

**U.S. NUCLEAR REGULATORY COMMISSION  
REGION I**

License Nos. DPR-53/DPR-69

Report Nos. 50-317/96-08; 50-318/96-08

Licensee: Baltimore Gas and Electric Company  
Post Office Box 1475  
Baltimore, Maryland 21203

Facility: Calvert Cliffs Nuclear Power Plant, Units 1 and 2

Location: Lusby, Maryland

Dates: October 20, 1996 through November 30, 1996

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EXECUTIVE SUMMARY  
Calvert Cliffs Nuclear Power Plant, Units 1 and 2  
Inspection Report Nos. 50-317/96-08 and 50-318/96-08

This integrated inspection report includes aspects of BGE operations, maintenance, engineering, and plant support. The report covers a six week period of resident inspection.

**Plant Operations**

- Operator response to an automatic reactor trip was prompt and very good. The operators were effective in stabilizing the plant and ensuring safety. The emergency operating procedures were accomplished satisfactorily and operators appropriately placed the plant in the hot standby condition.
- BGE personnel appropriately conducted an event review following the reactor trip and determined that the event had no consequence to public health and safety. The cause of the reactor trip was understood and corrected prior to unit restart. The unit was returned to full power operation without complication.
- The inspectors considered the actions of operations personnel and the related activities of engineering and maintenance personnel to be both prompt and appropriate following a control element assembly drop during testing.
- During a control room panel walkdown the inspectors noted that power to the 1A emergency diesel generator annunciator status panel had apparently been lost. When informed, operations personnel determined that power was available; however, the indicating light had burned out. The bulb was replaced and panel indication was restored to normal.
- Very good questioning attitudes and safety perspectives were noted during a meeting of the Offsite Safety Review Committee (OSSRC), particularly regarding the effectiveness of Unit 2 post-trip review, the timeliness of review of failed surveillance test data by the Plant Operations and Safety Review Committee (POSRC), and BGE's actions to respond to the recent 10 CFR 50.54(f) letter concerning the adequacy and availability of design basis information. Overall, the level of review and member participation met the OSSRC responsibilities.

**Maintenance**

- The inspectors reviewed a number of surveillance tests and found that the testing was performed safely and in accordance with proper procedures. The inspectors noted that an appropriate level of supervisory attention was given to the testing depending on its sensitivity and difficulty.

## Executive Summary (cont'd)

- BGE found fuel oil in earth samples taken in the vicinity of the 21 fuel oil storage tank. To determine the extent of suspected leakage, BGE unearthed the lines in the vicinity of the oil samples and conducted both a visual piping examination and a series of hydrostatic tests. No piping leaks were found. The inspectors considered the BGE activities prudent in ensuring fuel oil system integrity.

## Engineering

- The inspectors found that BGE did not have a criticality monitoring system and emergency evacuation procedures for the new fuel storage area and the spent fuel pool as required by 10 CFR 70.24(a). The issue was a violation of NRC requirements.
- The inspectors found that there was an apparent lack of ownership for the electrical cable separation barriers and that a related modification package initiated in 1990 remained open. The issue is unresolved pending further NRC review.

## Plant Support

- Regional inspectors verified that BGE has maintained on-shift dose assessment capability supported by appropriate procedural guidance.

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## ATTACHMENTS

Attachment 1:	Partial List of Persons Contacted
	Inspection Procedures Used
	Items Opened, Closed, and Discussed
	List of Acronyms Used

## Report Details

### Summary of Plant Status

Unit 1 began the inspection period at full power. On October 20, a control element assembly, (control rod) dropped fully into the core. Operators reduced reactor power to 90 percent, recovered the assembly, and restored power to 100 percent. Unit 1 remained at full power for the remainder of the report period.

Unit 2 started the inspection period at full power. A reactor trip occurred on November 17, 1996 due to a feedwater system component malfunction. Unit 2 was restarted on November 19, returned to full power on November 21, and remained at full power for the remainder of the report period.

## I. Operations

### **O1    Conduct of Operations <sup>1</sup>**

#### **O1.1   General Comments (71707)**

Overall, plant operations were conducted with a proper focus on nuclear safety.

