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License Nos: DPR-53  
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Licensee: Baltimore Gas and Electric Company  
1650 Calvert Cliffs Parkway  
Lusby, MD 20657

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

Dates: November 17 - 20, 1997

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## EXECUTIVE SUMMARY

### Calvert Cliffs Units 1 & 2 Full-Participation Emergency Preparedness Exercise Evaluation Inspection Report Nos. 50-317/97-09 and 50-318/97-09

Overall exercise performance was good. The ERFs were staffed and activated in a timely manner. The event classifications were correct and timely. Offsite notifications were completed within 15 minutes. The first PAR, at the general emergency (GE) declaration, was made within the 15 minute requirement and was upgraded as plant conditions changed.

Overall simulator control room command and control and security response was good. However, the inspectors concluded that the diagnosis of the general emergency condition (release from containment) and actions to mitigate this condition were slow.

An exercise strength was identified in the Technical Support Center (TSC). The Reactor Core Engineering Team performed an excellent analysis of time to core uncovering and cladding damage.

The inspectors concluded that the overall performance in the OSC was very good and capable of ensuring protection of onsite emergency responders.

An exercise weakness was identified in the dose assessment area at the Emergency Operations Facility (EOF). The dose assessment team produced unreasonable projections due to the operators' lack of understanding and knowledge of how to manipulate and interpret the licensee's automated dose assessment models. Because of this, the licensee could not adequately demonstrate that they were able to make a technically sound PAR based on radiological conditions.

Licensee performance in the media center was good. Communications between the licensee, county, and state personnel were effective and communicators posted plant conditions promptly outside of the briefing area.

Controller performance issues were identified, but did not preclude the overall good performance of the exercise. However, this is an area that the NRC has identified problems in past exercise evaluations for which the licensee needs to continue efforts to improve.

The inspectors determined that the licensee's formal critique did not meet the expectations described in NUREG-0654, Appendix E of Part 50 and NRC Procedure Module 82301. It appeared to be more of a "fact-finding" discussion than a formal presentation of exercise findings with preliminary qualitative assessment.



## Report Details

### IV. Plant Support

#### **P4 Staff Knowledge and Performance**

##### **a. Exercise Evaluation Scope (82301)**

During this inspection, the NRC inspectors observed and evaluated the performance of the licensee's emergency response organization (ERO) during the biennial, full-participation exercise in the simulator control room (SCR), TSC, operations support center (OSC) and EOF. The inspectors assessed licensee recognition of abnormal plant conditions, classification of emergency conditions, notification of offsite agencies, development of PARs, command and control, communications, and the overall implementation of the emergency plan. In addition, the inspectors attended the post-exercise critique to evaluate the licensee's self-assessment of the exercise.

##### **b. Emergency Response Facility Observations and Critique**

#### **Simulator Control Room (SCR) and Security Control Area**

##### Observations and Findings

Control room staffing and response to the events followed the licensee's conduct of operations procedures. The inspectors observed effective direction of emergency operating procedures, detailed periodic status briefings for control room personnel, and good understanding of the operation of essential emergency core cooling systems by the operators. Communications with the TSC personnel was effective, particularly during critical decisions. However, the emergency message process was not always consistent because some critical information messages were not properly documented on emergency message forms.

The declaration of the Alert and the Site Area Emergency (SAE) by the control room shift supervisor was prompt and actions by control room personnel following the event declarations were in accordance with the emergency plan.

However, the inspectors noted the following discrepancies regarding the diagnosis of emergency conditions and actions to mitigate the containment leak: (1) at shift turnover, the crew informed the control room staff that the containment airlock annunciator light had been lit. The crew took no action to investigate the alarm which may have led them to determine if the airlock had been breached; (2) at 9:00 p.m., 48 minutes prior to the GE declaration, the wide range noble gas monitor had increased from 2000 microcuries per second ( $\mu\text{Ci/sec}$ ) to 3670  $\mu\text{Ci/sec}$  with additional increases every 15 minutes, indicating that a release to the environment was in progress and escalating. Neither the TSC nor SCR staff identified this increase until 9:45 p.m.; and (3) the SCR personnel were not informed that radiation levels at the entrance to the auxiliary building had increased and that the area in the vicinity of the containment airlock had been evacuated.

The response of security personnel to a simulated intrusion event was very good, including notification of operations personnel, security response, and the decision to take positive action to identify if other intruders were present.

