

REGULATORY DOCKET FILE COPY

MARCH 10 1980

Dockets Nos. 50-317
50-318

Mr. A. E. Lundvall, Jr.
Vice President - Supply
Baltimore Gas & Electric Company
P. O. Box 1475
Baltimore, Maryland 21203

Dear Mr. Lundvall:

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The Commission has issued the enclosed Amendments Nos. ~~42~~ and ~~25~~ to Facility Operating Licenses Nos. DPR-53 and DPR-69 for the Calvert Cliffs Nuclear Power Plant, Units Nos. 1 and 2. These amendments: (1) delete satisfied License Condition 2.C.3 for Unit No. 2 in regard to the restrictions to prevent steam generator water hammer in response to Proposed Change No. 11 of your request of November 13, 1978; and (2) delete satisfied license conditions for both units in regard to Liquefied Natural Gas (LNG) traffic at the Cove Point LNG Terminal. These identical license conditions required analysis and commitments prior to initiation of LNG ship traffic at the terminal. The NRC review of this issue was presented in our Safety Evaluation dated June 13, 1978. Our review of your LNG contingency plan is continuing.

In addition, the enclosed Safety Evaluation documents our analysis of the acceptability of your modifications made to reduce steam generator water hammer events in the feedwater systems of Calvert Cliffs Nuclear Power Plant, Units Nos. 1 and 2, as described in your submittals dated July 8, 1975, November 14, 1977, November 13, 1978, March 15, 1979, and October 15, 1979.

Based on our review, we conclude that modifications made to install top discharge "L" tubes on the feeding for each steam generator and changes to the operating procedures that specify how the steam generator levels would be recovered, as described in your March 15 and October 15, 1979 submittals, will minimize the likelihood of steam generator water hammer events in the feedwater systems.

A copy of the Notice of Issuance is also enclosed.

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Mr. A. E. Lundvall, Jr.

- 2 -

According to our records, we have not completed action on Proposed Change No. 7 of your November 13, 1978 application. However, if you wish us to continue our review of this item, please let us know. Unless we hear from you within 30 days, we will take no further action on this item and will consider all requests of your November 13, 1978 application to have been completed.

Sincerely,

Original signed by
Robert W. Reid

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

Enclosures:

1. Amendment No. 2 to DPR-53
2. Amendment No. 25 to DPR-69
3. Safety Evaluation
4. Notice of Issuance

cc w/enclosures:
See next page

OFFICE

SURNAME

DATE



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

March 10, 1980

Dockets Nos. 50-317
50-318

Mr. A. E. Lundvall, Jr.
Vice President - Supply
Baltimore Gas & Electric Company
P. O. Box 1475
Baltimore, Maryland 21203

Dear Mr. Lundvall:

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Mr. A. E. Lundvall, Jr.

- 2 -

March 10, 1980

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Sincerely,



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

Enclosures:

1. Amendment No.42 to DPR-53
2. Amendment No.25 to DPR-69
3. Safety Evaluation
4. Notice of Issuance

cc w/enclosures:

See next page

Baltimore Gas and Electric Company

cc w/enclosure(s):

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U. S. Environmental Protection Agency
Region III Office
ATTN: EIS COORDINATOR
Curtis Building (Sixth Floor)
Sixth and Walnut Streets
Philadelphia, Pennsylvania 19106

cc w/4 cys enclosures and 1 cy
of BG&E filings dtd: 11/14/77,
11/13/78, 3/15/79, and 10/15/79
Administrator, Power Plant Siting Program
Energy and Coastal Zone Administration
Department of Natural Resources
Tawes State Office Building
Annapolis, Maryland 21401



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

BALTIMORE GAS & ELECTRIC COMPANY

DOCKET NO. 50-317

CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 42
License No. DPR-53

1. The Nuclear Regulatory Commission (the Commission) has found:
 - A. The facility will operate in conformity with the provisions of the Atomic Energy Act of 1954, as amended, and the rules and regulations of the Commission;
 - B. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
 - C. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
 - D. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.
2. Accordingly, Facility Operating License No. DPR-53 is hereby amended by deleting paragraph 2.C.(3) and renumbering the remaining paragraphs under 2.C.
3. This license amendment is effective as of the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

A handwritten signature in cursive script, reading "Robert W. Reid".

