Attachment

SUMMARY OF
DAEC PERFORMANCE PROGRESS

March 29, 1991

SUMMARY OF DAEC PERFORMANCE PROGRESS

This Attachment describes the performance and significant accomplishments since December 31, 1989 in each functional area that was rated in the SALP-8 report for the Duane Arnold Energy Center (DAEC), NRC Inspection Report No. 50-331/90001.

I. OPERATIONS

A. Overview of Indicators

1. Availability factor

   The DAEC had an equivalent availability of 65% during 1990. This is especially significant since the plant underwent a 74-day refueling outage and 8 outages of short duration. The number of automatic and manual scrams and forced outages was greater in this SALP period than in the last period and IE management has initiated corrective actions to reduce the likelihood of such events. The actions are described below (Section 3).

2. Unplanned safety system actuations

   Since October 1990, there have been no unplanned safety system actuations.* This performance is indicative of improved coordination among the Engineering, Maintenance, and Operations departments.

3. Operational Events and Related Corrective Actions.

   a. Manual and automatic reactor scrams

      During this SALP period, there have been 5 automatic and 3 manual reactor scrams. A listing of these scrams including their causes is included as Table 1. All but one of the scrams were caused by events unrelated to the performance of control room personnel or the Operations Department. Only the March 29, 1990, manual scram resulting from the loss of instrument air can be attributed in part to the performance of control room personnel. Even in this event, however, improper valve labelling and an inaccurate drawing contributed to the instrument air tagout error.

      To help determine the underlying causes of the 3 reactor scrams that occurred in September 1990, the Manager, Nuclear Generation Division, requested an INPO assistance visit. The INPO team reviewed the scrams and previous events to identify similarities and potential precursors.

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* Safety system actuations include ECCS actuations that result from off-normal conditions (setpoint reached) or spurious/inadvertent signals and emergency AC power actuations that result from a loss of power from the safeguards bus.

The INPO analysis of these events is consistent with IE's view that Operations had very limited responsibility for these scrams. The team noted that, although each of the events had maintenance implications, each scram resulted from a different cause. Team recommendations for preventing these types of events include improved adherence to post-maintenance testing requirements, more thorough investigation of events to identify root causes, and trending of past problems/events to identify precursors or adverse trends. Sections III and IV of this report discuss actions taken in response to these recommendations.

Throughout the SALP period and particularly during each of the events listed in Table 1, plant operators demonstrated good knowledge of the plant by initiating corrective measures in an efficient and timely manner. As noted in NRC Inspection Reports 90-04 and 90-17, operator actions and responses to the scrams were appropriate and brought the plant to a stable condition promptly. Conservative decision-making continued to be the governing philosophy of the Department as evidenced by the 3 manual scrams in which the operators chose to place the plant in a stable condition before automatic equipment was challenged.

Other instances of conservative decision making include:

- The plant has not entered a 24 hour LCO in over 2 years. This is attributable to careful planning and coordination between Engineering and Maintenance. By avoiding 24 hour LCOs, the number of plant transients is minimized.

- During troubleshooting activities on the feedwater system in February 1991, the Shift Supervisor suspended the late-night activities until morning. This decision allowed for better planning and supervision of activities by the day crew.

- No errors have been made in moving control rods since October 1987. This performance is attributable to Operation's sensitivity to reactivity control issues and the conservative decision to enforce Rod Worth Minimizer (RWM) controls up to 100% power. The Technical Specifications only require enforcement of these controls up to 30% power. In addition, a second licensed operator monitors all control rod movements as a backup to the RWM.

b. Heat-up rate event

On January 22, 1991, the heat-up rate for the reactor coolant exceeded 100 degrees F/hour during a reactor startup in violation of Technical Specifications. This event occurred when the operating crew chose an aggressive approach to heat up in order to avoid freezing the Circulating Water System during extremely cold weather.

The corrective actions taken in response to this incident include:

- The crew members and supervisory personnel involved were disciplined to emphasize the unacceptability of challenging a Technical Specification limit.

- The Shift Supervisor in charge during the evolution prepared a summary of the event and the lessons learned which he and the Shift Technical Advisor presented to all operating crews.

- The operator requalification training cycle scheduled for April through June will include a session reviewing the specific details of the event and simulator drills on reactor startups.

- The surveillance procedure used by the operators for monitoring and trending heat-up and cooldown rates for the reactor is being modified to make it simpler and more straight forward. This procedure will be revised by March 31, 1991.

- Procedures are being developed that will improve the operator's ability to start up the Circulating Water System during severely cold weather. These procedures will be implemented by December 1991.

B. <u>Organization, Management, Staffing</u>

1. Personnel and Position Changes

a. New Plant Superintendent, Nuclear

On February 22, 1991, a new Plant Superintendent, Nuclear was assigned to the Duane Arnold Energy Center. The new Superintendent has broad nuclear experience and has been an employee of Iowa Electric since 1971. He has held several supervisory positions including Manager, Nuclear Licensing and Emergency Planning; Training Superintendent; and, most recently, Outage Manager.

b. Outage Manager

In 1990, a permanent Outage Management organization was created including the assignment of an Outage Manager. This organization was created in response to management's recognition that successful outage performance is essential to achieving safety and reliability goals. The new organization has been assigned responsibility for all aspects of outage performance and was instrumental in the success of the 1990 refueling outage. Section III of this report contains further discussion of outage performance.

c. Radiation protection supervision

In February 1991, the responsibilities for Radiation Protection and Security were divided. An Assistant Plant Superintendent remains responsible for radiation protection. This change was made to provide additional attention by an experienced person to the activities of the Radiation Protection Department. The Security Supervisor is now designated as the Security Director and reports directly to the Plant Superintendent. (See section II on Radiological Controls.)

2. Management Involvement and Supervision

As noted in Inspection Report 90-02, the Plant Superintendent, Nuclear; Assistant Plant Superintendent for Operations and Maintenance; and Operations Supervisor keep themselves well informed on the overall status of the plant, make frequent visits to the control room, and regularly tour the plant. Several programs have been strengthened or implemented to maintain this level of management attention and improve plant housekeeping.

a. Plant area inspection tours

The purpose and importance of this program have recently been re-emphasized to the supervisors in the responsible departments by the Plant Superintendent, Nuclear. As part of this program, areas of the Reactor, Turbine, and Control Buildings, Pump House, Intake Structure, and radwaste buildings are assigned to specific members of the Operations and Maintenance Departments. These individuals are required to tour the assigned areas at least biweekly, usually as a group, in order to identify and correct housekeeping and safety concerns. A Supervisory Observation Form and a Safety Inspection Form must be completed within 5 days after each tour. These forms are then reviewed by plant management to ensure that appropriate corrective actions are undertaken and to identify adverse trends.

b. Off-hours supervisory plant inspections

The off-hours tour program was re-instated during February 1991 to promote increased management awareness of plant activities. Selected supervisory personnel perform off-hours tours of plant facilities on a rotating basis; at least one inspection occurs each week. These inspections must be performed between the hours of 2200 and 0500 on weekdays or at any hour on weekends. The inspection roster includes the Plant Superintendent, Nuclear; Assistant Plant Superintendents; and plant supervisors.

3. Operator Training

To address the weaknesses identified during the NRC-administered operator requalification exam, the Operations Department has worked closely with the Training Department to improve the requalification program. As discussed in section VI of this report, IE has implemented numerous corrective actions to improve operator performance on all aspects of the requalification exam. Operations has increased its involvement in both the development and implementation of this program in the following respects.

- Four control room operators have transferred into the Training Department to work in operations and simulator training. These instructors bring valuable and relevant experience to the program, enhancing instructor credibility.

- The "A" Operations Shift Supervisor is now responsible for critiquing sessions during simulator training for his crew. This responsibility provides Operations with an increased sense of ownership of the training program and ensures that operator performance both in the plant and on the simulator is consistent.

- The Operations Supervisor or his assistant frequently observes each crew's simulator performance to ensure that all crews are meeting the performance expectations of Operations Department management.

- All license holders at the DAEC participated in INPO-sponsored Control Room Teamwork Development Training sessions. These 3-1/2-day sessions were designed to enable control room and Operations personnel to recognize their individual strengths and weaknesses and apply this knowledge to improve teamwork.

C. Hardware Improvements/Housekeeping

1. Reactor Water Level Control

The March 1990 SALP report noted a concern with respect to control of reactor water level. During this SALP period, steps have been taken to provide both training and hardware solutions to resolve this concern. Each operations crew has undergone extensive simulator training on reactor water level control and response during plant transients and scrams. The effectiveness of this training and an increased awareness of water level control have been evident during recent operational events. During the current SALP period, only 25% of the scrams have resulted in vessel water levels exceeding the high level trip setpoint (211"). During 1989, all scrams resulted in water levels exceeding the high level trip setpoint.

Hardware modifications to improve feedwater system control are being planned for the next refueling outages including changes to feedwater bypass control logic and power supply and installation of air accumulators for major feedwater control valves. These changes are based on recommendations from the BWR Owners Group Scram Frequency Reduction Committee and should substantially improve the operator's ability to control reactor water level during plant transients. Possible use of a digital feedwater control system is also being evaluated by the Feedwater System Engineer.

2. Control Room Improvements

In response to Supplement 1 to NUREG 0737, IE has undertaken a major effort to improve the presentation of information to reactor operators and thereby enhance their ability to prevent accidents or cope with any accidents which may occur. This Detailed Control Room Design Review (DCRDR) program was implemented in 4 phases. Each phase included extensive control room modifications and was scheduled as part of the DAEC Integrated Plan. Phases I and II were completed on schedule in 1987 and 1988 respectively and Phase III modifications were completed during the 1990 refueling outage. Phase III modifications included all the remaining safety-significant Human Engineered Deficiencies identified in the DCRDR study. The following control room modifications were made as part of the Phase III effort.

- 7 back panel annunciators have been "Blackboarded." Implementation of the Blackboard concept for the remaining annunciators is scheduled for the next refueling outage as part of Phase IV DCRDR modifications.

- 22 Emergency Operating Procedure (EOP) override switches were installed on control room panels to provide the operators with the ability to bypass diverse functions ranging from safety system suction path changes to bypassing all automatic scrams. These overrides were previously accomplished by time-consuming and cumbersome installation of electrical jumpers.

- Level indicators for the Fuel Pool and Skimmer Surge Tank were installed in the Control Room.

- Approximately 350 control room annunciators were rearranged and 2 new alarm annunciator panels were added to the control room to improve human factors and operator response to these alarms.

- The Containment Isolation Monitoring System (CIMS) was installed in the control room. This system monitors approximately 275 digital indications of containment isolation valves, dampers and fans. The system processes these inputs to provide control room operators with the status of containment isolation functions. Previously, the operators had to review the position of each individual valve, fan, or damper.

Other control room improvements performed during this SALP period include the modification of position-indicating lights for 13 HPCI MOVs in the Control Room. The lights will blink when the breaker at the motor control center has tripped on thermal overload. Similar modification of other safety-related MOVs during the next refueling outage is planned. By providing a direct indication of valve inoperability due to a thermal overload condition the potential for a significant unidentified failure of an MOV is eliminated. DAEC is believed to be the only plant to have this feature.

3. Torus Room Improvements

The March 1990 SALP report noted that IE was taking steps to improve the lighting and cleanliness in less accessible plant areas including the Torus Room. During the 1990 refueling outage, Torus Room lighting underwent a major upgrade. Three circuits of high pressure long-life sodium light bulbs were installed in all areas of the Torus Room, including the basement, dramatically increasing the level of available lighting. In November 1990, IE initiated a Torus Room cleanup project. The goal of this project is to allow access to these areas in "street clothes." This project includes extensive decontamination, cleaning, labeling, and painting efforts. This project is approximately 45% done and is expected to be completed in July 1991.

4. Control Room Procedural Improvements

In response to recent plant events involving the mispositioning of an instrument root valve, IE has taken action to ensure that all instrument valves are positioned currently. As part of this effort, the Plant Procedures Group is creating separate valve lineups for those instruments that provide inputs into the Turbine Trip System, Reactor Protection System, and the Group I Containment Isolation system. These valve lineups will be completed by June 1991 and will be performed as part of the pre-startup valve lineups. In addition, the Plant Procedures Group is performing a plant walkdown to ensure that all plant instrument isolation valves are included in system valve lineups. This effort is expected to be complete by the end of the year.

To ensure that alarm setpoints listed in the control room Alarm Response Procedures (ARPs) are accurate, the Plant Procedures Group initiated a setpoint list verification project. This project involves a comparison of initiating device setpoints in the ARPs to the instrument's source document or calibration card. This process will be completed by year's end.

