U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Docket/Report Nos.: 50-317/88-02 License Nos.: DPR-53
50-318/88-02 DPR-69

Licensee: Baltimore Gas and Electric Company

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

Inspection at: Lusby, Maryland

Dates: January 1 - February 12, 1988

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Summary: January 1 - February 12, 1988: Inspection Report 50-317/88-02 and 50-318/88-02

Areas Inspected: (1) facility activities, (2) routine coverage of plant operations, (3) operational events, (4) maintenance, (5) radiological controls, (6) physical security, (7) NRC notifications, (8) Licensee Event Reports, (9) Natural Circulation Cooldown TI 2515/86, and (10) reports to the NRC.

Inspection Hours totalled 293.5 hours.

Results: Operator response to a February 1, 1988, fire in the Unit 2 annunciator cabinets was noted to be prompt and effective (detail 3 of this report). Electrical and Controls technicians performing troubleshooting and repair activities and their supervisor were knowledgeable and resourceful. They quickly restored the annunciator system to an operable status. A failure to fully carry out Emergency Plan Implementing Procedure requirements upon declaration of an "Alert" condition following the fire will be discussed in a separate inspection report.

The root cause leading to a January 22, 1988, Unit 2 reactor trip (detail 7 of this report) was found to be inadequate controls over troubleshooting activities and unclear communications between technicians and an inverter vendor regarding the means of removing power factor correction capacitors. Unclear vendor prints contributed to the problem. A weakness was noted in certain licensee electrical prints regarding inadequate description of the type of fuses to be installed in plant electrical circuits. The licensee did not aggressively pursue correction of a deficient condition existing in the level transmitter (Detail 8 of this report) for #21 safety injection tank (SIT). This was a contributing factor to an event in which the level in that tank was discovered to be below the minimum level required by Technical Specifications.

DETAILS

Within this report period, interviews and discussions were conducted with various licensee personnel, including reactor operators, maintenance and surveillance technicians and the licensee's management staff. Twenty-four hour shift inspections were conducted at Unit 2 during the period February 1-4, 1988 following loss of audible annunciators during a fire on February 1. A weekend inspection was performed on January 23, 1988.

1. Summary of Facility Activities

Unit 1

Unit 1 was operating at full reactor power at the beginning of this inspection period.

Power was reduced on January 21 to 97% due to a deficient condition in the moisture separator reheaters requiring isolation of the second stage heaters. The unit will continue to operate at this reduced power until the refueling outage.

The reactor was shut down at 2146 on January 29, 1988, to repair welds on high pressure extraction drain piping underneath the main turbine. The unit returned to power operation on January 31, 1988.

The unit ended this inspection period operating at 97% power.

Unit 2

Unit 2 began this inspection period at full reactor power. On January 12, 1988, technicians found that the level transmitter for #21B safety injection tank (SIT) was out of calibration and that the tank was five inches below the Technical Specification low level limit.

The unit tripped at 0958 on January 22, 1988, on low steam generator water level due to loss of instrument bus 2Y10 and subsequent loss of automatic feedwater control. The unit returned to power operation on January 23.

On February 1, at 1646, a fire occurred in the Unit 2 annunciator cabinets in the cable spreading room. The fire was quickly extinguished and the plant remained at full power. All annunciation in the Unit 2 control room was lost for about two and one-half hours; audible annunciation was not restored until February 3.

Power was reduced on February 10 to permit technicians to enter containment and perform a calibration check on safety injection tank level transmitters.

The unit returned to 100% power on February 11, 1988.

General

An NRC inspection team was onsite during the period of January 19-29 to examine licensee organizational interfaces.

A special NRC team was dispatched to the site in response to the February 1, Unit 2 annunciator fire. The team remained onsite over the period February 1-4, 1988.

2. Review of Plant Operation - Routine Inspections

a. Daily Inspection

During routine facility tours, the following were checked: manning, access control, adherence to procedures and LCO's, instrumentation, recorder traces, protective systems, control rod positions, containment temperature and pressure, control room annunciators, radiation monitors, effluent monitoring, emergency power source operability, control room logs, shift supervisor logs, and operating orders.