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

Date of Issuance: March 10, 1980

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

BALTIMORE GAS & ELECTRIC COMPANY

DOCKET NO. 50-318

CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 25
License No. DPR-69

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by Baltimore Gas & Electric Company (the licensee) dated November 13, 1978, as supplemented March 15, 1979 and October 15, 1979, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's rules and regulations set forth in 10 CFR Chapter I;
 - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
 - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
 - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
 - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.
2. Accordingly, Facility Operating License No. DPR-69 is hereby amended by deleting paragraphs 2.C.3 and 2.C.4 and renumbering the remaining paragraphs under 2.C.
3. This license amendment is effective as of the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

A handwritten signature in cursive script, reading "Robert W. Reid".

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

Date of Issuance: March 10, 1980



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

SAFETY EVALUATION BY

THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING LICENSE AMENDMENTS NOS. 42 AND 25 FOR UNITS NOS. 1 AND 2 AND

DOCUMENTING THE STEAM GENERATOR WATER HAMMER REVIEW FOR

CALVERT CLIFFS NUCLEAR POWER PLANT, UNITS NOS. 1 AND 2

BALTIMORE GAS & ELECTRIC COMPANY

DOCKETS NOS. 50-317 AND 50-318

1.0 INTRODUCTION

Steam generator water hammer has occurred in certain nuclear power plants as a result of the rapid condensation of steam in a steam generator feedwater line and the consequent acceleration of a slug of water which, upon impact within the piping system, causes undue stresses in the piping and its support system. The significance of these events varies from plant to plant. Since the total loss of feedwater could affect the ability of the plant to cool down after a reactor shutdown, the NRC is concerned about these events occurring, even though an event with potentially serious consequences is unlikely to happen.

Because of the continuing occurrence of water hammer events, the NRC, in September 1977, informed all pressurized water reactor (PWR) licensees that water hammer events due to the rapid condensation of steam in the feedwater lines of steam generators represented a safety concern and that further actions by licensees for Westinghouse and Combustion Engineering designed nuclear steam supply systems are warranted to assure that an acceptably low risk to public safety due to such events is maintained.

Various approaches have been proposed by the licensees to reduce the potential for steam generator water hammer in the feedwater piping. Considered among the acceptable ones are:

- (1) to keep the feedwater pipes filled with water under all normal and transient conditions; and
- (2) to prevent subcooled water from entering the feedwater piping while steam is present in the feedwater pipes.

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By letter dated November 13, 1978, Baltimore Gas & Electric Company (BG&E or the licensee) applied for eleven changes to Facility Operating Licenses DPR-53 and DPR-69 for the Calvert Cliffs Nuclear Power Plant (CCNPP) Units Nos. 1 and 2. Request No. 11 was to delete License Condition 2.C.3 from the CCNPP-2 license. This license condition states:

"Steam Generator Water Level Rise Rate

Except for the purpose of performing steam generator feedwater flow stability tests, the licensee shall, whenever the secondary side water level in a steam generator is below the level of the feedwater sparger, limit the secondary side water level rise rate in the steam generator to less than 1.2 inches per minute and shall reduce the rise rate to within this limit within two (2) minutes if this limit is exceeded. This condition shall be removed only by amendment of this license after the licensee has demonstrated to the satisfaction of the Commission that secondary side flow instability (water hammer) either will not occur, or does not result in unacceptable consequences."

This Safety Evaluation documents our review of the steam generator water hammer problem at the CCNPP units and the November 13, 1978 request for a license change for Unit No. 2. The pertinent licensee's submittals under review are dated July 8, 1975, November 14, 1977, November 13, 1978, March 15, 1979, and October 15, 1979.

