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July 3, 1979

ELECTRIC ENGINEERING
DEPARTMENT

Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attn: Mr. Robert W. Reid, Chief
Operating Reactors Branch #4
Division of Operating Reactors

Subject: Calvert Cliffs Nuclear Power Plant
Units Nos. 1 & 2, Dockets Nos. 50-317 & 50-318
Fee for Amendment Request

Reference: BG&E letter dated 7/3/79 from Gore to Denton,
Request for Amendment to Operating Licenses

Gentlemen:

The referenced letter submitted our application for an amendment to the Calvert Cliffs Units 1 and 2 Operating Licenses to allow spent fuel pool modifications. In support of that request and pursuant to the provisions of 10 CFR Part 170 paragraph 170.22, we have determined that the referenced request consists of a Class III and a Class I Amendment with resulting fees of $4,000.00 and $400.00, respectively.

Attached is BG&E check #B087488 in the amount of $4,000.00. An additional check in the amount of $400.00 (#B088142) is attached for Unit #2.

Very truly yours,

for R. C. L. Olson
Senior Engineer

RCLO/smn
Enclosure

cc: J. A. Biddison, Esquire
G. F. Trowbridge, Esquire
E. L. Conner, Jr. - NRC

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Licensing Report - Spent Fuel Storage Modification

1.0 Introduction

This report is submitted in support of Baltimore Gas and Electric Company's application to amend the Calvert Cliffs Unit No. 1 Facility Operating License No. DPR-53 for modification of the spent fuel storage facility.

The Calvert Cliffs Nuclear Power Plant (CCNPP) spent fuel pool (SFP) was originally designed with the storage capacity of 1-2/3 cores, (410 fuel assemblies) felt to be adequate for the storage of the discharge (72 assemblies per unit per year) from each reactor for one year prior to its shipment off-site for reprocessing, plus 217 storage locations for core unloading whenever it became necessary.

Spent fuel is not currently being reprocessed on a commercial basis in the United States and no away-from-reactor storage facilities are available. For these reasons, BG&E in August 1977 requested NRC approval of SFP modification at Calvert Cliffs Nuclear Power Plant to allow for storage of 528 spent fuel assemblies in both the North and the South pools. The South pool was modified as planned. Before work began on the North pool, however, it became apparent that an increase to a total of 14/3 cores (1056 spent fuel assemblies) which would allow operation of Calvert Cliffs until 1983, would not be adequate.

The spent fuel pool at Calvert Cliffs currently has the capacity to store 200 spent fuel assemblies in the North half of the pool (unmodified) and 528 assemblies in the South half of the pool (1977 modification).

Modification of the North half of the existing storage facility differing from that modification proposed in 1977 is required for continued operation while accomodating an expected increase in the inventory of spent fuel assemblies above the capacity of the existing storage facility. The modification utilizes a fuel rack design which allows for increased storage capacity without significant modification to the facility.

The proposed modification is to replace the existing fuel assembly storage racks in the North half of the spent fuel pool with high capacity poison racks supplied by Nuclear Energy Services capable of holding 840 fuel assemblies. The structural characteristics of the spent fuel storage pool are not altered by the change.

The design provides storage capacity for 840 fuel assemblies in the North half of the pool having a feed enrichment of $\leq$ 4.1 weight percent U-235 in UO_2 or the equivalent. The fuel is maintained in a safe and subcritical configuration, $k_{eff} \leq 0.95$, during normal and abnormal conditions including the safe shutdown earthquake.

The modification consists of nine (9) storage racks with three (3) having eighty (80) storage elements and six (6) having one-hundred (100) storage elements in a 9.75" center-to-center spacing.

Cooling of the spent fuel assemblies normally is achieved by a combination of natural circulation and spent fuel pool cooling.

The North half of the pool is scheduled for rack removal and new installation in the summer of 1980. Under this schedule all the fuel residing in the spent fuel pool can be moved to the South half of the pool. The North pool can then be drained and the modification can be accomplished in a dry pool.

Baltimore Gas and Electric Company is responsible for the modification to the spent fuel storage pool. Nuclear Energy Services is retained to design the spent fuel racks, contract for fabrication, perform analysis pertinent to the modification, and provide technical assistance during installation. Bechtel Power Corporation provided engineering assistance in reviewing the spent fuel pool structural considerations.

2.0 Description of Existing Racks

The existing spent fuel storage racks in the North half of the pool are a stainless steel structure consisting of vertical cells fixed to a continuous top deck and grouped in parallel rows with a center-to-center spacing of 18 inches. The storage racks are laterally braced on one another and against the walls of the spent fuel pool. The present design assures a k_{eff} of 0.98 or less and meets the requirements of Seismic Class I. Space is currently provided for the storage of 200 fuel assemblies in the North half of the pool and 528 in the South half for a total of 728 assemblies, nominally 10/3 core.

