U. S. NUCLEAR REGULATORY COMMISSION

REGION I

SYSTEMATIC ASSESSMENT OF LICENSEE PERFORMANCE

REPORT 50-334/87-99
REPORT 50-412/87-99

DUQUESNE LIGHT COMPANY

BEAVER VALLEY POWER STATION, UNITS 1 AND 2

ASSESSMENT PERIOD: Unit 1: March 16, 1987 - May 31, 1988

Unit 2: March 1, 1987 - May 31, 1988

BOARD MEETING DATE: July 15, 1988

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I. INTRODUCTION

The Systematic Assessment of Licensee Performance (SALP) is an integrated NRC staff effort to collect the available observations and data on a periodic basis and to evaluate licensee performance based upon this information. SALP is supplemental to normal regulatory processes used to ensure compliance with NRC rules and regulations. SALP is intended to be sufficiently diagnostic to provide a rational basis for allocating NRC resources and to provide meaningful guidance to the licensee management to promote quality and safety of plant operation.

An NRC SALP Board, composed of the staff members listed below, met on July 15, 1988, to review the collection of performance observations and data to assess the licensee performance in accordance with the guidance in NRC Manual Chapter 0516, "Systematic Assessment of Licensee Performance". A summary of the guidance and evaluation criteria is provided in Section III of this report.

This report is the NRC's assessment of the licensee's safety performance at Beaver Valley Power Station Unit 1 for the period March 16, 1987, to May 31, 1988, and at Unit 2 for the period March 1, 1987, to May 31, 1988.

The SALP Board was composed of:

W. Kane, Director, Division of Reactor Projects (DRP) and SALP Board Chairman
G. Sjoblom, Acting Director, Division of Radiation Safety and Safeguards (DRSS)
J. Stolz, Director, Project Directorate I-4, Office of Nuclear Reactor Regulation (NRR)
J. Wiggins, Chief, Projects Branch No. 3, DRP
J. Durr, Chief, Engineering Branch, Division of Reactor Safety (DRS)
L. Tripp, Chief, Reactor Projects Section 3A, DRP
P. Tam, Licensing Project Manager, NRR
J. Beall, Senior Resident Inspector

A. Licensee Activities

This assessment period started with Beaver Valley Unit 1 operating midway through the sixth fuel cycle and Unit 2 in the final stages of preoperational testing. After the licensee integrated Unit 2 areas into the Site Security Plan on April 13, 1987, Unit 1 was shut down and the wall separating the two control rooms was removed thus establishing a joint Unit 1 - Unit 2 control room. On May 16, 1987, Unit 2 completed the replacement, announced two months earlier, of the original ball-type main steam isolation valves with valves of a more conventional design. On May 28, 1987, Unit 2 received a low power operating license (OL) and completed initial core load on June 1, 1987.

Unit 1 restarted on May 31, 1987, and operated continuously, with the exception of hardware-caused trips on June 1 and June 9, as summarized in Section II.C until the start of the sixth refueling outage on December 11, 1987. The 185-day continuous run established a new site record surpassing the previous longest run of 104 days. Balance of plant (BOP) component failures caused power reductions on three occasions but, in each case, the licensee was able to effect repairs and return to full power.

Unit 2 achieved initial criticality on August 4, 1987, and on August 14, completed low power physics testing and received a full power OL. Unit 2 was first synchronized to the grid for power operations on August 17, 1987. The startup test program was completed during the next three months and included plant transient tests such as load swings and trip tests from power such as the loss of offsite power test Unit 2 entered commercial operation on November 17, 1987.

Unit 2 experienced three reactor trips after commercial operation. Trip experience during startup testing is discussed in Section IV.I. The first trip occurred on November 17, 1987, just hours after entering commercial operation and was caused by a technician inadvertently turning a turbine rotor position module off, then on again, which produced a spurious turbine trip. The reactor also tripped and offsite power motorized the main generator through the onsite buses causing a brief loss of offsite power as the breakers for site transformers tripped on overcurrent. The other two trips resulted from the loss of the 2A 4-kv bus from different component failures on January 27, 1988 and on April 4, 1988; in each case the resulting loss of the A reactor coolant pump (RCP) caused a low reactor coolant system (RCS) flow trip.

Unit 1 began the sixth refueling outage on December 11, 1987, and was returned to service on March 2, 1988. During the outage, all three steam generators received 100% tube inspections, three feedwater elbows were replaced, and a reactor vessel thermal shield bolt was replaced. Unit 2 entered a brief maintenance outage following the January 27, 1988, trip for a license-required first cycle snubber inspection. While cooling down, a loss of Unit 2 control room annunciators occurred due to a fire in an electrical cabinet which resulted in the declaration of an alert. Annunciation was restored and the alert was terminated within four hours. Unit 2 was restarted on February 12, 1988, and placed on the grid on February 13, 1988. Unit 2 tripped on April 4, 1988, and was returned to the grid on April 15, 1988.

At the end of the assessment period, both units were at 100% power and had been operating continuously for 91 and 57 days respectively.

B. Direct Inspection and Review Activities

At the beginning of the period, one NRC senior resident inspector and one resident inspector were assigned to each Beaver Valley unit. After Unit 2 received a full power operating license, completed startup testing and

entered commercial operation, the NRC resident staff was reduced to one senior resident inspector and one resident inspector for the two unit site. The total NRC inspection effort for the period was 10,650 hours (8,646 annualized) with a distribution in the various functional areas as shown in V.B. Over 5,000 hours of inspection were associated with Unit 2 due to extensive NRC coverage of Unit 2 preoperational and startup testing.

Several major NRC team inspections were conducted at Unit 2 during this period including the Emergency Preparedness Implementation Appraisal (March 3-7, 1987), the Proposed Technical Specifications Review (March 30 - April 10, 1987), As-Built Verification (March 16-26, 1987), Full Power Operations Readiness (July 31 - August 7, 1987), and Loss of Offsite Power Review (November 18-20, 1987). Unit 1 was reviewed by an NRC inspection team using PRA principles (March 21 - April 1, 1988). An NRC Emergency Preparedness Inspection Team observed the site annual emergency exercise on September 22, 1987.

II. SUMMARY OF RESULTS

A. Overview

Continued overall improvement in the level of performance was demonstrated during this assessment period despite increased pressures of starting up Unit 2. The licensee successfully integrated Unit 2 into the site security plan while maintaining program quality and effectiveness. Startup testing at Unit 2 was accomplished during this period in a well controlled, systematic manner with excellent interfaces between test and operations personnel. In particular, the performance of the operations staffs at both units throughout this period was strong in that it was nearly error free with timely appropriate actions on several occasions that prevented additional plant challenges and trips. Continued strong performance was observed in the area of Emergency Preparedness.

A high level of management involvement in day-to-day activities was evident. Weekly Unit 2 onsite meetings were attended by the Chairman of the Board through the completion of startup testing demonstrating active involvement of senior corporate management. Further, several licensee initiatives have been effective in addressing or anticipating problems. These initiatives included a task force to modify/replace the Unit 2 MSIVs, a task force to address Unit 2 recirculation spray system heat exchangers' fouling, and the Unit 2 self assessment during startup testing. In addition, a program to conduct safety system functional evaluations (SSFE's) was initiated on Unit 1. The Auxiliary Feedwater System SSFE was completed and the preliminary results were reviewed near the end of the period.

Notwithstanding the generally strong overall performance, some areas where improvements are needed were evident. More management attention to the ALARA program including increased staffing has the potential to reduce exposure for major tasks in high radiation fields. Also, better configuration control during high activity periods and improvements in post-maintenance testing are needed in order to achieve consistent high performance levels. Procedural deficiencies and weaknesses were noted in several areas and represent a generic problem. They contributed to a reactor trip, inadvertent ESF actuations and failures to return systems to the proper alignment following surveillances. Numerous deficiencies and inconsistencies including human factors deficiencies were evident in emergency operating procedures. Finally, performance of candidates in operator requalification examinations administered by NRC represented a significant weakness during this period.

Overall, although there were some noted weaknesses that require prompt licensee management attention, the performance of both units was considered good. Performance is especially noteworthy given the stress presented to the licensee by the completion of startup activities for Unit 2. The programs in place have set the stage for continued improvement in the overall operation of the facility.

B. Facility Performance Analysis Summary

Functional Area	Last Period Unit 1	Last Period Unit 2	This Period	Trend
Plant Operations	2	-	1	
Radiological Controls	2	-	2	
Maintenance	2	-	2	
Surveillance	2	-	2	
Emergency Preparedness	1	-	1	
Security	1	-	1	
Engineering/Technical Support	2	-	2	
Safety Assessment/Quality Verification	2	2	2	
Preoperational and Startup Testing	-	1	1	
Training Programs	-	-	3	Improving

The following were not treated as separate functional areas in this assessment. Relevant insights have been included in the above areas.

