SALP 9

INITIAL SALP REPORT

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

SYSTEMATIC ASSESSMENT OF LICENSEE PERFORMANCE

Inspection Report No. 50-331/91001

Iowa Electric Light and Power Company

Duane Arnold Energy Center

January 1, 1990 - March 31, 1991

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I. INTRODUCTION

The Systematic Assessment of Licensee Performance (SALP) program is an integrated NRC staff effort to collect available observations and data on a periodic basis and to evaluate licensee performance on the basis of this information. The program is supplemental to normal regulatory processes used to ensure compliance with NRC rules and regulations. It is intended to be sufficiently diagnostic to provide a rational basis for allocating NRC resources and to provide meaningful feedback to the licensee's management regarding the NRC's assessment of the facility's performance in each functional area.

An NRC SALP Board, composed of the staff members listed below, met on May 16, 1991, to review the observations and data on performance, and to assess licensee performance in accordance with the guidance in NRC Manual Chapter 0516, "Systematic Assessment of Licensee Performance."

This report is the NRC's assessment of the licensee's safety performance at Duane Arnold Energy Center (DAEC) for the period January 1, 1990, through March 31, 1991.

The SALP Board for DAEC was composed of the following individuals:

Board Chairman

H. J. Miller, Director, Division of Reactor Safety (DRS)

Board Members

W. L. Forney, Deputy Director, Division of Reactor Projects (DRP)
J. N. Hannon, Project Directorate III-3, Office of Nuclear Reactor Regulations (NRR)
W. L. Axelson, Deputy Director, Division of Radiation Safety and Safeguards (DRSS)
R. C. Knop, Chief, Reactor Projects Branch 3, DRP
M. E. Parker, Senior Resident Inspector, DRP
S. P. Sands, Project Manager, NRR

Other Attendees at the SALP Board Meeting

A. B. Davis, Regional Administrator
T. O. Martin, Deputy Director, DRS
E. W. Brach, Chief, Performance and Quality Evaluation Branch (LPEB), NRR
C. A. Carpenter, Staff member, LPEB, NRR
R. L. Hague, Chief, Reactor Projects Section 3C, DRP
R. J. Caniano, Chief, Radiological Controls and Emergency Preparedness Section, DRSS
W. G. Snell, Chief, Nuclear Materials Safety Section 2, DRSS
T. J. Kozak, Radiation Specialist, DRSS
C. F. Gill, Senior Radiation Specialist, DRSS
M. A. Ring, Chief, Engineering Branch, DRS
J. M. Ulie, Reactor Inspector, DRS
J. R. Creed, Chief, Safeguards Section, DRSS
J. R. Kniceley, Security Inspector, DRSS

T. J. Ploski, Emergency Preparedness Specialist, DRSS
R. A. Westberg, Reactor Inspector, DRS
F. A. Maura, Reactor Inspector, DRS
C. Miller, Resident Inspector, DRP
J. W. McCormick-Barger, Project Engineer, DRP
D. Hartland, Reactor Engineer, DRP
M. L. McCormick-Barger, Technical Support Staff, DRP

II. SUMMARY OF RESULTS

A. Overview

During the SALP assessment period, licensee performance declined in several significant areas. The large number of operational events combined with poor performance during the 1991 refueling outage were the results of an understaffed engineering department and a failure of management in some cases to become adequately involved with plant activities. Many of the plant problems were associated with balance-of-plant (BOP) equipment that had not received the attention needed to ensure high reliability. Due to the large number of ongoing engineering activities and the low number of engineering staff, many engineering issues had not been adequately addressed, some of which were significant contributors to plant events and/or shutdowns.

The area of Operations was rated a Category 2. This was a decline from the Category 1 rating it received during the previous assessment period. The decline was primarily due to the nature and high number of operational events, some caused by configuration management controls, and the initial problems identified during requalification testing. However, operators' response to off-normal events continued to be excellent.

The areas of Radiological Controls and Security were rated Category 2 which were the same ratings that they had received during the previous assessment period.

The area of Maintenance/Surveillance also retained a performance rating of Category 2. Several weaknesses in this area were identified concerning failure to follow or correct procedures, personnel errors resulting in plant events, and poor performance of balance-of-plant equipment which also resulted in plant events.

The area of Engineering/Technical Support declined and received a Category 3 rating. This area had received a Category 2 rating during the previous assessment period. This decline was attributed in a great extent to a lack of engineering resources that could both support immediate operational needs and adequately address longer-term design and operational issues. Although existing engineering staff in general was viewed as highly experienced and technically competent, the low number of staff had resulted in many instances of untimely corrective actions, lack of adequate equipment trending, weak configuration control, untimely resolution of vendor recommendations, and other engineering and management related weaknesses. In addition, a lack of management oversight of activities associated with licensee commitments concerning RG 1.97 resulted in several important activities not being completely

implemented. The Board acknowledges the recent extensive efforts the licensee has taken to add new engineering staff to its organization and has recommended that it continues this effort and also increase managements involvement in an effort to improve the performance of its engineering organization.

The area of Safety Assessment/Quality Verification also declined during the period and was rated Category 3. This area was rated Category 2 during the previous assessment period. The Board concluded that licensing performance was poor. For example, Technical Specification (TS) changes tended to focus on operational flexibility rather than safety, the bases for interpretations of several TS requirements were not adequate and several licensing submittals were untimely. In addition, there were problems with control of outage contractor activities and engineering staffing. We consider weaknesses in management oversight of activities to be a significant contributor to the overall decline in performance in this functional area. The Board recommends that the licensee increase management's oversight of licensing and plant activities and take appropriate steps to assure that significant activities/programs identified in the Integrated Plan are performed on schedule. The Board acknowledges improvements in the effectiveness of the licensee's quality assurance organization as a result of moving the QA organization to the site and improvements in the content of its QA audits.

