

**CALVERT CLIFFS
NUCLEAR POWER PLANT**

**STARTUP REVIEW BOARD
SELF-ASSESSMENT REPORT**

APRIL 1990 UNIT 1 STARTUP

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STARTUP REVIEW BOARD SELF-ASSESSMENT REPORT APRIL 1990 UNIT ONE STARTUP

EXECUTIVE SUMMARY

This report documents the Self-Assessment performed by the Startup Review Board (SURB) as called for by the Unit 1 Startup Plan. A general performance assessment comparing Spring 1989 performance with the April 1990 Startup was made and is summarized in Table 1 (see page 5). See Section 2.0 of this report for more details.

Notable improvement in performance was made in the areas of procedural compliance, identification and resolution (nuclear) safety issues, and systems and equipment performance.

Areas which are judged to have an improving performance trend include communications, safety perspective and professionalism of Nuclear Operations Section, safety and compliance aspects of work control processes, interface and teamwork, as well as supervisory oversight and involvement.

Areas which are judged to have experienced no change were personnel safety awareness/attitude, and plant material condition.

Only one area was judged to have a declining performance trend - efficiency of work control processes. This was the result of purposeful application of additional reviews and other process and schedule controls. Ongoing efforts to improve our work control processes to make them flow more smoothly while continuing to improve on quality and safety will result in efficiency/productivity gains over the long-term.

No areas were judged to have had a notable performance decline.

General "Lessons Learned" from the Unit 1 startup, include:

1. A number of substantial benefits were derived from the use of the Startup Plan. Consequently, it has been decided that the major elements of the Startup Plan will be used in the next Unit 1 startup and possibly in future, major startups of both units.
2. Continued emphasis must be given to recognition of and response to personnel safety issues. In addition to dealing with the individual problems as they were identified, personnel safety awareness is being re-emphasized. This will continue to be accomplished through such measures as Focus Meetings, more explicit emphasis of safety issues at the daily plant meetings, safety tailgate meetings, individual counseling and accountability, and the Dupont "Safety Training Observation Program" (S.T.O.P.).
3. The startup revealed that problems related to recognition, screening, prioritization, and closeout of preventive and corrective actions still exist. Specific corrective actions are being assigned and tracked for resolution (see Attachments 1 and 2). The underlying root causes for these problems are being addressed by the Performance Improvement Plan.
4. The startup revealed some problems in the area of communications and interfaces between Chemistry and Operations and between the Technical Services Engineering Units and System Engineering. Specific corrective actions are being undertaken in these areas (see Attachments 1 and 2). The underlying root causes for these problems are being addressed by the Performance Improvement Plan. See Section 4.0 of the report for more details.

Significant events and occurrences from the Unit 1 Startup include:

- o Development and use of the Startup Plan.
- o Successful execution of the Integrated Safety Features Actuation System Test.
- o 12B Reactor Coolant Pump vibration concerns and resolution thereof.
- o Plant heatup and parallel to grid was conducted in strict accordance with Operating Procedure and with a safety-conservative attitude.
- o Temporary loss of the 12 Auxiliary Boiler due to a print error.
- o Incore vs. Excore ASI Deviation and Delta-T Power Potentiometer Setting Notifications of Unusual Event
- o Coordinated Response to Balance-of-Plant Equipment Problems
- o Post-LOCA Core Flush Design Basis Review
- o Inadvertent Release of 13 Waste Gas Decay Tank

See Section 4.0 of this report and Attachment 5 for more details.

Strengths from the Unit 1 startup were Operations Section performance, thorough reviews of readiness including the SURB process and dedicated use of closeout processes, interface and communication between System Engineering and Nuclear Operations, and major improvements in procedure quality. Areas for further improvement include attention to detail, and the weaknesses which occurred during the delta-T power potentiometer setpoint problem that led to a second Notification of an Unusual Event.

The Startup Review Board concluded that overall performance during the Unit 1 startup effectively demonstrated the capability of our systems processes and personnel to safely and properly start up and operate the plant following a lengthy outage. There were several areas of improvement or significant improvement. The self-assessment also indicated areas where additional improvement is clearly needed.

1.0 INTRODUCTION

In accordance with the Unit One Startup Plan, the Startup Review Board (SURB) completed a self-assessment of the April 1990 Unit One startup and short period of operation. This report documents that assessment. It includes a general performance overview (summarized in Table 1), general lessons learned for performance improvement, a summary of significant events and occurrences, and a test and inspection summary. This self-assessment is supported by information contained in Attachments 1 through 4, which list items recommended for resolution/correction (prior to and after the next startup), improvements or good practices noted, and individual/team successes. Attachment 5 provides a chronology of the Startup, short period of operation, and the shutdown of Unit 1.

2.0 GENERAL PERFORMANCE ASSESSMENT

Based upon individual observations, post-run critique comments, and the information produced during the milestone SURB meetings, the SURB discussed and evaluated several different areas, comparing our performance during this startup to our general level of performance a year ago. A five position scale was used ranging from "Notable Performance Improvement" (1) to "Notable Performance Decline" (5). Refer to Table 1, page 5.

2.1 NOTABLE PERFORMANCE IMPROVEMENT

Three areas were evaluated as having experienced "Notable Improvement" since last year.

TABLE 1
UNIT 1 - APRIL 1990 STARTUP
GENERAL PERFORMANCE SUMMARY*

| | NOTABLE PERFORMANCE DECLINE | DECLINING TREND OF PERFORMANCE | PERFORMANCE ESSENTIALLY UNCHANGED | IMPROVING TREND OF PERFORMANCE | NOTABLE PERFORMANCE IMPROVEMENT |
|---|-----------------------------------|--------------------------------------|---|--------------------------------------|---------------------------------------|
| Safety Perspective & Professionalism of Operations | | | | X | |
| Procedural Compliance | | | | | X |
| Systems & Equipment Performance | | | | | X |
| Plant Material Condition | | X | X | | |
| Work Control Processes: Efficiency | | X | | | |
| Work Control Processes: Safety & Compliance | | | | X | |
| Personnel Safety: Compliance (Industrial & Radiation) | | | | X | |
| Personnel Safety: Awareness (Industrial & Radiation) | | | X | | |
| Engineering & Technical Support | | | | X | |
| Interface & Teamwork | | | | X | |
| Communications (Inter- & Intra-departmental) | | | | X | |
| Identification & Resolution of Safety Issues | | | | | X |
| Supervisory Oversight and Involvement | | | | X | |

* Comparison to Spring 1989 performance

Procedural Compliance.

Implementing procedure compliance was seen as very good, but compliance with "control" procedures (CCI's and QAP's) still needs improvement.

Identification and Resolution of Safety Issues.

Identification and resolution of safety issues was seen as much improved because of the significant advances made by the organization, especially the System Engineers, in the area of not only identifying safety issues, but also providing proper and safe solutions, supporting repairs and modifications to the plant, and getting more actively involved in all aspects of problem resolution.

Systems and Equipment Performance.

The performance of nearly all our systems and equipment exceeded our general expectations. We planned for, and expected to see more equipment problems (such as valve leakage, vibration problems, etc.) than we experienced. The primary and secondary systems proved to be very tight in general, and equipment was typically started and operated without difficulty.

There appear to be several reasons for the good performance of the unit:

- A significant amount of physical work was completed to repair/replace or improve plant equipment condition.
- Various processes were used to ensure problem resolution, such as the closeout of Non-Conformance Reports (NCRs).
- An overall strengthened effort and attention paid to making sure the plant was truly ready to be started up.

- Major improvements in the administrative closeout process:
 - o Facility Change Request/Field Engineering Change closeouts
 - o Training on and validation of major procedure and other changes
 - o Use of a Startup issues list and conduct of priority maintenance order reviews

2.2 IMPROVING TREND OF PERFORMANCE

Seven areas (or sub-areas) were judged to have "improved" or showed an improving trend when compared to the level of performance a year ago.

Communications

The Startup Plan effort resulted in the active involvement of significantly more people than previously experienced. Many more people were aware of the goals and general purpose of the startup process and the role they played in contributing to a successful startup.

Communications between and among Operations shift crews were typically precise and professional, utilizing good communications techniques. Use of portable radios allowed rapid access to and direction of plant watchstanders. Shift turnover briefings were thorough and informative. Some weaknesses were noted in the beginning of the period with the structure, attendance, and formality of the shift turnover briefing, which were improved upon over the course of the startup.

Some specific instances of communication errors or weakness proved there is still room for improvement, such as the difficulties in communication experienced between Operations and Chemistry on two occasions and the communication errors between Operators that led to the inadvertent release of 13 Waste Gas Decay Tank (see Section 4.9).

Outage Management's efforts to pull together all the activities required to be done prior to startup produced effective communication of priorities. Startup Review Board activities provided a responsive and positive forum for rapidly communicating management expectations, priorities, and results up and down the chain of command. Vertical communications in both directions were considered to have significantly improved.

Personnel Safety Compliance.

Personnel safety compliance (both industrial and radiation safety) was improved. There were many observations conducted through the startup period that indicated people are complying with protective equipment and other safety requirements. The need for us to continue emphasizing and improving personnel safety "awareness"/"consciousness" still exists.

Engineering/Technical Support.

Engineering/Technical Support was in general improved. A major contributor to this improvement has been the more active involvement of system and design engineers. There were several outstanding examples of professionally conducted and coordinated root cause evaluations by the System Engineers, who actively interfaced with Operations, Maintenance, and Design personnel to arrive at proper solutions. Improvement is still needed however, as

demonstrated by some of the ("ownership" and contingency) problems encountered with Engineering support for resolution of problems with RPS, calorimetrics, and delta-T power potentiometer settings.

Safety Perspective and Professionalism of Nuclear Operations Section.

A reduction in the number of operator error induced events as compared to last year and repeated observations during the startup which indicated that highly professional performance over a wide range of activities is becoming the norm supported a conclusion that performance in this area is on an improving trend. The excellent general performance in Operations during the startup was diminished by the inadvertent release of 13 Waste Gas Decay Tank (WGDT). Continued efforts to improve in this area will maintain the improving trend.

Work Control Processes* -- Safety and Compliance.

