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October 1, 1998

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Director, Office of Enforcement

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318
Reply to a Notice of Violation -- Notice of Violation and Proposed Imposition of
Civil Penalty - \$55,000 (NRC Inspection Report Nos. 50-317/98-05 and
50-318/98-05)

REFERENCE: (a) Letter from Mr. H. J. Miller (NRC) to Mr. C. H. Cruse (BGE), dated
September 2, 1998, Notice of Violation and Proposed Civil Penalty -
\$55,000 (NRC Inspection Report Nos. 50-317/98-05 and 50-318/98-05)

This letter provides Baltimore Gas and Electric Company's response to Reference (a), which identified three violations related to failures to properly implement radiological control procedures for activities in the reactor annulus during our 1998 Unit 2 refueling outage. The response details our short-term and long-term actions taken and planned to address the identified violations. More importantly, the response details why corrective actions for previous radiological safety events were not effective in preventing these events. Individual responses to each of these violations are provided in Attachments (1) through (3). Also, enclosed is Baltimore Gas and Electric Company Check No. 3121683 in the amount of \$55,000.

We share your concerns over our past performance in the area of radiation protection. Correcting the weaknesses in our program is essential to the long-term safe operation of Calvert Cliffs Nuclear Power Plant and will require sustained management emphasis and focus. We will continue to work hard to ensure effective implementation of the interim and longer term plans that will achieve the site vision for sustained, excellent, event-free performance in radiation protection.

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ATTACHMENT (1)

RESPONSE TO NRC INSPECTION REPORT

NOS. 50-317/98-05 & 50-318/98-05

VIOLATION 01013

**Baltimore Gas and Electric Company
Calvert Cliffs Nuclear Power Plant
October 1, 1998**

ATTACHMENT (1)

RESPONSE TO NRC INSPECTION REPORT NOS. 50-317/98-05 AND 50-318/98-05

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1. *On April 9, 1998, the requirements of RP-1-100, RSP 1-132, and RSP 1-124 were not implemented for an entry into the reactor annulus to remove insulation and prepare the NI detectors for removal and replacement, as evidenced by the following examples:*

The RST that entered the reactor annulus to perform surveys wore a RAD-100 dosimeter; however, issuance of the dosimeter was not recorded on a form or an approved computer database, as required by RSP 1-124.

Four workers entered the reactor annulus but were not provided and did not wear SAIC alarming dosimetry or ALNOR alarming dosimeters, as required by SWP 1312.

Radiation safety personnel did not adequately verify that the workers were wearing the dosimetry required by the SWP in that the Radiation Safety Technicians (RSTs) failed to identify that the workers entering the annulus were not wearing SAIC alarming dosimetry or ALNOR alarming dosimeters, as required by RSP 1-132. (01013)

I. ADMISSION OR DENIAL OF THE ALLEGED VIOLATION

Baltimore Gas and Electric Company accepts the violation as stated.

II. REASON FOR THE VIOLATION

On April 10, 1998, the Plant General Manager (PGM) appointed a Significant Incident Finding Team (SIFT) to investigate the event that had occurred the previous day where a plant worker received unplanned radiation exposure that exceeded his Special Work Permit (SWP) limit while working in the Unit 1 reactor vessel annulus. The SIFT learned that earlier in the morning on April 9, 1998, several plant workers had failed to wear required alarming dosimetry while performing work in the reactor vessel annulus. The SIFT also learned that the applicable SWP requirements to determine stay times for workers entering high radiation areas had not been correctly implemented by the coverage radiation safety technician (RST).

The SIFT completed its investigation of these radiation protection (RP) events, determined causal factors, and provided recommended corrective actions. The SIFT concluded these events involved multiple failures to adhere to radiological procedures including: (1) the failure of workers to wear alarming dosimetry when entering the reactor vessel annulus; (2) the failure of radiation safety personnel to stop work when unexpected alarms and radiological conditions were encountered; and (3) the failure to properly determine worker stay times for work in high radiation areas.

