ENVIRONMENTAL IMPACT APPRAISAL
BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATIVE TO A PROPOSED INCREASE IN STORAGE CAPACITY
OF THE SPENT FUEL POOL

NORTH ANNA POWER STATION, UNITS 1 AND 2

VIRGINIA ELECTRIC AND POWER COMPANY

DOCKET NOS. 50-338 AND 50-339

FACILITY OPERATING LICENSE NO. NPF-4

April 2, 1979

(with corrections of errata on pages 3 and 6)

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1.0 DESCRIPTION OF THE PROPOSED ACTION

By application dated May 1, 1978,[1] the Virginia Electric and Power Company (Vepco or the licensee) requested an amendment to Facility Operating License NPF-4, which was issued for North Anna Power Station Unit No. 1 on November 26, 1977. The proposed amendment would allow an increase in the storage capacity of the spent fuel pool (SFP), which is shared by Units 1 and 2, from 400 to 966 fuel assemblies. This increase in the capacity would be accomplished by installing storage racks with a center-to-center spacing of 14 inches between adjacent vertical cells in place of the existing racks which have a 21-inch center-to-center spacing between cells. No changes would be made in the overall pool dimensions or the pool cooling and purification systems.

The licensee proposes to complete the installation of the higher density racks prior to the initial discharge of spent fuel from Unit 1, which is scheduled for the fall of 1979.

Environmental impacts of Units 1 and 2, as designed, were considered in the "Final Environmental Statement related to the continuation of construction and operation of Units 1 and 2 and the construction of Units 3 and 4, North Anna Power Station," issued in April 1973 by the Directorate of Licensing, U.S. Atomic Energy Commission, and in the "Addendum to the Final Environmental Statement related t operation of North Anna Power Station, Units 1 and 2," NUREG-0134, issued in November 1976 by the U.S. Nuclear Regulatory Commission. The purpose of this environmental impact appraisal (EIA) is to determine and evaluate any additional environmental impacts which are attributable to the proposed increase in SFP storage capacity.

2.0 NEED FOR INCREASED STORAGE CAPACITY

According to the licensee's planned refueling schedule,[2] 52 spent fuel assemblies will be replaced in Unit 1 each fall beginning in 1979 and 52 assemblies will be replaced in Unit 2 each fall beginning in 1980. On this basis, 364 spent fuel assemblies will be discharged to the SFP by the end of 1982 and normal refueling of either reactor will not be possible thereafter unless the SFP's capacity is expanded or storage is made available offsite.*

*One of the reactors could have 52 assemblies replaced one more time by placing a spent fuel rack in the cask loading area, but this is not considered operationally feasible in that once all other racks are filled and spent fuel is placed in this particular rack, no interchange of racks could be made and no further refuelings could take place.[3]

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Without refueling in 1983, the reactor cores would soon have insufficient reactivity to continue operation and the facility would have to be shutdown.

The licensee is evaluating the use of reload cycles longer than 12 months; consequently, the scheduling of refueling operations may change. However, evaluations for similar units at the Surry Nuclear Power Station indicated that introducing extended cycles before Cycle 3 would not be economically attractive.[4] Furthermore, an extended cycle requires that a greater number of assemblies be replaced at each refueling. As a result, the date when the present SFP capacity will be full would not be extended appreciably by adoption of longer reload cycles.

A more immediate necessity for expanded storage capacity arises from the prudent practice of maintaining sufficient room in the SFP to off-load a full core (157 fuel assemblies) should this be necessary for inspection or repair of reactor internal equipment or piping. While this capability is not necessary to protect the health and safety of the public, it is desirable to reduce occupational exposures. With the present SFP capacity, the licensee will lose full core discharge capability after one unit is refueled in the fall of 1981.

As stated by the licensee,[1] the SFP design was predicated on being able to ship spent fuel offsite for processing after about 150 days of residence time in the pool for decay of short-lived radioactive fission products. However, spent fuel is not currently being reprocessed on a commercial basis in the United States and storage capacity away from reactor sites is available only on an emergency basis.[5] Additional spent fuel storage capacity is eventually expected to become available at facilities provided by the Department of Energy (DOE); various options are being considered which could result in shipments to such interim facilities in 1984 and to long-term disposition facilities commencing during the 1990-1993 time frame.[6,7] However, these dates are uncertain since the Congress has not yet authorized or funded these facilities. Furthermore, DOE has stated its intent not to accept spent fuel for interim storage until it has decayed for five years and not to accept it for long-term storage until it has decayed for ten years (so that the fuel can be stored dry without forced-air ventilation).[8] The earliest these conditions can be met by spent fuel discharged from Unit 1 would be in the fall of 1984 for interim storage and the fall of 1989 for long-term storage.

Based on the above information, there is clearly a need for additional onsite spent fuel storage capacity to assure continued operation of Units 1 and 2, with full core off-load capability, after the fall of 1981. The proposed expansion of the SFP capacity to 966 assemblies would provide this capability until the fall of 1987, using annual refueling cycles. If longer refueling cycles, such as the 18-month cycles at the Surry plant, were also adopted after the first two cycles, the staff estimates that operation with full-core off-load capability could be extended approximately one year beyond 1987. However, without expansion of the SFP, adoption of 18-month cycles would not extend the full-core off-load capability beyond the fall of 1981. Thus, additional storage capacity is needed even if extended refueling cycles are adopted.

3.0 THE FACILITY

Units 1 and 2 each have a pressurized water reactor (PWR) with a maximum design power level of 2900 megawatts thermal (MWt).[1] Steam generated with the reactor heat can be used in turbine-generators to produce up to 980 megawatts electrical (MWe) per unit. Unit 1 is presently licensed to operate at a maximum steady-state reactor power level of 2775 MWt, which provides an electrical output of approximately 942 MWe.

Principal features of the facility which are pertinent to this evaluation are briefly described below for convenience in following the discussion in subsequent sections of this appraisal. More details are presented in the FES and the Addendum mentioned in Section 1 and in the Safety Evaluation Report (SER) issued by the staff in June 1976.

3.1 Fuel Inventory

The weight of fuel, as UO_2, in each reactor is approximately 181,200 pounds. The fuel is contained in long sealed tubes called fuel rods. A cluster of 264 fuel rods arranged in a 17 x 17 array makes up each of the 157 fuel assemblies in a reactor.

The proposed modification of the SFP would not change the quantity of uranium fuel used in the reactor over the anticipated operating life of the facility and would not change the rate at which spent fuel is generated by the facility. The added storage capacity would increase the number of spent fuel assemblies that could be stored in the SFP and the length of time that some of the fuel assemblies could be stored in the pool.

3.2 Purpose of the Spent Fuel Pool

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.

3.3 Spent Fuel Pool Cooling and Purification System

The SFP is provided with a cooling system to remove residual heat from the fuel stored in the pool and purification equipment to maintain the quality and clarity of the water in which the fuel assemblies are immersed. This system is discussed in Section 9.1.3 of the SER.