Fire Protection and Housekeeping	2	2
Refueling and Outage Management	2	-
Licensing Activities	2	1
Training and Qualification Effectiveness	2	2
Construction	-	1
Operational Readiness	-	2

C. Unplanned Shutdowns, Plant Trips and Forced Outages

Date	Power Level	Root Cause	Functional Area
Unit 1			
6/1/87	95%	Material Failure	Maintenance
Description:	During the performance of a surveillance test to troubleshoot a low EHC control oil pressure, oil leakage past a cup valve and trip latch resulted in reaching the low control oil pressure. Automatic turbine/reactor trip.		
6/20/87	33%	Material Failure	Engineering/Tech Support
Description:	While initiating a power ascension after completing feed regulating valve repairs, several control rods dropped into the reactor core, resulting in a high negative neutron flux rate automatic reactor/turbine trip. The rod drop was due to a failed electronic card in the rod control system. The root cause of the failure was recurrent overheating of the rod control cabinets due to inadequate cooling air flow.		
2/19/88	0%	Procedural Inadequacy	Surveillance
Description:	Reactor trip on low-low steam generator water level due to the failure to return the reactor trip breakers to the as-found position. Operator error contributed in that "dummy" level signals were not inserted to block a trip signal.		
Unit 2			
8/5/87-11/17/87	A total of 16 trips were experienced between initial criticality and commercial operation. Six trips were the result of equipment failure; five occurred during testing, some of which were not unexpected; three were attributed to design problems; one to personnel error and one to procedural deficiency. Only one recurrent trip cause (equipment failure) led to two trips.		
11/17/87	98%	Personnel	Maintenance
Description:	An automatic turbine/reactor trip and brief loss of off-site power occurred due to a voltage spike to the turbine thrust bearing wear trip circuit. The spike was the result of an inadvertent bump of a turbine rotor position module power supply switch by a technician performing work on adjacent equipment.		

Unplanned Shutdowns, Plant Trips and Forced Outages (Continued)

Date	Power Level	Root Cause	Functional Area
1/27/88	100%	Random Material Failure	--

Description: An automatic reactor/turbine trip occurred due to low RCS flow. Within milliseconds after securing a service water system pump, a 4 kV bus overcurrent trip occurred which resulted in the loss of the "A" reactor coolant pump.

4/4/88	100%	Material Failure	--

Description: An automatic reactor trip occurred due to low RCS flow when a reactor coolant pump auto-tripped during the performance of a balance of plant surveillance test. During the test, a relay failed to block an undervoltage signal resulting in several motor loads (including the "A" RCP) isolating from the 4-kv bus.

III. CRITERIA

Licensee performance is assessed in selected functional areas, depending on whether the facility is in a construction or operational phase. Functional areas normally represent areas significant to nuclear safety and the environment. Some functional areas may not be assessed because of little or no licensee activities or lack of meaningful observations. Special areas may be added to highlight significant observations.

The following evaluation criteria were used, as applicable, to assess each functional area:

1. Assurance of quality, including management involvement and control;

2. Approach to the resolution of technical issues from a safety standpoint;

3. Responsiveness to NRC initiatives;

4. Enforcement history;

5. Operational and construction events (including response to, analyses of, reporting of, and corrective actions for);

6. Staffing (including management); and

7. Effectiveness of training and qualification program.

On the basis of the NRC assessment, each functional area evaluated is rated according to three performance categories. The definitions of these performance categories are as follows:

Category 1. Licensee management attention and involvement are readily evident and place emphasis on superior performance of nuclear safety or safeguards activities, with the resulting performance substantially exceeding regulatory requirements. Licensee resources are ample and effectively used so that a high level of plant and personnel performance is being achieved. Reduced NRC attention may be appropriate.

Category 2. Licensee management attention to and involvement in the performance of nuclear safety or safeguards activities is good. The licensee has attained a level of performance above that needed to meet regulatory requirements. Licensee resources are adequate and reasonably allocated so that good plant and personnel performance is being achieved. NRC attention may be maintained at normal levels.

Category 3. Licensee management attention to and involvement in the performance of nuclear safety or safeguards activities are not sufficient. The licensee's performance does not significantly exceed that needed to meet minimal regulatory requirements. Licensee resources appear to be strained or not effectively used. NRC attention should be increased above normal levels.

The SALP Board may assess a functional area to compare the licensee's performance during the last quarter of the assessment period to that during the entire period in order to determine the recent trend. The SALP trend categories are as follows:

Improving: Licensee performance was determined to be improving near the close of the assessment period.

Declining: Licensee performance was determined to be declining near the close of the assessment period and the licensee had not taken meaningful steps to address this pattern.

A trend is assigned only when, in the opinion of the SALP Board, the trend is significant enough to be considered indicative of a likely change in the performance category in the near future. For example, a classification of "Category 2, Improving" indicates the clear potential for "Category 1" performance in the next SALP period.

It should be noted that Category 3 performance, the lowest category, represents acceptable, although minimally adequate, safety performance. If at any time the NRC concluded that a licensee was not achieving an adequate level of safety performance, it would then be incumbent upon NRC to take prompt appropriate action in the interest of public health and safety. Such matters would be dealt with independently from, and on a more urgent schedule than, the SALP process.

It should also be noted that the industry continues to be subject to rising performance expectations. NRC expects licensees to use industry-wide and plant-specific operating experience actively in order to effect performance improvement. Thus, a licensee's safety performance would be expected to show improvement over the years in order to maintain consistent SALP ratings.

Further, in this assessment, Training Programs is evaluated as a separate functional area instead of combining its assessment with engineering activities. This approach was agreed to by the SALP Board in order to more clearly focus licensee attention toward needed improvements in the licensed operator training area.

IV. PERFORMANCE ANALYSES

A. Plant Operations (3388 hours, 32%)

1. Analysis

The previous assessment for Unit 1, evaluated as Category 2, noted improved performance in the overall conduct of operations with good and improving professionalism, active first-line supervision, and senior management involvement. There were seven plant trips during the previous period. Recurrent electronic equipment problems led to two plant trips due to vital bus losses and nine shutdowns or power reductions were caused by balance of plant (BOP) pump or feedwater control valve (FCV) problems. Unit 2 was not previously rated in this area. The current assessment includes Unit 2 operations since entering commercial operations.

Continued improvement was observed in this area for Unit 1 during the period. Two reactor trips were experienced during power operation, both caused by hardware failures. Another trip occurred while the unit was shut down during the refueling outage caused by a procedural deficiency and a weakness in configuration control. Unit 1 experienced both trips from power in early June during the first 10 days after startup following control room modifications. The first trip was caused by an EHC valve leak which dropped EHC turbine oil pressure and caused a turbine trip. The second trip was due to an electronic card failure which caused multiple dropped rods and a negative flux rate reactor trip. Three reportable events were attributable to Operations personnel during the period (including Unit 2 following commercial operation), all of which involved tagging out or restoring equipment to service. The absence of plant trips or significant operational events due to personnel errors is attributed to increased licensee emphasis on problem analysis and management attention to identification of root causes.

Unit 1 experienced four power reductions caused by BOP components, two from feedwater control valve (FCV) problems and two from feedwater heater drain system repairs. This represents a significant improvement from nine such reductions last period and twelve the period before and reflects increased licensee attention to BOP maintenance and reliability. Historically, the FCVs have exhibited substantial noise, vibration and displacement during power operation, and FCV problems have caused many of the past power reductions. Modifications completed late in this period appear to have nearly eliminated these visible indications of accelerated FCV wear and no FCV problems occurred during the three months of sustained power operation after the sixth refueling outage.

Unit 2 entered commercial operation on November 17, 1987; operational experience prior to that date is assessed in the Preoperational and Startup Testing functional area (IV.I). An NRC Special Assessment was conducted from August 4, 1987, to September 11, 1987, which concluded that the licensee had demonstrated very good operational performance.

Five hours after entering commercial operation, Unit 2 experienced a turbine trip from full power due to a spurious signal generated by a voltage spike following a technician's inadvertent toggling a turbine rotor position power module switch. The trip initiated a complex sequence of events which led to a 17-second loss of offsite power. Licensee management was closely involved with the troubleshooting and corrective action planning. The licensee's staff demonstrated excellent knowledge of the complex technical issues and design changes needed to prevent recurrence. A strong safety emphasis was evident as the licensee methodically and unhurriedly studied the event and completed necessary design modifications prior to restart.