D. Fire Protection Status and Improvements

As noted in NRC Inspection Report 90-15, overall implementation of the DAEC fire protection program is good. Strengths were identified in the following areas:

- Fire protection equipment in the Turbine Building and Reactor Building is well maintained and housekeeping is good.
- The licensee initiated a program to ensure that the plant fire hazards analysis is kept current as each plant modification or change is completed.

Actions that have been taken to improve overall performance in the area of Fire Protection include:

Control of fire extinguishers

The surveillance test procedure (STP) governing the inspection program for portable fire extinguishing equipment was revised to better ensure the location and integrity of all CO2, dry chemical, halon, and pressurized water fire extinguishers. As part of this effort, each extinguisher location was identified with a unique bar-coded label based on the fire zone in which it is located. The STP was revised to include these unique identifiers and more detailed information on the actual location of the fire extinguishers including plant elevation and grid coordinates.

Fire Marshal

A new Fire Marshal has been named in the Fire Protection Department. The new Marshal was formerly the Fire Brigade Instructor and, as noted in Inspection Report 90-15, he is a State-certified fire instructor and brings 20 years of fire-fighting experience to the department. His extensive experience in fire fighting instruction will allow IE to improve and expand the fire drill program.

Compensatory measures

In January 1990, the administrative procedure governing planned impairments to fire protection systems was revised to include Fire Suppression and Fire Detection Planned Impairment Matrices. These matrices describe which suppression systems protect safe shutdown equipment, identify the controlling post indicator valve (PIV) for each system, and list the compensatory measures required for impaired or inoperable fire protection or detection systems. To ensure that the Operations Department is fully aware of these improvements, personnel from the Department will be retrained on this procedure by the end of April 1991 and the operator requalification program will include training on this procedure. Utilization of this procedure will allow the operators to better assess the impact of tagouts on the operability of fire protection systems protecting safety-related components.

Drill Coordination

In response to Inspection Report 90-09 and to ensure that security procedures or requirements are not bypassed during fire drills, Security now reviews all new fire drill scenarios. The comments and suggestions from the Security Supervisors are retained and reviewed with the Security Department each time the drill is repeated.

Fire protection system demand

In NRC Inspection Report 90-15, the NRC issued a violation for failure to meet the Technical Specification requirements for electric fire pump discharge pressure and flow. As part of the evaluation of this violation, the history of the pressure and flow requirements for sprinkler system #4 was researched. It was determined that the fire pump discharge pressure and flow requirements contained in the Technical Specifications did not accurately reflect the as-built condition of the fire protection system. The following corrective actions were taken:

- Engineering completely re-analyzed pressure and flow requirements for each fire suppression system (including sprinkler #4) based on the current system configuration.
- The supply piping to sprinkler system #4 was modified to reduce the pressure drop across that piping, thereby lowering the requirement for the fire pump's discharge pressure.
- A Technical Specification Change Request has been submitted to the NRC which would revise the fire pump discharge pressure and flow requirements to reflect the revised system requirements.

TABLE 1

1990 - 1991 SCRAM HISTORY

DATE	TYPE OF SCRAM	CAUSE
03/29/90	MANUAL	Loss of instrument air caused by tagout and P&ID Error
04/01/90	AUTOMATIC	APRM high flux caused by spurious LPRM spike
09/10/90	AUTOMATIC	Falsely sensed high level in moisture separator reheater due to isolated instrument root value
09/13/90	MANUAL	Loss of instrument air due to inadequate soldering of instrument air joint
09/18/90	AUTOMATIC	Closure of 3 main steam isolation valves due to loose electrical lead
10/19/90	AUTOMATIC	Low vessel water level resulting from maintenance troubleshooting activities
01/06/91	MANUAL	Steam leak from break in extraction steam piping
02/09/91	AUTOMATIC	Electrical noise in EHC control logic circuit

I. RADIOLOGICAL CONTROLS

A. Personnel Exposures

The 1990 goal for collective radiation exposure was 722 man-rem. This number is higher than the INPO median for collective exposure but the goal was ambitious in view of the enormous amount of work planned for the 1990 refueling outage, much of which was in the drywell. Before the outage began, the trend of the 1990 collective exposure data was consistent with achieving the established goal.

An exposure goal of 591 man-rem was established for the 1990 outage. That goal had been set by developing a realistic estimate of the exposures which would result from the activities planned in the outage (about 700 man-rem) and then reducing that estimate by 15%. To achieve this goal, the Radiation Protection Department significantly increased the use of temporary shielding and chemically decontaminated the Reactor Water Cleanup and Recirculation systems. Over 400 additional lead blankets were procured for use as temporary shielding. Further discussion of chemical decontamination is included at F. below.

During the outage, although management emphasized the importance of keeping exposures within the goal, actual exposure accumulated was approximately 680 man-rem--less than the estimate but higher than the goal. The outage exposure goal was exceeded primarily because coordination between the organizations performing the recirculation pump upgrade project and the recirculation isolation and bypass valve project was less than satisfactory. As a result of the coordination problem and other unanticipated work activities, the recirculation system remained drained for approximately three weeks longer than had been planned. If the system had been filled, the water would have provided shielding and significantly reduced the dose in the vicinity of the recirculation system. It is estimated that leaving the system drained longer than planned resulted in an additional 100 man-rem of exposure. The lessons learned from this event have been incorporated into the ALARA program. The Work Control Task Force will review this event to develop corrective actions to prevent recurrence. Further discussion of the WCTF is contained in Section III of this report.

Without the additional outage-related exposure described above, Iowa Electric would have achieved its collective exposure goals for both the outage and 1990. This is especially significant in the context of the large amount of work performed during the refueling outage.

The collective exposure goal for 1991 is 230 man-rem which is better than the INPO best quartile for industry radiation exposure. During January and February 1991, the monthly goals were surpassed by 17% and 8% respectively. A detailed description of IE's efforts to reduce personnel exposures is provided at C. below.

B. Personnel Contamination Events

The 1990 goal of 100 personnel contaminations was established by reducing by 50% the number of contamination events that occurred in 1988--the year of the last refueling outage. IE recognized that the goal was ambitious but it was thought to be achievable due to the planned duration of the 1990 refuel outage (69 days) as compared with the duration of the 1988 outage (104 days).

IE realized that the contamination goal was in jeopardy early in the outage and that management attention was required to help solve the problem. In response, a radiological engineer was assigned full time on July 17, 1990, to investigate and trend personnel contamination events. By the end of July, additional personnel were assigned to the review and processing of contamination records; this permitted a same-day response to the events. Face-to-face interviews were conducted with each person who became contaminated. At the beginning of August, the Radiation Protection Supervisor began interviewing every person who had three or more individual contaminations. After August 23, any individual involved in a contamination event was restricted from access until he/she was interviewed by the Radiation Protection Supervisor and the Shift Outage Manager. On August 24, additional General Employee Training was mandated for individuals with three or more "at-fault" contamination events in a calendar quarter. These prompt responsive actions, however, did not isolate the underlying causes of the excessive events. Subsequently, based on analysis of information concerning the events, it was determined that the extreme environmental conditions encountered in the summer outage caused leaching of contamination from or through the protective clothing. IE estimates that 31% of the reported contaminations resulted from leaching.

Studies were performed on protective clothing to determine the cause of leaching. The results of these studies were inconclusive. Unannounced inspections of the laundry facilities were conducted. New, all-cotton protective clothing was purchased. In addition, routine cleaning of floors was increased from every other day to daily in order to limit the spread of contamination.

These actions helped to reduce the rate of contaminations but a total of 447 personnel contamination events occurred during the outage. While the absolute number of contamination events that occurred during the outage was high, notwithstanding strong management attention, the rate of contamination events was actually lower than during the 1988 outage. The number of contamination events per 1000 man-hours worked under a Radiation Work Permit (RWP) decreased from 3.3 in 1988 to 3.1 in 1990. This is explained by the fact that, although the 1990 outage was approximately 40% shorter than the 1988 outage (74 days vs. 104 days), the number of RWP man-hours was 75% greater. In fact, more RWP man-hours were worked in the first 4 weeks of the 1990 outage than during the entire 1988 outage.

A contamination goal of less than 1 contamination event per 1000 RWP man-hours has been established for 1991. Data thus far indicates that this goal is being met. The combined rate for January and February is approximately 0.9 contamination events per 1000 RWP man-hours.

C. <u>Reducing Radiation Exposures and Personnel Contamination Events.</u>

The Radiation Protection Department completed an assessment of the Department's performance against INPO Performance Objectives and Criteria in 1990. Sixteen recommendations from this assessment have been implemented. They include the following:

- Development of the program to categorize and trend root causes of radiation protection incidents.
- Special training for health physics technicians on contamination control, including training by an outside vendor on how to control contamination at the source.
- Incorporation of a survey tracking system (logbook) in the health physics program. The logbook provides a history of contamination and radiation area surveys listed by survey number. This tracking system has significantly improved the Department's ability to locate and reference previously-performed surveys.
- Posting of permanent "No eating . . . smoking" signs at entrances to radiologically controlled areas.
- Development of plans for systematic decontamination of plant floor areas during outage and non-outage conditions. Progress in implementing these plans will be tracked in connection with the Corporate Strategic Plan. Further discussion of the Strategic Plan is contained in Section VII of this report.

In Inspection Report 90-12, the NRC noted that the radiation protection and radwaste programs appear to be effective and capable of protecting the health and safety of workers and the public. No particular weaknesses were noted by the NRC inspectors. Among the positive aspects identified were the following:

- There are no apparent problems in the shipping and transportation of radioactive material.
- The DAEC is a zero release plant for liquid radioactive effluents.
- There is strong management support for these programs as demonstrated by the hiring of experienced health physicists.
- The trend charts of dose equivalent I-131 for 1989 and through July 1990 revealed that the concentrations were constant and well below the limits stated in the Technical Specifications, indicating that there is no fuel leakage. The Reactor Coolant System radiochemistry was noted as good.

In addition, the 1990 INPO evaluation identified as a GOOD PRACTICE the Radiation Protection Department's use of the resin decant system to provide additional purification of low quality radioactive waste water.

1. Radiological Protection Performance Monitoring Program

   IE has developed and implemented a program to review, categorize, and trend radiological good practices and deficiencies identified at the DAEC. The program requires that radiological incidents be reviewed by the Technical Support Department. If an incident is found to be significant, a Radiological Incident Investigation Committee is convened under a chairman assigned by the Technical Support Supervisor. The Committee is required to conduct a thorough investigation of the incident and perform a detailed root cause analysis and recommend corrective actions. The report summarizing the incident, root cause, and corrective actions is routed to the Assistant Plant Superintendent, Radiation Protection and Plant Superintendent, Nuclear for final review and approval.

2. ALARA Activities

Separate ALARA committees have been established at the corporate level and at the DAEC site. The two committees will meet quarterly and provide independent reviews of long-term programmatic and day-to-day performance respectively. The Manager, Nuclear Generation Division is the Chairman of the corporate ALARA committee.

Several enhancements to the ALARA work planning process have been implemented. ALARA personnel are now involved in initial work planning and scheduling. There are formal requirements for documentation of ALARA job planning activities for non-routine tasks with significant potential for cumulative personnel exposure. The documentation generated by this process is stored in job planning folders for reference when tasks of a similar nature are planned in the future. These folders will prove beneficial to ALARA planning for the next refueling outage.

3. Exposure Tracking System

To help in the tracking, trending, and monitoring of personnel exposures, a PC-based system has been established which permits quick retrieval of information to assist in the work-planning process. This system can also optically scan such documents as Information Notices and INPO GOOD PRACTICES, and it is being used to set up a text database of RP/ALARA-related documents.

4. Contamination Events

Efforts to reduce the number of skin contamination events at the DAEC continued to receive management attention. An on-going Contamination Control Program has been implemented in order to reduce the number of such events. This program is based on lessons learned from the 1990 refueling outage and industry experience. As part of the program IE is now evaluating several areas of potential improvement and has established policies which will help the Department to meet its goals of limiting the number of contaminated areas and of skin contamination events. Personnel attitudes, training, barriers, and posting of contaminated areas, clothing, and pre-planning are being addressed. The following improvements are underway:

- Workers and supervisors will be held accountable for following contamination control and skin contamination prevention measures shown in plant procedures. Contamination events are monitored as part of each Department's performance goals.
- Health Physics procedures will be revised by May 1991 to state that physical barriers such as waist high plastic walls are to be used as

contamination barriers instead of just marking the contaminated area. In addition, objects that must traverse contamination boundaries (such as hoses and ropes) are required to be secured or taped at the point of entry into the contaminated area in order to prevent dragging the object across the line and contaminating an otherwise clean area.