No unacceptable conditions were noted.

b. System Alignment Inspection

Operating confirmation was made of selected piping system trains. Accessible valve positions and status were examined. Visual inspection of major components was performed. The following systems were checked:

-- Unit 1 Salt Water System checked on February 9, 1988

-- Unit 2 Service Water System checked on February 10, 1988

-- The inspector noted an open (4-6 inches diameter) penetration in the east wall of the intake structure (Unit 1 side). This structure is designed for watertight integrity. The deficiency was identified to the shift supervisor who stated he would initiate corrective action to seal the hole.

The inspector noted that the equipment identification sign was missing on the box housing the shutdown transfer valves for auxiliary feedwater control valves 2CV4511 and 4512. The box is located in the Unit 2 Service Water Pump room. This condition was identified to the shift supervisor for correction.

c. Biweekly and Other Inspections

During plant tours, the inspector observed shift turnovers; boric acid tank samples and tank levels were compared to the Technical Specifications; and the use of radiation work permits and Health Physics procedures was reviewed. Area radiation and air monitor use and operational status were reviewed. Plant housekeeping and cleanliness were evaluated.

-- Fitness for Duty Information (RI TI 88-01)

The inspector examined data relating to the experience associated with the licensee's fitness for duty program. Information was provided to the Region as requested in RI TI 88-01.

No unacceptable conditions were noted.

3. Operational Events

Loss of Unit 2 Control Room Annunciators Due to Fire in Power Supply/Logic Panel

At 4:46 p.m. on February 1, 1988, a fire in an annunciator panel, located in the cable spreading room, caused a loss of all control room annunciators. The following sequence of events occurred in rapid succession. The Unit 2 audible annunciator alarm sounded and could not be silenced by the reactor operator. Annunciator module L-1 "Service Water Panel" went into alarm (white light on). Then various blocks of annunciators came into alarm on Unit 2. The "fire", "fire pumps running", and "fire system trouble" annunciators came into alarm. The fire annunciators are powered from Unit 1, the unaffected unit. The Unit 1 control room operator noted that the fire panel had alarms registered for the Unit 2 cable spreading room halon system and called this out. Two senior licensed operators immediately went toward the cable spreading room, verified that the main halon system for the room had not actuated, and entered the room. They smelled smoke and saw smoke coming out from beneath battery charger 13. They deenergized that battery charger; however, one of the individuals, while looking underneath the charger cabinet, noted smoke rolling along the floor from the southern side of the room. The second individual saw more smoke coming from the annunciator cabinets 2K01 and 2K02. They reenergized the battery charger, since it was not the source of the fire. They opened the annunciation cabinet doors, saw six local zone power breakers at the cabinet and opened those breakers. Smoke continued to come out of the cabinet. A third operator arrived with a CO_2 fire extinguisher. He saw flames from electrical components low in the cabinet, directed CO_2 at and extinguished the fire. The operators then ensured that all power to the cabinets was secured. During the fire a local halon system actuated and probably suppressed the fire, at least to some extent.

In accordance with the site emergency plan, an Alert was declared at 5:46 p.m. The plant was at full power and was maintained at full power, this being determined to be the most stable configuration.

At 7:10 p.m., power was restored to the visual portion of the annunciators, and the licensee secured from the Alert. An additional licensed operator on shift was assigned the dedicated duty of monitoring the Unit 2 control room annunciators as compensatory action for the lack of audible alarm. That function was maintained until the audible alarm capability was returned on February 3. All emergency systems, the computer, alarm printer, and safety parameter display system remained functional throughout the event. Computer alarms were closely monitored by operators.

Region I partially activated an alternate response center. The resident and a regional inspector were on site at the time of the fire and immediately went to the control room. They remained in the vicinity of the control room and cable spreading room (the location of the fire) throughout the event. The regional inspector was then assigned to evaluate the licensee's maintenance and troubleshooting efforts.

Three additional individuals (two senior resident inspectors and one licensing examiner) from Region I were sent to the site and began, on the evening of the event, 24-hour coverage of control room activities. On February 2, a representative from NRR and a fifth individual from Region I reported to the site to evaluate licensee efforts in determining root cause and to assess generic implications. Similar fires occurred (within a three week period including this event) at the Beaver Valley and Rancho Seco plants in annunciator systems manufactured by the same vendor (Electro Devices) that supplied the Calvert Cliffs equipment. The team remained on the site throughout the recovery.