Unit 2 experienced two additional reactor trips both caused by the loss of a 4-kv bus (and attendant loss of a RCP) due to unrelated hardware failures. The first occurred on a spurious overcurrent signal after securing a service water pump; the licensee was unable to reproduce the event and elected to replace the candidate relays and sent them to an offsite laboratory for further study. The second bus loss was due to a contact failure during a BOP surveillance test. Operator responses to the trips were excellent and the licensee's post-event troubleshooting thorough.

On January 28, 1988, erratic control room visual window display and horn operation occurred while Unit 2 was shut down for a planned maintenance outage. The operators immediately diagnosed the annunciator problem to be originating in specific remote cabinets and, within three minutes, responded to the correct location. A small fire was found in one cabinet and promptly extinguished. The licensee's actions during the event, especially the performance of the operators, was considered to be a notable strength.

Prompt and accurate operator response to plant transients during this period avoided several safety system challenges or plant trips, especially during Unit 2 startup testing. Control room professionalism and operator attitude were very good, even during high activity periods such as startup testing and major outages. Early in the period, prior to Unit 2 license receipt, Unit 1 entered a five-week outage to facilitate removal of a construction wall within the Control Building which divided the control room into separate areas for each unit. This activity was well planned and resulted in a control room facility with safety grade ventilation available from either unit.

The licensee's fire protection program was considered adequate with good site fire brigade training and off-site backup capability.

In summary, continued sound performance in Unit 1 operations was observed with few reactor trips and power reductions. Unit 2 operational performance was also very good, especially in comparison with other first cycle units. Notable strengths were observed in management involvement, operator event response and problem solving. The absence of any significant operational problems attributed to personnel performance difficulties demonstrated the effectiveness of licensee controls in this area.

2. Conclusion:

   Category 1

3. Board Recommendations:

   None

B. Radiological Controls (874 hours, 8%)

1. Analysis

The Unit 1 Radiological Controls and Chemistry Program was rated Category 2 last period. A need for improvement in management oversight of activities and improvement in the corrective action system was identified. The Unit 2 program evaluation was included in the Operational Readiness functional area last assessment period and was rated Category 2 with no radiological controls weaknesses. Ongoing licensee efforts to extend the radiation safety program to support combined unit operations were good.

Radiation Protection

Licensee efforts to ensure acceptable transition from single to dual unit operation was apparent, well planned and implemented. These efforts included appropriate increases in staffing and comprehensive training of personnel on differences between the two stations. Staffing was adequate to support routine radiation protection activities. The licensee also purchased and placed in service several whole body contamination monitors and whole body counters to enhance capabilities in this area.

Overall communications (e.g., between operations and radiation safety personnel) were good; however, some communications weaknesses between the radiation safety and security organizations at the beginning of the Unit 1 outage resulted in an initial shortage of contractor radiation protection technicians to support the outage. Some deficiencies observed during the outage (e.g., poor radiological posting and labeling and poor housekeeping) were attributed, in part, to this shortage.

A well defined and adequate training and qualification program for radiation protection personnel and radiation workers was established and implemented. The contractor technician training program was of good quality. A continuing training program was in place and implemented. Management attention to this training was evident.

Licensee audits of program implementation examined all appropriate areas; however, audits were compliance oriented in nature. Technical specialists were rarely used. QA personnel experience in the area of radiation safety was minimal. Consequently, evaluation of radiation safety program adequacy and performance relative to industry standards and performance was limited.

Weaknesses in the routine internal self assessment program identified last period (e.g., lack of formalization, trending, and evaluation) remain. An additional concern identified this period was lack of long term corrective actions on some self assessment findings. Although self identifying of problems by this routine program was an excellent licensee initiative, lack of long-term corrective actions on self-assessment findings limited the value in contributing to long-term program enhancement.

Weaknesses in the area of self assessment were compensated for this assessment period by the licensee's performance of an in-depth self assessment using INPO evaluation criteria. Items for improvement were included in a corrective action plan. The licensee's offsite review committee also reviewed recent inspection findings in the area of radiation protection to identify areas for improvement. These actions were considered good licensee initiatives.

High Radiation Area key control weaknesses identified last period were corrected. Radiological surveys to support on-going work were comprehensive. A need for more aggressive oversight and control of major exposure tasks and improvement in the quality of procedures controlling these tasks was identified by NRC during review of outage activities. There were lapses in control of diving operations in that no one had been clearly assigned specific responsibility for monitoring the diver's position. Also, weak procedures for control of steam generator entry coupled with poor oversight by supervision resulted in an individual's 1000 mR dosimeter going off-scale during a poorly controlled entry. Although no regulatory overexposure resulted, the individual exceeded his allowable administrative exposure limit by 500 mR. Diving procedures for the reactor vessel were improved to address NRC concerns. These weaknesses indicated the need for additional licensee attention to control of personnel exposure.

A defined Internal Exposure Control Program was in place and implemented. No significant individual intakes of radioactive material by personnel occurred. Previously identified weaknesses with whole body counting equipment were corrected by licensee purchase and placement in service of state-of-the-art whole body counting equipment. A program to select personnel from among those working on jobs with the potential for airborne radioactivity intake for whole body counts in order to provide a second check on the airborne radioactivity sampling and internal exposure control programs was not in place.

Lack of confirmatory termination whole body counts was not in consonance with general industry practice, and significant numbers of personnel were not provided confirmatory exit whole body counts as recommended by station procedures. Licensee control of contamination and efforts to minimize contaminated areas were good.

Weakness in control of air samples continued. There was a failure of a technician to notify supervision of unexpectedly high airborne radioactivity concentrations during clean up of the Unit 1 reactor cavity. Although licensee identified, there was a lack of timely corrective action reflecting weaknesses in the program for corrective action and a lack of appreciation of the significant airborne radioactivity levels identified (100 times maximum permissible concentration). Of particular concern was the fact that multiple supervisory personnel later signed o f acknowledging the air sample results without taking any action on them. This violation was symptomatic of weaknesses in the program for review of airborne survey results. In addition, it reflected continuing weaknesses in the control of air samples which was identified last period.

Station aggregate exposure for the past five years compares favorable with industry averages. This however is attributed to the licensee's lack of performance of significant steam generator work. Followup of previously identified weaknesses in the ALARA area continue to indicate a need for additional oversight and emphasis on ALARA. Observations during the Unit 1 outage identified lack of ALARA reviews for some steam generator work, lack of attendance at ALARA Review Committee meetings, weaknesses in ALARA goals due to lack of accurate person-hour estimates to perform work, lack of a defined program to perform review of on-going work from an ALARA perspective and lack of sensitivity to ALARA by workers.

General area radiation levels associated with steam generator work continue to be some of the highest in the industry indicating some weaknesses in licensee management of his radiological source term for steam generator work.

Some weaknesses in licensee planning for emergent work was also identified. Licensee ALARA planning for steam generator work only considered inspection of a single generator. The planning did not consider potential emergent work on other steam generators. Additional steam generator work subsequently was required.

Despite these weaknesses, good ALARA performance by contractors was noted on some major tasks (e.g., reactor vessel flow baffle work and thermal shield work). This work involved significant in vessel work. The licensee also removed a significant number of unnecessary snubbers thereby reducing the need for performance of surveillances in radiation areas.

Staffing in the ALARA area is considered weak. Although some individuals provided technical support, one individual was assigned responsibility for evaluating work packages, performing ALARA reviews, and performing in-plant ALARA functions (e.g., worker briefings). This represents a weakness in the staffing level to support activities in this area for two units.

Licensee corrective action on NUREG-0737 post-accident sampling findings were technically sound indicating a good understanding of the technical issues.

Radioactive Effluent Controls and Radwaste Systems

The preoperational test programs for the Unit 2 effluent monitoring, process sample stations, and radwaste systems were based on the FSAR and appropriate procedures and were good. Staffing was timely and generally complete with little reliance on contractor personnel. The licensee developed an adequate program for control of radioactive effluent from the site (Units 1 and 2) which demonstrated a viable and sound technical approach. Also, the preoperational testing of the radiation monitoring system was well planned with priorities assigned to support preoperational and operational milestones.

Numerous minor abnormal gaseous and liquid releases of radioactivity occurred early in the assessment period due to operator, surveillance, and maintenance errors. The need for greater attention to detail during operation of radwaste equipment was indicated. The Radiological Controls group demonstrated the capability to comply with the Technical Specification requirements during these abnormal releases.

Radiological Confirmatory Measurement

A confirmatory measurement inspection was performed using the NRC Region I Mobile Laboratory. All split sample results were in agreement between the licensee and the NRC. The licensee had state-of-the-art gamma and liquid scintillation counting systems which indicated management support. Procedures were generally adequate; however, the licensee did not implement certain aspects of the Laboratory Quality Control Program (comparisons of inter- and intra-laboratory blind samples). Audits by QA group were thorough and technically sound but one weakness noted was that audit personnel did not track the previously identified follow-up items thoroughly. These problems were minor; the licensee had a generally sound program in this area.

