

1981 Evaluation

Duane Arnold  
Energy Center  
Iowa Electric  
Light and Power  
Company

*Inspection - July 1981*

**INPO**

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EVALUATION

of

DUANE ARNOLD ENERGY CENTER

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Iowa Electric Light and Power Company

July 1982

## SUMMARY

### INTRODUCTION

The Institute of Nuclear Power Operations (INPO) conducted its first evaluation of Iowa Electric Light and Power Company's (IE) Duane Arnold Energy Center (DAEC) nuclear generating plant during the weeks of July 13 and July 20, 1981. Duane Arnold Energy Center consists of one 529 megawatt (electrical) General Electric boiling water reactor plant. The station is located near Cedar Rapids, Iowa, on the Cedar River. The plant began commercial operation in June 1974.

### PURPOSE AND SCOPE

INPO conducted an evaluation of site activities to make an overall determination of plant operating safety, evaluate management systems and controls, and identify areas needing improvement. Information was assembled from discussions, interviews, observations, and reviews of plant documents.

The INPO evaluation team examined station organization and administration, training, operations, maintenance, radiological and chemistry activities, and site technical support. Corporate activities were not included in the scope of the evaluation, except as an incidental part of the station evaluation. As a basis for the evaluation, INPO used performance objectives and criteria relevant to each of the six areas examined; these were applied and evaluated in light of both the experience of team members and INPO's observations of good practices within the industry.

INPO's goal is to assist member utilities in achieving the highest standards of excellence in all phases of nuclear plant operation. Accordingly, the conditions found in each area were compared to best practices, rather than to minimum acceptable conditions or requirements.

### DETERMINATION

The evaluation staff appreciates the cooperation received from all levels of the  
Iowa Electric Light and Power Company.

E. P. Wilkinson  
President

IOWA ELECTRIC LIGHT AND POWER COMPANY

## Response Summary

Iowa Electric Light and Power Company is pleased that the INPO Evaluation Team found the Duane Arnold Energy Center (DAEC) to be operated in a safe manner. That finding supports Company operational assessments made on a continuing basis since the DAEC became operational more than seven years ago.

The Company generally agrees with INPO findings. It is fully committed to continuing programs to achieve the highest standards of excellence in operation and administration.

Iowa Electric appreciates the efforts of the INPO evaluation staff in carrying out a complete evaluation in a highly professional manner.

Targeted completion dates for specific items have been noted in the details section where possible.

DETAILS

This portion of the report includes the detailed findings. It is composed of six sections, one for each of the major evaluation areas. Each section is headed by a summary describing the scope of the evaluation and the overall finding in that area. The summary is followed by the specific findings, recommendations, and utility responses related to each of INPO's evaluation procedures. Items listed in Category II relate to criteria not included in INPO procedures, but are generally recognized as desirable, accepted techniques of industry and management. The evaluation procedures that were used are listed in the ADMINISTRATIVE APPENDIX.

ORGANIZATION AND ADMINISTRATION

Seven performance areas were evaluated using current INPO criteria. The areas included objectives, organization structure, manpower resources, administrative controls, quality programs, equipment surveillance, and industrial safety.

ORGANIZATIONAL OBJECTIVES  
(INPO Procedure OA.1)

An evaluation was performed to determine how effectively goals and objectives are disseminated throughout all levels of the station and how effective they are in conveying intended operational and maintenance directions. Areas reviewed included specific goals in use, management goals issued to all personnel, measurement of goals and objectives attainment, and methods used to evaluate the performance of individuals.

## 1. Finding (Criteria A through D)

Recommendation

Response

2. Finding (Criterion E)

Recommendation

Response

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**ORGANIZATION STRUCTURE**  
(INPO Procedure OA.2)

The evaluation team examined the plant organization to determine if it supports safe and efficient operation of the station. The team looked into the responsibilities, authorities, and accountabilities of staff positions to determine if they are clearly defined, well understood, compatible with each other, and if excessive burdens were placed on any individuals. They also reviewed the staffing levels to determine if sufficient, qualified people are available to provide backups for management personnel and to prevent excessive overtime.