The functional area of Emergency Preparedness (EP) was rated a Category 1. This was an improvement from the Category 2 with an improving trend rating that it received during the previous assessment period. This functional area has continued to improve over the last two assessment periods and the licensee is now considered to have an excellent EP program.

The performance ratings during the previous assessment period and this assessment period according to functional areas are given below:

Functional Area	Rating Last Period	Rating This Period	Trend
Plant Operations	1	2	
Radiological Controls	2	2	
Maintenance/Surveillance	2	2	
Emergency Preparedness	2 I*	1	
Security	2	2	
Engineering/Technical Support	2	3	
Safety Assessment/Quality Verification	2	3	

*Emergency Preparedness was rated a Category 2 with an improving trend during the previous SALP 8 period.

B. Other Areas of Interest

None.

III. PERFORMANCE ANALYSIS

The total number of inspection hours expended during the assessment period was 6,121. This total does not include operator license examiner hours, NRC contractor hours, or hours expended by NRR staff. The inspection hours attributed to each functional area are presented in the following paragraphs.

A. Plant Operations

1. Analysis

Evaluation of this functional area was based on the results of 11 routine inspections and information from the Region III operator licensing section. There were 2077 hours expended in inspecting this functional area, comprising 34.0% of the total inspection hours.

Enforcement-related performance was fair but showed a decline over the previous period. Three Severity Level IV violations were identified. All of the violations involved the licensee's failure to comply with technical specifications and procedures. In one case, during single-loop operation, the reactor was operated in an area of the power to flow map prohibited by technical specifications, and in another case, the licensee failed to properly isolate a containment penetration when the containment isolation valve became inoperable.

The number of operational events experienced indicated a decline in performance since the previous period. Five automatic scrams (four at greater than 15% power) and three manual scrams occurred as a result of equipment problems and personnel error. In addition, two unplanned outages and five reactor scrams with no rod motion occurred and will be discussed as appropriate throughout this report. The overall contributor to these ten shutdowns included continuing equipment problems and personnel errors in the BOP areas.

The nature and increased number of licensee event reports (LERs) indicated a negative performance trend. Of the LERs that were issued, five were directly attributable to plant operations, again indicating an increase over the previous period. Two reactor scrams (one with no rod movement) were a result of personnel errors. The other three events resulted in two engineered safety feature (ESF) actuations and an excessive plant heatup (greater than 100°F/hr), which were a result of personnel and procedure errors.

The licensee operators' response to the off-normal events continued to be excellent. During off-normal events, the plant operators demonstrated good plant knowledge by initiating corrective or otherwise appropriate measures in a timely and appropriate manner. This knowledge was demonstrated by licensed operators when they initiated three manual scrams in response to equipment problems (two instances of complete and a partial loss of instrument air and an

excessive steam leak in the steam tunnel). While inspectors noted some problems with control of the heatup rate during startup and tagging errors that caused a reactor scram, overall, licensed operators performance was excellent during off-normal plant transients.

Management involvement and control to ensure quality in the area of plant operations was mixed. At times a very conservative approach to plant operations was taken. Examples included controlling rod movement by using a second licensed operator and by enforcing rod worth minimizer (RWM) restraints for all rod movements. Reactor water chemistry, hydrogen water chemistry, all barrier fuel, and maintenance of reduced fuel preconditioning limits contributed to the plant's operating without fuel cladding defects. The licensee was moderately successful in maintaining a "blackboard" concept for the front panel annunciators in the control room. However, progress in maintaining this concept on the back panels was limited, and the licensee is planning additional improvements. Operator involvement in the detailed control room design review (DCRDR) program led to a highly successful program. Despite a generally conservative approach to plant operations, management decisions to reduce the overall scope of the refueling outage to control outage length contributed to two unplanned outages, including a reactor scram. Also, a decision to continue plant operation after identifying a steam leak subsequently resulted in a forced shutdown.

The licensee's approach to identifying and resolving technical issues from a safety standpoint was adequate. The licensee continued to make extensive use of the site-specific simulator and fully integrated it into the training program. The simulator was utilized on several occasions to assess operational events and plant conditions (i.e., three main steam line operation, high-pressure coolant injection (HPCI) level control, DCRDR modifications, and scram followup). However, inspectors noted several instances in which interpretation of technical specifications provided inadequate operational guidance (e.g. fire protection, source range monitors, and containment isolation valves), that resulted in the licensee's extensive dialogue with the NRC to obtain an adequate resolution. Also during this SALP period, configuration management controls were brought into question in that use of inadequate plant procedures, drawings, and labeling contributed to several events, including four reactor scrams. Licensee management involvement was not fully effective in ensuring that these key operator tools and guidance on technical specifications were maintained to support plant operational needs.

Plant housekeeping and control of combustible material were generally good. However, instances of minor breakdowns occurred, such as during the refueling outage when work stoppage was necessary in the drywell to improve housekeeping. Another instance was the lack of control of combustibles during welding and cutting operations for which NRC issued a violation. The licensee took significant steps both before and following the refueling outage to improve overall plant conditions. The licensee undertook a project to recover the torus area room, thus reducing a significant portion of the overall contaminated areas of the plant. This action had resulted in a significant improvement to the overall plant because of improvements in labeling, lighting, and painting.