On October 20, during the conduct of routine control element assembly (CEA) testing, a shutdown CEA dropped fully into the reactor core. Using the appropriate abnormal procedure, reactor operators reduced reactor power to 90 percent and stabilized the plant. Engineering and maintenance personnel were informed and the dropped CEA was tested. Evaluation of the test data showed nothing abnormal, and the rod was returned to the normal full out position. Reactor power was then restored to full power. An issue report was generated to ensure a review of the event. The review suggested that the problem leading to the dropped rod may have involved the test circuitry. Subsequently, engineering personnel initiated actions to replace the Master Bypass Switch with a new, more reliable, model. The inspectors considered the actions of operations personnel and the related activities of engineering and maintenance personnel to be both prompt and appropriate.

During a control room panel walkdown on November 12, the inspector noted that power to the 1A emergency diesel generator annunciator status panel had apparently been lost. When informed, operations personnel determined that power was available; however, the indicating light had burned out. The bulb was replaced and panel indication was restored to normal. Neither the inspector nor BGE could determine how long the indicating bulb had been burned out prior to the observation.

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<sup>1</sup>Topical headings such as O1, M1, etc., are used in accordance with the NRC standardized reactor inspection report outline found in MC 0610. Individual reports are not expected to address all outline topics.

## O1.2 Reactor Trip Due to Feedwater System Malfunction

### a. Inspection Scope

The inspectors reviewed the circumstances associated with the Unit 2 reactor trip that occurred on November 17, 1996.

### b. Observations and Findings

During a feedwater system transient Unit 2 tripped automatically from 100% power due to low water level in the 21 steam generator. The plant responded as designed. Following the reactor trip, the 22 steam generator feedwater pump (SGFP) tripped on high discharge pressure and the 21 SGFP ramped to idle. The 21 SGFP did not trip because the high discharge pressure signal was not of sufficient duration to lock in the trip circuitry. Operators restored steam generator water level using the auxiliary feedwater pumps. Operators promptly stabilized the unit in Mode 3 (hot standby).

BGE formed a significant incident findings team to investigate the cause(s) of the trip and recommend corrective actions. The preliminary findings indicated that the 21 feedwater regulating valve (FWRV) positioner mechanical feedback spring retaining screw had broken, allowing the spring to relax. This failure caused the valve positioner to sense the position of the FWRV as full open. The system responded by closing the FWRV to re-establish the demanded position. Due to the relaxed spring, FWRV position continued to indicate full open even as the positioner drove the FWRV full closed. The transient resulted in a low water level in the 21 steam generator, causing an automatic reactor trip.

The transient occurred in about 12 seconds which prevented manual action to control steam generation level. Operators responded to the trip by implementing emergency operating procedure EOP-0, "Reactor Trip." All safety functions were met during the transient. The emergency operating procedures were accomplished satisfactorily and there were no complications which delayed stabilizing the plant in Mode 3. Subsequently, reactor operators transitioned to operating procedure OP-4, "Plant Shutdown From Power Operation to Hot Standby."

Accompanying the reactor trip was an expected rapid closure of the 22 FWRV, which caused the 22 SGFP to trip on high discharge pressure. A few minutes after the trip, control room operators noted that the 22 SGFP appeared to have reset itself and the steam admission valve indicated open. Following procedures, the operators attempted to trip the SGFP from the panel but no response was obtained from the trip pushbutton. An operator was dispatched to locally trip the pump. However, on receipt of the original trip signal, the pump turbine governor valve had closed as designed. The governor valve remained closed and the pump remained stopped throughout the event. On control room direction, the equipment operators isolated steam to the 22 SGFP. Troubleshooting disclosed that two relays in the feedpump control circuitry were degraded, the net effect being a false reset signal that opened the steam admission valve. The relay failure had no effect on plant



conditions during the event and did not delay recovery activities. The relays were replaced and the circuitry tested satisfactorily prior to reactor restart.

The FWRV positioner spring retainer for both the 21 and 22 FWRV were replaced. The failed component from the 21 FWRV was metallurgically evaluated and the root cause was determined to be torsional overload that likely occurred during installation during the spring 1995 refueling outage. A sampling of new spring retainers were evaluated and no deficiencies were found. Plant issue reports were written to document and resolve the identified deficiencies. Unit 1 FWRVs will be inspected at the next availability.

