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

ENVIRONMENTAL IMPACT APPRAISAL BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NOS. 27 AND 12 TO LICENSE NOS. DPR-53 AND DPR-69

RELATING TO MODIFICATION OF THE SPENT FUEL POOL

BALTIMORE GAS & ELECTRIC COMPANY

CALVERT CLIFFS NUCLEAR POWER PLANT UNIT NOS. 1 AND 2

DOCKET NOS. 50-317 AND 50-318

1.0 DESCRIPTION OF PROPOSED ACTION

By letters dated August 5, 1977, and September 7, 1977, Baltimore Gas and Electric Company (BG&E) proposed to change the spent fuel pool (SFP) storage design for Calvert Cliffs Nuclear Power Plant Unit Nos. 1 and 2 (CCNPP) from the design which was reviewed and approved in the operating license review and described in the Final Safety Analysis Report (FSAR). The proposed change consists of increasing the existing spent fuel storage capacity for both units from 410 fuel assemblies to 1056 fuel assemblies. In response to our questions, BG&E submitted supplemental information by letters dated October 7 and 19, 1977, November 1, 4, 16 and 17, 1977, and December 7, 1977.

The modification evaluated in this environmental impact appraisal is the proposal by the licensee to replace the existing spent fuel storage racks with closer spaced racks. The rack spacing would be changed from 18 inches center-to-center spacing to 13x12.5 inches center-to-center spacing of the individual spent fuel tubes.

2.0 NEED FOR INCREASED STORAGE CAPACITY

The CCNPP Unit Nos. 1 and 2 achieved initial criticality on October 7, 1974, and November 30, 1976, respectively. CCNPP Unit No. 1 was shut down on December 31, 1976, for a scheduled refueling and maintenance outage, at which time 72 fuel assemblies were replaced. The refueling schedule for Unit No. 1 shows next refueling in January 1978 and yearly thereafter. The first refueling for Unit No. 2 is scheduled for September 1978. Following this Unit No. 2 refueling outage there will not be space to offload either entire reactor core should this be necessary or desirable because of operational considerations. Likewise, following the second refueling of Unit No. 2 in late 1979, the existing fuel pool storage capacity will be used up completely.

The proposed modification would extend the spent fuel storage capability of the pool through 1982 and leave room for a complete core discharge. In our evaluation, we considered the impacts which may result from storing an additional 646 spent fuel assemblies in the SFP for an additional six years.

The proposed modification would not alter the external physical geometry of the spent fuel pool or involve significant modifications to the SFP cooling or purification systems. The proposed modification does not affect in any manner the quantity of uranium fuel utilized in the reactor over the anticipated operating life of the facility and thus in no way affects the generation of spent uranium fuel by the facility. The rate of spent fuel generation and the total quantity of spent fuel generated during the anticipated operating lifetime of the facility remains unchanged as a result of the proposed expansion. The modification will 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. On the basis of the evaluation discussed herein, we have concluded that the storage capacity of the Calvert Cliffs SFP should be increased.

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 at West Valley, New York, was shut down in 1972, for alterations and expansions; 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) Midwest Fuel Recovery Plant in Morris, Illinois, now referred to as Morris Operation (MO), is in a decommissioned condition. Although no plants are licensed for reprocessing fuel, the storage pool at Morris, Illinois, and the storage pool at West Valley, New York (on land owned by the State of New York and leased to NFS through 1980), 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, even from those power generating facilities that had contractural arrangements with NFS. Construction of the AGNS fuel 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 reprocessing facility. A fourth plant, the Exxon plant proposed for construction in Tennessee, is currently under license review.

4.0 THE PLANT

The CCNPP units are described in the Final Environmental Statement (FES), issued by the Commission in April 1973, related to the section on operation of the facilities. Each unit is a Pressurized Water Reactor (PWR) which produces 2700 megawatts thermal (MWt) and has a gross electrical output of 835 megawatts (MWe). Pertinent descriptions of principal features of the plant as it currently exists are summarized below to aid the reader in following the evaluations in subsequent sections of this appraisal.