An improving trend continues here. (Note, the area of Work Control Processes was broken into two parts: "Safety and Compliance" and "Efficiency.") The imposition of more stringent controls, additional reviews and approvals, and tighter adherence to the published schedule have improved the overall process structure and discipline as work is planned and scheduled and as tagging and post maintenance testing is carried out. By strengthening these controls, worker and plant safety is enhanced. Until the processes can be fully adjusted and streamlined while still retaining the appropriate degree of structure and schedule discipline, some reduction in "efficiency" is inevitable (see Section 2.4).

* (Planning, Scheduling, Testing, Tagging)

Interface and Teamwork.

There was a recognizably improved trend in this area during the startup, exemplified by the excellent teamwork and interface between groups which resolved problems such as the ERV-402 stroke problems, 12B Reactor Coolant Pump vibration concern, 12 MSIV handswitch troubleshooting, and the 12 Feedwater Regulating Valve control problem. Other examples included the thorough pre-test and pre-evolution briefings, the essentially error-free conduct of some major STP's, the systematic review of the maintenance backlog by the Maintenance and Operations organizations, and the interdisciplinary resolution of MOV design basis testing requirements.

A few examples of the need to improve interface and teamwork arose during the startup. Inadequate support and interface between the Nuclear Engineering Unit and System Engineering with respect to ownership of all core power measurements and lead responsibility for assuring thorough problem resolution, resulted in less than satisfactory and untimely support for Operations when the delta-T power potentiometer setpoint tolerance events occurred. There were some weaknesses noted in the Chemistry-Operations interface. Improvements in these areas are underway. Overall, continued improvement is also necessary and will be pursued.

Supervisory Oversight and Involvement.

First line supervisory involvement during this startup was a decidedly improved area. Frequent in-field walkdowns and active involvement in supervisory job observations, root cause investigations and issue resolution produced very good results. Increased second and third line supervisory involvement was also apparent throughout the startup period, but was limited partly by the significant

time demands associated with attendance at POSRC. Further long-term improvements can be expected from initiatives underway to change the Technical Specification POSRC membership requirements and as procedure upgrades begin to take effect.

2.3 PERFORMANCE ESSENTIALLY UNCHANGED

Two areas were viewed as having experienced "no change" when compared with their status a year ago.

Personnel (Industrial & Radiation) Safety Awareness/Attitude.

While compliance with the various safety rules and procedures is clearly improved, it is not as evident that our people have internalized a significantly higher level of awareness and responsiveness to safety issues. Observations of the organizational response to the Cable Spreading Room asbestos issue, the deterioration of caution boundaries around some switchgear, and the need to revisit the issue of exposed uninsulated piping, challenge us to continue to strive for a more responsive, pro-active attitude toward personnel safety concerns.

Plant Material Condition.

Plant material condition (preservation, cleanliness, structural repair, etc. as opposed to system and equipment condition and performance) has not declined but has not substantially improved either. Certain areas of the plant remained in excellent condition while others continued to receive little attention. The intake structure was singled out as a material condition "eyesore" during the startup due to the rust, water leakage, concrete, and painting deficiencies. Initiatives are underway to make the desired improvements in this area.

2.4 DECLINING TREND OF PERFORMANCE

One area has declined in comparison to last year, particularly when compared to very early 1989: Efficiency of Work Control Processes. The purposeful application of additional reviews and other process and schedular controls, including actual reduction in the amount of contracted physical work in the field had the desired effect of helping us gain firm control of the work to enhance safety and quality at the understood cost of a reduction in our "efficiency" or "productivity." Ongoing efforts to improve our work control processes to make them flow more smoothly while continuing to improve upon quality and safety will begin to register gains in efficiency/productivity.

2.5 NOTABLE PERFORMANCE DECLINES

There were no areas judged to have undergone a "notable performance decline."

3.0 GENERAL "LESSONS LEARNED" FOR PERFORMANCE IMPROVEMENT

The SURB utilized various measures to arrive at several general lessons learned from this startup.

General Supervisors conducted detailed "Post-run" critiques with key people in their organizations, forwarding their conclusions and comments to the SURB. SURB meeting minutes, individual member observations during the period, and a compilation of data from the Post-run critiques provided the base of information used by the SURB in a series of roundtable discussions from which the below lessons learned were derived. Specific corrective action items are provided in Attachments 1 and 2.

Improvements/good practices and Individual/Team successes are provided in Attachments 3 and 4.

3.1 USE OF A STARTUP PLAN

A number of substantial benefits were derived in the areas of pre-planning, communications, prioritization of activities, teamwork, and self-assessment as a result of the use of the Startup Plan. Consequently, the Plant Manager has decided that the major elements of this Unit 1 Startup Plan will be used for the next Unit 1 startup and possibly in future, major startups of both units.

At a minimum, supplementary coverage requirements will be specified, increased emphasis on contingency plans will be made, and "lessons learned" from previous startups will be incorporated.

3.2 CONTINUED EMPHASIS ON RECOGNITION OF AND RESPONSE TO PERSONNEL SAFETY ISSUES

Several observations of activities in progress revealed that recognition and response to personnel safety issues need further improvement. In addition to

dealing with the individual problems as they were identified, personnel safety awareness is being re-emphasized. This will continue to be accomplished through such measures as Focus Meetings, more explicit emphasis of safety issues at the daily plant meetings, safety tailgate meetings, individual counseling and accountability, and the Dupont "Safety Training Observation Program" (S.T.O.P.).

3.3 CORRECTIVE AND PREVENTIVE ACTION PROCESSES

The startup revealed that problems related to recognition, screening, prioritization, and closeout of corrective and preventive actions still exist.

The underlying root causes for those problems are being addressed by the Performance Improvement Plan notably:

Action Plan 2.5.1 - Commitment Tracking System

Action Plan 3.6.1 - Site Integrated Scheduling

Action Plan 3.6.2 - Maintenance Work Control

Action Plan 4.1.1 - Operating Experience Review

Action Plan 4.2.1 - Issues Management System

Action Plan 4.5 - Safety Assessment

Action Plan 4.8 - Root Cause Analysis

3.4 COMMUNICATIONS AND INTERFACES BETWEEN SITE ORGANIZATIONS

The startup revealed some problems in the area of communications and interfaces between Chemistry and Operations and between the Nuclear Engineering Unit and System Engineers. Specific corrective actions are being undertaken in these areas prior to restart of Unit 1.

The underlying root causes for these problems are being addressed by the Performance Improvement Plan, notably:

Action Plan 3.2 - Managing Organizational and Program Change

Action Plan 3.3 - Leadership Conferences

Action Plan 3.4 - Teamwork and Interfaces

Action Plan 3.6.1 - Site Integrated Scheduling

Action Plan 3.8 - System Circles

Action Plan 3.9 - Quality Circles Program

Action Plan 5.2.2 - Surveillance Test Program

Action Plan 5.4.1 - System Engineer Training

4.0 SIGNIFICANT EVENTS/OCCURRENCES

Several events occurred during the startup and short period of operation that may be characterized as significant for various reasons. They are listed in rough chronological order along with a short discussion of each.

4.1 UNIT ONE STARTUP PLAN

The development and approval of the Unit One Startup Plan was a significant step by Calvert Cliffs management in recognizing the importance of a well planned, deliberate startup with provision for self assessment after such a lengthy outage and major organizational and operating philosophy changes.

4.2 STP 0-4-1

A major integrated safety features actuation system test was successfully conducted prior to the heatup after a major revision and procedure upgrade. There was very good pre-test review and coordination by the Test Coordinator, Outage Management, and Nuclear Operations personnel. The test was conducted essentially error-free, required a minimal number of iterations and had very few problems to resolve.

4.3 UNIT ONE REACTOR AND PLANT STARTUP

The first plant startup in about ten months was conducted by Nuclear Operations in strict accordance with the Operating Procedures and with a safety-conservative attitude, then repeated twice more during the period. This was significant in that it provided demonstrable evidence of the quality of the (continuing) requalification training program and professionalism of the operations crews, the success of the pre-startup procedure validations that had

been performed, and the quality of the maintenance and testing programs that had prepared the plant for startup.

4.4 TEMPORARY LOSS OF 12 AUXILIARY BOILER

While this event did not have a major impact on the plant, it was significant in that it revealed some weaknesses in Chemistry - Operations interface, and in the need for improved quality of electrical prints used to research and establish tag-out boundaries. It was also significant as a demonstration of effective casualty control on the part of the operating crew and of a professionally conducted post-event critique.

4.5 12B REACTOR COOLANT PUMP (RCP) VIBRATION

The approximately 18 mil vibration levels on 12B Reactor Coolant Pump (RCP) were higher than the other RCP's during the startup. Renewed concern for this level of vibration arose during the period at Mode 3 (Hot Standby, 532°F) since the associated channel was in alarm. The vibration levels seemed to increase with increasing pressure, so pressure was temporarily maintained somewhat lower than normal, allowing the alarm to be clear while a setpoint change was processed. Significant effort on the part of Technical Services Engineering ensued to analyze the safety of changing the vibration alarm setpoints up to the values (approximately 24 mil Alert and 26 mils Danger) that had been in effect in the past. The setpoint change would allow clearing the alarm on 12B, thereby "unmasking" the alarms for the other RCP's, should they experience vibration problems.

Investigation of the history of this problem by Technical Services Engineering personnel indicated that: 1) Performance Engineering personnel had

adequately analyzed the vibration problem earlier in the outage and a conscious decision was made at the Manager level that continued operation would be acceptable. 2) The vibration during this startup was about the same (as predicted) as had been experienced before the plant first shut down for the outage. 3) The vibration alarm setpoints had been reduced last year as an independent, pro-active measure intended to give us earlier warning of RCP vibration trends. 4) We had not adequately communicated the results of the vibration analysis and management decision nor followed through to appropriately revise the alarm manual prior to startup.

