ROD CONSOLIDATION EXPERIENCE AT WEST VALLEY

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ABSTRACT

Four fuel assemblies were consolidated in December, 1985, at West Valley, New York. The equipment used was Nuclear Assurance Corporation's fuel disassembly elevator, which performed well and produced even rod pulling forces so that no fuel rods were broken. One rod with a collapsed section of cladding cracked at the damaged section and released a small quantity of Krypton-85 gas. No Health Physics effects were observed from this release. Nine additional assemblies will be consolidated in February and March of 1986.

A demonstration program to consolidate fuel was undertaken in the fall of 1985 at the decommissioned reprocessing plant in West Valley, New York. This program was to consolidate Westinghouse 14 x 14 PWR assemblies owned by Rochester Gas and Electric prior to shipment back to the R.E. Ginna power plant. This fuel was discharged from the Ginna plant over 12 years ago, and includes severe cases of fuel densification with collapsed cladding which makes removal of such rods much more difficult than removal of undamaged rods. The fuel was enriched to 2.8 w/o U-235 and experienced burnups of 10,000 to 21,000 MWD/MTU. In the rod consolidation process fuel rods are removed from the assembly and placed into a canister with the same external dimensions as the assembly, but with a closer spacing allowing rods from several assemblies to be placed into one can. Thus, the number of spent-fuel pool locations required to store fuel is reduced and congestion in the pool is alleviated.

The equipment used in this program was the third generation of rod consolidation equipment developed by Nuclear Assurance Corporation. This equipment consists of a fuel disassembly elevator that enables the operators to attach a hydraulic rod pulling grapple to the top of a fuel rod (or a number of rods), holding the rod fixed while the assembly is drawn downward away from the rod. This system allows the task of grapple attachment and other fuel handling tasks to take place as close to the surface of the pool water as possible to make best use of the operators' vision and fuel handling abilities. A benefit of this system is that the pulling of the rod is performed by holding the rod fixed while moving the much more massive elevator, so that the inertia of the moving elevator acts to smooth out fluctuations in the pulling force (10-15 pound fluctuations were observed) that occur as partially collapsed portions of the rod pass through the assembly grids. The upper end fitting of the assembly must be removed first, and this is accomplished by cutting the control rod guide tubes with an internal cutting tool. A motor-operated tool was used on the first assembly to be consolidated, but a manually-operated tool gave cleaner tube cuts, and was actually quicker.

The initial consolidation operation was limited to a short time period because of the need to ship assemblies to the Ginna power plant, so only four assemblies were consolidated in December of 1985. An additional nine assemblies are scheduled for consolidation in February, 1986. Only two rods of the four asssemblies taken apart caused difficulties: one rod that was known to be severely collapsed because of visual examination prior to consolidation, and one rod with no visible failures that reached the maximum allowed pulling force of 200 pounds. The damaged rod cracked at the edges of the crushed cladding and allowed a small quantity of Krypton-85 gas to escape. Operations were suspended to permit Health Physics to examine the radiological hazard according to plan, and operations were resumed several hours later. The rod was pulled without further significant release of radioactive gas, and normal operations resumed. The rod which exceeded the normal pulling force was from a different assembly which showed no damage under visual examinations. It was pulled partially (about a foot) from the assembly, at which time the excessive pulling force caused the operator to stop the elevator. This rod was in the outermost row of rods, and no further efforts were made to remove the stuck rod until all the other rods were pulled. The stuck rod was then pulled from the assembly skeleton with normal pulling forces. It was observed (as predicted by previous experience) that the outermost rods required 30-40 pounds greater force (nominally 100-120 pounds) than the inner rods. Pulling the inner rods before the outer resulted in a relaxation of the assembly skeleton grids and a reduction of the required pull force for the outer rods. The compaction factors achieved in this initial effort were about 75 percent of the theoretical optimum, but future operations will use an improved version of a rod guide that was tested during the December program.

The experience of consolidating four PWR assemblies at West Valley showed that the fuel disassembly elevator system gave good results and that even severely damaged fuel rods could be removed without significant radiation exposure to the operating crew.