Transportation

The position of Transportation Supervisor was assigned the responsibility for the maintenance of licenses and permits, compliance with applicable procedures, regulations related to the receipt and shipment of radioactive materials, and review and revision of the Process Control Program. However, this position, which was created in August 1986, had not been filled at the end of this assessment period. Two violations were identified during this period that might have been avoided had the position been filled. Although the licensee had an adequate transportation program, attention should be focused on filling needed positions.

Summary

Although some new equipment was purchased and placed in service, performance in the area of radiation safety and transportation continued at essentially the same level as last period. Licensee radiological control personnel performance in the area of radioactive effluent controls was generally strong. Station total personnel exposure has shown a decline over the past several years consistent with overall industry performance.

However, continued enhancement of worker consciousness of ALARA and program improvements in this area was warranted. Improvement in management and supervisory oversight of major exposure tasks was similarly warranted. The corrective action system, a previously identified area for improvement, continued to need additional management attention.

2. Conclusion:

Category 2

3. Board Recommendations:

Licensee:

Strengthen supervisory and management oversight and procedural controls for significant radiological tasks Additional efforts are needed to reduce personal exposure during future steam generator work.

NRC:

None

C. Maintenance (742 hours, 7%)

1. Analysis

During the previous assessment period, Maintenance and Modification was evaluated as Category 2 for Unit 1. Generally good control of preventive and corrective maintenance activities was noted. This current assessment includes Unit 2 maintenance activities which were incorporated into the common site programs when initial criticality was achieved (August 4, 1987).

Maintenance procedures and policies were typically followed well by station personnel. Maintenance goals had been established and the dates were being met within the tolerances established by the program. The backlog of maintenance tasks was well managed. In particular, it was noted that the licensee had developed a thorough maintenance and test program for electrical equipment, including battery chargers, batteries, circuit breakers and transformers.

Considering the time period covered, there was a relatively low number of problems attributable to personnel error. Three Unit 2 reactor trips occurred due to error; one was attributed to failure to perform adequate post-maintenance testing, another involved inadequate job preplanning and the lack of attention to detail, and the third was caused by an accidental bump of nearby equipment. Four ESF actuations occurred during maintenance activities due to various causes, including improper use of available equipment, technician failure to note the effect of work activities on associated plant equipment and deficient procedures. Generally, maintenance procedures were found to be technically sound but required improved human factors considerations, especially those that involve activities that can result in plant trips or ESF actuations.

Maintenance personnel were trained to work on both units and were found to be knowledgeable of station procedures and the tasks to which they were assigned. Toward the end of the SALP period, the mechanical and electrical maintenance training programs were accepted and accredited by INPO. The previous assessment noted that a list of personnel qualified to perform certain jobs was not maintained by the individual departments, and personnel were selected on an as-available basis by supervisors who were familiar with the individual's qualifications. A minimum job training concept was implemented. Although the minimum job training lists were not complete, updated lists were periodically distributed to supervisors to assist them in selecting personnel to perform maintenance activities. The current program appeared to be functioning properly in that the quality of maintenance was generally good and in accordance with site procedures.

Quality control involvement in maintenance activities was adequate. Quality control inspectors were usually present during significant activities and were performing in-process inspections of ongoing maintenance work activities. They were knowledgeable of the activities observed.

Day-to-day preventive and corrective maintenance of safety related components received adequate preplanning and supervisory oversight. Daily meetings provided a good mechanism through which proper coordination and interfaces were established with the various station groups. Proper use of clearances and adequate interface among the various station groups (radiological control, quality control, etc.) necessary to accomplish maintenance activities were observed in the field.

Previous assessments identified weaknesses in complying with administrative requirements associated with complete maintenance work requests (MWR) documentation. Improvements in this area occurred during this period, with the exception of post-maintenance testing. The required post-maintenance testing or reason for not performing testing were not always identified on the MWR. In one example, a manual reactor trip was required due to a Unit 2 rod control system problem. The failure to test the system properly following the associated maintenance troubleshooting activities resulted in a second manual reactor trip due to dropped control rods. A similar example was the failure to test a liquid waste motor-operated valve properly following maintenance resulting in an inadvertent liquid release. Root causes for the second event included improper maintenance and a breakdown in communication among the responsible station groups. Additional management attention will be necessary to achieve a better post-maintenance testing program.

Historical information in the maintenance database was very good. However, preventive maintenance trending at the site needs to be improved, in that trending was found to be performed on a reactive rather than systematic basis. Management did not provide the staffing necessary to provide a thorough trending program even though plant performance personnel had identified valuable information during several reactive trending analyses.

For the majority of the period, plant housekeeping during and following the conduct of maintenance was weak. Areas were littered with tools, component parts and debris. Additionally, unrestrained equipment, such as ladders, gas bottles, and large tool cabinets on rollers were often adjacent to equipment important to safety. The licensee developed detailed guidance in the Maintenance Manual in an attempt to resolve the concerns. While improvements were continuing, individual deficiencies continued to be identified to the licensee for resolution. Aggressive management oversight was not apparent in this area for the majority of the assessment period.

In summary, licensee activities associated with preventive and corrective maintenance were generally well controlled. The relatively low number of unnecessary challenges to safety equipment reflected overall satisfactory technician training and adequate procedures. Improvements in the areas of housekeeping, post-maintenance testing, and procedures are necessary if improvements are to be achieved in the maintenance program.

2. Conclusion:

Category 2

3. Board Recommendations:

Licensee:

Implement a program to improve procedures, post-maintenance testing and trending.

NRC:

None

D. Surveillance (790 hours, 7%)

1. Analysis

During the previous assessment period, Surveillance was evaluated Category 2 for Unit 1. Operational Readiness Category 2, Improving was evaluated for Unit 2. While a surveillance program that was generally functioning well was noted, concerns were identified with respect to reviews of test data for reasonableness, several missed surveillance tests, and the continued need to strengthen the 18-month operations surveillance test system alignment methodology. This current assessment includes Unit 2 surveillance activities which were incorporated into the common site programs when initial criticality was achieved (August 4, 1987).

The last assessment noted that Unit 2 operational surveillance tests were incorporated into the routine surveillance schedule once a system was turned over to the station to maintain operability. This process was continued and was a licensee strength, demonstrating that the licensee placed considerable effort in preserving plant equipment. There was one reactor trip and about 15 additional reportable events that occurred during surveillance testing activities. The majority of the reportable events were due to inadequate procedures. The number of missed surveillance tests occurred at about the same rate as during the last SALP period.

The licensee maintained a strong reliance on individual surveillance test coordinators who were accountable for the administrative implementation of the program. Each station group that performs surveillance tests was responsible for the overall coordination and control of their respective portions of the surveillance program. The licensee maintained an informal Technical Specification (TS) and procedure matrix which was a computerized cross reference of plant procedures and TS. The matrix was revised annually and provided a mechanism through which identification and cross referencing of procedures could be accomplished and was generally used effectively for a variety of administrative purposes. At the end of the period, licensee efforts were initiated to provide a more current matrix for use by surveillance test coordinators.

The four missed Technical Specification-required surveillance tests were all caused by different types of administrative/personnel errors. Increased attention to detail with respect to communication among the various departments may be necessary.

Staffing for each of the surveillance programs and the training and qualifications of radiological control, operating and test personnel with respect to surveillance testing performance were adequate. Preservice (Inservice) Inspection staffing was improved by the addition of a Level III and two Non-Destructive Examination (NDE) technicians. This permitted the licensee to take over review responsibilities for NDE results. Inservice testing of pumps and valves was performed adequately although NRC identified some minor problems concerning procedural details.

One programmatic area needing further management attention was the control of surveillance activities and adequacy of the associated procedures which impact operability or challenge safety systems. Three separate but similar events occurred when surveillance activities were performed which did not adequately return the systems to required positions or did not verify Technical Specification requirements. Prior to initial entry into Mode 4 (Hot Shutdown), the operational surveillance test procedure failed to identify that the Unit 2 control room emergency bottled air pressurization system actuating circuit was disabled. While Unit 1 was in a cold shutdown condition following completion of a surveillance test, the technicians failed to return the reactor trip breakers to the as-found position. Subsequent drain down of a steam generator resulted in a low - low level reactor trip signal and automatic opening of the reactor trip breakers. The third event involved the performance of a surveillance activity which left two high-high containment pressure bistables in a different configuration than as-found rendering two out of the four automatic actuation channels for the containment spray system inoperable. For the last two events, operator error and human factor deficiencies were contributing factors. Site management has recognized human factors concerns to be a problem; however, aggressive resolution was not apparent as a relatively large number of events were attributable to deficient procedures.

