SYSTEMATIC ASSESSMENT OF LICENSEE PERFORMANCE (SALP)

PILGRIM NUCLEAR POWER STATION

REPORT NO. 50-293/93-99

I. BACKGROUND

The SALP Board convened on October 20, 1994, to assess the nuclear safety performance of the Pilgrim Nuclear Power Station for the period March 14, 1993, to October 8, 1994. The board was convened pursuant to U.S. Nuclear Regulatory Commission (NRC) Management Directive (MD) 8.6, "Systematic Assessment of Licensee Performance (SALP)" (see NRC Administrative Letter 93-02). Board members were James T. Wiggins (Board Chairman), Director, Division of Reactor Safety, NRC Region I (RI); Richard W. Cooper, II, Director, Division of Reactor Projects, NRC RI; Susan F. Shankman, Deputy Director, Division of Radiation Safety and Safeguards, NRC RI; and Walter R. Butler, Director, Project Directorate I-3, NRC Office of Nuclear Reactor Regulation. The board developed this assessment for approval by the Region I Administrator.

The following performance category ratings and the assessment functional areas are defined and described in NRC MD 8.6.

II. PERFORMANCE ANALYSIS - OPERATIONS

Operations was rated a category 1 in the previous SALP period. Performance was characterized by sound safety perspectives in operational decision-making, improved interdepartmental communications and support for plant operations, excellent response to events, command and control by operators, and outstanding operator training program performance.

Operations Section Management continued its strong control and oversight of plant operations during this assessment period. Operations managers maintained a frequent control room presence and made conservative decisions when challenged by equipment problems. For example, the licensee's decision to shut down in August 1993 to replace a failed potential transformer associated with the A5 safeguards bus was appropriate, considering that a hurricane was approaching. In a more recent case, the licensee conservatively chose to shut down the plant in April 1994 to investigate increased scram times identified during surveillance testing, even though the Technical Specifications scram time requirements were not exceeded.

Notwithstanding the strong performance of Operations Section Management, there were noteworthy examples early in the SALP period in which senior plant management did not support Operations with a vigorous safety focus. For example, in December 1993 senior plant management failed to recognize the significance of an event during a storm that caused a substantial decrease of water level in the east bays of the intake structure. Although the Operations Section responded well to the event and subsequently performed reviews of the event to assess its safety significance and potential lessons to be learned, senior plant management did not recognize the broader implications of the event and did not cause the event to undergo a rigorous review until those

implications were highlighted to them by the NRC. In another instance, the licensee developed a detailed technical plan to perform leak repair of an ASME Code Class 1 pressure boundary valve while at power, but senior plant management did not assure, as part of the pre-job planning, that the consequences of failures of the various repair options were considered and that mitigation strategies were developed and briefed.

Early in the assessment period, several events occurred that were indicative of inattention to detail on the part of the operators. For example, in November 1993 operators did not notice diverging water level indication between the safety-related channels and the non-safety related level control channel during initial pressurization while performing a reactor startup, causing a low reactor vessel level condition and a subcritical reactor protection system (RPS) actuation. Other examples included licensee personnel not noticing an engineered safety feature (ESF) actuation, failing to make a one-hour emergency notification to the NRC after discovering pressure boundary leakage, and inadvertently causing a Group 1 isolation to occur. However, significant performance improvement in this area was noted in the last half of the assessment period. For example, operators' increased attentiveness to plant conditions resulted in the identification of ice floats accumulating at the intake structure that were dissipated by the initiation of a main condenser backwash. In addition, Operations Section Management established a task force to review possible configuration control weaknesses after operators found a few valves mispositioned in systems that did not have a direct operational impact on the plant.

Operator response to plant transients and off-normal conditions during this assessment period was excellent. Nuclear Watch Engineers consistently demonstrated superior command and control of off-normal and routine conditions. For example, operators responded well to weather-related switchyard events during the assessment period, several recirculation pump trips, and the August 1994 load reject and trip. Likewise, a refueling bridge operator properly stopped activities when unable to degrapple a previously damaged fuel assembly while lowering it into a new storage location in the spent fuel pool. Thorough shift turnovers and pre-evolution briefs, formal communications between operators, and professional decorum in the control room contributed to safe plant operation.

The licensee's use of experienced, licensed operators in organizations throughout the plant continued to provide valuable operations perspectives that facilitated effective support of operations by other plant departments. The initial and requalification training programs for operators remained highly effective in maintaining the skills and abilities of the operators. Although not resulting in operator performance problems, management observation and evaluation of training and the resultant operator performance deficiencies observed during training were not well documented, which could potentially lead to a lack of thorough followup of deficiencies.

