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SAFETY EVALUATION REPORT INPUT FOR SECTION 9.1.2, WPPSS-2

The criticality aspects of the spent fuel racks for WPPSS Nuclear Project No. 2 have been analyzed using the PDQ-7 code (with a version of the LEOPARD code used to provide cross-section input) for purposes of scoping and design. The KENO-IV Monte-Carlo code with the AMPX codes for cross-section has been used to verify the final design and to do selected cases for the sensitivity analyses. These codes have been benchmarked against experiment and calculational uncertainties obtained. The resultant design consists of stainless steel boxes on 6.5 inch center-to-center spacing with B_4C plates with an areal density of 0.0959 grams of B-10 per square centimeter surrounding each storage box.

The effective multiplication factor for the racks was calculated under the assumption of fresh fuel of 3.25 weight percent U-235 enrichment (15.67 grams of U-235 per centimeter of assembly length) at a pool temperature of 68 degrees Fahrenheit. No credit is taken for fixed neutron poisons in the fuel and the fuel racks are assumed to be infinite in extent.

Under these assumptions the nominal effective multiplication factor for the storage racks in their design configuration is 0.851 as determined by the KENO code. To this value must be added a calculational uncertainty (95 percent value) of 0.023 and uncertainties due to center-to-center spacing variations, production tolerances in the B_4C plates,

changes (reduction) in pool temperature and the possible lack of one in twenty-five B_4C plates. After all uncertainties are added the resulting value of the effective multiplication factor is 0.897. The effect of particle size in the B_4C has not been treated but the much larger effect of gross flux depression in the absorber slabs has been. The additional effect of the particle size can only be a very small fraction of the margin between 0.897 and the acceptance criterion of 0.95 for the effective multiplication factor of the racks.

The effect of credible accidents has been calculated and the most consequential one dropping a fuel assembly between racks has been shown to increase the effective multiplication factor by 0.006, still leaving ample margin to the acceptance criterion value of 0.95.

We conclude that the proposed storage racks meet the requirements of General Design Criterion 62 as regards criticality. This conclusion is based on the following considerations:

1. state-of-the-art calculation methods which have been verified by comparison with experiment have been used;
2. conservative assumptions have been made about the enrichment of the fuel to be stored and the pool conditions;

3. credible accidents have been considered;
4. suitable uncertainties have been considered in arriving at the final value of the multiplication factor; and
5. the final effective multiplication factor value meets our acceptance criterion.