On February 2, 1988, the licensee held a meeting onsite to discuss the event and plan corrective actions. The meeting was chaired by individuals from the systems engineering group and included representatives from design engineering and electrical maintenance. It was decided that the immediate path to restoration would be to use the remaining three spare audible driver cards to supply all five annunciation groups. Normally each group has a dedicated driver card associated with it. This necessitated "piggybacking" an extra annunciation group on two of the cards. Design engineering personnel examined card design and determined that the cards could drive two groups. Efforts were initiated to obtain additional driver cards. Investigations were also initiated to determine any possible link between the event and the simultaneous initiation and the deluge on transformer P 13000-2 and a ground on the #12 DC Bus. The annunciator panel (2K01 and 2K02) is powered from the #11 battery DC Bus.

Audible annunciation was restored on February 3, 1988.

a. Team Conclusions-Operations Area

As a result of the loss of the annunciator audio alarm, the licensee stationed an additional licensed operator, beyond their normal practice of having an extra licensed operator on shift, in the control room. This additional watchstander had no other duties but to monitor the annunciator panels and alert the operators to alarm conditions. The duties of the alarm monitor watchstander were issued via Night Orders to the operating crew. Direction was given in the Night Order Book that all scheduled surveillance and maintenance activities were to be reviewed for impact on the annunciator system. Only those activities that would minimally impact on the system would be allowed. The NRC conducted around the clock shift observations of the operating crews including the function of the additional alarm monitor watchstation. All crews were observed to be professional and exhibited adequate concern and control over plant conditions. Shift turnovers were witnessed and found to be thorough. Plant conditions remained stable (at 100% power) throughout the time when the annunciator audio alarm was not functioning. During repair efforts, the operators were kept informed of the progress of repairs. While technicians were actively working in the annunciator panels, communication between the operators and technicians was observed to be good (operators would call prior to clearing alarms). Surveillance Test Procedure (STP)0-9-2, Auxiliary Feedwater Logic Test, was postponed for a day until sufficient expertise was acquired from operating the plant without the audio alarm. When this STP was performed on February 3, it was conducted without incident and with no impact on the plant operators. When the annunciator audio alarm was restored, the operators were informed by the technicians performing the testing. Tests were coordinated through the control room operators. The one anomaly of the repaired system from the old system was thoroughly discussed at shift turnover (one transmitted alarm would be received anytime an alarm was received on panel IC06). An informational tag was hung on the common acknowledge push button alerting the operators that this one anomaly existed with the repaired system. The additional alarm monitor watchstation was secured at 3:15 p.m. on February 3. The NRC continued to monitor shift turnovers throughout the next day to observe the level of detail provided to oncoming crews concerning the annunciator system. Crews were able to demonstrate the anomaly in the annunciator acknowledge function by conducting a test of the alarms as is routinely done once a shift. Overall, operator action with no annunciator alarms was good.

The Abnormal Operating Procedures (AOPs) were reviewed for adequacy in handling the situation. There existed no procedure to address the condition of a loss of all annunciators. This was brought to the attention of the Manager, Nuclear Operations (MNO) who was asked to consider drafting such a procedure.

The Emergency Operation Procedures (EOPs) and AOPs were also reviewed for the impact that the loss of annunciators would have on the operators' ability to utilize the procedures. With the exception of alerting the operators to the entry condition for a specific procedure, the loss of annunciators would have no impact on their ability to implement the procedures. Although the licensee stated that the plant computer could function as a backup to the annunciator system, it is not known whether all of the annunciator alarms are repeated on the computer system.

During the review of the Emergency Response Plan Implementing Procedures (ERPIPs), it was noted that a condition of Alert or higher requires the support facilities to be manned and that accountability be initiated. A conscious decision was made by management that neither of the above actions was necessary. This decision was based upon the premise that the personnel needed to cope with the situation (extra operators and technicians) had already been notified and had responded to locations where they were needed. The ERPIPs did not, however, give the latitude to deviate from the procedure as written. This topic is the subject of a separate inspection report (317/88-04; 318/88-05).

b. Team Conclusions-Control of Maintenance/Troubleshooting Area

Preplanning

The licensee held the February 2 meeting described above to address the cause of fire, anomalies, and corrective actions. Responsibility assignments were made. Design engineering confirmed that audible driver cards had sufficient capacity to drive two annunciator blocks.

