UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

ENVIRONMENTAL ASSESSMENT

BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATING TO AN INCREASE IN THE CAPACITY OF THE SPENT FUEL STORAGE POOL

FACILITY OPERATING LICENSE NO. DPR-36

MAINE YANKEE ATOMIC POWER STATION

MAINE YANKEE ATOMIC POWER COMPANY

DOCKET NO. 50-309

1.0 INTRODUCTION

1.1 Description of Proposed Amendment

By letter dated January 25, 1993, as supplemented by letters dated November 3, November 23, December 9, 1993, and January 5, 1994, Maine Yankee Atomic Power Company (Maine Yankee, or licensee) requested to amend the Technical Specifications (TS) appended to Facility Operating License No. DPR-36 for the Maine Yankee Atomic Power Station. Specifically, the requested amendment would increase the capacity of the Maine Yankee spent fuel storage pool to 2019 assemblies (from 1476 assemblies). The increase would provide spent fuel storage space through the duration of the current operating license, including the final full core offload.

The ability to store an increased number of spent fuel assemblies will be provided by replacing the existing spent fuel storage racks with spent fuel storage racks that are capable of storing a larger number of spent fuel assemblies in the same volume. These high density fuel storage racks are similar to fuel storage racks approved for use at other currently licensed nuclear power plants.

The proposed arrangement will provide for conventional, upright storage of spent fuel in a single tier, rectilinear array of free-standing modules, compatible with existing fuel handling equipment, procedures and experience at Maine Yankee. The arrangement and design of the racks will create two separate regions in the spent fuel pool (SFP). Region I spent fuel racks are designed to accommodate any fuel to be stored (new or spent), regardless of initial enrichment (up to and including 4.5 weight percent U-235) or burnup level. (Maine Yankee currently is licensed to use fuel with a maximum enrichment of 3.95 weight percent U-235.) Region II spent fuel racks are designed to be used with fuel that has achieved a specified burnup level. Both Region I and II rack designs use the standard spent fuel storage rack materials of Boral (trademark) for neutron absorption, and 304l stainless steel for structural members.

There are several advantages to the installation of high density spent fuel storage racks in the existing Maine Yankee SFP. Installation will not require any modification to the plant or surrounding environment. Further, the location and method of storage of spent fuel assemblies will not change from current practice, so there is no need to transport spent fuel assemblies outside the existing SFP. Finally, no onsite construction activities are necessary, and the attendant environmental, operational and infrastructure concerns are obviated.

1.2 Need for Increased Storage Capacity

The Maine Yankee reactor core consists of 217 fuel assemblies, with 68 to 72 assemblies (about one-third of the core) discharged to the spent fuel storage pool each refueling outage. As a result of 20 years' operation, the Maine Yankee spent fuel storage pool presently contains 1148 spent fuel assemblies, with the capacity to store 328 more. Current projections show that storage capacity and the ability to completely offload the core will be exhausted in 1996. Installation of the proposed high density fuel storage racks will provide spent fuel storage space through the duration of the current operating license, including the final full core offload.

1.3 Alternatives

Maine Yankee has considered and evaluated various alternatives to the proposed increase in spent fuel storage capacity at the plant. The storage of spent fuel at Maine Yankee is an interim solution until a Federal repository, currently expected to be available in 2010, is established to accept spent fuel assemblies in accordance with the Nuclear Waste Policy Act of 1982 (Public Law 97-425). When Maine Yankee began operation, commercial reprocessing of spent fuel was expected, in large part, to minimize onsite spent fuel storage capacity requirements. Commercial reprocessing of spent reactor fuel has not developed and is, therefore, not a currently available option to minimize storage capacity.

In 1975 the Commission directed the staff to perform a generic environmental impact statement on spent fuel storage. The Commission directed the staff to evaluate alternatives for the handling and storage of spent light water power reactor fuel, with particular emphasis on developing a long-range policy. The impact statement was to consider alternative methods of spent fuel storage, as well as the possible termination of the production of spent fuel through reactor shutdown.

