BRAIDWOOD STATION

SALP 14

Report No. 50-456/97001; 50-457/97001

## 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 the Braidwood Station for the SALP 14 period from October 1, 1995, through August 30, 1997.

An NRC SALP Board, composed of the individuals listed below, met on September 10, 1997, to review the observations and data on performance and to assess performance in accordance with the guidance in NRC Management Directive 8.6, "Systematic Assessment of Licensee Performance."

Board Chairman

J. A. Grobe, Acting Director, Division of Reactor Safety, RIII

Board Members

M. L. Dapas, Acting Deputy Director, Division of Reactor Projects, RIII
T. J. Kozak, Acting Deputy Director, Division of Nuclear Materials Safety, RIII
R. A. Capra, Director, Project Directorate III-2, NRR

## II. PERFORMANCE ANALYSIS

### A. Plant Operations

Performance in the plant operations functional area improved during the assessment period primarily in the areas of conduct of operations and response to non-routine events. Close management involvement contributed to effective planning and coordination of work activities and improved oversight of infrequently performed evolutions. However, problems with configuration control need continued management attention.

Improvements in the conduct of normal operations were noted in communications, control room access control, and reactivity management during the assessment period. Management implemented three-way communication and other error reduction techniques which were routinely practiced by operators. The designated pre-shift briefing room had a sound system

added to enhance communications which contributed to the overall improvement in shift turnovers. In response to concerns with operator panel attentiveness, management clarified expectations regarding panel walkdowns. Administrative tasks and other distracting activities were eliminated from the control room by moving maintenance and out-of-service activities to a work control center. All of these actions contributed to a reduction in human performance errors in the control room. Early in the assessment period, two reactivity events occurred. These two events, combined with a more serious reactivity event at another ComEd station, prompted management to provide additional reactivity control training to operators, conduct frequent evaluations of operator performance during reactivity manipulations, and increase the supervision of evolutions involving reactivity changes. These corrective actions were effective in increasing operator sensitivity to the importance of reactivity management.

The conduct of operations in response to non-routine events was excellent. During the assessment period operators were challenged by a loss of offsite power on Unit 2, a 40 percent load rejection on Unit 1, and two loss of feed water pump events on Unit 2. Prompt actions by operators, combined with the improved material condition of plant equipment, resulted in continued safe operation of the plant.

The conduct of operations during outage periods also improved. Early in the assessment period, the inadvertent draining of 500 gallons of reactor coolant after a local leak rate test and the placement of an out-of-service on the wrong diesel generator were examples of outage evolutions that were not properly controlled. During the 1997 Unit 1 refueling outage, management augmented control room staffing with the addition of a senior reactor operator. This provided more direct supervision of infrequently performed evolutions. A second senior reactor operator was also assigned to assist the shift manager in handling outage related issues. Additionally, operators practiced infrequently performed evolutions, such as startups and shutdowns, on the simulator prior to actually conducting them in the plant. These corrective actions were effective in eliminating significant human performance errors during the Unit 1 refueling outage.

Early in the assessment period, configuration control and out-of-service errors were frequent. After the NRC proposed an escalated enforcement action, corrective actions taken by management in response to these errors were initially effective. However, near the end of the assessment period, some configuration control errors began to recur. For example, a fire protection sprinkler system for a safety-related transformer was inadvertently initiated during a surveillance test, spraying down the transformer; a safety-related containment spray system valve was found unlocked following maintenance; and a safety-related auxiliary feed water pump was inadvertently sprayed with boric acid during the draining of a boric acid storage tank. Continued management attention in this area is needed to ensure that the initial corrective actions remain effective.

With few exceptions, operations department personnel identified equipment problems in a timely manner. Operations management focused attention on degraded equipment by discussing problems daily with engineering and maintenance management at the Braidwood Station leadership meetings. These discussions involved identifying responsible organizations and individuals and establishing expected maintenance start and completion dates.

Self-assessments were thorough and self-critical. Bench marking trips to other utilities resulted in the implementation of the work control center and the scorecard system which provided for

supervisory review of various operating tasks with immediate feedback to the operators. The Independent Safety Engineering Group conducted operations assessments resulting in the identification of a number of issues. Another positive self-assessment initiative involved site vice presidents from other ComEd stations routinely observing control room activities and providing graded evaluations of operator performance.

The performance rating in Operations is Category 1.

B. Maintenance

Performance in the maintenance functional area was improved relative to the last SALP assessment. Sustained progress was made in several areas including: plant material condition, craft skill and supervision, conduct of surveillance testing activities, and self-assessment. However, continuing weaknesses were observed throughout the SALP period in the area of procedural adherence.

