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

September 11, 1991

Docket Nos. 50-317
and 50-318

Mr. G. C. Creel
Vice President - Nuclear Energy
Baltimore Gas and Electric Company
Calvert Cliffs Nuclear Power Plant
MD Rts. 2 & 4
P. O. Box 1535
Lusby, Maryland 20657

Dear Mr. Creel:

SUBJECT: ISSUANCE OF AMENDMENTS FOR CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NO. 1 (TAC NO. 79005) AND UNIT NO. 2 (TAC NO. 79006)

The Commission has issued the enclosed Amendment No. 160 to Facility Operating License No. DPR-53 and Amendment No. 140 to Facility Operating License No. DPR-69 for the Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2, respectively. The amendments consist of changes to the Technical Specifications in response to your application transmitted by letter dated November 5, 1990, as supplemented on June 11 and August 19, 1991.

The amendments modify the Technical Specifications (TS) for both units in accordance with the guidance provided in the Nuclear Regulatory Commission's Generic Letter (GL) 88-17, "Loss of Decay Heat Removal," dated October 17, 1988. The changes to TS 4.9.8.1 will change the flow rates currently specified for Mode 6 (Refueling) operation. The change requires that a minimum of 1500 gpm is required regardless of the Reactor Coolant System (RCS) inventory level. The reduced flow rates will decrease the likelihood of air ingestion into the RCS resulting in shutdown cooling in (SDC) pump vortexing which could lead to pump failure and subsequent loss of the decay heat removal capability.

The amendments also change the TS Bases 3/4.9.8 to support the change in the minimum specified flow rate for SDC during Mode 6 operation. The Bases also indicate that shutdown cooling flow must provide sufficient heat removal to match core decay heat generation and maintain the core exit temperature within the Mode 6 limit.

A copy of the related Safety Evaluation is enclosed. A Notice of Issuance will be included in the Commission's next regular biweekly Federal Register notice.

Sincerely,

Daniel G. McDonald, Senior Project Manager
Project Directorate I-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosures:
1. Amendment No. 160 to DPR-53
2. Amendment No. 140 to DPR-69
3. Safety Evaluation

cc w/enclosures:
See next page

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OFC	:PDI-I:LA	:PDI-I:PM	:OGC	:PDI-I:D	:
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DATE	:8/26/91	:8/27/91	:9/3/91	:9/11/91	:

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Document Name: AMEND 317/318

DATED: September 11, 1991

AMENDMENT NO. 160 TO FACILITY OPERATING LICENSE NO. DPR-53-CALVERT CLIFFS UNIT 1
AMENDMENT NO. 140 TO FACILITY OPERATING LICENSE NO. DPR-69-CALVERT CLIFFS UNIT 2

Docket File
NRC & Local PDRs
PDI-1 Reading
S. Varga, 14/E/4
J. Calvo, 14/A/4
R. Capra
C. Vogan
D. McDonald
C. Cowgill
OGC-WF
D. Hagan, 3302 MNBB
E. Jordan, 3302 MNBB
B. Grimes, 9/A/2
C. Liang, 8/E/23
G. Hill (8), P-137
Wanda Jones, P-130A
C. Grimes, 11/F/23
ACRS (10)
GPA/PA
OC/LFMB
Plant File

cc: Plant Service list

cc:

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

BALTIMORE GAS AND ELECTRIC COMPANY

DOCKET NO. 50-317

CALVERT CLIFFS NUCLEAR POWER PLANT UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 160
License No. DPR-53

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Baltimore Gas and Electric Company (the licensee) dated November 5, 1990, as supplemented on June 11 and August 19, 1991, 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, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. DPR-53 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 160, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance and shall be implemented within 30 days.

FOR THE NUCLEAR REGULATORY COMMISSION

Robert A. Capra

Robert A. Capra, Director
Project Directorate I-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: September 11, 1991

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

BALTIMORE GAS AND ELECTRIC COMPANY

DOCKET NO. 50-318

CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 140
License No. DPR-69

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Baltimore Gas and Electric Company (the licensee) dated November 5, 1990, as supplemented on June 11 and August 19, 1991, 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, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.2 of Facility Operating License No. DPR-69 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 140, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance and shall be implemented within 30 days.