In August of 1979, the Commission issued its "Final Generic Environmental Impact Statement on Handling and Storage of Spent Light Water Reactor Power Reactor Fuel" (FGEIS), as NUREG-0575, Volumes 1, 2 and 3. The FGEIS found that the environmental costs of interim storage are essentially negligible, regardless of where such spent fuel is stored. A comparison of the environmental costs of various alternatives reflects the advantage of

continued generation of nuclear power versus its replacement by coal-fired power generation. Continued generation of nuclear power versus its replacement by oil-fired generation provides an even greater economic advantage. In the bounding case considered in the FGEIS (shutting down reactors as their existing spent fuel storage capacity is filled), the cost of replacing nuclear stations before the end of their normal lifetime makes this alternative uneconomical. The storage of spent fuel is considered to be an interim action, not a final solution to permanent disposal.

One spent fuel storage alternative that the FGEIS considered in detail is the expansion of the onsite fuel storage capacity by modification of an existing SFP. Over 100 applications for SFP expansion have either been approved or are under consideration by the Commission. The finding in the staff's safety evaluation for each of these applications has been that the environmental impact of such increased storage capacity is negligible. However, because there are variations in storage design and limitations caused by spent fuel already in storage, the FGEIS recommends that licensing reviews continue to be done on a case-by-case basis, so as to resolve plant-specific concerns.

The licensee has considered several alternatives to the installation of high density spent fuel storage racks at Maine Yankee. These alternatives include fuel rod consolidation in the existing storage racks, construction of a new SFP, and dry cask storage. The staff has evaluated these and certain other alternatives. The following alternatives were considered and evaluated--either by the licensee or the staff:

(1) Fuel rod consolidation in the existing racks.

(2) Construction of a new SFP.

(3) Dry cask storage.

(4) Shipment of fuel to a permanent Federal fuel storage/disposal facility.

(5) Shipment of fuel to a fuel reprocessing facility.

(6) No action taken.

Each of these alternatives is discussed below.

(1) Fuel Rod Consolidation in the Existing Racks

Fuel rod consolidation is a process by which individual fuel rods are removed from their standard fuel assemblies and placed in special storage assemblies. Because the fuel has been burned in the core and the spent fuel assembly allowed to cool for many months in the fuel storage pool, a consolidated fuel assembly can be constructed to safely accommodate many more fuel rods than are found in a regular assembly. Fuel rod consolidation increases the total number of fuel assemblies that can be stored in existing fuel storage racks, thereby increasing the capacity of the current spent fuel storage pool.

Fuel rod consolidation, as currently licensed at Maine Yankee for demonstration purposes, is a technically feasible option for expanding spent fuel storage capacity. This process is essentially identical to that used in the past to recover damaged spent fuel assemblies. Because fuel rod consolidation occurs within the confines of the SFP, the impact of the process is limited to the existing Fuel Building and associated systems, and thus is deemed to have no significant impact on the environment. However, implementation of fuel rod consolidation at Maine Yankee would require the long-term dedication of manpower and equipment resources outside the normal operational requirements of the plant. The long-term use of these resources would require physical and operational modification at the plant.

(2) Construction of a New Spent Fuel Pool

The staff has generically assessed the impacts of the pool alternative and found, as reported in NUREG-0575, that the storage of spent light water reactor fuel in water pools has an insignificant impact on the environment. Additional storage capacity may be developed on the Maine Yankee site with the construction of a new SFP. Such a facility would operate completely independent from the existing fuel storage facility.

In assessing this alternative, it was noted that completion of such a facility to meet the needed additional storage capacity within the available time may be possible, but the capital costs appeared prohibitive in comparison to other alternatives. Construction of a Seismic Category I structure onsite would require additional site investigations to ensure no adverse environmental impacts during construction or operation. A new structure would require the use of additional mechanical, electrical and ventilation systems. These new systems would require changes to the existing infrastructure and would necessitate additional costs for operation, security and training. Additional staff and equipment associated with operating and maintenance would be required, as well as radioactive waste management, health physics, and fire protection.

