



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NOS. 122 AND 104

TO FACILITY OPERATING LICENSE NOS. DPR-53 AND DPR-69

BALTIMORE GAS AND ELECTRIC COMPANY

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

DOCKET NOS. 50-317 AND 50-318

INTRODUCTION

Baltimore Gas & Electric Company (BG&E, the licensee) has requested an emergency extension of the provisions of Section 3/4.8.1, "A.C. Sources", of the Calvert Cliffs 1 & 2 Technical Specifications (TS). The requested extension would allow the licensee to take Emergency Diesel Generator (EDG) 12 out of service for 240 hours (10 days) while in Limiting Condition For Operation (LCO) Action Statement "b" of the above TS prior to being required to shut down to Hot Standby conditions. During the review process, LCO 3.8.1.1.c, action statement "f", and surveillance requirements 4.8.1.1.3 and 4.8.1.1.4 were added to provide the operability and surveillance requirements for the 1000 kW, 480 volt portable diesel generator.

LCO 3.8.1.1.c specifies that the portable diesel generator must be operable, whereas action statement "f" states that, if the portable diesel generator is inoperable, it must be restored to operability within 72 hours or the unit must be in the hot standby condition within 6 hours and in cold shutdown within the following 30 hours.

Surveillance requirements 4.8.1.1.3 and 4.8.1.1.4 provide the surveillances that must be performed to demonstrate at least every 72 hours the operability of the portable diesel generator.

Additionally, minor changes were made to the numbering of the surveillance requirements of surveillance 4.8.1.1.2 for the purpose of clarification. The numbering of the surveillances was changed to reflect the standard numbering sequence used for Technical Specifications.

The licensee has requested the TS action in order to allow time to disassemble and inspect EDG 12 for possible breaches in the combustion chamber/jacket water boundary. The following is a discussion and the staff's evaluation of the licensee's request.

BACKGROUND

The licensee has observed an excessive gas buildup in the diesel jacket cooling water system which has rendered EDG 12 inoperable due to the resultant low cooling water pressure. The most probable source of the gas has been determined to be a crack in the cylinder liner of the No. 12 cylinder, emanating from the southeast fuel injector adapter port. The licensee needs to keep EDG 12 out of service for up to 10 days in order to replace the liner of the No. 12 cylinder, examine all other cylinder liners and adapter ports for cracks, and perform all necessary repairs and post-maintenance testing prior to returning EDG 12 to operable status.

STAFF CONCERNS

The onsite AC power system at Calvert Cliffs consists of three identical EDG's. EDG 11 is dedicated to Unit 1, while EDG 21 is dedicated to Unit 2. EDG 12 is a "swing diesel"; i.e., it can be aligned to substitute for EDG's 11 or 21. With EDG 12 out of service, there is no backup for the other EDG's. The principal issues involved in these amendments relate to the potential for a loss of offsite power (LOOP) coincident with the failure of EDG 11 or 21 during the 10 days EDG 12 would be out of service. This scenario would result in a station blackout for the unit associated with the failed EDG. The immediate concerns would be (1) decay heat removal, and (2) loss of primary inventory as a consequence of reactor coolant pump seal leakage.

The licensee has addressed the above concerns and provided data on plant design features and/or special considerations which the licensee feels will mitigate the consequences of the above event. These design features and special considerations are discussed in further detail in subsequent sections of this report.

MITIGATING FEATURES

Offsite Power

There are two, independent, 500 kV transmission lines coming into the Calvert Cliffs site. These transmission lines connect to the BG&E grid and supply power to the plant during normal operation as well as during shutdown and startup. In normal operation, Unit 1 is powered from one 500 kV source, and Unit 2 is powered from the other 500 kV source. However, the system is designed with the capability for each 500 kV source to power both units simultaneously. This diversity ensures that the loss of a single 500 kV source will not result in a station blackout, assuming the failure of an EDG. The operators at Calvert Cliffs are trained in the procedures to align the 500 kV sources, as required, to feed both units from either source.