FOR THE NUCLEAR REGULATORY COMMISSION

Robert A. Capra

Robert A. Capra, Director
Project Directorate I-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: September 11, 1991

ATTACHMENT TO LICENSE AMENDMENTS

AMENDMENT NO. 160 FACILITY OPERATING LICENSE NO. DPR-53

AMENDMENT NO. 140 FACILITY OPERATING LICENSE NO. DPR-69

DOCKET NOS. 50-317 AND 50-318

Revise Appendix A as follows:

Remove Pages	Insert Pages
3/4 9-7*	3/4 9-7
3/4 9-8	3/4 9-8
B3/4 9-2	B3/4 9-2
B3/4 9-3	B3/4 9-3

*Pages that did not change, but are overleaf.

REFUELING OPERATIONS

CRANE TRAVEL - SPENT FUEL STORAGE POOL BUILDING

LIMITING CONDITION FOR OPERATION

3.9.7 Loads in excess of 1600 pounds shall be prohibited from travel over fuel assemblies in the storage pool.

APPLICABILITY: With fuel assemblies in the storage pool.

ACTION:

With the requirements of the above specification not satisfied, place the crane load in a safe condition. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.9.7 The weight of each load, other than a fuel assembly and CEA, shall be verified to be $\leq$ 1600 pounds prior to moving it over fuel assemblies.

REFUELING OPERATIONS

SHUTDOWN COOLING AND COOLANT CIRCULATION

LIMITING CONDITION FOR OPERATION

3.9.8.1 At least one shutdown cooling loop shall be in operation.*

APPLICABILITY: MODE 6 at all reactor water levels.

ACTION:

a. With less than one shutdown cooling loop in operation*, suspend all operations involving an increase in the reactor decay heat load or a reduction in boron concentration of the Reactor Coolant System and, specifically, the charging pumps shall be de-energized and the charging flow paths shall be closed. Close all containment penetrations providing direct access from the containment atmosphere to the outside atmosphere within 4 hours. The shutdown cooling pumps may be de-energized during the time intervals required for local leak rate testing of containment penetration number 41 pursuant to the requirements of Specification 4.6.1.2.d and/or to permit maintenance on valves located in the common shutdown cooling suction line, provided (1) no operations are permitted which could cause dilution of the reactor coolant system boron concentration and, specifically, the charging pumps shall be de-energized and the charging flow paths shall be closed, (2) all CORE ALTERATIONS are suspended, (3) all containment penetrations providing direct access from the containment atmosphere to the outside atmosphere are maintained closed, and (4) the water level above the top of the irradiated fuel is greater than 23 feet.

b. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.9.8.1 A shutdown cooling loop shall be determined to be in operation and circulating reactor coolant at a flow rate of $\geq$ 1500 gpm at least once per 4 hours.

* The shutdown cooling loop may be removed from operation for up to 1 hour per 8 hour period during the performance of CORE ALTERATIONS in the vicinity of the reactor pressure vessel hot legs.

3/4.9.6 REFUELING MACHINE OPERABILITY

The **OPERABILITY** requirements for the refueling machine ensure that: (1) the refueling machine will be used for movement of CEAs and fuel assemblies, (2) the refueling machine has sufficient load capacity to lift a CEA or fuel assembly, and (3) the core internals and pressure vessel are protected from excessive lifting force in the event they are inadvertently engaged during lifting operations.

3/4.9.7 CRANE TRAVEL - SPENT FUEL STORAGE BUILDING

The restriction on movement of loads in excess of the nominal weight of a fuel assembly and CEA over other fuel assemblies in the storage pool ensures that in the event this load is dropped (1) the activity release will be limited to that contained in a single fuel assembly, and (2) any possible distortion of fuel in the storage racks will not result in a critical array. This assumption is consistent with the activity release assumed in the accident analyses.