Although the evaluation showed the potential of no significant environmental impact, construction of a new SFP is not an acceptable alternative to expanding the existing SFP.

(3) Dry Cask Storage

Maine Yankee assessed the use of dry casks to expand their existing spent fuel storage capacity. Fuel storage using dry casks entails loading the cask with spent fuel while in the spent fuel storage pool, then moving the cask to an independently controlled spent fuel storage facility on the site, but away from the existing fuel building.

The assessment of the use of dry cask storage at Maine Yankee noted that the generic use of certain cask models has been found to have no significant environmental impact, notwithstanding site specific environmental parameters. In reviewing the environmental parameters of its site, the licensee found that there would be no significant environmental impact from the use of certain dry casks to store spent fuel at Maine Yankee.

The staff has not made a generic assessment of the dry storage option; however, assessments for the dry cask independent spent fuel storage installation (ISFSI) at the Surry Power Station, and the dry modular concrete ISFSIs at the H.B. Robinson Steam Electric Plant and the Oconee Nuclear Station resulted in findings of no significant impact.

While this alternative is environmentally acceptable, dry cask storage at Maine Yankee would require new site-specific engineering and design, including equipment for the transfer of spent fuel. It is not likely that this entire effort would be completed in time to meet the need for additional capacity as discussed in Section 1.2, above. Furthermore, such construction would not take advantage of the ability to expand the existing pool, and thus would waste resources.

(4) Shipment of Fuel to a Permanent Federal Fuel Storage/Disposal Facility

Shipment of fuel to a permanent Federal fuel storage disposal facility is an alternative to increasing the onsite spent fuel storage capacity at Maine Yankee. The U.S. Department of Energy (DOE) is developing a repository under the Nuclear Waste Policy Act of 1982 (NWPA). The facility, however, is not likely to be able to receive spent fuel until approximately 2010, at the earliest. As described above, the existing Maine Yankee spent fuel storage pool will lose full core offload capability in 1996. Therefore, spent fuel shipment to, and acceptance and disposal by, DOE is not an alternative to increased onsite pool storage capacity at Maine Yankee.

As an interim measure, shipment to a Monitored Retrievable Storage (MRS) facility is an alternative to shipping Maine Yankee's spent fuel to a permanent Federal fuel storage/disposal facility. The Department of Energy,

under the NWPA, has recently submitted its MRS proposal to Congress. Because Congress has not authorized an MRS, and because the facility's availability date is uncertain, this alternative does not meet the near-term storage needs of Maine Yankee.

Under the NWPA, the Federal government has the responsibility to provide a maximum of 1900 metric tons capacity for the interim storage of spent fuel. The impacts of storing spent fuel at a Federal interim storage (FIS) facility fall within those already assessed by the Commission in NUREG-0575. In enacting NWPA, Congress found that the owners and operators of nuclear power stations have the primary responsibility for providing interim storage for spent nuclear fuel. In accordance with the NWPA and 10 CFR Part 53, shipping of spent fuel to an FIS facility is considered a last resort alternative. At this time, the licensee cannot take advantage of an FIS facility because existing storage capacity is not maximized.

(5) Shipment of Fuel to a Reprocessing Facility.

Reprocessing Maine Yankee's spent fuel is not an available alternative because there is no operating commercial reprocessing facility in the United States, nor is there the prospect of one in the foreseeable future.

(6) No Action Taken

If no action were taken, the storage capacity would become exhausted in the near future and the plant would have to shut down. This alternative is considered a waste of an available resource, Maine Yankee Atomic Power Station itself, and is not considered econmomically desirable.