The eddy-current testing of the steam generators during the Unit 1 refueling outage implemented an innovative approach in the data analysis in that independent reviews were performed by different vendors. However, one weakness in this method was that the different vendors did not use the same terminology in reporting the results although this did not lead to any problems. The licensee was responsive to the concerns associated with the North Anna steam generator tube rupture. Special eddy-current inspections were performed and preventive tube plugging was implemented. To provide a mechanism through which the failure of a tube susceptible to the North Anna type failure could be identified (even if plugged), six tubes were plugged with a standard plug in one end and a sentinel plug designed to limit a leak to 300 gallons per day in the other end. With this technique, if any of these six tubes ruptured, the leak rate would increase by 300 gallons per day (below emergency shutdown limits) and allow an orderly plant shutdown. Another example of the licensee's response to recent industry experience was the performance of eddy-current testing of all 50 in-core instrumentation thimble tubes. Indications were evaluated and appropriate corrective actions were implemented. These actions represented good safety perspective and initiatives.

The results of secondary water chemistry control during the majority of the period were excellent. Sodium, chloride, sulfates and silica were generally below the values that could be determined by the on-line, state-of-the-art equipment used for the analyses. The morpholine additions the licensee performed appeared to make the blowdown process more effective in sludge removal. Close attention to secondary water chemistry as demonstrated by the licensee should help to reduce steam generator tube degradation and improve plant safety.

In summary, the relatively low number of unnecessary challenges to safety equipment reflected overall satisfactory technician training and adequate procedures. The surveillance programs functioned adequately. Configuration control, particularly during high activity periods, and procedural adequacy were areas which required further management attention if the surveillance test program implementation is to be strengthened. Management commitment to address potential safety issues from a technically sound perspective was evident.

2. Conclusion:

Category 2

3. Board Recommendations:

Licensee:

Complete review of procedures for human factors deficiencies, especially those associated with outage recovery

NRC:

None

E. Emergency Preparedness (447 hours, 4%)

1. Analysis

During the previous assessment period, licensee performance in this area was rated Category 1. This was based upon exercise performance and the licensee's own initiatives in routine emergency preparedness activities. Inspections of emergency preparedness activities included the Emergency Preparedness Implementation Appraisal (EPIA) and three followup inspections prior to Unit 2 licensing. The annual emergency exercise (partial-participation) for both units was observed, and changes to emergency plans and implementing procedures were reviewed. Response to the January 28, 1988 loss of annunciator event was also evaluated.

The EPIA performed on March 2-6, 1987, about 10 weeks prior to license receipt, focused on the readiness to integrate the Unit 2 program into the overall site and corporate emergency preparedness program. The EPIA identified several program areas as incomplete or in need of correction before readiness to receive the low power and full power licenses. Followup inspections conducted in April through June 1987 tracked licensee progress in completing open items prior to full power licensing. By June 1987, all items had been adequately addressed, an indication of positive response to NRC initiatives.

Emergency response facilities were common to both units with the exception of the control rooms. As a result of EPIA findings, Unit 2 control room upgrades were made in communications capability, addition of protective clothing, and improvements in security arrangements. Other changes to facilities included enhancement of onsite and remote (offsite) assembly areas, and enlargement of the Radiological Operations Center (ROC). Capability of other facilities which include the Emergency Operations Facility (EOF), Technical Support Center (TSC), and Operations Support Center (OSC) were demonstrated in routine drills conducted at different times throughout the period and deemed effective as emergency response facilities. Full time site support staffs were adequate to maintain effective onsite and offsite activities associated with the program. This included permanent emergency preparedness staff with additional support from the Operations, Health Physics, and Training Departments.

During the partial-participation exercise conducted on September 22, 1987, the licensee again demonstrated an aggressive approach toward implementation of the Emergency Plan and implementing procedures while maintaining a high level of emergency preparedness. NRC identified only minor exercise deficiencies in the areas of TSC information flow, handling of the contaminated/injured individual, and functioning of the plant paging system. The licensee conducted an adequate self-critique by identifying deficiencies which occurred during the exercise and committed to take actions to correct the deficiencies.

On January 28, 1988, a loss of Unit 2 control room annunciators required declaration of an Alert emergency classification. Onshift staff promptly recognized the event, and after review of EALs, correctly classified the event as an Alert. Notifications of offsite authorities were performed within the 15 minute requirement. The emergency response organization was also notified while activation of the TSC, OSC, and ROC occurred. After activation of local Emergency Operations Centers (EOC), coordination with state and county representatives was closely maintained. Following event termination, the licensee reviewed the event to assess the response and identify actions to be taken to prevent recurrence. Overall, the licensee accurately and effectively implemented the site Emergency Preparedness Plan in a timely manner. Furthermore, the licensee recognized the unrealistic conservatism in the EALs associated with this event and appropriately revised the Emergency Plan prior to plant restart.

The interface between the emergency preparedness staff and licensee management was noteworthy. Upper level management was supportive in expediting correction of weaknesses identified during the EPIA. This was evidenced by prompt resolution of all 26 EPIA concerns within approximately 4 months of initial NRC identification. The relationship between the licensee and offsite authorities continued to be strong. Notification and coordination with the States of Pennsylvania, Ohio, and West Virginia, and counties of Beaver and Columbiana during the loss of annunciator event allowed the response to be carried out effectively.

In summary, the licensee successfully integrated Unit 2 into the site Emergency Preparedness Plan in a timely manner to support licensing. Excellent personnel attitude, management involvement and organizational responsiveness continued to be demonstrated in day-to-day activities and drills. Licensee overall performance was noted to be strong during the January 28, 1988 Alert.

2. Conclusion:

Category 1

3. Board Recommendations:

None

F. Security (433 hours, 4%)

1. Analysis

This is the first SALP of the combined Unit 1 and Unit 2 security program. The two programs were integrated early in this assessment period.

During the last assessment period, no major programmatic weaknesses were identified for Unit 1 and a Category 1 rating was assigned. The functional area of Security and Safeguards was included in the Operational Readiness portion of the previous Unit 2 SALP and that portion was assigned a Category 2 rating. A common concern in both the Unit 1 and Unit 2 assessments for the last period was the adequacy of the licensee's proprietary security staffing level, consisting of three full-time positions at that time, to provide the necessary effective oversight and control of the contract security force for a two unit site, especially considering the problems inherent with the startup and integrating of the systems and equipment.

The licensee recognized and responded to the NRC concern about the potential for problems with the then-existing proprietary staff and expanded the staff from three to eight full-time positions over this assessment period. A training coordinator and four security shift supervisors were added to the proprietary staff. The security shift supervisors provided around-the-clock shift oversight of the security contractor. The expansion of the proprietary staff demonstrated management support and attention to the security program. The shift oversight function was implemented toward the end of the assessment period and its effectiveness has not been assessed by the NRC.

At the start of the assessment period, the licensee experienced several problems inherent with the startup of the new systems and equipment, including new security computers installed as part of combining Unit 1 and Unit 2. Contributing to the problems was the fact that there were more than 3000 construction workers onsite completing work on Unit 2 at the time the combined security program was being made operational. The contract security force was also working a larger amount of overtime at that time to support Unit 2 construction activities and the preoperational testing and calibration of the new security equipment and systems. Towards the end of the assessment period, most of the integration, construction, and new equipment problems had been resolved, the proprietary security staff had been expanded and the security force overtime had been reduced to a minimum. Management's prompt action to resolve the problems encountered demonstrated the licensee's intent to maintain an effective security program. Security management personnel continued to be actively involved in industry groups engaged in nuclear plant security matters. This also demonstrated program support from upper level management.

About midway through the assessment period, the NRC identified concerns about the sparse maintenance support being afforded to Unit 1 security equipment and the use of long-term compensatory measures for inoperative equipment. The majority of the maintenance resources were being utilized for overall Unit 2 preoperational activities. Senior management promptly committed to review all the Unit 1 security maintenance concerns and to have all inoperable equipment repaired within 60 days. This was accomplished in the committed time period and the long-term compensatory measures were terminated. Subsequent inspections indicated that the maintenance work was very effective and that increased maintenance support was continuing. This demonstrated senior management's responsiveness to NRC findings; however it also indicated a previous lack of appropriate attention to corrective maintenance or escalation of maintenance problems to proper management levels to effect resolution. In either case, upper level management should have been alert for compensatory measures which resulted from untimely corrective maintenance.

