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

ENVIRONMENTAL IMPACT APPRAISAL BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 75 TO FACILITY OPERATING LICENSE NO. DPR-3

(MODIFICATION OF THE SPENT FUEL STORAGE POOL)

YANKEE ATOMIC ELECTRIC COMPANY

YANKEE NUCLEAR POWER STATION

DOCKET NO. 50-29

1.0 DESCRIPTION OF PROPOSED ACTION

By letter dated July 13, 1978, Yankee Atomic Electric Company (YAEC) (the licensee) set forth a proposed program for modifications and improvements to the spent fuel pool (SFP) at the Yankee Nuclear Power Station (Yankee). The modifications would include the installation of a stainless steel liner for the pool walls, additional decay heat removal capacity, provisions for the installation of a divider gate to allow the modifications to be made, and provisions for additional spent fuel storage capacity in the pool.

The licensee provided additional information regarding the proposal in letters dated July 13, 1978 (two supplements to the original letter), September 15, 1978, September 25, 1978, October 18, 1978, February 7, 1979, March 5, 1979, August 18, 1980, September 17, 1981 and July 28, 1982.

By letters dated October 6, 1978 (Amendment No. 51), April 3, 1979 (Amendment No. 57), and January 22, 1981, the NRC staff approved the initial phases of the program dealing with the installation of the stainless steel liner, the divider gate installation, and the spent fuel pool cooling system modifications.

This Environmental Impact Appraisal relates to the proposed licensing action of amending the Facility Operating License No. DPR-3 for Yankee to permit an increase in the storage capacity of the SFP from 391 to 721 fuel assemblies.

2.0 NEED FOR INCREASED STORAGE CAPACITY

The Yankee SFP is currently authorized to store 391 spent fuel assemblies. A full core for the plant consists of 76 fuel assemblies. The licensee stated that the number of unoccupied spent fuel storage locations would accommodate a full core offload only until the 1986 refueling outage. Yankee is on a 15-month refueling cycle with either 36 or 40 fuel assemblies discharged during each refueling outage.

The proposed modification would extend the spent fuel storage capability of the pool and leave room for a full core discharge until 1996. In our evaluation, we considered the impacts which may result from storing an additional 330 spent fuel assemblies in the Yankee SFP.

The proposed modification would alter the external physical geometry of the spent fuel pool. The proposed modification would not affect in any manner the quantity of uranium fuel consumed by the reactor over its anticipated operating life and thus in no way would affect that amount of spent fuel discharged from the reactor. The rate of spent fuel discharged and the total quantity discharged during the anticipated operating lifetime of Yankee would be unchanged as a result of the proposed expansion. The modification would increase the number of these spent fuel assemblies that could be stored in the SFP at one time and the storage time of some.

3.0 FUEL REPROCESSING HISTORY

Currently, spent fuel is not being reprocessed on a commercial basis in the United States. The Nuclear Fuel Services (NFS) plant in West Valley, New York, was shut down in 1972 for alterations and expansion; on September 22, 1976, NFS informed the Commission that they were withdrawing from the nuclear fuel reprocessing business. The Allied General Nuclear Services (AGNS) proposed plant in Barnwell, South Carolina, is not licensed to operate.

The General Electric Company's (GE) Morris Operation (MO) in Morris, Illinois is in a decommissioned condition. Although no plants are licensed for reporcessing fuel, the storage pool at Morris, Illinois and the storage pool at West Valley, New York are licensed to store spent fuel. The storage pool at West Valley is not full but NFS is presently not accepting any additional spent fuel for storage. Construction of the AGNS receiving and storage station has been completed. AGNS has applied for - but has not been granted - a license to receive and store irradiated fuel assemblies in the storage pool at Barnwell prior to a decision on the licensing action relating to the separation facility.

4.0 THE FACILITY

The Yankee Nuclear Power Station is with a licensed thermal core power of 600 MWth. The design net electrical output is 185 megawatts (MWe). Pertinent descriptions of principle features of Yankee as it currently exists are summarized to aid the reader in following the evaluations in subsequent sections of this appraisal.

4.1 SFP Cooling System

The spent fuel pool cooling system at Yankee consists of two pumps and one heat exchanger. The pumps are designed to pump 500 and 600 gpm, and the heat exchanger is designed to transfer 500 X 10^6 BTU/hr from the fuel pool water to the component cooling water which flows through the shell side of the heat exchanger.