The cooling system is designed to maintain the pool water temperature at or below 140 F under normal refueling conditions (when one-third of the fuel assemplies are replaced), and below bulk pool boiling temperature under abnormal conditions (unloading a full core of fuel assemplies into the SFP). Two cooling loops are provided, each with a full capacity (2750 gpm) circulating pump and a heat exchanger designed to remove heat from the pool at a rate of 56.8 x 10^6 BTU/hour. The two loops are also cross-connected for flexibility in the event of a component failure.

In operation, a circulating pump draws water from one end of the pool, circulates it through a heat exchanger and returns it to the other end of the pool. Purity of the water is maintained by passing a portion of the water, approximately 130 gpm, through a 45 ft^3 demineralizer and filter. Three purification pumps, two filters and one demineralizer are provided for this function. There is also a skimmer system to remove surface dust and debris from the SFP.

3.4 Cooling Water Systems

The heat exchangers in the SFP cooling system discharge the heat from the SFP to the closed-loop component cooling water system which is designed to remove heat from major components in the station. This system is cooled via heat exchangers by water from the service water reservoir which is circulated through the plant auxiliary cooling systems and returned to the service water reservoir.

Makeup water for the service water system (usually less than 200 gpm for two units) is taken from Lake Anna along with the much larger quantity of cooling water (1,905,600 gpm) which circulates through the turbine steam condensers and the waste heat treatment facility (WHTF) before returning to the lake. The maximum normal blowdown of the service water reservoir (when necessary to correct its chemistry) to the circulating water discharge tunnel is 50 gpm. This occasional blowdown to the WHTF, and thence to Lake Anna, is the only liquid under normal operating conditions which relates to the disposition of heat from the SFP and it will occur regardless of the proposed SFP modification.

Details of the WHTF are discussed in Section 3.3 of the FES. During full-load operation of Units 1 and 2, a total thermal load of approximately 13.7×10^9 Btu/hr will be dissipated to the environment. Of this amount, approximately 10.9×10^7 Btu/hr (about 0.7%) will be contributed by the service water system under normal operating conditions. If necessary to offload a full core to the SFP, the contribution of the service water system would increase to approximately 12.6×10^7 Btu/hr for a short time, but the total thermal load dissipated by the plant would diminish to about 6.9×10^9 Btu/hr as one of the units is shut down. Heat in the service water is normally dissipated by sprays in the service water reservoir; however, the service water can be discharged to the WHTF in emergencies.

.5 Radioactive Wastes

The station contains waste treatment systems designed to collect and process the gaseous, liquid and solid wastes that might contain radioactive material. These waste treatment systems for Units 1 and 2 were evaluated in the FES dated April 1973 and the Addendum to the FES dated November 1976. No changes in these systems are required due to the SFP modification.

4.0 ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

4.1 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 is intended to store spent fuel assemblies under water for a period of time to allow shorter-lived radioactive isotopes to decay and to reduce their thermal heat output. This type of use will remain unchanged by the modification but the additional storage capacity would provide for a total of 18 normal refuelings compared to 7 such refuelings at present. Thus, the proposed modification would result in more efficient use of the land already designated for spent fuel storage.

4.2 Water Use

As indicated in Section 2.5 of the staff's Safety Evaluation of the proposed modification, dated January 29, 1979, we have verified that the existing SFP cooling system can maintain the same pool water temperatures specified for the original fuel storage configuration. Although the heat to be dissipated would increase somewhat, the amount of makeup water required for pool operation would be essentially the same as that previously considered, since the design temperature limits and rate of water circulation through the pool remain the same.

However, storing additional fuel in the SFP would increase the heat load transferred to the closed-loop component cooling water system, and then to the service water system by a maximum of 5.6×10^6 Btu/hr. Dissipation of this heat by evaporation from the service water reservoir would require approximately 12 gpm of additional makeup water. This is a very small amount compared to the station's total water requirements (about 1,905,600 gpm) and would not have noticeable effects on Lake Anna.

4.3 Nonradiological Effluents

No additional chemicals or biocides are to be used because of the SFP expansion. Therefore, the only nonradiological effluent attributable to the amendment would be the additional heat load of 5.6×10^6 Btu/hr dissipated from the service water system. This is about 5.5 percent more than the 103.1×10^6 Btu/hr heat load on the service water reservoir under normal operation and about 4.6 percent of the 122.5×10^6 Btu/hr heat load under abnormal conditions (unloading a full core), without the SFP modification. The incremental effects of evaporating 12 gpm to dissipate this additional heat (Sect. 4.2) would be minimal. The service water reservoir is located onsite near the main structures of the station (FES Fig. 3.1) and any additional atmospheric effects of its operation such as fogging and icing are unlikely to occur offsite.

There is provision for discharge of the service water system to the WHTF if the need should arise. The addition of 5.6×10^6 Btu/hr to the total discharge from Units 1 and 2 (13.7×10^9 Btu/hr)* would be an increase of only 0.04%. This would not have noticeable incremental effects on aquatic biota or the environment.

4.4 Radiological Impacts

4.4.1 Introduction

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.

*The applicant's submittal of May 1, 1978, indicated 13.7×10^9 Btu/hr in Table 7-2 as the total heat discharged to the environment; of this total, 13.15 x 10 Btu/hr is discharged from the turbine steam condensers to the WHTF, 109×10^6 Btu/hr from the service water reservoir and 350×10^6 Btu/hr from the bearing cooling towers are dissipated to the atmosphere.

The additional spent fuel which would be stored due to the expansion is the oldest fuel which has not been shipped from the plant. This fuel will have decayed for at least three years. During 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 not volatile. The radionuclides that might be released to the water through defects in the cladding, such as CS-134, Cs-137, Sr-89 and Sr-90, are also predominately nonvolatile. The primary impact of such nonvolatile radioactive nuclides 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.

Experience at the General Electric Company's Morris Operation (MO) in Illinois and Nuclear Fuel Services (NFS) at West Valley, New York, indicates that there is little radionuclide leakage from spent fuel stored in pools after the fuel has cooled from four to six months.[9] The predominance of radionuclides in the spent fuel pool water appear to be radionuclides that were present in the reactor coolant system prior to refueling (which becomes mixed with water in the spent fuel pool during refueling operations) or crud dislodged from the surface of the spent fuel during transfer from the reactor core to the SFP. During and after refueling, the spent fuel pool purification system reduces the radioactivity concentrations considerably. It is theorized that most failed fuel contains small, pinhole-like perforations in the fuel cladding at the reactor operating condition of approximately 800°F. The cladding temperature declines rapidly after the reactor is shutdown and the cladding continues to cool in the pool so that its temperature after several weeks is relatively low, less than 180°F. This substantial temperature lowering should reduce the rate of release of fission products from the fuel pellets and decrease the gas pressure in the gap between pellets and clad, thereby tending to retain the fission products within the gap. In addition, most of the gaseous fission products have short half-lives and decay to insignificant levels within a few months.