- A contamination control class for instrument technicians, electricians, and mechanics was held as part of the continuing training program for these workers. The class stressed contamination control techniques and philosophy. This training will be repeated as part of the continuing training program.

- The reporting system for radiation protection incidents has been enhanced by specifying the mechanism for reporting and trending deficiencies in contamination control techniques. The system is also being used to document any deficiencies found by plant staff during plant tours.

- General Employee Training (GET) has been enhanced by placing increased emphasis on the importance of proper contamination control practices by everyone in the work place. In addition, the dress-out portion of GET has been changed to reinforce the proper techniques for removal of protective clothing. Health Physics Supervisors review and critique the dress-out portion of GET semi-annually.

D. Changes in Organization and Staffing

The Radiation Protection Department has been substantially reorganized in order to improve management of its activities. There is now an assistant plant superintendent responsible for radiation protection only. This provides additional attention by an experienced person to the activities of the Radiation Protection Department. One layer of management has been reduced through elimination of the position of Radiation Protection Supervisor. Key supervisors in the Department now report directly to the Assistant Plant Superintendent, Radiation Protection.

Five new radiological engineers have been added to the Radiation Protection professional staff. All had previous experience at other nuclear plants. There are now a total of eight radiological engineers.

E. Self-Assessment Activities

An ad hoc Self-Assessment Study Group was convened to review the functioning and effectiveness of the Radiation Protection Department in relation to the DAEC as a whole. The Group, consisting of seven radiological controls personnel, first discussed in detail the recent performance of the Radiation Protection Department to identify the areas which could potentially contribute to poor or inadequate performance. The Group made over 25 recommendations for improvement in these areas. Twelve of the Group's recommendations have already been implemented. For example, the Radiation Protection supervisors now meet each morning to discuss activities planned for the day, any special support required, and items of particular interest. A monthly Radiation Protection Summary Report is published. The report contains graphs and trends of

Radiation Protection performance against INPO indicators and information concerning significant events. In addition, a quarterly meeting of Radiation Protection supervisors and their counterparts in the Training Department is held in order to improve communications between the Departments and the training of Radiation Protection personnel.

An experienced outside contractor conducted another, separate assessment of the performance of Radiation Protection. This independent, in-depth analysis of the Department's functions and organization produced several recommendations which have been or are being implemented, including the departmental reorganization described earlier.

F. Decontamination Efforts; Radwaste Volume

1. Decontamination efforts

As part of an effort to reduce further the amount of contaminated floor space at DAEC, recovery of the Torus Room is now underway. The top half of the room has been painted and is now being prepared for release. Recovery of the remainder of the Torus Room is actively underway and is scheduled to be completed in July 1991.

The DAEC performed chemical decontamination of the Reactor Water Cleanup (RWCU) and Recirculation Systems during the 1990 refuel outage in an effort to reduce worker exposure. The total dose saving during the outage from the decontamination of these systems is estimated at 300 man-rem.

2. Reduction of radwaste volume

The volume of solid radwaste sent for burial during 1990 was 138.5 cubic meters, well below the company goal; over the last three years, the average for DAEC is 150.8 cubic meters/year. This places the DAEC in the INPO Best Quartile of Boiling Water Reactors in the U.S, as compiled by INPO Performance Indicators.

G. Chemistry

The purity of reactor water continues to be outstanding. The Chemistry Performance Index at the DAEC which measures impurities in the water is far better than the EPRI guidelines and frequently just above the theoretically lowest achievable value. The reactor water conductivity at the DAEC averages around 0.06 microsiemens/centimeter while the EPRI guidelines recommend 0.2 microsiemens/centimeter.

Backshift coverage in the Chemistry Laboratory has been implemented; thus, there is continuous chemistry staffing at the site. This permits immediate response to chemistry control transients and problems.

In February 1991, the NRC performed an inspection of the plant chemistry organization and radiochemical confirmatory measurements. As noted in NRC Inspection Report 91-06, the radiochemical confirmatory measurements were very good. Laboratory QA/QC programs were adequate. The Radiological Environmental Monitoring Program (REMP) appeared well managed and was operating satisfactorily. No violations or deviations were noted by the NRC inspectors. Among the positive aspects identified were the following:

- The chemist responsible for plant water chemistry, demineralizers, liquid radwaste, domestic water, post-accident sampling, and hydrogen water chemistry reports to the Radiological Engineering Supervisor. Placing responsibility with one individual for monitoring plant water systems is a good practice.
- Results of the confirmatory measurements were very good with the licensee achieving 49 agreements out of 49 comparisons.
- Chemistry technicians appeared knowledgeable, followed proper laboratory procedures, and took appropriate precautions when handling radioactive materials.

III. MAINTENANCE/SURVEILLANCE

A. Overview of Indicators

1. MAR backlog

   Since the 1990 refueling outage, the total number of open priority 1, 2, and 3 Corrective Maintenance Action Requests (CMARs) decreased from approximately 925 in August 1990 to 792 in February 1991. This reduction is notable when the major involvement of maintenance personnel in the several short duration outages which occurred in the period since the outage is taken into account.

2. Maintenance rework

   In March 1990, IE developed a definition of rework and initiated a process to track and trend all instances of rework. If the definition is met, a particular Maintenance Action Request (MAR) is identified as rework and the information is entered into the computerized equipment data base for tracking and trending. A Rework Evaluation Sheet must be prepared before the MAR can be closed out. This sheet describes the component failure and identifies the primary cause of the failure and the corrective actions taken to prevent recurrence. IE expects that the new tracking process will result in better management and resolution of recurring equipment problems. The Maintenance Department goal to limit rework efforts to less than 4% of the total work has been met. The total 1990 rework rate was less than 3%.

3. Preventive maintenance/total maintenance ratio

   The Maintenance Department's 1990 goal for preventive maintenance stated that preventive maintenance should represent 60% of the total maintenance effort. During 1990, this goal was surpassed with preventive maintenance accounting for over 70% of all non-outage maintenance items. During January and February 1991, preventive maintenance accounted for 69% and 73.7% respectively of total maintenance.

4. High Pressure Coolant Injection availability

HPCI availability has continued to improve. Since the 1990 refueling outage, HPCI unavailability has totalled only 3.6 hours. In contrast, HPCI unavailability during the 6 months prior to the outage was approximately 200 hours. The improved performance of this system is the result of significant management attention and hardware improvements installed during the outage.

5. Emergency diesel generator availability

Diesel generator availability continues to be high. During 1990, the diesels were only unavailable during surveillance testing. This is due to the performance of knowledgeable personnel in both the Maintenance and Engineering departments.

6. Surveillance testing

During January 1990, 2 surveillance tests were not performed within the required time frames. However, as noted in Inspection Report 90-02, the missed surveillances were of minor safety significance and adequate corrective actions were implemented. More than 4100 surveillances were performed during 1990.

Only 1 additional surveillance was missed during the current SALP period. In February 1991, a daily jet pump operability surveillance test was performed 4 minutes late. The plant was in Hot Shutdown at the time and it was mistakenly determined that the surveillance was not required. In response, the Surveillance Testing Supervisor discussed the incident with Control Room personnel. In addition, training on jet pump and recirculation pump procedures will be included in this cycle of operator requalification training.

B. Maintenance Quality Improvement Program

The Maintenance Department has developed and implemented a Maintenance Quality Improvement Program (MQIP). The Program is governed by a Maintenance Department Directive and concentrates on identifying and resolving problems in the maintenance process which have the potential to affect the Department's performance adversely. Examples of areas in which difficulties which have been identified include inter-departmental coordination, procurement of spare parts, and inaccuracy of certain instructions. An initial program objective is to remove cumbersome and unnecessary administrative impediments to maintenance, releasing more departmental time and energy for actual maintenance work.

The program includes critical self-assessment of maintenance activities. The MQIP Coordinator schedules an "Observer" for a specific maintenance job each week. This person observes and analyzes the job planning, the actual maintenance work, and post-job activities. The participation by other departments (e.g., Material Control, Operations, Health Physics, Engineering, and Scheduling) in the job is observed and evaluated. Upon completion of the evaluation, a meeting is held with the observer, Maintenance supervisors, and representatives of any other departments which were observed as part of the evaluation. Problems or deficiencies identified during the observations are discussed and follow-up actions are assigned. The scheduled observers are primarily maintenance foremen and supervisors but also include the Assistant Plant Superintendent, Operations and Maintenance and the Manager, Nuclear Generation Division. To date, 14 observations have been completed. As a result of this program, changes have been made to the Fire Protection Impairment Request system, Maintenance procedures, and the Maintenance planning process. IE anticipates that additional observations and utilization of the MQIP will result in further improvements in maintenance performance.

C. Improved Supervision in the Maintenance Area

Additional actions have been taken with respect to supervision in order to improve the quality of maintenance.

Supervisory staffing has been increased, reducing the number of craft persons each foreman supervises and enabling each to focus more productively on his assigned tasks. In addition, the foremen and Maintenance supervisors have received instruction on the expectations of plant management regarding the conduct of maintenance, including procedural adherence and achievement of departmental goals, and have been advised of their accountability for work performed in their respective areas. To ensure that the foremen and supervisors have the time for direct support of work activity, administrative duties previously assigned to them are being reassigned to a Maintenance Coordinator in each shop. Foremen and supervisors are expected to spend at least 25% of their time in the direct supervision of work activities.

D. Procedural Improvements/Adherence to Procedures

Steps have also been taken to improve both procedures and procedural compliance. These matters were addressed at meetings with personnel in each of the maintenance shops and with the Assistant Plant Superintendent, Operations and Maintenance. It is clear that people in each of the shops, Mechanical, Electrical, and Instrument and Control, are skilled workers who take pride in their work. However, they are concerned about problems in procedures that make it difficult for them to accomplish their tasks in a timely and effective manner. The resolution of these concerns is receiving priority attention; a number of steps have already been taken:

The Manager, Nuclear Generation Division and the Manager, Quality Assurance issued a Policy Statement on February 8, 1991, which reiterates management's expectations regarding procedural adherence. The Policy Statement provides guidance on how to resolve procedural discrepancies and perform complex or infrequently performed procedures.

A Maintenance Procedure Users Group has been formed. It consists of representatives from each shop (Mechanical, Electrical, and Instrument and Control) and Quality Assurance and is chaired by the Assistant Plant Superintendent, Operations and Maintenance. The purpose of this group is to evaluate the effectiveness of current procedures and develop a list of recommended actions to remove the potential barriers to procedural adherence.

A Procedural Coordinator has been assigned within each maintenance shop to act as the focal point for procedural issues within the shop and as the communication link to the Plant Procedures Group. The Procedure Writer responsible for each area will meet each week with the Maintenance Procedural Coordinator to discuss procedures that have been used during the week as well as those procedures which will be used in the upcoming week.

Steps have been taken to learn from the successful practices of other licensees with regard to procedural effectiveness and compliance. An IE team consisting of the Manager, Nuclear Generation Division, a Mechanic and a Maintenance Procedure Writer visited another utility to review that plant's procedures and meet with their counterparts to better understand their achievements in this area. Insights gained from this visit will be used to enhance IE's program.

E. Post-Maintenance Testing

Efforts to strengthen the post-maintenance testing program continued during 1990. Efforts which were begun in 1990 and are continuing in 1991 include:

- Maintenance Engineers and Operations Shift Supervisors responsible for the assignment of post-maintenance testing have received additional training. This training reinforces the importance of returning systems to the correct configuration after maintenance and details specific applications of post-maintenance testing techniques.
- The Maintenance Planning Group Leader reviews each MAR before the planning process is completed. This additional review is designed to ensure that post-maintenance testing prescribed in the MAR is adequate and consistent with the Maintenance Planning Directive.
- Post-maintenance testing matrices are being developed to assist Maintenance Planners to determine the appropriate testing requirements for the various types of maintenance work. The matrices will provide Planners with a definitive and consistent mechanism for determining the post-maintenance testing actions that will meet both regulatory and safety requirements. A matrix for post-maintenance testing of MOVs is nearing completion and is expected to be implemented before May 1, 1991. Matrices for pumps, doors, manual valves, and check valves are planned to be completed by December 1991.

In combination, these efforts will assist in strengthening post-maintenance testing program, further enhancing equipment and system reliability.

