N222. Hydro-Vac(R) Shield

Con Edison's Indian Point 2 Station experienced above average radiation exposure to refueling crew personnel from unshielded control rod drive shafts and in-core instrument tubes that protrude from the surface of their refueling cavity. The shafts are highly contaminated and/or activated with contact dose rates ranging up to 10 R/hr. Due to their location, effective shielding is difficult and can complicate operation of fuel handling equipment.

During the 1993 Refueling Outage, Con Edison solved the problem by installing the Hydro-Vac(R) Shielding System. This shield consists of a cylindrical tank open at the bottom that is suspended over the refueling pool with I-beams. The lower lip of the tank is two feel below normal pool level. After installation, the air within the tank is evacuated, thereby drawing water up into the shield. This extends the height and width of the natural shielding provided by the existing pool water.

The patented Hydro-Vac(R) system was developed jointly by Con Edison and Nuclear Power Outfitters, Inc. It was installed on the critical path in one hour and saved 20 person-rem of exposure during one use. The two feet of water shielding at its side and three feet on top essentially eliminated the dose rate associated with the protruding rod drives and in-core instrument sleeves. General area dose rates to refueling bridge personnel were reduced from 150 to less than 20 mR/hr, a decontamination factor (DF) of over 7.

A key technical advantage of the system is that it provides a better dose rate reduction factor with a smaller shield diameter than obtainable with external slab-type designs employing tanks or blankets. The Hydro-Vac(R) totally surrounds the 53 drive shafts and 7 in-core instrument tubes with shielding medium providing significant self-absorption. A smaller diameter is important as limited clearance between the fuel manipulator bridge and shield is available. In addition, use of existing water minimizes weight and cost, facilitates handling, and avoids concerns with inadvertent boron dilution (at PWRs).

Other possible applications from the Hydro-Vac(R) concept include PWR Lower Internals (ISI activities), and BWR Steam Separator Equipment.

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