Finding (Criterion B)

Recommendation

Response

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**MANPOWER RESOURCES**  
(INPO Procedure OA.3)

An evaluation was performed to determine if qualified individuals were available to operate and maintain the plant safely and efficiently. Areas reviewed included written qualification requirements for each plant staff position, policies for ensuring every position is filled by individuals meeting qualification requirements, and periodic reviews and revisions of these qualification requirements.

Finding

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ADMINISTRATIVE CONTROLS  
(INPO Procedure OA.4)

An evaluation was performed to determine the effectiveness of the controls for administrative functions. Areas reviewed included completeness, flexibility level of administrative actions, and effectiveness of the administrative control programs.

Finding

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MANAGEMENT QUALITY PROGRAMS  
(INPO Procedure OA.5)

An evaluation was performed to determine if quality programs were in effect to provide sufficient accomplishment of plant and company missions. Areas reviewed included management controls, approved quality assurance and quality control programs and organizations, self-auditing capability, and effectiveness of the programs and corrective actions.

1. Finding (Criterion A)

Recommendation

Response

2. Finding (Criterion R)

Recommendation



Response

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**SURVEILLANCE PROGRAM**  
(INPO Procedure OA.6)

An evaluation was performed to determine if a surveillance program existed that accomplished the required surveillance inspection and testing. Areas reviewed included procedures that address all areas of surveillance, acceptance criteria, out-of-range reporting requirements, timely completion requirements, management control systems, and actions to correct deficiencies.

Finding (Criterion D)

Recommendation

Response

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**INDUSTRIAL SAFETY**  
(INPO Procedure OA.7)

The on-site industrial safety program was evaluated to determine if plant policies and practices provide a safe working environment for all personnel at the plant.

Finding (Criterion B)

Recommendation

Response

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## TRAINING AND QUALIFICATIONS

Evaluations were conducted to determine the effectiveness of the training organization and administration; the adequacy of training facilities and equipment; and the effectiveness of licensed and non-licensed operator, shift technical advisor, and maintenance training activities.

Strengths were noted in the sixth operations shift dedicated to training and in the ongoing effort to improve lesson plans. Areas needing improvement are delineated below.

### **TRAINING ORGANIZATION (INPO Procedure TQ.1)**

An evaluation was performed to determine if a clearly defined training organization exists that is staffed with qualified personnel capable of accomplishing all assigned training tasks.

Finding (Criterion B)

Recommendation

Response

### **TRAINING ADMINISTRATION (INPO Procedure TQ.2)**

An evaluation was performed to determine if the activities necessary to initiate and control personnel qualification programs are accomplished in a well-defined, coordinated, and effective manner.

Finding

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**TRAINING FACILITIES AND EQUIPMENT**  
(INPO Procedure TQ.3)

An evaluation was performed to determine if sufficient training facilities, equipment, and materials exist for development and evaluation of knowledge and skills needed by plant personnel.

Finding (Criteria A and D)

Recommendation

Response

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**NON-LICENSED OPERATOR TRAINING**  
(INPO Procedure TQ.4)

An evaluation was performed to determine if an effective program exists to develop and maintain the necessary skills and knowledge for non-licensed operators to perform their assigned job functions.

Finding (Criterion A)

Recommendation

Response

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LICENSED OPERATOR TRAINING  
(INPO Procedure TQ.5)

An evaluation was performed to determine if a program exists to develop the skills and knowledge necessary for licensed operators to perform their assigned job functions.

Finding (Criterion E)

Recommendation

Response

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LICENSED OPERATOR REQUALIFICATION TRAINING  
(INPO Procedure TQ.6)

An evaluation was performed to determine if a program exists to maintain the skills and knowledge necessary for licensed operators to perform their assigned job functions.