4.6 INCORE VS. EXCORE ASI DEVIATION AND DELTA-T POWER POTENTIOMETER SETTING NOTIFICATION OF UNUSUAL EVENTS

Efforts to calibrate Excore Ni calculated Axial Shape Index (ASI) values on April 13 to within the tolerances previously established for deviation from Incore calculated ASI, led to Delta-T power potentiometer settings that exceeded the allowable setpoint file tolerances (in the conservative direction). Lack of written guidance for interpreting these deviations led to a conservative decision on the part of the Shift Supervisor to declare the associated Reactor Protective System (RPS) channels inoperable, commence a reactor shutdown, enter Technical Specification 3.0.3, and make a Notification of Unusual Event.

An inadequate response to the original ASI and delta-T power setpoint problems [that assumed the corrective action to change the setpoint tolerance bands was sufficient, failed to consider what additional procedural guidance was warranted, failed to dig deeply enough into the root causes of the setpoint deviations, and failed to provide for or communicate effectively the contingency actions necessary should the problem recur] led to a nearly identical occurrence of the

problem and Notification of Unusual Event at 65% power. Power was reduced to less than 50%, whereupon the delta-T power potentiometer settings were within the larger setpoint file tolerances allowed below 50% power. A more thorough response to the second event provided the necessary corrective action and procedural guidance, and a firmer understanding of the probable causes of the tolerance problems.

An investigation team was formed to fully examine the two events, determine the root causes and produce corrective action recommendations. Their results will be reported to management in a Calvert Cliffs Event Report (CCER) and if warranted, to NRC in a supplement to the Licensee Event Report.

4.7 COORDINATED RESPONSE TO BALANCE-OF-PLANT EQUIPMENT PROBLEMS

Problems encountered with the operation of 12 FRV controller in automatic necessitated FRV operation with the controller in manual and a controlled reduction in power (to Mode 2) to allow troubleshooting and repairs.

The feed flow, steam flow comparator had developed an internal ground, causing the FRV to open to an 80% position when the controller was shifted to automatic. This part of the control circuit was replaced. Additionally, a calibration problem with the lead/lag circuit that would have resulted in FRV oscillations above 90% power was identified and the faulty component replaced. At the same time, Electrical and Controls personnel performed troubleshooting and repairs to a Main Turbine steam intercept valve which was noted to improperly come open when the turbine was reset, and conducted adjustments and repairs to several turbine bypass valves. These coordinated actions were taken to better assure reliable plant operation.

4.8 CORE FLUSH DESIGN BASIS REVIEW

Reverse core flush is required following a LOCA in which subcooled margin has been lost, in order to prevent boric acid concentration and crystallization in the upper regions of the core. Lack of an in-depth review of the design basis for the required time to initiate core flush resulted in a procedure revision in February 1988 that improperly allowed too much of a time delay. This problem was discovered during the heatup/startup period. More detailed discussion of this event is provided in Licensee Event Report 90-12.

Corrective actions were taken to reanalyze the basis, calculate the proper time allowance, and change the procedures. Appropriate consideration was given to the need for a delay in the onset of core flush to reduce cumulative exposure of the Low Pressure Safety Injection (LPSI) pump seals which had components made of teflon. These seals are being replaced during the scheduled Spring 1990 Outage for Unit 1 and prior to restart for Unit 2.

4.9 INADVERTENT RELEASE OF #13 WASTE GAS DECAY TANK

On April 21, 1990 Operators discovered they had inadvertently released #13 Waste Gas Decay Tank contents instead of #11 tank, for which a release permit had been prepared. The discharge was stopped, tank contents sampled, and the release evaluated to be well within limits. The event was investigated and the root cause determined to be inadequate communications between the Control Room Operator directing the evolution and the Auxiliary Building Operator carrying out the procedures. Contributing causes were unclear procedural controls for placing and documenting locked valves out of their normal positions.

Corrective actions are being developed, which include review of the event by Shift Supervisors with their sections, emphasizing proper communication practices and attention to detail, and improvements to associated procedures. Licensee Event Report 90-16 will provide more details.

5.0 TEST & INSPECTION SUMMARY

All required post maintenance and surveillance tests were completed prior to startup. Various Surveillance Test Procedures (STP's) and Engineering Test Procedures (ETP's) were carried out as scheduled or as necessary. More than four dozen STP's were performed by Operations and Maintenance personnel during the period 3/30 to 4/24, not including some of the very frequently scheduled or partial (for post-maintenance testing) STP's. ETP #90-21, "Control Element Drive Mechanism (CEDM) Performance Testing," was performed. Several equipment problems were discovered and corrected through the conduct of this test. ETP #90-20, "1-ERV-402 Operability Test," was run on April 1 after an apparently slow response by the valve during STP M-572B-1, "Pressurizer Relief Valve Channel Calibration," resulted in discovery of a tripped C phase overload device. The test was stopped when the "PORV energized" alarm did not clear after removing the test pressure signal. Root cause analysis and troubleshooting efforts by the System Engineer and E&C personnel solved the problem and the test was successfully run again on April 3, demonstrating valve operability. ETP 90-15, "Unit-1 Salt Water System Performance Test" was run on April 22 to obtain temperature, pressure and flow data in support of the Cooling Water Study being conducted by Design Engineering Section personnel.

ETP 89-05, "21 Diesel Generator SIAS/SRW Speed Acceptance Test" was run on April 2nd. ETP 90-01 "Unit-2 Shutdown Cooling Heat Exchanger Noise Measurement" was performed on April 18th.

Just prior to the heatup/startup period, as part of the efforts to ensure readiness to start up, the Plant Engineering Section System Engineers performed thorough walkdowns of their assigned systems, and reported the results of their inspections to management. Discrepancies were noted, maintenance requests generated where necessary, and issues resolved appropriately.

After proceeding to Milestone 2 and at each startup milestone thereafter, detailed inspections and walkdowns were conducted by the applicable System Engineers for systems listed in Attachment 6 of the Startup Plan, "System Walkdown Summary." In addition, Operations watchstanders and augmented teams of maintenance personnel conducted thorough inspections of systems and equipment around the clock. At Milestone 3, detailed inspections were conducted by Materials Engineering and Analysis Unit personnel in accordance with the In-Service Inspection program. Minor discrepancies noted were promptly resolved.

The walkdown inspections proved to be very useful. As an example, the alert detection of leakage in the Auxiliary Building by an operator led to identification and isolation of No. 12 Chemical and Volume Control System (CVCS) filter, eliminating the cause of higher than expected apparent Reactor Coolant System (RCS) leakage.

Inspection and walkdown results were reported to the SURB at each Milestone meeting and formed part of the basis for their recommendations to the Plant Manager.

6.0 OVERALL CONCLUSIONS

6.1 STRENGTHS

Overall, there were several strengths associated with this startup:

- Operations section performance was in general highly professional, properly oriented toward safe plant operation and conservative in the application of procedures and Technical Specifications.
- The thorough reviews of readiness prior to startup and dedicated use of closeout processes for maintenance and modification work played a major role in the smooth performance of the plant for startup.
- The Startup Review Board (SURB) process was believed to be a strong additional measure used by the Plant Manager to effectively and critically review the startup preparation, activities, and events in a formal and deliberate fashion.
- The level of supportive interface and communication between System Engineering and Nuclear Operations was a strong indicator of the improvements made thus far and the trend we can expect to see.
- Major improvements in procedure quality were evidenced by the reduced number of POSRC meetings necessary to change procedures during the startup.

6.2 AREAS FOR FURTHER IMPROVEMENT

There were also some disappointments which indicate the need to continue to improve.

- The release of 13 Waste Gas Decay Tank was a disappointing lapse in attention to detail and formality of operating communications which demonstrated a need to work on this area.
- The repetition of the delta-T power potentiometer problems that led to a second Notification of Unusual Event was disturbing. Even though it was handled in a safety-conservative manner, the problem should have been foreseeable. Corrective actions in this area will focus on the weaknesses in communication, forethought, problem "ownership" and timely root cause analysis.

The Startup Review Board concluded that overall performance during the Unit 1 startup effectively demonstrated the capability of our systems, processes and personnel to safely and properly start up and operate the plant following a lengthy outage. There were several areas of improvement or significant improvement. The self-assessment also indicated areas where additional improvement is clearly needed.

ATTACHMENT 1

Items To Resolve Prior to Next Startup of Unit 1

- B1 Evaluate, and if necessary, replace cardboard safety tags on H₂ purge and Containment Purge valves in containment with more permanent means.
RI: General Supervisor - Nuclear Operations
- B2 Make necessary improvements to CCI-300, Calvert Cliffs Operating Manual, to allow the Shift Supervisor and CRS to authorize a one time procedure change for out-of-service equipment.
RI: General Supervisor - Nuclear Operations
- B3 Replace, if possible, relief valve on Unit 1 Blowdown Tank to allow removal of flow restricting orificas (to assure maximum blowdown capacity will be available).
RI: Manager - Nuclear Engineering Services Department
- B4 Take appropriate steps to resolve (Rosemount transmitter) I&E Bulletin 90-01 actions.
RI: General Supervisor - Plant Engineering
- B5 Resolve the discrepancy between the Operations Maintenance Coordinator status on number of outstanding Post Maintenance Tests vs. the Nuclear Maintenance System status in this area.
RI: General Supervisor - Nuclear Operations
- B6 Evaluate the use of Assistant General Supervisor-Nuclear Operations shift coverage during future startups. Provide for incorporation of this measure into future startup plans.
RI: General Supervisor - Nuclear Operations
- B7 Make improvements to CCI-205, Setpoint Control Procedure – to allow prompt temporary setpoint changes so other channels/alarms can be unmasked.
RI: General Supervisor - Nuclear Operations
- B8 Evaluate and implement corrective action to reduce the possibility of seismic interactions caused by cluttered work areas and/or heavy portable equipment.
RI: Superintendent - Nuclear Maintenance
- B9 Evaluate and implement the actions necessary to improve Steam Generator instrumentation reliability (to assure better responsiveness in Sodium determinations.)
RI: General Supervisor - Chemistry
- B10 Take steps to improve (radiation) contractors' knowledge concerning expected changes in radiological conditions encountered during a plant startup and how it affects their activities.
RI: General Supervisor - Radiation Safety

Attachment 1

Items to Resolve Prior to Next Startup of Unit 1 (Cont'd.)