The training program was administered by four full-time, experienced instructors. In-depth lesson plans had been developed, were current, and reflected the commitments in the NRC-approved security program plans. Training facilities were professional and instructional aids were utilized extensively. All security-related facilities, e.g., guard house, alarm stations and office areas, were well maintained, orderly and clean. Licensee oversight of the training program was provided through a proprietary training coordinator and demonstrated the licensee's intent to maintain an effective and professional training program. Program implementing procedures and instructions continued to be updated when required, based on feedback from training and security operations supervision, to provide the security force with current, clear and concise directions. Members of the security force were knowledgeable of their duties and responsibilities. The high quality of the training program and the procedures and instructions was apparent from the relatively few personnel errors during the assessment period and was further evidence of management support and attention to the program.

The turnover rate in the contractor security force remained low and staffing appeared to be sufficient, as indicated by the limited amount of overtime being worked at the end of the assessment period. Contractor supervisory and administrative staffing was also sufficient for the current work load. The licensee's oversight of the contract security force was adequate to provide the licensee with necessary and current knowledge regarding program implementation. This was apparent by the licensee's self identification of several program deficiencies throughout the period.

The licensee submitted 30 event reports under 10 CFR 73.71(c). This relatively large number of reports was due to several factors: (1) a revision to the NRC reporting requirements in October 1987; (2) very conservative reporting practices on the part of the licensee, (3) the startup of new systems and equipment; and (4) the integration of the Unit 2 systems with Unit 1. A detailed review of the event reports by NRC indicated that only ten of the events had to be reported under the current NRC reporting requirements. Of these ten events, three involved guards who were inattentive to duties. These events occurred during the period when large amounts of overtime were being worked by the security force to support Unit 2 construction activities and the installation and testing of new security equipment. None of the events constituted a security vulnerability. Immediate and appropriate compensatory measures were implemented in each case and corrective actions appear to have been effective. There were no such incidents during the last half of the assessment period.

During the assessment period, the licensee transmitted four revisions to the Security Plan under the provisions of 10 CFR 50.54(p). Two of these revisions were found acceptable, the others are currently under review. The revisions were adequately summarized, appropriately marked to facilitate the NRC review, and of good quality. This was indicative of work by personnel who were knowledgeable of NRC security requirements and program objectives and management attention to submittals to the NRC.

In summary, the licensee has continued to implement an effective and quality security program. The proprietary security organization has been expanded and significant capital resources have been expended to upgrade security systems and equipment. Problems with the integration of Unit 1 and Unit 2 encountered early in the assessment period received management attention and were resolved effectively. The licensee continues to be responsive to NRC initiatives, however, better long-range planning is warranted.

2. Conclusion:

Category 1

3. Board Recommendations:

None

G. Engineering/Technical Support (1065 hours, 10%)

1. Analysis

During the previous assessment, Unit 1 received a Category 2 rating in Engineering Support. Strengths were noted in the on-site location, day-to-day involvement and increasing emphasis on problem investigation; weaknesses were identified in timeliness to respond to station requests, corrective actions to long-standing problems and program oversight. During this period, this functional area addresses design of plant modifications, training and engineering/technical support for all plant activities.

Training programs which would normally be assessed within this functional area has been addressed separately in Section IV.J.

The licensee was in a transition period in an effort to combine the engineering functions for both Units 1 and 2. At the end of the assessment period, engineering effort was about equally divided between licensee personnel and the original Architect/Engineer for the station, Stone and Webster Engineering Corporation (SWEC). The SWEC personnel were primarily working on engineering projects concerning Unit 2 since much of the working knowledge for this unit still rested with the contractor. However, the SWEC organization was considered much the same as another section of the licensee's engineering organization except that a licensee engineer was assigned to monitor each project performed by SWEC. SWEC used the same procedures as the licensee in controlling work performed.

The overall resources for engineering support greatly diminished during the current assessment period as the licensee completed construction and startup on Unit 2. Unit 2 completion led to a large reduction in resources (from 6000 to 2000 workers) with the support responsibility being assumed by the licensee on-site engineering department as augmented by SWEC. In recognition of the increased work load presented by two operational units, the licensee added twenty additional positions in the NED to staff for Unit 2 operations and ensure adequate support for both unit . Multiple or complex events appeared to challenge available re rces, but in general, the existing manpower was sufficient to meet demand.

Procedural control of work in the engineering department was good. Records of implementation of engineering work including task specifications, procurement controls, safety evaluations and project documentation were readily available as part of the design control packages. The procedures were adequate and, in all cases observed, were being implemented. The observations included both short and long term projects. Active projects were discussed in daily meetings to assist in preventing problems. Plant staff participated with engineering management in establishing project priorities thus ensuring timely resolution of significant operational problems.

The Engineering Department had a strong training program for maintaining individual engineers' knowledge current. The Nuclear Engineering and Records Unit maintains training records of engineering personnel, including required reading checklists, which require engineers to review various engineering, administrative and quality assurance procedures, Regulatory Guides and the relevant parts of the Code of Federal Regulations, Title 10. Supplemental Nuclear Engineering Department management, technical and professional development training classes, seminars and lectures taken by the staff also were tracked on a computer data base for each employee. To ensure knowledge of changes to engineering procedures, the Nuclear Engineering Department routed a copy of the procedure with an acknowledgement signature required to each section member for review of the revision.

Technically sound support was provided to resolve, at least partially, the long-standing problems with the Unit 1 feedwater control valves, rod control cabinets, and vital bus No. 3 by hardware design modifications. Timely support to operational events allowed Unit 2 to complete electrical modifications following the complex loss of off-site power event on November 17, 1987 and start up five days later. Responsiveness was also exhibited following the identification that certain required Unit 1 control room indicators had been inadvertently deleted in 1980, such that proper indication capability was restored days after discovery. Just after the close of the period, Unit 1 experienced a trip due to personnel error. A second trip occurred during restart that required engineering support and engineering personnel, including mechanical, electrical and I&C specialists, to be called in on a third shift for support. Overall, support in response to events was very good and improvements in resolving long-standing problems were noted.

Engineering support was complete and adequate with respect to procurement activities, potential inter-system LOCA (Event V) review, reactor trip breaker modifications, outage activities, and NUREG 0737 post accident sampling system issues. Further, the licensee developed an extensive engineering program to address the equipment environmental qualification requirements imposed by 10 CFR 50.49. A Unit 2 team inspection verified that a sound program had been developed and was being implemented to ensure that environmentally qualified equipment was being properly maintained. No significant concerns were identified during the inspection indicating that a comprehensive and technically thorough effort had been mounted. An extension of this program was the inspection effort to deal with Limitorque valve actuator problems. The program was found to be thorough and in depth; however, an inspection of Unit 1 immediately following the assessment period identified problems in the use of unqualified wirenuts and unqualified wire in Limitorque operators which may raise significant concerns with the EQ program.

The technical content of the licensee's emergency operating procedures was adequate; however, a number of deficiencies and inconsistencies were identified, particularly in the Unit 1 procedures. These deficiencies indicated a weakness in site management's attention to detail in validation, verification and implementation of high quality emergency operating procedures. Procedural human factor deficiencies were compensated by operator experience; operator performance during plant events was excellent.

In summary, improvements were noted in engineering support for long term problems and plant events. These improvements were achieved during a time of transition with good evidence that licensee senior management was involved in matching staffing to site needs. Continued senior management attention is needed to assure that engineering/support resources are adequate for the increased demands inherent in two unit operation, especially in support of the back-to-back refueling outages planned in the next period.

2. Conclusion:

Category 2

3. Board Recommendations:

Licensee: Implement a program to resolve the deficiencies existing in the Emergency Operating Procedures in a timely manner.

H. Safety Assessment/Quality Verification (729 hours, 7%)

1. Analysis

Management involvement in assuring quality has been considered as a separate functional area in past SALPs in addition to being one of the evaluation criteria in each functional area.

This area has been expanded to encompass activities previously evaluated in Licensing, including safety evaluations. This discussion is a synopsis of quality and safety evaluation philosophies reflected in other functional areas. In assessing this area, the SALP Board has considered attributes which are key contributors in assuring safety and verifying quality. Implementation of management goals, planning of routine activities, worker attitude, management involvement, and training are examples. This area received a Category 2 rating for both Unit 1 and Unit 2 in the last assessment period. Strengths were identified in worker attitude, first line supervision, QC aggressiveness and management involvement. A weakness was identified in the overemphasis by QA on documentation completeness rather than on assessment of the technical adequacy of the area audited.