F. Predictive Maintenance

The Predictive Maintenance Program continues to identify and resolve equipment problems prior to failure. This program involves 2 full-time and 2 part-time maintenance personnel and utilizes a number of technologies, including thermography, heat exchanger performance trending, oil/wear particle analysis and trending, and vibration monitoring. The latter technique has produced the most marked results, yet each technique contributes to the Program's effectiveness. During 1990, this Program was further enhanced by the introduction of a Computerized Central Maintenance Management Program which will allow the Maintenance personnel to better manage and customize the monitoring and trending program. Some notable examples of the effective application of this program are discussed below.

During the 1990 refueling outage, the vibration monitoring of the recirculation system was enhanced by the installation of new vibration sensors and a control room recirculation pump vibration alarm and by providing on-line indication of pump vibration levels.

During February 1990, increasing vibrations were detected on the lower bearing of the "B" condensate pump. Although the vibration readings were relatively low, the pattern of the readings was indicative of potential bearing failure. Power was reduced and Maintenance performed the repairs, without incident, and the unit was returned to full power after 2 days. An examination of the replaced bearing indicated a flaw on its inner race. As noted in Inspection Report 90-04, the vibration monitoring program was successful in detecting an incipient failure that could have led to motor failure and a significant plant transient.

In another example, a vibration analysis of the turbine generator exciter coupling indicated possible abnormalities in the coupling prior to the 1990 refueling outage. This information was provided to the turbine vendor who concluded that the vibrations were not significant. As a result, only a coupling inspection and relubrication were performed by the turbine vendor during the outage. After the outage, however, vibration levels were higher than prior to the outage and continued to climb. To verify the cause of the increased vibrations, IE initiated a plant shutdown and disassembled the coupling. Investigation revealed that the coupling was out of alignment. The coupling was repaired during the brief outage and vibrations have been reduced by 83%. Without aggressive and persistent troubleshooting on the part of Maintenance and Engineering, the coupling could have failed, possibly resulting in turbine damage and a lengthy outage.

Further enhancements to the Predictive Maintenance program are planned for 1991. These enhancements include implementation of a check valve testing program, purchase of additional vibration and computer monitoring hardware, and upgrading of program software.

G. Local Leak Rate Testing (LLRT) Program

During the 1990 refueling outage, the LLRT results for the Primary Containment improved significantly as evidenced by a 25% reduction in as-found leakage. This improvement is attributed to better valve maintenance, design modifications, and better program coordination.

As noted in Inspection Report 90-14, as-found local leak rate testing of the Main Steam Isolation Valves (MSIVs) during the 1990 refueling outage resulted in the lowest leakage experienced in over a decade. This significant improvement in performance is attributed to improved valve maintenance and alignment activities.

Integral to the success of LLRT program has been the assignment of the LLRT Coordinator to the Maintenance Department. Previously, this testing program was part of the Plant Performance Department. By being part of the Maintenance Staff, the Coordinator is better able to monitor repairs to valves and trend valve performance, thereby avoiding repeat failures. In the 1988 outage, 7% of the valves failed retest; none failed in the 1990 outage.

Further improvements to containment leak tightness are expected as a result of major MSIV improvements completed during the 1990 refueling outage. These improvements included increasing the pneumatic seating force by 100% and spring seating force by 130% and restoring all clearances and alignments to manufacturer's minimum tolerances.

H. Maintenance Program Manuals

During the current SALP period, a Maintenance Directive was issued which required the development of Maintenance Program Manuals by the Maintenance Engineers. These manuals are component specific, i.e., pumps, motors, control valves, etc., and include information relevant to the components. Specifically, historical, industry, regulatory and vendor information is incorporated into a standardized manual format. This information is to be used by the Maintenance Engineers to trend equipment performance and form the bases for an effective, component-specific preventative maintenance program. A total of 24 manuals are being developed; they are expected to be completed by December 1991. These manuals are all reviewed by the Maintenance Engineering Supervisor upon issuance and after any significant future manual revisions.

I. 1990 Refueling Outage

The DAEC 1990 refueling outage began on June 28, 1990, and ended on September 10, 1990, a total duration of 74 days. This outage was originally scheduled for 69 days with the critical path for outage completion being the upgrade of the "A" and "B" main reactor coolant recirculation pumps. The 5-day extension was due to complications and delays associated with the recirculation pump project.

The scope of the 1990 outage was greater than ever before, especially with regard to work in the Drywell (a high Radiation Area), making it more difficult to manage and implement work activities in an efficient manner. Integration of a contractor's large management and supervision group into the overall outage team was a new concept for IE and presented an additional challenge. The 69-day schedule was ambitious but thought to be achievable. IE believes that the 1990 outage was a success considering the major challenges that were faced.

1. Outage accomplishments

The success of this outage was primarily due to planning undertaken long before the outage began. Some of these efforts are discussed below:

- The creation of a permanent outage organization and assignment of full-time, experienced personnel to the organization clearly communicated senior management's determination to improve outage performance. All departments assigned members to the outage management team, which established plant-wide ownership of outage planning and implementation efforts.

- The pre-planning of work and issuance of a formal outage scope document four months prior to the outage allowed for a focused work-planning process. The scope was frozen 3 months before the outage; management controls were established to review and approve all scope changes thereafter.

- Before the outage, a team-building seminar was held to emphasize and promote teamwork, accountability, and leadership within the outage team. This training again reflected management's determination to assist in making this outage successful.

The scope of the outage was extensive and included major projects scheduled in response to both regulatory requirements and IE initiatives. Among these projects were the following:

- The Recirculation and Reactor Water Cleanup Systems were chemically decontaminated to reduce personnel exposure. The total dose savings during the outage from this effort are estimated at 300 man-rem.

- The motor-operated valve (MOV) project consisted of overhauling 37 motor operators, replacing 43 torque switches, and performing 32 diagnostic tests.

- The Recirculation Pump Upgrade project consisted of replacement of the recirculation pump rotating assembly and cover/heat exchanger assembly, removal (and return) of the recirculation motors from the drywell, removal and re-routing of structures and piping interfering with the removal of the motors, and the removal and re-installation of the instrumentation on the motors and pumps.

- Twelve modifications proposed by the joint IE/GE Plant Performance Program were installed on the HPCI system.

- The Main Steam Isolation Valves (MSIVs) underwent major modifications to improve their operation and local leak rate test (LLRT) performance.

- Approximately 240 feet of 20-inch extraction steam piping between the low pressure turbines and feedwater heaters was removed and replaced with more corrosion-resistant piping.

- The Cooling Towers underwent major improvements including the replacement of the fill and fill grid supports in 10 cells of the "B" tower and replacement of 19 fan assemblies in the "A" and "B" towers.

- Approximately 175 feet of RWCU piping was replaced with IGSCC resistant stainless steel pipe. Weld crowns on an additional 100 feet of RWCU piping were ground down and ultrasonically examined.

  Portions of 50 Control Rod Drive (CRD) insert and withdraw lines in the Drywell were replaced because leakage had been identified in the air gap between the Drywell shell and the Drywell concrete shield wall. This work consisted of cutting each line to allow access for UT examination, coring out the Drywell shell at the pipe penetration, and replacing the section of pipe where it penetrated the Drywell shell. This project included 350 welds, 50 of which were pipe-sleeve-to-drywell-shell welds. A dedicated team was formed to address this project. As a result of the application of good work control measured this project did not extend the outage despite its extensive nature.

2. Necessary improvements in outage work controls

While a number of strengths were demonstrated, there are also several areas in which opportunities for improvement exist. These include personnel exposure, personnel contaminations, and contractor work control. The first two topics are discussed in Section II, Radiological Controls. A number of actions were taken to achieve control over contractor's work after Corrective Action Report 90-01 was issued (on August 15, 1990) by the QA Manager to the Outage Manager. The CAR cited numerous examples of inadequate work control on various refuel outage projects that were assigned to contractor organizations. The immediate actions that were taken to address the concern included:

- An IE Electrician and a Mechanic were assigned to the Drywell project team. Guidance was provided to them to ensure that management's expectations concerning work control practices were understood.

- The IE Quality Control (QC) organization performed additional surveillances of on-going work activities to monitor conformance to work control procedures.

- The Drywell management contractor defined and implemented a work control plan to increase the effectiveness of its work supervision including the addition of a full-time General Work Supervisor for the Drywell. In addition, the ratio of field engineers to craft personnel was adjusted to ensure that sufficient supervisory resources were available to monitor specific craft tasks.

The Outage Management organization recognized that other issues contributed to the work control problems and would require further review. In response, the Work Control Task Force (WCTF) has been created to review craft training and supervision, work planning and management, contractual arrangements and the interaction between contractor and IE Quality Control programs. The membership includes personnel from Maintenance, Project Engineering, Outage Management, Quality Assurance, Operations, Radiation Protection, and contractor personnel. The WCTF is to make recommendations by April 1, 1991, on how to improve performance in these areas during the next refueling outage.

A milestone schedule for WCTF progress has been developed. The schedule includes implementation of recommendations by October 31, 1991.

V. EMERGENCY PLANNING

The NRC's evaluation of the DAEC 1990 full-scale emergency preparedness exercise identified no violations, deficiencies, or weaknesses. Overall performance was good. All emergency classification decisions were correct; timely notifications of State and County officials were made. Coordination between the licensee's emergency response facilities, as well as coordination with State and County officials, was good.

This evaluation is especially significant because this exercise involved the first use in an emergency preparedness exercise of the DAEC Control Room Simulator and the relocated Operations Support Center (OSC). The exercise included an onsite medical response, an assembly and accounting of more than 400 personnel, and participation of the State, two "risk" and three "host" counties.

NRC Inspection Report noted that the Quality Assurance audit performed to satisfy the requirements of 10 CFR 50.54(t) did not include the required evaluation, by the QA staff, of the adequacy of the licensee's interface with the State government. In response to the deficiency, a level IV violation was issued. As noted in the Inspection Report, steps were taken to correct the identified violation and to prevent recurrence. IE believes that, while the QA audit was deficient as noted, it does not reflect adversely on the excellent overall performance of emergency planning activities.

Emergency Planning accomplishments during the current SALP period are discussed below.

A. Staffing and Organization

The Emergency Planning Department increased its experience level by having personnel attend Emergency Planning Training courses during the current SALP period and by assigning each planner both onsite and offsite responsibilities. IE established and filled a position for a scenario-developer with a Senior Reactor Operator who transferred from the DAEC Simulator Training Department.

B. Training of State of Iowa Emergency Response Personnel

Iowa Electric's Emergency Planning training staff trained approximately 2,500 persons to participate in offsite response if needed and conducted several drills prior to the evaluated exercise. Correspondence from the Administrator of the Iowa Disaster Services Division indicated that the training was well attended and well received. As another indication of the value of the work done by IE Emergency Planning staff, a member of the EP staff received an award from the Governor of Iowa in April 1990 in recognition of IE's efforts providing radiological emergency response training.

C. Emergency Response Facilities (ERF)

The NRC concluded in NRC Inspection Report 90-11, that the ERFs were being well maintained and that IE has initiated a number of improvements and refinements based on self-identified concerns. Improvements to ERFs and drill scenarios include:

- The Control Room Simulator was used to drive the accident scenario for the first time in 1990. Use of the Simulator provided a more realistic challenge to exercise participants in the Simulator Control Room and reduced the impact of the exercise on activities in the plant Control Room. The Simulator was also used to drive the Safety Parameter Display System (SPDS) terminals in both the ERF and Emergency Operations Facility (EOF).

- The public information program was enhanced by the introduction of pocket-sized emergency information cards for the public and the use of an interactive telephone information service to supplement the annual distribution of the public information brochure.

- Onsite ERFs were enhanced by the introduction of new status boards, maps and displays. SPDS capability was added at both the EOF and Technical Support Center (TSC). In addition, the OSC, which was previously located in a series of corridors, was relocated to a permanent, modernized facility.

- The Emergency Planning Department has purchased a new 800 MHZ communication system which will provide a network for all of Iowa Electric's emergency response resources. This system is used by the TSC/EOF to communicate with Off-Site Field Monitoring teams.

- Control Room emergency notifications to State and local authorities are now made via a facsimile machine. This change expedites the notification process, minimizes confusion over the phone by providing written details of the event and allows the Shift Supervisor to focus more attention on plant operation.

D. Planned Improvements

IE is developing a new computerized tracking system for emergency planning commitments which will better enable the Department to track and trend assigned actions. This system is an improvement on previous tracking systems in that it permits the incorporation of closure statements and on-line review by Emergency Planning Supervisors. IE expects this system to be fully operational during the second quarter of 1991.

Iowa Electric will acquire the Emergency Response Data System (ERDS) prior to the end of 1991. This system will provide the NRC with real-time data on vital parameters of the reactor and safety systems.