Deteriorating plant material condition was considered a weakness during the last assessment period. An NRC inspection early in this period identified that several hundred preventive maintenance items were overdue, rework was not being tracked, root causes for repetitive work were not being identified, and corrective maintenance backlogs were large and growing. Subsequently, significant management attention was focused on raising standards and improving material condition. Overdue preventative maintenance items were evaluated and either completed or rescheduled, as appropriate. Rework was tracked and root cause evaluations were initiated. Management successfully implemented a new work planning schedule and reclassified some work as minor maintenance, resulting in improved schedule adherence and a reduction in the corrective maintenance backlog by more than 50 percent. In addition to maintaining effective inservice inspection and motor-operated valve programs, longstanding equipment problems involving charging, essential service water, safety injection, condensate, condensate booster, and feed water pumps were addressed. Complicated repairs were also successfully completed on non-essential service water pump discharge check valves.

Early in the assessment period, a number of problems occurred during the conduct of maintenance activities due in large part to insufficient craft skill and supervision. For example, while removing a residual heat removal pump impeller, workers damaged the pump shaft and motor which led to the unscheduled replacement of these components. The ability to plan, conduct and complete maintenance activities improved over the course of the SALP period. On-line maintenance was scheduled for, and generally completed in, about half of the Technical Specification limiting condition for operation allowed outage time. Inspection and repair work on the Unit 1 system transformers, preparation for execution of repairs to the Unit 1 "C" loop reactor coolant cold leg stop valve, post-event response to the Unit 1 boric acid tank spill, and planning for and execution of the March 1997 Unit 1 refueling outage reflected careful planning and proper execution of maintenance activities.

Surveillance tests were generally well written and properly performed and adequately tested system design. However, the NRC identified some instances where Technical Specification requirements were not being complied with regarding the venting of the charging system discharge piping and pump casings and during check valve testing of the safety injection and charging systems.

While the majority of maintenance and surveillance activities were conducted well, the failure to adhere to procedural controls throughout the period resulted in a number of problems, including a misplaced fuel bundle in the spent fuel pool, inadequate foreign material exclusion control on an emergency diesel generator, and over-pressurization of an emergency diesel generator jacket water system.

In the previous assessment period, self-assessment activities were not fully effective in identifying and resolving problems in the maintenance area. While the station is still in the process of developing a formal process for performing self-assessments, some recent improvements were noted in this area. An assessment of maintenance activities performed by the Independent Safety Engineering Group was self-critical and thorough in identifying problems in the station's maintenance processes. Improvement in the effectiveness of recent departmental self-assessments was also observed.

The performance rating in Maintenance is Category 2.

C. Engineering

Performance in the engineering functional area was improved relative to the last SALP assessment. Although several weaknesses were observed during this assessment period, most occurred early in the period. Steady progress was made in several areas including day to day support to onsite organizations, resolution of equipment problems, support of major activities, and self-assessments. The engineering staff also developed an effective program for replacement of Unit 1 steam generators. However, continued inattention to detail resulted in some NRC violations and licensee event reports.

The engineering department provided excellent day-to-day support to operations, maintenance, and other onsite organizations. Active involvement by the engineering staff in resolving equipment problems resulted in improved material condition of the essential service water, condensate, and feedwater pumps. However, some weaknesses were identified. For example, check valve surveillance testing on the safety injection and centrifugal charging systems was poorly controlled by system engineers. Also, engineering personnel failed to perform an adequate review of ASME Code requirements and applicable Generic Letter guidance when the staff identified a through-wall flaw in the 1A essential service water system. Finally, engineering personnel failed to perform a required safety evaluation when the auxiliary building ventilation system was placed in an abnormal configuration.

Good engineering department support to operations resulted in the steady reduction of operator work-arounds, open operability assessments, temporary alterations and drawing change notices. A number of timely and well-written operability evaluations also reflected improvement in this area. However, a large backlog of engineering requests exists and continued to increase during most of the assessment period. In addition, although identification of material condition deficiencies during system walkdowns in frequently accessed areas was good, the identification of material condition problems in infrequently accessed areas was poor as demonstrated by a refueling water storage tank heater mounting deficiency not being identified for an extended period of time.

Engineering support of major activities was good. Plant and system design changes which were well thought out and implemented contributed to the improved material condition of

systems and components. The engineering department recently initiated a design review to verify that plant systems, components, and parameters meet the design basis. Engineering staff response to industry events was good, and an operating experience coordinator was assigned to monitor, track, and coordinate the distribution of industry experience data.

The engineering staff developed and implemented an effective program for replacement of the Unit 1 steam generators. The program included the use of a dedicated ComEd engineering team to provide oversight of several contractors and incorporated lessons learned from other steam generator replacement projects. In-house engineering and engineering staff oversight of the steam generator repair effort for the Westinghouse D-4 steam generators was good. The engineering staff also took a leadership role in developing and proposing a plan to safely operate the current steam generators until they are replaced.

Attention to detail problems detracted from the overall good performance observed with other aspects of engineering activities. For example, a modeling error in a vendor-performed criticality analysis and the inadequate review of the analysis' input assumptions resulted in the failure to detect deficiencies in the fuel pool criticality analysis. In addition, nuclear component transfer lists which were prepared using unverified and uncontrolled information led to fuel storage in an area of the fuel pool that was outside the criticality analysis. Also, an unrealistic and non-conservative flow resistance constant was used in the auxiliary feedwater flow calculation in the feed line break analysis. Several in-service inspection relief requests initially lacked sufficient technical bases for approval of the relief requests.