Contingencies were developed if any of the immediate corrective maintenance actions failed. For example, if any of the spare cards could not be used, new cards were going to be made since the licensee had the proprietary card design data from the vendor. The data was bought because vendor no longer makes annunciator equipment.

Electrical leads to be laid down were worked out in advance. The licensee followed Calvert Cliffs Instruction (CCI 117), "Temporary Mechanical Device, Electrical Jumper and Lifted Wire Control" requirements. As per CCI 117 an evaluation was performed to see if a safety analysis was required prior to initiation of temporary corrective action. The Plant Operations and Safety Review Committee reviewed the event and the planned corrective action.

Investigation of Existing Conditions/Interface with Vendor

The licensee is still investigating the root cause because the component was too badly burned to readily identify the root problem.

The electricians, after the fire, removed the burnt component and the damaged wiring. The component and the damaged wiring were replaced by a modified housing for the component parts and temporary wiring since a spare component was not available. The electricians used a controlled copy of the vendor technical manual and its drawings as well as plant drawings. The technical manual and drawings were found to be adequate.

The licensee contacted Mehta Corporation, the company which took over Electro Devices, Inc. The licensee also contacted appropriate personnel on the staff at Beaver Valley, other utilities, and other plants in their own company to see if compatible replacement cards could be found. Later, after a similar fire at Rancho Seco, the licensee contacted Rancho Seco staff personnel to discuss the event and that utility's corrective actions.

Use of Appropriate Precautionary Steps

The electricians were thorough in their performance of work. This was evident during the following activities:

-- Building the housing to accommodate the cards. Though they had only three cards, the housing was built for the five cards required in the original component. The housing terminals were installed vertically one above the other to avoid overheating problems which might have contributed to the failure.

-- Connections between the terminals, existing wiring and temporary wiring were deliberately checked by the electricians and independently verified by another electrician and a QC inspector.

-- During the continuity checks for the installed component, the electricians questioned and began investigating readings of a wire leading to terminal ACK from the 2K02 panel. Initially the electricians had difficulty in identifying the purpose of the wire to terminal ACK. They found that form print file drawing 13-36B-04 did not show this printed circuit card unit to TB125 terminal 6. The purpose of TB125 is to transmit U13-U24 window alarms to window L02. A senior electrician prepared a request for the cognizant system engineer to take corrective action.

There were good interface actions among Operations, Electrical and Controls (E&C), QC, Design and Engineering personnel as evidenced by:

-- Operations continually phoning the electricians at the work site whenever they wanted to use the alarm panel. The panel was in an energized state during the final stages of repair. In one case, they paged the electricians when they could not be contacted at the work site.

-- Operations and E&C jointly preparing the distribution of the alarms from the five card distribution to the three card distribution. Engineering later reviewed and approved the card distribution.

-- QC coverage and support of the effort to expedite a quality job. Also, Operations supervision frequently visited the work site to support the work.

-- Support of the five groups to resolve TB125 terminal 6 additional circuit problem.

Technical Knowledge

Personnel performing troubleshooting and repairs were very knowledgeable of the system and very resourceful. They were closely supervised during the repair effort. Field activities were monitored by knowledgeable QC inspectors. Technicians were well supported by engineering personnel.

c. Team Conclusions-Evaluation of Root Cause

Preliminary findings by the licensee indicated that the cause of the fire was attributed to a continuously conducting SCR located in the Audible-Driver-Card unit. This unit provides the audible portion of the visual/audible annunciator system in service at the Calvert Cliffs plant. The basis for the finding resulted from the licensee's examination of the burnt driver cards. In this respect, the areas immediate to the location of the SCR on the circuit board were "white" without any carbon deposit which indicates the area was subjected to intense high temperature conditions. In addition, to further support this conclusion, the suspect SCR was "burnt-out" of its mounting such that only a hole in the circuit board remains.

During inspector review of the design documents associated with the annunciator system at Calvert Cliffs and discussions held with the licensee, it was agreed that the existing circuit breaker protection may not be adequate to protect the subcomponents and associated wiring of the audible driver card circuitry as intended. In this regard, the licensee has stated that they are instituting a study to determine if "sub-fusing" within the annunciator system is the solution to prevent the recurrence of a similar event.