IE is preparing a new procedure which will address the interface between onsite and nearsite NRC Incident Response and Incident Investigation Teams as well as the Department of Energy to facilitate assessment of offsite radiological impact. This procedure is expected to be approved in March 1991.

V. SECURITY

A. Overview

Iowa Electric management has devoted substantial resources to improving security at DAEC. The March 1990 SALP report noted that management support for improvements in the security system was excellent. This support continued during the current SALP period as evidenced by completion of major upgrades in the security system and was again acknowledged in NRC Inspection Report 91-04. NRC inspections during the current SALP period have found no violations of NRC requirements in the DAEC security program and concluded generally that the program is adequately implemented and managed. (See Inspection Reports 90-21 and 91-04). IE is also aggressively implementing additional hardware improvements to the Physical Security Computer System which will further improve security at the plant.

B. Indicators

Only 2 security events were reported during the current SALP period. This number of events is the same low number as reported in 1988 and 1989. The first event involved granting access authorization to a contractor based on the background investigation performed on an individual with the same name (his father). As a result, the initiation and tracking of background investigations are now controlled by social security numbers. The second event involved the degradation of the pump house vital barrier. This event is discussed in greater detail later in this report. Both of these events were of a minor safety significance and corrective actions have been implemented which will prevent their recurrence.

During 1990, the system that tracks entries in the Security Event Log was computerized to facilitate better analysis and trending. Comparison of 1989 and 1990 data indicates a decrease of approximately 29% in the number of loggable events caused by hardware. This reduction is attributable to the installation of the new security equipment. Events caused by human error increased from a total of 24 in 1989 to 48 in 1990; this is attributable to the fact that a substantially greater number of personnel were on site during the 1990 refueling outage. The new computerized system also permits tracking of security equipment availability. During the last quarter of 1990, cameras and detection equipment were available 99.96% and 99.82% of the time, respectively.

C. Self-Assessment

In March 1990, Iowa Electric engaged a contractor to develop a self-assessment plan for the Security Department. The plan includes selective examinations to identify areas where improvements can be made and development of recommendations for enhancements to security operations. The self-assessment plan consists of 27 self-inspection modules for individual functions such as Secondary Alarm Station (SAS), Control Alarm Station (CAS), and access control.

To determine the effectiveness of the self-assessment program, the contractor performed an assessment at the DAEC last fall. This assessment included a review of current Security Department procedures and directives, interviews with security personnel, and a review of randomly-selected records and forms. The assessment concluded that the Security organization is meeting its responsibilities to protect the health and safety of the public and that improvement in the physical security system is obvious. The majority of the weaknesses identified were procedural concerns and inconsistent records. The contractor recommended improvements such as changes to administrative practices and revisions of procedures and of the Security Plan to further enhance the program. Management of the Security Department has evaluated the recommendations and corrective actions are now in progress. The on-site security staff plans to perform a similar self-assessment in 1991.

D. Security Organization, Staffing, and Training

In February 1991, the responsibilities for Radiation Protection and Security were divided. An Assistant Plant Superintendent remains responsible for Radiation Protection. The Security Supervisor is now designated as the Security Director and reports directly to the Plant Superintendent, Nuclear. This change in the security organization ensures more direct oversight by the Plant Superintendent in security matters.

The attitude and cooperation of the Security Department staff was noted in Inspection Report 90-21, as excellent and that the Department has done a good job in the performance of its duties. The housekeeping practices and general appearance of the Protected Area and plant were also noted as excellent. No instances of inattentive security personnel on post have been identified during the current SALP period.

The SALP-8 Report indicated that the training program for personnel in the Security Department required additional management attention. IE has taken action to address this concern. In August 1990, IE added a staff position with responsibility for managing and improving the Tactical Response Program, including training. Training activities conducted during 1990 included:

- Training the Security Staff on appropriate use of deadly force.
- Performing a vital target analysis to determine which areas of the plant would be likely targets for intruders and training of security personnel on how to best defend these areas.
- Developing pre-designated defensive response positions to better intercept intruders while maintaining maximum concealment and training of Security personnel on these positions.
- Performing night time CCTV/response assessment exercises.
- Performing exercises involving simulated intrusions into the Protected and Vital Areas.
- Performing joint security exercises with a local law enforcement agency.

IE plans an aggressive training program for 1991. Goals include further training to familiarize personnel with tactical weapons, increased security drill activity, revision of procedures governing safeguards contingency events, and an external evaluation of the Tactical Training Program.

E. Security Equipment

1. Completed security equipment upgrades

   The following improvements to the DAEC security system were completed during this SALP period:

- The perimeter fences around the Protected Area and the Intake Structure were replaced; the new fencing is taller and better secured to the fence posts and the ground.
- A second (nuisance) fence was installed around the Protected Area.
- The perimeters of the Protected Area and the Intake Structure were regraded to enhance detection capability.
- Exterior lighting was modified to improve visibility. Additional lighting was added to enhance camera resolution and temporary lighting was replaced with permanent lighting.
- A new electronic system was installed to detect intrusion for the Protected Area and the Intake Structure.
- New closed-circuit television cameras were installed on the perimeters of the Protected Area and Intake Structure.

2. Future security equipment upgrades

Additional major upgrades to the Security Computer and Access Control Systems are scheduled to be completed before the end of 1993. The Physical Security Computer System (PSCS) project consists of upgrading the hardware of the main security computer, the operator's consoles in the Central Alarm Station (CAS) and the Secondary Alarm Station (SAS), access control, and the Video Switching Sub-system (VSS). The major functions provided by the PSCS will be access control, alarm monitoring and annunciation, security record storage and report generation, security material issue control, and training. IE plans to install new walk-through explosive detectors with increased sensitivity for detection and new X-ray machines in 1991 and 1992 respectively.

3. Maintenance of security hardware

The Security Department has developed and implemented a computerized maintenance tracking program for security equipment. This system permits the trending of Security Maintenance Action Requests (SMARs) for individual pieces of equipment in order to determine those which require increased maintenance. By using this system, Security has determined that SMARs on cameras and microwave equipment accounted for only 13% of SMARs through June 1990 compared to 35% in 1989. This decrease is attributable to equipment upgrades. A trend toward increased numbers of SMARs for doors and card readers indicates need for increased preventive maintenance or improvement of equipment. In response, card readers are scheduled for replacement during the next series of security equipment upgrades and current maintenance practices on the doors are being evaluated for improvement. Overall, IE believes that security equipment is currently maintained in operable condition with minimum downtime through prompt response to problems, adequate spares, and skilled technical efforts. IE is continuing trending efforts so that it can target the areas where improved reliability is most needed.

4. Control of safeguards information

In response to concerns identified by an audit sponsored by the IE Safety Committee, IE has taken action to consolidate and limit the access to safeguards information. Two storage locations at the corporate offices for safeguards information have been eliminated. The two remaining locations at the corporate offices include a locked cabinet within a locked vault and a locked cabinet in a controlled area.

F. <u>Response to Level IV Violation</u>

One Level IV violation was issued in the security area during this SALP period involving the degradation of the Pump House vital area barrier. As explained in a meeting with the NRC on November 8, 1990, this incident was of minimal safety significance due to the location of the degradation and the status of the plant at the time. Furthermore, extensive corrective actions were taken promptly. The event did indicate that weaknesses existed in communication and coordination between the Security and Maintenance Departments. To prevent the recurrence of events of this type, a number of changes have been made. They include the following:

- Security procedures have been revised to indicate that the Security Shift Supervisor (SSS) is responsible for receiving and evaluating requests for Security support. The SSS coordinates with the responsible individual to ensure that the scope of the requested work activity is clearly understood and that security requirements are met.

- The Security Department is now involved much earlier in planning activities conducted by Maintenance and Engineering. Security personnel attend job planning meetings and the Security Department is specifically listed among the IE departments responsible for supporting the activities of Maintenance and Engineering.

G. <u>Response to NRC Inspection Report 91-04</u>

Actions are being taken in response to several observations made in Inspection Report 91-04 which reported the results of the NRC's most recent inspection in the area of security. The Inspection Report noted that management support for the security program was good as demonstrated by the procurement and installation of upgraded protected area barriers and intrusion detection and assessment systems and plans to install new computer equipment. However, the report also noted that resolution of certain technical security issues could be improved. In particular, attention was directed to three areas: 1) search practices, 2) control of personnel access to vital areas, and 3) implementation of the physical agility requirements for Security personnel. IE is evaluating each of the areas discussed in IR 91-04 to identify potential enhancements; initial improvements are outlined below.

- Search Activities

  Security Management recognizes that during high traffic periods the officers assigned to ingress can sometimes feel the pressure to process all the individuals waiting to be admitted. Our observations of performance during such periods do not lead to the conclusion that any officer has sacrificed thoroughness for speed. However, in order to ensure the level of attention expected of our officers, supervisory security personnel have been directed to observe search performance during high traffic periods and correct any noted deficiencies on the spot. Unsatisfactory performance must be documented along with corrective actions.

The vehicle search that the inspector witnessed was unsatisfactory in that the mirror used to perform the under-vehicle search was dirty. The security force has been counseled and instructed to ensure that equipment used in searches is in a condition which permits correct performance of duties.

- Access to Vital Areas

  IE has implemented an effective program to limit access to vital areas to authorized personnel who have a work-related need. Currently, access authorization is based upon departmental assignments. Security developed the authorization process recognizing the limited benefits of, and the time and expense necessary to perform, a review of each individual's need for access to a particular area on a periodic basis. IE does require strict control of temporary personnel. Supervisors of temporary contract personnel are required to authorize access only to those areas in which the individual will be working. Additionally, supervisors are required to review access authorizations of badged individuals in their respective organizations on an annual basis and make the appropriate changes in authorizations. Security also performs a monthly review of the vital area access authorizations. This review ensures that individual badges are in good condition (show no signs of tampering) and that the access levels granted for the individual are correctly reflected on the badge.

- Physical Fitness Program

  IE has reviewed the performance requirements for the physical agility test and agrees that the test can be improved. In response to the inspector's comments, the physical agility test is being evaluated to ensure continued compliance with 10 CFR Part 73, Appendix B, and with the goal of having a test which requires a greater degree of strenuous activity. The evaluation will be completed by June 1991.

H. <u>Fitness for Duty</u>

The Fitness for Duty (FFD) Program continues to produce excellent results from pre-badging and random tests for drugs and alcohol. Of the 2,795 tests conducted during 1990, 11 persons tested positive for marijuana. All positive test results involved contractor personnel. There were only two confirmed positives among the 1,237 random tests performed, yielding a 0.2% positive rate. This is well below the recently-reported industry average of 0.4% for random testing. In addition, FFD hands-on searches were initiated at security access during 1990. These random work-place searches look for contraband and verify that individuals are registering all prescription drugs with Security.

Since September 1990, the FFD training for supervisors and workers has been conducted by trained personnel from a Cedar Rapids hospital. This change in the program brings valuable experience with health care and substance abuse diagnosis and treatment into the training session.

VI. ENGINEERING/TECHNICAL SUPPORT

A. Design Engineering Department,

1. 1990 reorganization

In early 1990, the Design Engineering Department was reorganized. The reorganization resulted in the establishment of six major engineering groups: Analysis Engineering, Response Engineering, Discipline/Component Engineering, Systems Engineering, Project Engineering, and Configuration Control. In addition, staff personnel were assigned to coordinate and facilitate professional development and engineering practices. Certain line functions were also realigned between the plant organization and Design Engineering organizations.

1990 presented a significant challenge to the Design Engineering organization. The reorganization required a significant degree of technical and supervisory attention and involved the re-alignment of personnel, responsibilities, and work activities. In addition, while the reorganization progressed, the Department met the challenges associated with support of an NRC Safety System Functional Inspection as well as support of routine operational activities, significant demands for issuance of design change packages, and successful completion of a refueling outage during which major plant modifications were accomplished. Some attrition within Design Engineering was experienced as a result of the reorganization with attendant loss of certain personnel acquainted with organizational processes and technical aspects of DAEC operations. In the latter part of 1990 and early 1991, the rate of personnel turnover stabilized and IE is now aggressively recruiting qualified personnel to fill vacant and recently authorized engineering positions. The realigned responsibilities have now been successfully integrated within the Design Engineering organization.

2. Staffing

Although some attrition was experienced during 1990, 85 of the 87 IE authorized positions were filled by December 1990. Eleven new engineers had been hired and 5 transferred from other departments. The average experience level of the new engineers is 8 years although some are recent university graduates. Engineering activities are also accomplished through the use of onsite, long-term contract personnel and offsite engineering organizations.