4.1 Fuel Inventory

Each CCNPP reactor contains 217 fuel assemblies. The fuel assemblies are a cluster of 176 fuel rods or sealed tubes arranged in a 14 by 14 array. The weight of the fuel, as UO_2, is approximately 207,200 pounds. About one-third of the assemblies are removed from the reactor and replaced with new fuel each year. Present scheduling is for the refueling outage to be in the first few months for Unit No. 1 and the last few months of each year for Unit No. 2.

4.2 Purpose of Spent Fuel Pool

The SFP at CCNPP was designed to store spent fuel assemblies prior to shipment to a reprocessing facility (these assemblies are transferred from the reactor core to the SFP during a core refueling) or to allow for inspection and/or modification to core internals. The latter may require the removal and storage of up to a full core. The assemblies are initially intensely radioactive due to their fission product content and have a high thermal output. They are stored in the SFP to allow for radioactive and thermal decay.

The major portion of decay occurs during the 150-day period following removal from the reactor core. After this period, the assemblies may be withdrawn and placed into a heavily shielded fuel cask for offsite shipment. Space permitting, the assemblies may be stored for an additional period allowing continued fission product decay and thermal cooling prior to shipment.

4.2.1 Spent Fuel Pool Cooling System

The spent fuel pool for CCNPP is provided with a cooling loop which removes decay heat from fuel stored in the SFP. The cooling system for the SFP has two pumps and two heat exchangers. These are cross-connected so that any combination of a pump and heat exchanger can be used to cool the SFP for either Unit Nos. 1 or 2. There is also additional cooling available from valving the shutdown cooling system of either unit to the SFP cooling system. Each SFP cooling pump is designed to pump 1390 gallons of water

per minute. With both pumps and heat exchangers in operation the spent fuel cooling system is designed to remove $20x10^6$ BTU/hr while maintaining the fuel pool outlet water temperature at 127°F with 95°F service water cooling the heat exchangers. The shutdown cooling system when connected to the SFP is designed to remove $27x10^6$ BTU/hr while maintaining the fuel pool outlet temperature at 130°F with 95°F service water cooling the heat exchanger. After the SFP modification, the maximum possible total heat load including uncertainties will be $17.3x10^6$ BTU/hr, within the capacity of the SFP Cooling System. Our Safety Evaluation finds the maximum possible temperatures of 127°F and 155°F, for both SFP loops operating and single failure leaving one SFP loop operating, respectively, to be acceptable.

4.2.2 Spent Fuel Pool Purification System

The SFP purification loop consists of a cartridge filter, a mixed bed demineralizer and the required piping, valves and instrumentation. The SFP cooling system pumps draw water from the pool or the refueling cavity. A fraction of this flow is passed through the SFP purification loop. The water is returned to the pool or the refueling cavity.

Because we expect only a small increase in radioactivity released to the pool water as a result of the proposed modification as discussed in Section 5.3.1, we conclude the spent fuel pool filtering system is adequate for the proposed modification and will keep the concentrations of radioactivity in the pool water to acceptably low levels.

4.3 Radioactive Wastes

The plant contains waste treatment systems designed to collect and process the gaseous, liquid and solid waste that might contain radioactive material from both units. The waste treatment systems are evaluated in the Final Environmental Statement (FES) for both units dated April 1973. There will be no change in the waste treatment systems described in Section III.D.2 of the FES because of the proposed modification.

5.0 ENVIRONMENTAL IMPACTS OF PROPOSED ACTION

5.1 Land Use

The proposed modification will not alter the external physical geometry of the SFP at CCNPP. 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 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 modification will not change the basic land use of the SFP. The pool was designed to store the spent fuel assemblies from five 1/3 cores (410 assemblies) for both units. The modification would provide storage for fourteen 1/3 cores (1056 assemblies) from the two units. The pool was intended to store spent fuel. This use will remain unchanged by the proposed modification.

