November 7, 2000

Mr. Charles H. Cruse
Vice President - Calvert Cliffs Nuclear Power Plant, Inc. (CCNPPI)
Constellation Nuclear
Calvert Cliffs Nuclear Power Plant
1650 Calvert Cliffs Parkway
Lusby, MD 20657-4702

SUBJECT: CALVERT CLIFFS - NRC SUPPLEMENTAL INSPECTION REPORT 05000317/2000-010

Dear Mr. Cruse:

On October 21, 2000, the NRC completed a supplemental inspection at Calvert Cliffs Nuclear Power Plant Unit 1. The enclosed report presents the results of this inspection which were discussed with Mr. Katz and other members of your staff on October 23, 2000.

This inspection was an examination of your activities associated with a white performance indicator for Unit 1 scrams with a loss of normal heat removal (LONHR) using NRC Inspection Procedure 95001, “Inspection for One or Two White Inputs in a Strategic Performance Area.” The NRC determined that your staff had not evaluated recent LONHR events in sufficient detail to understand common causes and performance problems in order to establish corrective actions with reasonable assurance of minimizing future scrams with a LONHR. During the exit meeting, your staff acknowledged this observation and initiated an Issue Report to address the shortfalls in your evaluations and corrective actions, to date.

Based upon our review, the Inspection Procedure 95001 objectives could not be achieved for assuring that the extent of condition is identified and assuring that the corrective actions for these more risk significant scrams with a LONHR are sufficient to address the root and contributing causes. Inspection activities to follow-up our observations have not been determined. In accordance with Inspection Procedure 95001, we may elect either to conduct a subsequent supplemental inspection or to follow-up your actions during the next annual problem identification and resolution baseline inspection per Inspection Procedure 71152.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publically Available Records (PARS) component of the NRC's document system (ADAMS). ADAMS is accessible from the NRC Web Site at http://www.nrc.gov/NRC/ADAMS/index.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Richard V. Crlenjak, Deputy Director
Division of Reactor Projects

Docket No. 05000317
License No. DPR-53

Enclosure: Supplemental Inspection Report No. 05000317/2000-010

cc w/encl:
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REGION I

| | |
|---|---|
| Docket No.: | 05000317 |
| License No.: | DPR-53 |
| Report No: | 05000317/2000-010 |
| Licensee: | Calvert Cliffs Nuclear Power Plant, Inc. |
| Facility: | Calvert Cliffs Nuclear Power Plant<br>Units 1 and 2 |
| Location: | 1650 Calvert Cliffs Parkway<br>Lusby, MD 20657-4702 |
| Dates: | September 11, 2000 to October 21, 2000 |
| Inspectors: | David Beaulieu, Senior Resident Inspector |
| Approved by: | William A. Cook, Chief,<br>Projects Branch 1<br>Division of Reactor Projects |

## SUMMARY OF FINDINGS

IR 05000317/2000-010, on 09/11/00 - 10/21/00; Calvert Cliffs Nuclear Power Plant, Inc.; Calvert Cliffs Nuclear Plant; Unit 1. Initiating Events.

This report documents a supplemental inspection to review a Unit 1 white performance indicator for scrams with a loss of normal heat removal (LONHR). This inspection was conducted in accordance with the NRC's Reactor Oversight Process (Attachment 1). The significance of issues is indicated by their color (green, white, yellow, red) and was determined by the Significance Determination Process (SDP).

Cornerstone: Initiating Events

The NRC identified that the licensee had not reviewed previous LONHR events in sufficient detail during common cause development resulting in some corrective actions that were too general in nature. Because of the lack of specificity, it was not evident that performance problems were sufficiently understood to provide reasonable assurance that the corrective actions will minimize the future scrams with a LONHR. In addition, corrective actions to address plant equipment problems known to contribute to post-scram LONHR events appear to have been unnecessarily delayed. Consequently, the licensee’s corrective actions have not yet been sufficiently developed to allow the NRC to complete the inspection objective of providing assurance that the corrective actions are sufficient to address the causes of scrams with a LONHR events and to prevent recurrence. The loss of normal heat removal following a scram is more risk significant because it increases the potential for a more adverse consequences. Notwithstanding, the use of backup safety systems to compensate for the LONHR function is not a violation of regulatory requirements.