### Conclusions

Overall simulator control room command and control and security response were good. However, the inspectors concluded that the diagnosis of the general emergency condition (release from containment) and actions to mitigate this condition were slow. The inspectors concluded that had the SCR staff known important radiation level information at the containment airlock, they may have been able to determine that the release of radioactive material was via the containment airlock to the atmosphere. Also, the GE declaration would have been declared much sooner than at 9:48 p.m. The inspectors discussed these issues with the licensee and determined that poor scenario control was a major contributor to these discrepancies. This is further discussed in Section P5.

### **Technical Support Center**

#### Observations and Findings

The overall performance of the TSC staff was very good. The TSC was promptly and efficiently staffed within one hour of the Alert declaration. The plant General Manager and Technical Support Director exhibited good facility management and control and briefings were timely and succinct. The TSC staff maintained cognizance of the plant status and emergency response activities. Intra-facility communications were very good in that individual teams were informed of the priorities and of significant new information. However, the TSC personnel were not notified that the facility was switched from the ventilation mode to the recirculation mode and that potassium iodide had been issued to all onsite personnel.

The inspectors noted that the licensee did not monitor EOF-8, "Functional Recovery Procedure" to determine how the Emergency Action Level (EAL) condition of .... "can NOT meet core and RCS heat removal acceptance criteria..." was being approached. Although the control room has the responsibility for monitoring this condition, it would be beneficial for the TSC staff reviewing the classifications to be cognizant of the plant conditions which could escalate the classifications.

The Reactor Core Engineering Team's analysis of the time of core uncovering and cladding damage was excellent. They were very knowledgeable of methods for performing time of core uncovering estimates. The engineers used both automated support and hand calculations to determine the time to core uncovering. Evaluations of the magnitude and type of fuel damage based upon core exit thermocouple readings and containment high range gas monitor readings were performed. Projections of the amount of damage were made before clad damage occurred and the evaluations were updated numerous times as plant conditions changed.

### Conclusions

The overall performance of the TSC staff was very good. The engineering support team's analysis of time of core uncovering and cladding damage was considered an exercise strength.

### **Operations Support Center**

#### Observations and Findings

The OSC staffing and activation was timely as required by the licensee's E-Plan. Command and control was very good and maintenance teams were briefed appropriately prior to dispatch. Onsite protective actions were demonstrated by radiological briefings, provision of protective clothing and dosimetry and early consideration of potassium iodine administration. Also, the licensee was very conservative in recalling repair teams when radiological conditions changed dramatically.

The inspectors observed some of the maintenance teams in the field and found dispatch to be timely and the teams to respond in a professional manner. The team members were very good at discussing efficient and safe methods of repair.

#### Conclusion

The inspectors concluded that the overall performance in the OSC was very good and capable of ensuring protection of onsite emergency responders.

### **Emergency Operations Facility**

#### Observations and Findings

The EOF was staffed and activated in a timely manner and the staff demonstrated good use of procedures. The EOF staff promptly and accurately identified the conditions for declaring the SAE and GE and offsite agency notifications were timely.

The EOF Director exhibited good command and control and promoted teamwork between the Site Emergency Coordinator (SEC), Alternate SEC and Recovery Manager. They would independently review and discuss information and decisions regarding procedures, EALs, plant status and notification forms to ensure thoroughness and accuracy. As was the case with the SCR staff, the EOF staff did not promptly recognize conditions indicative of a containment release. As was discussed in the simulator control room section, the cause of this oversight was attributed to poor scenario control.



Although status boards were consistently updated, there was a 15 minute delay in obtaining and documenting the information received from the plant. The inspectors discussed this issue with the licensee and stated that since the EOF is responsible for making classifications and PARs, it is important that they receive information in a timely manner.

Finally, it should be noted that there were more players at the EOF than are specified in the licensee's emergency plan and/or ERPIPs. Specifically, there were two additional communications, an additional EOF Director, an Alternate SEC and an alternate Radiological Assessment Director (RAD).

#### Dose Assessment

The RADs exhibited very good command and control in the dose assessment area. They conducted excellent briefings, questioned erroneous information and promoted very good teamwork among the Radiological Assessment Staff. Offsite field teams were dispatched immediately and communications and coordination were excellent. The PARs to the SEC were timely; however, the dose assessment team encountered many difficulties in operating the dose assessment computer models for projecting radiological dose information.