Unit 2 was returned to critical operations on November 19. The reactor was returned to full power on November 21.

c. Conclusions

Operator response to the automatic reactor trip was prompt and very good. The operators were effective in stabilizing the plant and ensuring safety. The inspectors considered the operator response, well controlled, using correct procedures, and effective in ensuring the plant remained in a safe condition.

BGE personnel appropriately conducted an event review and determined that the event had no consequence to public health and safety. The cause of the reactor trip was understood and corrected prior to unit restart. The unit was returned to full power operation without complication.

**07 Quality Assurance in Operations**

**07.1 Offsite Safety Review Committee**

The inspectors attended portions of the Offsite Safety Review Committee (OSSRC) meeting on November 21. The OSSRC composition and agenda were in compliance with the requirements of Quality Assurance Policy, Addendum 1B-1, Review Functions of the OSSRC. The agenda included a review of plant status, significant safety issues, 10 CFR 50.59 evaluations, and proposed changes to the operating license, including the planned change to improved Technical Specifications. A very good questioning attitude and safety perspective were noted, particularly regarding effectiveness of Unit 2 post-trip review, the timeliness of review of surveillance test data by the Plant Operations and Safety Review Committee (POSRC), and BGE's actions to respond to the NRC 10 CFR 50.54(f) letter concerning the adequacy and availability of design basis information. Overall, the level of review and member participation met OSSRC responsibilities.

## II. Maintenance

### **M1 Conduct of Maintenance**

#### **M1.1 Routine Maintenance Observations**

Using Inspection Procedures 62703, 62707, and 61726, the inspectors observed the conduct of maintenance and surveillance testing on systems and components important to safety. The inspectors also reviewed selected maintenance activities to assure that the work was performed safely and in accordance with proper procedures. The inspectors noted that an appropriate level of supervisory attention was given to the work depending on its priority and difficulty. Maintenance activities reviewed included:

MO 1199505993	Replace 11 Plant Air Compressor
MO 0199602195	Excavate at 21 Fuel Oil Storage Tank to Determine Source of Fuel Oil Leak
MO 2199604661	Overhaul 24 Circulating Water Pump

#### **M1.2 Suspected Fuel Oil Leak**

On November 11, the inspectors were informed by BGE that the Maryland Department of the Environment has been notified of a suspected underground leak of fuel oil from the 21 fuel oil storage tank. Ground samples taken while drilling test wells during a non-safety related anodic protection activity indicated that fuel oil had contaminated soil in the vicinity of the fuel oil supply lines to the emergency diesel generators. To determine the extent of the suspected leakage, BGE unearthed the lines in the vicinity of the oil samples and conducted both a visual piping examination and a series of hydrostatic tests. No piping leaks were found. BGE then concluded that the leakage was from an external source, possibly overflow of a fuel oil sump some time in the past. While the lines were uncovered, BGE conducted an evaluation of the protective wrap for the piping and replaced wrap that had degraded. The inspectors considered the BGE activities prudent in ensuring fuel oil system integrity.

#### **M1.3 Routine Surveillance Observations**

The inspectors witnessed and reviewed selected surveillance tests to determine whether approved procedures were in use, details were adequate, test instrumentation was properly calibrated and used, technical specifications were satisfied, testing was performed by qualified personnel, and test results satisfied acceptance criteria or were properly dispositioned.

The surveillance testing was performed safely and in accordance with proper procedures. The inspectors noted that an appropriate level of supervisory attention was given to the testing depending on its sensitivity and difficulty. Surveillance testing activities that were reviewed are listed below:



STP-0-005-1 AFW System Performance Testing  
 STP-0-073F Boric Acid Pump Performance Test  
 STP-0-008A 1A EDG and 4KV Bus Test

### III. Engineering

## **E2 Engineering Support of Facilities and Equipment**

### **E2.1 Special Nuclear Material Criticality Monitors**

As a follow-up to a review conducted by the NRC Office of Nuclear Reactor Regulation, the inspectors conducted a review of BGE's compliance with or exemption from the criticality monitoring requirements of 10 CFR 70.24(a).

At the time of this inspection, BGE was not in compliance with 10 CFR 70.24(a) because BGE did not have a monitoring system that would energize clearly audible alarms if accidental criticality occurred in each area in which licensed quantities of special nuclear material was handled, used, or stored. Specifically, the new fuel storage area and the spent fuel pool were affected areas. BGE also did not have emergency procedures for these areas.