In the event both 500 kV power sources are lost, there is a third offsite power source available. This third source is a 69 kV feeder from the Southern Maryland Electric Cooperative (SMECO). The SMECO feeder is not connected directly to the BG&E grid. SMECO obtains power from Potomac

Electric Power Company (PEPCO), which in turn, is connected to a larger, East Coast grid which includes BG&E. With the above arrangement, the SMECO feeder is essentially isolated from the BG&E distribution system. This ensures that disturbances on the BG&E system will have little, if any, impact on the 69 kV SMECO feeder. During the out of service period for EDG 12, the 69 kV feeder will be used to energize 13 kV bus 23. Bus 23, in turn, can be aligned to power all plant safety buses through manual action in the control room. The SMECO feeder is sized to carry safe shutdown loads in both units simultaneously.

For added reliability, the licensee has committed to limit maintenance on the 500 kV transmission lines to only necessary activities during the time EDG 12 is out of service. This will minimize challenges to offsite power availability.

Calvert Cliffs has never had a complete loss of offsite power, which indicates good stability of the BG&E grid. The 500 kV transmission lines and towers are designed to withstand winds of 100 and 160 mph, respectively. Winds of this velocity could be from a hurricane or a tornado. While the incidence of hurricanes of 100 mph magnitude in the Calvert Cliffs area is very low (only one in recorded history), the licensee has committed to reduce power to 300 MW in the event a hurricane with 70 mph winds is anticipated, and to shut down in the event a hurricane with 90 mph winds is anticipated. Tornadoes can be spawned at any time, given the right meteorological conditions. Tornadoes with wind velocities in excess of 100 mph in the Calvert Cliffs area are also very rare. Regardless of the incidence of tornadoes, the offsite power network could withstand a tornado with winds in excess of 100 mph. This is because the BG&E transmission line and the SMECO feeder occupy different rights of way and it is extremely unlikely that a single tornado would strike both. At the site, the 500 kV lines are overhead while the SMECO feeder is underground. A tornado right at the site may damage the 500 kV lines, but would not affect the SMECO feeder.

To compensate for the loss of EDG 12 during the requested 10 day outage of the diesel, the staff will impose an LCO requiring all the offsite power sources be available during the time EDG 12 is out of service. The specifics of this LCO are contained in the one-time Technical Specifications which are included as Appendix A of this evaluation.

125 VDC Power

The DC electrical power system (including batteries, battery chargers, and inverters) consist of four separate, independent and isolated channels, each of which feeds both units. In the event of a complete loss of AC power to one unit, the DC system battery chargers would be powered from the other unit's AC power (either offsite or EDG). With this arrangement, 125 VDC power for operation of the auxiliary feed pumps and atmospheric dump valves would be available for an indefinite period of time.

Auxiliary Feed Pumps

There are two steam driven auxiliary feed pumps in each unit at Calvert Cliffs. The steam admission valves to these feed pumps are maintained closed by air pressure during normal operation. To open the steam valves, a 125 VDC solenoid valve is opened by remote control and the air in the pressure chamber is released to the atmosphere. As described above, 125 VDC power will be available for solenoid valve operation. In addition to the solenoid valve, the air in the pressure chamber can be released through a manually operated valve. Each pump is capable of providing the feedwater required for decay heat removal. The redundancy of the auxiliary feed pumps with the capability of manual operation assures the availability of auxiliary feedwater, if required.

If both steam driven auxiliary feed pumps were not available, there is a cross connect between units which allows a motor driven auxiliary feed pump in the non-affected unit to supply feed water to the unit without AC power or steam driven pumps.

In the event of a shutdown using onsite (EDG) AC power, auxiliary feed pump control (for steam generator level control) is accomplished automatically using compressed air from the instrument air system. The licensee has stated that there is adequate compressed air storage for auxiliary feed pump control for about 2 hours following the complete loss of AC power. When the compressed air is depleted, the pump/steam generator level can be controlled manually by throttling the auxiliary feed pump steam inlet valve or feedwater discharge valve, or both.

Atmospheric Dump Valves

The atmospheric dump valves are powered from the 125 VDC bus and can be operated remotely from the control room. As stated above, the 125 VDC systems can be assured from either unit and would be available for an indefinite period of time. Therefore, the atmospheric dump valves would be available for decay heat removal for an indefinite period of time. Should the remote control become inoperative for any reason, the atmospheric dump valves can be operated manually from the auxiliary building at the 45 foot elevation. Personnel operating the valves manually would be protected from the heat and noise attendant to opening steam dump valves.