The SIFT identified the following root causes for the events described above:

1. The RP Program has some fundamental weaknesses in its work practices. These weaknesses exist because some radiation safety practices are not adequately defined.
2. Radiation Safety supervision failed to follow-up on expectations and ensure personnel were performing as expected.
3. The specific behaviors to support our concept of "200% accountability" were not defined, communicated, or enforced.
4. Radiation Safety supervision failed to prioritize their work in order to support higher risk jobs.

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5. There was no regular, effective reporting of the status and adequacy of the RP Program at the precursor level.
6. Previous recommendations and corrective actions were insufficient to prevent these events.
7. Management failed to recognize weaknesses in the RP Program.

On June 17, 1998, the Vice President- Nuclear Energy Division (VP-NED) approved the results of a Special Assessment Team (SAT) led by the Manager-Nuclear Performance Assessment Department. The SAT was appointed to provide an assessment of why corrective actions from previous RP events were not effective in preventing the reactor vessel annulus entry events on April 9, 1998. The SAT firmly endorsed the results of the SIFT.

The SAT evaluated root cause analysis reports, independent assessments, NRC correspondence, and corrective actions associated with RP from the April 1997 Spent Fuel Pool Dive Event, up to and including the events of April 9, 1998. The SAT concluded that the April 9, 1998 reactor annulus entry events were similar to previous radiological events. This was determined by a method of investigation called collective significance analysis. Collective significance analysis involves a systematic investigation of multiple events in order to determine underlying causes linked throughout the events, rather than focusing on a single event. This is helpful in uncovering common underlying causes and allowing the selection of more effective and efficient corrective actions.

The SAT concluded that there were no new common causes for the April 9, 1998 reactor vessel annulus entry events. Corrective actions for the previous RP events were narrowly effective. An example of this was the corrective actions implemented following the 1997 dive event. These corrective actions led to several effective spent fuel pool dives in January 1998. Had these corrective actions been expanded to higher-risk radiological work in general, they would have been equally effective in preventing the reactor vessel annulus entry events of April 9, 1998.

The SAT also concluded that we had developed comprehensive plans for addressing the key radiological control deficiencies identified earlier. However, the plans were not effective in preventing the events on April 9, 1998, for the following reasons:

1. The plans did not address the weakness in the basic application of RP fundamentals by the Radiation Safety Section;
2. Although improving procedure compliance was identified as an action in the plans, it was not effectively implemented; and
3. While some actions to be taken under the plans extended well into 1999, adequate compensatory actions were not taken for the 1998 refueling outage.

The SAT identified five general areas for RP Program improvement:

1. **Application of RP Fundamentals** — There was less than adequate focus on basic RP fundamentals to ensure worker safety. This weakness was coupled with poor procedure compliance within the Radiation Safety Section.
2. **Corrective Actions, Self-Assessment, and Trending** — These areas were weak and were not used effectively to improve performance.

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3. **Oversight and Management** — The content and presentation of independent assessment reports concerning RP did not lead mid-level management and above to take timely, effective actions to prevent the events of April 9, 1998, even though the reports identified numerous weaknesses.
4. **Risk Management** — Even though the events on April 9, 1998 had been identified as the first radiological higher risk evolutions of the 1998 Unit 1 refueling outage, we did not focus on these activities as being the most important.
5. **Behavior Management** — The key behaviors needed to support the concept of 200% accountability for protecting radiological workers were not defined.

III. CORRECTIVE STEPS THAT HAVE BEEN TAKEN AND RESULTS ACHIEVED

- A. The following is a listing of the immediate and short-term corrective actions documented by the SIFT:

Immediate Actions

1. The PGM declared this event a Nuclear Plant Incident, stopped all reactor vessel annulus work, and initiated a SIFT investigation.
2. All use of the SAIC (Science Application International Corporation) alarming dosimetry system was stopped.