B11 Evaluate, develop if necessary, and perform appropriate functional checks of the following equipment prior to power operation:

- a. Turbine Bypass Valve controls and actuators
- b. Safety Injection Tank level alarm circuits
- c. Steam Generator Feed Pump control circuits

(Note: These kinds of checks to be incorporated into next Startup Plan.)

RI: General Supervisor - Electrical and Controls

B12 Evaluate operability of instrument air compressors/dryers/system; implement appropriate corrective and preventive actions to achieve peak readiness well before startup.

RI: General Supervisor - Plant Engineering

B13 Reduce the number of Control Room deficiencies in accordance with stated management expectations prior to startup.

RI: General Supervisor - Electrical and Controls

B14 Feedback results of previous system walkdowns to improve future walkdowns by System Engineers (include guidelines and lessons learned).

RI: General Supervisor - Plant Engineering

ATTACHMENT 2

Items That Can Be Resolved After Startup of Unit 1

- N1 Investigate the root cause for the Auxiliary Feedwater Pump wrong oil problem and implement appropriate corrective actions.
RI: General Supervisor - Plant Engineering
- N2 Develop and implement a method for formally controlling the oil data list.
RI: General Supervisor - Nuclear Operations
- N3 Implement a design change to address problems with the condensate demineralizer conductivity monitors; they cannot operate when morpholine concentration reaches equilibrium in the demineralizer due to the rise in conductivity at the demineralizer outlet.
RI: Manager - Nuclear Engineering Services Department
- N4 Auxiliary Building lighting. Evaluate methods to ensure adequate levels of replacement bulbs are in stock.
RI: Supervisor - Procurement and Contract Coordination Unit
- N5 Calvert Cliffs Instruction (CCI) 115, Containment Access Requirements, temporary change process only allows for a one-time change, and makes no provision for a review for Change of Intent. (Note, CCI-115 being corrected.)
RI: Project Manager - Procedure Upgrade Program
- N6 Make appropriate changes to Surveillance Test Procedures resulting from the Acoustic Monitor Event and its subsequent investigation for generic implications.
RI: Manager - Nuclear Engineering Services Department
- N7 Reduce the drawing change request backlog for electrical prints, and improve the prints in general. The drawing change request backlog in Design Engineering Services is approximately 500.
RI: General Supervisor - Design Engineering
- N8 Evaluate feasibility of incorporating Control Element Drive Mechanism (CEDM) Testing into an Operating Instruction and implement as appropriate.
RI: General Supervisor - Nuclear Operations
- N9 Clarify CCI-117, Temporary Modification Control and CCI-228, Lifted Components/Temporary Jumpers Tracking, for applicability to the various situations being encountered.
RI: Manager - Nuclear Engineering Services
- N10 Resolve switchgear room ventilation overpressure to eliminate need for posting guards at the vital doors to ensure doors shut.
RI: General Supervisor - Plant Engineering
- N11 Correct plant page system - deficiencies in the Auxiliary Building and containments. The plant emergency alarm was tested and/or used on several occasions without the message being heard or understood.
RI: General Supervisor - Plant Engineering

Attachment 2

Items That Can Be Resolved After Startup of Unit 1 (Cont'd.)

- N12 Evaluate possibility of change to degas requirements to preclude long delays during shutdown.
RI: General Supervisor - Chemistry
- N13 Improve method of tracking post maintenance tests and operability tests -- currently have excessive amount of manual tracking. Improve Nuclear Maintenance System data accuracy.
RI: Superintendent - Nuclear Maintenance
- N14 Evaluate use of Type D Non-Conformance Reports to address/track cannibalization of parts, implement appropriate changes.
RI: Manager - Quality Assurance & Staff Services
- N15 Improve the "overall plan/big picture" portion of backshift turnovers in Operations.
RI: General Supervisor - Nuclear Operations
- N16 Improve control over the parts order prioritization process.
RI: Manager - Nuclear Engineering Services Department
- N17 Evaluate mandatory use of disposable shoe covers to reduce number of Personnel Contamination Incidents, implement appropriate changes.
RI: General Supervisor - Radiation Safety
- N18 Evaluate root cause(s) of Noble Gas Leakage in Auxiliary Building and implement appropriate corrective actions.
RI: General Supervisor - Plant Engineering
- N19 Evaluate reasons for auxiliary feedwater pump packing being changed back to old style without correct paper/adequate consideration, take appropriate corrective actions.
RI: General Supervisor - Plant Engineering
- N20 Scaffold - Scaffold platforms were found erected in several "soon to be" HRAs (i.e. during power operation) just prior to start-up. Evaluate and implement appropriate actions to ensure disassembly of scaffolding prior to startup in support of ALARA goals.
RI: Superintendent - Nuclear Maintenance
- N21 Implement design change to address trip circuit breaker shunt trip indicating light problem discovered on STP M-210A-1. (Non-conformance report issued, later determined reportable.)
RI: Manager - Nuclear Engineering Services Department
- N22 Evaluate and make necessary improvements to the Technical Specification manuals update process to assure latest Technical Specification amendments are incorporated in a timely manner.
RI: Assistant General Supervisor - Administrative Services
- N23 Develop a project plan and schedule to upgrade the Material Condition of Intake.
RI: Superintendent - Nuclear Maintenance

Attachment 2

Items That Can Be Resolved After Startup of Unit 1 (Cont'd.)

- N24 Evaluate the need for a comprehensive guide for Chemistry/Radiation Control similar to OP-1, OP-6 for Operations to help direct efforts during startup, implement appropriate changes.
RI: General Supervisor - Radiation Safety/General Supervisor - Chemistry

ATTACHMENT 3

Improvements and Good Practices Noted

1. Excellent procedural compliance, self-verification, procedure change, and communications practices were observed.
2. Assistant General Supervisor-Nuclear Operations transfer of information/attendance at pre-shift briefs improved during the startup.
3. Good teamwork and communications occurred to resolve perceived Maintenance Order high priority problem.
4. Operations/Maintenance interface (priority/"driver seat") concerns were improved over the course of this startup.
5. Use of Assistant General Supervisor-Nuclear Operations on shift and his interface with Shift Supervisor was seen to work well.
6. Radio communication between the Control Room and Plant Operators provided for efficient, prompt control of plant evolutions.
7. Chemistry communications with Operations improved during the startup process.
8. The Operations procedure review and validation conducted months before the startup was a good forward thinking process.
9. General Supervisor-Nuclear Operations discussions with former General Supervisor-Nuclear Operations to gain lessons learned, "corporate memory" of past startups was valuable, and provided good input to the Startup Plan.
10. A professional atmosphere was observed in the Control Room.
11. The dedicated Senior Reactor Operator function for major plant evolutions is a very significant asset to plant safety and event-free operation.
12. Resolution of Maintenance Order priority concerns was seen as good example of quality interface and communications.
13. Good Operations briefings were observed prior to significant tests or other major operational events.
14. Overall, procedures (routine) seemed to be in pretty good shape, as evidenced by small number of Plant Operations and Safety Review Committee meetings for procedure changes during the startup.
15. Excellent critique was held by the Operations crew after the loss of 12 Auxiliary Boiler incident.
16. Notification of Unusual Event actions were carried out properly and professionally.

Attachment 3

Improvements and Good Practices Noted (Cont'd.)

17. The reduction of "nuisance" alarms in Control Room speaks well of Electrical and Controls efforts in this area.
18. The condition of the secondary plant reflects strong efforts by Maintenance, Engineering, and Nuclear Operations.
19. The use of the "roving" Maintenance Order worked well during the startup as a vehicle for correcting minor leaks, and for conducting post maintenance testing adjustments.
20. Daily plant walkdowns were useful in identifying leaks and stopping them before they became major corrective maintenance problems.
21. Good material condition was observed in 11 & 12 Diesel Generator rooms, cable spreading room.
22. Early Secondary System cleanup using Condensate Polishing System and Steam Generator feed and bleeds was of major benefit in being able to easily transition from mode to mode.
23. The Startup Review Board concept was helpful to the Maintenance Superintendent. It provided an exchange with plant management that "encompassed maintenance in the broad plant startup and maintainability context," allowing adjustments to the maintenance process to better serve plant startup.
24. Systematic review of the maintenance backlog conducted prior to the startup by the Maintenance Superintendent, the Operations-Maintenance Coordinator, and Maintenance Assistant General Supervisors was thorough and effective.
25. Supervisory and other personnel were observed on numerous occasions making detailed inspection of systems and equipment.
26. Repeated examples of good preparation for the startup in our overall maintenance, procedures, training areas were observed.
27. There was a well coordinated, successful effort to get the spent resin metering tank and associated handling equipment repaired, resin transferred and another chemical volume control system ion exchanger filled and readied for startup. This issue had been brought up as a concern before the Start Up Review Board and promptly addressed by the line organization.
28. Several major Surveillance Test Procedures conducted since the inadvertent Engineered Safety Features Action System actuation were performed error-free.
29. Strong progress was made to reduce the number of Control Room deficiencies, but there is still work to do in this area.
30. Use of post maintenance tests appears to have produced good results; plant is in good condition.

Attachment 3

Improvements and Good Practices Noted (Cont'd.)

31. Good awareness of power level status and communications was apparent in the Radiation Control/Radiation Control Shift Supervisor area.
32. Numerous observations relating to radiation protection practices were made during this startup, with the majority of these being very positive. Company as well as contractor personnel in general appeared better prepared and focused on correct radiological work practices.
33. Good general housekeeping in the Auxiliary Building and other areas of the plant was noted on several tours/inspections.
34. Safety and Fire Protection Unit personnel noted improved safety compliance by craft personnel.
35. Root Cause Analysis efforts are doing better at solving problems. There was good teamwork between maintenance and engineering personnel and root cause "mindset" in approaching problems.
36. Once problem was identified, problem resolution was thorough and effective:
 - Leak Repair Team
 - Control Element Drive Mechanism Testing
 - Reactor Coolant Pump 12B Vibration
 - 12 Feedwater Regulating Valve Control Problem
37. Electrical and Control interfaces with Nuclear Operations, System Engineering, and Design Engineering were noted as being good.
38. During the 12B RCP vibration problem, the thorough research, discussion and arrival at a single Nuclear Engineering Services Department recommendation to Nuclear Operations and Plant Manager was observed as a good practice.
39. System Engineer support for troubleshooting, testing their systems was seen as generally very effective.
40. The idea of having engineers do plant walkdowns during the startup was very beneficial; it kept them in touch with maintenance and operations problems.
41. The pre-startup system readiness evaluation conducted by System Engineering is an excellent practice for startup after any lengthy outage and should be used again in the future.
42. The use of Senior Chemistry Technicians on backshifts aided the quality of Chemistry coverage and enhanced communications.
43. The positive and supportive attitude from Chemistry Section Personnel enhanced a proactive approach to problem resolution.