An exemption from the requirements of 10 CFR 70.24(a) was granted with the issuance of Calvert Cliffs SNM License Nos. SNM-1364 and SNM-1624; however, the exemption was not specifically carried forward with the issuance of the Part 50 Operating License. Pursuant to the requirements of 10 CFR 70.14(a) and 10 CFR 70.24(d), BGE has requested a permanent exemption from the criticality monitoring requirements of 10 CFR 70.24(a) by a letter to the NRC dated August 19, 1996.

The inspectors concluded that the BGE failure to have a criticality monitoring system and emergency procedures for the new fuel storage area and the spent fuel pool was a violation of 10 CFR 70.24(a). (VIO 50-317&318/96-08-01)

### **E2.2 Electrical Separation Barriers**

#### **a. Inspection Scope**

The inspectors reviewed safety related cable separation to assure that requirements were met for redundant channels that support protective functions during postulated events.

#### **b. Findings and Observations**

The inspectors reviewed the electrical separation criteria in FSAR chapter 8.5, "Separation Criteria," and design document E-406, "Design and Construction Standards for Cable and Raceway," and walked down the penetration rooms with Plant Engineering and project engineering personnel. Separation barriers were required when three feet horizontal or five feet vertical cable tray separation as specified in the Final Safety Analysis Report (FSAR) were not maintained.

On October 9, the inspectors identified damaged and apparently missing electrical separation barriers in the 45 foot electrical penetration rooms. The following apparent deficiencies were identified:

- Cable tray ZA1AE70 (separation group 1) had a broken marinite board/separation barrier on top and did not have horizontal separation from tray ZB1AE66 (separation group 2)
- Cable tray ZD1AE80 (separation group 1) had a missing marinite board/separation barrier and needed to be extended to provide separation from ZE1AE83 (separation group 2)
- Cable tray ZA2AE74 (separation group 1) had a broken and missing marinite board/separation barrier on the bottom and did not have separation from trays ZB2AE66 and ZB2AE63 (separation group 2)

BGE entered the deficiencies in the corrective action system as issue reports. The inspector also identified several other potential separation issues. BGE personnel indicated that an extensive review of and repair to separation barriers were performed by a plant modification that started in 1990 and an associated project plan to correct electrical cable separation deviations and anomalous conditions identified as a result of corrective actions for NRC Notice of Violation 50-317/89-27-05. The BGE personnel indicated that records from this project and plant drawings would need to be researched to resolve the potential issues.

During the review of the plant drawings for the cable trays associated with the deficiencies, BGE personnel identified that the drawings for Unit 2 had not been updated to reflect the as-built conditions for changes made to the separation barriers in 1990. An issue report was generated by BGE to address this issue.

The inspector reviewed the drawings with BGE personnel and noted that the drawings also did not appear to have been updated to reflect the as-built conditions for a second area common to Units 1 and 2. Therefore, based on the extent of the deficiencies, the inspector questioned the adequacy of the plant drawings to reflect as-built conditions. The inspector also reviewed some of the original project records related to the walkdown, engineering evaluation, and repair of separation barriers for the project plan. The inspector noted that these records appeared to be quality records that were not stored in the records vault and were not available for general use by engineering personnel. The inspector also questioned whether the 1990 modification documentation had been closed since the effort was completed in 1994. BGE personnel responded that the modification was one of several older modifications that had not been closed out.

c. Conclusions

The inspectors concluded that there was an apparent lack of ownership for the electrical cable separation barriers and the modifications performed in 1990. This issue will remain open pending further NRC review of (1) BGE's corrective actions

for NRC violation 50-317/89-27-05, for barrier deficiencies and to assess whether or not additional deficiencies exist; (2) BGE actions to update the configuration control drawings for the Unit 2 separation barrier installation changes; (3) the significance of the BGE actions to complete the closeout of the 1990 modification package; and (4) whether appropriate administrative controls have been applied to the storage and retention of the applicable project records. (URI 50-317&318/96-08-01)

#### IV. Plant Support

##### **P8 Miscellaneous EP Issue**

##### **P8.1 Licensee On-Shift Dose Assessment Capabilities**

On the week of September 30, 1996, a region-based inspector conducted an in-office telephone interview with BGE to complete NRC Temporary Instruction (TI) 2515/134, "Licensee On-Shift Dose Assessment Capabilities". The goal of the instruction was to gather information on the BGE capabilities to perform on-shift dose assessment. It was determined that BGE does have on-shift dose assessment capability supported by appropriate procedural guidance. The inspector concluded that BGE met NRC requirements to be able to perform dose assessment at all times.