Adequacy of Licensee Fire Response

From the inspectors' review of the events surrounding the fire, it appears that the "in-cabinet" automatic halon system had operated in a satisfactory manner. Also, the site personnel, by opening the proper circuit breakers to isolate the electrical fire, took proper action. These actions, coupled with the fact that the CO_2 bottle was used to extinguish the second ignition of fire when the cabinet door was opened indicates the site personnel acted in a prompt and efficient manner.

The licensee was considering removal of the "in-cabinet" halon system because it is difficult to maintain. The room in which the annunciator cabinets are located is protected by a larger halon system which will not be removed. Because of the fire, the licensee is re-examining the decision to remove the "in-cabinet" system. During the fire, there was not a lot of visible smoke but there was a very strong, acrid smell in the cable spreading room and control room. The inspector asked if the room halon system would be expected to actuate under such a circumstance. The licensee stated they would look into the question.

Generic Implications

This aspect of the fire event is still in review because similar fires that occurred recently at the Beaver Valley Unit 2 power plant and at Rancho Seco have not undergone a comparative review by the NRC at this time. However, further review by the inspectors revealed that the manufacturer (Electro Devices, Inc., St. Louis, Mo.) of the Calvert Cliffs annunciator system also provided the annunciator systems at both Beaver Valley Units 1 and 2 and Rancho Seco. On this basis, it appears that possible generic implications are associated with this fire event.

Adequacy of Past Licensee Maintenance/Monitoring of Annunciator Systems

Other than experiencing repeated problems with the status cards (visual) of the annunciator system, the licensee indicates that no previous problems related to this fire event were encountered or identified. According to the licensee, only limited preventive maintenance (PMs) is performed on the system because it is not classified as a Class 1E system.

A sample of 1986 and 1987 monthly, quarterly and annual PM cards were reviewed. They deal with the Electro Device Ground Eliminator (EDGE), Annunciator Cabinet, and the Control Room Annunciation Window Fans. PMs for the Annunciator Cabinet and Window Fans are basically clear and inspect evolutions.

Determine the Susceptibility of Unit 1 to a Similar Problem

Since Unit 1 and 2 employ similar annunciator systems, the inspectors believe that a similar event can occur at Unit 1 as well as recurring at Unit 2, however, the licensee 's intentions are to initiate a study of the "sub-fusing concept" regarding Unit 2. It is assumed that Unit 1 will receive similar considerations of any corrective actions taken to resolve this particular fire event issue.

Is BG&E Design Configuration Unique or Similar to Other Plants?

Based on the inspectors' review of this issue and discussions with licensee personnel that were involved in the restoration effort associated with the damaged annunciator system, it has not yet been determined if other nuclear plants employ similarly designed systems. However, the NRC is presently pursuing this aspect of the event in order to determine if some form of generic communications is needed to alert other facilities of the potential problems resulting from the fire event.

Was Vulnerability to Single Event (Fire) Previously Recognized?

Given the facts that the automatic halon system initially extinguished the fire, and the subsequent use of CO_2 by site personnel to extinguish the fire after it reignited when the panel door was opened, the inspectors believed that the vulnerability to a fire event in that area of the cable spreading room is recognized by the licensee.

Is the System as Described in the FSAR?

The inspectors' review of that portion of Chapter 7 of the Calvert Cliffs FSAR for Unit 2 showed that details such as audible driver card function and equipment protection circuitry are not addressed. It does describe, in general, the alarm features when a plant parameter has entered an off-normal condition.

4. Plant Maintenance

The inspector observed and reviewed maintenance and problem investigation activities to verify compliance with regulations, administrative and maintenance procedures, codes and standards, proper QA/QC involvement, safety tag use, equipment alignment, jumper use, personnel qualifications, fire protection, retest requirements, and reportability per Technical Specifications. The following activities were included:

-- Troubleshooting and repair of Unit 2 Annunciator Cabinets

No unacceptable conditions were noted.

5. Radiological Controls

Radiological controls were observed on a routine basis during the reporting period. Standard industry radiological work practices, conformance to radiological control procedures and 10 CFR Part 20 requirements were observed.

No unacceptable conditions were identified.

6. Observation of Physical Security

Checks were made to determine whether security conditions met regulatory requirements, the physical security plan, and approved procedures. Those checks included security staffing, protected and vital area barriers, vehicle searches and personnel identification, access control, badging, and compensatory measures when required.