3.0 Spent Fuel Storage Facility Support Systems

3.1 Spent Fuel Pool Cooling System

The spent fuel pool cooling system is described in the Calvert Cliffs Nuclear Power Plant Final Safety Analysis Report, Section 9.4. The flow diagram for the system is contained in the above document as Figure 9-7. The proposed modification does not require any physical change to the existing cooling system, as shown by the analysis contained in Section 3.1.2 of this report, except for removal of an existing supply header.

3.1.1 The spent fuel pool cooling system, common to both units is a closed loop system consisting of two pumps in parallel and two heat exchangers in parallel, a bypass filter and a demineralizer. Makeup water comes from either the refueling water tanks or the demineralized water connection. The heat exchangers are cooled by the service water systems. The Unit 1 service water cools the No. 11 SFP heat exchanger and the Unit 2 service water cools the No. 12 SFP heat exchanger. For additional heat removal, if required, connections are provided for a temporary tie-in to the shutdown cooling system of either unit.

The clarity and purity of the water in the spent fuel pool is maintained by the bypass filter and/or the demineralizer. Skimmers remove dust from the pool. An eight inch diameter suction pipe extends down into the spent fuel pool. Loss of the spent fuel pool water is avoided by routing all spent fuel pool piping connections above the water level and providing them with siphon breakers to prevent gravity drainage.

The system provides no emergency functions. Pool level and temperature alarms are provided.

3.1.2 <u>Evaluation of the Existing Cooling System for Increased Storage Capacity</u>

The spent fuel pool cooling system has been evaluated, in accordance to ANS5.1, to determine the effect on the system of increasing the spent fuel stored in the pool to 18/3 core (1368 assemblies).

The spent fuel pool cooling system provides adequate capacity and component redundancy to assure the cooling of stored spent fuel, even when the racks for both pools are full. The maximum decay heat load in the pool increases to 17.[illegible]7 x 10^6 BTU/HR for 15/3 cores stored. The maximum steady state pool water temperature which occurs with only one pump operating increases to 154°F, which is in the range of a "safe" maximum spent fuel pool temperature. The maximum normal operating temperature, with both subsystems operable, will be 124°F. Therefore, the existing spent fuel cooling system is adequate.

Table 3.1-1 outlines the generation of decay heat by the spent fuel. The following assumptions were made:

1. 1/3 core unloaded 7 days after reactor shutdown.

2. Refueling of Units 1 and 2 will occur a minimum of two months (60 days) apart.

3. A fuel cycle is 314 days; total burnup time is 942 days; refueling outage lasts 28 days.

4. Batch power is 900 MW_{th}.

5. Both units have "steady state" cores.

6. Spent fuel cooling system flow is 2780 gpm (with two pumps).

7. Service water flow to the Unit No. 1 spent fuel pool heat exchanger is 3037 gpm and 1869 gpm for the Unit No. 2 heat exchanger.

TABLE 3.1-1

Schedule of Decay Heat Output of Spent Fuel

Unit	Size Of Discharge	Amount Stored In Pool	Time After Removal	Time Of Burn Up	Heat Generation BTU/HR ($x10^6$)
1	1/3	1/3	7d	942d	7.37
2	1/3	2/3	67d	942d	2.65
1	1/3	3/3	349d	942d	0.906
2	1/3	4/3	409d	942d	0.797
1	1/3	5/3	691d	942d	0.508
2	1/3	6/3	751d	942d	0.470
1	1/3	7/3	1033d	942d	0.345
2	1/3	8/3	1093d	942d	0.327
1	1/3	9/3	1375d	942d	0.258
2	1/3	10/3	1435d	942d	0.247
1	1/3	11/3	1717d	942d	0.204
2	1/3	12/3	1777d	942d	0.196
1	1/3	13/3	2059d	942d	0.167
2	1/3	14/3	2119d	942d	0.161
1	1/3	15/3	2401d	942d	0.140

Total = 14.746×10^6 BTU/HR

+ uncertainties

Should the pool contain 15/3 cores and one unit must be shutdown and defueled, the shutdown cooling system would be utilized to supplement the SFP cooling system.

3.2 Spent Fuel Pool Makeup

Makeup water comes from the refueling water tanks. Neither the design basis nor the functional requirements for makeup to the spent fuel pool is affected by the increased storage capacity. Because the temperatures will be maintained consistent with values stated in the FSAR makeup requirements for the low evaporative losses remain the same.

3.3 Heating and Ventilation - Spent Fuel Pool

Neither the design requirements nor the operational function of the spent fuel pool heating and ventilation system is affected by the new modification to the pool. Temperatures remain within the range for which the system was designed and, therefore, do not necessitate changes to the system.

Spent fuel pool air is drawn through HEPA filters and discharged to the constantly monitored plant vent. If the activity level becomes too high, the air can be diverted into charcoal filters for the removal of iodine and other radioactive particulates after it leaves the HEPA filter bank. The air is then discharged from the charcoal beds to the plant vent.

3.4 Spent Fuel Pool Building - Structural Analysis

The spent fuel pool is a reinforced concrete structure with a 3/16" thick stainless steel liner plate for leak tightness. The pool is 92 feet long, 25 feet wide, and 39 feet deep, with a 2 foot wall dividing the two halves. A slot in the wall has removable gates allowing for the movement of fuel between the two halves of the pool. The pool is an intergal part of the auxiliary building and designed as a Seismic Class I structure in accordance with Section 5.6.1 of the Calvert Cliffs Nuclear Power Plant FSAR.