5.2 Water Use

There will be no significant change in plant water usage as a result of the proposed modification. As discussed subsequently, storing additional spent fuel in the SFP will increase the heat load on the SFP cooling system, which is transferred to the service water system and to the plant salt water system. The modification will not change the flow rate within these cooling systems. Since the temperature of the SFP water during normal refueling operations will remain below 127°F presented in the FSAR and evaluated in the FES, the rate of evaporation and thus the need for makeup water will not be significantly changed by the proposed modification.

5.3 Radiological

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

5.3.1 Source of Radioactive Nuclides

The additional spent fuel which would be stored due to the expansion is fuel which has decayed at least three years. 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 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 indicates that there is little radionuclide leakage from Zircaloy-clad spent fuel stored in the pools even after an extended period, over 10 years. 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. A recent Battelle Northwest Laboratory (BNWL) 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.

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5.3.2 Effect of Fuel Failures on the SFP

In handling defective fuel, the BNWL 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 demonstrated in laboratory studies and also by casual observations of pellet behavior when broken rods are stored in pools.

Operators at several reactors have discharged, stored, and/or shipped relatively large numbers of Zircaloy-clad fuel which developed defects during reactor exposures, e.g., Ginna, Oyster Creek, Nine Mile Point, and Dresden Unit Nos. 1 and 2. Several hundred Zircaloy-clad assemblies which developed one or more defects in-reactor are stored in the GE-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. Normal radioactivity concentrations in the Morris pool water are about 3×10^{-4} $\mu Ci/ml$ which is near the maximum desired concentration for occupational exposure considerations, in bathing and culinary uses. The radioactivity concentrations rose to 2×10^{-3} $\mu Ci/ml$ during a month when the water cleanup system was removed from service.

Based on the operational reports submitted by the licensees or discussions with the operators, there has not been any significant leakage of fission products from spent light water reactor fuel stored in the Morris Operation (MO) (formerly Midwest Recovery Plant) at Morris, Illinois, or at Nuclear Fuel Services' (NFS) storage pool at West Valley, New York. Spent fuel has been stored in these two pools which, while it was in a reactor, was determined to have significant leakage and was therefore removed from the core. After storage in the onsite spent fuel pool, this fuel was later shipped to either MO or NFS for extended storage. Although the fuel exhibited significant leakage at reactor operating conditions, there was no significant leakage from this fuel in the offsite storage facility.

BG&E has proposed that the 20 specially constructed cans originally designed to contain all leakage from failed fuel assemblies be eliminated in the SFP modification. These cans were not installed to meet any known Commission requirements. Based on the lack of any findings that significant radionuclides will leak from damaged fuel assemblies, we agree that the special leaking fuel cans may be eliminated from the SFP at CCNPP.

5.3.3 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 previously, 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 90 curies per year of krypton 85 may be released for both units when the modified pools are completely filled. This increase would result in an additional total body dose at the site boundary to an individual of less than 0.001 mrem/year. This dose is insignificant when compared with 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 is less than 0.001 mrem/year. This is less than the natural fluctuations in the dose this population would receive from natural background radiation. Under our conservative assumptions, these exposures represent an increase of less than 0.5% of the exposures from the plant evaluated in the FES for the individual (Table V-5) and the population (Table V-6). 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 for each unit.

Storing additional spent fuel assemblies is not expected to increase the bulk water temperature above the 127°F during normal refuelings used in the design analysis. Since the temperature of the pool water will normally be maintained below 127°F, it is not expected that there will be any significant change in evaporation rates or the release of tritium or iodine as a result of the proposed modification from that previously evaluated. Most airborne releases from the plant result from leakage of reactor coolant which contains tritium and iodine in higher concentrations than the spent fuel pool. Therefore, even if there were a slightly higher evaporation rate from the spent fuel pool, the increase in tritium and iodine released from the plant as a result of the increase in stored spent fuel would be small compared with the amount normally released from the plant and that which was previously evaluated in the FES. If levels of radioiodine become too high, the air can be diverted to charcoal filters for the removal of radioiodine before release to the environment.