3/4.9.8 COOLANT CIRCULATION

The requirement that at least one shutdown cooling loop be in operation ensures that (1) sufficient cooling capacity is available to remove decay heat and maintain the water in the reactor pressure vessel below 140°F as required during the **REFUELING MODE**, and (2) sufficient coolant circulation is maintained through the reactor core to minimize the effects of a boron dilution incident and prevent boron stratification.

The requirement to have two shutdown cooling loops **OPERABLE** when there is less than 23 feet of water above the core ensures that a single failure of the operating shutdown cooling loop will not result in a complete loss of decay heat removal capability. With the reactor vessel head removed and 23 feet of water above the core, a large heat sink is available for core cooling, thus in the event of a failure of the operating shutdown cooling loop, adequate time is provided to initiate emergency procedures to cool the core.

In **MODE** 6, shutdown cooling flow must provide sufficient heat removal to match core decay heat generation rates and maintain the core exit temperature within the **MODE** limit. Thus, as decay heat production is reduced with time, shutdown cooling flow may be proportionally reduced. Pursuant to NRC Generic Letter 88-17, flow reduction is necessary for operations near the mid-point of the hot leg piping to prevent vortex formation at the shutdown cooling suction nozzle. Prevention of vortex formation reduces the potential for a loss of shutdown cooling due to air binding of the low pressure safety injection (LPSI) pump(s) operating to provide shutdown cooling flow. In accordance with the recommendations of NRC Bulletin 88-04, "Safety Related Pump Loss," a minimum flow rate requirement of 1500 gpm is imposed. This protects the vendor-recommended minimum continuous duty flow rate of 1340 gpm for the LPSI pumps. The

1500 gpm minimum flow rate is also more than adequate to preclude a boron dilution event in **MODE** 6 operation and in no way restricts the ability to increase flow as necessary to remove decay heat.

3/4.9.9 CONTAINMENT PURGE VALVE ISOLATION SYSTEM

The **OPERABILITY** of this system ensures that the containment purge valves will be automatically isolated upon detection of high radiation levels within the containment. The **OPERABILITY** of this system is required to restrict the release of radioactive material from the containment atmosphere to the environment.

3/4.9.10 and 3/4.9.11 WATER LEVEL-REACTOR VESSEL AND SPENT FUEL POOL WATER LEVEL

The restrictions on minimum water level ensure that sufficient water depth is available to remove 99% of the assumed 10% iodine gap activity released from the rupture of an irradiated fuel assembly. The minimum water depth is consistent with the assumptions of the accident analysis.

3/4.9.12 SPENT FUEL POOL VENTILATION SYSTEM

The limitations on the spent fuel pool ventilation system ensure that all radioactive material released from an irradiated fuel assembly will be filtered through the HEPA filters and charcoal adsorber prior to discharge to the atmosphere. The **OPERABILITY** of this system and the resulting iodine removal capacity are consistent with the assumptions of the accident analyses.

3/4.9.13 SPENT FUEL CASK HANDLING CRANE

The restriction on movement of the spent fuel shipping cask within one cask length of any fuel assembly ensures that in the event this load is dropped (1) the stored spent fuel assemblies will not be damaged, and (2) any possible distortion of fuel in the storage racks will not result in a critical array.

3/4.9.14 CONTAINMENT VENT ISOLATION VALVES

The **OPERABILITY** and closure restrictions on the containment vent isolation valves are sufficient to restrict radioactive material release from a fuel element rupture based upon the lack of containment pressurization potential while in the **REFUELING MODE**.

REFUELING OPERATIONS

CRANE TRAVEL - SPENT FUEL STORAGE POOL BUILDING

LIMITING CONDITION FOR OPERATION

3.9.7 Loads in excess of 1600 pounds shall be prohibited from travel over fuel assemblies in the storage pool.

APPLICABILITY: With fuel assemblies in the storage pool.