In summary, Operations exhibited strong performance during the latter half of the assessment period, recovering from an earlier performance decline that was accompanied by less vigorous senior plant management oversight and safety focus, and several events resulting from operators' inattention to detail.

Operations continued its strong performance in response to events and off-normal conditions, and exhibited strong command and control of plant operations. The highly effective operator training program and continued use of experienced operators in plant departments that support operations contributed to safe plant operation.

The Operations area is rated as **Category 1**.

III. PERFORMANCE ANALYSIS - MAINTENANCE

The Maintenance area was rated Category 2, in the last assessment, with an improving trend noted. Strengths included improved first-line supervision of maintenance activities, the use of multi-disciplinary teams (MDAT) to examine root causes of problems, an improved work planning process, and an effective surveillance program. Weaknesses included personnel errors that resulted in plant transients, procedural weaknesses, and weaknesses in post-maintenance testing.

This period, the overall quality of maintenance performance was good. Key maintenance successes included the repair of an unisolable socket weld leak on a reactor vessel drain line, the temporary leak repair of a valve located in the steam tunnel, a 4 kV potential transformer replacement, and feedwater heater repairs.

Maintenance management oversight and control of activities were generally strong throughout the period. Coordination and communications with the Operations and Engineering organizations were excellent. Planning and scheduling were well-controlled. Maintenance management controlled the backlog of corrective maintenance tasks well, contributing to an overall improvement in material condition and equipment reliability. Preventive maintenance was generally effective, however weaknesses were noted in the management controls over the use of the preventive maintenance deferral process. Late in the period, a noteworthy exception to this generally strong performance was shown by poor first-and second-line supervisory oversight of maintenance activities on the station blackout (SBO) diesel generator and emergency diesel generators that, if gone undetected, would have resulted in the diesel generators being unable to perform their intended safety function. Quality assurance/control activities also failed to avert these problems. Further, a series of component failures occurred during the period that resulted in either plant transients or forced power reductions and outages. Although each failure was effectively dealt with, the collective failures caused challenges to the plant operators. As of the end of the period, the licensee had recognized these problems and established a task force to review the failures but had not yet determined the broader root causes for the failure.

Work packages were generally complete and provided the needed direction to the craft in the field. Troubleshooting activities were well-controlled and were effective at diagnosis and correction of problems. Craft performance in the field was very good, however, problems in craft performance associated with the SBO diesel generator and previous reactor core isolation cooling (RCIC)

system control valve repairs indicated the need for further improvements. Similar to issues noted in the previous SALP, procedural problems adversely affected performance during this period; problems usually involved minor deficiencies in the procedures themselves and not with the failure to correctly implement the procedures. Examples of such problems included an inadequate surveillance procedure resulting in improper source range monitor trip settings, a weakness in the control rod drive system filling and venting procedure, a procedure deficiency that contributed to a pressure transmitter being valved out of service during a reactor startup, and the failure to revise a high pressure coolant injection (HPCI) system surveillance procedure to reflect a system modification.

Personnel engaged in maintenance activities displayed excellent knowledge and technical ability. However, personnel errors occasionally marred performance. For example, craftsmen errors contributed to the performance issues associated with the SBO diesel repairs, scram time testing errors, and local power range monitor (LPRM) maintenance errors. The LPRM problems also involved an isolated breakdown in the control of contractor-performed work.

The inservice inspection and testing programs contributed to the safe operations of the facility. In addition, the programs for check valve and snubber testing and maintenance were generally strong. The program for foreign material exclusion, implemented on the refueling floor, was also very good. Further, during this period, post-maintenance testing was effective and identified problems with maintenance activities prior to the associated equipment being returned to service with one notable exception being the SBO diesel generator.

In summary, maintenance management's oversight and control of activities were generally strong and effective. Maintenance activities contributed favorably to improved material conditions in the plant and equipment reliability. However, despite these improvements, we noted that a relatively high incidence of component failures challenged the operators throughout the period. The licensee recognized this issue and established a task force to review maintenance performance. Craft performance was generally very good. However, craft and management control shortcomings that occurred late in the period, led to poor performance during diesel generator maintenance activities. Further, continuing procedural problems also detracted from the otherwise very good performance in the maintenance area.

The Maintenance area is rated as **Category 2**.

IV. PERFORMANCE ANALYSIS - ENGINEERING

The Engineering area was rated Category 2, improving in the last SALP evaluation. The engineering staff had strong technical backgrounds and were routinely provided relevant training. The Nuclear Engineering Department (NED) process for making design changes to plant safety-related systems remained effective and resulted in high quality plant design changes. The management attention to the backlog of pending engineering work continued throughout the assessment period and the backlog at the end of the assessment

period was within established goals. NED's support of plant requirements on a day-to-day basis was excellent. The system engineers and the technical support organizations were effective in addressing both planned and emergent issues. However, a weakness in engineering calculations for motor-operated valves was identified which required additional attention.

