DOE'S EFFORTS TO 'ENCOURAGE AND EXPEDITE' UTILITY STORAGE OF SPENT FUEL

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ABSTRACT

At reactor spent fuel storage capacity must be expaned between now and the projected availability of geologic repositories and/or monitored retrievable storage facilities. The Nuclear Waste Policy Act of 1982 (NWPA) charges the Department of Energy with the responsibility for encouraging and expediting new techniques for storing spent fuel at reactor sites. This briefly recounts the assignments of responsibility under NWPA and describes the concepts being pursued by the Department of Energy and its partners and why they may offer attractive alternatives provided they can be licensed in a timely manner.

INTRODUCTION

As of the end of 1983 approximately 10,000 metric tons of spent fuel were in temporary storage in water basins at nuclear power reactors around the country. By the year 2000 approximately 50,000 metric tons will exist. For most reactors, wet pool storage designs were based on the assumption that reprocessing of spent fuel would be an integral part of the nuclear fuel cycle. Currently, reprocessing is not prohibited by U.S. policy, but such services are not available and the commercial viability of reprocessing is not expected to come about in the near future. Spent fuel assemblies to be generated for the next 20 years will continue to be discharged to water pools and remain there until they cool sufficiently to permit their removal for subsequent dry storage or disposal. In fact, the major fraction of the spent fuel inventory will remain in pool storage.[1] Our projections indicate, however, that wet storage capacities even with widespread utilization of licensable re-racking techniques will be exceeded before 1998 - the scheduled date for DOE acceptance of spent fuel.

The Nuclear Waste Policy Act of 1982 (NWPA)[2] clearly assigns primary responsibility to provide for spent fuel storage to the generators and owners of such fuel and also assigns to them the full responsibility to pay for the costs of storage until accepted by the Secretary of Energy. It further provides for Federal support of activities aimed at encourging and expediting the availability of new techniques for at reactor storage. The Department of Energy's FY 1985 Budget request, the first budget prepared since passage of the NWPA, includes a significant increase in funding for these activities - an increase of $8.2 million over the FY 1984 appropriation of $5.0 million. In the paper that follows this, Messrs. Newman and Cole present a detailed report on the Civilian Spent Fuel Management program accomplishments in 1983, the status of ongoing activities and the schedule for the availability of dry storage and rod consolidation as licensed option for utility deployment. The purpose of this presentation is to briefly highlight why we are pursuing these concepts.

PROGRAM OBJECTIVES

The objectives of the Department's program efforts in this area are quite simply to utilize all means directed or available through the NWPA or other authority to encourage and expedite the most efficient use of existing storage facilities and the addition of new capacity in a timely fashion. The primary means for accomplishing this under the Act are:

1. A cooperative demonstration program with the private sector to develop dry storage technologies that the Nuclear Regulatory Commission (NRC) can generically approve (Section 218(a)).
2. Assist commercial reactors with demonstration of spent nuclear fuel storage casks, caissons or silos at their sites (Section 218(a)).
3. Provide consultative and technical assistance on a cost shared basis for design and licensing documentation for NRC licensing of on-site storage technologies (Section 218(b)(2)).
4. Perform generic research and development to supplement utility sponsored work (Section 218(b)).
5. Establish a cost-shared research and development program at Federal facilities for not more than 300 MT of spent fuel to collect necessary licensing data (Section 218(c)(1)).
6. A cooperative program with the private sector to demonstrate spent fuel rod consolidation in an existing water basin (Section 218(a)).

ROD CONSOLIDATION

Rod consolidation involves the dismantling of the fuel assembly and rearranging the spent fuel rods into a more compact array. It represents a cost-effective method for significantly increasing the capacity of storage pools that have sufficient structural strength to safely support the added weight.

An objective of demonstrations underway and planned is to make use of and demonstrate the 10 CFR 50 licensing process. Another specific objective of the

new rod consolidation demonstrations is to demonstrate the feasibility of the proposed rod consolidation storage system including an assessment of the performance characteristics and cost effectiveness. After completion of these demonstrations, the Department expects that an adequate data base will have been assembled to allow licensing of rod consolidation for commercial use. It is expected that significant quantities of spent fuel will be consolidated and that this will result in a substantial increase in storage capacity at the reactor sites. Furthermore, rod consolidation appears to offer significant benefits to the overall storage and disposal system.