Attachment 3

Improvements and Good Practices Noted (Cont'd.)

44. Design Engineering Section second shift staffing. Although use was limited, requests were handled in a timely manner and future startups will be supported with extended coverage.
45. The estimated critical condition calculated by Nuclear Engineering Unit was very close to actual condition.
46. Management willingness to reduce power and shut down the turbine for work on 12 Feedwater Regulating Valve sent a strong message about "no trips" and event-free operation.
47. Strong management support for Chemistry Program improvements over the past year was visibly evident during the startup, and significantly improved Chemistry section personnel morale.
48. Pre-startup review plans appeared to be generally well communicated.
49. QC Inspectors made good use of QC Inspection Instructions.
50. Actions taken by line management to observe, correct, and follow up a personnel fatigue/alertness problem found during a plant tour were an example of active involvement by all levels of supervision during the startup.
51. Employees noted that Management has clearly demonstrated their concern for safety and quality, indicated in part by their increased presence in the field during the startup and by their safe, conservative approach to operating decisions.
52. General consensus is held that we had a very good, organized, much improved approach to this startup.
53. Manning levels, contingency support for the startup were overall very good.
54. There were several positive comments on the active involvement in the field by all levels of supervision and management, performing tours, inspections, and issue resolution.
55. There was prompt management response to clarify the Quality Control Hold Tag requirements in CCI 116, "Control of Deficiencies and Non-Conformance Reports."
56. There was good supervisory/management response to E&C safety practices problems to clearly establish expectations.

ATTACHMENT 4

Individual and Team Successes

1. Root Cause Analysis methods successfully applied to:
 - a. ERV-402 (PORV)
 - b. Main Steam Isolation Valve 12 Handswitch
 - c. Main Steam Isolation Valve 12 Interference Problem
 - d. 21 Emergency Diesel Generator
2. Good team approach on:
 - ERV-402 problem (including Operator self verification and communication with E&C on test)
 - 12B Reactor Coolant Pump vibration
3. Systems Engineering demonstrated excellent responsiveness to solve Blowdown Radiation Monitoring System problem (implemented FCR 87-12).
4. Good efforts to resolve Boric Acid Storage Tank level indication problems.
5. Good quality/thorough System Engineer walkdowns and engineering support.
6. Excellent Operations support for Systems - led problem resolutions.
7. Fuel oil storage tank problem resolution.
8. Control Element Drive Mechanism Testing - quick response, worthwhile results.
9. Electrical and Controls forecasted several potential problem areas in their contingency planning - Control Element Drive Mechanisms, Turbine Control, Reactor Protective System/Nuclear Instrumentation System - and were prepared to provide the needed support.
10. Successful Electrical and Controls troubleshooting of feedwater control problems and Main Steam Isolation Valve handswitch problem.
11. The Startup Plan was thorough, organized, and well prepared. Minimal changes were necessary.
12. Several examples were observed of excellent operator teamwork, professionalism, and communications, including repeat-backs.
13. Good collective response to the problem of 11B Safety Injection Tank in-leakage.
14. Exemplary actions by the shift crew on loss of 12 Auxiliary Boiler.
15. Excellent support by Instrument Maintenance in resolving problems with level alarms on 11A and 12A Safety Injection Tanks, and with their troubleshooting and repair efforts on the Turbine Bypass Valves.

Attachment 4

Individual and Team Successes (Cont'd.)

16. Excellent support by Electrical and Controls and Mechanical Maintenance during startup and shutdown; System Engineering also provided good support.
17. The Assistant General Supervisor-Nuclear Operations on shift displayed exceptional judgement and professionalism - significantly contributing to nearly event-free operation.
18. The Operations crew performed without error through a number of operating evolutions. These included initial reactor startup, reducing power and taking the unit off-line, reparallelizing the unit, and bringing the unit to full power.
19. Conservative decision was made by Assistant General Supervisor-Nuclear Operations to delay the heatup and change the oil in 11 Auxiliary Feedwater Pump governor.
20. Excellent support from Maintenance and Engineering on the second Notification of Unusual Event involving delta-T power potentiometer settings.
21. There was an outstanding team effort to achieve near-flawless execution of STP 0-4-1, Integrated Safety Features Actuation System Test, prior to startup.
22. There was a cooperative team effort between Operations and Radiation Control to locate and isolate 12 Chemical Volume Control System filter leak.

ATTACHMENT 5

Chronology

The Unit One Startup Plan was approved and issued March 19, 1990 following a series of management meetings which refined and shaped the plan.

The first Startup Review Board (SURB) Meeting (#90-01) was held March 28, 1990 to discuss concerns, action items and readiness for startup. Additional meetings were held March 29th (#90-02) and March 31st (#90-03) to address resolution of action items, readiness for heatup, and the process for resolving the remaining items prior to the Plant Manager's decision to authorize proceeding to Milestone 2 (Mode 4, 270°F). Following final preparation for heatup, the SURB met again briefly on Tuesday, April 3rd (Mtg. #90-04) to determine whether any additional concerns had arisen since March 31, and to discuss the resolution of several issues, including the root cause investigations of problems with power operated relief valve 1-ERV-402 and 12 Main Steam Isolation Valve (MSIV) handswitch, post-maintenance testing, filling Unit 1 Refueling Water Tank, etc.

The unit entered Mode 4 at 0300 on April 4, 1990. By 1015 on April 4, RCS temperature was stabilized at 270°F and the period at Milestone 2 began. Following two days of walkdowns and inspections, the SURB met on Friday, April 6 to discuss Milestone 2 activities. Upon completion of their review and discussions, the SURB recommended the Plant Manager authorize proceeding to Milestone 3 (Hot Standby, RCS temp 532°F), after resolution of any Mode 3 "restraining" issues.

The heatup to Milestone 3 conditions began later on the 6th of April. The Unit reached Mode 3 (RCS temp > 300°F) at 0233 on April 7 and achieved normal operating temperature and pressure (532°F, 2250 psi) at 1935 on April 7. Several days followed during which Milestone 3 walkdowns, inspections and testing were performed.

Attachment 5

Chronology (Cont'd.)

The SURB met on Wednesday, April 11 (Mtg. #90-06) to review Milestone 3 activities. Various events and issues of concern were discussed. The SURB recommended, pending completion of the OP-6 "Pre-Start-Up Check-off" list and resolution of the few remaining issues, the Plant Manager authorize proceeding with Reactor Startup and power escalation to Milestone 4 (30% power). The Containment was closed out at 1434 on April 12. At 0102 on Friday, April 13, Unit 1 entered Mode 2 and at 0245 the Reactor achieved criticality. Unit 1 entered Mode 1 at 1025, the Main Turbine roll commenced at 1326, and the Unit was paralleled to the grid at 1529, reaching 30% power later that evening.

On late Friday evening/early Saturday morning, out-of-tolerance comparisons of "incore" versus "excore" calculated Axial Shape Index (ASI) and subsequent Nuclear Instrument/Delta-T power calibration efforts led to three of four Reactor Protective System (RPS) channels being declared "out-of-service." This resulted in the Notification of Unusual Event based on initiation of Unit Shutdown under Technical Specification 3.0.3.

The Unit was removed from the grid at 0321 Saturday morning, April 14. Unit 1 was paralleled back to the grid at 1946 after a setpoint change was approved to resolve the apparent Delta-T power potentiometer setpoint tolerance problem. The unit achieved 30% power at 0030 on Sunday, 15 April and continued operating at this level until April 17 at 0506 when it was disconnected from the grid to facilitate troubleshooting and repairs to #12 Feedwater Regulating Valve controls.

SURB Meeting #90-07 was held Tuesday, April 17 to hear reports and discuss the significant issues and events during the period at Milestone 4. Major areas discussed included

Attachment 5

Chronology (Cont'd.)

the Delta-T power potentiometer Notification of Unusual Event, Incore vs. Excore ASI deviation tolerance and calibration, and personnel safety in checking circuits dead prior to working in them. The SURB determined no concerns existed that would prohibit raising power to full load, upon resolution of any current mode-restraining equipment maintenance (including #12 Feedwater Regulating Valve control circuit repairs). Unit 1 achieved Mode 1 at 2040 April 17, and the generator was paralleled to the grid at 2225.

On Thursday, April 19th at 1017, the results of a Nuclear Instrument/Delta-T power calibration at approximately 65% power showed 3 channels Delta-T power potentiometer setpoints outside the allowed tolerances of the Setpoint File. Lacking any additional written guidance, Operations supervision determined the associated Reactor Protective System (RPS) channels inoperable, entered Technical Specification (T.S.) 3.0.3, and made a Notification of Unusual Event. At about 1215, T.S. 3.0.3 was exited and the Unusual Event terminated when, after reducing power below 50%, the Delta-T power potentiometer settings were within the tolerance band allowed below 50% power.

Upon resolution of the Delta-T power tolerance problem, power escalation was resumed, with power stabilized at several levels to allow additional calibrations and checks of NI/Delta-T power instrumentation.

At 0029 Saturday, April 21, #3 Waste Gas Decay Tank was inadvertently discharged without the required release permit. ER 90-12 describes this event. At 0540 on April 22nd, Unit One achieved 100% power. Full power operation continued until 2200 that night when power reduction and shutdown commenced in preparation for the scheduled Eddy-Current mini-outage.

Attachment 5

Chronology (Cont'd.)

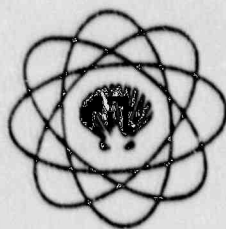
The turbine generator was removed from the grid at 0430 on Monday, April 23. Reactor shutdown commenced at 0450 and was completed at 0539 when the Unit entered Mode 3. The unit was cooled down to Mode 5 condition by 1815 that day.