ACTION:

With the requirements of the above specification not satisfied, place the crane load in a safe condition. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.9.7 The weight of each load, other than a fuel assembly and CEA, shall be verified to be $\leq$ 1600 pounds prior to moving it over fuel assemblies.

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LIMITING CONDITION FOR OPERATION

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ACTION:

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b. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.9.8.1 A shutdown cooling loop shall be determined to be in operation and circulating reactor coolant at a flow rate of $\geq$ 1500 gpm at least once per 4 hours.

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3/4.9.8 COOLANT CIRCULATION

The requirement that at least one shutdown cooling loop be in operation ensures that (1) sufficient cooling capacity is available to remove decay heat and maintain the water in the reactor pressure vessel below 140°F as required during the **REFUELING MODE**, and (2) sufficient coolant circulation is maintained through the reactor core to minimize the effects of a boron dilution incident and prevent boron stratification.

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 160 TO FACILITY OPERATING LICENSE NO. DPR-53

AND AMENDMENT NO. 140 TO FACILITY OPERATING LICENSE NO. DPR-69

BALTIMORE GAS AND ELECTRIC COMPANY

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

DOCKET NOS. 50-317 AND 50-318

1.0 INTRODUCTION

By letter dated November 5, 1990, as supplemented on June 11 and August 19, 1991, the Baltimore Gas and Electric Company (the licensee) submitted a request for changes to the Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2, Technical Specifications (TS). The requested changes would modify the surveillance requirement of TS 4.9.8.1 to reduce the shutdown cooling (SDC) system flow rate to greater than or equal to 1500 gpm during refueling (Mode 6) regardless of the reactor coolant water levels. The June 11 and August 19, 1991, letters provided clarifying information that did not change the initial proposed no significant hazards consideration determination.

In the NRC Generic Letter 88-17, the staff identifies a concern regarding potential loss of decay heat removal (DHR) due to air ingestion into the SDC system as a result of vortexing during reduced reactor coolant system (RCS) inventory operation. The high SDC system flow rate contributes to the likelihood that air will be ingested which could bind the DHR pumps and result in the loss of DHR. The NRC staff recommended that licensees should evaluate and propose changes to their Technical Specifications (TS) limiting condition for operation (LCO) on SDC system flow rate to enhance the overall reliability of SDC system operation.

In response to the NRC Generic Letter 88-17, the licensee in its letter dated January 27, 1989, indicated that it would take action to submit an amendment request which would reduce the minimum flow rates allowed by TS in order to reduce likelihood of air ingestion into the SDC system as a result of vortexing.

The current TS Surveillance Requirement 4.9.8.1 for the Calvert Cliffs facilities require that when the RCS water level is above the midplane of the hot leg, a SDC loop shall be determined to be in operation and circulating reactor coolant at a flow rate of greater than or equal to 3000 gpm at least once per 4 hours during refueling. When the RCS is drained to a level below the midplane of

the hot leg, a SDC system flow rate of greater than or equal to 1500 gpm is required. The basis for this TS limitation is to assure that (1) sufficient cooling capacity is available to remove decay heat and maintain the water in the reactor pressure vessel below 140°F, as required during the refueling, and (2) sufficient coolant circulation is maintained through the reactor core to minimize the effects of a boron dilution incident and prevent boron stratification.

