

U.S. NUCLEAR REGULATORY COMMISSION
REGION 1

Report Nos. 50-317/92-05
50-318/92-05

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50-318

License Nos. DPR-53
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Licensee: Baltimore Gas and Electric Company
MD Routes 2 and 4
Post Office Box 1535
Lusby, Maryland 20657

Facility Name: Calvert Cliffs Nuclear Power Plant

Inspection At: Lusby, Maryland

Inspection Conducted: February 10-14, 1992

Inspectors:

[Signature]
L. M. Kay, Reactor Engineer, Electrical
Section, EB, DRS

12 March 1992
Date

[Signature]
R. J. Paolino, Sr. Reactor Engineer,
Electrical Section, EB, DRS

12 March 1992
Date

Approved by:

[Signature]
C. J. Anderson, Chief, Electrical
Section, Engineering Branch, DRS

3/6/92
Date

Areas Inspected: A special inspection by region-based inspectors was conducted to determine the status of the Cable Separation Issue Resolution Program created in response to a previously identified violation regarding inadequate cable separation.

Included in this review was the licensee's activities for identifying and correcting deficiencies associated with electrical separation issues.

This inspection addressed the program scope, licensee self assessment of separation deficiencies, corrective actions taken to prevent recurrence, and the current status of the program. A walkdown of several congested and safety related areas was performed for verification that adequate corrective actions were completed.

Results: An unresolved item was identified regarding an incomplete 10CFR 50.59 review. This item resulted from the licensee's failure to adequately address the applicability of a generic study to specific Calvert Cliffs cable configurations. Additionally, the supporting documentation justifying the FSAR change to less restrictive criteria was requested. Violation 89-27-005 remains open.

1.0 Background

Inspection Reports 50-317/89-27 and 50-318/89-28, dated February 7, 1990, identified a violation of several examples of inadequate cable separation. This violation was based on both units not maintaining minimum physical separation distances for cable trays. It was determined that these deficiencies were the result of original construction and modifications. The report further stated that the findings were indicative of a programmatic weakness in the assurance of adequate separation of safety related cables.

Cable separation criteria for Calvert Cliffs are specified in two documents, the Final Safety Analysis Report (FSAR) and design document E-406, "Design and Construction Standards for Cable and Raceway." The criteria address the physical separation of cable trays and the routing of cables. Six separation groups are specified. Cable tray or raceway separation criteria delineate a minimum horizontal separation of 2 feet, vertical separation of 5 feet, and vertical separation of 9 inches for the crossover of safety related trays. Cable routing criteria prohibit the routing of redundant separation groups in the same tray. However, these criteria allow for the routing of non-safety and safety related cables in the same tray.

A followup inspection documented in Inspection Report 50-317/90-02 reviewed the licensee's engineering support for correcting the problems identified. No deficiencies were identified. However, the licensee's assessment was in an early developmental stage.

On March 9, 1990, Baltimore Gas and Electric Company (BG&E) submitted their response to violation 89-27-005 as identified in Inspection Report 50-317/89-27. Following receipt of this response the resident inspector conducted a walkdown to verify the corrective actions. As discussed in Inspection Report 90-05, good progress was noted in correcting the programmatic weakness of cable separation. However, the report identified a concern regarding the separation of safety related cables from non-safety related cables.

2.0 Purpose

The purpose of this inspection was:

1. To review the licensee's activities for identifying and correcting the deficiencies associated with electrical separation.

2. To evaluate the adequacy of the licensee's resolution program and current program status.
3. To review corrective actions and actions to prevent recurrence.

3.0 Scope

In the March 9, 1990 response to the violation, the licensee explained their "Electrical Separation Issue Resolution Plan." This plan described their objectives to address cable separation discrepancies. Included in the objectives of the plan is the establishment of an adequate basis for separation. This was to be done by identifying as-built conditions, correcting deficiencies, developing a separations philosophy, and assuring future compliance.

The process of assessing the plant configuration began with walkdowns. The walkdowns were performed by both licensee and contractor personnel. Training of personnel performing the walkdowns was provided by the responsible project engineer. Training addressed the design basis for separation, the concept of facility codes and their relationship to separation groups, the method for performing these inspections, and general employee training.

Upon receipt of walkdown results, Design Engineering reviewed the walkdown information, dispositioned nonconformance reports (NCR), maintenance orders (MO), or field engineering changes (FEC) where appropriate, to correct deficiencies. Walkdown results found to be incomplete or conflicting were returned to Quality Control (QC) for reinspection.

In addition, audits of the walkdown results were performed. Upon identification of a problem not previously recorded, reinspections were conducted and the original reports invalidated. It is noted that because of the large number of anomalies identified in the cable spreading rooms, the entire room was considered under one FEC for each unit. This will be discussed further in Section 4.2.

The licensee's program included an identification of differences in the plant cable installations from the design and installation criteria set forth in Section 8.5 of the FSAR and design document E-406.