5.3.4 Solid Radioactive Wastes

The concentration of radionuclides in the pool is controlled by the cartridge filter and the demineralizer and by decay of short-lived isotopes. The activity is high during refueling operations while reactor coolant water is introduced into the pool and decreases as the pool water is processed through the filter and demineralizer. The increase of radioactivity, if any, should be minor because the additional spent fuel to be stored is relatively cool, thermally, and radionuclides in the fuel will 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 64 cubic feet of resin a year from the demineralizer (2 resin beds/year). Because Unit No. 1 has operated for only 2 years and Unit No. 2 has operated for less than one year, we have estimated the annual average amount of solid waste shipped from both units from the volume of solid waste shipped from a representative number of pressurized water reactors during 1973 to 1976. This is 18,300 cubic feet per year for both units. If the storage of additional spent fuel does increase the amount of solid waste from the SFP purification systems by about 64 cubic feet per year, the increase in total waste volume shipped would be less than 0.4% and would not have any significant environmental impact.

In addition to the above, there are also the present spent fuel racks to be removed from the SFP from both units and disposed of. They will be crated and stored on site until they are disposed of as low level waste or scrap. Averaged over the lifetime of the plant, this will increase the total waste shipped from the plant by less than 2.5% and would not have any significant environmental impact.

5.3.5 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 cartridge filter and demineralizer might slightly increase due to the additional spent fuel in the pool but this increase of radioactivity should not be released in liquid effluents from the station.

The cartridge filter removes insoluble radioactive matter from the SFP water. This is periodically removed to the waste disposal area in a shielded cask and placed in a shipping container. The insoluble matter will be retained on the filter or remain in the SFP water.

The resins are periodically flushed with water to the spent resin tank. The water used to transfer the spent resin is decanted from the tank and returned to the liquid radwaste system for processing. The soluble radioactivity will be retained on the resins. If any activity should be transferred from the spent resin to this flush water, it would be removed by the liquid radwaste system.

5.3.6 Occupational Exposures

We have reviewed the licensee's plan for the removal, disassembly and disposal of 12 low density racks and the installation of 22 high density racks for both units with respect to occupational radiation exposure. The occupational radiation exposure for this operation is estimated by the licensee to be about 6.25 man-rem. We consider this to be a reasonable estimate. This operation is expected to be performed only once during the lifetime of the station and will therefore represent a very small fraction of the total man-rem burden from 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 realistic 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 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 will add less than one percent to the total annual occupational radiation exposure burden at this facility. The small increase in radiation exposure will not affect the licensee's ability to maintain individual occupational doses to 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.

5.3.7 Evaluation of Radiological Impact

As discussed above, the proposed modification does not significantly change the radiological impact evaluated in the FES.

5.4 Nonradiological Effluents

There will be no change in the chemical or biocidal effluents from the plant as a result of the proposed modification.

The only potential offsite nonradiological environmental impact that could arise from this proposed action would be additional discharge of heat to the atmosphere and to the Chesapeake Bay. Storing spent fuel in

the SFP for a longer period of time will add more heat to the SFP water. The SFP heat exchangers are cooled by the service water system which in turn is cooled by the salt water system. As discussed in the staff's Safety Evaluation, the maximum incremental heat load resulting from the SFP modification is $2.64 \times 10^{+6}$ BTU/hr. Compared with the existing heat load on the plant salt water cooling system, this small additional 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 plant. No environmental impacts on the environs outside 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. No significant environmental impact on the community is expected to result from the fuel rack conversion or from 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 a postulated fuel handling accident in the SFP area from those values reported in the FES for CCNPP dated April 1973.

Additionally, the NRC 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. Because CCNPP has the requirement to prohibit the movement of loads in excess of 1600 pounds over fuel assemblies in the SFP, we have concluded that the likelihood of a heavy load handling accident is sufficiently small that the proposed modification is acceptable and no additional restrictions on load handling operations in the vicinity of the SFP are necessary while our review is under way.

