

October 22, 1998

Mr. Charles H. Cruse
Vice President - Nuclear Energy
Baltimore Gas and Electric Company
Calvert Cliffs Nuclear Power Plant
1650 Calvert Cliffs Parkway
Lusby, MD 20657 - 4702

SUBJECT: QUESTIONS AND ISSUES FOR CALVERT CLIFFS MEETING

Dear Mr. Cruse:

An inspection was conducted at Calvert Cliffs Nuclear Power Plant during the week of July 6, 1998, to review Appendix R related open items. At the July 10, 1998, exit meeting, the inspector presented his preliminary findings to members of your staff. However, upon NRC management review, several questions arose regarding Appendix R self-assessment issues.

We have scheduled a meeting with your staff on November 18, 1998 (Notice of Significant Meeting No. 98-82) to discuss these issues. The enclosure provides a list of questions for your review in advance of the meeting. It is also requested that the status of the Appendix R program with regard to the Appendix R self-assessment report be presented during the meeting.

No response to this letter is required, and your cooperation with us in this matter is appreciated. If you have any questions or comments, please call me at (610) 337-5066.

Sincerely,

ORIGINAL SIGNED BY:

David C. Lew, Acting Chief
Electrical Engineering Branch
Division of Reactor Safety

Docket Nos. 50-317
50-318

Enclosure: Calvert Cliffs Appendix R Self-Assessment Comments and Questions

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ENCLOSURE

Calvert Cliffs Appendix R Self-Assessment Questions

Topic: External Hot Shorts

Appendix R Self-Assessment Recommendation

Appendix R self-assessment report recommended that Baltimore Gas & Electric Company (BGE) reevaluate Appendix R safe shutdown component circuits and consider all single external hot short cable faults.

BGE Actions

Your actions, as stated in task number SA-1 of the project plan and scope document, was that you only considered cable to cable faults for high/low pressure interfaces and that, as part of BGE's Appendix R long term configuration control program, postulated cable to cable faults will be analyzed for any possible effects.

NRC Comments and Questions

10 CFR 50, Appendix R, Section III.G.2, "Fire protection of safe shutdown capability," states, in part, "Except as provided for paragraph G.3 of this section, where cables or equipment, including associated non-safety circuits that could prevent operation or cause maloperation due to hot shorts, open circuits, or shorts to ground, of redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located within the same fire area outside of primary containment, one of the following means of enduring that one of the redundant trains is free of fire damage shall be provided: a.) Separation of cables and equipment associated non-safety circuits of redundant trains by a fire barrier having a 3-hour rating. Structural steel forming a part of or supporting such fire barriers shall be protected to provide fire resistance equivalent to that required of the barrier; b.) Separation of cables and equipment and associated non-safety circuits of redundant trains by a horizontal distance of more than 20 feet with no intervening combustible or fire hazards. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area; or c.) Enclosure of cable and equipment and associated non-safety circuits of one redundant train in a fire barrier having a 1-hour rating. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area; Inside noninerted containments one of the fire protection means specified above or one of the following fire protection means shall be provided: d.) Separation of cables and equipment and associated non-safety circuits of redundant trains by a horizontal distance of more than 20 feet with no intervening combustibles or fire hazards; e.) Installation of fire detectors and an automatic fire suppression system in the fire area; or f.) Separation of cables and associated non-safety circuits of redundant trains by a noncombustible radiant energy shield."

10 CFR 50, Appendix R, Section III.L.7, "Alternative and dedicated shutdown capability," states, in part, "The safe shutdown equipment and systems for each fire area shall be known to be isolated from associated non-safety circuits in the fire area so that hot shorts, open circuits, or shorts to ground in the associated circuits will not prevent operation of the safe shutdown equipment."

GL 86-10, question 5.3.1, Circuit Failure Modes, provides guidance that all possible functional failure states must be evaluated.

The NRC recognizes that BGE is currently in the process of analyzing postulated cable to cable faults for all hot shorts and the results of this analysis will be included in the interactive cable analysis (ICA). Calvert Cliffs had only evaluated postulated cable to cable faults for high/low pressures interfaces. This implies that Calvert Cliffs did not evaluate all postulated cable to cable faults until after the Appendix R self-assessment.