## Report Details

### 01 Inspection Scope

This supplemental inspection was performed by the NRC to address a change in performance as indicated by the white Unit 1 performance indicator for scrams with a loss of normal heat removal (LONHR). The inspector reviewed pertinent corrective action documents and post-trip evaluations, discussed the issue with responsible Calvert Cliffs personnel, and verified the status of selected corrective actions to assess the adequacy of the licensee's response to this performance indicator change.

#### Performance Indicator (PI) Definition

The objective of this performance indicator is to monitor that subset of unplanned and planned automatic and manual scrams that necessitate the use of mitigating systems and therefore, are more risk significant than uncomplicated scrams. The performance indicator for scrams with a LONHR is defined as the number of unplanned scrams while critical, both manual and automatic, during the previous 12 quarters that also involved a LONHR through the main condenser prior to establishing reactor conditions that allow use of the plant's normal long term heat removal systems. A loss of the normal heat removal path via the main condenser is considered to exist when any of the following conditions occur:

- loss of main feedwater
- loss of main condenser vacuum
- closure of the main steam isolation valves
- loss of turbine bypass capability

#### Background - PI Color Change

The Unit 1 scram on January 14, 2000, was the third scram with a LONHR at Unit 1 in the previous 12 quarters which met the threshold (greater than 2) for changing this performance indicator from green to white. The previous two scrams occurred on September 22, 1999, and October 24, 1997. This white performance indicator was reflected in the performance indicator results for the first quarter of 2000. The performance indicator could have returned to green the fourth quarter of 2000 had it not been for an additional scram with a LONHR which occurred on September 10, 2000. The earliest this indicator can now return to green is the third quarter 2002. The licensee documented this performance indicator changing to white in Issue Report IR3-029-799 and performed Causal Analysis PD200000003, Collective Significance Analysis of Reactor Trips with Loss of Normal Heat Removal.

### 02 Evaluation of Inspection Requirements

#### 02.01 Problem Identification

a. Determine that the evaluation identifies who (i.e., licensee, self-revealing, or NRC), and under what conditions the issue was identified.

The concern with scrams with a LONHR was self-revealing through the licensee's collection of performance indicator data taken in support of the NRC's reactor oversight process (ROP).

b. Determine that the evaluation documents how long the issue existed, and prior opportunities for identification.

Although the white performance indicator was the result of scrams with a LONHR that occurred at Unit 1 over the last 12 quarters, the licensee's causal analysis evaluated all 13 scrams that occurred at Unit 1 and 2 over the last five and one-half years. Of the 13 scrams, 12 resulted in a loss of the normal heat removal function. (The licensee's causal analysis was approved on June 8, 2000, and therefore, it did not address the Unit 1 scram with a LONHR that occurred on September 10, 2000.

Although past trips gave the licensee an opportunity to identify the LONHR issue, they had not previously considered a LONHR following a scram to be a performance concern. Licensee interviews with various members of the plant staff and management found that: (a) plant personnel were generally unaware that almost every recent scram has resulted in a LONHR; (b) a LONHR following a scram, while a nuisance, was not considered to be a significant issue; and (c) restoring normal heat removal functions following a scram was not considered a high priority, if the alternate heat removal method was functioning properly.

c. Determine that the evaluation documents the plant-specific risk consequences (as applicable) and compliance concerns associated with the issue.

For actual plant consequences, the licensee's causal analysis stated that, other than reducing the margin to safety for decay heat removal, the plant functioned as designed using backup systems. For potential plant consequences, the licensee's causal analysis stated that losing normal heat removal following a scram increases the potential for a more adverse event. In addition, over-reliance on backup systems desensitizes personnel to the loss of normal equipment such that the use of backup systems is no longer considered abnormal. The inspector noted that the use of backup systems is not a violation of regulatory requirements.

02.02 Root Cause and Extent of Condition Evaluation

a. Determine that the problem was evaluated using a systematic method(s) to identify root cause(s) and contributing cause(s).

The licensee evaluated the scrams with a LONHR by performing a causal analysis using the Collective Significance Analysis method. Administrative Procedure QL-2-104, Self Assessment, states that a Collective Significance Analysis is an evaluation tool for recognizing the most significant behaviors, conditions, or causes affecting the performance of an organization or program. The analysis is conducted by collecting individual performance reports and assessment and then developing a matrix to identify the commonalities.

b. Determine that the root cause evaluation was conducted to a level of detail commensurate with the significance of the problem.