7.0 ALTERNATIVES

In regard to this licensing action, the staff has considered the following alternatives: (1) shipment of spent fuel to a fuel reprocessing facility, (2) shipment of spent fuel to a separate fuel storage facility, (3) shipment of spent fuel to another reactor site, and (4) ceasing operation of the facility. These alternatives are considered in turn.

The total construction cost associated with the proposed modification is estimated to be about $3 million or approximately $4,650 for each of the 646 fuel assemblies that the increased storage capacity will accommodate.

7.1 Reprocessing of Spent Fuel

As discussed earlier, none of the three commercial reprocessing facilities in the U. S. is currently operating. The General Electric Company's Midwest Fuel Recovery Plant (MFRP) at Morris, Illinois, is in a decommissioned condition. On September 22, 1976, Nuclear Fuel Services, Inc. (NFS) informed the Nuclear Regulatory Commission that they were "withdrawing from the nuclear fuel reprocessing business." The Allied-General Nuclear Services (AGNS) reprocessing plant 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 been completed, but hearings with respect to that application have not yet commenced and no license has been granted. Even if AGNS decides to proceed with operation of the Barnwell facility in light of the President's policy statement of April 7, 1977, the reprocessing plant will not be licensed until the issues presently being considered in the GESMO proceedings are completed.

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. The application for a construction permit is under review.

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."

The licensee had intended to reprocess the spent fuel to recover and recycle the uranium and plutonium in the fuel. Due to a change in national policy and circumstances beyond the licensee's control, reprocessing of the spent fuel is not an available option at this time.

7.2 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. Fuel storage pools at GE Morris and NFS are functioning as ISFSIs although this was not the original design intent. Likewise, if the receiving and storage station at AGNS is licensed to accept spent fuel, it would be functioning as an ISFSI until the separations facility is licensed to operate. The license for the GE facility at Morris, Illinois was amended on December 3, 1975, to increase the storage capacity to about 750 MTU;* as of April 1, 1977, approximately 259 MTU was stored in the pool in the form of 1,055 assemblies. The staff has discussed the status of storage space at Morris Operation (MO) with GE personnel. We have been 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 informed that the present GE policy is not to accept spent fuel for storage except for that fuel for which GE has a previous commitment.** The NFS facility has capacity for about 260 MTU, with approximately 170 MTU presently stored in the pool. The storage pool at West Valley, New York, is on land owned by the State of New York and leased to NFS thru 1980. Although the storage pool at West Valley is not full, since NFS withdrew from the fuel reprocessing business, correspondence we have received indicates that they are not at present accepting additional spent fuel for storage even from these reactor facilities with which they had contracts. The status of the storage pool at AGNS was discussed above.

With respect to construction of new ISFSIs, Regulatory Guide 3.24, "Guidance on the License Application, Siting, Design, and Plant Protection for an Independent Spent Fuel Storage Installation," issued in December 1974, recognizes the possible need for ISFSIs and provides recommended criteria and requirements for water-cooled ISFSIs. Pertinent sections of 10 CFR Parts 19, 20, 30, 40, 51, 70, 71 and 73 would also apply.

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*An application for an 1100 MTU capacity addition is pending. Present schedule calls for completion in 1980 if approved.

**The requested 1100 MTU addition is needed to accommodate previous commitments, and GE has no plans to make space available on a commercial basis.

The staff has estimated that at least five years would be required for completion of an independent fuel storage facility. 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 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. In 1974, E. R. Johnson Associates estimated their construction cost at approximately $9,000 per spent fuel assembly.

Several licensees have evaluated construction of a separate independent spent fuel storage facility and have provided cost estimates. Connecticut Yankee, for example, estimated that to build 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. Commonwealth Edison estimated the construction cost to build a fuel storage facility at about $10,000 per fuel assembly. To this would be added costs for maintenance, operation, safeguards, security, interest on investment, overhead, transportation and other costs.