Based on the above, please explain whether you agree or disagree that Appendix R requires that you evaluate all possible functional failure states, including postulated cable to cable faults and provide your basis. Also, please describe your assumptions for the analysis currently underway and your projected completion date.

Topic: Reportability

Appendix R Self-Assessment Report Recommendation

Appendix R self-assessment report recommended that the reportability of potential Appendix R non-conformance be reevaluated. A BGE criteria and checklist based on 10 CFR 50.72 and 50.73 should be generated to assist identification of reportable major and/or critical non-conformances.

BGE Actions

Your actions, as stated in task number SA-4 of the project plan and scope document was to reevaluate the Appendix R reportability issue. After the reevaluation of this issue, you determined that Calvert Cliffs was not an industry outlier regarding Appendix R reportability issues and that further discussion with the NRC is expected.

NRC Comments and Questions

10 CFR 50.73(a)(2)(ii) states, Licensees shall report, "Any event or condition that resulted in the condition of the nuclear power plant, including its principal safety barriers, being seriously degraded; or results in the nuclear power plant being:

- (A) In an unanalyzed condition that significantly compromised plant safety;
- (B) In a condition that was outside the design basis of the plant;"

NUREG-1022, Revision 1, "Events Reporting Guidelines 10 CFR 50.72 and 50.73," provides guidance and examples of reportable issues including an example of an Appendix R issue. Section 3.2.4, "Operating Plant Found in Degraded or Unanalyzed Condition," Paragraph 3, "The nuclear power plant being in a condition that is outside the design basis of the plant," states, "Violation of fire protection commitments regarding safe shutdown capability may indicate that the plant is outside of its design basis. For example, if fire barriers are found to be missing, such that the required degree of separation for redundant safe shutdown trains is lacking, the plant would be outside of the design basis with respect to Appendix R to 10 CFR Part 50. On the other hand, if a fire wrap, to which the licensee has committed, is missing from a safe shutdown train but another safe

shutdown train is available in a different fire area, protected such that the required separation for safe shutdown trains is still provided, the plant would not be outside of its design basis with respect to Appendix R."

The distinction between these two examples is that, an Appendix R issue is reportable when the required post-fire safe shutdown capability is lacking. This places the plant in a condition outside of its design basis with respect to Appendix R and thus, is reportable.

For example, BGE determined that the RCS/LPSI suction valves (MOV-651 and 652) could open based on a postulated fire in several locations since the breaker for at least one of the valves in series had not been placed in the "CFF" position during normal plant operation. This is a condition that would not meet the requirements of 10 CFR 50, Appendix R, section III.G.1.a, thus placing the plant outside of its design basis. This condition appears reportable under 10 CFR 50.72 and 10 CFR 50.73(a)(2)(ii).

The NRC does recognize that BGE is in the process of reevaluating and modifying their reportability criteria for Appendix R issues in accordance with the guidance provided in NUREG-1022, Revision 1. However, in the past, it appears that you may not have appropriately submitted all Appendix R reportability issues to the NRC.

A search of the 50.72 database from January 1995 through September 1998 revealed no reports by Calvert Cliffs on Appendix R issues. However, during the search, it was noted that Calvert Cliffs reported an unusual event because of a fire in their auxiliary building ventilation system. It was also noted that Calvert Cliffs reported the isolation of a portion of their fire suppression system to make repairs to a section of fire main piping.

A search of the 50.73 database from May 1995 through February 1998 revealed that Calvert Cliffs generated several licensee event reports (LERs) regarding various fire protection issues in general. However, no Appendix R issues were apparent.

Based on the above, please explain your basis for not reporting this particular Appendix R compliance issue and other issues as appropriate. Also, state your plans to revise your reportability procedures and criteria.

Topic: Self-Induced Station Blackout

Appendix R Self-Assessment Report Recommendation

Appendix R self-assessment report recommended that the self-induced 4 kv bus blackout actions be reevaluated and that cooling water (and other plant supports) needed by the emergency diesel generators (EDGs) should be provided by performance of plant modifications and/or system lineup procedure changes.

