UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

March 24, 1992

NRC INFORMATION NOTICE 92-21: SPENT FUEL POOL REACTIVITY CALCULATIONS

Addressees

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to potential errors in reactivity calculations for spent fuel pools. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

On February 14, 1992, the NRC was notified by Northeast Utilities of a discrepancy between reactivity calculations performed for the Millstone, Unit 2, spent fuel pool by ABB Combustion Engineering (CE) and the licensee's contractor (Holtec). The licensee has indicated that the k_{eff} calculated by Holtec was approximately 5 percent higher than that previously calculated by CE.

The NRC has recently learned that Houston Lighting and Power (HLP) has identified a discrepancy between the reactivity calculations performed for the South Texas, Unit 1, spent fuel pool by Pickard, Lowe and Garrick (PLG) and the licensee's contractor (Westinghouse). The licensee has indicated that the k_{eff} calculated by Westinghouse was approximately 2 to 2.5 percent higher than that previously calculated by PLG.

Boraflex is utilized as a neutron absorber between spent fuel pool rack cells in both the Millstone, Unit 2, and South Texas, Unit 1, spent fuel pools.

Discussion

The computer code analyses performed by CE to predict neutron transport for the Millstone, Unit 2, spent fuel storage racks used the two-dimensional, discrete ordinates code DOT. CEPAK was used to generate the neutron cross sections for DOT. The computer code analyses performed by Holtec used KENO (Monte Carlo method). The source of the discrepancy between the CE and Holtec calculations has been attributed by CE to two approximations made in the generation of neutron cross sections. First, a transport cross section was used by CE as

an approximation for the total cross section. While this approximation is valid for most materials, it is not valid for materials having large thermal cross sections. Therefore, applying this approximation to regions containing a strong neutron absorber (such as Boraflex) results in an overestimation of the neutron absorption and a corresponding lower calculated k_{eff} in that region. Second, a geometric buckling term corresponding to a sparsely populated and weakly absorbing (unpoisoned) array was utilized by CE as an approximation of buckling in the highly absorbing configuration. This approximation, however, is not valid for the specific configuration found in the Millstone racks where the assembly pitch is small and the fuel assembly is completely surrounded by a strong neutron absorber. After these approximations were corrected, the results of the CE analyses were in good agreement with Holtec's.

The original computer code analyses performed by PLG to predict neutron transport for the South Texas, Unit 1, spent fuel storage racks used the two-dimensional diffusion theory code PDQ. LEOPARD was used to generate the cross sections for PDQ. Computer code analyses performed by Westinghouse utilized KENO (Monte Carlo method). The lower value of k_{eff} calculated by PLG has been attributed by HLP to the inaccuracies inherent in using diffusion theory to predict neutron attenuation through a thin region that strongly absorbs neutrons (such as Boraflex).

Both the CE and PLG methodologies had been benchmarked against criticality experiments that have been reported to closely represent the characteristics of the spent fuel storage racks. However, it should be noted that the number of criticality experiments that included a strong neutron absorber (such as Boraflex) was limited.

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Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

Technical contacts: Jack Ramsey, NRR
(301) 504-1167

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(301) 504-2879

Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
92-20	Inadequate Local Leak Rate Testing	03/03/92	All holders of OLs or CPs for nuclear power reactors.
92-19	Misapplication of Potter & Brumfield MDR Rotary Relays	03/02/92	All holders of OLs or CPs for nuclear power reactors.
92-18	Potential for Loss of Remote Shutdown Capability during A Control Room Fire	02/28/92	All holders of OLs or CPs for nuclear power reactors.
92-17	NRC Inspections of Programs being Developed at Nuclear Power Plants in Response to Generic Letter 89-10	02/26/92	All holders of OLs or CPs for nuclear power reactors.
92-16	Loss of Flow from the Residual Heat Removal Pump during Refueling Cavity Draindown	02/25/92	All holders of OLs or CPs for nuclear power reactors.
92-15	Failure of Primary System Compression Fitting	02/24/92	All holders of OLs or CPs for nuclear power reactors.
92-14	Uranium Oxide Fires at Fuel Cycle Facilities	02/21/92	All fuel cycle and uranium fuel research and development licensees.
92-02, Supp. 1	Relap5/Mod3 Computer Code Error Associated with the Conservation of Energy Equation	02/18/92	All holders of OLs or CPs for nuclear power reactors.
92-13	Inadequate Control Over Vehicular Traffic at Nuclear Power Plant Sites	02/18/92	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

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Original Signed by
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