Staffing in the area of plant operations was generally good. The licensee adequately met its long-term shift staffing needs and increased the staff when three reactor operator candidates and three senior reactor operator candidates passed their initial licensing examinations. One significant staffing improvement occurred late in the assessment period when the licensee announced that it had assigned two permanent assistant operations supervisors. One of these positions had been detailed as a temporary acting position for the previous 5 years, and the other had been vacant for the previous 5 months. Several management changes also occurred at the end of the assessment period, including assignment of a new plant superintendent, an outage manager, and a radiation protection manager. The licensee continued to rotate licensed senior reactor operators in various positions of the plant (maintenance, quality assurance (QA), and licensing) in order to assist other departments and to provide an operations perspective to these departments.

The effectiveness of the licensee's initial operator training was acceptable; however, the effectiveness of the continuing training (requalification) program declined. Three Senior Reactor Operators (SROs) and four Reactor Operators (ROs) candidates took an initial licensing examination. All candidates passed the operating portion, but one RO failed the written portion of the examination. In June 1990, the operator requalification program was assigned an overall rating of unsatisfactory because greater than one-third of the examined crews were evaluated as unsatisfactory; three of four crews (two operating, one staff) failed the dynamic simulator portion. The overall pass rate for individuals examined was 75%. Weaknesses existed in the operating crews' knowledge and abilities to use emergency operating procedures (EOPs). Because the plant was already shut down for refueling, an operational evaluation was delayed to allow for remedial training of all operating crews. An operational evaluation of the remaining plant operating crews, and a re-examination of the previously failed crews and individuals were conducted in August 1990. The NRC determined that all three remaining operational crews performed satisfactorily in the dynamic simulator portion. Individually, six SROs and five ROs passed the entire examination, and one RO failed the dynamic simulator portion. All of the previously failed crews and individuals subsequently passed the re-examination.

2. Performance Rating

The licensee's performance is rated Category 2 in this area. The licensee's performance was rated Category 1 in the previous assessment period.

3. Recommendations

None.

B. Radiological Controls

1. Analysis

Evaluation of this functional area was based on the results of five inspections. There were 254 inspection hours expended in this functional area, comprising 4.1% of the total inspection hours.

Enforcement-related performance was adequate except for circumstances surrounding failures to make adequate radiation surveys before, during, and after removal of incore radiation detectors from the reactor vessel and failure to have required procedural control of the removal activities. Although inspectors identified these two Severity Level IV violations early in this assessment period, they were associated with work evolutions that occurred late in the previous period and that were discussed in the previous SALP report. A substantial potential for an overexposure did not exist.

Licensee management involvement in ensuring quality was mixed. Management continued to emphasize as-low-as-reasonably-achievable (ALARA) radiation exposure and radiological housekeeping improvements and quality assurance support in the chemistry program and the radiological environmental monitoring program (REMP). Examples of this involvement included reactor recirculation system decontamination, decontamination and painting of the torus room, and improvements in the audit of the chemistry program. Management commitment to developing additional dose-saving techniques was evidenced by the formation of a corporate ALARA committee with the Director, Nuclear Division, as Chairman, and the authorization to hire an ALARA engineer and two additional salaried ALARA staff members to correct a staffing weakness. However, management involvement was not adequate to ensure that corrective action for a previously identified violation would prevent recurrent communication and job planning problems. For example, because of poor planning, communication, and coordination between two outage jobs, the recirculation riser remained empty for a period longer than anticipated which increased the outage dose by approximately 70 person-rem due to the extended loss of shielding effect.

Staffing levels, qualifications, and training were adequate to implement the routine radiation protection program. The chemistry and REMP staff were knowledgeable and skilled in performing their jobs. The radiation protection (RP) staff had an overall increase of two RP professionals. Although the turnover rate for the RP professional staff remained high through most of the period, it appeared to have stabilized. The licensee made some progress in reducing the technician turnover rate, which had remained high for the past several assessment periods. However, because of the previous poor rate of retention of the RP staff, the fraction of qualified technicians and the technician experience level remained relatively low. The licensee reorganized the RP group late in the assessment period. This reorganization was prompted by an independent outside audit of the RP program, which focused on improving efficiency and morale of the staff. For example, the reorganization eliminated a level of management between the workers and the plant superintendent and switched the responsibilities of two first-line managers to give them additional experience and career paths. The training and qualification requirements for radwaste technicians were upgraded, formalized, and made similar to those for radiation protection technicians. The technician training program was well implemented and of high quality.

The licensee's approach to identifying and resolving technical issues was mixed. Examples of good performance included progress in reducing contaminated areas, and the complete revision of the radwaste procedures to improve their clarity and put them into a standard format. The station dose for 1990 was 861 person-rem (778 from the outage), which was 70% higher than the dose in the previous outage year and about 200 person-rem higher than the

licensee's goal. Contributing factors to this increase included a 60% increase in the total radiation work permit hours expended and some occurrences of poor job planning, communication, and coordination during the 1990 outage. Some significant ALARA efforts occurred during the outage, including chemical decontamination of the reactor recirculation system piping and the chemical decontamination and replacement of reactor water cleanup system (RWCU) piping. The licensee also adopted the use of electronic dosimeters for all high radiation areas.

The licensee continued the conservative policy of prohibiting routine liquid radioactive releases, and no releases occurred during this period. Gaseous releases were low and well within technical specification limits. No solid radioactive waste or transportation problems occurred during the period. However, the total number of personal contaminations for 1990 was 492 (461 during the outage), which represented weak contamination control. Also, the licensee received and used for 3 months equipment contaminated above the licensee's possession limit for cobalt-60. This problem was eventually identified during a routine licensee audit conducted 7 months after the equipment was shipped back to the vendor.

The results of radiological confirmatory measurements between the licensee and the NRC were very good, with all in agreement. Results of the interlaboratory comparison program were also very good, with 108 agreements out of 111 comparisons. The licensee achieved two agreements in two comparisons in the NRC radiological chemistry split-sample program. The REMP met regulatory requirements, and the licensee maintained the REMP equipment calibrated and in good operating condition.