BGE Actions

Your actions, as stated in task number SA-5 of the project plan and scope document, was to review an issue that occurred at Arkansas Nuclear One regarding a concern that the diesels, if running too long without service water in an Appendix R scenario, may damage themselves. Based on an initial review, BGE determined that there is reasonable assurance that their AOP-9 procedures will protect the originally installed diesels (1B, 2A, and 2B) from this occurrence by shutting them down when service water is lost under certain post-fire conditions and that they have a strong licensing position to support this action. It was also determined that diesel restart can occur in less than 60 minutes.

NRC Comments and Questions

There are no specific regulatory requirements for addressing Self Induced Station Blackout. However, 10 CFR 50, section III.L.1(e), "Alternate and dedicated shutdown capability," states, "maintain cold shutdown conditions there after. During post-fire shutdown, the reactor coolant system process variables shall be maintained within those predicted for a loss of normal AC power, and the fission product boundary integrity shall not be affected; i.e., there shall be no fuel clad damage, rupture of any primary coolant boundary, or rupture of the containment boundary." Section III.L.2, states, "The performance goals for the shutdown shall be: a.) The reactivity control function shall be capable of achieving and maintaining cold shutdown reactivity conditions. b.) The reactor coolant makeup function shall be cable of maintaining the reactor coolant level above the top of the core for BWRs and be within the level indication in the pressurizer for PWRs. c.) The reactor heat removal system shall be capable of achieving and maintaining decay heat removal. d.) The process monitoring function shall be capable of providing direct readings on process variables necessary to perform and control the above functions. e.) The supporting functions shall be capable of providing the process cooling, lubrication, etc., necessary to permit the operation of the equipment used for safe shutdown."

GL 86-10, response 5.3.6, "On-Site Power," states, "These statements are meant to indicate that the alternative shutdown capability should be powered from an onsite power system independent (both electrically and physically) from the area under consideration. Further, if the normal emergency onsite power supplies (diesel generators) are not available because of fire damage, then separate and independent onsite power systems shall be provided. As an example, some plants are utilizing a dedicated onsite diesel generator or gas turbine to power instrumentation and control panels which are a part of the alternative shutdown capability."

The NRC does recognize that BGE has decided to use the OC EDG, which does not rely on service water for cooling, for AOP-9 scenarios where using the originally installed diesels is of concern. However, there are still instances where the original diesels may have to be shutdown. Based on the requirements of III.L.1(e), III.L.2, and the guidance provided in GL 86-10, response 5.3.6, the NRC's position is that shutting down operating diesel generators with the loss of off site power is not appropriate.

Based on the above, please explain your basis for the actions taken to shutdown the diesel generators under certain post-fire scenarios and the reason that this is acceptable. Also, state your final plans to resolve this issue.

Topic: Raceway Enclosure

Appendix R Self-Assessment Report Recommendation

Appendix R self-assessment report recommended that this issue be brought to managements attention and that BGE reevaluate basis for acceptability of one hour conduit enclosure installed on charging pump number 11 powerfeed (Room 115C).

BGE Actions

Your actions, as stated in task number SA-6 of the project plan and scope document, was to perform an engineering evaluation of the one hour fire barrier that encloses conduit containing the number 11 charging pump power cable conduit where it traverses the number 13 charging pump room. BGE determined that the configuration was acceptable, that the current installation was safe and the existing enclosure would protect the conduit. Additionally, BGE determined that the smoke detection and sprinkler systems in the area along with low combustibile loading ensure that the exposure to the enclosure would be minimal. However, it appears that the end use of structural steel protection is not consistent with conduit protection.