During the current assessment period, NED continued to exhibit excellent management support and oversight in engineering design and technical evaluations. This was exhibited through the successful completion of a number of major plant modifications including the service water system pipe replacement; the self initiated fatigue study of primary system components; and the testing and installation of the reactor vessel water level instrumentation reference leg fill subsystem. NED provided for comprehensive analysis of technical requirements, for detailed planning and for well controlled implementation and post installation test plans for the modifications.

During this assessment period, the licensee formalized and began implementation of the switchyard betterment program to enhance switchyard performance during severe weather conditions. The switchyard betterment program includes replacing the 345 kV circuit breakers with modern dead tank breakers, some insulator replacements, and recoating of others with Silguard at more frequent intervals. The projected completion of the betterment program is late 1995. The engineering organization provided high quality technical support and completed the engineering for the switchyard betterment program in an expeditious manner.

The engineering department's use of multi-disciplined analysis teams (MDAT) has been successful in resolving a number of complex operational problems. MDAT efforts that were particularly noteworthy were associated with reviews of degraded scram time testing results and recurring recirculation pump trips. Sound technical judgement and an appropriate safety perspective were reflected in the determination to shut down the reactor following an inspection of a sample of scram solenoid pilot valve diaphragms that exhibited accelerated degradation.

The motor-operated valve (MOV) program has improved substantially during the rating period. Maintenance activities to resolve MOV generic issues, design changes and performance testing were effectively integrated through close cooperation between design engineers and the scheduling group.

The Engineering Department's self-assessment and the oversight provided by the Nuclear Safety Review and Audit Committee (NSRAC), the Design Review Board (DRB) and the Onsite Review Committee (ORC) have been effective in assuring comprehensive evaluations and high quality work products. Licensee event reports (LER) remain excellent and include detailed documentation of root cause evaluations and corrective actions. The root cause analysis to determine the trip concerns on HPCI/RCIC inverters performed by the licensee's engineering staff was thorough and comprehensive.

Engineering relocated its support activities to the site from Braintree, Massachusetts, in December 1993. The move was well managed and avoided potential adverse impacts on quality or timeliness of the work products. Engineering continued to show significant strength in coordination, communication and integration of their activities with the Operations and Maintenance Departments. The licensing action submittals were thorough and conclusions were based on sound technical evaluations.

During the SALP period, some isolated areas of weakness were noted. For example, when the reactor vessel water level instrument modification was installed, that modification did not address similar level indication problems in the non-safety level instrument reference legs, which are typically used for indication during routine operations. Further, Engineering did not ensure that the reference legs would be back-filled before return to service. This oversight combined with operator error caused a low vessel level reactor scram from a subcritical condition during a plant startup. Further, configuration control was not always effective as indicated by incorrect circuit breaker setpoints associated with regulating transformers installed during a modification.

In summary, performance in the engineering area continued to improve throughout the assessment period. The major challenges during the period included the service water pipe replacement activity, the fatigue study of the primary system components, the instrumentation modification to the reactor vessel water level, the switchyard betterment program, and a number of complex operational problems requiring engineering support. The management support and oversight throughout these challenging activities were notable strengths. Some isolated areas of weaknesses relating to inadequate attention to detail were observed during the period.

The Engineering area is rated as **Category 1**.

V. PERFORMANCE ANALYSIS - PLANT SUPPORT

This is a new functional area, representing a significant change from the previous SALPs. The plant support functional area covers all activities related to plant support functions, including radiological controls, emergency preparedness, security, chemistry, fire protection, and housekeeping.

In the previous SALP period, the radiological controls, emergency preparedness and security functional areas for Pilgrim were rated Category 1. Performance in the radiation protection area reflected improvements observed in many aspects of the radiological controls program that resulted in a high level of performance. Station personnel exposures continued to decrease, and radioactive effluent and environmental monitoring programs were assessed as excellent. The radioactive waste and transportation programs demonstrated continued strong performance. The emergency preparedness program was assessed as excellent with strengths in training, management, and auditing. The long term effects of a recent station reorganization were yet to be assessed. Security was assessed as excellent with notable strengths in management support for improvements, training, liaison with law enforcement agencies and effective program and contractor oversight.