The inspector made a number of observations regarding the level of detail in the licensee's evaluation. These observations are discussed in Section O2.03.a below.

c. Determine that the root cause evaluation included a consideration of prior occurrences of the problem and knowledge of prior operating experience.

The licensee did not limit their review to the three scrams at Unit 1 which resulted in the white performance indicator. They appropriately expanded their review to include an additional 12 scrams that occurred in the last five and one half years at Units 1 and 2 that involved a LONHR function.

d. Determine that the root cause evaluation included consideration of potential common cause(s) and extent of condition of the problem.

As discussed further in Section 02.03.a, the licensee appropriately considered potential common causes and extent of condition. However, the inspector had a number of observations regarding the extent of the licensee's review in developing the common causes.

02.03 Corrective Actions

a. Determine that appropriate corrective action(s) are specified for each root/contributing cause or that there is an evaluation that no actions are necessary.

The licensee's causal analysis captured the following common causes and associated corrective actions to address scrams with a LONHR:

(1) Common Cause: Inappropriate human behaviors were the leading contributor to the LONHR events.

The licensee identified that there were seven LONHR events attributed to human performance, with five being caused by maintenance department activities and two by operations department activities. While the operations staff has not had a human performance related LONHR event since 1995, maintenance department human performance errors have contributed to events in 1995, 1996, 1997, and 1999.

Corrective Action: The licensee's causal analysis concluded that further development of the causes for the behaviors was needed and that it was beyond the scope of this initial analysis to understand and develop specific corrective actions for all the human behavior causes. Nevertheless, the licensee established a corrective action to improve the maintenance department human performance error reduction program, with the focus on improving the use of event-free tools when conducting maintenance, modifications, and testing activities on equipment that is necessary for maintaining the normal heat removal path in the event of a trip. The licensee also established a site level self-

assessment program to capture supervision, communications, work practices, and training precursor events and to provide prompt feedback. This program involves establishing a trending database that is used to track causal factors associated with issue reports.

Status: The trending database was established June 30, 2000. Actions to improve maintenance human errors was scheduled for December 1, 2000.

Inspector Observations: See (2) below.

(2) Common Cause: Ineffective implementation of corrective actions has been a significant contributor to LONHR events.

Corrective Action: The licensee plans to revise the appropriate control procedures to require that the approving department manager be briefed on the purpose and intent of the corrective actions, how the corrective actions were accomplished, and a summary of any deviations or changes to the overall intent of the corrective actions.

Status: Ongoing.

Inspector Observations:

The inspector observed a lack of specificity in these first two common cause descriptions. Interviews with licensee personnel revealed that they did not review the specific details of the 12 scrams when developing the common causes or corrective actions associated with the LONHR function. Instead, the common causes were developed using Human Performance Evaluation System (HPES) cause codes that were assigned following each scram. The four HPES common cause code trends identified were: (1) human performance issues; (2) lack of preventive maintenance; (3) failure to implement corrective actions; and, (4) ineffective component monitoring. The inspector noted that using these standard HPES cause codes provided only a general category of the type of problem and limited potential insights into understanding the specific cause(s) for past events. For example, the inspector identified that the equipment problems for three LONHR events (01/14/00, 10/14/97, and 01/13/95) involved improper wire terminations. In addition, two LONHR events (05/04/95 and 01/13/95) involved plant personnel opening electrical panels during the work planning process.

The inspector noted that licensee's corrective actions, to date, for the first two common causes, based on their general cause code descriptions, were similarly non-specific. Although the corrective action to improve the maintenance department human error reduction program appears appropriate, a more detailed review of human performance errors may reveal the need for an additional, focused corrective action. For example, corrective actions could be developed to address human errors related to wire termination problems. The inspector also noted that while the licensee's causal analysis stated inappropriate human behaviors was the leading contributor to the LONHR

events, the licensee's statement that "understanding and developing specific corrective actions was beyond the scope of this analysis," appeared inconsistent with the objective of minimizing LONHR events.

Lastly, the inspector noted that the licensee's corrective action to address ineffective implementation of corrective actions was similarly general in nature.

(3) Common Cause: The licensee developed a list of plant systems and equipment, any one of which, could cause a LONHR event.