SUMMARY OF ALTERNATIVES

The only viable long-term solution to the licensee's spent fuel storage problem is construction of an ISFSI. However, it is not likely that the construction of such a facility could be completed in time to meet Maine Yankee spent fuel storage requirements. Furthermore, construction of such a facility would be a waste of available resources, in that it would fail to use the expansion capacity of the existing spent fuel pool.

1.4 Fuel Reprocessing History

Currently, commercial fuel is not being reprocessed in the United States. The Nuclear Fuel Services (NFS) plant at West Valley, New York, was shut down in 1972 for alterations and expansion. In September 1976, NFS informed the Commission that it was withdrawing from the nuclear fuel reprocessing business. The General Electric Company (GE) Morris operation in Morris, Illinois, has been decommissioned.

In 1977, President Carter issued a policy statement on commercial reprocessing of spent nuclear fuel that effectively eliminated reprocessing as part of the nuclear fuel cycle.

Although no plants are licensed for reprocessing fuel, the storage pools at Morris and West Valley are licensed to store spent fuel. The storage pool at West Valley is not full, but the licensee is not presently accepting any additional spent fuel for storage. On May 4, 1982, the license held by GE for spent fuel storage at its Morris operation was renewed for another 20 years; however, GE is committed to accept only limited quantities of additional spent fuel for storage at this facility from Cooper and San Onofre Unit 1 nuclear stations.

2.0 RADIOACTIVE WASTES

The Maine Yankee plant uses waste treatment systems designed to collect and process gaseous, liquid, and solid waste that might contain radioactive material. These radioactive waste treatment systems are evaluated in the Final Environmental Statement (FES) dated July 1972. The proposed rerack will not involve any change in the waste treatment systems described in the FES.

2.1 Radioactive Material Released to the Atmosphere

With respect to releases of gaseous materials to the atmosphere, the lone radioactive gas of significance that could be attributable to storing additional spent fuel assemblies for a longer time is the radionuclide Krypton-85 (Kr-85). Experience has demonstrated that after spent fuel has decayed 4 to 6 months, there is no longer a significant release of fission products, including Kr-85, from stored spent fuel containing cladding defects. To determine the average annual release of Kr-85, it was assumed that all of the Kr-85 released from any defective fuel discharged to the SFP would be released before the next refueling. Enlarging the storage capacity of the SFP has no effect on the calculated average annual quantities of Kr-85 released to the atmosphere. There may be some small change in the calculated quantities due to a change in fuel burnup; however, this is expected to be a small fraction of the calculated annual quantities. Historically, actual Kr-85 releases have been a small fraction of that assumed in the Maine Yankee FES. For example, the FES calculated that the annual release of Kr-85 would be 750 curies per year. The actual measured release of Kr-85 during the latest 12-month period for which data is available (second and third calendar quarters of 1992; first and second calendar quarters of 1993) was 1.26 curies.

Iodine-131 releases from spent fuel assemblies to the SFP water will not increase significantly, because Iodine-131 decays to negligible levels between refuelings.

The amount of tritium in the SFP water will not be affected by the proposed changes. Most of the tritium in the SFP water results from neutron activation of boron and lithium in the primary coolant. A relatively small amount of

tritium is produced during reactor operation by the fission process within the reactor fuel. The subsequent diffusion of the tritium through the fuel and cladding represents a small contribution to the total amount of tritium in the SFP water. Tritium releases from the fuel assemblies occur mainly during reactor operation and, to a limited extent, shortly after shutdown. Thus, expanding the SFP capacity will not increase the tritium activity in the pool.

Storing additional spent fuel assemblies is not expected to increase the bulk water temperature above the value used in the design analysis for normal refueling. Therefore, it is not expected that there will be any significant change in the annual release of tritium or iodine as a result of the proposed modifications from that previously evaluated in the FES. Most airborne releases of tritium and iodine result from evaporation of reactor coolant, which contains tritium and iodine in higher concentrations than the SFP. Therefore, even if the additional fuel resulted in a higher evaporation rate from the SFP, the resulting tritium and iodine releases would be small in comparison to the amount already evaluated in the FES. The SFP exhaust system must be operating and discharging through both high-efficiency particulate air (HEPA) and charcoal filters whenever spent fuel is being moved, and whenever loads are being carried over the pool.