Short-Term Actions

1. The PGM mandated a site-wide "Safety Break" to ensure site awareness of the event. He also directed that his approval was needed to resume work in the reactor vessel annulus and specified measures that needed to be met in order to reinstitute use of the SAIC alarming dosimetry system.
2. The VP-INED issued a site-wide notice of barriers broken during the events and immediate actions taken. He also directed that site-wide "High Radiation Event Prevention Training" be conducted by May 7, 1998. Access to the radiologically-controlled area was dependent upon completing this training.
3. A set of questions concerning RP requirements on alarming dosimetry were asked of personnel entering the radiologically-controlled area to increase and maintain worker awareness.
4. Stay time calculations and peer and supervisory checks of the calculations, were required to be documented. Stay time was required to be monitored by Radiation Safety Section personnel and relayed to radiation workers. Two independent methods of notifying radiation worker's of dose being received was required (i.e., remaining stay time and alarming dosimeter).
5. Radiological "Higher Risk" work is not allowed to start until the Superintendent-Maintenance, the Radiation Safety Manager, and the General Supervisor-Radiation Safety have consulted with the PGM and all agree that all personnel and radiological safety conditions are properly addressed.

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6. The General Supervisor-Maintenance and General Supervisor-Radiation Safety were required to be present at pre-job briefs for all radiological higher risk jobs. Baltimore Gas and Electric Company RSTs were designated as the "Lead Technicians" (contractor personnel were previously allowed to be "Lead Technicians"), and in-field Radiation Safety supervisory oversight was increased for these jobs. Maintenance groups have been provided with an enhanced pre-job brief sheet and reference copies of the applicable SWPs and ALARA (as low as reasonably achievable) reviews are now made available to all personnel in pre-job briefs.
- B. On June 1, 1998, we established the position of Superintendent-Technical Support. The Radiation Safety, Chemistry, and Plant Engineering Sections report directly to this Superintendent. This is a new management position that will assist the PGM in managing these critical areas.
- C. On June 10, 1998, the General Supervisor-Radiation Safety issued a memorandum, "Radiation Safety Section Procedure Usage, Rev. 1," to all Radiation Safety Section personnel. This memorandum clearly reinforced his expectations for procedure use by Radiation Safety Section personnel.
- D. On June 12, 1998, the PGM issued his "On-Line Radiation Protection Risk Management Interim Compensatory Measures," memorandum to all site supervisors. This document defined the management process to be used for on-line radiological high risk jobs until site procedures have been upgraded. The requirements of this plan became effective on June 19, 1998. Training was provided to the appropriate site personnel during the week of June 15, 1998.
- E. A summary of the immediate and short-term actions was provided to the NRC in Reference (1). At the June 18, 1998 pre-decisional enforcement conference, we provided you with a summary, dated June 17, 1998, [Attachment (3) to Reference (3)] of the actions we had taken as described in Reference (1) and your related April 29, 1998 Confirmatory Action Letter [Reference (2)]. We informed you at the enforcement conference that all immediate and short-term actions had been completed. These actions included, but were not limited to: (1) increased management involvement; (2) increased supervisory oversight; and (3) heightened worker awareness.
- F. The SIFT process was completed on June 16, 1998. The SIFT performed an investigation of the April 9, 1998 events, determined causal factors, and provided recommended corrective actions. These long-term corrective actions are being incorporated into the site Radiation Protection Improvement Plan (RPIP) [see Section IV].
- G. On June 17, 1988, the VP-NED approved the results of the SAT led by the Manager-Nuclear Performance Assessment Department. The SAT was initiated to provide an assessment of why corrective actions from previous RP events were not effective in preventing the reactor vessel annulus entry events on April 9, 1998. The SAT also provided compensatory action recommendations as additional short-term means of ensuring no further events occur.
- H. On June 24, 1998, we instituted a Radiological Controls Subcommittee (RCS) to our Offsite Safety Review Committee. The RCS is chaired by an outside (non-Baltimore Gas and Electric Company) principal member of our Offsite Safety Review Committee. The first meeting of the

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RCS was held on July 17, 1998. The formation of the RCS was a compensatory action recommendation of the SAT.