4.4.2 Effect of Fuel Failure on the SFP

Experience indicates that there is little radionuclide leakage from Zircaloy-clad spent fuel stored in pools for over a decade. Operators at several reactors have discharged, stored, and/or shipped relatively large numbers of Zircaloy-clad fuel elements which developed defects during reactor exposures, e.g., Ginna, Oyster Creek, Nine Mile Point, and Dresden Units Nos. 1 and 2. Based on the operational reports submitted by licensees and discussions with the operators, there has not been any significant leakage of fission products from spent reactor fuel stored in the MO pool or the NFS pool. Several hundred Zircaloy-clad assemblies which developed one or more defects in-reactor are stored in the Morris pool without need for isolation in special cans. Detailed analysis of the radioactivity in the pool water indicates that the defects are not continuing to release significant quantities of radioactivity.

A recent Battelle Northwest Laboratory (BNL) report, "Behavior of Spent Nuclear Fuel in Water Pool Storage: (BNWL-2256 dated September 1977), states that radioactivity concentrations may approach a value up to 0.5 μCi/ml during fuel discharge in the SFP. After the refueling, the SFP ion exchange and filtration units will reduce and maintain the pool water in the range of 10^{-3} to 10^{-4} μCi/ml.

In handling defective fuel, the BNL study found that the vast majority of failed fuel does not require special handling and is stored in the same manner as intact fuel. Two aspects of the defective fuel account for its favorable storage characteristics. First, when a fuel rod perforates in-reactor, the radioactive gas inventory is released to the reactor primary coolant. Therefore, upon discharge, little additional gas release occurs. Only if the failure occurs by mechanical damage in the basin are radioactive gases released in detectable amounts, and this type of damage is extremely rare. In addition, most of the gaseous fission products have short half-lives and decay to insignificant levels. The second favorable aspect is the inert character of the uranium oxide pellets in contact with water. This has been determined in laboratory studies and also by casual observations of pellet behavior when broken rods are stored in pools.

4.4.3 Radioactive Material Released to Atmosphere

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. As discussed in Section 4.4.1, 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 80 curies per year of Krypton-85 may be released from the two units when the modified pool is completely filled. This increase would result in an additional total body dose of less than 0.0002 mrem/year to an individual at the site boundary. This dose is insignificant when compared to the approximately 100 mrem/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 would be less than 0.0005 man-rem/ year. Under our conservative assumptions, these exposures represent an increase of less than 0.1% of the exposures from the plant evaluated in the FES for the individual and the population (Table 5.8). Thus, we conclude that the proposed modification will not add significantly to radiation exposures or resultant health effects 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.

Storing additional spent fuel assemblies should not increase the bulk water temperature during normal refuelings above the 140°F used in the design analysis. Therefore, it is not expected that there will be any significant change in the annual release of tritium or iodine from that previously evaluated in the FES.

Most airborne releases from the plant result from leakage of reactor coolant which contains tritium and iodine in higher concentrations than in the spent fuel pool. Therefore, even if there is a slightly higher evaporation rate from the SFP, the increase in tritium and iodine released from the plant as a result of the increase in stored spent fuel would not be significantly greater than the amount previously evaluated in the FES for releases from the plant. If levels of radioiodine become too high, the air can be routed through charcoal filters for the removal of radioiodine before release to the environment. (The plant radiological effluent technical specifications, which are not being changed by this action, restrict the total releases of gaseous activity from the plant, including the SFP.)

4.4.4 Radioactivity Released to Receiving Waters

There should not be a significant increase in the liquid release of radionuclides from the station as a result of the proposed modification. The amount of radioactivity on the SFP filters and demineralizer might slightly increase due to the additional spent fuel in the pool, but this increase of radioactivity would not be released in liquid effluents from the station, as discussed below.

The cartridge filters remove insoluble radioactive matter from the SFP water. These filters are periodically removed to the waste disposal area in a shielded cask and placed in a shipping container. Any insoluable matter that remains in the SFP water will be too small to be trapped on the filters or not mobile enough to be taken up in the SFP cooling loops.

The demineralizer resins (which remove some of the soluable radioactive matter through ion exchange) are periodically flushed with water to the spent resin tank. The water used to transfer the spent resin is returned to the liquid radwaste system for processing. If any activity should be transferred from the spent resin to this flush water, it would be removed by the liquid radwaste system.

Finally, leakage from the SFP, if any, is collected in the fuel building floor drain sumps. This water is transferred to the liquid radwaste system and is processed by the system before any water is discharged from the plant. (All such releases are limited by the plant radiological effluent technical specifications, which will be unchanged by the proposed modification of the SFP.)

4.4.5 Solid Radioactive Wastes

The concentration of radionuclides in the pool is controlled by the filters and demineralizer, and by decay of short-lived isotopes. The activity is highest during refueling operations while spent fuel is being removed from the core and reactor coolant water is introduced into the pool. The activity decreases as the pool water is processed through the filters and demineralizer. The increase of radioactivity as a result of the modification, if any, would be minor because the spent fuel affected would be that which has been in the pool for several years. That fuel would be relatively cool, thermally, and radionuclides in the fuel would have decayed significantly.

While we believe that there should not be an increase in solid radwaste due to the modification, as a conservative estimate we have assumed that the amount of solid radwaste may be increased by 45 cubic feet of resin a year from the demineralizer (an additional resin bed/year). The annual average amount of solid waste shipped from both units is about 58,800 cubic feet per year. If the storage of additional spent fuel does increase the amount of solid waste from the SFP purification systems by about 45 cubic feet per year, the increase in total waste volume shipped would be less than 0.1% and would not have any significant environmental impact.

The licensee plans to remove the present spent fuel racks before they are contaminated and dispose of them as scrap. If the proposed modification of the SFP is not accomplished in time to prevent contamination of the present racks, the licensee has estimated that about 2,695 cubic feet of low level radwaste will be generated in removal of the contaminated fuel racks when the modification is made. The total waste shipped from the plant would be increased by less than 2% per year when averaged over the lifetime of the plant. This will not have any significant incremental environmental impact.

4.4.6 Occupational Exposures

Since the licensee plans to dispose of the present SFP storage racks before they are contaminated, no occupational dose would result from their disposal and the installation of the higher density racks. In the event the modification takes place after spent fuel is stored in the spent fuel pool, there will be some radiation exposure to the plant personnel who replace the racks which have been exposed to radioactively contaminated coolant. Based on information we have on exposures to personnel from pressurized water reactors which already have modified their spent fuel storage pools, we would expect the exposure at the North Anna Power Station to be less than 20 man-rem. This installation is expected to be performed only once during the lifetime of the station; therefore, any resultant exposure would represent only a small fraction of the total man-rem burden from expected occupational exposure.

We have estimated the increment in onsite occupational dose 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 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 dose rates in the pool area because of the depth of water shielding the fuel. The occupational radiation exposure resulting from the proposed action represents a negligible burden. Based on present and projected operations in the spent fuel pool area, we estimate that the proposed modification should add less than one percent to the total annual occupational radiation exposure burden at this facility. This small increase in radiation exposure will not affect the licensee's ability to maintain individual occupational doses as low as is reasonably achievable and within the limits of 10 CFR 20. Thus, we conclude that storing additional fuel in the SFP will not result in any significant increase in doses received by occupational workers.