Emergency Diesel Generators

The staff has reviewed operational data and inspection reports relating to all EDG's at Calvert Cliffs. The staff did not find any history of frequent failures or indications of adverse trends for any of the EDG's. Following this review of data, the staff concluded that the EDG's are well maintained and that the personnel responsible for the EDG's are knowledgeable and are thorough in their approach to EDG maintenance. The staff could not find any obvious reason why the EDG's could not be relied upon to start when required.

The staff also witnessed a firing pressure test on EDG 12 during a site visit to review operational data. The firing pressures were in the proper range for the operating load and were uniform (within acceptable tolerances). The crankcase vacuum was high which indicates good piston ring sealing and confirms the adequacy of the firing pressures. The results of the above test support the staff's observations made during the review of operational data.

Portable Diesel Generator

The licensee has obtained a 1000 kW portable diesel generator (PDG) and located it onsite. The PDG operates at 480 VAC and 60 Hz. It would be connected to either the 14A bus in the event of a Unit 1 AC blackout or the 24A bus for a Unit 2 AC blackout. The PDG would then be used to power a charging pump and battery charger for the unit in order to maintain primary inventory and adequate decay heat removal.

Procedures to connect the PDG to either the 14A bus or the 24A bus have been developed, approved, and tested. Additionally, all staff personnel who may need to conduct this procedure have been trained in the use of these procedures through their actual performance. The time necessary to connect the PDG to either bus and commence supplying AC power was consistently in the range of 45 to 60 minutes.

The licensee has committed to providing 24-hour onsite staffing of personnel trained in connecting the PDG.

The licensee has agreed that the operability of the PDG shall be demonstrated at least once per 72 hours. If the PDG is found to be inoperable, the licensee may continue to operate up to 72 hours prior to being required to shut down to hot standby conditions.

STAFF EVALUATION AND CONCLUSIONS

The licensee's requested TS change involves extending the period of time that one diesel generator may be out of service without a plant shutdown. To fully evaluate the potential effects of the proposed action, the staff postulated an event which, itself, is beyond those normally, specifically considered in the design basis for the plant; however, it is appropriate in this case because of the extended inoperability status of the "swing diesel." This event is a complete loss of AC power to one unit. The staff then reviewed and evaluated the plant design features, additional equipment, and/or plant personnel actions the licensee would utilize to mitigate the consequences of the postulated event. The preceding sections of this evaluation contain descriptions of the plant design features and/or personnel actions the licensee would utilize. These features and actions, combined, are adequate to mitigate the consequences of the postulated event.

Results of tests on reactor coolant pump seals by the pump vendor (Byron Jackson), and actual pump operating history, support the vendor position that these seals would not be damaged as a consequence of a loss of seal cooling water due to a complete loss of AC power. However, in the unlikely event of seal damage, the licensee has stated that the reactor coolant pump seals would not fail from a 2-hour complete loss of AC power. The PDG would be connected and providing AC power to the blacked out unit in less than 1 hour. This would provide charging capability to the unit. Additionally, previous experimental test data has indicated that, in the event of the failure of all four seals on a reactor coolant pump, the expected seal leakage would not exceed 40 GPM. At this rate, it would take approximately 1 day to deplete the primary inventory to an unsafe level. The underground 69 kV feeder at Calvert Cliffs is not as susceptible to failure during adverse meteorological conditions as are the 500 kV transmission lines. This provides added assurance that offsite power can be restored quickly. Commission studies state that restoration of offsite power to nuclear plants generally occurs within 4 hours for the loss of offsite power events. Based on all of the above, power would be restored to the charging pumps long before any likely threat to the primary inventory occurred. The above scenario is unlikely because it would require, simultaneously, (1) complete loss of three offsite power sources to the extent they could not be restored in a day's time; (2) loss of an EDG; and (3) failure of four reactor coolant pump seals, resulting in a net leakage rate of 40 GPM.

Based on its evaluation, the staff concludes that an emergency TS change to allow EDG 12 to be out of service for 10 days while the plant (Units 1 and 2) remains at full power is acceptable.

