

# OCRWM Background

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## COOPERATIVE DEMONSTRATION PROJECTS FOR SPENT NUCLEAR FUEL

### INTRODUCTION

The U.S. Department of Energy (DOE) is implementing, in cooperation with the nuclear power industry, several technology demonstration projects designed to assist utilities in enhancing spent fuel storage capacity at primary nuclear reactor sites.<sup>1</sup> Objectives of the cooperative demonstration projects, in accordance with Section 132 and Section 218 of the Nuclear Waste Policy Act of 1982 (NWPA), are to encourage and to expedite the efficient use by the utilities of existing storage facilities and to provide technologies for adding new storage capacity.

Until DOE accepts the spent fuel for disposal at a geologic repository, nuclear utilities have the primary responsibility for the storage of their spent fuel and for the effective use of that storage capacity. By focusing on cooperative demonstration projects with utilities that have expressed a high degree of interest in specific technologies, the storage concepts developed will be those which most appropriately address the needs of the utilities.

### STORAGE OF SPENT FUEL

Spent fuel assemblies removed from nuclear reactors are stored temporarily in water pools that cool the spent fuel rods and shield workers and others at the site against radiation. Many of these storage pools were intended originally for short-term storage, and their capacities are generally limited. Some utilities, faced with potential spent fuel storage problems, have developed and subsequently obtained approval from the U.S. Nuclear Regulatory Commission (NRC) for various methods of extending their onsite storage capacity.

<sup>1</sup>Spent nuclear fuel refers to fuel that has been removed from a nuclear reactor core primarily because it can no longer sustain an efficient chain reaction. High-level radioactive waste, generated from the reprocessing of spent nuclear fuel to extract plutonium and the remaining usable uranium, results largely from defense nuclear activities.

One method employed by the utilities is the "reracking" of fuel assemblies in storage pools to obtain greater storage densities. By changing the configuration of the racks that hold the spent fuel in the storage pools, and by adding neutron-absorbing material, it is possible to store more than double the fuel that had been held in the originally designed racks. Another method, called "transshipping," involves transporting spent fuel from reactor sites with storage limitations to other reactor sites of the same utility that have available storage capacity.

### CURRENT DEMONSTRATION PROJECTS

DOE's Office of Civilian Radioactive Waste Management (OCRWM) is implementing the provisions of the NWPA that are designed to establish, in cooperation with the utilities, new technologies for onsite dry storage and consolidation of spent fuel. The efficient use of existing storage facilities and the addition of new at-reactor storage capacity will be enhanced through the following activities:

- a cooperative demonstration program with the private sector to
  - demonstrate spent fuel rod consolidation in existing storage pools and in a dry environment, and
  - develop dry storage technologies that the NRC may, by rule, approve for use at civilian reactor sites;
- consultative and technical assistance to utilities on a cost-shared basis to assist each utility in obtaining NRC licensing and construction authorization for the application of new technologies; and
- a cost-shared research and development (R&D) program at Federal facilities to collect the necessary data to assist the utilities in the licensing process.

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 To provide current background information on program facts, issues, and initiatives. For further information write to: Information Services Division, Office of Civilian Radioactive Waste Management, U.S. Department of Energy, Mail Stop RW-40, Washington, DC 20585, Telephone (202) 586-5722.

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OCRWM is currently supporting cooperative demonstrations of rod consolidation and dry storage with several utilities. In addition, OCRWM is conducting spent fuel research and development to provide data to the utilities for obtaining licenses for these new technologies. These cooperative R&D activities are intended to establish one or more technologies that the NRC may approve by rule for use at reactor sites without, to the maximum extent practicable, the need for additional site-specific approvals.

### Rod Consolidation Cooperative Demonstration Projects

Rod consolidation differs from reracking in that rod consolidation involves dismantling the fuel assemblies and placing them in canisters, whereas reracking places the intact assemblies in reconfigured storage racks that are designed for higher storage densities. Rod consolidation may be done in a storage pool, or it may be done in a dry environment. Rod consolidation increases the capacity of spent fuel storage pools which have sufficient structural strength to safely support a more compact array of spent fuel rods that have been separated from their associated hardware components.