If there is an incremental 20 man-rem increase in occupational exposure, the increased risk of premature fatal cancer induction is predicted to be much less than one event (0.002 events estimated from data for the population as a whole, as given in the BEIR report[10]). The increased risk of this exposure on genetic effects to the ensuing five generations is also predicted to be much less than one event (0.005 events estimated from data for the population as a whole, as given in the BEIR report[10]). For a selected population such as is likely for the exposed workers involved, consisting principally of males in the ages from 20 to 40, these risks would tend to be somewhat less.

4.4.7 Evaluation of Radiological Impact

As discussed above, the proposed modification does not significantly change the radiological impact determined in the FES and the Addendum to the FES.

4.5 Impacts on the Community

The new storage racks were fabricated offsite and shipped to the station, where they are stored. Only a few truck or rail shipments would be involved in shipment of these racks and disposal of the present ones. The impacts of dismantling the present racks and installing the new ones will be limited to those normally associated with metal working activities. During fuel handling operations, the impacts will be confined to the spent fuel storage building. Consequently, no significant impact on the community is expected to result from the fuel rack conversion or subsequent operation with increased storage of spent fuel in the SFP.

5.0 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 a postulated fuel handling accident (the design basis event) in the SFP area from those values reported in the FES dated April 1973.

The licensee has modified the design of the SFP to provide a wall between the spent fuel storage area and the fuel cask loading pit to preclude damage to stored fuel in the event of a cask drop and/or tip. This modification was evaluated and found acceptable in Supplement 8 to the Safety Evaluation Report dated December 1977.

Furthermore, the staff has under way a generic review of load handling operations in the vicinity of spent fuel pools to determine the likelihood of a heavy load impacting fuel in the pool and, if necessary, the radiological consequences of such an event. The licensee is prohibited by the operating license technical specifications from moving loads with weight in excess of 2500 pounds over spent fuel assemblies in the SFP. With this restriction, we have concluded that the liklihood of a heavy load handling accident is sufficiently small that acceptability of the proposed modification is not affected and no additional restrictions on load handling operations in the vicinity of the SFP will be necessary while the generic review is under way (see Sect. 2.4 of the Safety Evaluation related to the proposed modification, dated January 29, 1979).

6.0 ALTERNATIVES

The staff has considered the following alternatives to the proposed expansion of the SFP storage capacity at North Anna Units 1 and 2: (1) reprocessing the spent fuel; (2) shipment of spent fuel to a separate fuel storage facility; (3) shipment of spent fuel to another reactor site; (4) lengthening the fuel cycles; (5) reduced plant operation; and (6) shutdown of Units 1 and 2. These alternatives are discussed below.

6.1 Reprocessing of Spent Fuel

As discussed earlier, none of the three commercial reprocessing facilities in the United States is currently operating. The General Electric Company's Midwest Fuel Recovery Plant at Morris, Illinois (MO) has not been licensed and Nuclear Fuel Services, Inc. (NFS) informed the Nuclear Regulatory Commission on September 22, 1976, that it was "withdrawing from the nuclear fuel reprocessing business." The NFS facility is on land owned by the State of New York and leased to NFS through 1980. The Allied-General Nuclear Services (AGNS) reprocessing plant at Barnwell, South Carolina, received a construction permit on December 18, 1970. In October 1973, AGNS applied for an operating license for the reprocessing facility; construction of the reprocessing facility is essentially complete but no operating license has been granted. On July 3, 1974, AGNS applied for a materials license to receive and store up to 400 MTU of spent fuel in the onsite storage pool, on which construction has also been completed but hearings with respect to this application have not been held and no license has been granted.

In 1976, Exxon Nuclear Company, Inc. submitted an application for a proposed Nuclear Fuel Recovery and Recycling Center (NFRRC) to be located at Oak Ridge, Tennessee. The plant would include a storage pool that could store up to 7,000 MTU in spent fuel. However, licensing review of this application was discontinued in 1977 as discussed below.

On April 7, 1977, the President issued a statement outlining his policy on continued development of nuclear energy in the U.S. The President stated that: "We will defer indefinitely the commercial reprocessing and recycling of the plutonium produced in the U.S. nuclear power programs. From our own experience, we have concluded that a viable and economic nuclear power program can be sustained without such reprocessing and recycling."

On December 23, 1977, the Nuclear Regulatory Commission terminated the fuel cycle licensing actions involving mixed oxide fuel (GESMO) (Docket No. RM-50-5), the AGNS' Barnwell Nuclear Fuel Plant Separation Facility, Uranium Hexafluoride Facility and Plutonium Product Facility (Docket Nos. 50-332, 70-1327 and 70-1821), the Exxon Nuclear Company, Inc. Nuclear Fuel Recovery and Recycling Center (Docket No. 50-564), the Westinghouse Electric Corporation Recycle Fuels Plant (Docket No. 70-1432), and the Nuclear Fuel Services, Inc. West Valley Reprocessing Plant (Docket No. 50-201). The Commission also announced that it would not at this time consider any other applications for commercial facilities for reprocessing spent fuel, fabricating mixed-oxide fuel, and related functions. Consideration of these or comparable facilities has been deferred indefinitely. Accordingly, the Staff considers that shipment of spent fuel to such facilities for reprocessing is not a feasible alternative to the proposed expansion of North Anna SFP storage capacity, especially when considered in the relevant time frame - i.e., 1982 and at least several years thereafter - when the expanded capacity will be needed. Even if the government policy were changed tomorrow to allow reprocessing of spent fuel, the present backlog of spent fuel at various plants and the time it would take to bring adequate reprocessing capacity on line would require that current spent fuel be stored somewhere for up to another 10 years.

6.2 Independent Spent Fuel Storage Facility

An alternative to expansion of onsite spent fuel pool storage is the construction of new "independent spent fuel storage installations" (ISFSI). Such installations could provide storage space in excess of 1,000 MTU of spent fuel. This is far greater than the capacities of onsite storage pools. The fuel storage pools at MO and NFS are functioning as smaller ISFSIs although this was not the original design intent. The license for the GE facility was amended on December 3, 1975 to increase the storage capacity to about 750 MTU; and, as of August 30, 1978, 310 MTU was stored in the pool in the form of 1196 spent fuel assemblies. An application for an 1100 MTU capacity addition is pending and the present schedule calls for completion in 1980 if approved. However, by a motion dated November 8, 1977, General Electric requested the Atomic Safety and Licensing Board to suspend indefinitely further proceedings on this application. This motion was granted.

The staff has discussed the status of storage space at Morris with GE personnel. We were informed that GE is primarily operating the MO facility to store either fuel owned by GE (which had been leased to utilities on an energy basis) or fuel which GE had previously contracted to reprocess. We were also informed that the present GE policy is not to accept spent fuel for storage except fuel for which GE has a previous commitment.* There is no such commitment for North Anna spent fuel. The licensee estimated[1] that the cost of shipping 550 fuel assemblies from North Anna to Morris would exceed $9,500,000 (in 1977 dollars), or $16,750 per assembly. This is substantially more than the estimated cost of $2,700,000 (or $4,770 per added assembly) to expand the North Anna SFP capacity from 400 to 966 assemblies.