Heat is transferred from the spent fuel pool cooling system to the closed-loop component cooling water system. The component cooling water system, in turn, transfers heat to the service water system. The service water system is a once-through cooling system in which strained water from Sherman Pond is supplied from pumps in the intake structure and returned to the pond after removing heat from a number of systems including the component cooling water system.

4.2 Radioactive Waste

The Yankee plant contains waste treatment systems designed to collect and process the gaseous, liquid, and solid waste that might contain radioactive material. There will be no change in the waste treatment systems described in the above cited evaluation because of the proposed modification.

4.3 Purpose of the SFP

Spent fuel assemblies are intensely radioactive due to their fresh fission product content when initially removed from the core and they have a high thermal output. The SFP was designed for storage of these assemblies to allow for radioactive and thermal decay prior to shipping them to a reprocessing facility. The major portion of decay occurs in the first 150 days following removal from the reactor core. After this period, the spent fuel assemblies may be withdrawn and placed in heavily shielded casks for shipment. Space permitting, the assemblies may be stored for longer periods, allowing continued fission product decay and thermal cooling.

4.4 Spent Fuel Pool Purification System

The spent fuel pool purification system consists of a cartridge type filter, a 20 ft^3 flushable mixed bed demineralizer and the associated piping, valves and instrumentation. Cleanup of the pool is normally provided by a continuous flow through the demineralizer and, during periods of low water clarity, through the filter.

Because we expect only a small increase in radioactivity to be released to the pool water as a result of the proposed modification as discussed in Section 5.3 of this Environmental Impact Appraisal, we conclude that the spent fuel pool purification system is adequate for the proposed modification and will keep concentrations of radioactivity in the pool water to acceptably low levels.

5.0 ENVIRONMENTAL IMPACTS OF PROPOSED ACTION

5.1 Land Use

The external dimensions of the SFP will not change because of the proposed expansion of its storage capacity; therefore, no additional commitment of land is required. The SFP was designed to store spent fuel assemblies under water for a period of time to allow shorter lived radioactive isotopes to decay and to reduce the associated thermal heat output. The Commission has never set a limit on how long spent fuel assemblies could be stored onsite. The longer the fuel assemblies decay, the less radioactivity they contain. The proposed modifications will not change the basic land use of the SFP. The SFP was designed to store 391 spent fuel assemblies. The proposed modifications would provide storage for 721 spent fuel assemblies. This use will remain unchanged by the proposed modifications.

5.2 Water Use

There will be no significant change in plant water consumption or use as a result of the proposed modifications. As discussed subsequently, storing additional spent fuel in the SFP will slightly increase the heat load on the SFP cooling system. This heat is transferred in turn to the component cooling water system and to the service water system. The modifications will not change the flow rate within these cooling systems.

The spent fuel pool cooling system is designed to keep the pool temperature below 150°F with all storage spaces full (721 fuel elements). The calculated evaporation rate at this temperature is approximately 290 gal/day, assuming a sufficient volume of ventilation air to hold the water. This rate is well within the plant's ability to make up, and is insignificant when compared with the normal average water usage of 11,700 gal/day for primary and secondary makeup.

5.3 Radiological

5.3.1 Releases to the Environment

The potential offsite radiological environmental impacts associated with the expansion of the spent fuel storage capacity were evaluated and determined to be environmentally insignificant as addressed below.

During the storage of the spent fuel under water, both volatile and nonvolatile radioactive nuclides may be released to the water from the surface of the assemblies or from defects in the fuel cladding. Most of the material released from the surface of the assemblies consists of activated corrosion products such as Co-58, Co-60, Fe-59, and Mn-54 which are nonvolatile. The radionuclides released to the water through defects in the cladding, such as Cs-134, Cs-137, Sr-89, and Sr-90 are predominantly nonvolatile and, as with the activated corrosion product nuclides, the primary impact is their contribution to radiation levels to which workers in and near the SFP would be exposed. The volatile fission product nuclides of most concern that might be released through defects in the fuel cladding are the noble gases (xenon and krypton), tritium and the iodine isotopes.

The spent fuel pool is provided with a purification system which prevents the buildup of radioactivity in the fuel pool water. Purification of the spent pool fuel pool water is accomplished by routing up to 40 gpm of the cooled water (pool volume is approximately 48,000 gallons) continuously through either a cartridge type filter or a 20 ft^3 flushable mixed bed ion exchanger.