On December 2, 1976, Stone and Webster Corporation submitted a topical report requesting approval for a standard design for an independent spent fuel storage facility. No specific locations were proposed, although the design is based on location near a nuclear power facility. No estimated costs for fuel storage were included in the topical report.

On a short-term basis (i.e., prior to 1983) an independent spent fuel storage installation does not appear to be a viable alternative based on cost or availability in time to meet the licensee's needs. It is also unlikely that the total environmental impacts of constructing an independent facility and shipment of spent fuel would be less than the minor impacts associated with the proposed action.

In the long-term, the U. S. Department of Energy (USDOE) is modifying its program for nuclear waste management to include design and evaluation of a retrievable storage facility to increase Government storage at central locations for unreprocessed spent fuel rods. As announced in the President's

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energy policy statement of April 29, 1977, the Government is committed to provide a retrievable, long-term storage facility for nuclear wastes by 1985. On October 18, 1977, USDOE announced a new "spent nuclear fuel policy." USDOE 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 storage facilities. It was announced by USDOE at a public meeting held on October 26, 1977, that this interim storage is expected to be available in the 1981-1982 time frame.

If the CCNPP SFP is not modified as proposed, the plant would lose the ability to discharge a full core in 1978, and would have to shutdown about January 1980 since the SFP would be essentially full. The precise date that interim storage would be available is not known at this time with sufficient precision to provide for planning. Should these facilities not be available when needed, the plant would be forced to shut down. Therefore, this does not appear to be a viable alternative especially when considering the impact of plant shutdown as compared with the negligible environmental consequences of the proposed amendments.

The proposed increase in storage capacity will allow CCNPP to operate both units until 1985, by which time interim storage and the Federal repository for spent fuel are expected to be operable.

7.3 Storage at Another Reactor Site

Baltimore Gas & Electric Company (BG&E) does not have another nuclear plant other than the Calvert Cliffs Power Plant in their system that is operating or under construction. According to a survey conducted and documented by the former Energy Research and Development Agency, 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, the cost would probably be comparable to the cost of storage at a commercial storage facility.

7.4 Shutdown of Facility

Storage of spent fuel from the CCNPP units in the existing racks is possible but only for a short period of time. As discussed above, if expansion of the SFP capacity is not approved and if an alternate storage facility is not located, BG&E would have to shut down Unit No. 1 in early 1980 and Unit No. 2 by the end of 1980 due to a lack of spent fuel storage facilities, resulting in the cessation of at least 1630 Megawatts net electrical energy production.

According to the licensee, the levelized annual fixed change on invenstment is $121,800,000/yr and on fuel is $7,300,000 for a total of $129,100,000/yr. BG&E states that if a forced shutdown from lack of fuel storage capibilities occurred, they would keep the majority of their 250-man staff over the short term for possible restart. This size crew would cost about $10,100,000/yr. These values are based on 1977 dollars and could be slightly different in 1980.

If Calvert Cliffs terminated operations, replacement power would be derived principally from operation of fossil fuel plants. Monthly replacement power would cost an average of $8.3 million with a maximum of $12 million at current rates. In addition to the cost of replacement power, the real cost could be a power curtailment and resultant hardships in the BG&E service area.

7.5 Summary of Alternatives

In summary, the alternatives (1) to (3) described above are presently not available to the licensee or could not be made available in time to meet the licensee's need. Even if available, alternatives (2) and (3) do not provide the operating flexibility of the proposed action and are likely to be more expensive than the proposed modification. The alternative of ceasing operation of the facility would be much more expensive than the proposed action because of the need to provide replacement power. In addition to the economic advantages of th. proposed action, we have determined that the expansion of the storage capacity of the spent fuel pool for CCNPP would have a negligible environmental impact. Accordingly, deferral or severe restriction of the action herein proposed would result in substantial harm to the public interest.