*GE letter to NRC dated May 27, 1977. The licensee had a reprocessing contract which was terminated by GE.

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The NFS facility has capacity for about 260 MTU, with approximately 170 MTU presently stored in the pool at West Valley. Although the storage pool is not full, NFS has indicated that it is not accepting additional spent fuel, even from the reactor facilities with which it had reprocessing contracts.

If the receiving and storage station at Barnwell is eventually licensed to accept spent fuel, as discussed in Section 6.1, it would be functioning as an ISFSI until the reprocessing facilities there are licensed to operate. The pool has unused space for about 400 MTU, but AGNS has indicated that it does not wish to operate the storage facility without reprocessing. The cost of shipping 566 assemblies from North Anna to Barnwell has been estimated by the licensee to exceed $6,500,000 (in 1977 dollars), or $11, 485 per assembly compared to $4,770 per assembly for the proposed expansion at North Anna. Storage charges at AGNS would be additional.

With respect to construction of new ISFSIs, on October 6, 1978 the NRC proposed a new Part 72 of its regulations specifying procedures and requirements for the issuance of relevant licenses, along with requirements for the siting, design, operation and record keeping activities of the facilities (43 FR 46309). The staff has estimated that at least five years would be required for completion of an ISFSI This estimate assumes one year for preliminary design; one year for preparation of the license application, environmental report, and licensing review in parallel with one year for detail design; two and one-half years for construction and receipt of an operating license; and one-half year for plant and equipment testing and startup.

Industry proposals for additional independent spent fuel storage facilities are scarce to date. In late 1974, E. R. Johnson Associates, Inc. and Merrill Lynch, Pierce, Fenner and Smith, Inc. issued a series of joint proposals to a number of electric utility companies having nuclear plants in operation or contemplated for operation, offering to provide independent storage services for spent nuclear fuel. A paper on this proposed project was presented at the American Nuclear Society meeting in November 1975 (ANS Transactions, 1975 Winter Meeting, Vo.. 22, TANSAO 22-1-836, 1975). In 1974, E. R. Johnson Associates estimated the construction cost would be equivalent to approximately $9,000 per spent fuel assembly.

Several licensees have evaluated construction of an ISFSI and have provided cost estimates. In 1975, Connecticut Yankee, for example, estimated that an independent facility with a storage capacity of 1,000 MTU (BWR and/or PWR assemblies) would cost approximately $54 million and take about 5 years to put into operation. The Commonwealth Edison Company estimated the construction cost of an ISFSI in 1975 at about $10,000 per fuel assembly. To this would be added the costs for maintenance, operation, safeguards, security, interest on investment, overhead, transportation and other costs. Vepco's more current estimate for a new storage pool, either on or offsite, is approximately $25 million (in 1977 dollars), or $22,000 per fuel assembly.[1] Considering these varied estimates, the staff has concluded that the capital costs of a new ISFSI would now be in the range of $20,000 to $30,000 per spent PWR fuel assembly.

For the long term, the U.S. Department of Energy (DOE) is modifying its program for nuclear waste management to include design and evaluation of a long term repository to provide Government storage of unreprocessed spent fuel rods in a retrievable condition. It is estimated that the long-term storage facility will start accepting commercial spent fuel in the time frame of 1990 to 1993. The criteria for acceptance is that the spent fuel must have decayed a minimum of ten years so it can be stored in dry condition without need for forced air circulation.

As an interim alternative to the long term retrievable storage facility, on October 18, 1977,[8] DOE announced a new "spent nuclear fuel policy." DOE will determine industry interest in providing interim fuel storage services on a contract basis. If adequate private storage services cannot be provided, the Government will provide interim fuel storage facilities. These interim facilities would be designed for storage of the spent fuel under water. DOE, through its Savannah River Operations Office, is preparing a conceptual design for an interim spent fuel storage pool of about 5000 MTU capacity. Congressional authorization has been requested to borrow $300 million (about $30,000 per spent PWR fuel assembly) for design and construction of this facility.[11]

Based on recent DOE testimony before Congress,[7] it appears that the earliest DOE's interim storage pool could be licensed to accept spent fuel would be about 1984. However, DOE has also stated its intent not to accept any spent fuel that has not decayed for a minimum of five years.[8] Since North Anna spent fuel would thus not be accepted before November 1984, the licensee would have to store the spent fuel elsewhere until that time, in order to continue operation with full-core off-load capability after the fall of 1981.

Based on the above information, neither an independent spent fuel storage installation or a Government interim storage facility appears to be a feasible alternative to meet the licensee's needs. The staff does not regard the alternative of storing spent fuel at Morris, West Valley or Barnwell as offering a significant environmental advantage over construction and use of an expanded storage facility at North Anna. The availability of this alternative is speculative and it also would be considerably more expensive. Furthermore, constructing a new ISFSI or a Governmental interim storage facility would clearly have a greater environmental impact than the proposed action. It would require additional land and considerable equipment and structures, whereas installing new racks at North Anna requires only the small amount of material necessary to construct the racks and minor personnel exposure during installation, if the present racks are contaminated prior to their removal.

6.3 Storage at Another Reactor Site

A possibility is to ship the spent fuel from North Anna to the licensee's Surry Nuclear Power Station which is located approximately 110 miles (by road) to the southeast. Expansion of Surry SFP capacity to 1044 fuel assemblies was previously authorized. However, the full-core discharge capability at Surry would be lost in 1983, assuming that the spent fuel from North Anna 1 and 2 in excess of its present storage capacity were stored at Surry in addition to the fuel assemblies normally discharged from Surry units 1 and 2. If full-core discharge capability were not maintained at Surry, its SFP storage capacity would be exceeded in 1984. Therefore, this possibility offers only a very short-term solution.

Offsite shipment for short-term storage of spent fuel would involve additional handling and expense since the fuel would eventually have to be reshipped to other facilities. The transportation cost would probably be on the order of $2,000 to $4,000 for each of the North Anna fuel assemblies stored at the Surry plant, plus $10,000 or more per assembly for subsequent shipment to Barnwell, South Carolina or another ISFSI when such facilities become available. The additional transportation and handling involved would also incur the minor environmental impacts associated with these actions. Therefore, the staff has concluded that short-term storage of the North Anna spent fuel at Surry does not offer a significant environmental advantage over the proposed SFP modification at North Anna and it would be substantially more expensive.

Storage of spent fuel at another reactor facility outside the VEPCO system would be physically possible but is not considered a realistic alternative. Most operating reactors in the United States are experiencing shortages in spent fuel storage capacity and could not efficiently provide storage space for spent fuel from other plants. According to a survey conducted by the former Energy Research and Development Administration,[12] up to 27 of the operating nuclear power plants will lose the ability to refuel during the period 1977-1986 without additional spent fuel storage pool expansions or access to offsite storage facilities. Thus, the licensee cannot assuredly rely on any other power facility to provide additional storage capability except on a short-term emergency basis. If space were available in another reactor facility, it is unlikely that the cost would be less than storage onsite as proposed.