Following shutdown, the various line organization General Supervisors conducted self assessment critiques with their key personnel to discuss and evaluate the startup and period of operation. Strengths, weaknesses, lessons learned, and other comments were compiled from these critiques and presented to the SURB, which discussed and evaluated the information provided along with their own observations and conclusions in a series of meetings. The SURB compared the organization's performance during this startup period with our general level of performance a year ago over a broad spectrum of areas. They reached conclusions and made observations and recommendations which are provided in other sections of this report or in attachments to the report.

INDEPENDENT ASSESSMENT OF
CALVERT CLIFFS UNIT 1 STARTUP

SPRING 1990

CALVERT CLIFFS NUCLEAR POWER PLANT
BALTIMORE GAS & ELECTRIC COMPANY



MAY 25, 1990

EXECUTIVE SUMMARY
INDEPENDENT ASSESSMENT OF
CALVERT CLIFFS UNIT 1 STARTUP

ASSESSMENT

From April 2 through April 25, 1990, as part of the Calvert Cliffs Unit 1 Startup Plan, a team of eight evaluators performed an independent assessment of selected station activities. This independent assessment is one of two efforts directed at performing a self-assessment of the Unit 1 startup plan. This self-assessment was undertaken to assess the results of efforts to improve safety, quality, and procedural compliance, and to determine how well changes have been assimilated.

One part of the Self-Assessment Plan involved the line organization and supervision using the processes that have been developed and are in place such as supervisory job observations and QA/QC surveillances. This part of the Self-Assessment Plan emphasized the "real-time", active involvement of the line organization, exercising and evaluating the established processes.

A second part of the Self-Assessment Plan utilized an independent process of observation, data gathering, and evaluation that was less "real-time" and organizationally more global in nature. This aspect of the process was independent, as this assessment was conducted by the Independent Safety Evaluation Unit (ISEU), consultant resources, and reported directly to the Vice-President, Nuclear Energy Division (VP-NED).

The independent assessment was a performance based evaluation. The Independent Assessment Team (IAT) conducted observations of the actual performance of station activities during the startup of Unit 1. Areas evaluated were station organization and administration, operations, maintenance, engineering (plant and design), radiological protection, and chemistry.

Conclusions from the Team's observations were assessed based on the Performance Objectives and Criteria for Operating and Near-Term Operating License Plants published by the Institute of Nuclear Power Operations. Recommendations resulting from this assessment are based on best industry practices rather than minimum acceptable standards or requirements. Thus, areas where improvements are recommended are not necessarily indicative of unacceptable performance.

Similarly, strengths resulting from this assessment are based on performance considered to be exceptional or well above industry standards. Areas where performance was considered to meet or slightly exceed industry standards are not addressed by this report.

The IAT evaluation involved the expenditure of over 1100 man-hours including more than 130 man-hours of backshift observations. Two strengths were noted and 13 recommendations were made as a result of this assessment. Overall, results indicate that performance at Calvert Cliffs is improving and the trend is in the positive direction.

The two strengths noted by the IAT members are as follows:

- o A very knowledgeable and experienced plant and plant support staff. Throughout the organization, the staff seemed to have a very positive attitude toward nuclear safety and quality, resolving plant problems, and returning the Units to operation.
- o The effective use of the Startup Review Board (SURB) in resolving Unit 1 startup issues. It fostered nuclear safety awareness by supporting the Plant Operating and Safety Review Committee (POSRC) activities and by ensuring deliberate, safe plant operations. The SURB focused management and staff efforts by conveying expected results and instilling a sense of accountability and ownership.

Two areas were considered to need immediate management attention by the IAT members. These two areas were:

- o Personnel safety practices and repair of safety equipment need improvement. It should be noted that immediate action was taken by management concerning personnel safety practices. Safety meetings were held with appropriate department personnel to discuss improper safety practices observed and to emphasize the need and expectation that work would be performed safely.
- o Actions to reduce the backlog of open maintenance orders (MOs) need to be taken. An MO backlog of corrective and maintenance for both Unit 1 and Unit 2 currently totals over 2,500, some of which are over two years old. The overall trend of open MO's is not declining.

ASSESSMENT EXIT MEETINGS

Meetings were held by the IAT evaluators for each functional area evaluated with the appropriate Manager and General Supervisors or Superintendents. During these meetings the evaluators discussed the strengths noted and issues needing improvement based on observations of staff performance.

On April 25, 1990, an exit was held with the Vice President, Nuclear Energy Division and the Plant Manager to summarize the team's overall conclusions and to briefly describe some of the observations that contributed to those conclusions.

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1.0 INTRODUCTION AND BACKGROUND

Baltimore Gas & Electric Company (BG&E) issued a Calvert Cliffs Unit 1 Start-Up Plan in March 1990. The Start-Up Plan intent was to provide additional assurance that the significant changes that had been implemented at Calvert Cliffs since shutdown in May 1989 were proven by demonstration to be sufficiently workable during start-up and operation.

There were three major parts to the Calvert Cliffs Start-up Plan. These major parts were:

- I. Plant Readiness for Start-up. This part called out the actions necessary to clearly assure both physical and administrative readiness for start-up.
- II. Start-up Contingency and Management Plan. This part compiled the contingency plans prepared by the various groups and sections on site, and provided expectations regarding the preparation of these plans and any start-up coverage requirements.
- III. Start-up Self-Assessment Plan. This part provided the two-pronged approach taken to assess the results of efforts to improve safety, quality, and procedural compliance, and to determine how well these changes have been assimilated. Lessons learned from this assessment effort were to be incorporated into present and future improvements as warranted by the priority of the issues that may surface.

The first part of the Self-Assessment Plan involved the line organization and supervision using the processes that had been developed and were in place such as supervisory job observations and QA/QC surveillances. This part of the Self-Assessment Plan emphasized the "real-time", active involvement of the line organization, exercising and evaluating our established processes. Timely observation, evaluation, and feedback to Senior Management (the SURB) allowed the Plant Manager to make well-informed decisions regarding start-up progress.

The second part of the Self-Assessment Plan utilized an independent process of observation, data gathering, and evaluation that was less "real-time" and organizationally more global in nature. An Independent Assessment Team (IAT) was to conduct an assessment using similar criteria; However, the team would also look at the communications, teamwork, and interface activities between different groups. This aspect of

the process was independent of the line organization's assessment. The IAT utilized the Independent Safety Evaluation Unit (ISEU) and consultant resources, and reported directly to the Vice President, Nuclear Energy Division (VP-NED).

The results of the second part of the Start-up Self-Assessment Plan, the Independent Assessment Team's conclusions, are the subject of this report.

1.1 SCOPE AND OBJECTIVES

The objective of the IAT evaluation is to provide the VP-NED with a critical evaluation of the performance and effectiveness of plant programs, hardware, and personnel as the unit proceeds from shutdown, through start-up, and on through power operations.

The functional areas evaluated by the IAT members were station organization and administration, operations, maintenance, plant and design engineering, radiological protection, and chemistry. Within each of these functional areas, the teamwork, communications, and interface activities between the different groups were assessed.

1.2 METHODOLOGY

The methodology employed was similar to that used by the Institute of Nuclear Power Operations (INPO) and was performance based. The IAT conducted observations of the actual performance of station activities during the preparation for and start-up of Unit 1.

Conclusions from observations were assessed based on the Performance Objectives and Criteria for Operating and Near-Term Operating License Plants published by the Institute of Nuclear Power Operations. Recommendations resulting from this assessment are based on best practices rather than minimum acceptable standards or requirements. Thus, areas where improvement are recommended are not necessarily indicative of unacceptable performance.

Similarly, strengths resulting from this assessment are based on performance considered to be exceptional or well above industry standards. Areas where performance was considered to meet or slightly exceed industry standards are not addressed by this report.

PREPARATION

During the preparation period, the team members reviewed the Unit 1 Start-Up Plan, INPO's Performance Objectives and Criteria for Operating and Near-Term Operating License Plants, and plant procedures describing expected work practices in each functional area evaluated. This documentation review was used to establish a baseline to determine the effectiveness of programs and work processes.

The IAT members received formal training on the INPO Observation Methodology and Techniques. Additional team training concerning documentation of observed activities, and final report preparation was conducted.

ASSESSMENT

The assessment phase covered the period from April 2 to April 25, 1990. An entrance meeting was held on April 4th to discuss the purpose and scope of the assessment, to establish communications and protocol, and to introduce team members to BG&E personnel with whom they interfaced during the assessment. The team was on site during the entire time period conducting interviews, attending meetings as observers, monitoring performance of work activities and plant operation, conducting material condition inspections, and reviewing documentation of completed activities. Heavy reliance was placed on monitoring the performance of work activities as a basis to make judgments. Corroboration of these observations was obtained through the interviewing process.

The IAT evaluation involved the expenditure of over 1100 man-hours including more than 130 man-hours of backshift observations.

PRESENTATION OF RESULTS

Meetings were held by the IAT evaluators for each functional area evaluated with the appropriate manager and general supervisors or superintendents. During these meetings the evaluators discussed the strengths noted and issues needing improvement based on observations of staff performance.

On April 25, 1990, a meeting with the VP-NED and the Plant Manager was held by the IAT team leader to summarize the team's overall conclusions. Some of the observations that contributed to the conclusions were also discussed; however, not every team observation was discussed.

REPORT PREPARATION

A draft report was prepared and issued in May to the VP-NED and the Plant Manager for review. Editorial and format comments were incorporated into the report and a final report issued.

1.3 TEAM COMPOSITION

The Independent Assessment Team required expertise in the areas of commercial nuclear utility organization and administration, operations, maintenance, plant and design engineering, radiological protection and chemistry, as well as experience with proven assessment methods. The team was comprised of three team members from the Independent Safety Evaluation Unit (ISEU), four team members from United Energy Services Corporation (UESC) and the Team Leader from the Plant Engineering Section. The assessment team members have a combined experience of over 125 years in the area of expertise required for this assessment. A brief summary for each team member is given below:

1. Larry Tucker - Team Leader. Mr. Tucker has over 15 years of nuclear experience including utility management, reactor engineering, plant maintenance, start-up testing, quality assurance, etc. Prior to joining the Plant Engineering Section at BGS&E, Mr. Tucker was a Senior Program Manager at INPO responsible for coordination and implementation of various industry wide programs in the areas of plant safety and reliability. While at INPO, he participated in six plant evaluations.