2. Performance Rating

The licensee's performance is rated Category 2 in this area. The licensee's performance was rated Category 2 in the previous assessment period.

3. Recommendations

None.

C. Maintenance/Surveillance

1. Analysis

The evaluation of this functional area was based on the results of 13 routine inspections and 2 team inspections; a Safety System Functional Inspection (SSFI) and an Electrical Distribution System Functional Inspection (EDSFI). There were 1591 inspection hours expended in this functional area, comprising 26.0% of the total inspection hours.

Enforcement-related performance indicated a slight declining trend. Inspectors identified five Severity Level IV violations. One violation involved numerous examples of failure to follow procedures, primarily during outage maintenance activities. A violation involving fire protection surveillance and maintenance also included further examples of failure to properly follow procedures. Both of these violations involved some instances of insufficient control to ensure contractor work met Duane Arnold Energy Center (DAEC) QA standards.

DAEC experienced more reportable events this period than the previous period. As in the last period, personnel errors continued to be a factor in the events, contributing to six ESF actuations, two reactor scrams at power, and four reactor scram signals while shut down. Equipment failures, however, were another major contributor to reportable events in this area, causing four reactor scrams at power and two ESF actuations. The licensee took steps late in the period to reduce personnel errors, such as requiring supervisory oversight for major backshift maintenance, improving procedures, and emphasizing adherence to procedures. In addition, the licensee took some action to reduce equipment failures related to plant events, such as changing some turbine trip logic to two out of three sensors. These activities were recently implemented and their effectiveness have not been evaluated.

The licensee was generally able to identify and resolve technical issues within the maintenance and surveillance areas with an adequate perspective on safety. The licensee made good use of current technological advances to troubleshoot and predict equipment failures including successful use of vibration analysis equipment to predict an imminent bearing failure in a condensate pump motor, thereby averting a plant transient that would have occurred if the condensate pump was lost. An increase in the licensee's utilization of thermography equipment, electrical ground locating equipment, improved motor-operated valve diagnostic equipment, and other devices demonstrated a continued commitment to improve its capability to resolve problems. While licensee modifications to the main steam isolation valves (MSIVs) to correct leakage problems were thorough, the solution to resolve the feedwater check-valve leakage problem was superficial and did not take into account the experience of other licensees with similar problems.

The licensee generally made conservative decisions about repairing safety related equipment. This conservatism was not always evident when resolving BOP equipment problems. Some BOP problems went unresolved and resulted in several reactor scrams and plant shut downs when problem resolutions at an earlier time would have prevented these transients. For example, the extraction steam leaks and wall thinning, which the licensee had identified but not resolved, resulted in one manual scram and one forced outage. Also, repairs of some safety equipment, such as the control building chillers, were delayed because of lack of spare parts, work-package preparation, or scheduling problems.

Management involvement to assure the quality of surveillance activities was adequate. Planning and scheduling activities appeared to be well coordinated. Some minor surveillances were missed, but the licensee discovered their omission shortly after they were due and once performed they were within tolerances. Problems involving failure to implement required temporary procedure changes and procedure adherence were noted earlier in the period. Initial

attempts to resolve the procedure adherence and change implementation problem by issuing a management directive to strictly adhere to procedures and the procedure change process did not resolve the problem. After problems continued to occur, management took additional steps to upgrade both the procedures and the procedure change process to resolve these types of problems. This effort was ongoing at the end of the assessment period and its effectiveness has not been evaluated. The surveillance procedures for instrumentation and electrical equipment referenced in TS were well written and included clear acceptance criteria. The instrument setpoints and tolerances specified in the procedures were within values required by TS. The calibration procedures for non-TS equipment, however, were poor and contained questionable acceptance criteria for setpoints. To complicate the issue, technicians did not always follow the acceptance criteria and left instruments out-of-tolerance in several cases.

Management involvement to assure quality in maintenance activities was mixed. Some notable plant improvements were made during the refueling outage that demonstrated increased management attention such as HPCI modifications which resulted in improved HPCI performance. Extensive repairs and upgrades on MSIVs and reactor recirculation pumps were also made to improve performance. A live-load packing installation effort was effective in reducing valve leakage in the drywell and other areas inaccessible during operations. In addition, creating a separate outage management organization and outage manager position improved the overall outage maintenance process. The well-coordinated maintenance effort to inspect and repair control rod drive hydraulic lines within the scope of the refueling outage reflected this improved outage maintenance process. Also, the licensee implemented a method to track rework.

Conversely, management involvement was not effective in other areas. Numerous contractor maintenance errors occurred that required rework on such major plant equipment as reactor recirculation pump motors, reactor recirculation motor generator drive motors, circulating water pump motors, and motor-operated valves. Some reactor scrams could have been prevented had appropriate attention been given to identified potential problems. For example, a reactor scram caused by three MSIV closures may have been avoided if wire connections in the control room panels had been tightened before startup from the refueling outage, as originally scheduled.

The licensee was not effective in resolving some equipment problems on important plant equipment because of inadequate classifications of quality level. For example, in some instances, known problems with the quality level IV (non-safety) feedwater flow transmitters were not addressed properly because of its quality level classification, allowing the indications for the feedwater flow and the resultant reactor thermal power to remain inaccurate. In another instance, the licensee determined that a quality level IV instrument was out of calibration but still used it to verify a TS surveillance. At the end of the assessment period, the licensee was working on improving the classification system for components that (1) have an effect on safe operation of the plant, (2) are required by TS or (3) are used to verify TS parameters.