6.4 Lengthening the Fuel Cycle

Most of the present fuel cycles for light water reactors were based on the premise that spent fuel would be reprocessed and the fissionable material recovered and recycled. With the change in national policy to a "throw- away" cycle, the industry is evaluating higher initial loadings, higher burnups, recycling of low burnup fuel assemblies and extension of periods between refuelings. These types of changes generally are not an immediate alternative. To obtain data to support higher burnups, exposure of experimental fuel in reactors for several years will be necessary. The lead time for design and procurement of core reloads is one to two years. However, in the long run, redesigning the fuel cycle can extend the time between refuelings by 50 to 100%. The number of fuel assemblies that would be replaced during each refueling would increase, but the total number of spent fuel assemblies generated over the lifetime of the facility would be reduced.

In planning fuel cycles, however, there are other factors that have to be taken into consideration other than just minimizing the number of spent fuel assemblies generated. For example, utilities normally try to schedule refuelings during the spring and fall to avoid having the facility shut down during peak load periods. The licensee currently designs 18-month reload cycles for the units at Surry Nuclear Power Station. "To date, one 18-month reload cycle has been completed and two cycles are currently in operation at Surry. Since Vepco already has experience in the design and operation of extended reload cycles, an extended cycle length design could be introduced in Cycle 3 for North Anna Units No. 1 and 2. Initiation of the extended cycle design for Cycle 2 was evaluated and found not economically attractive based on studies performed for Surry Units No. 1 and 2."[2]

As indicated in Section 2.0, the staff has considered the effect of 18- month reload cycles and concluded that adoption of the 18-month cycles after Cycle 2 at North Anna 1 and 2 would not extend its present full-core off-load capability beyond the fall of 1981. Even without the full-core off-load capability, the SFP would not be able to accommodate a normal reload from either unit after the fall of 1982. Consequently, one unit would have to shut down in the spring of 198[illegible] and the other unit would have to shut down in the fall of 1984. Therefore, this arrangement would not meet the station's need for additional storage capacity until at least November 1984 when storage in DOE interim facilities may become possible, and that possibility is uncertain. Furthermore, since the staff previously concluded that Units 1 and 2 can be operated with only minimal environmental impacts (FES Addendum, Sect. A.10.3), the operation of other generating facilities to meet load requirements during shutdown of these units would not offer a significant environmental advantage.

6.5 Reduced Plant Output

Nuclear plants are usually base-loaded because of their lower costs of generating a unit of electricity compared to other thermal power plants on the system. Therefore, reducing the plant output to reduce spent fuel generation is not an economical use of the resources available. The total production costs remain essentially constant, irrespective of plant output. Consequently, the unit cost of electricity is increased proportionately at a reduced plant output. We note that North Anna Unit 1 has been operating at a cumulative capacity factor of approximately 81 percent; but Units 1 and 2 would have to operate at about half of this capacity factor to avoid filling the SFP prior to the fall of 1984, when government interim storage facilities, if available, may accept spent fuel from North Anna. If the plant is forced to substantially reduce output because of spent fuel storage restrictions, the licensee would be required to purchase replacement power or operate its higher cost fossil-fired units, if available, without any accompanying environmental advantage. The cost of electricity would therefore be increased without any likely reduction of environmental impact.

6.6 Shutdown of the Facility

Shutdown of North Anna Units 1 and 2 after the SFP is full would result in cessation of approximately 1800 megawatts of electrical production (at full load). The licensee has estimated that replacement energy conservatively would cost $250,000 per day for each unit shut down, based on the average difference in present fuel costs between fossil-fired generation and nuclear generation on its system. At $500,000 per day for the two units, the estimated cost of $2,700,000 for the proposed expansion of the SFP capacity to avoid such a shutdown would be offset in 6 days. While the availability of replacement energy and its cost in the future are uncertain, it is obvious from the above figures that the alternative of shutting down the facility would result in far greater costs than expanding the SFP storage capacity to allow several years of additional operation until other storage or disposal facilities are available.

The need for North Anna Units 1 and 2 was substantiated in previous licensing actions. The staff is not aware of any reason why that need will substantially diminish in the future. Furthermore, since the staff previously concluded that Units 1 and 2 can be operated with only minimal environmental impacts (FES Addendum, Sect. A.10.3), the operation of other generating facilities to meet load requirements during shutdown of these units would not offer a significant environmental advantage. Therefore, we do not regard shutdown of these units to be a desirable alternative to the proposed action.

6.7 Comparison of Alternatives

In Section 4 the incremental environmental impacts of the proposed expansion of the SFP storage capacity were evaluated and were found to be insignificant. Therefore, none of the alternatives to this action offers a significant environmental advantage. Furthermore, alternatives (1), reprocessing, and (2), storage at an independent spent fuel storage facility, are not presently available to the licensee and are not likely to become available in time to meet the licensee's need. Alternative (3), shipment to another reactor site, would be a short-term solution but would eventually involve shipment to another temporary storage facility. Alternative (4), lengthening the fuel reload cycle would not alleviate the licensee's need for additional storage capacity after 1981. Alternatives (5), reducing the plant output, and (6), shutdown of the facility, would both entail substantial additional expense for replacement electrical energy which may not be available for prolonged periods of time.

Table 1 presents a summarized comparison of the alternatives, in the order presented in subsections 6.1 through 6.6. From inspection of the table, it can be seen that the most cost effective alternative is the proposed spent fuel pool modification, which is included as alternative (7). The SFP modification would provide the required storage capacity, while minimizing environmental effects, capital cost and resources committed. The staff therefore concluded that expansion of the North Anna SFP storage capacity is superior to the alternatives available or likely to become available within the necessary time frame.

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TABLE 1

COMPARISON OF ALTERNATIVES

	Alternative	Cost	Benefit
1.	Reprocessing of Spent Fuel	>$10,000/assembly	Continued production of electrical energy by Units 1 & 2. This alternative is not available either now or in the foreseeable future.
2a.	Storage at Reprocessor's Facility	$3,000 to $6,000/assembly per yr* plus shipping costs of $11,485 to $16,785 per assembly.	Continued production of electrical energy by units 1 & 2. This alternative is not available now or in the foreseeable future.
2b.	Storage at a new Independent Facility	$20,000-$40,000/assembly plus operating and transportation costs, and environmental impacts related to development of a new facility.	Continued production of electrical energy by Units 1 & 2. This alternative could not be available for at least 5 years.
3.	Storage at Other Nuclear Plants	$2,000-$4,000/assembly for shipment to Surry, plus $10,000/assembly for subsequent shipment to an ISFSI; increased environmental costs of extra shipping and handling.	Continued production of electrical energy. However, this alternative is unlikely to be available except at Surry, and then only until 1983 or 1984.
4.	Lengthening Fuel Cycle	$1,000 per storage space saved,** plus replacement electricity (see alt. 6).	Continued production of electrical energy by one unit for an additional year.
5.	Reduction in Plant Output	See below for replacement electricity costs. Amount of replacement required would be equivalent to at least 50% reduction in rated output of Units 1 and 2.	Continued production of electrical energy by Units 1 and/or 2 - but at much higher unit cost. The generation of replacement electricity elsewhere would probably create no less impacts.
6.	Reactor Shutdown	Replacement electricity costs are estimated to be as much as $500,000/day if both units are shutdown, plus the costs of maintenance and security of the plant.	Environmental impacts associated with plant operation would cease but the generation of replacement electricity elsewhere would probably create no less impacts.
7.	Increase storage capacity of North Anna SFP	$4,770/assembly space added	Continued production of electrical energy by North Anna Units 1 & 2.