8.0 EVALUATION OF PROPOSED ACTION

8.1 Unavoidable Adverse Environmental Impacts

8.1.2 Radiological Impacts

Expansion of the storage capacity of the SFP will not create any significant additional adverse radiological effects. As discussed in Section 5.3, the additional total body dose that might be received by an individual or the estimated population within a 50-mile radius is less than 0.001 mrem/yr and 0.001 man-rem/yr, respectively, and is less than the natural fluctuations in the dose this population would receive from background radiation. The total dose to workers during removal of the present storage racks and installation of the new racks is estimated to be about 6 man-rem. 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.

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

Expansion of the storage capacity of the SFP, which would permit the plant to continue to operate until 1985 when offsite storage facilities are expected to be available for interim or long-term storage of spent fuel will not change the evaluation in the FES.

8.3 Irreversible and Irretrievable Commitments of Resources

8.3.1 Water, Land and Air Resources

The proposed action will not result in any significant change in the commitments of water, land and air resources as identified in the FES. No additional allocation of land would be made; the land area now used for the SFP would be used more efficiently by reducing the spacings between fuel assemblies.

8.3.2 Material Resources

Under the proposed modification, the present spent fuel storage racks will be replaced by new racks that will increase the storage capacity of the SFP by 646 spent fuel assemblies. The new spent fuel storage racks consist of type 304 austenitic stainless steel tubes, 8.875 inches square by approximately 14 feet long with a 3/16 inch wall thickness. Each storage rack consists of a 6x8 array of individual storage tubes, a base with four legs, and various bracing and support members. The fuel assemblies sit on bars across the bottom of each storage tube. The top of the storage tubes are flared to form a lead-in funnel. Each rack is estimated to weigh approximately 20,000 lbs. empty. Eleven of these racks will be used in each section of the SFP, for a total of 22 racks weighing 440,000 lbs.

Thus, the resources to be committed for fabrication of the new spent fuel storage racks total approximately 440,000 pounds of stainless steel. The racks do not use a poison material such as boron impregnated stainless steel, B_4C plates or boral. The amount of stainless steel used annually in the U. S. is about 2.82×10^{11} lbs. The material is readily available in abundant supply. The amount of stainless steel required for fabrication of the new racks is a small amount of this resource consumed annually in the United States. We conclude that the amount of material required for the new racks at CCNPP is insignificant and does not represent a significant irreversible commitment of material resources.

The 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. No other resources need be allocated because of design characteristics of the SFP remain unchanged.

We conclude that the expansion of the SFP at the Calvert Cliffs' facilities 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.

8.4 Commission Policy Statement Regarding Spent Fuel Storage

On September 16, 1975, the Commission announced (40 F.R. 42801) 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 statement is expected to be completed by the end of 1977.

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

The reactor cores for CCNPP units contain 217 fuel assemblies. The refueling of the unit, which consists of replacing about 72 fuel assemblies, is done annually. The SFP was designed on the basis that a fuel cycle would

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be in existence that would only require storage of spent fuel for about a year prior to shipment to a reprocessing facility. Therefore, a pool storage capacity for 410 assemblies (about 1-2/3 cores) was considered adequate. This provided for complete unloading of the reactor even if the spent fuel from 2 previous refuelings were in the pool. While not required from the standpoint of safety considerations, it is prudent engineering practice to reserve space in the SFP to receive an entire reactor core, should this be necessary to inspect or repair core internals or because of other operational considerations.

If 72 fuel assemblies are discharged each year, the SFP will be full after the refueling scheduled for late 1979. The spent fuel must be stored onsite or elsewhere if the facility is to be refueled. If expansion of the SFP capacity is not approved or if an alternate storage facility is not located, the licensee will have to shut down Unit No. 1 in the spring of 1980 and Unit No. 2 in the late fall. As discussed under alternatives, an alternate storage facility is not now available. Storage onsite is an interim solution to allow the plant to continue to operate.