2.2 Solid Radioactive Wastes

Currently, about 22 cubic feet of solid radioactive waste per year is generated by the SFP cooling and purification system. As a result of the frequent fuel shuffling and underwater hydrolasing of the old racks during removal, the SFP cooling and purification system may register a small increase in radioactive material trapped by its filters and demineralizers. These resins are periodically replaced (annually) and disposed of as solid radioactive waste. However, no change in the volume of solid radioactive wastes is expected as a result of the expansion of the capacity of the SFP.

All 26 existing spent fuel racks (weighing approximately 498,000 pounds) will be removed from the SFP and be disposed of. The licensee intends to clean (by hydrolase) the old racks to the extent possible, prior to packaging for shipment offsite to the disposal contractor. The licensee's contractor will cut, dismantle, decontaminate and survey the old racks. Clean material will be released for scrap. Any material exceeding "release" levels of contamination will be sent to a licensed low level radioactive waste melt facility for further use as contaminated shielding, or may be disposed of in an approved, licensed low level radioactive waste facility.

The estimated volume of radwaste resulting from the Maine Yankee reracking project is 415 cubic feet. This represents an approximate 97% reduction in the volume of the material in the old racks removed from the SFP.

It is not expected that the disposal of the old spent fuel storage racks will have a significant effect on the quality of the human environment.

2.3 Radioactive Material Released to Receiving Waters

There should not be a significant increase in the liquid release of radionuclides from the plant as a result of the modifications. The SFP cooling and purification system operates as a closed system. The SFP demineralizer resin removes soluble radioactive materials from the SFP water. A small increase in activity on the filters and demineralizers may occur during the installation of the new racks, due to the more frequent fuel shuffling and underwater hydrolysing of the old racks during removal. However, the amount of radioactivity released to the environment as a result of the proposed reracking is expected to be negligible.

3.0 RADIOLOGICAL IMPACT ASSESSMENT

Operating experience shows dose rates of 1.3 to 1.5 mrem/hour in the vicinity of the pool, regardless of the quantity of fuel stored. These dose rates may temporarily increase to about 4 mrem/hour during refueling operations. The impact that re.acking will have on the dose rates in the vicinity of the spent fuel storage pool, and on the SFP cooling and purification system, is expected to be negligible. Because the proposed added storage capacity allows storage of older spent fuel, and because the depth of the water covering the spent fuel is not changed, fuel pool surface dose rates are expected to remain the same.

The new fuel storage racks will allow spent fuel assemblies to be stored closer to the walls of the fuel pool. This required an evaluation of the expected dose rate through the SFP walls. The calculated dose rates as a result of the proposed spent fuel storage arrangement are well within the Radiation Zone II limits (2.5 mrem/hr) for Maine Yankee's Fuel Building passageways. To further minimize area dose rates, the pool walls and floor--with special attention to the area under the old racks--will be cleaned as part of the rerack effort.

A temporary area radiation monitoring system will be installed to monitor gamma radiation levels in the SFP area. Standard instrumentation for underwater surveys, air sampling, and normal surveys will be used in conjunction with direct monitoring equipment for surfaces and materials outside the pool. Continuous air monitors (CAMs) will be used, as appropriate, to support specific activities that could generate airborne radioactivity. The CAMs will augment the normal radiation and contamination surveys of the area that will be performed during the rerack effort.

The total occupational exposure to plant workers as a result of the reracking operation is estimated to be 4.66 man-rem. This range is the estimate of the expected accumulated dose, and represents the maximum or upper boundary conditions. It is assumed that the currently measured radionuclide concentrations in the fuel pool water remain constant throughout reracking. The rerack effort is expected to be accomplished by remote methods only; no diving operations are planned. The reracking operation will follow detailed

procedures prepared with full consideration of ALARA principles. Similar operations have been performed at a number of other facilities in the past, and there is every reason to believe that reracking can be safely and efficiently accomplished at Maine Yankee, with minimum radiation exposure to personnel.