*Since NFS and MO are not accepting spent fuel for storage, the cost range reflects prices that were quoted in 1972 to 1974. GE estimates that if they were to accept spent fuel on a temporary basis until a utility could locate other storage space, it would probably be at the rate of $20,000 per MTU, which equates to about $15,300 per PWR assembly.

**Based on estimated R&D costs, differential fuel costs and costs for revised ECCS and reload analyses.

7.0 EVALUATION OF THE PROPOSED ACTION

7.1 Unavoidable Adverse Environmental Impacts

7.1.1 Physical Impacts

As discussed in Sections 4.1, 4.2 and 4.3, expansion of the SFP storage capacity would not result in significant adverse environmental impacts on the land, water, air or biota of the area.

7.1.2 Radiological Impacts

As discussed in Section 4.4, expansion of the SFP storage capacity will not create significant radiological effects. The additional total body dose that might be received by an individual at the site boundary or the estimated population within a 50-mile radius is less than 0.0002 mrem/yr and 0.0005 man-rem/yr, respectively. These exposures are small compared to the fluctuations in the annual dose this population receives from background radiation and represent an increase of less than 0.1% of the exposures from the plant evaluated in the FES. The total occupational exposure of workers during removal of the present storage racks (if they become contaminated) and installation of the new racks is expected to be less than 20 man-rem. This is a small fraction of the total man- rem burden from occupational exposure at the plant. 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 present total annual occupational exposure at this facility.

7.2 Relationships Between Local Short-Term Use of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

Expansion of the SFP storage capacity would permit more efficient use of the land already committed to this purpose. There would be no other changes from the evaluation in the FES.

7.3 Irreversible and Irretrievable Commitments of Resources

7.3.1 Water, Land and Air Resources

The proposed action would not result in any significant changes in the commitments of water, land and air resources identified in the FES.

7.3.2 Material Resources

Under the proposed modification, the present spent fuel storage racks would be replaced by higher-density racks that will increase the SFP storage capacity from 400 to 966 fuel assemblies. In its submittal, the licensee estimated that approximately 322,000 pounds of type 304 stainless steel will be required. This is a small percentage of the stainless steel used annually in the United States (about 2.8×10^{11} lb) and does not represent a significant commitment of resources. No other material resources will be required since the fuel pool will otherwise remain unchanged.

If the present storage racks are replaced before being contaminated, as expected, they will be scrapped and the materials can be reused.

Longer term storage of spent fuel assemblies withdraws the unburned uranium from the fuel cycle for a longer period of time. Its usefulness as a resource in the future, however, is not changed. The provision of longer onsite storage does not result in any cumulative effects due to plant operation since the throughput of materials does not change. Thus, the same quantity of radioactive material will have been produced when averaged over the life of the plant. This licensing action would not constitute a commitment of resources that would affect the alternatives available to other nuclear power plants or other actions that might be taken by the industry in the future to alleviate fuel storage problems.

7.4 Commission Policy Statement Regarding Spent Fuel Storage

On September 16, 1975, the Commission announced (40FR42801) its intent to prepare a generic environmental impact statement on handling the storage of spent fuel from light water reactors. In this notice, the Commission also announced its conclusion that it would not be in the public interest to defer all licensing actions intended to ameliorate a possible shortage of spent fuel storage capacity pending completion of the generic environmental impact statement. The draft statement was issued for comment on March 17, 1978, (Draft Generic Environmental Impact Statement on Handling and Storage of Spent Light Water Power Reactor Fuel" NUREG-0404, March 1978).

The Commission directed that in the consideration of any such proposed licensing action, among other things, the following five specific factors should be applied, balanced, and weighed in the context of the required environmental statement or appraisal:

1. It is likely that the licensing action proposed here would have a utility that is independent of the utility of other licensing actions designed to ameliorate a possible shortage of spent fuel capacity?

As discussed in this EIA, the North Anna SFP is not expected to have sufficient storage capacity available for off-loading a full-core after the reloads of Units 1 and 2 are accomplished in the fall of 1981. Lacking assurance that storage capacity will be available elsewhere except on an emergency basis, expansion of the SFP capacity will therefore be necessary if that capability is to be maintained. It is also doubtful that the licensee could ship spent fuel to interim storage facilities being proposed by DOE prior to November 1984 because of DOE's intent not to accept spent fuel until it has decayed for five years. This is well beyond the fall of 1982 when the licensee expects to need space in the SFP in order to accomplish the reloads scheduled for that time. Furthermore, there is a growing need for offsite storage facilities to accommodate spent fuel which has been accumulating at other reactor sites for years. We have therefore concluded that a need for additional SFP storage capacity exists at North Anna which is independent of the utility of other licensing actions designed to ameliorate a possible shortage of spent fuel storage capacity.

2. Is it likely that the taking of the action here proposed prior to the preparation of the generic statement would constitute a commitment of resources that would tend to significantly foreclose the alternatives available with respect to any other licensing actions designed to ameliorate a possible shortage of spent fuel storage capacity?

The only material resources needed for the proposed action would be approximately 322,000 pounds of type 304 stainless steel. This is less than 0.0001 percent of the stainless steel used annually in the United States. The non-material resources required would be primarily the engineering talent and about 5000 man-hours of labor to accomplish the SFP modification.

The increased storage capacity of the North Anna spent fuel pool was also considered as a nonmaterial resource and was evaluated relative to proposed similar licensing actions at other nuclear power plants, fuel reprocessing facilities and fuel storage facilities. We have determined that the proposed expansion in the storage capacity of the SFP is only a measure to allow for continued operation of this facility, and it will not affect similar licensing actions at other nuclear power plants. In 1978-88, the modified pool is estimated to be full if no fuel is removed. At that time, the licensee will need to ship spent fuel to other storage or disposal facilities which are being contemplated by industry and the Department of Energy. Such facilities will be needed even earlier to accommodate spent fuel from other nuclear power plants.

We have therefore concluded that the expansion of the SFP at North Anna, prior to issuance of the final generic statement, does not constitute a commitment of either material or nonmaterial resources that would tend to significantly foreclose the alternatives available with respect to any other individual licensing actions designed to ameliorate a possible shortage of spent fuel storage capacity.

3. Can the environmental impacts associated with the licensing action here proposed be adequately addressed within the context of the present application without overlooking any cumulative environmental impacts?

Potential nonradiological and radiological impacts resulting from the fuel rack conversion and subsequent operation of the expanded SFP at this facility were considered by the staff.

No environmental impacts on the environs outside of the spent fuel storage building are expected during removal of the existing racks and installation of the new racks. The impacts within this building are expected to be limited to those normally associated with metal working activities and to the occupational radiation exposure to the personnel involved.