The licensee recognized that although the performance indicator is white for Unit 1, both units are vulnerable to a LONHR event following a scram. Main feedwater was lost on seven scrams and was the leading system contributor to LONHR events. One of the predominant reasons was Unit 1 steam generator feedwater (SGFW) pumps tripping on high discharge pressure following a scram. After the high pressure set-back circuitry for the digital feedwater control system was enabled, the SGFPs have not tripped on high discharge pressure following a scram. In addition, secondary system equipment malfunctions, especially failure of the second stage moisture separator reheater (MSR) source valves to close, continue to challenge operators following a scram. An MSR source valve's failure to close results in an excessive reactor coolant system (RCS) cooldown. To prevent the rapid reactor plant cooldown, operators close the main steam isolation valves (which is a LONHR) which causes a loss of the steam driven SGFPs (also a LONHR).

Corrective Actions: Plant Engineering has been assigned to evaluate this list and recommend corrective actions, such as additional preventive maintenance or modifications, to reduce the potential for a LONHR event.

Status: Plant Engineering recommendations were scheduled to be completed by October 27, 2000.

Inspector Observations: The inspector noted that the licensee recognizes that an essential element in reducing the likelihood of future scrams with a LONHR is by improving the physical condition of plant components via preventive maintenance or design modifications. However, the inspector found the corrective action to address the secondary plant component problems was deferred by creating a corrective action to perform additional evaluations. The licensee did develop a list of components in which a single failure could cause a LONHR event and identified the need for additional preventive maintenance or modifications. The inspector observed that it has been approximately nine months since the licensee began their causal analysis and, to date, no specific corrective actions associated with plant equipment have been defined. Although not causing a LONHR event, a motor-operator wiring termination problem on a moisture separator reheater (MSR) source valve resulted in the valve failing to close following the Unit 1 scram on September 10, 2000.

(4) Common Cause: A majority of plant personnel were unaware that 12 of 13 reactor scrams at Units 1 and 2 over the last five and one-half years have involved a loss of normal heat removal function.

Corrective Action: The licensee developed a briefing sheet on the LONHR events that was used for conducting site-wide awareness training.

Status: Completed July 11, 2000.

Inspector Observations: The inspector noted that this license identified common cause for LONHR events was reflective of a general insensitivity to the increased risk significance of these events. Notwithstanding, the license has appropriately addressed this performance issue.

(5) Common Cause: The routine assessments of risk for online maintenance need to be broadened beyond trip prevention to include preventing the loss of normal heat removal systems.

Corrective Action: The license recognized that to reduce the challenges to equipment important to normal heat removal, this action must be included in the population of equipment considered as risk significant when planning on-line work activities. To accomplish this, the licensee is revising administrative Procedure NO-1-117, Integrated Risk Management.

Status: The scheduled completion date is November 11, 2000.

Inspector Observations: Similar to the common cause discussed above, the licensee recognized a lack of sensitivity to LONHR events was reflected in their online maintenance planning processes. Appropriate action has been taken to address this aspect of site performance.

(6) Common Cause: Upon the loss of normal heat removal function following past reactor scrams, control room operators have not always been aggressive in restoring this function, particularly if the alternate heat removal methods (e.g. auxiliary feedwater) were functioning properly.

Corrective Action: Consistent with corrective actions for common causes (4) and (5) above, the licensee plans to revise appropriate operating procedures to stress the importance of restoring normal heat removal functions.

Status: The scheduled completion date for procedure revisions is December 5, 2000.

Inspector Observations: Licensee actions to address this performance issue and minimize dependence on back-up safety systems appear appropriate.

Inspector Observations Summary:

The first three common causes and corrective actions were observed by the inspector to be the most important because these items can directly affect the physical condition of plant components and thus are most essential in minimizing the recurrence of LONHR events. However, the inspector found that the licensee did not review previous LONHR events in sufficient detail, when developing the common causes, resulting in corrective actions that were either too general in nature (such as the corrective actions to address human errors and inadequate corrective actions) or had their corrective actions deferred, pending further review (such as the corrective actions to assess secondary plant equipment malfunctions, particularly the MSR source valve failures). Overall, licensee corrective actions have not yet been sufficiently developed to allow the NRC staff to complete this specific inspection objective.

b. Determine that the corrective actions have been prioritized with consideration of the risk significance and regulatory compliance.