This Safety Evaluation also considers removal of satisfied license conditions for both CCNPP units in regard to Liquidified Natural Gas (LNG) traffic at the Cove Point LNG Terminal.

2.0 DISCUSSION AND EVALUATION

2.1 FEEDWATER SYSTEM DESCRIPTION

The feedwater system is designed to provide an adequate supply of feedwater to the secondary side of the two steam generators during all operational conditions. The two main feedwater pumps are each one-half of the full power capacity. Each pump has a capacity of 15,000 gpm at 2350 feet total dynamic head (TDH). The pumps are each driven by a separate variable speed steam turbine. Feedwater from the main feedwater pumps is supplied to a main header which splits into two 16-inch feedwater lines to supply a feedring inside each steam generator. Feedwater is discharged inward through inverted "L" shaped tubes at the top of the feedring. The horizontal run of feedwater piping just upstream of the feedring is about 12 feet.

The auxiliary feedwater system (AFWS) is designed to provide feedwater for the removal of decay heat and to cool the primary system to 300°F upon loss of main feedwater flow. The system may also be used for normal system startup.

Auxiliary feedwater can be supplied by two noncondensing steam turbine-driven pumps. Each of the pump units has a capacity of 700 gpm at 2490 feet TDH. This is sufficient for the removal of decay heat.

The main suction supply for the AFWS is the 300,000 gallon condensate storage tank. AFWS flow is discharged from the pump to a common line which branches into two 4-inch lines to each of the two steam generators. The horizontal piping upstream of the steam generator nozzle contains only an elbow and is about 6 inches long.

The AFWS at the CCNPP units feeds the steam generators via a separate feedring located about one foot below the main feedring. There is no cross connection between the main feedwater and auxiliary feedwater piping. As a result, the cold water delivered by the AFWS cannot enter the main feedwater piping.

The AFWS is presently initiated by remote manual control. However, as a result of the Three Mile Island Review (NUREG-0578), BG&E will be installing an automatic initiating circuit for the AFWS in the near future. The system is normally used for either of the following conditions:

- (1) loss of off-site power, or
- (2) complete loss of main feedwater flow.

Under proposed procedural changes by the licensee in their October 15, 1979 submittal, the AFWS will also be used if both of the following conditions exist:

- (1) the main feedring is uncovered, and
- (2) the main feedwater flow is stopped, interrupted or decreased to less than 5% of rated flow.

2.2 WATER HAMMER EXPERIENCE

Four water hammer events have occurred at the CCNPP units, including preoperational tests, since 1974. Two of these events were reported as follows:

- (1) At 9:04 a.m. on May 13, 1975, Unit No. 1 tripped on loss of main feedwater. Approximately 40 minutes after the trip, three water hammers were experienced in the feedwater piping as the main feedwater was being reestablished to the steam generators.

- (2) On May 19, 1976, a preoperational test was performed on Unit No. 2 to determine the effectiveness of the addition of internal standpipes to the new main feedring. With the reactor in mode 3, steam generator level was decreased to 85" via the blowdown system. Thirteen minutes after securing blowdown, feedwater was introduced into the steam generator at 5% of rated flow via the main feedring. As the water level reached the feedring, a water hammer occurred.

A review of these water hammer events indicates that water hammer could be expected following the initiation of main feedwater system flow when the steam generator level is below the feedring following loss of main feedwater flow. Even with top discharge devices on the feedring, the second event at Unit No. 2 showed that the potential for water hammer might still exist under the conditions of stop and restart of main feedwater flow. This is because the feedring can still be drained through the small thermal sleeve opening even though the drainage rate is much less than that from a bottom discharge feedring.

2.3 MEANS TO REDUCE THE POTENTIAL FOR WATER HAMMER

The following means are now employed at the CCNPP units to reduce the potential for damaging water hammer:

- (1) top discharge "L" tubes on the feedring, and
- (2) procedures that require that the AFWS be used to recover the steam generator water level following a reactor trip.