The licensee performed their radiological offsite dose calculations on two computers. One was for performing calculations based on "real-time" data and the other was for performing "what if" calculations. The inspectors observed that the dose assessment operators appeared to have limited knowledge for operating and understanding the full capabilities of the computer programs. Specifically, during the course of the exercise, the "what if" calculations were interrupted because the operators were not able to calculate offsite doses using conversion factors from the licensee's Core Release Fraction Assumptions Table, ERPIP-8234, Attachment 13. This was necessary for the computer to perform the calculation. However, near the end of the exercise, the RAD suggested performing the calculations by hand which resulted in a late but reasonable estimate.

Additionally, at 9:45 p.m., the RAD announced that there was a 20% GAP release. The operator for the "real time" dose assessment computer continued to run calculations based on a loss of coolant accident (LOCA) source term rather than a GAP release source term. This contributed to erroneous doses of 5 Rem at 5 miles and zero dose at the site boundary. This confused the RADs because the data did not support an 80 mR/hr radiological instrumentation reading taken three miles off site. However, the RAD questioned the measured offsite dose information rather than evaluating or exploring the legitimacy of his "real-time" projections. The error in assumption was found accidentally approximately one hour after the GE declaration and the PAR upgrade had been made. When the release assumption was changed to a GAP release, the higher dose was at the site boundary with the minimal dose found at 5 miles, as would be expected. The licensee determined that by using the wrong accident type, dose calculations were high by a factor of 100.

When the general emergency was declared, the RAD's PAR to the SEC was to evacuate sectors 1, 2, 4 and 5. The SEC and Alternate SEC elected to base the PAR strictly on plant conditions and evacuate sectors 1 and 2 only. At 10:22 p.m., the PAR was upgraded to include sectors 3, 4 and 5. The inspectors determined that since the "real-time" projections were incorrect, had the SEC made the PAR based on the recommendations made by the RAD, the population located in sectors 4 and 5 would have been evacuated unnecessarily for the existing radiological conditions.

The dose assessment staff held an excellent critique immediately after the exercise. Comments were detailed and self-critical. The team noted their frustration with the dose assessment models and stated that more extensive training was needed and an understanding of the software would be helpful for determining how calculations were performed and what factors were introduced into the equations. The staff also expressed that some of these findings had been repeat items in the dose assessment area from previous exercises.

The inspectors discussed these concerns with the EP Director prior to the exit. The EP Director committed to revise the Emergency Response Training Program Manual for inclusion of **monthly** Radiological Assessment Staff dose assessment training. Also, discussions with the lead RAD indicated that the licensee plans to train more personnel with health physics experience and background to operate the dose assessment model for better assistance to the RAD for interpreting the data.

### Conclusions

Overall, the operation and performance in the EOF were good. The presence of additional responders, although a condition that would likely occur during an actual emergency event, made it impossible for the inspectors to determine if the minimum staffing described in the emergency plan is adequate to deal with such events. Although the licensee was fortuitous in making the right PARs because they were based on plant conditions only, the Radiological Assessment Staff was unable to produce reliable dose projections using their dose assessment models. The inspectors determined that the licensee did not adequately demonstrate the ability to use the dose assessment computer code to perform dose projections for use in determining PARs based on radiological conditions. This was considered an exercise weakness. (IFI 50-317/97-09-01; 50-318/97-09-01)

### Media Center

The inspectors observed media center activities at the end of the scenario. Licensee performance was good. Simulated press personnel actively questioned plant management about release conditions. Communications between the licensee, county, and state personnel were effective, and communicators posted plant conditions promptly outside of the briefing area.



### Exercise Simulation and Control

The inspectors noted several examples of inadequate scenario simulation or control that affected player performance. These examples did not preclude an overall satisfactory exercise evaluation, but one problem in this area affected the licensee's demonstration of the ability to promptly recognize the loss of the containment as a fission product barrier and the resulting General Emergency condition.

The licensee did not adequately simulate the condition of the containment personnel airlock as degraded due to work simulated as occurring before the start of the scenario. The licensee intended for the control room staff to investigate and discover this condition based on annunciator indication. This annunciator indication was normal for the work that had been described to the control room players at the beginning of the scenario, and they did not question it. The annunciator was not, by itself, an indication of a breach of the containment barrier. The players did not recognize the loss of the containment barrier until after radiation levels in the auxiliary building and release paths reached such levels as to indicate undeniable failure of the containment barrier.