Storing additional spent fuel in the SFP may increase the amount of corrosion and fission product nuclides introduced into the SFP water. The purification system is capable of removing the increased radioactivity so as to maintain acceptable radiation levels above and in the vicinity of the pool. The increase in the storage capacity of the SFP racks increases only the storage capacity of the pool and not the frequency or the amount of the core to be replaced for each fuel cycle. Thus, the amount of corrosion product nuclides released into the pool during any year will be about the same regardless of the length of time of number of assemblies stored in the pool. Expansion of the capacity of the spent fuel pool does increase the potential for increasing the amount of fission products introduced into the SFP water. If this potential were realized, the amount of radioactivity accumulated on the filter and demineralizer which are disposed of as solid waste could be increased. At present, the licensee packages and ships about 20 ft^3 of spent resin from the SFP purification system every year. The licensee has estimated that there will be an increase of 5 ft^3/yr in the amount of solid radwaste from the SFP purification system or from SFP operations as a result of the proposed modification. As a conservative estimate, we have assumed that the amount of solid radwaste generated each year by the SFP purification system may be increased by one resin bed (20 ft^3). For the years 1972-1981, the licensee has shipped an average of 7300 ft^3/yr of solid waste with an average activity of less than 0.01 Ci/ft^3. If the increased storage of spent fuel does eventually increased the amount of solid waste by 20 ft^3/year, the increase in total waste volume would be less than 1% and would not have any significant environmental impact.

With respect to gaseous releases, the only significant noble gas isotope attributable to storing additional assemblies for a longer period of time would be Krypton-85. Experience has demonstrated that after spent fuel has decayed 4 to 6 months, there is no significant release of fission products from defective fuel. However, we have conservatively estimated that an additional 18 curies per year of Krypton-85 may be released when the modified pool is completely filled. This increase would result in an additional total body dose to a maximally exposed individual at the site boundary of less then 0.01 mrem/year. This dose is insignificant when compared to the approximately 100 mrems/year that an individual receives from natural background radiation. The additional total body dose to the estimated population within a 50-mile radius of the plant is less than 0.001 person-rem/yr. This is less than the natural fluctuations in the dose this population would receive from natural background radiation. Thus, we conclude that the proposed modification will not have any significant impact on exposures offsite.

Assuming that the spent fuel will be stored onsite for several years, Iodine-131 releases from spent fuel assemblies to the SFP water will not be significantly increased because of the expansion of the fuel storage capacity since the Iodine-131 inventory in the fuel will decay to negligible levels between refuelings.

Due to conservatism in the original SFP cooling system design, storing additional spent fuel assemblies is not expected to increase the bulk water temperature significantly. Cross connections are available to use the shutdown heat exchanger and pump to supplement the SFP cooling system. On this basis, it is not expected that there will be a significant change in evaporation rates and the release of tritium.

5.3.2 Occupational Exposures

We have reviewed the licensee's plant for the installation of the double-tier storage rack system with respect to occupational radiation exposure. The occupational exposure for the entire operation is estimated by the licensee to be approximately 1.25 person-rem. We consider this to be a conservative estimate because this is based on conservative dose rates and occupancy factors for individuals performing a specific job during the modification. This operation is expected to be a small fraction of the total annual person-rem burden from occupational exposure.

We have estimated the increment in onsite occupational doses resulting from the proposed increase in stored fuel assemblies on the basis of information supplied by the licensee and by utilizing relevant assumptions for occupancy times and for dose rates in the spent fuel pool area from radionuclide concentrations in the SFP water. The spent fuel assemblies themselves contribute a negligible amount to the dose rates in the pool area because of the depth of water shielding the fuel. The occupational radiation exposure resulting from the proposed actions represents a negligible burden. Based on present and projected operations in the spent fuel pool area, we estimate that the proposed modifications should add less than one percent to the total annual occupational radiation exposure burden. Thus, we conclude that storing additional fuel in the pool will not result in any significant increase in doses received by occupational workers.

5.3.3 Summary

The GEIS on Handling and Storage of Spent Light Water Power Reactor Fuel findings were that the environmental impact of interim storage of spent fuel was negligible and the cost of the various alternatives reflect the advantage of continued generation of nuclear power with the accompanying spent fuel storage. Because of the differences in spent fuel pool designs the GEIS recommended licensing spent fuel pool expansions on a case-by-case basis. For Yankee, expansion of the storage capacity of the SFP does not significantly change the radiological impact evaluated in the Environmental Impact Appraisal for the previous modification in 1976. As discussed in Section 5.3.1, the additional total body dose that might be received by an individual or by the estimated population within a 50-mile radius is less than 0.01 mrem/yr and 0.001 person-rem/yr, respectively, and is less than the natural fluctuations in the dose this population would receive from background radiation. The occupational exposure for the modifications of the SFP is estimated by the licensee to be 1.25 person-rem. This is conservative. Operation of the plant with additional spent fuel in the SFP is not expected to increase the occupational radiation exposure by more than one percent of the total annual occupational exposure.