Significant resources continued to be dedicated to the assurance of quality. The recent licensee commitment to procuring a new simulator for Unit 2 represents a significant capital investment in enhancing the quality of Unit 2 operator training. Manpower and analysis resources were also allocated to the licensee's recently completed Safety System Functional Evaluation (SSFE) of the Unit 1 AFW system. The SSFE was a broad-based technical audit involving over 3000 man hours of effort and was modeled after the NRC Safety System Functional Inspection. The SSFE was used to reconstitute the design bases of the much-modified Unit 1 AFW system and reconcile differences between the two units as well as provide enhanced assurance of AFW operability. The licensee plans to conduct SSFEs on other Unit 1 safety systems after reviewing the results of the AFW SSFE.

In the licensing area, the licensee demonstrated a good working knowledge of applicable regulations, guides, standards and generic issues during the period, in particular, during the final licensing stages for Unit 2. The licensee was generally responsive in addressing unresolved issues; this was especially notable during the completion of the Unit 2 Technical Specifications. Licensee preparedness, technical competence and effectively proposed resolutions were evidence of the licensee's commitment to resolve safety issues in a timely manner. Over 100 licensing actions were completed including application of leak-before-break technology (Unit 1), ATWS rule implementation (Unit 1 and 2), and inservice testing of pumps and valves (Unit 2). Conservatism was consistently exhibited with sound technical judgement provided for most deviations from NRC guidance.

Prior to receipt of the Unit 2 full power license, the licensee conducted a self-assessment of startup testing and power operations at the 50% power testing plateau. Good agreement was noted between the licensee's self-assessment and the independent assessment made by the NRC staff. The licensee's self-assessment was noted to be strong on root cause analysis, to be self-critical where warranted, and to use existing management information systems. The use of already in-place resources instead of a unique task force approach was a notable strength since it indicated that the analysis tools are consistently available to licensee management. This self-assessment and the ongoing use by senior management of the contributing reports and trending/tracking documents were positive initiatives.

Utilizing the evaluation methodology presented in NUREG-1022, Licensee Event Report System, the overall quality of LERs exhibited weakness in that they contained inaccuracies, and overall weaknesses in report completeness, root cause determinations and safety significance evaluations. The licensee was responsive to these concerns as demonstrated by the significant improvements in LER quality noted during the last quarter of this assessment.

A formal and systematic approach to root cause analysis was implemented later in the assessment period which forced a broad-based approach to event review and which led to higher quality analysis. The ISEG developed a computer program which compares Unit 2 trip response to a standard trip without other failures. The program flags which of over 100 computer address data points do not appear within the expected time "window" and will greatly facilitate the identification of equipment failures or unexpected component response following an event. The program also establishes a database which can be analyzed for trending studies. This program is a notable initiative which, when fully implemented and extended to Unit 1, will enhance the licensee's ability to assess plant response to events.

Management oversight has generally been effective, considering the increased demands the Unit 2 project placed on licensee resources. Senior management was involved in improving availability of safety related components and systems, promoted accountability and ownership among licensee staff, ensured participation in INPO audits to learn from other utilities and kept abreast of regulatory and industry initiatives to be aware of potential problems. Especially effective oversight was demonstrated at Unit 2 during MSIV replacement, recirculation spray heat exchanger flushing and startup testing. Actions taken by management have achieved partial resolution of two long standing equipment problems at Unit 1; Vital Bus No. 3 inverter unreliability and FCV vibration-induced failures. Vital Bus No. 3 inverter trips have continued to occur, but an automatic bypass circuit was installed which provides a backup power supply and has

prevented the inverter failures from causing plant trips. Additional BOP modifications have greatly reduced FCV vibration during power operation, although the greater feed flow available post-modification has appeared to increase the severity of the transient following a plant trip during startup. After the close of the assessment period, other Unit 1 feedwater, SG level control and RCS pressure problems indicate revised flow characteristics for the FW systems which may not have been fully anticipated by the licensee. Additional attention appears to be required to fully resolve the problems with the inverter and FCVs.

The various station safety committees functioned well during the period. The Offsite Review Committee (ORC) included members of senior corporate personnel and continued to be an effective and aggressive organization. One example of the ORC's use as a management tool was the allocation of resources to conduct Safety System Functional Evaluations (SSFEs) to assure safety system reliability and upgrade design basis documentation. The continued onsite location of senior corporate personnel and engineering support groups enhanced the oversight and integration functions essential to the solution of complex problems. The ORC, acting through subcommittees, acted to improve EDG reliability by installing air dryers in the starting air system, to improve fire damper reliability by implementing a specific maintenance program and to reduce unplanned reactor trips by installing an inverter auto bypass circuit to prevent recurring inverter trips from causing reactor trips.

A major licensee reorganization was announced late in the assessment period following Unit 2 commercial operation. The new senior onsite executive, Vice-President Nuclear, began to restructure his staff to integrate the Unit 2 project personnel into the site organization. The large QC staff, whose thoroughness and aggressiveness was a notable strength during Unit 2 construction, was greatly reduced as the work for the group was completed. The QA organization, previously noted to overemphasize "paper", has been tasked with increasing technical assessment and quality enhancement. Audit results showed some improvements in quality and technical depth near the end of the assessment period but further improvements appear to be warranted.

In summary, during this assessment period, very effective management was evident in achieving the licensing, testing and commercial operation of Unit 2. Partial resolution of longstanding Unit 1 problems was also achieved. Some areas were identified which need further management attention, but notable initiatives such as the Unit 2 simulator commitment, the Unit 2 self-assessment, the Unit 1 SSFE program and programmatic root cause analysis improvements indicate a strong and long term management dedication to assuring quality.

2. Conclusion:

   Category 2

3. Board Recommendations:

   None

I. Preoperational and Startup Testing - Unit 2 (2182 hours, 21%)

1. Analysis

During the previous assessment period, Preoperational Testing was assigned a Category 1 rating. The preoperational test program was identified as a notable strength, with well controlled tests and highly professional problem solving. The licensee successfully completed several major testing milestones on or ahead of schedule. Test data were of high quality with a conservative threshold for identifying potential deficiencies. Test results were reviewed in a thorough, well organized manner.

During this period, the licensee continued to demonstrate a high level of performance while completing the preoperational test program. Strong management oversight occurred at the twice daily planning meetings, test results review was very good and test deficiency resolution was technically sound.

Good test personnel performance occurred during the preoperational loss of offsite power test, containment leak rate tests, retests of the reactor head vent system, ECCS flow and pressure drop testing, and testing for minimum continuous spray flow. In many of the large integrated tests, only minor test deficiencies were recorded indicating good planning. Test reports were well organized and complete. Justifications for all test completion deferrals (beyond core load) were valid. Most of the new start up schedule dates assigned for test deficiency completion were realistic and consistent with the work to be performed. The licensee's letter requesting deferral of some operational tests was well thought out and technically sound.

Personnel with experience gained from the preoperational test program were used in the development of the startup test program. Some problems occurred during the transition phase in that the initial procedures still reflected many of the controls, such as construction deficiencies, which were not consistent with the controls that would be required by an operating license. The licensee's performance in the preparation of the startup testing improved during the course of the program. Management was fully involved in the preparation and review of the procedures with completed procedures being approved by the Joint Test Group (JTG) and the On Site Review Committee prior to being issued. Plant management tracked test procedure development status and test schedule, and were knowledgeable of the technical details of test content.

Licensee performance throughout the entire fuel loading period was good, with activities being performed in a deliberate, and carefully controlled manner. Fuel loading activities were conducted by qualified personnel and interfaces among various groups were smooth. Problems identified were properly evaluated and resolved with management involvement and control evident. Licensee performance during this evolution was enhanced by utilizing personnel experienced in loading fuel at Unit 1.

Licensee performance during startup testing was also good. Management oversight and control of testing activities were observed to be good and effective with consistent monitoring of plant activities during major plant evaluations and tests. Strong management attention to the safety implications of problems identified by startup testing was evident. Information and work status were presented clearly and objectively at the daily plant meetings. Management presence at these meetings helped in resolving schedule conflicts and assigning priorities among many activities.

Equipment problems identified during startup testing were properly evaluated and followed. Management attention to these problems was consistently evident and factored into later testing. For example, a problem with the reactor coolant pump underfrequency relays was identified, but not fully resolved for several days. In the interim period, further testing was conducted using offsite power supplies so the problem with the fast transfer capabilities of these relays would not be a factor. Other instances of problems were identified in configuration control, information feedback and pretest briefing, but licensee corrective action was effective in preventing repetition and these examples are considered isolated cases.

The startup test administration program was logical and comprehensive. A change in the test plan was made toward the end of the 30% power plateau to defer the MSIV closure test and the loss of offsite power test until after the 50% power non-transient type tests. The change was properly reviewed by the appropriate licensee groups and NRC concurrence was obtained in a timely manner. This schedule change allowed the thorough exercise of BOP equipment prior to the plant challenging tests at 30% power. If a post-trip outage had been necessary, then any problems identified in BOP equipment could also have been addressed. In another case, the licensee was able to avoid an additional plant challenging trip test from 100% power. The licensee elected to wait until an operational event resulted in a trip from full power. Until such time, recorders remained hooked up to record the necessary data and the plant was operated with conservatively reduced trip setpoints (Over Pressure Delta T and Over Temperature Delta T). These two examples demonstrated the strong, proactive involvement of licensee senior management.