The additional thermal effluent from the station and the additional water use associated with storage of the greater number of spent fuel assemblies were determined to be very small compared to those presently associated with Units 1 and 2. Expansion of the SFP would not result in radioactive effluent releases that could significantly affect the quality of the human environment during either normal operation of the expanded SFP or under postulated fuel handling accident conditions.

We have therefore concluded that the environmental impacts associated with this licensing action have been adequately addressed without overlooking any cumulative impacts.

4. Have the technical issues which have arisen during the review of this application been resolved?

This Environmental Impact Appraisal and the related Safety Evaluation adequately address the health, safety and environmental technical issues which have arisen during consideration of this application.

5. Would a deferral or severe restriction on this licensing action result in substantial harm to the public interest?

The staff has evaluated the impact of deferral of the proposed action as it relates to the public interest. We have found that there are significant economic advantages associated with this proposed action, and that expansion of the storage capacity of the SFP will have a negligible environmental impact. Therefore, it is clear that the proposed action itself is in the public interest.

Deferral of this action until the publication of the Final Generic Environmental Impact Statement (GEIS) would not be in the public interest. There is nothing in the Draft GEIS which is in conflict with the conclusions presented here - that the proposed rack modification is both a cost-effective and environmentally benign approach to the spent fuel storage problem as an interim measure. Further, there is nothing to suggest at this point that the Final GEIS will reach any different conclusions in this regard.

While it is true that North Anna Unit 1 does not face certain shutdown until 1983, and Unit 2 not until 1984, if 18-month reload cycles are adopted with the third refueling, there are other factors which weigh in favor of issuing the proposed amendment now. Following the refueling of Unit 1 in the fall of 1981, the existing SFP will not have sufficient room to accommodate a full core (157 assemblies) should this be necessary to effect repairs, for example, to return the unit to service. After this point in time, North Anna faces the possibility of shutdown at any time due to lack of a full core reserve in the SFP. While no serious adverse consequences to the public health and safety or the environment would likely result from this action itself, the reactor shutdown would, of course, remove the unit from service. This, in turn, could adversely affect the licensee's ability to meet electrical energy needs, or force the operation of other plants which are less economical to operate or have greater environmental impact, thereby resulting in substantial harm to the public interest.

Following the fall 1979 refueling, spent fuel in the pool would increase the difficulty of re-racking the pool and would result in occupational exposure to workers involved in this operation. In addition, contamination of the present fuel racks by exposure to the spent fuel would create the necessity of disposing of such racks as approximately 2695 cubic feet of low level radwaste at a licensed burial site when the modification is made. For these reasons, delay until after refueling is undesirable from a public interest standpoint.

Based on the foregoing, we conclude that public interest consideration weighs in favor of taking the proposed action now.

We have applied, balanced, and weighed the five specific factors and have concluded that the proposed expansion of the spent fuel pool is in the public interest.

8.0 BENEFIT-COST BALANCE

As discussed in Section 4 of this assessment, expansion of the North Anna SFP storage capacity would not result in any significant adverse environmental impacts on the land, water, air or biota of the area and it would not create any significant radiological effects.

During construction, the impacts on the community would be limited to those of a few truck or rail shipments carrying the new storage racks to the station and removing the present racks. No incremental occupational exposure of workers would occur if the modification is accomplished, as planned, before the present racks must otherwise be used for storage of spent fuel beginning in November 1979. However, if the racks are removed after being contaminated, the total occupational exposure is estimated to be less than 20 man-rem.

During operation of Units 1 and 2 with the expanded SFP capacity, a small additional amount of heat would be released by evaporation of water from the service water reservoir and up to 12 gpm of additional makeup water would be required by the service water system. The additional total body dose that might be received by an individual at the site boundary or the estimated population within a 50-mile radius would be less than 0.1% of the exposures from the plant evaluated in the FES. These exposures are small compared to the annual dose this population receives from background radiation. Occupational radiation exposure at the station is not expected to increase more than one percent.

The capital cost of the proposed modification is $2,700,000. This is considerably less than the cost of any of the alternatives considered in Section 6 which can meet the licensee's need for additional spent fuel storage capacity.

The benefit of the proposed modification is sufficient spent fuel storage capacity to allow continued operation of North Anna Units 1 and 2, with full-core off-load capability, beyond the fall of 1981 until 1987-1988. By that time, adequate interim storage facilities provided by the U.S. Department of Energy are expected to be available. This particular licensing action would not preclude the development of such government facilities and would not affect similar licensing actions at other nuclear power plants.

The staff therefore concludes that the benefits from continued operation of the facility far outweigh the costs attributable to the proposed modification.

9.0 BASIS AND CONCLUSION FOR NOT PREPARING AN ENVIRONMENTAL IMPACT STATEMENT

We have reviewed this proposed facility modification relative to the requirements set forth in 10 CFR Part 51 and the Council of Environmental Quality's Guidelines, 40 CFR 1500.6, and have applied, weighed, and balanced the five factors specified by the Nuclear Regulatory

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Commission in 40 FR 42801. We have determined that the proposed license amendment will not significantly affect the quality of the human environment and that there will be no significant environmental impact attributable to the proposed action other than that which has already been predicted and described in the Final Environmental Statement dated April 1973 and the Addendum to the Final Environmental Statement dated November 1976. Therefore, the staff has found 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.

References

1. Letter from Virginia Electric and Power Company to Mr. Edson G. Case, U.S. Nuclear Regulatory Commission, May 1, 1978.

2. Letter from Virginia Electric and Power Company to Mr. Harold R. Denton, U.S. Nuclear Regulatory Commission, September 7, 1978, page 5 of attachment.

3. Same as ref. 2 except p. 8.

4. Same as ref. 2 except p. 3.

5. Same as ref. 2 except p. 4.

6. Draft Environmental Impact Statement on Storage of U.S. Spent Power Reactor Fuel, U.S. Department of Energy, August 1978.

7. Testimony before the House of Representatives' Committee on Interior and Insular Affairs by Worth Bateman, Acting Deputy Assistant Secretary for Energy Technology, January 26, 1979, p. 5.

8. Department of Energy News release dated October 18, 1977, announcing a "New Spent Nuclear Fuel Policy" and public briefing held October 26, 1977.

9. "Control of Nuclear Fuel Storage Basin Water Quality by Use of Powdered Ion Exchange Resins and Zeolites," L. L. Denio, D. E. Knowlton and E. E. Voiland, presentation at ASME-IEEE Joint Power Generation Conference, September 1977, Paper 77-JPGC-NE-15.

10. "The Effects on Populations of Exposures to Low Levels of Ionizing Radiation (BEIR Report)," National Academy of Sciences, November 1972, reprinted July 1974.

11. Department of Energy news release dated February 26, 1979, announcing submittal of legislation to Congress authorizing DOE to construct or acquire facilities for temporary storage of spent fuel from commercial nuclear power plants.

12. "LWR Spent Fuel Disposition Capabilities, 1977-1986," ERDA 77-25, U.S. Energy Research and Development Administration, 1977.