No unacceptable conditions were noted.

7. Events Requiring NRC Notification

The circumstances surrounding the following event requiring prompt NRC notification pursuant to 10 CFR 50.72 were reviewed. For this event, resulting in a plant trip, the inspector reviewed plant parameters, chart recorders, logs, computer printouts and discussed the event with cognizant licensee personnel to ascertain that the cause of the event had been thoroughly investigated for root cause identification.

Unit 2 Reactor Trip Following Loss of 120 VAC Instrument Bus

At 9:58 a.m. on January 22, 1988, Unit 2 tripped from 100% power due to low steam generator level. The initiator of the low level condition was a loss of power to both main feedwater pump and the moisture separator reheater (MSR) shell and MSR first and second stage drain tank level control systems. This caused the main feedwater pumps to hold at a constant

speed. It also caused the MSR shell and drain tank inventories to dump to the main condenser instead of ultimately flowing to the heater drain tanks. Heater drain tank (HDT) levels lowered, resulting in HDT level control valves shutting, reducing flow to the main feedwater pump suctions. Less feedwater was then pumped to the steam generators (SG) and SG levels fell. Electrical and Controls personnel performing a troubleshooting operation on the Unit 2 computer inverter introduced a phase-to-phase short on 120 VAC instrument power bus 2Y10 which caused two inverter supply fuses to blow and the feeder breaker for 2Y10 to open. The plant was quickly stabilized and plant systems performed as designed. The plant was returned to power operation at 11:15 p.m. on January 22, 1988 with the affected inverter disconnected from 2Y10.

Immediately prior to the trip, technicians had attempted to remove power factor correction capacitors from the circuit as a part of their inverter troubleshooting effort. The inverter was being powered from the AC backup power source (2Y10) at the time. Due to a combination of unclear communications between technicians and the vendor regarding the means of removal of the capacitors and an unclear vendor print, technicians installed jumpers around the capacitors which effectively created a short circuit path.

For corrective action, the licensee initiated a study of the proper fusing size and fuse-to-circuit breaker coordination and plans to clarify vendor prints, investigate the use of special procedures in troubleshooting complex equipment, and train all maintenance electricians on the details of the event. Additionally the inspector asked the licensee to consider including additional information on all applicable electrical prints regarding the type or characteristics of fuses installed. Currently only the ampere rating is included on non-vital 120 VAC and DC circuits. Following the event, the licensee found a mixture of fuses associated with inverter supply switch 2Y10-80, i.e., two of the phases were protected by FRN 100 Amp. time delay fuses (which blew during the event) and one phase by a 100 Amp. non-fuse (which did not blow).

Additional information regarding the event will be included in Inspection Report 50-317/88-01;50-318/88-01.

No unacceptable conditions were noted.

8. Review of Licensee Event Reports (LERs)

LERs submitted to NRC:RI were reviewed to verify that the details were clearly reported, including accuracy of the description of cause and adequacy of corrective action. The inspector determined whether further information was required from the licensee, whether generic implications were indicated, and whether the event warranted on site follow up. The following LERs were reviewed:

LER No.	Event Date	Report Date	Subject
Unit 2			
87-09	12/21/87	01/20/88	Loss of Main Generator Permanent Magnet Generator
88-01*	01/12/88	02/05/88	21B Safety Injection Tank Low Water Volume

* This Licensee Event Report describes a problem with oscillating water level indication on Unit 2's No. 21B Safety Injection Tank (SIT). The tank is equipped with one level transmitter which feeds a wide range (WR) indicator and a narrow range (NR) indicator in the control room. Also, the tank has high (1) and low (1) sonic level probes. Fluctuations in level indication began on July 15, 1987 and recurred in late July and October 1987. Some dampening of oscillations was performed but efforts to troubleshoot and repair the transmitter were unsuccessful and oscillations returned. Additional actions were not taken because the sonic probes were operable and did not indicate an alarm condition, and because oscillations were not as pronounced on the WR indicator.

On October 23, 1987, excessively erratic indication of No. 21B SIT level led operators to place the high/low alarm feature which was initiated by transmitter indication out of service. On January 11, 1988, the high/low level alarm switch system alarmed. Troubleshooting of the transmitter was commenced to provide confidence in level indication.