#### V. Management Meetings

##### **X1 Exit Meeting Summary**

During this inspection, periodic meetings were held with station management to discuss inspection observations and findings. On December 19, 1996, an exit meeting was held to summarize the conclusions of the inspection. BGE management in attendance acknowledged the findings presented.

##### **X3 Management Meeting Summary**

On October 23, 1996, Richard Crlenjak, Acting Deputy Director, Division of Reactor Projects, Region I toured the facility and held discussions with BGE staff as part of the NRC preparations for the Systematic Assessment of Licensee Performance (SALP) process.

On October 24, and 25, 1996, Hubert Miller, the Regional Administrator, NRC Region I toured Calvert Cliffs and held general discussions with plant personnel.

On November 15, 1996, NRC Commissioner Edward McGaffigan toured Calvert Cliffs and held general discussions with plant personnel.

**L1      Review of UFSAR Commitments**

A recent discovery of a licensee operating its facility in a manner contrary to the Updated Final Safety Analysis Report (UFSAR) description highlighted the need for a special focused review that compares plant practices, procedures and/or parameters to the UFSAR description. While performing the inspections discussed in this report, the inspectors reviewed the applicable portions of the UFSAR that related to the areas inspected to verify that the UFSAR wording was consistent with the observed plant practices, procedures and/or parameters. Inconsistencies were noted concerning electrical cable separation as discussed in Section E2.2.

## ATTACHMENT 1

### PARTIAL LIST OF PERSONS CONTACTED

#### BGE

P. Katz, Plant General Manager  
K. Cellers, Superintendent, Nuclear Maintenance  
K. Nietmann, Superintendent, Nuclear Operations  
P. Chabot, Manager, Nuclear Engineering  
T. Camilleri, Director, Nuclear Regulatory Matters  
B. Watson, General Supervisor, Radiation Safety  
C. Earls, General Supervisor, Chemistry  
L. Gibbs, Director, Nuclear Security  
T. Sydnor, General Supervisor, Plant Engineering  
T. Forgette, Director - Emergency Preparedness  
M. Polak, Supervisor - Engineering Assessment Unit  
C. Cruse, Vice President - Nuclear Energy

#### NRC

Edward McGaffigan, Commissioner  
Richard Crlenjak, Acting Deputy Director, Division of Reactor Projects, Region I  
Hubert Miller, Regional Administrator, Region I

### INSPECTION PROCEDURES USED

IP 62707: Maintenance Observation  
IP 71707: Plant Operations  
IP 93702: Prompt Onsite Response to Events at Operating Power Reactors  
IP 61726: Surveillance Observations  
IP 37550: Engineering  
IP 37551: Onsite Engineering  
IP 71750: Plant Support Activities  
IP 83750: Occupational Exposure  
IP 92700: Onsite Followup of Written Reports of Nonroutine Events at Power Reactor Facilities  
IP 92902: Followup - Engineering  
IP 82701: Operational Status of the Emergency Preparedness Program

ITEMS OPENED, CLOSED, AND DISCUSSEDOpened

50-317&318/96008-01	URI	Cable Separation Issues
50-317&318/96008-02	VIO	Failure to Monitor for Criticality of New Reactor Fuel

## LIST OF ACRONYMS USED

EDG	Emergency Diesel Generator
EP	Emergency Preparedness
SGFP	Steam Generator Feedwater Pump
FWRV	Feedwater Regulating Valve
OSSRC	Offsite Safety Review Committee
POSRC	Plant Operations Safety Review Committee
FSAR	Final Safety Analysis Report
UFSAR	Updated Final Safety Analysis Report
TI	Temporary Instruction
IFI	Inspector Followup Item
SALP	Systematic Assessment of Licensee Performance
SNM	Special Nuclear Material
URI	Unresolved Item
KV	Kilovolts (1,000 volts)
MO	Maintenance Order
STP	Surveillance Test Procedure
IP	Inspection Procedure
CFR	Code of Federal Regulations