D870715

Mr. Victor Stello, Jr.
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Stello:

SUBJECT: ACRS COMMENTS ON THE EMBRITTLEMENT OF STRUCTURAL STEEL

Surveillance samples of steel used in the pressure vessel of the High Flux Isotope Reactor (HFIR) at the Oak Ridge National Laboratory recently have shown that the nil-ductility transition (NDT) temperature of steel irradiated slowly at 120oF can rise much more rapidly with exposure to fast neutrons than would be expected from the available experimental work obtained in test reactors. This appears to be due to two causes:

- a flux rate effect (A lower fast neutron flux embrittles more than the same fluence accumulated at a much higher flux in test reactors.)

- the difference in temperature (550oF for commercial reactor pressure vessels vs. 120oF for the HFIR)

This has led to a significant shift in the NDT of the steel at a fast neutron fluence lower by roughly a factor of 20 than that predicted by the correlations used in the past for low temperature irradiations. This acceleration is independent of the copper content of the material. This suggests that steel structures outside the pressure vessel in commercial nuclear power plants may have embrittled where such behavior was not expected. We believe it would be prudent for the NRC to do the following:

1. Determine if the brittle failure of any structural steel component near the outside of the primary pressure boundary would have safety significance.

2. Determine, using the low temperature irradiation data now available from test reactors, whether an increase in the fast neutron fluence by a factor of 10-100 would be predicted to give brittle behavior in these components.

3. Implement a research program which would assemble better information on the rate of shift of the NDT of structural steels in commercial nuclear power plants at these lower rates and temperatures.

4. Include consideration of the accelerated shift in NDT as part of the evaluation of structures in the program on plant aging.

Sincerely,

William Kerr
Chairman

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