NRC Comments and Questions

10 CFR 50, Appendix R, section III.G.2.c, "Fire protection for safe shutdown capability," states, in part, "Enclosure of cable and equipment and associated non-safety circuits of one redundant train in a fire barrier having a 1-hour rating, In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area;"

GL 86-10, response 3.2.2, "Deviations from Tested Configurations," states, "Where exact replication of a tested configuration cannot be achieved, the field installation should meet all of the following criteria:

1. The continuity of the fire barrier material is maintained.
2. The thickness of the barrier material is maintained.
3. The nature of the support assemble is unchanged from the tested configuration.
4. The application or "end use" of the fire barrier is unchanged from the tested configuration. For example, the use of a cable tray barrier to protect a cable tray which differs in configuration from those that were tested would be acceptable. However, the use of structural steel fire proofing to protect a cable tray assembly may not be acceptable.
5. The configuration has been reviewed by a qualified fire protection engineer and found to provide an equivalent level of protection."

The NRC recognizes that BGE performed an evaluation in which they did recognize the difference between structural steel and conduit protection and that the type of cable in the conduit had been tested to temperatures of 1800 to 2000°F (a temperature well above the maximum temperature of 1000°F permitted for structural steel). A fire protection engineer found the configuration to be acceptable. Based on the requirements of 10 CFR 50, Appendix R, III.G.2.c and the guidance provided in GL 86-10, response 3.2.2, it appears that the end use of the rated enclosure was not consistent with the tested design implemented by BGE.

Based on the above, please explain your basis for installing a 1-hour rated enclosure on charging pump No. 11 powerfeed and how that installation conforms to the requirements of Appendix R and to the guidance provided in GL 86-10, response 3.2.2. Also, please explain how you determined that the enclosure meets the requirements.

Topic: Manual Repair Issues

Appendix R Self-Assessment Report Recommendation

Appendix R self-assessment report recommended that BGE management reevaluate the use of wrenches and fuse pullers (tools) which may constitute a hot shutdown repair.

BGE Actions

As stated in task number SA-7 of the project plan and scope document, BGE has reevaluated the issue of manual repairs and has taken the position that their licensing basis supports their current approach of using tools to reach hot shutdown. BGE does not consider these actions to be repairs. BGE believes that no further action is needed on this issue and further NRC review is expected. The Appendix R self-assessment team identified several steps in procedure AOP-9A, "Control Room Evacuation and Safe Shutdown Due to a Severe Control Room Fire," that require the use of wrenches to disconnect valve air fittings to relieve pressure and/or the use of fuse pullers to fail valves in their required position for hot shutdown equipment.

NRC Comments and Questions

10 CFR 50, Appendix R, III.G.1, "Fire Protection for safe shutdown capability," states, "Fire protection features shall be provided for structures, systems, and components important to safe shutdown. These features shall be capable of limiting fire damage so that: a.) One train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station(s) is free of fire damage; and b.) Systems necessary to achieve and maintain hot shutdown from either the control room or emergency control station(s) can be repaired within 72 hours."

Safety Evaluation Report, dated September 27, 1982, Evaluation - section C., "Repairs," states, "No repairs are planned by the licensee to comply with Appendix R post-fire shutdown requirements."

NRC memorandum, "Position Statement on Allowable Repairs for Alternative Shutdown and on the Appendix R Requirement for Time Required to Achieve Cold Shutdown," dated July 2, 1982, states, "Section III.G.1 of Appendix R states that one train of systems needed for hot shutdown must be free of fire damage. Thus, one train of systems needed for hot shutdown must be operable during and following a fire. Operability of the hot shutdown systems, including the ability to overcome a fire or fire suppressant induced maloperation of hot shutdown equipment and the plant's power distribution system, must exist without repairs. Manual operation of valves, switches and circuit breakers is allowed to operate equipment and isolate systems and is not considered a repair. However, the removal of fuses for isolation is not permitted. All manual operations must be achievable prior to the fire or fire suppressant induced maloperations reaching an unrecoverable plant condition."

BGE's position is that they are operating within their licensing basis as reviewed by the NRC in 1984 and they are still using tools in the same manner or for the same purposes the NRC reviewed in their Alternate Shutdown Procedures in 1984. The NRC's position is that the actions of disconnecting air lines or pulling fuses to reach hot shutdown are repairs and do not meet the requirements stated above.

Based on the above, please explain your basis for using wrenches and fuse pullers, as stated in your AOP procedures, to bring the plant to a hot shutdown condition. Also, explain how the use of tools meet the intent of your licensing basis.