In the March 15, 1979 and October 15, 1979 submittals, BG&E proposed the following modification to the procedures:

"Given the initial condition that the steam generators are being supplied with feedwater from the main feedwater system via the main feedring, we propose to continue to supply feedwater using this path provided the following conditions do not exist simultaneously:

- a) The volumetric flow rate of main feedwater being supplied to a steam generator drops below 5 percent of full (100%) feedwater flow; and
- b) The water level in the steam generator drops below the top of the main feedring.

"If the above conditions exist simultaneously, we propose to cease feeding the steam generator from main feedwater and to commence feeding the steam generator using the auxiliary feedwater system

via the separate and independent auxiliary feeding at such time as it is determined that this flow path should be initiated based on the operating conditions in effect at that time.

"When the steam generator water level has once again risen above the top of the main feeding, the normal feed path using the main feedwater system will be permissible."

The intent of the "L" tubes is to keep the main feeding filled with water under all normal and transient conditions so that conditions conducive to water hammer would not occur in the feedwater piping. However, should a leakage path develop in the feeding, a complete interruption or loss of feedwater can cause a partial or complete draining of the main feedings. That could in turn result in conditions conducive to water hammer if cold water were ever reintroduced into the steam generator via the main feedwater piping.

For the CCNPP units, a small leakage path is found behind the thermal sleeve at the feedwater nozzle connection. Here a drainage rate in the order of 10 to 20 gpm could occur if the steam generator water level drops below the main feeding. A continuous feedwater flow greater than this drainage rate would be needed to keep the main feeding full of water.

Under the proposed operational procedure, the main feedwater system flow would be maintained at a rate of at least 5% of full flow when the steam generator water level drops below the feeding. The 5% flow is approximately 750 gpm and is more than sufficient to keep the main feeding full of water.

Under the same proposed procedure, the AFWS must be used to feed the steam generator if the main feedwater is decreased below 5% of full flow and concurrently the steam generator water level drops below the main feeding. This procedure would prevent the cold condensate water from reentering drained, steam-filled main feedings. Consequently, it would eliminate the potential for water hammer in the main feedwater piping.

2.4 SUSCEPTIBILITY OF AUXILIARY FEEDWATER SYSTEM TO WATER HAMMER

The CCNPP units have the unique design of separate bottom-discharge feedings for the auxiliary feedwater system. Because of that, the conditions conducive to water hammer such as drained feedings may be encountered in the operation of the AFWS. However, the potential for damaging water hammer would be reduced if either or both of the following conditions exist:

- (1) The feedwater is supplied at a sufficiently high flow rate such that partially filled piping and formation of a slug of water in the piping would not be likely to occur.
- (2) The horizontal piping is sufficiently short so that a damaging water hammer would not be likely to result.

Our evaluation of the CCNPP AFWS indicates that the system operation and piping configuration meet both of the above conditions. The auxiliary feedwater is normally supplied about 9 ft/sec which we believe is sufficient to preclude a partially filled condition in the piping. In addition, the horizontal piping is the shortest length practical and contains only an elbow attached to the steam generator. Therefore, we conclude that a damaging water hammer would be very unlikely to occur in the AFWS. This conclusion has been substantiated by the plant operating experience. Since November 30, 1976, the AFWS has been operated many times each year and has not experienced a single water hammer event.

2.5 SUMMARY OF FINDINGS

The licensee has installed top discharge main feedwater rings ("L" tubes) in both steam generators at each CCNPP unit and also committed to shift to the AFWS when the operating conditions require.

Based on our knowledge of water hammer phenomena and our review of the licensee's submittals, we have concluded that the provisions for minimizing the likelihood of steam generator water hammer events in the feedwater systems are adequate and acceptable. We therefore find that steam generator water hammer presents no undue risk to the health and safety of the public resulting from the continued operation of the Calvert Cliffs Nuclear Power Plant, Units Nos. 1 and 2. Therefore, the Unit No. 2 License Condition 2.C.3 can be deleted.