The proposed licensing action (i.e., installing new racks of a design that permits storing more assemblies in the same space) would provide the licensee with additional flexibility which is desirable even if adequate offsite storage facilities hereafter become available to the licensee.

We have concluded that a need for additional spent fuel storage capacity exists at CCNPP which is independent of the utility of other licensing actions designed to ameliorate a possible shortage of spent fuel 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?

With respect to this proposed licensing action, we have considered commitment of both material and nonmaterial resources. The material resources considered are those to be utilized in the expansion of the SFP.

The increased storage capacity of the CCNPP spent fuel pool was 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 and to provide operational flexibility at the facility, and will not affect similar licensing actions at other nuclear power plants. Similarly, taking this action would not commit the NRC to repeat this action or a related action in 1984, at which time the modified pool is estimated to be full if no fuel is removed.

We conclude that the expansion of the SFP at the CCNPP, prior to the preparation of the 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 non-radiological 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 imapcts on the environs outside 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 potential non-radiological environmental impact attributable to the additional heat load in the SFP was determined to be negligible compared to the existing thermal effluents from the facility.

We have considered the potential radiological environmental impacts associated with the expansion of the SFP and have concluded that they would not result in radioactive effluent releases that significantly affect the quality of the human environment during either normal operation of the expanded SFP or under postulated fuel handling accident conditions.

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

This Environmental Impact Appraisal and the accompanying Safety Evaluation respond to the questions concerning health, safety and environmental concerns.

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

We have evaluated the alternatives to the proposed action, including storage of the additional spent fuel offsite and ceasing power generation from the plant when the existing SFP is full. We have determined that there are significant economic advantages associated with the proposed action and that expansion of the storage capacity of the SFP will have a negligible environmental impact. Accordingly, deferral or severe restriction of the action here proposed would result in substantial harm to the public interest.

9.0 COST-BENEFIT BALANCE

This section summarizes and compares the cost and the benefits resulting from the proposed modification to those that would be derived from the selection and implementation of each alternative. The table below presents a tabular comparison of these costs and benefits. The benefit that is derived from three of these alternatives is the continued operation of the CCNPP units and production of electrical energy. As shown in the table, the reactor shutdown and subsequent storage of fuel in the reactor vessel results in the cessation of electrical energy production. The remaining alternative, storage at other nuclear plants, is not possible at this time or in the foreseeable future except on a short term emergency basis and, therefore, has no associated cost or benefit.

From examination of the table, it can be seen that the most cost-effective alternative is the proposed spent fuel pool modification. As evaluated in the preceding sections, the environmental impacts associated with the proposed modification would not be significantly changed from those analyzed in the Final Environmental Statement for CCNPP Unit Nos. 1 and 2 issued in April 1973.

10.0 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 Commission in 40 FR 42801. We have determined that the proposed license amendments will not significantly affect the quality of the human environment. 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.

Date: January 4, 1978

SUMMARY OF COST-BENEFITS

Alternative	Cost	Benefit
Reprocessing of Spent Fuel		None - This alternative is not available either now or in the foreseeable future.
Increase storage capacity of Calvert Cliff's SFP	$4650/assembly	Continued operation of CCNPP and production of electrical energy.
Storage at Independent Facility**	$10,000/assembly plus annual costs for maintenance, operation, safeguards, interest on investment and overhead plus shipping costs to facility.	Continued operation of CCNPP and production of electrical energy. This alternative is not available for several years.
Storage at Reprocessor's Facility		Continued operation of CCNPP and production of electrical energy. However, this alternative is not available now. It is uncertain whether this alternative will be available in the future.
Storage at Other Nuclear Plants		None - This alternative is not likely to be available.
Reactor Shutdown	$121,800,000/Yr for levelized fixed charge on investment plus $7,300,000 /Yr for fuel charges or $129,100,000/Yr plus $10,100,000 /Yr for maintenance and security.	None - No production of electrical energy.

*In order to use this alternative, a minimum commitment of seven to ten years of storage is required.

**Costs for interim Government storage are expected to be published early in 1978.

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