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

May 14, 1975

Note to C. R. Chappell

SECOND SHIELDING REVIEW OF ATCOR's APPLICATION FOR THE VANDENBURGH CASK TO SHIP LACROSSE-BWR SPENT FUEL (SAR DATED FEBRUARY 21, 1975)

I would like to straighten out some facts for the record. On page S-4 of the above application, ATCOR implies that NRC's neutron dose rate estimate of 13 mrem/hr at the surface of the cask is much too low considering that ATCOR calculated (using a 1/R variation) approximately 28 mrem/hr at the surface of the cask due to Cm^{242} and Cm^{244}.

For a clarification, I am appending my note to you of December 5, 1974. No further comment is necessary.

ATCOR's estimate of the neutron dose rate due to the Curiums is based on appropriate scaling and interpolation of G.E. dose rate data calculated for BWR assemblies as a function of exposure and lead thicknesses. Corrections were made to the data to reflect the differences in fuel loading (8 vs 10 BWR assemblies) and different lead thicknesses (6 vs 9 inches) and calculating equivalent Pb thicknesses for the Fe lamination. The treatment of the data and subsequent analyses for this Curium dose rate is found acceptable.

Since ATCOR failed to calculate the contribution from the plutonium the total neutron surface dose rate should be 28 + 13 = 41 mrem/hr.

The original gamma dose rate analyses and results were found acceptable. The gamma dose rate at the surface of the package was calculated to be 75 mrem/hr. This was then used (on a 1/R variation) to calculate 23 mrem/hr at three feet from the package. The dose rate would have to increase by at least a factor of 44(= $\frac{1000 \text{ mrem/hr}}{23 \text{ mrem/hr}}$) to be in violation of the regulations.

The above analysis assumed gammas only and was based on a decrease of lead thickness by .6 inches increasing the dose rate by a factor of 2. To arrive at the factor of 44 increase in dose rate would correspond to a loss of 3 inches of lead in the radial shield - an unattainable condition for either the drop or fire tests.

The new maximum surface dose rate considering neutrons is now: 75 + 41 = 116 mrem/hr. At three feet from the surface this decreases to 39 mrem/hr. The new dose rate factor is reduced from 44 to 26(=$\frac{1000}{39}$).

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The increase by a factor of 26 is equal to 4.7 half thicknesses (i.e. $2^x=26$; $x=4.7$) or $(4.7)(.6) = 2.82$ inches decrease in lead thickness over the surface of the cask. I have estimated approximately a 13% increase in the total neutron dose rate at 3 feet by the loss of 3" of lead. Even this reduction, i.e. 2.82" versus 3.28" of lead thickness is not attainable for the drop or fire test. These shielding considerations therefore remain unchanged and acceptable.

The estimate of streaming due to the lead slump is an acceptable analysis. However, we point out that now the factor of 26 (versus 44) gives only a margin of safety of 13 (versus 20 previously). For a 2.2 inch lead slump the shielding for the cask is adequate. For slumps significantly greater than 2.2 inches ATCOR should submit a new analysis.

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cc: CEMacDonald