The licensee's training and qualification program for Iowa Electric staff was adequate. Craft personnel were generally competent, dedicated, and well prepared technically for their tasks. The need to stress attention to detail and procedure adherence was a repeat issue this period, as evidenced by the large number of events caused by personnel errors, and the instances of procedure adherence problems noted in two violations. Inadequate training of contract personnel this period was a contributor to procedure violations and led to errors that required rework during the refueling outage.

While staffing in the maintenance and surveillance areas was generally adequate, the licensee was taking steps to reduce the maintenance backlog and overtime usage. Of all the hours worked for outage year 1990, 21% were overtime hours, and of all hours worked during the 1991 portion of this assessment period, 8% were overtime hours. The backlog for nonoutage corrective maintenance work requests averaged eight weeks. At the end of the assessment period, the licensee authorized four positions to staff a maintenance and test equipment laboratory. Individuals from the maintenance organization filled these four positions but because of budget constraints, their replacements were not authorized. The licensee authorized three new positions for maintenance coordinators. The licensee was working on other initiatives, such as the maintenance quality improvement program, which is designed to improve the efficiency of maintenance work and thus help reduce the maintenance backlog.

2. Performance Rating

The licensee's performance is rated Category 2 in this area. The licensee's performance was rated Category 2 in the previous assessment period.

3. Recommendations

None.

D. Emergency Preparedness

1. Analysis

Evaluation of this functional area was based on the results of two inspections. There were 160 inspection hours expended in this functional area, comprising 2.6% of the total inspection hours.

Enforcement performance continued to be excellent. Inspectors identified no violations.

Management involvement in ensuring quality was excellent. Upgrades to the well-maintained emergency response facilities included the installation of a dedicated communications line to State and county operations centers and the movement of the Operational Support Center to a more suitable location. The licensee implemented several measures to add greater realism to the annual exercise. The emergency planning group remained well staffed to address licensee, State, and county emergency planning needs. They were also very proactive in addressing offsite planning issues. The annual audit of the program was significantly improved compared to the previous annual audit.

The licensee's identification and resolution of technical issues were very good. In response to operational events, the licensee correctly declared three Unusual Events. Associated offsite notifications were timely, as were analogous actions during the annual exercise. The licensee reformatted the Emergency Action Level (EAL) table, revised several EALs to facilitate emergency classification decisions and cross-referencing to emergency operating procedures, and enhanced several aspects of the public information program for the Emergency Planning Zone's permanent and transient populations.

The licensee's overall performance during the annual exercise was excellent. The exercise scenario was very challenging. The simulated major radiological release necessitated activation of all the licensee's emergency response facilities, numerous inplant repair teams, several offsite survey teams, and the emergency news center. Inspectors identified no weaknesses or other concerns requiring corrective action. The control room simulator and several equipment mockups were successfully used for the first time in the annual exercise. Safety Parameter Display System terminals, which were linked to the simulator, were operable in several response facilities and also provided greater realism for the exercise. Other challenging aspects of the exercise were a successful accountability demonstration, an onsite medical response, and use of the post-accident sampling system.

Emergency Response Organization (ERO) staffing levels were very good. Three to five persons were qualified to fill each key position. With the reasonable exception of a pool of senior managers qualified for several key positions, no one was assigned to multiple positions. Semiannual, off-hours drills, involving key and support staffs, have continued to demonstrate the ERO's capability to augment onshift personnel. The well staffed emergency preparedness group comprised of six planners and four instructors, each of whom had responsibilities directly related to the licensee's program and the programs of State or local governments. The group was experienced and exhibited no significant turnover or any decrease in size.

The ERO's training program was effective, as exemplified by the overall excellent exercise performance. The training program was refined by the implementation of a computerized training tracking system. Administrative controls were effective in ensuring that only currently qualified persons were listed in the ERO callout procedure. The licensee remained very involved in providing periodic training to over 2000 persons in State and local emergency response organizations.

2. Performance Rating

The licensee's performance is rated Category 1 in this area. The licensee's performance was rated Category 2 with an improving trend in the previous assessment period.

3. Recommendations

None.

E. Security

1. Analysis

Evaluation of this functional area was based on the results of four inspections. There were 182 inspection hours expended in this functional area, comprising 3.0% of the total inspection hours.

Enforcement-related performance was adequate and improved slightly since the previous period; inspectors identified one Severity Level IV violation that had no major safety significance.

Management's involvement in assuring quality in this functional area was adequate with an isolated example of a performance weakness. Continued management support for improvements to security equipment was exemplified by the installation of new protected area security equipment and vendor analysis of the new equipment to ensure its operational effectiveness. Management's timeliness of security plan changes improved and was adequate. Security management's involvement in the oversight of day-to-day program implementation was weak because of strained supervisor resources. This strain resulted in minimally acceptable performance evaluations of search programs for personnel, packages, and vehicles that led to marginally acceptable searches.

The licensee's approach to identifying and resolving technical issues from a safety and security standpoint was good and continued to improve. During the previous assessment period, the licensee initiated a comprehensive evaluation of technical components in the newly installed security system. This evaluation resulted in significantly improving the effectiveness and reliability of perimeter security equipment during this period. This evaluation is continuing and additional improvements have been identified to further enhance program effectiveness. To support this effort, professional security consultants were being utilized and a member of the security supervisory staff was assigned to monitoring activities.

The licensee's performance in reporting and responding to security events was good. Required reports were accurate and timely. Security reports were thorough and technically sound. The licensee's program for logging security events utilized NRC guidance. Security-related records were complete, well maintained, and readily available. The licensee's security staff maintained good communication with the regional staff and provided them details about their identification and resolution of security issues.

