From: Goutam Bagchi NRR
To: Diane Jackson, George Hubbard NRR
Date: Monday, February 12, 2001 08:25 AM
Subject: SFP Study: Structural and Seismic Questions

Listed below are my thoughts:

Seismic Hazard for Robinson Site:
The LLNL 93 seismic hazard for the site is about a factor 100 higher than the EPRI 89 hazard estimate. The original LLNL 89 seismic hazard estimate was updated to account for "known errors" in the treatment of uncertainty in the magnitude frequency relationship and to accommodate some refinements in the expert opinion elicitation process. However, the seismic source zones were not changed because of cost impact. One unique feature of the Robinson site is the proximity to the Charleston event in South Carolina - 125 miles. It appears that the LLNL experts for seismic source were more influenced by the Charleston event than were the EPRI experts. Both seismic hazard estimates are considered credible.

More recent (90s) geological investigations of paleo-liquefaction features led to the conclusion that the Charleston event is confined to the Charleston area. A new seismic source characterization for this site can produce a different result, but the USGS seismic hazard map, a more recent (mid to late 90s) work, shows fairly high seismic hazard values for this coordinate.

Cask Drop Effect:

NUREG/CR-5176, "Seismic Failure and Cask Drop Analysis of the Spent Fuel Pools at Two Representative Nuclear Power Plants" describes the FEM analysis of Robinson and Vermont Yankee plants. The drop was considered on the side walls. The model considered cask drops on top of walls that are approximately 4.5 ft thick by 40 ft deep acting as a deep beam spanning about 55 ft. Various cask designs (largest 110 tons) were used. The result is extensive damage to concrete and large areas of reinforcement yielding. Statement on Page 7-4, "...pool walls similar to those of both the Vermont Yankee and Robinson plants would suffer severe damage as a result of the worst-case cask drops."

Cask drops inside the pool:

There is no analysis of this case in the NUREG. If the pool floor slab is assumed to be supported on unyielding foundation, the cask would probably not go through the floor, but cause local impact zone failure - considerable water leaking into the foundation. If the slab is not directly supported by the foundation, a 110 ton cask dropped from 4 ft height would go through the slab based on very approximate energy balance. The potential energy of the 110 ton drop from 4 ft height is 0.9 million ft-lbs, but the available resistance energy (calculated as work done by the punching shear in 4.5 ft thick concrete slab on a generous shear area and high shear stress) is about a tenth of that required. The travel of the cask though water before impact will hardly dissipate any energy - in the order of 1 to 5% or less. The claim that the cask will not go through a typical spent fuel pool slab not supported by the foundation will have to be validated by credible analysis.

Thank you,
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CC: David Jeng, Gene Imbro, Glenn Kelly, Jack Strosnider, Kamal Manoly, Richard Wessman, Robert Rothman

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