S. Hanauer

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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MEMORANDUM FOR: A. Thadani, Task Manager, A-9

THRU: Karl Kniel, Chief, Core Performance Branch, DSS KK

FROM: Ralph O. Meyer, Leader, Reactor Fuels Section, Core Performance Branch, DSS

SUBJECT: FUEL FAILURE CRITERIA FOR ATWS RULEMAKING

It is our understanding that a proposed rule on anticipated transients without scram (ATWS) is to be submitted to the Commission early in 1980 and that the rule will contain information of the sort presented in Appendix of NUREG-0460, Vol. 2. Section IV.5 of that appendix sets forth some proposed acceptance criteria and assumptions to be used in the calculation of radiological consequences.

Because the fuel rod cladding serves as the first barrier to fission product release, the first step in a dose calculation for a postulated ATWS requires an estimation of the number of rods that will fail (i.e., that will experience cladding perforation or rupture). We have provided you with guidelines for ATWS fuel failure prediction in memoranda spanning the last 1 1/2 years or so. Those guidelines were also presented in Appendices XIV to XVII of NUREG-0460, Vol. 2. Earlier this year, we restated our position (memorandum, Meyer to Thadani, January 26, 1979) so that you could provide the industry with guidelines for the "early verification" effort.

Our fundamental requirement has been, and continues to be, that all relevant fuel rod failure criteria, whether of thermal/hydraulic or mechanical origin, should be taken into account in the calculation of radiological consequences. In most cases, existing failure criteria and models are adequate for use in ATWS fuel behavior analyses. As you know, however, we have had difficulty in dealing with pellet/cladding interaction (PCI) because we have lacked acceptable criteria and models. Consequently, our position regarding the calculation of CPI-initiated failure for ATWS has been as follows:

1. For PWRs, we have stated that the number of rods that fail due to PCI should be calculated, but we had not specified how this was to be done. We had assumed that the vendors would submit PCI failure estimates and models for us to review, but we have received nothing in this area.

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2. For BWRs, we have stated that the number of rods calculated to be in boiling transition, which is relatively large (~10 to 17%) for a MSIV-closure ATWS, would be likely to encompass the number that would fail due to PCI (in part, because not all rods in boiling transition are sure to fail).

The above-stated position stemmed from the fact that, while we believed that there was a significant probability of PCI failure during power-increasing ATWS events, we did not have a PCI model for use in reactor regulation. With the development of the Battelle Northwest PROFIT model, however, that deficiency has been eliminated. We, therefore recommend that the purposed ATWS rule be phrased to require the calculation of PCI-initiated fuel failure for events involving power increases, and that in lieu of an approved vendor model, calculation should be made with a model to be provided by NRC. Because of the need for judgment and flexibility in using a PCI model, the rule should not specify further details regarding the particular model to be used, but PROFIT will be available in case we need it.

To effect as much consistency as possible regarding the treatment of PWRs and BWRs, the above position should apply to both types of reactors. Because the BWRs also have a large number of rods that are calculated to fail on the basis of thermal/hydraulic criteria, and because we believe it would be overly-conservative to add those rods to the number calculated to fail by PCI, we recommend that the larger of the two estimates should be used in the dose calculation. (Note that for PWRs this is not an issue since no rods are currently calculated to be in DNB for any power-increasing PWR ATWS).

Except for the modifications indicated above, the remainder of our ATWS fuel failure recommendations remain unchanged.

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