3.0 LNG LICENSE CONDITION

A condition of each license for the CCNPP units required the licensee to provide to the NRC certain items related to LNG traffic prior to the initiation of LNG ship traffic at the Cove Point LNG Receiving Terminal. The licensee has complied with these requirements and our review of this issue is contained in our Safety Evaluation dated June 13, 1978. Our conclusions presented in that Safety Evaluation remain valid. We conclude that the licensee has satisfied the license condition and its deletion from each license is therefore acceptable. The administrative action of deleting this now obsolete requirement involves no significant hazards consideration and no significant environmental impact.

4.0 ENVIRONMENTAL CONSIDERATION

We have determined that this action does not authorize a change in effluent types or total amounts nor an increase in power level and will not result in any significant environmental impact. Having made this determination, we have further concluded that this involves an action which is insignificant from the standpoint of environmental impact and pursuant to 10 CFR §51.5(d)(4) that an environmental impact statement or negative declaration and environmental impact appraisal need not be prepared in connection with this action.

5.0 CONCLUSION

We have concluded, based on the considerations discussed above, that: (1) because this action does not involve a significant increase in the probability or consequences of accidents previously considered and does not involve a significant decrease in a safety margin, the action does not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (3) such activities will be conducted in compliance with the Commission's regulations and the action will not be inimical to the common defense and security or to the health and safety of the public.

Dated: March 10, 1980

UNITED STATES NUCLEAR REGULATORY COMMISSIONDOCKETS NOS. 50-317 AND 50-318BALTIMORE GAS & ELECTRIC COMPANYNOTICE OF ISSUANCE OF AMENDMENTS TO FACILITYOPERATING LICENSES

The U. S. Nuclear Regulatory Commission (the Commission) has issued Amendments Nos. 42 and 25 to Facility Operating Licenses Nos. DPR-53 and DPR-69 issued to Baltimore Gas & Electric Company, which revised the licenses for operation of the Calvert Cliffs Nuclear Power Plant, Units Nos. 1 and 2 (the facility) located in Calvert County, Maryland. The amendments are effective as of the date of issuance.

The amendments: (1) delete satisfied License Condition 2.C.(3), "Steam Generator Water Level Rise Rate", for Unit No. 2, and (2) delete satisfied license conditions concerning Liquefied Natural Gas (LNG) traffic at Cove Point Terminal for both units.

The application for amendment complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations. The Commission has made appropriate findings as required by the Act and the Commission's rules and regulations in 10 CFR Chapter I, which are set forth in the license amendments. Prior public notice of these amendments was not required since the amendments do not involve a significant hazards consideration.

The Commission has determined that the issuance of these amendments will not result in any significant environmental impact and that pursuant to 10 CFR §51.5(d)(4) an environmental impact statement or negative declaration and environmental impact appraisal need not be prepared in connection with issuance of these amendments.

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For further details with respect to this action, see (1) the application for amendment dated November 13, 1978, as supplemented March 15, 1979, and October 15, 1979, (2) Amendments Nos. 42 and 25 to Licenses Nos. DPR-53 and DPR-69, (3) the Commission's concurrently issued Safety Evaluation on Steam Generator Water Hammer, and (4) the Commission's June 13, 1978, Safety Evaluation on LNG traffic at the Cove Point Terminal. All of these items are available for public inspection at the Commission's Public Document Room, 1717 H Street, N.W., Washington, D. C. and at the Calvert County Library, Prince Frederick, Maryland. A copy of items (2), (3), and (4) may be obtained upon request addressed to the U. S. Nuclear Regulatory Commission, Washington, D. C. 20555, Attention: Director, Division of Operating Reactors.

Dated at Bethesda, Maryland, this 10th day of March.

FOR THE NUCLEAR REGULATORY COMMISSION



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