On January 12, 1988, technicians found that the transmitter was reading five inches higher (due to a problem in the force-balance mechanism) than actual level. True level was five inches below the Technical Specification limit of 187 inches. The appropriate Technical Specification action statement was entered (T.S. 3.5.1.a). The transmitter was successfully recalibrated and level restored.

The licensee plans to (1) replace the transmitter during the February-March 1988 Unit 2 outage, (2) make operators aware of the event, (3) consider design improvements for the SIT level/pressure indication and alarm systems, and (4) adhere to a recent policy to improve plant material condition and not tolerate nagging maintenance problems. One factor that had delayed licensee repair actions since July 1987 was that a spare replacement transmitter was not available and is no longer made by the vendor.

On February 10, the licensee reduced power on Unit 2, entered containment and confirmed that the level transmitters on the other three SIT's were properly calibrated.

As acknowledged by the licensee in their corrective actions, the issue does highlight a situation in which the licensee tolerated, for an extended period, a deficient condition (oscillations) in the No. 21B SIT level transmitter. They have also tolerated a SIT pressure/level annunciator design which is difficult for operators to use in diagnosing tank conditions because of the common alarm windows for high/low pressure and high/low level. Hanging SIT alarms are often present, particularly on the Unit 2 annunciator panel. The situation could have been avoided entirely by a more aggressive commitment to maintenance of equipment.

9. Natural Circulation Cooldown (TI 2515/86)

The inspector reviewed licensee actions in response to Generic Letter 81-21, "Natural Circulation Cooldown". The licensee's Abnormal Operating Procedure AOP 3F, Natural Circulation Cooldown, Rev. 0, incorporates the applicable guidelines from CEN 152, "Combustion Engineering Emergency Procedure Guidelines, Rev. 2 (specifically the "Loss of Forced Circulation" section). The licensee's procedure conservatively maintains a high subcooled margin (near to but not to exceed 200 degrees F) during the cooldown. The 200 degrees F limitation is based on pressurizer thermal shock considerations. The inspector contacted a representative of the Combustion Engineering Company to obtain additional information on the basic philosophy behind the CEN 152 guidelines. Some voiding in the upper head region is possible while following the guidelines; however, the voiding is expected to be limited to a point that would not interfere with natural circulation cooling. The inspector confirmed that plant operators have received appropriate training on natural circulation procedures.

The inspector noted that AOP 3F references attachment #1 of the Emergency Operating Procedures as a means of determining the appropriate reactor coolant system (RCS) pressure necessary to maintain a 200 degrees F subcooled margin for a given RCS temperature. That attachment contains several RCS pressure vs. RCS temperature limit curves on a single graph. Some of the curves on attachment #1 would require RCS cold leg temperature to be used as the entering argument (reactor coolant pump NPSH curves). The subcooled margin curves would require core exit thermocouple temperatures to be used as the entering argument. However, the graph is not annotated to reflect which type of temperature should be used with which curve. Although operators have procedural guidance and training in determining which RCS temperature is appropriate for a given situation, the inspector pointed out that the graph would be more "user friendly" if appropriate annotations were made. A consequence of entering with RCS cold temperature vs. core exit thermocouple temperature (a possible difference of 50 degrees F during natural circulation cooling) could cause a determination of RCS pressure which is 650 psi lower than required.

The inspector could not confirm that the NRC has accepted the operational philosophy for natural circulation cooldown described in Rev. 2 of CEN 152. This TI remains open until the inspector can confirm the Calvert Cliffs procedures conform with a philosophy approved by the NRC.

No unacceptable conditions were noted.

10. Review of Periodic and Special Reports

Periodic and special reports submitted to the NRC pursuant to Technical Specification 6.9.1 and 6.9.2 were reviewed. The review ascertained: inclusion of information required by the NRC: test results and/or supporting information; consistency with design predictions and performance specifications; adequacy of planned corrective action for resolution of problems; determination whether any information should be classified as an abnormal occurrence, and validity of reported information. The following periodic report was reviewed:

-- December Operations Status Reports for Calvert Cliffs No. 1 Unit and Calvert Cliffs No. 2 Unit, dated January 15, 1988.

No unacceptable conditions were identified.

11. Exit Interview

Meetings were periodically held with senior facility management to discuss the inspection scope and findings. A summary of findings was presented to the licensee at the end of the inspection.