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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D. C. 20555

May 6, 1983

Information Notice No. 83-29: FUEL BINDING CAUSED BY FUEL RACK DEFORMATION

Addressees:

All nuclear power reactor facilities holding an operating license (OL) or a construction permit (CP) and spent fuel storage facilities.

Purpose:

This information notice is provided as a notification of a potentially significant problem pertaining to spent fuel storage racks. It is expected that recipients will review the information for applicability to their facilities. No specific action or response is required at this time.

Description of Circumstance:

In October of 1982, Maine Yankee Atomic Power Company reported indications that the spent fuel racks at Maine Yankee were bulging (LER 50-309/82-033). The plant had shut down for refueling and was unloading the reactor core in preparation for the ten year in-service inspections. The aluminum-clad boral (boron-aluminum) plates which form two of the four sides of each fuel cell had bulged inward. The deformation was so severe that it caused the fuel assembly to bind upon being inserted into the cell. A total of twenty-one cells appeared to have deformed, all of which were "Phase I design," fabricated before 1975.

The problem was detected when the licensee attempted to load a fuel assembly into a cell and the weight indication on the load cell dropped by about 100 pounds, indicating the fuel assembly was binding in the cell. The inserting operation was halted according to procedures and all other unoccupied "Phase I" cells were tested by inserting a dummy fuel bundle into each cell. Occupied cells were tested by attempting to lift the fuel bundle from the cell, stopping when the load cell indicated a weight of 100 pounds in excess of nominal. Fifteen empty cells were identified as having indications of deformation, and in six of the occupied cells, the deformation was so severe that it caused the stored fuel to bind in the cell.

A deformed empty cell was removed from the rack and visually inspected. Bulging was seen in the lower two feet of the cell. A 1/16-inch hole was drilled into the top of the plate and into the face of the bulge, venting hydrogen. The probable source of the hydrogen was water contamination of the boral matrix and water-to-aluminum reaction. Venting the gas caused a reduction of the deformation.

A section of the bulged face showed clad separation from the boral matrix but no indications of cracking or flaking of the boral.

The licensee's analysis showed K-eff for the spent fuel in the pool remained less than 0.95 assuming 0 ppm soluble boron in the water, 3.3% enriched fuel, and 68F pool water temperature. Bulging in the boral plates changes K-eff since it displaces water and is equivalent to changing the physical separation between cells. The analysis treated this parametrically over the range of a reduction in equivalent cell separation of 50-92.5%. Assuming the normal 1720 ppm boron concentration in the spent fuel pool water, an additional reduction of 30% in K-eff was obtained. The licensee plans to drill and vent all affected cells as an interim fix. The licensee plans to replace the "Phase I design" spent fuel racks.

Similar problems involving cell bulging or gas liberation have occurred in the past. Yankee-Rowe identified gas bubbles in the spent fuel pool in 1963, indicative of a similar problem. Haddam Neck reported bulging of their racks from a gas buildup in 1978 and Kewaunee reported a similar situation in 1980. (LERs 50-213/78-004; 50-305/80-039).

If you have any questions regarding this matter, please contact the Regional Administrator of the appropriate NRC Regional Office or this office.

Edward L. Jordan, Director
Division of Emergency Preparedness
and Engineering Response
Office of Inspection and Enforcement

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