- I. The Radiation Protection Oversight Committee (RPOC) charter was formalized into a plant procedure on April 8, 1998. The RPOC is chaired by the PGM and will continue to meet on a monthly basis to review the overall effectiveness of the site RP Program. The RPOC requirements for membership composition, responsibilities, meetings, and presentations are also detailed in the procedure.
- J. On July 1, 1998, a full-time position of Project Manager-Radiation Protection Improvement Project (RPIP) was established. The RPIP Project Manager reports to the Superintendent-Technical Support and provides the management oversight required to successfully upgrade required elements of our RP Program prior to the 1998 refueling outage, as well as identifying those that will extend beyond that time. The RPIP project is organized around the RP Program weaknesses identified in the June 1998 SAT report. This will ensure that project improvements are focused on program weaknesses and provide a direct means of evaluating project success and closure.
- K. On July 9, 1998, the General Supervisor-Radiation Safety completed compensatory actions to implement Radiological Protection procedure adherence and accountability. The compensatory actions included: expectations, scope (i.e., technical and administrative procedures, SWPs, ALARA reviews, postings and survey maps), usage levels (i.e., referral, continuous use), evaluation and feedback of performance, supervisory oversight, and field verification. Training was provided to the appropriate Radiation Safety Section personnel.
- L. On August 4, 1998, the PGM issued "On-Line RP Risk Management Compensatory Measures, Rev. 1," that defined the on-line radiological higher risk work management process to be used until site procedures have been updated. These measures have been revised to incorporate provisions for managing emergent and urgent radiological work.
- M. On September 14, 1998, we implemented RP-1-102, "Control of Radiation Protection Higher Risk Activities," Revision 0. This procedure provides the necessary tools to safely manage radiological higher risk activities. It formalizes management expectations and compensatory measures previously established by the PGM in memos dated June 12, 1998, and August 4, 1998. This procedure establishes the responsibilities for direction, control, oversight, and conduct of radiological higher risk activities at Calvert Cliffs Nuclear Power Plant (CCNPP). It also implements the VP-NED's commitment to continue 1998 refueling outage compensatory actions until the RPIP corrective actions are in place.
- N. We have conducted leadership training for Radiation Safety Section supervisors and work leaders.

As a result of our immediate, short-term and strong compensatory actions, we completed the Unit 1 refueling outage without any additional significant radiological safety events.

Subsequently, we performed an unplanned Unit 2 outage from July 23, 1998 until August 7, 1998 without any significant radiological safety events. This outage included repair to a pressurizer level

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tap penetration, an inspection of similar penetrations, and an inspection of the pressurizer heater sleeves

IV. CORRECTIVE STEPS THAT WILL BE TAKEN TO AVOID FURTHER VIOLATIONS

- A. We are in the process of implementing the site RPIP. The five common weaknesses in our RP Program identified by the SAT constitute the problem statement for the RPIP. Correcting these weaknesses is essential to the long-term safe operation of CCNPP and will require sustained management emphasis and focus. The plan's mission is to enhance RP Program significant event-free performance by effectively managing the transition from compensatory measures to site-wide corrective actions. The scope of the plan is to: (1) manage compensatory measures to prevent significant RP events; (2) implement a step-change in site RP performance for all modes of operation and provide overall site change management to assure effective implementation in the 1999 refueling outage; and (3) to identify improvements that extend beyond the 1999 refueling outage to achieve the site vision for sustained, excellent, event-free performance in RP. The plan's objectives are as follows:
1. Maintain effective compensatory measures to prevent significant RP events while long-term corrective actions are established.
 2. Define, communicate, and enforce radiation worker behaviors necessary for 200% accountability prior to the 1999 refueling outage.
 3. Upgrade radiation worker and Radiation Safety Section personnel knowledge, and improve key RP processes and procedures prior to the 1999 refueling outage. Identify, plan, and schedule long-term improvements to the RP Program.
 4. Establish an integrated work management process for identifying, planning, and managing RP risk for all modes of operation prior to the 1999 refueling outage.
 5. Improve the RP self-assessment program and establish better ties to the corrective action program.
 6. Manage project activities, including overall site change management, and identify subsequent actions for continued improvement to support event-free turnover to the line organization.
- B. A lack of supervisory/management field presence during radiological higher-risk work (from the SIFT Report) will be corrected through task-elements associated with the weaknesses of Behavior and Risk management in the RPIP.
- C. Incorporating lessons learned for Nuclear Performance Assessment Department and mid-level managers and above (from the SAT report) will be addressed by a special project addressing the division's self-assessment program.