DRY STORAGE

An alternative for additional spent fuel storage at nuclear power plants that cannot accommodate reracking or rod consolidation because of seismic or structural constraints is dry storage. Systems for dry storage include casks, drywells, silos, or vaults. The cask dry storage system is passive, modular, and low in maintenance requirements. The modular aspect offers the economic advantage of adding storage in small increments, thereby avoiding large initial capital outlays.

Over the years a considerable amount of experience has been gained in dry storage concepts. Spent fuel in a variety of forms is being stored in France, Japan, the Federal Republic of Germany (FRG), the United Kingdom, Canada, Switzerland and the United States. Dry storage techniques have been licensed in Switzerland, Canada and the FRG.[1]

The Department has over 20 years experience with dry storage technologies. Drywell, silo and vault storage have been demonstrated at the Department's facilities in Nevada. Dry storage of light water reactor spent fuel, however, has never been licensed in the United States.

There exist a number of uncertainties that must be resolved before licenses may be granted for dry storage in the United States. These uncertainties can be grouped into two separate categories relating first to system performance and second out ability to predict fuel degradation.

The performance of the container/fuel/environment or system must consider such things as:

- Heat Removal and Radiation Shielding Capacity
- Heat Generation and Radiation Source Rate of Fuel
- Monitoring Requirements
- Handling Procedures
- Decontamination Requirements
- Mechanical Integrity of Storage System
- Gas Confinement Requirements
- Failure Consequences
- Basis for NRC License by Rule

Fuel degradation predictions are concerned with fuel behavior in inert gases and ultimately in air.

A number of activities have been underway and new initiatives have been undertaken to resolve these uncertainties. For example, the Department entered into a cooperative agreement with Tennessee Valley Authority (TVA) in 1982 to demonstrate the licensed storage of Boiling Water Reactor spent fuel in two prototype dry storage casks. This demonstration will exercise the licensing process, including involvement of the public, as required by 10 CFR 72. A license application will be submitted to the NRC in 1984. The casks will be loaded with fuel following NRC's approval of the license application, which could be in 1986 or 1987. Fuel will be stored at conservative conditions for about two years at which time the fuel will be returned to the storage pool.

In addition, a solicitation for cooperative agreement proposals for dry storage demonstrations was issued in May 1983. Two proposals were received and accepted as the basis for negotiations. It is expected that agreements will be in place by the Spring of 1984. Actual schedules for the demonstrations will depend on the negotiated scope of work. New dry storage demonstrations will seek to expand the data base available for licensing of this storage method, and will build upon previous demonstrations such as the one with TVA. It is expected that these demonstrations will include tests, some at Federal sites, that will address storage under conditions approaching the bounding parameters and limiting conditions of the dry storage equipment. Performance characteristics and cost effectiveness of the dry storage equipment will be assessed. The 10 CFR 72 licensing process will be demonstrated.

After completion of these demonstrations, the Department expects that an adequate data base will have been assembled to allow licensing of the dry storage processes tested.

CONCLUSION

To the extent the Department and its partners successfully demonstrate the licensability of rod consolidation and dry storage techniques in a timely fashion the problem of providing additional at reactor spent fuel storage can be resolved in a cost-effective way. Should we be able to license these techniques in the near term we may eliminate any significant need for implementing the Federal Interim Storage provisions of the NWPA. Ultimately, the availability of licensed techniques for rod consolidation and dry storage will make a significant contribution to the total system for spent fuel storage and disposal.

REFERENCES

1. A.B. Johnson, Jr. and E.R. Gilbert, "Technical Basis for Storage of Zircaloy-Clad Spent Fuel in Inert Gas," PNL-4835, Pacific Northwest Laboratory (September 1983).

2. The Nuclear Waste Policy Act of 1982, as signed by the President on January 7, 1983 (Pub. L. 97-425, 96 Stat. 2201, 42 U.S.C. 10101 et seq., referred to herein as "the Act").