4.0 Program

Cable separation is required to assure that a single failure or event could not impact more than one train of safety equipment. This assures that the minimum required equipment necessary to shut down the plant will remain operable for all plant conditions. The licensee's resolution plan is designed to maintain this assurance through a two phase approach. Phase 1 addressed separation of safety related Voltage Classification Groups (VCGs) inside containment and Appendix R safe shutdown circuits. Phase 2 addressed all remaining circuits including the penetration rooms, cable spreading rooms, and other congested or hostile environment areas.

Phase 1 was conducted prior to startup in 1989. Phase 2, regarding all remaining circuits, is in progress. These phases were based on technical classifications of cables. These classifications, VCGs, were distinguished by cable type and voltage rating. Cable types include power, control, or instrumentation. Voltage ratings are 4160 Vac, 480 Vac, 125 Vdc, or 50 Vdc.

BG&E's commitment as presented in their March 9, 1990 response stated that full compliance with the original license basis and design document E-406 would be achieved prior to the end of each unit's respective next refueling outage. The licensee stated that this date cannot be met due to existing asbestos conditions in both cable spreading rooms. Also, the risk of removing cable tray covers while at power, increases the possibility of unnecessarily causing a plant transient. Thus, work must be performed during extended shutdown conditions. Hence, the licensee's commitment dates for full compliance have been changed prior to the end of Unit 1 cycle 12 and Unit 2 cycle 10 refueling outages. This was docketed formally on March 4, 1992.

4.1 Licensee Self Assessment

Upon identification of cable separation anomalies in 1989, the licensee contracted an independent third party to survey the switchgear and cable spreading rooms and containment areas. Results of these surveys led to the development of the "Electrical Separation Issue Resolution Plan." This plan led to walkdowns performed by both licensee and contractor personnel. This process was described in section 3.0 of this report.

Root cause analysis performed by the licensee attributed the failure to meet the separation requirements presented in E-406 to "insufficient programmatic controls of barriers installed for cable separation." The reason for this lack of barrier control was not determined by the licensee. This was observed to be an inadequate root cause determination. However, the inspectors recognized that corrective actions have been taken to install missing barriers. Corrective actions to prevent recurrence included updating the modification process to include verification of barriers. In response to the inspectors' observation, the licensee stated that emphasis was placed on providing assurance that barriers were in place.

4.2 Corrective Actions

A review of the licensee's response to violation 89-27-005 was conducted to ascertain that the corrective actions were timely, appropriate, and thorough. Management tasking assignments, procedures, and practices were also reviewed for applicability to the cable tray separation deficiencies and associated resolution plan.

The inspectors determined that responsibilities had been assigned for effecting changes to practices and correcting most separations deficiencies existing in the plants. These corrective actions included verification of the physical separation criteria of raceways or verification of the existence of marinite fire barriers where such separation could not be met. Upon assessment of the as built plant conditions, by means of the walkdown results, the licensee issues maintenance orders, field engineering changes, or memorandums to correct the identified problem.

Upon review of corrective actions regarding anomalies that currently exist in the cable spreading rooms, it was found that each units' cable spreading room was covered under one minor modification evaluation. This modification, FEC 90-10, involved a change to the FSAR. Accordingly, a safety evaluation, 5904-04.001, Revision 2, per 10CFR 50.59 was performed. This 10CFR 50.59 review was the licensee's justification used prior to startup of Unit 1 in 1990 for existing cable separation deficiencies. This evaluation used as a basis a method presented in a report by an IEEE working group, Safety Committee 6.5, titled "Cable Separation - What Do Industry Testing Programs Show?" This report presents the acceptance of less

restrictive requirements than standard separation specifications. The licensing basis specifications for physical separation at Calvert Cliffs were not met at the time of the unit's startup. The licensee determined that this condition was acceptable based on results presented in the IEEE working group report.

Derivation of this IEEE working group report is from IEEE Standard 384, IEEE 384-1974, "Criteria for Independence of Class 1E Equipment and Circuits" and Regulatory Guide 1.75, "Physical Independence of Electric Systems" set forth independence requirements of circuits and equipment comprising or associated with Class 1E systems. These documents find analysis acceptable where separation criteria cannot be met. However, the analysis should be based on tests which reflect the characteristics of the cable installation. The analysis considers cable features such as cable insulation and jacket materials, cable tray fill, and cable tray arrangements. The applicability of the IEEE working group report to the cable separation anomalies at Calvert Cliffs was not established.

The inspector also observed that the IEEE working group report referenced tests that were conducted using cable qualified in accordance with IEEE Standard 383, "IEEE Standard for Type Test of Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations." However, Calvert Cliffs never committed to IEEE 383 and analysis was not performed to demonstrate that the intent of IEEE 383 is met at Calvert Cliffs.

In conjunction with the IEEE report, the licensee employed a contractor, TENERA, to determine minimum analyzed separation distances between cables in free air to redundant cable trays, a situation existing in the plants. It is noted that the contractor reports are based on the test results presented in the IEEE report.

The technical bases for use of separation criteria substantially less than the design documents is currently under NRC review. The inspectors observed that the safety evaluation used to support the relaxed cable separation criteria failed to adequately address the applicability of the generic study configurations to the specific installations at Calvert Cliffs. This is an unresolved item pending NRC review of licensee supporting documentation for the 10CFR 50.59 review and FSAR change. (Unresolved Item 50-317/92-05-01, 50-318/92-05-01). Before the close of the inspection the licensee stated their intent to withdraw the original 50.59 review.