Finding (Criterion F)

Recommendation

Response

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SHIFT TECHNICAL ADVISOR TRAINING  
(INPO Procedure TQ.7)

An evaluation was performed to determine if a program exists to develop and maintain the skills and knowledge necessary for shift technical advisors (STA) to perform their assigned job functions.

Finding (Criterion A)

Recommendation

Response

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**MAINTENANCE PERSONNEL TRAINING**  
(INPO Procedure TQ.8)

An evaluation was performed to determine if a program exists to develop and maintain the knowledge and skills necessary for maintenance personnel to perform their assigned job functions.

Finding (Criterion A)

Recommendation

Response

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## OPERATIONS

Evaluation of the Operations area included actual observations of plant operation such as reactor startup, surveillance performance tests, shift turnovers, tagouts, and other normal evolutions. Also reviewed were the methods and controls for communicating and maintaining plant status, organization and administrative aspects, facilities and equipment, and the use and content of procedures relating to the operation of the facility. Areas where improvements can be made are detailed below.

### OPERATIONS ORGANIZATION AND ADMINISTRATION (INPO Procedure OP.1)

An evaluation was performed to determine the existence of a clearly defined operations organization that assigns responsibility and delegates adequate authority for accomplishment of required tasks. Areas reviewed included organizational structure, job descriptions, shift administrative assignments, written and oral instructions and orders, and miscellaneous administrative programs. Determinations were made as follows:

Finding (Criterion A)

Recommendation

Response

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### OPERATIONS FACILITIES AND EQUIPMENT (INPO Procedure OP.2)

An evaluation was performed to determine if plant facilities and equipment are operated and maintained in a manner that ensures safe and efficient operation. Areas reviewed included equipment service needs, effect of the working environment on safe and efficient station operation, and the adequacy of communications equipment. Determinations were made as follows:

1. Finding (Criterion A)

Recommendation

Response

2. Finding (Criterion B)

Recommendation

Response

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CONDUCT OF SHIFT OPERATIONS  
(INPO Procedure OP.3)

Shift operations were evaluated to determine if operator activities and the aids for these activities support safe and efficient operation of the station. Areas reviewed included the observation of operations, station cleanliness and order, response to abnormal conditions, logkeeping practices, reliability of control room instrumentation, and operator awareness of plant conditions. Determinations were made as follows:

1. Finding (Criterion B)

Recommendation

Response

2. Finding (Criterion D)

Recommendation



Response

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**PLANT OPERATIONS PROCEDURES**  
(INPO Procedure OP.4)

An evaluation was performed to determine if procedure content and use are appropriate for conducting operations safely and reliably. Areas reviewed included management policies for use of procedures and changes to procedures. In addition, procedures were reviewed for clarity, continuity, identification of "sequence required" actions, and suitable advisory information. Determinations were made as follows:

1. Finding (Criterion B)

Recommendation

Response

2. Finding (Criterion C)

Recommendation

Response

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**PLANT STATUS CONTROLS**  
(INPO Procedure OP.5)

An evaluation was performed to determine if plant status controls are provided to ensure adequate equipment and system availability. Areas reviewed included management programs and policies that provide guidance for status control, actual practices in status control, responsibilities of senior licensed operators assigned to monitor and review status control, and provisions for status control under special conditions (e.g., outages, accident recovery, or refueling). Determinations were made as follows:

Finding (Criterion J)

Recommendation

Response

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**SHIFT TURNOVER**  
(INPO Procedure OP.6)

An evaluation was performed to determine if a continuous, current understanding of station conditions is maintained at all shift positions. Areas reviewed included programs and policies controlling shift turnover practices for individual shift positions, checklists, operating panel reviews, and review of station activities in progress or planned. Determinations were made as follows:

1. Finding (Criteria A and C)

Recommendation

Response

2. Finding (Criterion B)

Recommendation

Response

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**TAGOUT PRACTICES**  
(INPO Procedure OP.7)