4.0 NONRADIOLOGICAL IMPACT

No effect on the waste heat rejected by the plant is expected as a result of the reracking effort. Administrative controls currently in place at Maine Yankee ensure that the design limits of the SFP cooling and purification system will not be exceeded under normal or full core discharge conditions. As more spent fuel storage locations become filled, the incremental increase in residual heat load in the pool will result in a slightly longer time required for refueling. Administrative controls limit the refueling rate so that the maximum heat load in the pool will not be increased beyond the design conditions of the fuel pool cooling and purification system. Thus, the nonradiological impact will remain within the limits of the Maine Yankee Final Environmental Impact Statement.

The licensee has not proposed any change in the use or discharge of chemicals in conjunction with the expansion of the SFP. The proposed expansion will not require any change to the National Pollution Discharge Elimination System permit. Therefore, the staff concludes that the nonradiological environmental impacts of expanding the SFP will be insignificant.

5.0 ACCIDENT CONSIDERATIONS

The staff, in its Safety Evaluation of this matter to be issued at a later date, has addressed both the safety and environmental aspects of a fuel handling accident. A fuel handling accident bounds the potential consequences of an accident attributable to operation of the SFP with high density fuel storage racks. A fuel handling accident may be viewed as a "reasonably foreseeable" design basis event that the pool and its associated structures, systems, and components (including the racks) are designed and constructed to prevent. The environmental impacts of the accident were found not to be significant.

6.0 SUMMARY

The FGEIS on Handling and Storage of Spent Light Water Reactor Fuel concluded that the cost of the various alternatives reflects the advantage of continued generation of nuclear power with its accompanying requirement of spent fuel storage. Because of the differences in SFP designs, the FGEIS recommended environmental evaluation of SFP expansions on a case-by-case basis.

The total occupational radiation dose estimated for the proposed rerack of the Maine Yankee SFP is extremely small (4.66 man-rem) compared to Maine Yankee's current annual occupational exposure (normally about 460 man-rem in a year that includes a refueling outage). The small increase in radiation dose should not affect the licensee's ability to maintain individual occupational doses within the limits of 10 CFR Part 20, and as low as reasonably

achievable. Furthermore, the nonradiological impacts of expanding the SFP will be insignificant, and the alternatives to reracking are neither practical nor reasonable.

6.1 Alternative Use of Resources

This action does not involve the use of resources not previously considered in connection with the Commission's Final Environmental Statement, dated July 1972, in connection with Maine Yankee Atomic Power Station.

6.2 Agencies and Persons Consulted

The staff reviewed the licensee's request. The staff also consulted with the State of Maine regarding the environmental impact of the proposed action. The State of Maine has reviewed the licensee's amendment request to rerack the Maine Yankee SFP. The State of Maine addressed questions on the reracking project to Maine Yankee on July 7 and December 6, 1993. The licensee responded to these questions on September 7 and December 17, 1993, respectively. The State of Maine has no unresolved comments regarding the request to amend the Maine Yankee Technical Specifications to allow the proposed reracking.

7.0 BASIS AND CONCLUSIONS FOR NOT PREPARING AN ENVIRONMENTAL IMPACT STATEMENT

The staff has reviewed the proposed SFP modification to Maine Yankee Atomic Power Station, relative to the requirements set forth in 10 CFR Part 51. Based upon the environmental assessment, the staff has concluded that there are no significant radiological or nonradiological impacts associated with the proposed action and that the proposed license amendment will not have a significant effect on the quality of the human environment. Therefore, the Commission has determined, pursuant to 10 CFR 51.31, not to prepare an environmental impact statement for the proposed amendment.

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