Staffing to meet security plan requirements was adequate; inspectors saw one example of a performance weakness. The number of security officers and assigned support and administrative staff was adequate to meet minimum normal and compensatory post responsibilities. However, staffing to support operational oversight of security activities was strained. An NRC-identified finding pertaining to weaknesses in search programs was partially attributed to limited supervisor resources. The licensee increased duties and responsibilities for some members of the security management staff when a reorganization eliminated a security shift supervisor position and the assistant plant superintendent from the security organization. The shift supervisor was

transferred from operational oversight to administration of the Fitness-for-Duty Program. The assistant plant superintendent was reassigned to concentrate on radiation protection duties; his security duties were required to be absorbed by the existing staff with no like reduction in the existing staff's responsibilities.

The training and qualification program for the security organization has improved and met regulatory requirements. In response to the previous SALP concern a new training position was established and subsequently staffed. The individual's duties included responsibilities for tactical training and associated drills and was viewed as a program improvement.

2. Performance Rating

The licensee's performance is rated Category 2 in this area. The licensee's performance was rated Category 2 in the previous assessment period.

3. Recommendations

None.

F. Engineering/Technical Support

1. Analysis

Evaluation of this functional area was based on two team inspections (SSFI and EDSFI), several routine inspections, and operator licensing examinations. There were 1266 inspection hours expended in this functional area, comprising 20.7% of the total inspection hours.

Enforcement-related performance was about the same this period as last. Five Severity Level IV violations were issued. However, some of the violations contained several examples which were indicative of weaknesses in design control throughout the assessment period.

Management involvement in ensuring quality continued to be mixed. Aggressive management involvement was noted in the repair and replacement of the cracked control rod drive (CRD) lines and in the resolution of environmental qualification (EQ) issues. In the operator requalification area, the facility evaluators demonstrated unbiased judgement and an excellent ability to recognize errors. The licensee's power systems analysis (PSA) program was considered a strength as it had identified similar design control and hardware problems as those identified by the SSFI. However, the licensee was slow to take corrective action on some selective issues identified in the PSA. Examples included incorrect breaker settings, fuse and thermal overload sizing, and lack of design basis or qualification documentation. Weak performance was also identified in the area of operator requalification training. The quality of the test material provided to the NRC for the June 1990 requalification examination was marginal with revisions to the written examination and job performance measure questions being required. In addition, the simulator scenarios were not adequate in scope or involvement of EOPs, requiring extensive revision.

There was a lack of management control over the activities associated with the licensee's Regulatory Guide (RG) 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident," program. As a result, the licensee had not completely implemented commitments it made in response to Generic Letter (GL) 90-04 at the time of an NRC inspection of RG 1.97 activities. For example, the licensee did not have a formalized list of the instrumentation channels to be used to meet the recommendations of RG 1.97, labels identifying the RG 1.97 designated instruments had not been installed in the control room, and operator training had not been addressed. During the end of the assessment period a new Instrumentation and Control Engineering Group was formed, which was reviewing RG 1.97 issues that should have been resolved several years ago.

The licensee's performance in identifying and resolving technical issues declined and was considered poor. Inadequate trending of some instruments contributed to the reactor being operated (1) above its licensed thermal power, (2) in an area of the power to flow map prohibited by technical specifications, and (3) with the recirculation flow biased average power range monitor (APRM) trip setpoint set nonconservatively. In another instance, improper setting of the steam detection setpoints for the Reactor Water Cleanup (RWCU) system, as a result of a design modification, caused an isolation of the RWCU system. On the positive side, the licensee identified the cracking problem in the CRD hydraulic line. The corrective actions to resolve the CRD problem were thorough and conservative. An aggressive long-term investigation into the root cause of the cracking was still in progress.

Three of the operational events reflected a licensee weakness in the area of instrument calibration or setpoint determination with inadequate engineering attention to vendor recommendations the predominant root cause. In addition, the non-TS calibration problems discussed in the Maintenance/Surveillance functional area were aggravated by poorly engineered bases for setpoints and a resulting lack of confidence in the setpoints by technicians. One LER was the result of the CRD hydraulic line cracking. The remaining LERs dealt with original design issues resulting in ESF actuations or reactor scrams, which the licensee was not aggressively pursuing resolution.

While in general the experience level and technical competence of the engineering staff was excellent, the staffing level was marginal. The welding engineering group and the RG 1.97 program were insufficient. Recurrent weaknesses in the configuration control area, identified during the NRC SSFI and EDSFI, also indicated marginal staffing. As a result of problems experienced during the previous assessment period, the licensee added resources in the EQ area; however, during an EQ program audit, auditors identified numerous findings that the licensee was unable to resolve because of understaffing. The large number of systems assigned to certain engineers indicated a shortage of system engineers. This shortage led to some of the problems with equipment trending, and problem resolution. At the end of the assessment period the licensee informed the NRC that it plans to add approximately 33 new engineering positions to its staff.

The effectiveness of the operator requalification training program was rated unsatisfactory but was improving in the latter part of the assessment period as the result of effective corrective actions. In the area of inservice inspection, the licensee's and NDE contractor's training and qualification program were generally acceptable. However, although training in the EQ area was conducted in response to the previous SALP period violations, additional EQ training needs were identified by the licensee.

2. Performance Rating

The licensee's performance is rated Category 3 in this functional area. The licensee's performance was rated Category 2 in the previous assessment period.

3. Recommendations

The licensee should increase managements involvement in this area to ensure that technical issues are identified and resolved on a timely basis. The licensee should also continue to give a high priority to its efforts to increase staffing in this area along with oversight and training of the new staff. The NRC should closely monitor the licensee's activities.

G. Safety Assessment/Quality Verification

1. Analysis

Evaluation of this functional area was based on the results of several routine inspections and the NRR licensing project manager's reviews. There were 591 inspection hours expended in this functional area, comprising 9.6% of the total inspection hours.

Enforcement related performance was generally good; the NRC issued two Severity Level IV violations.