During this assessment period, the radiation protection program continued to be effective. Radiological work coverage and housekeeping were generally very good. Audits and surveillances of the radiation protection area were effective in identifying performance problems. The implementation of the revised 10 CFR 20 regulations was successfully accomplished through appropriate program changes and through an effective training program. The radioactive waste handling, processing, packaging, storage, and transportation programs continued to be very good. The spent fuel pool clean-up was a good initiative that was well executed and a significant volume of radioactive material was removed from the site and shipped for disposal.

During the SALP period, the NRC identified several areas where enhancement opportunities existed regarding the implementation of the licensee's "as low as is reasonably achievable" (ALARA) program. Although the exposure reduction program was broad based and achieved some good results and the overall radiation exposure ALARA tracking was very good, the ALARA program was not always well focused. Areas for improvement were noted that included shielding and scaffolding design and radiological postings. For example, the "B" residual heat removal (RHR) system Quad work area was only partially shielded during the 1994 mid-cycle outage (an issue identified by the licensee during the 1993 refueling outage) and one-third of the job-in-progress ALARA reviews reported that the ALARA requirements had not been completely incorporated. Another area for enhancement identified early in the SALP period was the thoroughness of root cause analyses for radiological problem reports. The licensee recognized the need for improvement and was developing a procedure to ensure sufficient root cause analyses and associated corrective actions were provided during problem resolution involving unplanned radiation exposures. Finally, problems were noted with radiation worker compliance with the requirements of radiation work permits, early in the SALP period during the refueling outage, despite the fact that radiation protection personnel generally performed well during the outage.

Performance in the radiological environmental monitoring (REMP) and effluent control programs continued to be a strength. Chemistry personnel were especially knowledgeable and kept abreast of current industry practices to improve radiological effluent control. The licensee maintained an excellent quality assurance/quality control program to assure the validity of the analytical measurements for the REMP samples and environmental thermoluminescent dosimeters (TLD) measurements. A highly effective radiological environmental monitoring program continued to be implemented.

The emergency preparedness (EP) program continued to be well managed and effectively implemented even with major changes to the EP staff. The emergency response organization maintained sufficient qualified personnel for all but a few minor positions, generally meeting the goal of having several layers of back-up support. A new dose projection program that allows dose projections for releases from plant areas other than the plant stack release point was instituted. The Alternate Emergency Operations Facility and the Joint Public Information Center were relocated to improve the performance of the facilities. Extensive assistance was provided to the Commonwealth of Massachusetts to locate and establish a replacement reception center for the one in Wellesley. The full participation exercise conducted in December 1993,

demonstrated that the licensee's onsite emergency plan and procedures were adequate and that the plant staff was capable of implementing them. Further, the exercise scenario was challenging and involved venting the containment to prevent its failure, thereby mitigating the consequences of the simulated accident. However, two weaknesses were identified: (1) problems with the management of the emergency repair teams dispatched from the Operations Support Center and (2) problems between the Technical Support Center (TSC) and the Emergency Operations Facility (EOF) in communicating ongoing plant conditions for accident assessment.

The security program continued to be highly effective and well managed. Management attention and involvement continued at a high level, as evidenced by further program enhancements. Upgrades included construction of a new and enhanced access control point, procurement of a new security computer system, installation of an enhanced fire arms training system, and establishment of a new source of power. The licensee also continued a good performance-oriented training and qualification program. Additionally, the system for tracking fitness-for-duty information is especially notable. Preparations for an impending strike, late in the SALP period, demonstrated the licensee's ability to maintain excellent site security. However, some minor security program implementation problems were noted. Specifically, a preventive maintenance backlog of up to seven weeks existed for certain security equipment, vehicles designated for protected area use were improperly parked outside of the protected area, and an uncalibrated meter was used to conduct weekly and bi-monthly lighting surveys.

The fire-protection and prevention program was, in general, effectively implemented. A previously identified problem was corrected by completing fire proofing of the reactor building structural steel and installing the diesel fire pump day tank sight glass modification. Fire-fighting equipment was well maintained and tested, and combustibles and ignition sources were generally well controlled. However, instances were observed in which fire doors had been blocked open without the required compensatory fire watches and a vehicle was parked in the reactor building trucklock without the required fire watch. Except for these instances and an occasion when discarded protective clothing and maintenance material were not properly controlled, housekeeping was generally effective.

In summary, the plant support functions contributed very effectively to safe plant performance. Performance in the radiological controls area continued to be good with some areas for enhancement, particularly regarding the ALARA program. Excellent performance in the radiological effluent and environmental monitoring programs was again noted. There was continued excellent performance in the emergency preparedness program; however, two exercise weaknesses were noted during the full performance exercise. Security program performance continued to be outstanding. Fire-protection program implementation was effective.

The plant support functional area is rated as **Category 1**.