2. Paul Pieringer - Assistant Team Leader. Mr. Pieringer has over 14 years of nuclear experience including utility management, plant operations, quality assurance, and industry operating experience review. Mr. Pieringer has held a Reactor Operators License at Calvert Cliffs and is currently the Supervisor of the Independent Safety Evaluation Unit at BG&E.
3. Ray Hardwick - Mr. Hardwick has over 20 years of nuclear power experience. Mr. Hardwick's experience includes utility management experience in the areas of quality assurance, reactor licensing, emergency planning, independent safety engineering, etc. and senior level management consulting services, including project management support for special assessments such as Safety System Functional Inspection (SSFI's). Mr. Hardwick experience also includes being an NRC Regional Inspector as well as a Senior Evaluator at the Institute of Nuclear Power Operations. While at INPO, he participated in nineteen plant evaluations and three corporate evaluations.
4. Mr. Harold Bibb - Mr. Bibb has over 27 years of commercial and naval nuclear experience. He has served for nine years as an NRC resident inspector in implementing the Commission's inspection program in all functional areas. Additionally, Mr. Bibb has provided assistance to utility quality assurance programs in the development of task specific assessment criteria and standards for all functional areas.
5. Curt Kloman - Mr. Kloman has over 15 years of commercial and naval nuclear experience in the areas of engineering, testing, operations, and maintenance. His experience has included the evaluation and control of plant modifications including design adequacy and compliance with requirements, modification installation, post-modification testing, and incorporation of the modification into affected drawings and procedures. Mr. Kloman held a Senior Reactor Operator Certification on BWR plants.
6. Mark Granus - Mr. Granus has over twelve (12) years of applied radiation protection experience. He has participated in and managed efforts regarding the development of state-of-the-art radiation protection programs. Mr. Granus also possesses special expertise in the areas of radioactive waste management, programmatic assessment and emergency preparedness. He is

qualified as a Radiation Protection Manager per ANS 3.1 and Lead Auditor per ANSI N45.2-23.

7. David LeDoux - Mr. LeDoux has over 22 years of nuclear experience which includes electrical design, start-up testing, and system engineering support. He is currently a member of the BG&E ISEU staff.
8. Maria Miller - Ms. Miller has approximately four years of nuclear experience at BG&E. Her experience includes analytical work involving dose assessment, shielding and accident analysis. She is currently a member of the BG&E ISEU staff.

2.0 DETAILED ASSESSMENT RESULTS

This section of the report contains detailed descriptions of the observations, conclusions, and recommendations for each of the functional areas evaluated. The section is organized by area with subsections related to a specific work process or program.

2.1 ORGANIZATION AND ADMINISTRATION

Two evaluators reviewed organization and administration (O&A) activities including the quality control process, communications, and plant committees. The assessment spanned 200 man-hours, including 37 hours of backshift activities. Approximately 15 people were interviewed at the supervisory level and management levels.

The assessment area included reviews of procedures related to the quality control process and the activities of the Start-Up Review Board (SURB), Plant Operating and Safety Review Committee (POSRC), Plant Operating Experience Assessment Committee (POEAC) and the Significant Safety Issues Subcommittee. Ten observations of activities in these areas were conducted.

One strength was noted in this assessment area concerning the Start-Up Review Board (SURB) activities. The strength noted is as follows:

- o The SURB was effective in resolving Unit 1 start-up issues. It fostered nuclear safety awareness by supporting the Plant Operating and Safety Review Committee (POSRC) activities and by ensuring deliberate, safe plant operations. The SURB focused management and staff efforts by conveying expected results and instilling a sense of accountability and ownership.

The following issues were identified during the assessment which require management attention and, when corrected, can be expected to result in improved performance:

- o Administrative controls for activities that affect plant operation are not always effective. The procedure validation process does not consistently result in a procedure that provides adequate guidance for users to understand and perform their activities effectively. Three examples are as follows:
 - a. On two occasions during Unit 1 start-up, power level was reduced per Technical Specifications due to lack of procedural guidance. Neither the Setpoint File or Operating Instruction-30 (OI-30) provided adequate guidance to the operator concerning operability of Delta T Power Channels when setpoints were outside allowable tolerances.
 - b. STP-0-13, 18 month Engineered Safety Features Test, was approved by the POSRC, but later withdrawn for further revision after problems were identified by operations personnel.
 - c. Procedure changes needed to procedures OP-2, Plant Startup from Hot Standby to Minimum Load, and AOP- 01B, CEA Malfunction, were identified during operator training. The functional reviews of changes made to Nuclear Engineering Operating Procedures 11, 12, and 13 should have identified the required changes for OP-2 and AOP-01B.

Recommendation

Revise Calvert Cliffs Instruction 101 (CCI-101) to provide specific requirements for performing adequate procedure validation and verification (V&V). The requirements should specify when V&V is to be performed and who should perform the V&V.

- o Communications between work units are not always effective. As a result, several problems occurred during Unit 1 start-up that could have been avoided with clearly communicated expectations. The following examples illustrate ineffective communications during the assessment:
 - a. The Chemistry Unit notified Operations via a memo that Unit 1 steam generators contained low level tritium contamination. However,

steam driven auxiliary feedwater pumps were tested per Surveillance Test Procedure (STP-09A-1 and STP-05-1) resulting in at least four unmonitored low level releases.

- b. Operations notified the Chemistry Unit of the imminent use of the atmospheric dump valves (ADV) following an unexpected loss of condenser vacuum. Chemistry advised Operations not to use the ADV because of steam generator contamination.
- c. Revised technical specifications allowed High Pressure Safety Injection (HPSI) system testing to be performed at a lower system temperature. However, testing was not scheduled to be performed when these lower system temperature conditions existed. Consequently, the testing became a plant mode change requirement/issue.

Recommendation

Improve communications between work units.

2.2 INDUSTRIAL SAFETY ASSESSMENT

The evaluator reviewed the industrial safety practices including personnel actions and equipment status. The assessment involved the expenditure of approximately 31 man-hours which included 6 man-hours of backshift observations. Interviews were conducted with industrial safety supervision and staff.

Two observations were made. These involved fire safety and personnel safety equipment material condition.

The following issue was identified during the assessment which requires management attention and when corrected, can be expected to result in improved performance.

- o Sufficient Management attention is not directed at identifying and correcting safety hazards in a timely manner.
 - a. Numerous material deficiency tags exist throughout the station identifying personnel safety conditions. All examined were designated as Priority 4 maintenance orders.

- b. Maintenance personnel interviewed stated that as a Priority 4 maintenance order, the personnel safety deficiencies are at a relatively low priority.
- c. Safety and Fire Protection Unit Management were unaware as to the status and number of material deficiency tag which exist.
- d. An operator was observed using poor industrial safety practices near the sodium hypochlorite storage tank in an attempt to use a temporary modification. The temporary modification was instituted to mitigate a mechanical breakdown of the tank fill piping.

Recommendation

Establish ownership of and responsibility for the correction of personnel safety condition maintenance orders. Allocate necessary resources to aggressively address personnel safety maintenance orders. Develop means to identify and prioritize maintenance orders that are related to personnel safety conditions so that they may be resolved in a timely manner.

MANAGEMENT ACTION TAKEN

Immediate action was taken by management concerning personnel safety practices. Safety meetings were held with appropriate department personnel to discuss the improper safety practices observed and to emphasize the need and expectation that all work would be performed safely.

2.3 OPERATIONS ASSESSMENTS

The evaluator reviewed operations activities including: conduct of operations, plant status controls, operator knowledge and performance, operations procedures and documentation, and facilities and equipment. This assessment involved approximately 143 man-hours conducting interviews and direct observation of operational activities including 24 man-hours of backshift observation. Interviews with operations management included the General Supervisor of Nuclear Operations, two Shift Supervisors, the Safety-Tagging Group Supervisor and support group supervisors.

The assessment included observing individual shift turnovers, shift briefings and plant operator tours/rounds. Key operating procedures used during plant start-up were reviewed for technical content and

adequacy. A total of six observations of operational activities were conducted. These included: safety-tagging, containment walkdown, equipment labeling, and shift turnovers.

The following issue was identified during the assessment which requires management attention and when, corrected, can be expected to result in improved performance:

- o Procedures used to control the placement and removal of personnel safety tags need improvement. For example:
 - a. Temporary modifications are not systematically evaluated during preparation of personnel safety tagouts to determine possible system changes.
 - b. Operational drawings used by Operations and Safety-Tagging personnel are not marked up to show installed temporary modifications.
 - c. Drawings used to prepare safety tagouts resulted in unexpected operation events on two recent occasions. One occasion was the loss of water from the spent fuel pit and the second was the loss of the Number 12 Auxiliary Boiler from service.

Recommendations

Require review of installed temporary modification during preparation of safety tagouts to ensure actual system configuration is known. Consider marking up key piping and electrical drawings used by Safety-Tagging and Operations personnel to show installed temporary modifications. Re-emphasize to Safety-Tagging personnel the need to review plant system drawings in detail. Encourage use of redundant/multiple drawings when available to verify adequate system tagging precautions are specified.

2.4 MAINTENANCE ASSESSMENT

Two evaluators reviewed the maintenance activities including: plant material condition, work control system, conduct of maintenance, materials management, maintenance history, and maintenance procedures and documentation. The assessment involved approximately 280 man-hours conducting interviews and direct observation of maintenance activities including 38 man-hours of backshift observations. Interviews with

maintenance management included the Nuclear Maintenance Superintendent, three General Supervisors, two Assistant General Supervisors, and thirteen Supervisors. Numerous discussions were held with Technicians in the different maintenance disciplines.