2.0 EVALUATION

2.1 Adequate Flow to Remove Decay Heat

The design basis for the SDC system at Calvert Cliffs is to assure sufficient decay heat removal is available to reduce the temperature of the RCS at a controlled rate from 300°F to a refueling temperature of less than 140°F within 27½ hours after shutdown, and to maintain these conditions once they are reached. This design basis assumes the component cooling water is at its maximum design temperature. The licensee stated that operational experience at Calvert Cliffs has shown that a SDC pump flow rate of 1500 gpm is more than adequate to remove decay heat in Mode 6 and allows the operator sufficient time to control the RCS temperature changes. The licensee proposes to use the low pressure safety injection (LPSI) pump discharge valve to throttle pump flow to 1500 gpm and control the decay heat removal capacity with the shutdown cooling heat exchanger (SCHX) bypass valve. Instructions for these operations are contained in the plant operating procedures. The core exit temperature, SDC system flow, LPSI pump suction pressure and LPSI pump motor current indications are available to support operator actions. While it is likely that a SDC pump flow rate of 1500 gpm is adequate to handle the heat load during refueling (Mode 6), additional SDC system flow can be obtained by operating the LPSI pump discharge valve. The redundant train of the SDC system flow path can provide sufficient SDC system flow when a single active failure in the system is assumed. Therefore, the NRC staff has determined that the proposed TS change provides reasonable assurance that adequate flow to remove decay heat will be available during Mode 6 operation, while the potential to vortexing is minimized.

2.2 Adequate Flow to Ensure Sufficient Mixing

The SDC system circulates the reactor coolant via the LPSI pump, the shutdown cooling heat exchanger, the safety injection nozzles, the downcomer of the reactor, and the bottom of the reactor vessel during Mode 6 operation. A SDC flow rate of 1500 gpm is sufficient to maintain constant circulation through the reactor vessel resulting in adequate mixing and the prevention of boron stratification within the reactor vessel. This was demonstrated by the results of testing using RCS sampling. The inadvertent boron dilution event during Mode 6 has been analyzed for Calvert Cliffs and documented in Section 14.3 of the Updated Final Safety Analysis Report (UFSAR). The analysis assumes that the RCS boron concentration is uniform at all times when operating in Mode 6. The results of the analysis indicate that the operator has sufficient time

to take appropriate actions to mitigate the consequences of this design basis event. A SDC flow rate of 1500 gpm will provide adequate circulation and mixing to satisfy the assumption of uniform RCS boron concentration at time of an inadvertent boron dilution event. Therefore, the NRC staff considers that the consequences of a boron dilution event, when the SDC flow rate is 1500 gpm, bounded by the UFSAR analysis.

2.3 Adequate Flow to Prevent Pump Damage

The manufacturer of the LPSI pumps used at the Calvert Cliffs facilities recommends that these pumps not be operated continuously at a flow rate less than 1340 gpm to protect the pumps from failing. A minimum flow rate of 1500 gpm specified in the proposed TS surveillance requirement satisfies the manufacturer's recommendation and will provide adequate protection against pump failure.

2.4 Adequate Flow Limits to Prevent Vortexing

The licensee has completed tests to demonstrate that the potential for vortexing will be minimal at flow rate of 1500 gpm. Each LPSI pump was tested at various RCS levels from the top of the hot leg down to 15 inches from the bottom of the hot leg. At each level, flow was incrementally increased from 500 gpm to 4000 gpm. The test verified that the existing plant procedural controls for RCS level and SDC system flow are adequate to avoid system conditions leading to the loss of SDC due to vortexing. However, some evidence of air entrainment was experienced at a flow rate of 3000 gpm at mid-loop conditions. Based on the above test results, the NRC staff has determined that the proposed change to the TS surveillance requirement for greater than or equal to 1500 gpm will provide sufficient margin to prevent vortexing.

3.0 SUMMARY

Based on the details discussed above, the NRC staff has determined that the licensee's proposed TS Surveillance Requirement, TS 4.9.8.1, and its supporting bases are acceptable. The licensee's initial request did not include the 1500 gpm flow rate in the surveillance requirement, but indicated this value would be controlled by administrative procedures. The licensee modified this by its letter dated August 19, 1991, which retained the minimum flow rate in TS 4.9.8.1. As noted in the licensee's request, this change did not impact the initial determination of no significant hazards. The inclusion of the 1500 gpm in the TS instead of procedural controls provides a more conservative approach to assure the minimum limit is maintained during refueling operation.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Maryland State official was notified of the proposed issuance of the amendments. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendments change a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes to the surveillance requirements. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (55 FR 49446). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

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