An evaluation was performed to determine if established tagout practices ensure protection for personnel and station equipment. Areas reviewed included senior reactor operator (SRO) approval of safety-related tagouts, double verification of tagged equipment for personnel safety, double verification of important or safety-related components without control room indication that are repositioned during maintenance or test, tag coloring and numbering, and review of the clearance log. Determinations were made as follows:

1. Finding (Criterion B)

Recommendation

Response

2. Finding (Criterion F)

Recommendation

Response

3. Finding (Criterion G)

Recommendation

Response

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## MAINTENANCE

The evaluation encompassed the maintenance organization, preventive maintenance program, work control system, maintenance history, control and calibration of testing equipment, procedures, and facilities and equipment.

### MAINTENANCE ORGANIZATION AND ADMINISTRATION (INPO Procedure MA.1)

The maintenance organization and administrative programs were evaluated to determine their effectiveness in supporting safe plant operations. Areas reviewed included the organization structure, staff size, assignment of authorities and responsibilities, training, and certain administrative programs. Determinations were made as follows:

Finding (Criterion A)

Recommendation

Response

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### MAINTENANCE FACILITIES AND EQUIPMENT (INPO Procedure MA.2)

The location, size and condition of offices, work, and storage spaces were examined. In addition, the number, type, condition, and location of maintenance tools and equipment were reviewed.

1. Finding (Criterion A)

Recommendation

Response

2. Finding (Category II)

Recommendation

Response

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**WORK CONTROL SYSTEM**  
(INPO Procedure MA.3)

The effectiveness of the work control system was evaluated. The system functions were checked to see if they promote adequate identification of potential work; define and authorize work to be performed by the maintenance groups; provide for planning, scheduling, and control of actual work; and have a mechanism to input the maintenance results into an equipment history file for future evaluation.

1. Finding (Criterion C)

Recommendation

Response

2. Finding (Criterion F)

Recommendation

Response

3. Finding (Category II)

Recommendation

Response

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**MAINTENANCE PROCEDURES  
(INPO Procedure MA.4)**

The team evaluated the degree to which procedures enhance the quality and effectiveness of maintenance activities. Procedures and manuals were examined to determine the type of maintenance covered, scope, level of detail, review and approval process, and document control requirements and methods of revision.

1. Finding (Criterion A)

Recommendation

Response

2. Finding (Criterion F)

Recommendation

Response

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**MAINTENANCE HISTORY**  
(INPO Procedure MA.5)

The ability of maintenance history records to support maintenance evolutions was reviewed. Areas covered were the equipment included in maintenance history, content and accessibility of records, history review and evaluation methods, implementation of an equipment performance program, and procedures for program implementation.

Finding (Criteria D and E)

Recommendation

Response

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**PREVENTIVE MAINTENANCE**  
(INPO Procedure MA.6)

The team evaluated the effectiveness of maintenance in optimizing equipment reliability and performance. The preventive maintenance (PM) program was assessed to determine if it was well defined and effectively implemented. Other areas of review included criteria used to determine the equipment to be included in the program, frequency of maintenance, effectiveness of program control, coordination, and adequacy of individual procedures.

1. Finding (Criterion C)

Recommendation

Response

2. Finding (Criterion D)

Recommendation



Response

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**CONTROL OF MEASUREMENT & TEST EQUIPMENT**  
(INPO Procedure MA.7)

The team evaluated the adequacy and effectiveness of methods used for calibration and control of test equipment and instrumentation. Specifically, methods used for identifying, calibrating, storing, issuing, transporting, and using measurement and test equipment (M&TE) were examined. Procedures establishing and governing the calibration program and existing calibration records were also reviewed.

1. Finding (Criterion C)

Recommendation

Response

2. Finding (Criterion D)

Response

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**CONTROL OF SPECIAL PROCESSES**  
(INPO Procedure MA.8)

The qualification and control of personnel, procedures, equipment, and material were evaluated to ensure the quality of welding processes.