The assessment included reviews of procedures and work activities. Pertinent Calvert Cliffs Instructions, Operations Procedures, Functional Test Procedures, Electrical Control Standard Practices and Section Guidelines, Quality Control Procedures were reviewed. A total of 31 observations of maintenance activities were conducted. These included: repair of a steam generator feed pump flow transmitter, replacement of an ERB relay on 21 diesel generator, reactor trip breaker functional testing, testing and electrical determination of a component cooling pump motor, material deficiency tagging, control of work instructions, etc.

The following issues were identified during the assessment which requires management attention and when, corrected, can be expected to result in improved performance:

- o The following condition of some plant systems equipment needs improvement. Not all material deficiencies are identified and in the work control system. Examples of material condition problems observed include the following:
 - a. Electrical panels and components in the Intake Structure are rusted and corroded due to exposure to saltwater spray.
 - b. Approximately 19 different components in the turbine building are missing cover screws.
 - c. Some equipment is not adequately protected from adverse environment conditions in that cover gaskets are broken or missing, conduit covers are missing, electrical panel knockout plugs are missing and unsealed, etc.
 - d. Approximately 60 items were identified during plant equipment inspections that were not in the work control system.
 - e. A backlog of over 2,500 corrective MO's currently exist for both Unit 1 and Unit 2, some of which are over two years old. The number of open corrective MO's is not declining.

Recommendation

Improve the material condition of plant systems and equipment. Increase efforts to reduce the backlog of open MO's.

- o The maintenance order (MO) process does not effectively control work activities. Accomplishment of some MO's have not been scheduled and coordinated to avoid unnecessary removal of equipment from service. The instructions and testing requirements provided by MO's need to be improved to ensure that activities are performed correctly. For example:
 - a. An MO backlog of corrective and corrective maintenance for both Unit 1 and Unit 2 totals over 2,500, some of which are over two years old. The number of open corrective MO's is not declining.
 - b. The material condition of equipment in the Material Processing Facility has significantly reduced the Facility's functional capability.
 - c. Maintenance was performed on the Unit 2 Diesel Generator and a Unit 1 Safety Injection Valve per MO's, however, other material deficiencies (MO's) within the equipment tagging boundary were not corrected.
 - d. Approximately 10 MO's were not corrected on each diesel generator during the recent outage overhaul.
 - e. Instructions in the Work Instructions Section of MO's sometimes reference procedures or standards without specifying the applicable steps or sections to be used.
 - f. A post-maintenance test used to verify proper operation of a temperature meter did not specify the system condition or configuration for the test. Thus, correction of the original problem was not assured.

Recommendations

Take appropriate actions to reduce the current open MO backlog. Require maintenance planners to minimize removal of equipment and systems from

service by improving the coordination and scheduling of MO's. Ensure detailed work and test instructions are provided in MO's to correct identified problems.

- o Work activities were not always performed in accordance with instructions and drawings using safe work practices. Known errors in instructions and drawings are sometimes not corrected prior to performing the work activity. Examples of work practices include the following:

- a. MO instructions for swapping a failed flow transmitter in Unit 1 with a Unit 2 flow transmitter required the failed flow transmitter to be installed in Unit 2 with electrical fuses pulled and electrical leads taped. The failed transmitter was installed in Unit 2 as required, however, it was electrically reconnected.
- b. Technicians replacing an electrical relay in a diesel generator control panel noted that an elementary wiring diagram indicated only one relay contact was used. Two contacts were actually used on the installed relay. A correction to the elementary wiring diagram was not initiated.
- c. A Technician, using a meter to verify power circuits for a component cooling pump motor were de-energized, reached both arms into the back of a switchgear panel without safety gloves, safety glasses or another technician present.
- d. A Technician testing an electrical relay with 130 VDC did not use low voltage gloves as required by E&C Standard Practice No. 26.

Recommendations

Ensure work activities are performed in accordance with approved instructions and drawings using safe work practices. Require incorrect instructions and drawings to be corrected prior to use.

- o Routine MO's for Surveillance Test Procedures and Priority 2 and 3 work are sometimes planned or modified without required reviews being performed by Quality Engineering (QE). Additionally, in several instances, controlled drawings and attachments used in performing work per MO

instructions were observed to be past their stamped expiration date.

Recommendations

Ensure routine MO's are reviewed and approved by QE prior to performing actual work. Emphasize that all referenced controlled documents are required to be within the expiration date and should be checked prior to use.

2.5 ENGINEERING ASSESSMENT

Two evaluators reviewed engineering activities including: reactor engineering, surveillance testing, performance monitoring and system engineering. The assessment spanned 310 man-hours including 40 hours of backshift observation activities. Approximately 45 people were interviewed including 3 Managers, 3 General Supervisors and 4 Principal Engineers. The assessment included reviews of procedures and work activities. Pertinent CCI's, Surveillance Test Procedures (STP's), Nuclear Engineering Operating Procedures (NEOP's) and Performance Engineering Unit Instructions (PEUI's) were reviewed. A total of 10 observations of engineering work activities were conducted. These included: performance of STP's, system walkdowns, reactor engineering support of start-up/criticality, resolution of reactor coolant pump vibration problems, and review of the temporary modification program.

The following issues were identified during the assessment which require management attention, and when corrected, can be expected to result in improved performance:

- o Some temporary modifications have not been permanently resolved in a timely manner.
 - a. There are 67 temporary modifications installed in Unit 1. Of these, 42 are installed per CCI-117 and 25 are installed per CCI-228.
 - b. Some temporary modifications installed per CCI-117, date to 1982. A review indicated that eight temporary modifications have been installed more than two years and seventeen have been installed more than one year.

Recommendations

Increase management emphasis on resolving long-standing temporary modifications.

- o Nuclear Engineering Operating Procedures (NEOP) did not initially contain adequate information for users to understand and perform their activities effectively. Functional reviews of the original procedures were ineffective in identifying procedural problems. Two examples are as follows:
 - a. Procedural changes needed to procedures OP-2, Plant Start-Up from Hot Standby to Minimum Load, and AOP-01B, CEA Malfunction, were identified during operator training and not during functional reviews.
 - b. Changes to instructions in NEOP 11 specifying time requirements for boron concentration monitoring were identified during operator training and not during functional reviews.

Recommendations

Revise guidance in administrative instructions to clarify individual responsibilities in performing functional reviews of procedures. Ensure individuals assigned to perform functional reviews are knowledgeable of current station practices and procedures associated with the functional review area.

- o The erosion-corrosion program does not require inspection of all Priority A inspection points before Priority B and C inspection points. Criteria is not provided for determining the sequence that uninspected points are to be inspected within each category (Priority A, B, or C). Also, there is no formal requirement to document the basis of the determination.

Recommendations

Revise the erosion-corrosion program to require completing the inspection of Priority A inspection points on an expedited basis. Establish criteria for determining the sequence for inspecting uninspected points. Document the evaluation for uninspected point based on the established sequencing criteria.

- o System Engineering did not clearly assume a leadership role in resolving the nuclear instrumentation calibration problems identified during the Unit 1 start-up. Thus, the activities of the Nuclear Engineering Unit, Operations Unit, and System Engineering were inefficient and not well coordinated.

Recommendation

Management should clarify and re-emphasize the role and responsibilities of the system engineer in resolving plant system problems.

2.6 RADIOLOGICAL PROTECTION ASSESSMENT

The evaluator reviewed the Radiological Protection (RP) activities including: external radiation exposure, internal radiation exposure, radioactive contamination control, solid radioactive waste, and radiological protection personnel knowledge and performance. The assessment involved the expenditure of 34 man-hours which included 10 man-hours of backshift observations. Interviews were conducted with four individuals in RP management. All radiation protection CCI's were reviewed. A total of six observations of radiation protection activities were made. These included: conduct of ALARA, contamination control, and Access Control Point Activities.

The following issue was identified during the assessment which requires management attention, and when corrected, can be expected to result in improved performance:

- o The design of the Access Control Point does not minimize the spread of contamination. Proper radioactive work practices are not enforced in the locker area to prohibit radioactive material ingestion. Examples are as follows:
 - a. Workers traverse the Access Control area in protective clothing (PCs) although previously used PCs often have some level of fixed contamination.
 - b. Low levels of contamination have been found in the locker area in the past.

- c. The issue area for PCs is posted "Radioactive Materials Area" - thus eating, smoking, drinking or chewing is prohibited. Workers use the adjacent locker area as a break area for eating, drinking and smoking while other workers don PCs.

Recommendations

Rearrange the Access Control area to reduce the potential for contamination spread. Enforce good radiation work practices in the locker area.

MANAGEMENT ACTION TAKEN

Actions to rearrange the Access Control Area to reduce the potential for contamination spread are being implemented.

2.7 CHEMISTRY ASSESSMENT

The evaluator reviewed the chemistry practices including: chemistry control, laboratory activities, radioactive effluents, and personnel knowledge and performance. The assessment involved the expenditure of approximately 28 man-hours which included eight man-hours of backshift observations. Interviews and discussions were held with management and staff members.

The chemistry program CCI's were reviewed as well as procedure revision currently being generated. These observations were made in the areas of hazardous material control, unmonitored releases, and radiogas.

The following issue was identified during the assessment which requires management attention, and when corrected, can be expected to result in improved performance:

- o Sufficient management attention has not been applied to improving material control and hazardous waste management in timely manner.

Some problems were noted:

- a. Approximately 270 drums of hazardous/radioactive waste exist on site which require sampling and analysis for disposition. The generation of this material is a by-product

of normal station operations. The equipment necessary to provide analysis for receipt inspections and hazardous determination has been purchased and is on site. To date, no facility or space has been allocated to locate the laboratory so that the material can be dispositioned.

- b. The need for several additional hazardous waste satellite collection areas has been identified. The establishment of the additional collection areas has been delayed until the implementation of revised hazardous waste procedures. Continued delays in procedure implementation impact the productivity of various organizations and increases the potential for a hazardous material incident.
- c. Response to INPO findings indicated an implementation date for a chemical control program of September 1989. A schedule for implementation of a chemical control program and hazardous waste control was developed with a June 1990 date. This schedule was revised and has subsequently slipped.

Recommendations

Devote additional management attention and resources to establish and implement the chemical control and hazardous waste programs. Establish the location and commit sufficient resources to operate the laboratory facility.