Topic: Multiple High Impedance Fault (MHIF) Analysis

Appendix R Self-Assessment Report Recommendation

Appendix R self-assessment report recommended the following:

- a. A similar MHIF analysis of memorandum DE01738, "Appendix R MHIF," October 9, 1996, in the self-assessment report be prepared for both units 4 kv buses, 480v load centers, and 480v MCC that are used for Appendix R.
- b. The MHIF analysis of 125 Vdc and 120 Vac systems be completed, promptly.

BGE Actions

Your actions, as stated in task number SA-16 of the project plan and scope document, was to complete the AC analysis, which included the 120 Vac analysis, and the 125 Vdc analysis. BGE has completed calculation 95-0049, "Multiple High Impedance Faults-AC Distribution System," Revision 0, and is reviewing calculation CA04043, "Multiple High Impedance Faults-125 VDC Distribution System," for approval. It appears that BGE's AC and DC analysis did not address MHIF as described in GL 86-10.

NRC Comments and Questions

10 CFR 50, Appendix R, Section III.G.2, "Fire protection of safe shutdown capability," states, in part, "Except as provided for paragraph G.3 of this section, where cables or equipment, including associated non-safety circuits that could prevent operation or cause maloperation due to hot shorts, open circuits, or shorts to ground, of redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located within the same fire area outside of primary containment, one of the following means of enduring that one of the redundant trains is free of fire damage shall be provided: a.) Separation of cables and equipment associated non-safety circuits of redundant trains by a fire barrier having a 3-hour rating. Structural steel forming a part of or supporting such fire barriers shall be protected to provide fire resistance equivalent to that required of the barrier; b.) Separation of cables and equipment and associated non-safety circuits of redundant trains by a horizontal distance of more than 20 feet with no intervening combustible or fire hazards. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area; or c. Enclosure of cable and equipment and associated non-safety circuits of one redundant train in a fire barrier having a 1-hour rating. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area; Inside noninerted containments one of the fire protection means specified above or one of the following fire protection means shall be provided: d.) Separation of cables and equipment and associated non-safety circuits of redundant trains by a horizontal distance of more than 20 feet with no intervening combustibles or fire hazards; e.) Installation of fire detectors and an automatic fire suppression system in the fire area; or f.) Separation of cables and associated non-safety circuits of redundant trains by a noncombustible radiant energy shield."

GL 86-10, response 5.3.8, "Short Circuit Coordination Studies," states, "To meet separation criteria of Section III.G.2 and III.G.3 of Appendix R, high impedance faults should be considered for all associated circuits located in the fire area of concern. Thus, simultaneous high impedance faults (below the trip point for the breaker on each individual circuit) for all associated circuits located in the fire area should be considered in the evaluation of the safe shutdown capability. Clearing such faults on associated circuits which may affect safe shutdown may be accomplished by manual breaker trips governed by written procedures. Circuit coordination studies need not be performed if it is assumed that shutdown capability will be disabled by such high impedance faults and appropriate written procedures for clearing them are provided."

BGE did not perform their evaluation of MHIF utilizing the guidance provided in GL 86-10. Based on the requirements above, the NRC's position regarding MHIFs, is that an evaluation is required for all buses used for Appendix R safe shutdown operation and that the evaluations should be done in accordance with the guidance provided in GL 86-10.

Based on the above, please explain your basis for not performing MHIF evaluations for all AC and DC Appendix R safe shutdown circuits using the guidance provided in GL 86-10.

Topic: High/Low Pressure InterfaceAppendix R Self-Assessment Report Recommendation

Appendix R self-assessment report recommended that BGE revise AOPs/EOPs/OIs to reflect new breaker configuration and be incorporated in a timely manner. The Report also recommended that a section be added to the ICA to address the basis for exclusion of potential high/low pressure boundary paths (e.g., reactor head vents and pressurizer PORVs, etc.). Presently such discussion only appears in the associated issue report.