As highlighted above, the licensee has completed their causal analysis and initiated some corrective actions and follow-up evaluations. The licensee had not yet completed their evaluation (scheduled to be completed October 27, 2000) of plant systems and components whose failure or malfunction have contributed to past LONHR events. Accordingly, the inspector was not able to assess whether all resulting corrective actions have been properly prioritized. The inspector did not identify any regulatory compliance issues associated with LONHR event corrective actions, to date.

c. Determine that a schedule has been established for implementing and completing the corrective actions.

As discussed above, some corrective actions have been implemented, but corrective actions involving known plant equipment problems, which have contributed to LONHR events, have not been developed due to the deferral of the detailed evaluation of these problems to October 27, 2000.

d. Determine that quantitative or qualitative measures of success have been developed for determining the effectiveness of corrective actions to prevent recurrence.

The effectiveness of the licensee’s corrective actions to address scrams with a loss of normal heat removal will continue to be monitored by the associated performance indicator.

## 4 OTHER ACTIVITIES

### 4OA6 Meetings

#### .1 Exit Meeting Summary

On October 23, 2000, the inspector conducted a meeting with Mr. Katz and other members of plant management and presented the inspection results. Licensee management acknowledged the observations presented and did not identify any information discussed as proprietary.

SUPPLEMENTAL INFORMATION Attachment 1

KEY POINTS OF CONTACT

Licensee

C. Cruse, Vice President
P. Katz, Plant General Manager
D. Holm, Superintendent, Nuclear Operations
L. Wechbaugh, Superintendent, Technical Support
M. Navin, Superintendent, Technical Support
P. Furio, Acting Director, Nuclear Regulatory Matters
S. Davis, Plant Engineering

## ATTACHMENT 2

## NRC'S REVISED REACTOR OVERSIGHT PROCESS

The federal Nuclear Regulatory Commission (NRC) revamped its inspection, assessment, and enforcement programs for commercial nuclear power plants. The new process takes into account improvements in the performance of the nuclear industry over the past 25 years and improved approaches of inspecting safety performance at NRC licensed plants.

The new process monitors licensee performance in three broad areas (called strategic performance areas): reactor safety (avoiding accidents and reducing the consequences of accidents if they occur), radiation safety (protecting plant employees and the public during routine operations), and safeguards (protecting the plant against sabotage or other security threats). The process focuses on licensee performance within each of seven cornerstones of safety in the three areas:

| Reactor Safety | Radiation Safety | Safeguards |
|---|---|---|
| •Initiating Events | •Occupational | •Physical Protection |
| •Mitigating Systems | •Public | |
| •Barrier Integrity | | |
| •Emergency Preparedness | | |

To monitor these seven cornerstones of safety, the NRC used two processes that generate information about the safety significance of plant operations: inspections and performance indicators. Inspection findings will be evaluated according to their potential significance for safety, using the Significance Determination Process, and assigned colors of GREEN, WHITE, YELLOW or RED. GREEN findings are indicative of issues that, while they may not be desirable, represent very low safety significance. WHITE findings indicate issues that are of low to moderate safety significance. YELLOW findings are issues that are of substantial safety significance. RED findings represent issues that are of high safety significance with a significant reduction in safety margin.

Performance indicator data will be compared to established criteria for measuring licensee performance in terms of potential safety. Based on prescribed thresholds, the indicators will be classified by color representing varying levels of performance and incremental degradation in safety: GREEN, WHITE, YELLOW, or RED. GREEN indicators represent performance at a level requiring no additional NRC oversight beyond the baseline inspections. WHITE corresponds to performance that may result in increased NRC oversight. YELLOW represents performance that minimally reduces safety margin and requires even more NRC oversight. RED indicates performance that represents a significant reduction in safety margin but still provides adequate protection to public health and safety.

The assessment process integrates performance indicators and inspection so the agency can reach objective conclusions regarding overall plant performance. The agency will use an Action Matrix to determine in a systematic, predictable manner which regulatory actions should be taken based on a licensee's performance.

The NRC's actions in response to the significance (as represented by the color) of issues will be the same for performance indicators as for inspection findings. As a licensee's safety performance degrades, the NRC will take more and increasingly significant action, which can include shutting down a plant, as described in the Action Matrix.

More information can be found at: http:\\www.nrc.gov\NRR\OVERSIGHT\index.html.