BRAIDWOOD SALP 13

Report No. 50-456/457/95001

I. INTRODUCTION

The Systematic Assessment of Licensee Performance (SALP) process is used to develop the Nuclear Regulatory Commission's (NRC) conclusions regarding a licensee's safety performance. Four functional areas are assessed: Plant Operations, Maintenance, Engineering, and Plant Support. The SALP report documents the NRC's observations and insights on a licensee's performance and communicates the results to the licensee and the public. It provides a vehicle for clear communication with licensee management that focuses on plant performance relative to safety risk perspectives. The NRC utilizes SALP results when allocating NRC inspection resources at licensee facilities.

This report is the NRC's assessment of the safety performance at Braidwood for the period February 20, 1994, through September 30, 1995.

An NRC SALP Board, composed of the individuals listed below, met on October 11, 1995, to assess performance in accordance with the guidance in NRC Management Directive 8.6, "Systematic Assessment of Licensee Performance."

Board Chairperson

W. L. Axelson, Director, Division of Reactors Projects, RIII

Board Members

R. A. Capra, Director, Project Directorate, III-2, NRR
G. E. Grant, Director, Division of Reactor Safety, RIII

II. PERFORMANCE ANALYSIS

A. Plant Operations

Performance in operations during the assessment period was cyclical, but declined overall. Performance was characterized by an excellent response to plant transients, generally good management involvement, and a good safety focus. However, the failure on the part of licensed and non-licensed operators to identify some degrading material condition problems and consistently demonstrate a questioning attitude, occasions of noncompliance with procedures, lapses in control room shift teamwork, and toleration of inadequate procedures demonstrated weaknesses in day-to-day operations.

A good focus on safety was normally demonstrated. For example, following a reactor trip as a result of an inadvertent closure of all main steam isolation valves (MSIVs), operations department response to concerns that a steam generator safety valve may have lifted prematurely was conservative and demonstrated an excellent focus on safety. However, late in the assessment period, a decision to cooldown the reactor without considering the effects on shutdown margin was contrary to expected operator performance.

Operator performance during transients such as a feedwater pump controller failure and an inadvertent closure of all MSIVs was excellent, but during routine operations, performance was occasionally weak. For example, due to lapses in crew teamwork and other distractions, operators on two occasions, failed to comply with technical specification action requirements for a failed radiation monitor. On another occasion, the failure of the operators to understand and control main steam isolation valve testing resulted in two of the four valves being rendered inoperable.

Management involvement in plant operations was good overall. Operations management appropriately assessed a reactor coolant bypass valve leak and a stuck control rod and developed effective response plans to address these events. In addition, significant management involvement was noted in the area of simulator training that contributed to the excellent operator response to plant transients observed during the period. However, some weaknesses were noted also. For example, management failed to adequately specify and communicate performance standards to operations personnel with respect to problem identification. As a result, operators did not consistently identify degraded plant equipment and other material condition problems during their day-to-day activities.

The operations plant staff was not always aggressive in identification and resolution of issues because of a lack of a questioning attitude by operators, a tolerance for degraded conditions, and a generally high threshold for identifying concerns. For example, operators did not recognize that the installation of a temporary fan for a failed safety-related battery exhaust fan did not meet design requirements, nor that an emergency diesel generator (EDG) jacket water leak had the potential to effect EDG operability. Also, operators did not realize that safety-related coolers were becoming fouled when cooling water throttle valves were continually being opened to achieve proper flow. Finally, hydrogen monitor lines were not reconnected following testing that resulted in a containment bypass release path. These three examples were missed opportunities to identify issues before they became operational safety problems.

Programs and procedures were generally effective; however, several inadequate procedures led to workarounds and operational problems. For example, due to an inadequate control rod surveillance procedure, operators were unaware of technical specification requirements to open reactor trip breakers if more than one control rod groups withdrew during the test. A cumbersome procedure change process, which has been recently improved, sometimes caused difficulty in revising procedures and contributed to recurrent problems with inadequate procedures.

The Plant Operations area was rated Category 2.

B. Maintenance

Overall performance in the maintenance area declined relative to the last assessment period. The majority of maintenance programs were fundamentally sound and implemented properly. In addition, most work activities were performed effectively and demonstrated appropriate safety focus and management

involvement. However, several weaknesses were observed in problem identification standards, self-assessment, procedural quality and adherence, craft capability, and in the consistency of work quality. These factors contributed to a decline in material condition of the plant.