Management's involvement and controls to assure quality in this functional area were mixed. There were several areas where management's involvement and controls were not sufficient to ensure a high level of quality. For example, during the 1990 refuel outage, a contractor performed drywell quality control (QC) inspections and Iowa Electric QC was not directly involved with quality oversight of drywell work activities until numerous problems occurred due to contractor work. The licensee's corrective action program was not always thorough or timely as indicated by the violation involving the licensee's inadequate actions to address vendor information and a similar issue identified in a licensee QA Corrective Action Report. The NRC staff identified similar concerns during the previous assessment period. Also, the failure to provide adequate staff in the Engineering/Technical Support functional area to support plant needs reflects a weakness in management oversight of plant activities. On the positive side, the licensee noticeably improved its QA audit and surveillance organization activities. The NRC staff viewed management's decision to move the QA audit group to the site as an improvement, particularly

because it helped to facilitate review and closure of audit findings. The licensee's successful actions to resolve EQ issues previously raised by NRC were also positive. In addition, the licensee's ongoing scram reduction efforts have resulted in extensive plant modifications to date.

The licensee's approach to identifying and resolving technical issues from a safety standpoint appeared to be generally adequate. The licensee has undertaken several resource intensive efforts to address known weaknesses as well as to improve overall plant performance. However, these efforts were relatively new and the NRC has not performed inspections in each case to determine the effectiveness of the licensee's actions. Examples of these ongoing efforts included: configuration management/digital imaging program improvements; design basis documents improvement program; power systems analysis efforts; and the bill of material including onsite spare parts improvement program. In addition, the licensee's formal QA programs, including QA/QC, the Operations Committee, and the Safety Committee, demonstrated a continued commitment to identifying and resolving weaknesses. Audits were (1) performed as required by technical specifications, (2) adequate to assess performance, (3) in compliance with requirements and personnel training/qualifications, and (4) improved over previous assessment period audits. For example, audits of the chemistry program, a noted weakness in SALP 8, improved significantly. The Safety Committee continued to be actively involved in plant activities and performed in-depth reviews of major plant events. The licensee's actions to reduce the number of active Operations Committee members resulted in a core group that was better able to evaluate plant activities.

The licensee's request for an independent third party to conduct a SCRAM-assist visit following three scrams soon after restart from the 1990 refuel outage and its long-term efforts to reduce scrams were noteworthy and exemplify the licensee's efforts to improve plant operating performance. For example, the licensee installed MSIV solenoid failure detection light-emitting diodes and modified most of the turbine trip logic to two out of three sensors to reduce single failure turbine trip events. Additionally, turbine trip logic and other changes are planned for the 1992 refueling outage. Licensee efforts to identify and resolve some issues were slow, including the initial actions taken to correct drawing and procedural problems, nonconservative and and untimely review of several applicable vendor service information letters (SILs), untimely resolution of some PSA deficiencies, and the silting problems which continue to cause equipment failures. The licensee has not implemented a fully effective control program for tracking the implementation of licensee commitments which in several instances contributed to the lack of timely corrective actions to known or suspected plant problems.

Activities in the licensing area were, on balance, poor. The applications associated with the seven license amendments issued during the period and the responses to NRC generic communications were technically sound; several of the amendment requests conformed with NRC generic TS line item improvements. However, licensee management did not appear to place the proper emphasis on TS improvements that focused on safety; instead, emphases was given to those that

provided greater operational flexibility or resource savings. For example, an amendment request to revise ECCS conditional surveillances to enhance plant safety through the reduction in challenges to redundant trains of safety systems took more than two years to submit to the NRC after the need for the change was identified. In addition, several TS issues were raised by NRC during the period that indicated that the licensee does not have adequate bases for its interpretations of some TS requirements. Some of these TS requirements concerned the minimum number of operable source range monitors required for startup, operability of dual function RHR/containment isolation valves (CIVs), acceptable methods to isolate inoperable CIVs, shutdown cooling requirements, and the operability of the fire suppression system. This concern was also raised during the previous SALP. The NRC staff considers the the licensee's failure to provide a valid documented basis for many TS interpretations to be a weakness. This coupled with the need for an increased focus on TS changes having potential safety benefits, indicates a need for a greater degree of management involvement.

Some licensee submittals were untimely. Notably an exemption request from Appendix J leak testing requirements and an amendment request to allow the use of two liquid radwaste tanks, placed an extensive burden on NRC resources that was inconsistent with the priority of the proposed actions. This occurred even though the need for timely submittals was previously discussed with the licensee and the licensee was aware of the issues well in advance of the actual submittals. The effectiveness of the licensee's Integrated Plan was limited during the period, due, in part, to the lack of a formal process for the prioritization and scheduling of work. The licensee subsequently developed a priority tool and established a priority review board to formalize the planning process and to better coordinate the budgeting and scheduling of work. The licensee revised the semiannual update to the Integrated Plan to provide greater detail.

In one specific area, the licensee's response to Generic Letter (GL) 88-01, concerning intergranular stress corrosion cracking in BWR piping, was of particularly high quality, conforming with all 13 staff positions. The program and associated TS changes were implemented in accordance with established schedules.

The problems discussed in the preceding section regarding the licensee's implementation of RG 1.97 requirements are also indicative of poor internal communications. It appeared that licensee management, and ultimately the NRC, were given conflicting information on the implementation status of this program, which the licensee initially reported as complete in September of 1990. The licensee subsequently acknowledged that it was uncertain of the RG 1.97 program status. An NRC inspection later determined that all elements of the RG 1.97 program had not been implemented.