All long-term RP corrective actions from the SIFT and SAT have been captured under our site RPIP. This RPIP was approved by our Management Review Board on July 30, 1998. The long-term actions are being tracked in accordance with our action item tracking system.

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V. DATE WHEN FULL COMPLIANCE WILL BE ACHIEVED

Full compliance was achieved on April 9, 1998, when the radiation workers exited the radiation areas associated with the April 9, 1998 reactor annulus entries.

REFERENCES:

- (1) Letter from Mr. C. H. Cruse (BGE) to NRC Document Control Desk, dated April 27, 1998, "Actions to Improve Radiation Safety During the Unit 1 Refueling Outage"
- (2) Letter from Mr. H. J. Miller (NRC) to Mr. C. H. Cruse (BGE), dated April 29, 1998, "Confirmatory Action Letter" [CAL No. 1-98-006]
- (3) Letter from Mr. J. T. Wiggins (NRC) to Mr. C. H. Cruse (BGE), dated July 9, 1998, "Pre-Decisional Enforcement Conference and Closure of Confirmatory Action Letter No. 1-98-006 (References: NRC Combined Inspection Report Nos. 50-317/98-05; 50-318/98-05, dated June 2, 1998, and NRC Confirmatory Action Letter No. 1-98-006, dated April 29, 1998)"

ATTACHMENT (2)

RESPONSE TO NRC INSPECTION REPORT

NOS. 50-317/98-05 & 50-318/98-05

VIOLATION 01023

**Baltimore Gas and Electric Company
Calvert Cliffs Nuclear Power Plant
October 1, 1998**

ATTACHMENT (2)

RESPONSE TO NRC INSPECTION REPORT NOS. 50-317/98-05 AND 50-318/98-05

VIOLATION 01023

2. On April 9, 1998, the requirements of RSP 1-129 and RSP 1-132 were not implemented for a subsequent entry into the reactor annulus to attempt to relatch a NI detector well, as evidenced by the following examples:
- Three of the five detector dose alarms on the PD(E)-4 dosimetry used by an I&C technician performing work in the reactor annulus were not set at the SWP dose limit of 600 mR and the dose rate limit of 8000 mR/hr, as required by SWP 1312. The three dose alarms were left at the calibration settings of 25 mR and 2780 mR/hr.
 - A PD(E)-4 was issued to an I&C technician entering the annulus and the applicable information was not recorded on Attachment 5 or a similar form, as required by RSP 1-129.
 - Radiation safety personnel failed to adequately monitor radiological conditions and worker's dose and did not stop the work and instruct personnel to exit the area when unexpected alarms and radiological conditions were encountered, as required by RSP 1-132. Specifically:
 - RP personnel inadequately monitored a worker's dose, in that only one of five SAIC detectors on the technician was monitored in a real time mode and the dose provided by the monitored detector (chest) was not the highest integrated dose to any portion of the whole body. The highest integrated dose was at the thigh.
 - Three of five SAIC detectors continuously alarmed, including the detector indicating the highest whole body dose location, upon the worker's entry into the annulus, and no action was taken in response to the alarms. The three alarms remained in alarm condition for the duration of the entry (approximately nine minutes).
 - RP personnel took no action when one of the non-monitored detectors (left thigh) detected radiation dose rates in excess of the dose rate limit specified on the SWP. (01023)

I. ADMISSION OR DENIAL OF THE ALLEGED VIOLATION

Baltimore Gas and Electric company accepts the violation as stated.