Appropriate safety focus was demonstrated during the majority of maintenance work activities and in the implementation of programs to manage shutdown risk and on-line maintenance. Although some weaknesses were noted with the on-line maintenance program, its implementation demonstrated management's sensitivity to the risks associated with performing maintenance on-line. On occasion, management was insensitive to certain conditions and actions which could have impacted plant safety. This was demonstrated by setting a low priority for the repair of a battery room exhaust fan.

Good management involvement was shown in the effective implementation of most maintenance and surveillance activities. However, management did not set high standards for material condition of the plant, create a working environment which fostered aggressive and proactive problem identification, or respond appropriately to Site Quality Verification (SQV) Department findings. In recognition of these weaknesses, management initiated a comprehensive material condition improvement program, however, because of its recent implementation, program effectiveness could not be assessed.

Maintenance Department management and personnel did not consistently demonstrate attention to identifying and resolving programmatic problems and equipment deficiencies. Some weaknesses were identified in the use of the problem identification system and self-assessments were not totally effective in assisting in the identification and resolution of problems. In spite of these weaknesses, an aggressive approach to problem identification and resolution was demonstrated on a variety of complex issues.

Maintenance programs were appropriately managed and effectively implemented. However, some weaknesses were identified in the implementation of the foreign material exclusion (FME) control program. For example, in December 1994 poor implementation of the FME program led to extensive damage to a condensate booster pump. In May 1995, a near miss event associated with a component cooling water pump demonstrated that effective corrective action had not been taken to address all aspects of FME control. Some deficiencies were also identified in the quality of maintenance procedures, work instructions and in the area of procedural adherence by maintenance personnel.

Safety and nonsafety-related equipment were generally available and operated reliably; however, material condition gradually degraded during the assessment period and resulted in some plant transients and forced shutdowns. For example in April 1995, the failure of a capacitor in an inverter firing card, which was a known problem, resulted in a Unit 1 reactor trip and forced shutdown. Excessive leakage from a reactor coolant system bypass valve that was incorrectly repacked also led to a forced shutdown. Other examples of the degradation in material condition were evidenced by: safety-related and nonsafety-related heat exchanger fouling, poor availability of the

hypochlorite system, seal leakage from nearly all safety-related pumps, inability to isolate the essential service water (SX) system, and auxiliary building ventilation system exhaust fan failures.

In general, work control planning and scheduling was good; however, several problems occurred in work execution primarily due to weaknesses in interdepartmental communications. Examples included an excursion above 100 percent power due to troubleshooting efforts going beyond the actions discussed with operations and failure to enter a limiting condition for operation when a chemical volume control system snubber was removed during work on a containment spray valve.

Overall, the majority of the repair work was done effectively. This was demonstrated by excellent performance during: troubleshooting and repair efforts associated with a rod control system malfunction, troubleshooting of failed circuit cards in the 2B feedwater pump, repair of a control room ventilation chiller essential service water system isolation valve, and planning and maintenance associated with the 2B emergency diesel generator master connecting rod failure. However, on some occasions, inattention to detail, failure to follow procedures, and craft personnel's lack of training and experience resulted in poor work quality. Craft skill deficiencies were exemplified by improper packing of a reactor coolant system loop bypass isolation valve, inoperability of the 2B residual heat removal pump room cooler, and incorrect installation of an essential service water lube oil cooler gasket.

The Maintenance area was rated Category 2.

Engineering

Overall performance in the Engineering area was good. Closer management attention could have avoided the development of some significant weaknesses. While the results observed in special engineering activities were usually indicative of proper management attention, day-to-day engineering activities often lacked sufficient attention and consequently exhibited a number of weaknesses. Among these weaknesses were acceptance of degrading plant conditions and a lack of rigor in engineering analyses which resulted in weak operability determinations. These weaknesses contributed in part to the general decline in plant material condition. While some equipment improvements were noted, overall engineering support was not fully effective in addressing material condition issues.

Additional management oversight and emphasis is needed to improve the quality and effectiveness in several areas. Performance on high visibility issues and programs, such as event analysis and motor-operated and check valve testing, was good. The engineering effort on the station auxiliary transformers was technically rigorous with good operability determinations performed. However, engineering was not effective in identifying and resolving many long-standing material condition problems. Numerous material condition problems were noted throughout the plant; many of these had existed for a long time, but resolution efforts were flawed, resulting in recurring problems. For example, the engineering staff, until recently, failed to recognize that incorrectly

sized gaskets on the condensate booster pumps contributed to the continuing leakage problems. Some issues appeared to have been known by cognizant system engineers but were not formally identified.