In December 1990, a decision was made by IE management to reduce reliance on contractors for design and engineering services and to increase correspondingly the permanent staff resources of Design Engineering. Twenty contractor staff positions are being eliminated and replaced with 29 salaried Iowa Electric employees. Following further evaluation in March 1991, IE management authorized an additional 24 permanent Design

Engineering engineering positions, for a total of 53 new Iowa Electric permanent positions. These combined changes raise the authorized number of permanent DAEC Design Engineering professional positions from 87 to 140. Additional contractor engineering support will continue to be utilized as required.

3. Engineering training

The Design Engineering Department has implemented a new department-specific training program, which is designed to provide further assurance that both experienced and junior professional staff have the tools and skills necessary to perform their assignments competently. This training is, and will be, particularly helpful to the new personnel joining the Department. Training is done on a quarterly basis. Each quarter, a two-day session (offered twice to accommodate all professionals in the Department) focuses on topics of importance to technical support for the DAEC. The topics addressed in the first session in October 1990 included environmental qualification, design verification, design analysis, and self-assessment. The session in January 1991 included environmental qualification, project planning, design inputs, and configuration management. While some of this training was in the form of lectures, most of the sessions focused on problem solving in small working groups. These groups provide a constructive forum for identifying, discussing, and resolving problems.

4. Engineering activities to enhance/maintain system and equipment performance

Iowa Electric has made significant progress in resolving long-standing equipment problems, as well as acting to assure that deterioration in equipment and system performance is prevented.

a. Actions to enhance/maintain performance of particular systems and equipment

1) High Pressure Coolant Injection System (HPCI)

During the 1990 refueling outage, 12 modifications were installed on the HPCI system to improve its reliability. These modifications were proposed by a joint IE/GE plant performance program and based on a review of past HPCI performance data. HPCI performance has continued to improve since the outage. Recent test data show that HPCI start time has decreased from an average of 28 seconds to approximately 23 seconds. In addition, the HPCI transient recorder indicates that the startup transient has been dampened, indicating a more controlled startup of the HPCI turbine. HPCI system availability has also increased. Since the 1990 refueling outage, the HPCI system has been unavailable for only 3.6 hours. For the six months prior to the outage, the HPCI system was unavailable for over 200 hours.

2) Main Steam Isolation Valves (MSIVs)

In an effort to improve MSIV performance and lessen maintenance demands, a GE/IE MSIV performance improvement program was developed.

As part of this program, during the refueling outage 5 major modifications were performed on each MSIV, including the installation of larger actuators, additional guide pads, and stronger springs. These modifications should enhance MSIV performance substantially, but their success will be determined primarily by the results of future MSIV Local Leak Rate Tests.

3) Source Range Monitor/Intermediate Range Monitor (SRM/IRM)

During the 1990 refueling outage, aggressive action was taken to identify the root cause of the frequent failures of SRMs and IRMs. Using vibration analysis equipment, Engineering and Maintenance personnel were able to identify excessive vibration in the instruments' gear boxes and repairs were made. All vibrations are now within allowed tolerances. Since completion of these repairs during the 1990 refueling outage, there have been no failures.

4) Recirculation pumps

During the 1990 refueling outage, the recirculation pumps underwent major modifications including the replacement of the recirculation pump rotating assembly and cover/heat exchanger assembly. While IE had no indications of pump performance degradation or imminent pump failure at DAEC, these modifications were in response to industry concerns regarding recirculation pump shaft cracking. By performing these modifications during the outage, IE avoided a potential plant transient and a lengthy outage had the pumps failed while on-line.

5) Reactor Water Cleanup (RWCU) piping

During the 1990 refueling outage, 175 feet of the high temperature, non-safety related RWCU piping was replaced with corrosion-resistant stainless steel piping. This replacement will reduce the risk of intergranular stress corrosion cracking during the plant operation and reduce the number of inspections required under NUREG 0313 by upgrading the welds in the piping to Category A.

6) Extraction steam line

During the 1990 refueling outage, 240 feet of 20-inch carbon steel extraction steam line piping was replaced with more erosion/corrosion-resistant piping. Ultrasonic examinations performed as part of the erosion/corrosion program allowed Engineering to determine that this replacement was necessary. These modifications should extend piping life through the period of expected plant life.

7) Control Rod Drive (CRD) Line Repair

In May 1990, Engineering personnel identified leakage from a control rod withdraw line inside the annulus area between the steel drywell shell and the concrete shell wall. The leak was identified by using a video inspection probe. Extensive action was taken by Engineering, Maintenance, Quality Control, and Operations to determine the extent of the problem, repair the defects, and identify the root cause of the failures. Notable actions taken in response to this concern included:

- Engineering, Operations, and Licensing worked closely to determine the safety significance of the leaking CRD line and prepared a Justification for Continued Operation.

- All 4 bundles of CRD insert and withdraw lines underwent detailed video probe inspections to determine the extent of the leakage. Each bundle represents approximately 25% of the CRD piping. No leakage was identified in any of the 3 remaining bundles.

- All 50 CRD insert and withdraw lines in the affected bundle underwent detailed ultrasonic (UT) examinations. Additional UT exams were performed on the basis of a statistical sampling of lines in the 3 remaining bundles as an added conservatism.

- Sections of the cracked piping were sent off-site for metallurgical analysis of the cracking phenomenon. This activity was directly supervised by an IE engineer.

- All 50 CRD insert and withdraw lines in the affected bundle were replaced. The work involved cutting each line, coring out the drywell shell at the pipe penetration, and replacing the section of piping where it penetrated the drywell shell. This effort included over 350 welds.

- Special monitoring devices including strain gauges, accelerometers, and temperature sensors were installed on several CRD lines in an attempt to identify the root cause(s) of the failures. Engineering is in charge of the program to gather and analyze data which utilizes state-of-the-art computer systems to provide real-time analysis of the monitored parameters.

The NRC inspection of the fatigue cracking of the CRD insert and withdraw lines noted that the DAEC's actions were commensurate with assuring the safe operation of the CRD system. In addition, the inspection report noted that the special monitoring devices installed on the CRD lines to help identify the root cause of the failures would help to ensure a comprehensive resolution.

While a significant amount of operational data on the CRD lines during both steady state and transient conditions has been gathered and evaluated, no conclusive root cause has yet been determined.

8) Engineering activities supporting service water system reliability

Engineering's efforts to minimize the effects of low flow conditions in the Cedar River and silt intrusion and to detect system fouling in the service water systems have improved the performance of these systems. The actions to improve service water system reliability include:

- A pump packing improvement program has been implemented to minimize excessive leakage through pump packing and route normal leakage to pump pits. Some modifications have been made on nearly all the service water pumps including the installation of different shaft sleeve designs and packing arrangements to determine the most effective combination. The remaining packing improvements are to be installed on individual pumps as part of the pump rebuild program. The pump rebuild program is designed to improve the maintainability, parts availability and design of the service water supply pumps including the river water supply pumps, RHR-SW pumps, ESW pumps, GSW pumps and fire pumps. Eight service water pumps are scheduled to be rebuilt during 1991 and 1992. The completed modifications have already had a positive effect on housekeeping and packing performance of equipment in the pump house.

- The River Sediment Management (RSM) system is designed to minimize deposition of sediment in front of the intake structure, thereby ensuring an adequate water supply even during drought conditions. The University of Iowa Hydraulic Research Laboratory, under contract with IE, developed a scaled hydraulic model of the intake structure and the Cedar River which was used to design the vanes and retaining wall which constitute the RSM system. These are currently being constructed and installed. Installation of these structures began in December 1990. However, due to recent rains and the resulting high river flow conditions, construction has been temporarily suspended. Construction will resume as conditions permit.

- The Service Water System Engineer coordinated the re-analysis of the service water system heat loads. This analysis reconstructed component heat load and flow requirements. The results of the analysis indicate that substantial reductions in heat removal and flow requirements are justified. A Technical Specification Change reflecting the revised flow requirements will be submitted by June 1991.

- Through persistent troubleshooting efforts by Engineering and Maintenance, it was determined that the normal running speed of the river water pumps is close to their natural resonant frequency. Operation at speeds close to the resonant frequency amplifies small pump vibrations or imbalances, resulting in increased wear and maintenance. Temporary modifications were made to the pumps to reduce this effect. Engineering is working closely with predictive maintenance personnel to resolve this concern permanently and thereby improve pump performance.

9) Torus Inspections

During the 1990 refueling outage, Engineering supervised the underwater inspection and repair of the torus and torus coating. The DAEC is only the second nuclear plant to undergo this type of inspection. Through Engineering's efforts, it was confirmed that the torus is free of pitting and corrosion.

b. Equipment performance monitoring

Iowa Electric has formalized and expanded plant equipment performance monitoring activities to enhance the reliability of safety systems and improve plant availability. A Nuclear Generation Division procedure on the Performance Monitoring Program was developed by the Systems Performance Engineer and issued on March 8, 1991. This procedure establishes the requirements and responsibilities for monitoring operational data, common mode failures, periodic maintenance, test information, and other parameters important to plant and system availability. The Manager, Design Engineering, has overall responsibility for the program and the Plant Superintendent, Nuclear, is responsible for supporting it through data acquisition, analysis, and distribution. Status reports for the Performance Monitoring Program will be issued by the Systems Engineering group on a semi-annual bases. Further improvements in performance monitoring, which had been planned for 1990, were deferred due to the press of emergent, higher priority engineering work. There are now targeted for implementation during the second and third quarters of 1991. A review of the effectiveness of this trending program will be accomplished by September 1991 and may identify additional monitoring activities which are warranted.

c. Engineering support of maintenance

The Design Engineering Department has contributed significantly to the support of maintenance activities during the current SALP period. Engineering assistance during equipment troubleshooting and repair efforts has minimized plant transients and the duration of unplanned outages. Some notable examples of their support include:

- In January 1991, the plant was manually scrammed in response to a steam leak in a drain line off the extraction steamline. Design Engineering prepared a modification package to replace the line with an expansion loop to prevent future failures. The evaluation, modification design, package issuance, and construction were completed in a time frame that allowed plant startup within 48 hours of the scram.

- During 1990, repairs to the recirculation motor generator required shipment of the motor to an off-site repair facility. To accommodate the removal of the motor while maintaining the plant on-line, Engineering designed a temporary structure which allowed secondary containment requirements to be met during the evolution. Interface and support of Operations, Construction, Maintenance, and Engineering led to the success of this project.

- After the failure of a soldered joint in the Instrument Air System, the Codes and Materials group of Engineering worked with Maintenance and Quality Assurance to develop an ultrasonic examination technique to verify the bond in soldered joints. Critical joints are being examined using this technique. Previously, soldered joints were only examined visually. IE is unique in applying the UT technique to soldered joints.

d. Power systems analysis

In April 1990, IE implemented the Power Systems Analysis project in an effort to enhance the control of DAEC electrical power systems loading and operation. The project is managed by the Analysis Group of Design Engineering and involves detailed analysis of the DC and AC distribution systems, Station Batteries and Emergency Diesel Generator systems, and an integrated plant analysis. The Power System Analysis will reverify plant loads, re-examine emergency power loading sequences and load initiation timing, and provide a diesel transient dynamic model. Substantial elements of this project are scheduled to be completed by July 1991.

e. Scram frequency reduction

The DAEC Scram Reduction Group was formed in September 1989 in response to the unacceptable trend in reactor scrams. The Group's mission was to identify and implement changes to plant operating practices, procedures, and system design to reduce the potential for reactor scrams. The group utilized the BWR Owners Group document, "Actions for Reducing Scrams at Boiling Water Reactors" and began a systematic review of major areas of concern. An action plan was developed and responsibility was assigned for each item. The plan addresses scram reduction in several areas with priorities based on the DAEC's scram history. A review of DAEC scram history from 1979-90 indicated that over 30% of reactor scrams were initiated by the turbine generator system and 10% by feedwater systems; an additional 10% occurred when plant air or electrical power supplies were lost. Therefore, the priority for scram reduction was placed on the balance-of-plant systems.

During the 1990 refueling outage, several plant modifications recommended by the Scram Reduction Group were completed:

- Meters were installed in the control room to provide operators with an indication of the mismatch or deviation between actual and designed speed of the recirculation pumps. Minimizing the deviation will minimize the possibility of recirculation flow transients following surveillance testing of the pumps.

- Three inputs into the turbine trip logic were modified from a single element logic scheme to a 2-out-of-3 scheme. This change prevents single instrument trips or failures from causing a turbine trip and reactor scram.