BGE Actions

Your actions, as stated in task number SA-33 of the project plan and scope document, was to document the basis for excluding PORV's and reactor head vents as high/low pressure boundary valves among others. Your stated actions also included completing documentation for MOV-651 breaker position. The NRC recognizes that you have modified the appropriate procedure to deenergize both PORVs by placing their associated breakers to "OFF." The NRC also recognizes that BGE has modified the appropriate procedure to lock the MOV-651 breaker open with the valve in the closed position for normal operating conditions. MOV-651 is one of two shutdown cooling return isolation valves. These actions were taken to preserve the RCS due to spurious operation of these valves during Appendix R fire scenario.

NRC Comments and Questions

10 CFR 50, Appendix R, Section III.G.2, "Fire protection of safe shutdown capability," states, in part, "Except as provided for paragraph G.3 of this section, where cables or equipment, including associated non-safety circuits that could prevent operation or cause maloperation due to hot shorts, open circuits, or shorts to ground, of redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located within the same fire area outside of primary containment, one of the following means of enduring that one of the redundant trains is free of fire damage shall be provided: a.) Separation of cables and equipment associated non-safety circuits of redundant trains by a fire barrier having a 3-hour rating. Structural steel forming a part of or supporting such fire barriers shall be protected to provide fire resistance equivalent to that required of the barrier; b.) Separation of cables and equipment and associated non-safety circuits of redundant trains by a horizontal distance of more than 20 feet with no intervening combustible or fire hazards. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area; or c.) Enclosure of cable and equipment and associated non-safety circuits of one redundant train in a fire barrier having a 1-hour rating. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area; Inside noninerted containments one of the fire protections means specified above or one of the following fire protection means shall be provided: d.) Separation of cables and equipment and associated non-safety circuits of redundant trains by a horizontal distance of more than 20 feet with no intervening combustibles or fire hazards; e.) Installation of fire detectors and an automatic fire suppression system in the fire area; or f.) Separation of cables and associated non-safety circuits of redundant trains by a noncombustible radiant energy shield."

10 CFR 50, Appendix R, Section III.L.7, "Alternative and dedicated shutdown capability," states, in part, "The safe shutdown equipment and systems for each fire area shall be known to be isolated from associated non-safety circuits in the fire area so that hot shorts, open circuits, or shorts to ground in the associated circuits will not prevent operation of the safe shutdown equipment."

GL 86-10, response 5.3.1, "Circuit Failure Modes," states, "Sections III.G.2 and III.L.7 of Appendix R define the circuit failure modes as hot shorts, open circuits, and shorts to ground. For consideration of spurious actuations, all possible functional failure states must be evaluated, that is, the component could be energized or de-energized by one or more of the above failure modes. Therefore, valves could fail open or closed; pumps could fail running or not running; electrical distribution breakers could fail open or closed. For three-phase AC circuits, the probability of getting a hot short on all three phases in the proper sequence to cause spurious operation of a motor is considered sufficiently low as to not require evaluation except for any cases involving Hi/Lo pressure interfaces. For ungrounded DC circuits, if it can be shown that only two hot shorts of the proper polarity without grounding could cause spurious operation, no further evaluation is necessary except for any cases involving Hi/Lo pressure interfaces."

GL 86-10, Response 5.3.10, "Design Basis Plant Transients," states, "The safe shutdown capability should not be adversely affected by any one spurious actuation or signal resulting from a fire in any plant area; and the safe shutdown capability should not be adversely affected by a fire in any plant area which results in the loss of all automatic function (signals, logic) from the circuits located in the area in conjunction with one worst case spurious actuation or signal resulting from fire; and the safe shutdown capability should not be adversely affected by a fire in any plant area which results in spurious actuation of the redundant valves in any one high-low pressure interface line."

BGE plans to document the basis for excluding PORVs and reactor head vents as high/low pressure boundary valves. Based on the above requirements and guidance, the NRC considers these valves as high/low pressure boundary interfaces.

Based on the above, please explain your basis for documenting the exclusion of PORVs, reactor head vents and MOV-651 as high/low pressure interface valves. Also, please explain procedural changes made to stop spurious actions from causing these valves to open. Additionally, please explain how you demonstrated the plant can be safely shutdown with a RCS release and what is your basis.