4.3 Current Program Status

Inspection Report 50-317/90-02 noted the completion of licensee walkdowns of Unit 1 containment. In the violation response dated March 9, 1990, cable deficiencies outside of the Unit 1 containment involving safety related 4160 and 480 Vac load center raceway transitions as well as cable separation barriers involving Appendix R safe shutdown cables were reported to be corrected. The licensee also concluded that the corresponding Unit 2 deficiencies were corrected. However, the licensee noted that Unit 1 and Unit 2 cable spreading room deficiencies were not corrected. The inspector determined that the licensee's definition of corrected was that cable separation satisfied the relaxed cable separation of the IEEE working group report. The licensee indicated that final corrective actions to the more stringent original license basis and the E-406 criteria are scheduled to be completed prior to the restart following Unit 1 cycle 12 and Unit 2 cycle 10 refueling outages.

5.0 Walkdown

A walkdown was performed by the inspectors of the following areas for verification of existing plant configurations using as built drawings.

- ♦ Unit 1 Fan Room 5' Aux Building
- ♦ Unit 1 Boric Acid Storage Room Aux Building
- ♦ Unit 1 Cryogenics Room
- ♦ Unit 1 Reactor Coolant Waste Transfer Pump Area
- ♦ Unit 1 45' East-West Hallway
- ♦ Unit 2 45' Switchgear Room
- ♦ Unit 1 45' Switchgear Room
- ♦ Vertical Cable Chase 1A and 1B
- ♦ Control Room: Panels 1C10 and 1C22A
- ♦ Cable Spreading Rooms: Units 1 and 2

The walkdown included a review of previously identified discrepancies. One anomaly was identified however, it was determined to be part of a modification currently in progress. The inspectors did not identify any new separation deficiencies.

6.0 Training

A review of specialized training for craft and technical personnel on the subject of raceway separation was made. Technical staff personnel are provided training initially during orientation training of twelve weeks duration. During this time, an electrical theory course, systems course, and mini courses such as print reading are taught. Beyond this, specific training on topics is provided. Further training applicable to specific positions is provided at the section level through the use of qualification cards.

Craft personnel include electricians; instrumentation and controls technicians, and contractor and quality verification personnel. These employees who deal with separation issues receive procedure based training on selected portions of E-406. Portions of this training are based on the task involved. Training prior to walkdowns was conducted by the responsible project engineer. The training agenda presented the design basis for separation, method for performing inspections, and examples of both acceptable and deviant configurations.

It was concluded that cable separation training was acceptable.

7.0 Conclusion

Review of the scope of the "Electrical Separation Issue Resolution Plan," corrective actions taken as well as corrective actions for program completion, and assessment of cable separation discrepancies previously identified was made. The program was found to be acceptable for identification of cable separation anomalies from the original licensing basis and E-406. The licensee indicated that final corrective actions to satisfy the original license basis and E-406 criteria are scheduled to be completed prior to the restart following each unit's second upcoming refueling outage. In the interim, the licensee concluded that the relaxed separation criteria specified in the IEEE working group report are applicable to the Unit 1 and 2 cable configurations and that the criteria justify continued operation of the units. The applicability of the relaxed criteria has not been established for the Unit 1 and 2 cable configurations. However, the inspectors concluded that the IEEE working group report provides a reasonable basis that no significant cable separation safety concerns exist pending the licensee's completion of the final corrective actions. Accordingly, violation 89-27-005 remains open pending licensee completion of adequate corrective actions of the cable separation anomalies and review by the NRC. Unresolved item 92-05-001 remains open pending licensee submittal of supporting documentation for the previously discussed 10CFR 50.59 and review by the NRC.

8.0 Exit Meeting

The inspectors met with those individuals denoted in Appendix 1 on February 14, 1992. Inspection findings detailed in this report were discussed.

APPENDIX 1

Persons Contacted

Baltimore Gas and Electric Company

- J. Austin, Supervisor, E&C Maintenance Training
- * A. B. Anuje, Supervisor, Quality Assurance Unit
- * T. J. Camileri, Maintenance Supervisor
- * S. C. Collins, Principal Engineer, Design Engineering
- * C. H. Cruse, Manager, Nuclear Engineering
- E. Deas, E&TS Initial Training Coordinator
- * R. E. Denton, Plant General Manager
- * G. L. Detter, Director, Nuclear Regulatory Matters
- * R. E. Franke, Regulatory Compliance Engineer
- * D. V. Graf, Nuclear Outage and PM Unit
- * J. J. Ihnacik, Senior Engineer
- * A. G. Miranda, Project Management
- B. S. Montgomery, Licensing
- * B. C. Rudell, G.S. Project Management
- * R. H. Waskey, Jr., G.S. Design Engineering
- * L. O. Wenger, Project Engineer, Compliance Unit

Nuclear Regulatory Commission

- * P. R. Wilson, Sr. Resident Inspector

* Denotes those present at the exit meeting conducted onsite on 14 February 1992.