- Indication of failed MSIV solenoids was added to control room back panels. Operators can now determine the status of MSIV solenoids prior to testing. Previously, if the operators tested an MSIV with an undetected solenoid failure, the MSIV would shut and possibly result in a plant scram.

Further scram reduction modifications are planned for the 1992 refueling outage. These modifications address the areas of turbine trip system logic, feedwater control, and control room human factors improvements. IE believes that the accomplishments of the Scram Reduction Group and management's commitment to the Scram Frequency Reduction Program will be instrumental in helping to meet IE's goal of one automatic scram per year.

5. Maintaining the DAEC design and design documentation

   a. Design basis documents

   IE has initiated a program to re-assemble the design bases and design basis documents for the DAEC. This program is the responsibility of the Configuration Management group of Design Engineering and is based on NUMARC's DBD program guidelines. The program uses NSSS Design Safety Standards and Nuclear Safety Criteria to build system-level documents. Phase I of the program involves the Emergency Core Cooling System (ECCS) and other selected safety-related systems and, as reported to the NRC in our semi-annual report under the Integrated Plan, is scheduled to be completed in September 1993. Currently, the program is on schedule with 4 systems complete and 7 others nearing completion.

   b. Design Change Process Enhancements

   In December 1990, the Project Engineering group initiated actions to improve the Design Engineering Department's ability to process and implement design changes. The computer-based program can track project status, create milestone schedules, develop accurate time and cost estimates, and integrate project schedules. The project engineers have entered each of their projects into a computer and are in the process of refining schedules and learning the various aspects of the software program. This system will be linked with Iowa Electric's mainframe computer to allow remote access to the system and the preparation of project plans and schedules on a Department wide basis. The project manager has established a goal of having all 1992 refuel outage work packages entered into the mainframe system by June 1991. These efforts will enhance the design change process.

   c. Upgrading DAEC station drawings

   Iowa Electric has taken action to improve the accuracy, clarity, and level of detail of important station drawings and to correct any deficiencies that might affect the safety of plant operations. These efforts include a major upgrade of the station drawings of the instrument air system to incorporate additional component detail. This project doubled the number of drawing sheets for the system from 5 to 10, and affected over 40 other system drawings. Because of the size of the task, IE performed this Design Document Change (DDC) on a computer-aided drawing system (CAD). Use of the CAD system substantially augmented the capability to improve plant drawings and to process DDCs quickly. However, the manual process of improving the clarity of drawings introduced errors into drawings which were identified by Operations and Procedures Group personnel. After those inaccuracies were identified, a team of engineers verified each drawing in the DDC line by line, item by item. The majority of the problems identified were transpositions of valve numbers and equipment IDs. IE then established a drawing review panel consisting of personnel from Operations, Quality Assurance, and Engineering. The panel reviewed all identified discrepancies to determine their operational impact. Deficiencies determined to be significant, (e.g., valve number errors) were identified on control room drawings using the "greenline" process. This process involves highlighting control room copies of drawings to alert the Operations staff to differences between as-built conditions and the information on plant drawings. The control room copies remain highlighted until corrected drawings are issued.

This exercise and other indications focused attention on the possibility of a broader concern regarding the accuracy of information on station drawings. As a result, IE will conduct a systematic review of station drawings to determine what actions are required to ensure that the drawings accurately reflect the station configuration. A plan and schedule for correcting these deficiencies will be issued by May 1991.

d. Timely Update of Manuals

1) Procedure Manuals

In order to ensure the timely update of procedure manuals to reflect approved revisions, the Document Control Resource Center Supervisor has been charged with responsibility for assuring that working copies of control room operating procedures, simulator manuals, and library manuals are issued within 1 working day after final approval of revisions to procedures. All other procedure manuals must be updated within 5 working days. To ensure that operating procedures are properly revised, if needed, after changes are made in station drawings, the Plant Procedures Group is now part of the review cycle for all Design Document Change (DDC) packages. The Plant Procedures Group reviews the DDC to identify equipment ID changes or equipment additions and revises operating procedures accordingly.

2) Vendor Manuals

Iowa Electric continues to make progress in the review, necessary updating, and approval of vendor manuals for both safety-related and non-safety-related components. The DAEC Vendor Manual Review implements technical guidance from INPO's guidelines for assuring that vendor manuals are controlled. The name and identifier for each vendor manual for a safety-related component is incorporated into a computerized data base. Vendors are contacted for manual updates. Controlled copies of the manuals in the main plant library and satellite libraries are verified to assure that they contain current revisions. Some 2,500 of the approximately 4,000 vendor manuals have been reviewed and verified, and approved copies are now in the libraries. Review, updating, and verification of the remaining manuals by the Configuration Management Group are on schedule and will be completed by December 1991.

6. Environmental qualification program

   IE has taken several actions to strengthen the effectiveness and improve staff awareness of the environmental qualification (EQ) program. Significant steps include:

   - The Discipline/Component (D/C) Electrical Group in the Design Engineering Department is now responsible for the EQ program. Currently, this group consists of 6 engineers; approximately 30% of their total man hours is devoted to the EQ program. Additional contract support is provided as necessary.

   - Twenty-one of the 49 EQ files have been reformatted and undergone a preliminary engineering review by the D/C Electric Group. The primary purpose of the reformatting is to make the files more user friendly. The reworking of all the files is to be completed by December 1992.

   - The D/C Electrical Group now reviews Maintenance Action Requests (MARs) on equipment in the EQ program. This review is designed to ensure that the proper procedures and EQ requirements are assessed in each MAR.

   - EQ configuration detail drawings for each of the 386 pieces of equipment in the EQ program have been completed and entered into the controlled document list by the D/C Electrical Group. These drawings depict the as-built configuration of each component within the EQ program. Approximately 600 drawings have been generated as part of this effort.

   - Prior to the 1990 refueling outage, most craft personnel attended formal training to instruct them on EQ requirements including the proper performance of EQ splices. In addition, an EQ topic has been included in the Design Engineering Department's training program each quarter. This additional training is designed to reinforce the awareness and knowledge of EQ issues within the Department.

   Although there are opportunities for further improvement in the EQ program, implementation of the actions listed above has strengthened the program and IE management is committed to continuing improvements.

B. <u>System Engineering/Technical Support</u>

1. System Engineering Organization and Staffing

   As part of the 1990 Design Engineering Department's reorganization, the Shift Technical Advisor (STA) function was removed from the Systems Engineering Group's responsibilities. This action, coupled with staff attrition, resulted in reducing the Systems Engineering staff from approximately 23 to 11. However, recruitment efforts have increased the staff from 11 to 15. Eight additional positions are authorized and expected to be filled by October 1991. This will bring the Systems Engineering staff to a total of 26 including 1 supervisor and 2 group leaders. The primary responsibilities of a System Engineer are as follows:

- Maintenance/Operations Support
- Component Quality Level Determination
- Industry Experience Review
- EWR Management
- Equipment Performance Monitoring
- Engineering Program Support
- Audit/Inspection Support

The attrition in Systems Engineering during 1990 strained resources at times; however, as noted below, the System Engineers were nonetheless able to contribute importantly to plant support activities.

2. Systems Engineering Plant Support and Resolution of Equipment Problems

During this SALP period, the System Engineers have contributed significantly to the resolution of equipment problems and support of the plant. Examples of their support include:

a. Refueling Outage Support

During the 1990 refueling outage, the System Engineers played a key role in the planning and execution of Corrective Maintenance and Preventative Maintenance Action Requests (CMARs/PMARs) on their respective systems. In addition to this effort, several System Engineers coordinated activities on construction projects to better blend construction and maintenance work in an efficient manner. These projects included the cooling tower fill/drift replacement project.

b. High Pressure Core Injection (HPCI) Improvement Program

During this SALP period, the HPCI System Engineer helped coordinate the planning and implementation of the major HPCI improvement program. His involvement in the many details of the program helped to ensure successful resolution of long-standing equipment problems. As a result, availability of the HPCI system has been excellent. As noted above, since the 1990 refueling outage, the HPCI system has been unavailable only 3.6 hours.

c. Service Water System Improvements

During this SALP period, the engineer responsible for Service Water Systems played an important role in the implementation of Generic Letter 89-13 and the resolution of pump packing problems.

Generic Letter 89-13, Service Water System Problems Affecting Safety-related Equipment, recommended that licensees implement extensive inspection and monitoring all the service water systems to ensure satisfactory operation. The System Engineer developed and managed the actions taken in response to this Generic Letter. Actions taken included:

- A proactive program of inspections and cleaning of service water pits was developed and implemented to limit the accumulation of sediment in the pits and ensure the proper functioning of Service Water System components.

- A Heat Exchanger Performance Monitoring Program was developed. This program utilizes portable, non-intrusive inspection techniques to monitor and trend heat exchanger performance to ensure the heat exchangers are meeting their design requirements. Twenty heat exchangers, which constituted 100% of the safety-related service water heat exchangers, underwent performance monitoring during the 1990 refueling outage.

- Flow monitoring of Emergency Service Water (ESW) components was performed to verify that each component was receiving adequate flow. These values are used to "balance" the flow to each component within the system.

- To ensure that any appearance of the zebra mussel in the area of the DAEC is detected, monitoring of the Cedar River for mussels is being performed by the University of Iowa and the Iowa Department of Natural Resources. While no zebra mussels have been detected, monitoring will continue.

The System Engineer's work with the Maintenance Department has produced significant improvements in pump packing performance. The System Engineer is also working closely with Design Engineers on the service water pump rebuild program.

d. Reduction of Engineering Work Request Backlog

In 1989, Engineering reduced the backlog of open Engineering Work Requests (EWR) from approximately 900 to less than 500 and maintained this level during 1990. While the System Engineers addressed all Priority 1 EWRs and worked to keep the backlog from rising significantly, reorganization of the Department and the 1990 refueling outage prevented further backlog reduction. The Systems Engineering Supervisor has been assigned responsibility for reducing the backlog of EWRs to less than 350 by July 1991. Increases in the System Engineering staff discussed previously should assist in achieving this goal.

e. Instrument Air System Test Program

Generic Letter 88-14 recommended that licensees verify the ability of the instrument air system to perform as designed upon system demand. The initial actions responding to the Generic Letter were completed in 1989 and an extensive test program was conducted during the 1990 refueling outage in accordance with the requirements of the Generic Letter. The test program was conducted by the engineer responsible for the instrument air system and consultant engineers. The tests involved both rapid and gradual loss of air to verify that all safety-related components supplied by the instrument air system would fail in the positions specified in the design requirements. The tests successfully verified that components and systems met design requirements.

3. Improvement in Root Cause Analysis

During the current SALP period, efforts have continued to improve the ability to perform accurate and effective root cause analyses.

In March 1990, the procedure which governs the Deviation Reporting System was revised. The procedure now specifies that the Technical Support Group must screen each Deviation Report (DR) in order to evaluate its significance and determine whether a root cause analysis is to be prepared. The screening considers the effects of the event on safe operation of the plant, possible adverse trends or significant effects on plant availability, and the applicability of reporting requirements. A root cause analysis is performed if the screening process indicates that one is warranted. This process allows for the elimination of less significant events and helps ensure that staff resources available for performing root cause analyses are focused on the events which have the highest overall significance in terms of potential effects on safety and reliability. During 1990, more than 40 formal root cause evaluations were conducted by the Technical Support Group, including all scrams and LERs as well as other significant events identified through the screening process. In addition to these evaluations, significant events involving human error are evaluated using the Human Performance Evaluation System (HPES).

Other initiatives to improve root cause analysis include:

- Two additional persons in the Technical Support Group have been trained in HPES. The entire professional staff of the group is now formally trained in the performance of root cause analyses.

- The Technical Support group will expand the scope of DR system to include significant deficiencies in balance-of-plant equipment and operation. Expansion of the DR system will be implemented by June 1991.

- Three Technical Support engineers have been assigned responsibility for evaluation of plant Deviation Reports. This designation of responsibility more effectively focuses resources on the review and evaluation of DRs. The DR backlog has been reduced from an average of 200 in 1989 to less than 100 currently. During 1991, the average time to disposition a DR has been 19 days. (DR completion times were not tracked prior to 1991.)

- The Technical Support Group has implemented a periodic review of formal root cause evaluations to determine whether the causes collectively warrant supplemental corrective action which had not been recognized previously. This review process will be implemented prior to May 31, 1991.

- The Radiological Protection Department issued a Radiological Protection Performance Monitoring procedure which requires that root cause evaluations be performed for all radiological incidents. Previously, there was no such programmatic requirement. Radiological incidents are those events involving a serious degradation of radiological protection performance.