II. REASON FOR THE VIOLATION

See Attachment (1), Item II. Specifically, note that fundamental weaknesses in the Radiation Protection Program, 200% accountability not understood, procedure non-adherence, and application of radiation safety fundamentals were major weaknesses that contributed to this violation.

III. CORRECTIVE STEPS THAT HAVE BEEN TAKEN AND RESULTS ACHIEVED

See Attachment (1), Item III. Specifically, note that all use of the SAIC was stopped and a Significant Incident Finding Team was initiated to investigate the events of April 9, 1998. Also, note that prior to reinstating use of the SAIC, personnel training records were reviewed and system experts were identified. The remainder of the 1998 refueling outage was completed allowing the system operator to operate the system under the direct oversight of a system expert. Currently, anyone who operates the system is required to be checked out by a system expert two times during actual system operation.

ATTACHMENT (2)

RESPONSE TO NRC INSPECTION REPORT NOS. 50-317/98-05 AND 50-318/98-05

VIOLATION 01023

IV. CORRECTIVE STEPS THAT WILL BE TAKEN TO AVOID FURTHER VIOLATIONS

See Attachment (1), Item I7.

V. DATE WHEN FULL COMPLIANCE WILL BE ACHIEVED

Full compliance was achieved on April 9, 1998, when the radiation workers exited the radiation areas associated with the April 9, 1998 reactor annulus entries.

ATTACHMENT (3)

RESPONSE TO NRC INSPECTION REPORT

NOS. 50-317/98-05 & 50-318/98-05

VIOLATION 01033

**Baltimore Gas and Electric Company
Calvert Cliffs Nuclear Power Plant
October 1, 1998**

ATTACHMENT (3)

RESPONSE TO NRC INSPECTION REPORT NOS. 50-317/98-05 AND 50-318/98-05

VIOLATION 01033

3. On April 9, 1998, the requirement of SWP 1312, to determine stay times for workers entering high radiation areas, was not implemented by the coverage RST, as evidenced by the following examples:
- The stay time determined for the workers entering the annulus to remove insulation and prepare the NI detectors for removal and replacement was incorrect. The coverage RST incorrectly assumed a stay time of 9 minutes which was determined based on the time to accumulate 600 mR in a 4000 mR/hr radiation field. However, as specified in SWP 1312 the stay time should have been determined based on the ALNOR dose alarm set point of 510 mR to preclude workers from exceeding the SWP 600 mR dose limit. The correct stay time was 7.6 minutes.
 - The stay time determined for the workers entering the annulus to attempt to relatch a NI detector well was incorrect. The stay time of 10 minutes used by the coverage RST was incorrect. The stay time was determined based on the time to accumulate 600 mR in a 6000 mR/hr radiation field. The correct stay time was 6 minutes. (01033)

I. ADMISSION OR DENIAL OF THE ALLEGED VIOLATION

Baltimore Gas and Electric company accepts the violation as stated.

II. REASON FOR THE VIOLATION

See Attachment (1), Item II. Specifically, note that application of radiation safety fundamentals and poor procedure compliance were major factors in this event.

III. CORRECTIVE STEPS THAT HAVE BEEN TAKEN AND RESULTS ACHIEVED

See Attachment (1), Item III. Specifically, note that Attachment (1) details that stay time calculations and peer and supervisory checks of the calculations are now required to be documented. Stay time is required to be monitored by Radiation Safety Section personnel and relayed to radiation workers. Two independent methods of notifying radiation workers of dose being received has been required (i.e., remaining stay time and alarming dosimeter).

IV. CORRECTIVE STEPS THAT WILL BE TAKEN TO AVOID FURTHER VIOLATIONS

See Attachment (1), Item IV.

V. DATE WHEN FULL COMPLIANCE WILL BE ACHIEVED

Full compliance was achieved on April 9, 1998, when the radiation workers exited the radiation areas associated with the April 9, 1998 reactor annulus entries.