were specified in Staff documentation of these past AFW reviews, the associated recommendations in the TMI Action Plan Item II.E.1.1 (NUREGS-0611 and -0635) were designed to decrease the unreliability of the AFW systems towards a goal of 10^{-4} - 10^{-5} per demand. The recommendations of the ACRS, Presidential Commission and the Lessons Learned Task Force following TMI included increasing the reliability of the AFWS, but were not specific in setting a reliability criterion.

Review experience has taught us that to reach this range of between 10^{-4} and 10^{-5} per demand it is necessary to have at least three AFW pumps, assuming all other safety criteria for the AFW system have been met. During the Bulletins and Orders Task Force reviews, most operating plants with two pump auxiliary feedwater systems recognized this deficiency and elected, on their own, to install a third AFWS pump.

ANSI N-667 is the proposed industry standard for the AFWS. In preparing this standard an appendix was attached that considered the reliability of the AFWS and showed that a three pump system was a marked improvement over a two pump system. Although the appendix was endorsed by the majority of the standard committee members, it was ultimately dropped since it went beyond previous NRC requirements which would allow two pumps.

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Harold R. Denton

When you approve this SRP section, which we urge you to do now, we propose to require all plants (including those operating plants which have not acted voluntarily) to provide three auxiliary feedwater pumps.

The indepth review of the AFWS reliability studies required by NUREG-0737 for operating reactors was performed by the Office of Nuclear Regulatory Research, and for OLs the work is being performed by the Reliability and Risk Assessment Branch (RRAB) utilizing personnel from Sandia Laboratory. With some assistance from the RRAB, we believe the ASB has the staff expertise to do an indepth review of AFWS designs to determine if they fall into the 10⁻⁴ to 10⁻⁵ range. The proposed reliability study is based on simplistic reliability methodology and relatively little new training is required for our staff. Some members of ASB have taken NRC reliability courses. Both ASB Section Leaders have formal training in PRA methods and one has considerable experience in applying these methods.

The 10⁻⁴ - 10⁻⁵ criterion has been incorporated into the proposed revision to SRP 10.4.9 by the ASB. As presently worded, the implementation section of the SRP would require all plants subject to the NUREG-0737 implementation requirements to meet the numerical criterion. The numerical criterion still leaves a possibility for acceptance of a two pump AFWS if other methods for cooling the reactor core during abnormal conditions are considered to justify a larger unreliability of the AFWS. The SRP does not specify what criteria would have to be met by the other system.

We have experience and favorable comments from industry, ACRS and the Commission on this approach for auxiliary feedwater systems. The TMI Action Plan will ultimately lead to the application of these techniques to the review of other engineered safety features. But that is not a reason to delay. We have to start somewhere and our previous use of reliability analysis for the AFWS as well as the present capability of ASB personnel appear to make this a desirable first application of these techniques in the licensing process.

The reliability criterion chosen here can be related to the ACRS numerical safety goals. Using the AFWS reliability estimates and core melt probabilities given in WASH-1400, we conclude that the proposed AFWS reliability criterion would give a core melt probability less than the numerical AFWS safety goal for a large scale core melt. This conclusion is based on the fact that the AFWS reliability numbers of WASH-1400 for several of the cases considered (e.g., loss of offsite power for greater than 8 hours and high energy line break) are greater than the proposed criterion, yet the resulting WASH-1400 core melt probabilities are less than the ACRS safety goal value.

While such a comparison cannot be exact due to the limitations of WASH-1400 results and the uncertainties in extrapolation to other reactor designs, we believe that the conclusion is, in general, valid.

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We, therefore, recommend that a numerical goal for AFWS reliability be put into the Standard Review Plan since past practice and current NRC reviewer capabilities make this a practical first application of reliability and risk analysis in the licensing process.

for P. Check
Roger J. Mattson, Director
Division of Systems Integration

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