The inspectors observed other examples of problems with scenario simulation or controller performance. In the SCR, radiation monitor information was posted prior to the occurrence of events which would have supported the information. When questioned by players about the information shown, the controller told the operators to ignore the information. The inspectors concluded that the availability of this information unnecessarily prompted the players to upcoming events. The drill controllers also prematurely simulated the restoration of 11 ECCS suction header before the players had adequately demonstrated the ability to send in a repair team. The controllers simulated the return of the header to service to preserve the scenario time line, but doing so precluded the inspectors' ability to evaluate the adequacy of repair activities for this component. The controllers also confused the players by simulating conflicting turbine building radiation levels that allowed one repair team to enter while another was turned back. Players were also confused by a controller-directed message describing a seismic event that was not given in the appropriate units for the players to interpret its magnitude. During the licensee's previous NRC evaluated exercise in September 1995, the licensee had three examples of controller performance problems. The inspectors discussed this with the licensee and stated that the problems were indicative of poor pre-exercise training and strongly emphasized the need for improvement in this area.

### Post-Exercise Critique

Immediately following the exercise, the licensee began its debrief/critique process. Players and controllers assembled in their assigned facilities and critiqued their exercise performance. These findings were collected and presented in a formal licensee critique which the inspectors attended.



The player debriefs immediately following the exercise were very informative. They included both written and verbal feedback from the players, controllers and observers. However, the licensee's formal critique presentation to the players and the NRC was minimally acceptable. The EP Director was still soliciting facts from players at this critique to explain negative exercise comments rather than making a presentation of the findings with preliminary qualitative assessment. The inspectors discussed the NRC's expectations of a formal critique as defined in NRC NUREG-0654, Appendix E of 10 CFR Part 50 and NRC Inspection Module 82301 with the licensee. Although the licensee did not agree with the NRC's assessment in this area, they agreed to review and assess their current critique process.

c. Overall Exercise Conclusions

Overall exercise performance was good. The ERFs were staffed and activated in a timely manner. The event classifications were correct and timely. Offsite notifications were completed within 15 minutes. The first PAR, at the general emergency (GE) declaration, was made within the 15 minute requirement and was upgraded as plant conditions changed.

**P8 Miscellaneous EP Issue**

Exercise Scenario Development (82302)

The licensee submitted the exercise objectives and scenario for NRC review in a timely manner. After reviewing the scenario, the inspectors discussed its contents with licensee representatives and concluded that it adequately tested the major portions of the emergency plan and ERPIPs. However, the inspectors were surprised by the licensee's decision to stage the players at the site even though the exercise was scheduled to begin after normal working hours. The inspectors considered that this decision negatively impacted the licensee's ability to demonstrate the prompt recall of responders from their homes. The licensee stated that this decision was based on the successful demonstration of a previous staff recall drill. The inspectors accepted this explanation but strongly encouraged the licensee to take advantage of the opportunity to perform a staff recall for the next off-hours exercise.

**V. Management Meetings**

**X1 Exit Meeting Summary**

The inspectors presented their results to members of licensee management at the conclusion of the inspection on November 20, 1997. The licensee acknowledged the inspectors' findings.

## PARTIAL LIST OF PERSONS CONTACTED

Licensee

T. Forgette, Director, Emergency Planning  
J. Lemons, Manager, Nuclear Support Services Department  
P. Katz, Plant General Manager  
J. Osborne, Nuclear Regulatory Analyst  
T. Pritchett, Acting Manager, Nuclear Engineering Department  
G. Rudigier, Sr. Emergency Planning Analyst

NRC

H. Nieh, Resident Inspector, Salem  
S. Roudier, International Visitor, NRR  
T. Eaton, Intern, NRR

## INSPECTION PROCEDURES USED

82301: Evaluation of Exercises for Power Reactors  
82302: Review of Exercise Objectives and Scenarios for Power Reactors

## ITEMS OPENED, CLOSED AND DISCUSSED

Opened

IFI 50-317/97-09-01;50-318/97-09-01). The dose assessment staff at the EOF could not use the on-line dose assessment code to provide an accurate protective action recommendation.

Closed

None

Discussed

None



## LIST OF ACRONYMS USED

EP	Emergency Preparedness
EAL	Emergency Action Level
EOF	Emergency Operations Facility
ERF	Emergency Response Facility
ERO	Emergency Response Organization
ERPIP	Emergency Response Plan Implementing Procedures
GE	General Emergency
IFI	Inspector Follow-up Item
LOCA	Loss of Coolant Accident
mR/hr	milli Röntgen per hour
NRC	Nuclear Regulatory Commission
OSC	Operations Support Center
PAR	Protective Action Recommendation
RAD	Radiological Assessment Director
RCS	Reactor Coolant System
SAE	Site Area Emergency
SCR	Simulator Control Room
SEC	Site Emergency Coordinator
TSC	Technical Support Center
$\mu$ Ci/sec	micro curies per second