A major challenge to the engineering staff was addressing steam generator tube degradation issues and the development of a new alternate repair criteria. Significant management involvement in this activity was evident; however, considerable guidance was necessary from the NRC staff before all the engineering issues were effectively addressed. The licensee's performance in this area could have been improved through more thorough engineering evaluation prior to submittal to the NRC and greater oversight of contractor activities.

In some cases, the quality of engineering effort indicated a lack of a full understanding of the design basis, a continuing problem that was discussed during the previous SALP cycle. On occasion, key plant personnel were unaware of the safety function of support equipment. Day-to-day engineering performance, such as identifying material condition problems, making operability determinations, and controlling plant configuration and testing, was occasionally weak. The lack of a questioning attitude and a lack of rigor contributed to the failure to improve in this functional area during this SALP cycle. This was demonstrated by engineering personnel failing to identify recurring water hammers in the service water line to the EDG, even though there were audible and visible indications whenever the EDG was started.

Temporary alterations were sometimes used to circumvent a slow and cumbersome modification process. System engineers and operators made some unauthorized changes to the plant's configuration without considering the effect on plant design or safety consequences. Some engineering evaluations to support operability determinations were weak, lacked rigor, and were not thoroughly reviewed. In one case, the results of a computer program used to predict heat exchanger performance went unquestioned even though significant data scatter and questionable results were obtained.

Licensing submittals were generally of high quality and contained detailed analysis. An example of this was the control room ventilation chiller amendment. Good safety evaluations and calculations were performed to support formal design modifications, such as the RTD bypass removal and the safety-related battery replacement.

The Engineering area was rated Category 2.

D. Plant Support

Overall plant support was excellent with continued improvements noted in Radiation Protection (RP), Chemistry and Security. Management provided strong support toward maintaining excellent RP and Chemistry programs, maintaining low source term, low station dose, and excellent chemistry analytical capabilities. Performance in Emergency Planning (EP) indicated management support and training. Facilities and equipment were maintained in excellent condition. Security performance showed improvement during the latter part of

the assessment period as a result of enhanced program management and increased emphasis on communications and teamwork. Fire protection was adequate; however, continued problems were noted in the control of combustible material.

The radiation protection program continued to be well implemented with improvements noted during the latter part of the assessment period. Management oversight of the radiological controls was strong resulting in low station dose, low source term, continued decrease in the amount of contaminated areas in the plant, and continued excellent ALARA planning and implementation. Problems with contamination control were identified early in the assessment period and resulted in an aggressive effort to identify contaminated items inside and outside the Radiation Protected Area (RPA). Corrective actions to date have been effective in preventing recurrence.

Chemistry management performance improved during the assessment period. Laboratory analytical performance was excellent as evidenced by results of the NRC analytical and radiochemistry comparison programs. Management's commitment to maintaining secondary system performance was evidenced by maintaining very good water quality and by implementation of recent industry innovations for lengthening steam generator life. The self-assessment program was very effective at problem identification and resolution followup. The quality verification group was technically competent and performed very well in the followup of resolving quality assurance problems with the in-line chemistry monitors. The radiological environmental monitoring program was well managed; vendor oversight was strong and effective.

Security performance was good. Performance improved during the second half of the assessment period as a result of management achievements in improving open communication, teamwork, professionalism and personnel initiative to improve performance. Management overcame weak program performance early in the assessment period that was illustrated by lack of attention to details in the staff's performance, the failure to fill some key management positions in a timely manner, and slow progress in the development of definitive strategies with operations.

Performance in the Emergency Preparedness (EP) area was good and there were indications of improving trends. Increased management attention and support for the program was demonstrated by emergency facilities, equipment, and supplies being in an excellent state of operational preparedness. EP training shows indications of improving trends in formal training, critiques and written exams for all EP training. The Corporate Emergency Preparedness Peer Review, provided good recommendations to the station EP program. EP exercise overall performance during this assessment period was good in both the 1994 and 1995 drills.

The fire protection program was adequate to achieve safety objectives. However, a longstanding engineering problem, identified in the previous SALP, with auxiliary building ventilation had not yet been resolved. The control of unattended combustibles in the auxiliary and turbine buildings continued to be a weakness that was noted in the previous assessment period.

The Plant Support area was rated Category 1.