FINAL NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

The Commission's regulation 10 CFR 50.92 states that the Commission may make a final determination that a license amendment involves no significant hazards consideration if operation of the facility in accordance with the amendment would not:

- (1) Involve a significant increase in the probability or consequences of an accident previously evaluated; or
- (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or
- (3) involve a significant reduction in a margin of safety.

The only accident considerations affected by the amendments are those relating to the potential for station blackout. The station blackout (the loss of all AC power) is protected against by the provisions of 10 CFR Part 50, Appendix A, Criterion 17 (GDC 17), "Electrical power systems," and by the limited period of inoperability permitted for power supplies by the Technical Specifications. GDC 17 ensures that the licensee has sufficient redundancy of electrical systems, both offsite and onsite, to ensure that the core is cooled and

containment integrity and other vital functions are maintained in the event of postulated accidents. Normally, the licensee is permitted to operate both reactors for periods of up to 72 hours with one diesel generator inoperable. In the event of a single failure of one of the two remaining diesel generators following a loss of the two offsite AC power circuits, one of the two units would be in the station blackout scenario. The only affect of these amendments is to extend this diesel generator out-of-service period.

Operation of the facility in accordance with the proposed amendments would allow the licensee to operate for a period of up to 10 days with one diesel generator inoperable. To assure that the proposed amendments would not result in a significant increase in the probability of the station blackout scenario as a result of the 7 additional days of permissible diesel generator inoperability, additional requirements are provided to have three operable offsite AC power circuits operable rather than the two offsite AC power circuits normally required. The probability of the station blackout scenario is reduced by the source and design of the third operable offsite AC circuit. This circuit provided power from a grid different from that which supplies the two circuits normally utilized. Additionally, the right-of-way of this circuit comes underground from the west while the other two circuits come from the north. A 1000 kW PDG has been located on site. The PDG has the capability to provide within 1 hour AC power, concurrently, to a charging pump and a battery charger for an AC blacked out unit. Due to these factors, the Commission has determined that operation of the facility in accordance with the proposed amendment would not involve a significant increase in the probability or consequences of the station blackout or of any other accident previously evaluated.

The accident of concern for these proposed amendments as discussed above is the station blackout which was previously considered. The proposed amendments would not create the possibility of a new or different kind of accident from any previously evaluated.

Finally, these proposed amendments do not involve a significant reduction in any margin of safety.

Based upon the consideration provided above, the staff concludes that the proposed amendments meet the three criteria of 10 CFR 50.92 and, as such, involve no significant hazards considerations.

STATEMENT OF EMERGENCY CIRCUMSTANCES

The crack in the No. 12 cylinder liner in EDG 12, which requires an extension of the diesel generator outage time for repair of EDG 12, was discovered during a series of tests conducted on EDG 12 during the period from September 10, 1986 to September 18, 1986. These tests were being performed to identify the source of the gas leakage into the jacket water cooling system of EDG 12. Upon determination of the crack in the No. 12 cylinder, the licensee promptly informed the Commission of this problem and of their need for an emergency amendment, additionally, the licensee began their preparations for the submittal of the proposed amendment request and to repair the cylinder liner crack.

Repair of the cracked cylinder liner will require that EDG 12 be out-of-service for a period of time greater than normally permitted by TS 3/4.8.1.

The staff concludes that an unavoidable emergency situation does exist that would unnecessarily cause the shutdown of at least one unit and as such, warrants the emergency amendment procedures provided by 10 CFR Part 50.91.

STATE CONSULTATIONS

A good faith attempt was made to consult with the appropriate official of the State of Maryland. This official was unavailable for a 3-day period.

ENVIRONMENTAL CONSIDERATION

These amendments involve a change in the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The 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 made a final no significant hazards consideration finding with respect to these amendments. According, these 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 these amendments.

CONCLUSION

We have concluded, based on the considerations discussed above, that (1) this emergency situation could not be avoided, (2) the licensee acted in a timely manner with respect to responding to this emergency, (3) because the amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated, does not create the possibility of an accident or a type different from any evaluated previously, and does not involve a significant reduction in margin of safety, the amendment does not involve a significant hazards consideration, (4) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (5) such activities will be conducted in compliance with the Commission's regulations, and 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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