Self-assessments of engineering department activities provided a self-critical evaluation of the department's performance. The Independent Safety Engineering Group also provided assessments of the engineering department containing findings that were generally consistent with the engineering department's self-assessments. Through the self-assessment process, the system engineering staff identified drawing discrepancies in control room drawings that had existed since initial plant construction.

The performance rating in Engineering is Category 2.

D. Plant Support

Plant Support performance remained consistent with the Category 1 rating from the previous assessment period. Management involvement resulted in strong performance in the radiation protection, security, and emergency preparedness program areas. Good teamwork and effective communications with other plant organizations were also evident in these programs. However, some weaknesses in the fire protection area, which included problems with the adequacy of cable separation and with fire doors, were observed during this assessment period.

Radiation protection program performance continued to be strong. Radiological work planning and oversight were effective in reducing personnel exposures. The resistance temperature detection modification was well planned and controlled, resulting in low personnel dose and in a significant reduction in radiological source term. In addition, worker exposures were reduced through the use of a mock-up for the repair of the Unit 1 loop stop isolation valve. The radiation protection staff provided excellent support to station personnel and radiation worker practices were generally good. Decreases in the amount of contaminated area ensured

access to plant equipment was essentially unencumbered by radiological impediments. The radioactive material shipping and radiological environmental monitoring programs were well implemented.

The chemistry program continued to focus on maintaining plant water quality. Effective control of chemical intrusions and secondary system additives reduced the potential for system corrosion and decreased the radiological source term. The chemistry training program was interactive and thorough. Although the chemistry laboratory quality control program was acceptable, some problems were identified concerning the adequacy and the implementation of procedures. In addition, the material condition of the post accident sampling system was in need of improvement.

Security performance continued to be good. The security plan was effectively implemented and performance of the security force was good. Implementation of a hand geometry access control system, installation of a vehicle barrier system and a new security computer system enhanced security operations. Security management fostered good departmental communications and teamwork. Effective and critical self-assessments were performed by site quality verification and by the ComEd Nuclear Assistance Team. Problem identification and resolution of technical issues were strong as evidenced by the identification and assessment of a failure of the Biometrics access control system and by the investigation of an adverse trend in security force human performance. Although maintenance support was generally effective in ensuring operability of security equipment, the security staff was not aggressive in addressing maintenance needs for a security door and a perimeter alarm zone that required compensatory measures for several months. The security contingency response program was weak in the beginning of the assessment period but significant improvements occurred late in the assessment period during preparations for the Operational Safeguards Response Evaluation.

Performance in emergency preparedness was excellent. Emergency response facilities, equipment, and supplies were in excellent material condition. Management support was clearly a factor in the program's improvement over the assessment period. Training initiatives, such as unannounced emergency response table-top drills, improved the readiness of the emergency response organization, and emergency response personnel demonstrated a thorough knowledge of emergency implementing procedures and responsibilities. Overall performance during the 1996 emergency preparedness exercise was very good. The exercise was a successful demonstration of the licensee's capabilities to implement its emergency plans and procedures.

In the area of fire protection, some strengths were noted in the 10 CFR 50, Appendix R, Enhancement Plan, and the material condition of fire protection equipment was good. However, problems were identified by the licensee concerning the adequacy of cable separation and roll-up fire doors. As a result of these deficiencies, areas of the plant containing redundant, safe shutdown equipment were vulnerable to fires which could cause damage and impairment of the required equipment. In addition, corrective actions for degraded fire barriers and impairments were sometimes not timely, and some procedure adherence problems were evident.

The performance rating in Plant Support area is Category 1.

Excellent day-to-day support to operations, maintenance, and other onsite organizations was evident in the engineering area and was in part, responsible for the improved material condition of plant equipment. However, occasional errors due to inattention to detail detracted from the excellent day-to-day engineering support.

Performance improvements in the radiation protection, security, and emergency preparedness program areas resulted from strong management support. Initiatives in radiological work planning and training reduced personnel exposures, and strong teamwork and effective communications between the radiation protection staff and other organizations were evident. Emergency preparedness training initiatives, strong teamwork, and effective communications ensured the effectiveness of the emergency response organization. However, weaknesses in fire protection were observed during this assessment period. The most significant problems involved the adequacy of cable separation and fire doors problems that resulted in potential increases in equipment vulnerabilities.

In accordance with Section 2.790 of the NRC "Rules of Practice," Part 2, Title 10, Code of Federal Regulations, a copy of this letter and the SALP report will be placed in the NRC's Public Document Room.

Should you have any questions concerning the SALP Report, we would be pleased to discuss them with you. While no written response is required, you may provide written comments within 30 days of the SALP meeting.

Sincerely,

/s/A. Bill Beach

A. Bill Beach
Regional Administrator

Docket No. 50-456; 50-457

Enclosure: SALP 14 Report No. 50-456/97001; 50-457/970001

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