4. Licensee Event Reports (LERs)

During 1990, 24 LERs were issued including 2 associated with the Security Department. This is an increase from 1989 when 18 LERs were issued. The average number of LERs submitted over the last 5 years is 25/year.

C. Training

As discussed previously in meetings with the NRC, IE's primary goal in this area during this SALP period has been to improve the operator requalification training program. The passing rates (100% for crews and 96% for individuals) during the August 13, 1990, Operations evaluation and re-examination conducted by the NRC demonstrate the effectiveness of corrective actions and improvements.

1. Requalification Training Program

In June 1990, control room crews performed unsatisfactorily during the NRC-administered requalification examination. IE management established a task force to investigate the causes of the unsatisfactory performance. The task force included three Iowa Electric employees who had experience in the areas of root cause analysis, control room operations, and off-site safety assessment. The Operations Training Supervisor and an Operations Training Instructor from Northern States Power Company were also members of the task force, thereby providing an independent perspective to the evaluation.

The task force identified 3 root causes of the unsatisfactory performance in the requalification examination. These included insufficient training time spent on the simulator; deficiencies in communication between the Operations Department and the Training Department, especially in resolving disputes arising during simulator training; and over confidence of licensed operators and managers involved in the training program. The following actions have been taken to address these causes:

- Simulator training time for all operating crews has been increased. After the July requalification examination, each operating crew received over 60 hours of hands-on simulator time before it was re-examined. Beginning with the 1991 requalification training cycle, the schedule will provide a minimum of 96 hours of simulator time per operator each year. This exceeds industry guidelines which recommend 60 hours per year.

- A remediation process has been developed for individuals and crews whose performances do not meet standards during the weekly evaluated scenario using Emergency Operating Procedures (EOPs) on the simulator. Any individual or crew who fails to meet the criteria for passing (which are patterned after NRC Examiner Standards ES601) is not permitted to return to shift until training in the area of weakness has been completed and satisfactory performance is demonstrated.

- A formal procedure has been established by the Training Department for resolving disputes or questions that arise during simulator training.

The instructor must pursue any question which cannot be answered immediately and provide the answers to the student prior to the end of the class, if possible. If Operations personnel and the instructors do not agree on a resolution, the matter is resolved by the Training Supervisor and the Operations Supervisor. The agreed upon resolution must be presented to both Operations and Training personnel by the next working day.

- The "A" Operations Shift Supervisor is now responsible for and leads critique sessions following simulator training. This provides Operations with an increased sense of "ownership" of the training program and assures that performance in the plant and on the simulator is consistent.

- Operations Department involvement in the licensed operator training program has been increased. Six new instructors entered the Operations Training program during 1990. Four are licensed operators who transferred from the DAEC Operations Department into the Training Department; the other 2 had nuclear instruction experience at other facilities.

- Additional simulator accident scenarios have been developed which meet the NRC standards for complexity. They are used in the requalification training program. This ensures that operators are trained on scenarios which are as difficult as those they will encounter during the examination. Currently, more than 20 exam scenarios are in use.

- During the 1991 requalification cycle, all sections of the exam will be stressed. Mock exams will be conducted by external evaluators during cycles 2 and 3 of the 1991 requalification training. The mock exam in Cycle 2 will focus on performance of the Job Performance Measures (JPMs) and dynamic simulator performance. The mock exam in Cycle 3 will focus on static and dynamic simulator performance.

2. Initial Reactor Operator and Senior Reactor Operator License Training

Iowa Electric's initial licensing training program continued to achieve good performance during this SALP period. During 1990, candidates achieved a 100% success rate on the NRC Generic Fundamentals examination, 3 out of 4 candidates passed the initial Reactor Operator examination, and 3 out of 3 passed the Senior Reactor Operator upgrade examination.

3. Training of Shift Technical Advisors

Training of Shift Technical Advisors (STA) has been enhanced by incorporating critical task performance requirements into the programs for initial and requalification training. The requirement for a passing grade in the STA initial qualification exam has been raised from 70% to 80%.

4. Reaccreditation; Simulator Certification

The National Nuclear Accrediting Board renewed the accreditation of Iowa Electric's training programs for non-licensed operator, Reactor Operator, Senior Reactor Operator/Shift Supervisor, and Shift Technical Advisor and the continuing training for licensed personnel on September 27, 1990. The Board noted three minor areas of concern, all of which were corrected prior to renewal. In March 1990, the DAEC simulator was certified in accordance with the requirements of 10 CFR 55.45(b).

5. College Degree Program

The college degree program sponsored by IE continues to achieve high levels of success. This program is offered in cooperation with a local community college and permits IE personnel to pursue an associate's degree. More than 70 students were enrolled each semester during the spring and fall of 1990; approximately 70% of the students completed their courses. In the spring, the grade point average achieved was 3.39 and, in the fall, it was 3.68. These statistics indicate a high level of motivation and commitment to a voluntary program by persons who continue to perform their normal full-time work duties.

6. Other training

The Training Department is developing new programs in Warehouse Apprentice Training and DAEC Helper Training. The Warehouse Training Program will cover such topics as industrial safety and fraudulent materials. The training courses for DAEC Helpers will focus on industrial safety and warehouse practices and will include additional training in radiological protection practices. Development of these programs will be completed this year with initial training to begin at the end of 1991.

Maintenance training has been enhanced by the introduction of a course on the design, operation, and troubleshooting of microprocessor based equipment. This 5-week course is geared to both Instrument Control Technicians and engineers. This course was given initially in 1990 and will be repeated in 1991.

VII. QUALITY ASSURANCE SAFETY ASSESSMENT/QUALITY VERIFICATION

A. Quality Assurance Staffing and Organizational Changes

Substantial changes have been made in the Quality Assurance (QA) organization in order to better coordinate its activities. These changes include:

- In May 1990, IE appointed a new Quality Assurance Manager. The new manager is a registered Professional Engineer with 10 years of varied experience at the DAEC in Design Engineering, procurement, Operations, and QA. The Manager, QA continues to report directly to the Vice President, Production.
- In December 1990, the Manager and all QA staff were moved from the corporate office to the DAEC site in order to facilitate more direct QA involvement in plant activities.
- A Group Leader position for Material and Supplier Quality was created and filled. This position is responsible for the procurement cycle from a QA perspective. The focus and added emphasis on procurement is consistent with NUMARC's recently issued Procurement Initiatives.

- A Group Leader position for Internal Audits was created and filled. This position will provide a stronger focus on the area of internal auditing. The auditing staff has been enlarged and increased funding made available for contract technical specialists, implementing IE management's decision to further strengthen this area.

- A new Quality Assurance Program Engineer position has been filled which will provide a focus for the improvement of QA implementing procedures and QA programs as a whole.

- Two additional professional staff positions have been authorized for the QA department. One position will provide support for the internal audit program, and the other for internal surveillance and corrective action programs. These positions will be staffed as a matter of high priority.

B. Management Involvement

The quality and detail of the QA reports issued to management improved substantially during 1990. The Quarterly Trend Report now includes a detailed listing and description of the events underlying the report's trending graphs. In addition, a new section has been added which addresses functional strengths and weaknesses identified in NRC Inspection Reports. These comments are sorted by functional area to facilitate their use.

In February 1991, QA began issuing a monthly status report to management detailing significant QA activities. This report is sent to the Vice President, Production and the Manager, Nuclear Division and details the status of the audit and surveillance program, NRC inspections, and any adverse quality trends.

C. Self Assessment Activities

The QA internal audit program has been significantly upgraded during this SALP period. IE no longer relies on a single contractor to support the program with technical specialists but now uses multiple contractors with diverse expertise to ensure that technical specialists with experience in the specific area to be audited are available to supplement the internal QA audit team. Contract organizations and other nuclear utilities supply these specialists.

The NRC inspection of IE's Quality Assurance and Self Assessment program conducted during this SALP period noted that QA audits and surveillances were thorough and identified good findings and observations. In addition, Inspection Report No. 90-16 noted that recent changes in the QA organization should improve the organization's ability to identify problem areas and aid management in determining areas where additional attention is warranted.

NRC Inspection Report 91-06 noted that the QA Audit of the plant chemistry program appeared to be very thorough, detailed, and performance-oriented. The QA audit of the Radiological Environmental Program was also noted to be thorough and performance-oriented.

During an NRC exit meeting following an inspection of the DAEC EQ program held on March 15, 1991, the inspector specifically noted the thoroughness of the QA audit of the EQ program.

Several other internal audits performed by the QA department during 1990 were especially thorough and indicative of an improving audit program. The areas audited included chemistry, fuel reload management, and Design Change Package (DCP) safety evaluations. Each of the teams assembled for these audits included technical specialists with extensive experience in the area to be audited.

In addition to the normal INPO evaluation of November 1990, IE requested INPO to perform assistance visits in the areas of outage management, training, and plant operations.

D. Contributions of Standing Assessment Groups

IE has taken action during this SALP period to strengthen the effectiveness of the DAEC Safety Committee (offsite review committee). In November 1990, committee membership underwent a major revision. While the changes were made in part to reflect organizational and personnel changes, the primary goal was to establish a membership that could consistently attend meetings while reflecting a diversity of experience. Since 1989, DAEC and Monticello managers have attended and participated in each other's Safety Committee meetings; this exchange program continues to be successful. As noted in Inspection Report 90-16, the Committee meetings are well attended and the discussions are generally thorough. While the Technical Specifications require the Safety Committee to meet at least twice per year, meetings are typically held twice per month. During 1990, the Safety Committee requested an audit on the nuclear fuel reload program. This audit was performed under the cognizance of the Safety Committee by a team of recognized fuel experts from Yankee Atomic. While several findings resulted from this audit, the team was very complimentary of IE's attention to the nuclear fuel area, as evidenced by DAEC's fuel performance history.

IE has also taken actions to strengthen the effectiveness of the Operations Committee (onsite review committee). Committee membership has been tightened by reducing the number of alternate members and limiting the number of personnel from each department who can be included for purposes of establishing a quorum. These actions have resulted in more consistent individual and departmental representation. In addition, an Operations Committee subcommittee has been formed which has the authority to review and approve Maintenance and Test Equipment procedures. This time-consuming process was formerly accomplished by the full Operations Committee. Creation of the subcommittee allows for a more thorough review of the procedures and allows the full Operations Committee to devote increased attention to safety-significant issues. All Operations Committee (and Safety Committee) members and alternates have received formal training on 10 CFR 50.59, committee procedures, and Technical Specification requirements.

E. Strategic Plan

Senior management of the Nuclear Generation Division initiated a process in 1990 to define, assign, and prioritize certain activities necessary to achieve DAEC's performance objectives in the coming year. Departmental managers identified the major tasks within their respective areas. In further reviews with senior managers, tasks were prioritized and divided into sub-tasks to facilitate the monitoring of progress.

Among the tasks being tracked are technical procedure improvement; completion of maintenance program manuals; improvement in trending programs; integration and expansion of the preventive maintenance program; upgrading of station drawings; reduction of numbers of contractor personnel and their replacement with permanent IE staff; reclamation of contaminated areas; and refinement of the outage management control system.

The tasks and subtasks are now on a computerized database which includes a brief description of the activity, its scheduled and actual start and completion dates, and the individual/organization with the assigned accountability for its completion. Progress in implementing the plan is reported monthly; the percent completion for each task and subtask is recorded on a printout of the database, updated and issued each month. In addition, a quarterly update will be prepared. The Manager, Nuclear Licensing, is responsible for monitoring and recording progress under the plan.

Implementation of the Plan is at an early stage. However, it is expected that the Plan will serve as a useful management tool to monitor progress on key activities in support of DAEC as well as strengthening personal accountability for their achievement.

F. Implementation of Corrective Actions

IE management believes that personal accountability and the communication of expectations for performance in implementation of commitments and corrective actions is vital to ensure that these efforts are successful. The steps IE has taken to address these issues include:

- On January 18, 1991, a Policy Statement on accountability was issued by the Manager, Nuclear Division. This statement describes management's expectations regarding the performance of all personnel. In particular, the role of supervisors in helping to assure accountability was stressed.

- Relatedly, IE is refining the performance appraisal system to more clearly communicate with, provide leadership for, and enforce management expectations regarding the performance of station, department and salaried personnel. This new system will measure performance against pre-determined goals including the completion of commitments and corrective actions. Results will directly influence personnel performance evaluations.

- In February 1991, a position with responsibility for monitoring the progress and implementation of commitments and corrective actions was created and staffed. This position reports directly to the Manager, Nuclear Division and is responsible for keeping management informed of any delays or impediments to meeting commitments on time. The functional success of this new position will be evaluated in December 1991.