5.4 Nonradiological Effluents

There will be no additional chemical discharge as the result of the proposed modification. However, the plant thermal discharge will be increased somewhat by the proposed modification. As discussed in Section 3.6 of the NRC staff's Safety Evaluation regarding the proposed SFP expansion, the maximum heat load that could be generated by increasing the number of spent fuel assemblies in the pool from 391 to 721, is 6.62 X 10^6 BTU/hr. This head load would be discharged to Sherman Pond via heat exchangers in the SFP cooling system and the component cooling water system.

The total heat rejected by the main condenser to Sherman Pond is about 1.4 X 10^9 BTU/hr. The increase discussed above is less than .5% of the thermal discharge from the main condenser. We conclude that the increase in heat load from the SFP cooling system will be negligible.

5.5 Impacts on the Community

The new storage racks will be fabricated offsite and shipped to the facility. No environmental impacts are expected on the environs outside of the site during installation of the new racks. The impacts onsite are expected to be limited to those typically associated with normal metal working activities.

No environmental impact on the community is expected to result from the modification or from the subsequent operation with the increased storage of spent fuel in the SFP.

6.0 ENVIRONMENTAL IMPACT OF POSTULATED ACCIDENTS

Although the new high density racks will accommodate a larger inventory of spent fuel, we have determined that the installation and use of the racks will not change the radiological consequences of the worst fuel handling accident in the SFP area as discussed in Section 3.7 of the Safety Evaluation relating to the proposed SFP modification.

7.0 EVALUATION OF PROPOSED ACTION

7.1 Unavoidable Adverse Environmental Impacts

7.1.1 Radiological Impacts

Expansion of the storage capacity of the SFP will not create any significant additional radiological effects. As discussed in Section 5.3, the additional total body dose that might be received by an individual at the site boundary or by the estimated population within a 50-mile radius is less than 0.01 mrem/yr and 0.001 person-rem/yr, respectively, and is less than the natural fluctuations in the dose this population would receive from background radiation. The occupational exposure of workers during removal of the failed fuel rack and installation of the new racks is estimated to be 1.25 person-rem. This is a small fraction of the total annual person-rem burden from occupational exposure. It is expected that operation of Yankee with additional aged spent fuel in the SFP will not result in any significant increase in doses received by occupational workers.

7.2 Irreversible and Irretrievable Commitments of Resources

7.2.1 Water, Land and Air Resources

The proposed action will not result in any significant change in the commitment of water, land and air resources. No additional allocation of land would be made. The land area now used for the SFP would be used more efficiently by adopting the proposed action.

7.2.2 Material Resources

The new spent fuel racks will be constructed of 6061-T6, 6063-T5 and 5052-H32 aluminum alloy. The licensee has stated that the empty weight of the new storage racks is approximately 280 pounds per cavity so that, for the addition of the proposed 330 cavities (one per assembly), the modification would require the use of 92,400 lbs of the aluminum alloy for the total empty weight of the new storage racks. The amount of aluminum used in the Boral neutron absorbing material is small compared to the weight of the rack material. The amounts of aluminum and boron produced annually in the U.S. are approximately 4,900,000 and 79,000 short tons, respectively, and neither material is considered to be in short supply in this country. In the context of this criterion, we conclude that the amount of material (aluminum and boron) required for the new racks at Yankee is insignificant and does not represent an irreversible commitment of natural resources. We also conclude that there are no unresolved conflicts in alternative uses of available resources associated with the fabrication of the new racks.

8.0 BASIS AND CONCLUSION FOR NOT PREPARING AN ENVIRONMENTAL IMPACT STATEMENT

The NRC staff has reviewed this proposed facility modification relative to the requirements set forth in 10 CFR Part 51 of the Commission's regulations. The staff has determined, based on this assessment, that the proposed license amendment will not significantly affect the quality of the human environment. Therefore, the Commission has determined that an environmental impact statement need not be prepared, and that, pursuant to 10 CFR 51.5(c), the issuance of a negative declaration to this effect is appropriate.

9.0 ACKNOWLEDGEMENTS

The following NRC personnel contributed to this assessment:

R. Caruso	M. Lamastra	J. Hayes
M. Wohl	W. Meinke	S. Block

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