The load carrying capability of the floor has been evaluated by Bechtel Power Corporation, the original design organization. The results of the evaluation shows that the existing design is adequate.

The pool floor will support the high capacity racks as a free standing structure during all design conditions.

4.0 Accident Analysis

4.1 Loss of Spent Fuel Pool Coolant System

Increasing the spent fuel storage capacity results in a heat load of 17.67×10^6 BTU/HR. In the event of a complete loss of cooling capacity, the heat up rate, assuming an adiabatic pool, is 3.6 F/hr.

The time required to heat up from 154°F to 210°F is 15.6 hours. This is sufficient time to restore cooling. Because the pool was designed for a heat up rate of 20.2×10^6 BTU/HR, the heat load increase is acceptable. The increase in heat load does not alter existing facility design basis.

4.2 Loss of Make Up

As discussed in Section 9.4.5 of the Calvert Cliffs FSAR, total water loss cannot occur. In the event of a partial water loss, the fuel assemblies remain covered with water and no radioactivity is released.

4.3 Liquid and Gaseous Releases

The storage of additional spent fuel assemblies in the spent fuel pool will not result in any additional liquid release from the plant. Because the added capacity represents longer term storage of well-cooled fuel, further releases of gaseous or volatile fission products is expected to be negligible. After 300 days decay, much of the iodines and Xenon has decayed. Because of the long half life of Kr-85, detectable levels remain in older fuel. Air samples taken from around the spent fuel pool after the first Unit 1 refueling do not show Kr-85 at detectable levels and it is not expected to become significant as fuel storage increases. Increased fuel storage will have no observable impact on concentrations of airborne radioactivity in the auxiliary building. Therefore, the design is acceptable with regard to gaseous releases.

4.4 Fuel Handling

The storage of an increased number of spent fuel assemblies in the spent fuel pool will not alter the analysis and consequences of the design basis fuel handling accident as presented in the FSAR, Section 14.5.

4.5 Operational Radiation Exposures

Storing the fuel for longer periods of time yields a greater amount of non-volative fission products and corrosion products released from the SFP. The SFP filter and demineralizer will remove this radioactive material, thereby preventing higher activity levels from building up in the pool. The increase in filter and demineralizer change out because of the greater activity accumulated does not result in significant man rem expenditure when compared to the total annual man rem exposures.

Measurements taken in the SFP area both before and after the first Calvert Cliffs refueling outage indicate that the radiation levels are independent of the number of assemblies in the pool.

5.0 Alternative Evaluation

With the current capacity of the spent fuel pool storage facility, Calvert Cliffs will lose the ability to discharge a full core in spring of 1981. The Unit 1 refueling in 1982 will completely fill the spent fuel pool. This can be seen in Table 5.0-1.

TABLE 5.0-1

SCHEDULE OF CORE DISCH'RGES

Unit 1		Unit 2		Accumulated
Date Out	# Assys	Date Out	# Assys	Inventory
Up to 1/79				228
4/79	72			300
		10/79	72	372
4/80	72			444
		10/80	72	516
4/81	73			589
		10/81	73	662
4/82	72			734
		10/82	72	806
4/83	72			878
		10/83	72	950
4/84	73			1023
		10/84	73	1096
4/85	72			1168
		10/85	72	1240
4/86	72			1312

If the North half of the spent fuel pool was modified identically to the recent South pool modification, full core discharge capability would be extended until Spring of 1983. Capacity would be reached in Spring of 1984 with the Unit 1 refueling.

The proposed modification, however, to the North half of the pool extends until spring of 1985 the full core discharge ability. The pool would not be full until spring of 1986.

The alternative to the poison design modification is termination of reactor operation in 1983 (Unit 2) and 1984 (Unit 1).

Neither a licensed fuel reprocessing facility nor a licensed independent storage facility is available at this time. BG&E does not have another nuclear power plant to which spent fuel can be shipped. High capacity poison racks will allow for continued plant operation while allowing additional time for the development of off-site storage.

If Calvert Cliffs terminated operations, replacement power would be derived principally from operation of fossile plants. Daily replacement energy, at current rates, would cost $1 Million.

6.0 Installation

BG&E will be responsible for the installation of the spent fuel racks. Nuclear Energy Services will provide technical assistance.

The overhead cranes in the auxiliary building at Calvert Cliffs will be used for removing the racks from the trucks on which they will arrive, lifting up to the 69" elevation, where the pool is located, and lowering them into the pool.

All spent fuel will be moved into the South spent fuel pit prior to the spent fuel pool modification. The North pool will be drained and hydrolazed to allow for dry removal of the old racks and installation of the new racks.

The removed racks will be decontaminated, boxes and shipped off-site for burial.

A total exposure of 3.75 man-rem is anticipated in replacing the racks in the North pool.