The staffing for safety assessment and quality verification functions was strained. On the positive side, the QA audit group typically relies on expertise and staff from within the plant organization and uses consultants when appropriate. This practice resulted in technically sound audits that identified meaningful weaknesses. However, the low number of permanent staff made followup of audit findings and observations difficult and contributed to

the relatively large number of open items. The QA surveillance group was also small. The licensee augmented the staff during the 1990 refueling outage to adequately cover the outage activities. The licensee has since added two staff members to the surveillance group.

2. Performance Rating

The licensee's performance is rated Category 3 in this area. The licensee's performance was rated Category 2 in the previous assessment period.

3. Recommendations

The licensee should increase management's oversight of licensing and plant activities and take appropriate steps to assure that significant activities/programs identified in the Integrated Plan are adequately performed and are conducted in accordance with the schedule currently in place.

IV. SUPPORTING DATA AND SUMMARIES

A. Major Licensee Activities

The Duane Arnold Energy Center began the assessment period at full power operations and later underwent a refueling outage that included the conduct of significant plant maintenance and modification work. Following completion of the outage, the plant resumed full power operations. The plant experienced eight scrams (including three manual scrams) at various power levels above 5% and several unscheduled outages. Significant outages and other major events are discussed as follows:

1. On March 29, 1990, a manual reactor scram was initiated in response to increasing reactor vessel water level that was caused by feedwater regulating valve lockup. The lockup occurred when the operating air to the feedwater valve was inadvertently isolated during a tagout activity. The plant was restarted on March 31, 1990.

2. On April 1, 1990, a momentary spike in indicated flux on APRMs "C" and "D" resulted in a reactor scram at 9% power from high flux in the startup range. Restart occurred the same day following bypassing of the shared Local Power Range Monitor (LPRM).

3. On April 22, 1990, the licensee administratively limited reactor power to 75% following a failure of the "A" outboard MSIV. On the basis of the results of a safety evaluation, power was increased to 83% and remained at about that level until the refueling outage began on June 27, 1990.

4. On April 23, 1990, NRC approved a license extension (Amendment 164).

5. On June 27, 1990, the licensee commenced a reactor shutdown to begin a planned 67-day refueling outage. The outage was extended 5 days primarily to repair CRD insert and withdrawal lines. Other major activities conducted during the outage included repair and modification of MSIVs, replacement of RWCU piping, replacement of the reactor recirculation pump rotating assembly, modifications to the HPCI system, overhaul of the emergency diesel generator, and inspection of the service water system. Restart occurred on September 7, 1990.

6. On September 10, 1990, the reactor scrammed from 25% power on high pressure following a turbine trip on sensed high-moisture separator reheator (MSR) level owing to failure to unisolate the MSR level sensor following maintenance. Restart occurred on September 12, 1990.

7. On September 13, 1990, a manual scram occurred from 37% power following the failure of a soldered joint on the instrument air system that rapidly decreased the air pressure and caused reactor vessel level control difficulties. Following repairs, restart occurred on September 14, 1990.

8. On September 18, 1990, a reactor scram occurred from 52% power when 3 inboard MSIVs closed unexpectedly following main steam line radiation monitor testing. The cause of the MSIV closures was attributed to loose control panel wiring. Restart occurred on September 22, 1990.

9. On October 19, 1990, a reactor scram occurred from 67% power as a result of troubleshooting activities on the reactor recirculation pump MG set drive motor. A Notice of Unusual Event was declared as a result of the event. Restart occurred on October 21, 1990.

10. On December 9, 1990, the plant was shut down to correct main turbine exciter bearing vibrations and perform other maintenance activities. Restart occurred on December 14, 1990.

11. On January 6, 1991, a manual reactor scram occurred from 63% power following discovery of an unisolable extraction steam line leak. A Notice of Unusual Event was declared as a result of this event. Following repairs, startup occurred on January 8, 1991.

12. On January 16, 1991, a maintenance outage was entered to repair several steam leaks in the heater bay area. Following repairs, startup occurred on January 22, 1991.

13. On February 9, 1991, a reactor scram occurred from 100% power during testing of the turbine overspeed trip device. Startup occurred on February 13, 1991.

B. Major Direct Inspection and Review Activities

1. Inspection Data

This SALP 9 report (January 1, 1990, through March 31, 1991) discussed 29 inspection reports, which are listed below.

Facility: Duane Arnold Energy Center

Docket: 50-331

Inspection Reports: 90002 through 90023, 91002 through 91008

2. Special Inspection Summary

Significant inspections performed during this assessment period are as follows:

a. From February 5 through March 16, 1990, NRC conducted an SSFI to assess the operational readiness and functionality of the emergency service water (ESW) System. The inspection team determined that the ESW system was operable and, in general, the design control program was adequate. They identified some concerns and four Severity Level IV violations (IR No. 331/90003).

b. From February 27 through March 9, 1990, NRC conducted a special safety inspection to review the circumstances surrounding an unplanned radiation exposure event (IR No. 331/90005). NRC conducted an enforcement conference on April 5, 1990, to address the unplanned radiation exposure event. The NRC determined that a substantial potential for an overexposure did not exist. NRC issued two Severity Level IV violations (IR No. 331/90006).

c. On September 10, 1990, NRC conducted a reactive safeguards inspection to review a degraded vital area barrier event and issued a Severity Level IV violation (IR No. 331/90019).

d. From February 4 through March 8, 1991, NRC conducted an EDSFI at the plant. The inspection team determined that the plant's electrical distribution system was functional; however, they identified several concerns and two Severity Level IV violations (IR No. 331/91002).

e. From March 11 through 15, 1991, NRC performed a special safety inspection to review licensee actions to address previously identified EQ concerns and their implementation of commitments pertaining to RG 1.97. The NRC concluded that the licensee's activities pertaining to RG 1.97 were not adequately completed but that its actions to address EQ concerns were adequate.