Particularly effective interfaces were developed between the Operations and Test Groups. Prior to performing testing, pretest briefings were conducted by test personnel. Also before transient type tests, the Nuclear Shift Supervisor reminded the operation crews to monitor key parameters during the test. Test prerequisites, initial test conditions and plant responses were jointly monitored by operations and test personnel. Test identified problems were correctly and promptly fed back to Operations and corrective actions were properly taken.

The effective interface between the Nuclear Shift Supervisor (NSS) and test supervision was a notable strength. Prior to the MSIV closure test, the NSS discussed that he would wish to reopen the MSIVs as soon as feasible to restore the normal path of decay heat removal. The reactor tripped within ten seconds of MSIV closure; the NSS oversaw the accurate completion of immediate actions, asked the test supervisor about the MSIVs, and was able to quickly reopen them such that no steam generator relief valves were actuated. Excellent control of the loss of offsite power (LOOP) test was also demonstrated. After the plant was stabilized, the NSS asked the test supervisor about reopening the MSIVs. In this case, the test supervisor requested 30 minutes of data under the existing conditions to assure all data trends were captured. This request was accommodated by the Operations crew and the desired data was acquired. These examples were indicative of the excellent control and cognizance of plant activities that the on-shift operations staff exhibited throughout this period of numerous parallel on-going activities.

The NRC reviewed Unit 2 startup experience with emphasis on unplanned reactor trips and ESF functions during startup testing through commercial operation. Unit 2 had about an average number of unplanned trips and fewer than average ESF actuation, TS violations and LSSFs compared with similar facilities, as documented in NUREG-1275, "Operating Experience Feedback Report - New Plants" July 1987. Unit 2 completed the startup testing program in three months after initial criticality compared with the greater than ten-month average for NUREG-1275 units. The Unit 2 performance was comparable in scrams and substantially better than average in the startup testing program taken as a whole, and demonstrated a very good level of performance during that active period. The success of the startup program was also demonstrated by the high level of operational performance of Unit 2 during the first 100 days of commercial operation with a scram rate less than half the NUREG-1275 average, ESF rate less than one-fourth the average, and no TS violations or LSSFs. Effective senior management oversight, active day-to-day management involvement, and strong technical troubleshooting during the startup testing program were key factors in attaining a high level of performance.

In summary, the licensee demonstrated a high level of performance in the area of Preoperational and Startup Testing. A slow and deliberate approach to initial criticality was observed and initial low power physics testing was conducted in an almost error-free manner. A strong and effective interface was maintained between the licensed operators and the test crew. Both groups showed flexibility in cooperating with each other to acquire good test data while enhancing plant safety. First hand observations of control room performance following trips from power showed excellent operator initial response and subsequent licensee problem solving efforts.

2. Conclusion:

   Category 1

3. Board Recommendations:

   None

J. Training Programs

1. Analysis

A similar area, Training and Qualification Effectiveness, was assessed as Category 2 for Unit 1 last period. Training was considered as part of Operational Readiness for Unit 2 which was assessed as Category 2. Ample resources were observed to be devoted to training and effectiveness was noted to be good as evidenced by low incidence of personnel error. The performance of license candidates on Unit 1 during the last period was relatively poor declining from the previous assessment period as 9 of 16 SRO and 5 of 17 RO candidates failed various portions of NRC administered exams. Weakened program effectiveness was considered to be indicative of decreased management oversight. The high success rate of license candidates on Unit 2 with 16 of 19 passing NRC administered exams is in part due to significant prior operating experience.

During this assessment period, the performance of license candidates declined at both units as 5 of 6 SRO and 4 of 6 RO candidates failed various portions of NRC administered exams for Unit 1, and 5 of 19 SRO and 4 of 11 RO candidates failed various portions for Unit 2. The Unit 1 failures all involved requalification exams and led to the NRC evaluation that the requalification program was unsatisfactory. The Unit 2 decline in candidate performance was also substantial but was due, in part, to the unusually high level of previous licensed experience of the initial group of candidates with the recent performance approximating the industry average. The knowledge and use of normal and abnormal procedures was a generic weakness affecting candidates of both units. Additionally, numerous human factors deficiencies were identified in the Unit 1 emergency operating procedures as was a lack of quality assurance review. The decline in performance was indicative of poor management oversight of the training program and preoccupation with other issues such as dual licensing of operators and Unit 1 simulator adequacy for Unit 2. Evidence of increased senior management involvement was noted late in the period with the commitment to provide a new simulator specific to Unit 2 which should significantly enhance the quality of training available to Unit 2 operators. Similarly, the licensee is implementing commitments to revise the requalification program including learning objectives, lesson plans and examination development.

Training for maintenance personnel, emergency preparedness personnel, the security force, and engineers was good. Training in the area of radiation protection was also good but there is a need for additional emphasis on ALARA.

In summary, the significant weaknesses in the licensed operator training program noted during the period overshadowed the generally sound performance of other training activities and indicated a need for more senior management attention. These weaknesses, when viewed with weaknesses in knowledge and use of EOPs during examinations as well as the EOP procedural deficiencies and inconsistencies as discussed in the Engineering/Technical Support functional area, raise a concern regarding the support provided the operators to enable them to handle significant or unusual transients or events.

2. Conclusion:

Category 3, Improving.

3. Board Recommendations

Licensee:

Increase senior management attention to licensed operator training with particular emphasis on the requalification program.

NRC:

None

V. SUPPORTING DATA AND SUMMARIES

A. Enforcement Activity

Functional Area	No of Violations in Each Severity Level V	IV	III	II	I	Total
Unit 1						
Plant Operations		3				3
Radiological Controls		2				2
Maintenance		2				2
Surveillance			1			1
Emergency Preparedness						0
Security						0
Engineering/Technical Support		1				1
Safety Assessment/Quality Verification						0
Unit 1		8	1			9
Unit 2						
Plant Operations						0
Radiological Controls						0
Maintenance						0
Surveillance						0
Emergency Preparedness						0
Security						0
Engineering/Technical Support		3				3
Safety Assessment/Quality Verification	1					1
Unit 2 Total	1	3				4

Two enforcement conferences were held with the licensee at the NRC Region I Offices. On July 2, 1987, an enforcement conference was held regarding the inoperability of the Unit 1 chlorine detection system. The March 24, 1988, enforcement conference was in regard to defeated containment high-high pressure bistables at Unit 1. No civil penalties resulted from the associated violations.

B. Inspection Hour Summary

	Actual	Annualized Hours	Percent
Plant Operations	3388	2756	32
Radiological Controls	874	711	8
Maintenance	742	603	7
Surveillance	790	643	7
Emergency Preparedness	447	363	4
Security	433	352	4
Engineering/Technical Support	1065	866	10
Safety Assessment/Quality Verification	729	577	7
Preoperational & Startup Testing	2182	1775	21
	10650	8646	100

C. Licensee Event Report Causal Analysis

Functional Area	Number By Cause Code A	B	C	D	E	X	Total
Unit 1							
Plant Operations	2	2			2		6
Maintenance	1				3		4
Surveillance	2			8		1	11
Engineering/Technical Support		1			2*		3
Unit 1 Total	5	3	0	8	7	1	24

*LER 87-13 contained two related reportable events.

Functional Area	Number By Cause Code A	B	C	D	E	X	Total
Unit 2							
Plant Operations	1	3	2	1	1		8
Maintenance	4*				1		5
Surveillance	6			1			7
Engineering/Technical Support		2		1			3
Preoperational and Startup Testing	5	4		3	3*	2	17
Other	1				3		4
Unit 2 Total	17	9	2	6	8	2	44

*LER 87-12 contained two related reportable events.

Cause Codes:

		Combined Total	%
A	Personnel Error	22	32
B	Design, Manufacturing, Construction or Installation Error	12	18
C	External Cause	2	3
D	Defective Procedures	14	21
E	Component Failure	15	22
X	Other	3	4

The following common mode events were identified:

Approximately one-third of the events are attributable to personnel error; surveillance activities accounted for the greatest fraction (36%) of these events.

Licensee Event Report Causal Analysis (Continued)

While 12 events were attributed to design, manufacturizing, construction or installation errors, most were identified during pre operational and start-up test of Unit 2 as would be anticipated.

Inadequate procedures accounted for 14 events of which 9 were related to the surveillance program.