In 1981, DOE successfully completed a "cold" (nonradioactive) demonstration of prototypical rod consolidation equipment. In May 1983, DOE issued a solicitation for cooperative agreement proposals for in-pool rod consolidation demonstrations that could provide a basis for future licensing by the NRC. A cooperative agreement for a rod consolidation demonstration project has been negotiated with the Northeast Utilities Services Company of Hartford, Connecticut. After the completion of the cooperative demonstration project, DOE expects to assemble a data base that will provide sufficient data to enable the utilities to apply for licensing of rod consolidation.

OCRWM has initiated R&D of equipment and methods for dry rod consolidation of spent fuel at the Idaho National Engineering Laboratory (INEL). The purpose of this demonstration, which is known as the Prototypical Consolidation Demonstration Project (PCDP), is to show that dry rod consolidation is feasible on a production line scale for use at NWPFA facilities, including the repository or the monitored retrievable storage (MRS) facility, if authorized by Congress. The PCDP consists of four sequential phases that will lead to a planned demonstration of the process in 1989.

OCRWM has two new rod consolidation projects that are in the planning phase. The first one is known as the Nonfuel-bearing-component Volume Reduction Demon-

stration. The objective of this project is to design new equipment that will reduce the overall bulk of residual nonfuel hardware and other parts. The second project will be a canister welding project to test various methods of sealing canisters containing spent fuel rods from a rod consolidation process. These two projects are to be initiated in fiscal year 1989 and are expected to be completed several years later.

### Dry Storage Cooperative Demonstration Projects

Dry storage systems provide a fuel storage alternative whenever reracking or rod consolidation cannot be undertaken because of economic, seismic, or structural limitations of spent fuel storage pool systems. Systems for dry storage include casks, drywells, silos, and vaults. Casks are large metal containers with radiation shielding that are stored aboveground. Drywells are below-grade wells with steel and concrete linings that are designed to hold one or more spent fuel assemblies; the surrounding earth provides an additional radiation barrier, as well as a medium for conducting heat from the drywell. Silos are concrete cylinders built aboveground that provide sealed secondary containment for spent fuel. Vaults are large concrete structures that use natural air convection for cooling. All of these dry storage systems are designed to have low maintenance requirements and to be modular in order to provide additional capacity as required.

DOE has extensive experience in conducting demonstrations of dry storage systems for spent fuel. Drywell, silo, and vault storage systems have been demonstrated at several DOE facilities in Nevada. However, dry storage systems demonstrated under DOE's auspices have never been licensed by the NRC for commercial use.

A solicitation for cooperative agreement proposals for licensed dry-storage demonstrations was issued by DOE in May 1983, leading to cooperative agreements that were negotiated with the Virginia Electric Power Company and the Carolina Power & Light Company in March 1984. At Virginia Power's Surry Nuclear Plant, construction of an independent spent fuel storage installation has been completed, and NRC issued a license for the system in July 1986.

DOE's agreement with Carolina Power & Light (CP&L) provides for a licensed demonstration of dry storage in horizontal, modular concrete silos at the site of the H.B. Robinson plant in South Carolina. On March 28, 1986, NRC approved the topical report prepared on CP&L's demonstration. Licensing of CP&L's Independent Spent Fuel Storage Installation is upcoming, and construction is expected to begin in the near future.

OCRWM has also initiated dry storage technology R&D activities at DOE's Idaho National Engineering Laboratory (INEL). Spent fuel assemblies from the Surry plant were shipped to INEL for an unlicensed demonstration of dry storage casks and to conduct tests under situations that approach the bounding parameters and limiting conditions of dry storage. Initial testing has been completed at INEL on dry storage casks of three different designs and manufacture; long-term monitoring is now in process.

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