Finding

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RADIOLOGICAL PROTECTION AND CHEMISTRY

Radiological protection and chemistry were evaluated by reviewing radiological protection training, personnel dosimetry, external and internal radiation exposure, radioactive contamination control, and chemistry. This portion of the evaluation was primarily a review of plant programs as they function under normal (non-outage) conditions.

MANAGEMENT OF RADIOLOGICAL PROTECTION  
(INPO Procedure RC.1)

An evaluation was performed to determine the effectiveness of the management of the radiological protection program.

Finding (Criterion D)

Recommendation

Response

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**RADIOLOGICAL PROTECTION TRAINING**  
(INPO Procedure RC.2)

An evaluation was performed to determine if plant staff members have the knowledge and practical abilities to implement radiological protection practices effectively.

1. Finding (Criterion A)

Recommendation

Response

2. Finding (Criterion B)

Recommendation

Response

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**PERSONNEL DOSIMETRY**  
(INPO Procedure RC.3)

An evaluation was performed to verify that personnel radiation exposures were determined and recorded accurately.

Finding (Criterion C)

Recommendation

Response

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**EXTERNAL RADIATION EXPOSURE**  
(INPO Procedure RC.4)

An evaluation was performed to determine if the plant was minimizing personnel external radiation exposure.

Finding (Criterion A)

Recommendation

Response

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**INTERNAL RADIATION EXPOSURE**  
(INPO Procedure RC.5)

An evaluation was performed to determine if internal radiation exposure was minimized.

Finding

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RADIOACTIVE EFFLUENTS  
(INPO Procedure RC.5)

Finding

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SOLID RADIOACTIVE WASTE  
(INPO Procedure RC.7)

An evaluation was performed to determine if solid radioactive waste volumes were minimized.

1. Finding (Criteria D, E, and F)

Recommendation

Response

2. Finding (Criterion C)

Recommendation

Response

Inpo Comment

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**TRANSPORTATION OF RADIOACTIVE MATERIAL**  
(INPO Procedure RC.8)

An evaluation was performed to determine if the transportation of radioactive material meets requirements.

**Finding**

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**RADIOACTIVE CONTAMINATION CONTROL**  
(INPO Procedure RC.9)

An evaluation was performed to determine if the plant was minimizing contamination of equipment and areas of the plant and to determine if personnel contaminations were minimized.

1. **Finding (Criterion A)**

**Recommendation**

**Response**

2. **Finding (Criterion B)**

Recommendation

Response

3. Finding (Category II)

Recommendation

Response

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CHEMISTRY  
(INPO Procedure RC.10)

An evaluation was performed to determine if accurate measurements are taken and if aggressive control of chemistry parameters is practiced.

1. Finding (Criteria D and L)

Recommendation

Response

2. Finding (Criterion E)

Recommendation

Response

3. Finding (Category II)

Recommendation

Response

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TECHNICAL SUPPORT

On-site engineering support was evaluated in the areas of organization and administration, plant efficiency and reliability, nuclear operating experience evaluation, plant modification, and reactor engineering. The commitment to improving the design change request (DCR) process at the Duane Arnold Plant, as evidenced by the effort currently underway to close out completed DCR packages and the addition of an on-site design engineering staff to facilitate the DCR process, is noteworthy. Areas where improvements can be made are detailed below.

**ON-SITE TECHNICAL SUPPORT ORGANIZATION AND ADMINISTRATION**  
(INPO Procedure TS.1)

The on-site engineering staff was evaluated to determine if it is capable of performing all assigned responsibilities efficiently, if a training program exists to enhance and develop the skills of engineering personnel, and if technical personnel are being utilized efficiently. Determinations were made as follows:

Finding (Criterion A)

Recommendation

Response

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**PLANT EFFICIENCY AND RELIABILITY**  
(INPO Procedure TS.2)

Finding (Criteria A, D, and E)

**Recommendation**

**Response**

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**NUCLEAR OPERATING EXPERIENCE EVALUATION PROGRAM  
(INPO Procedure TS.3)**

An evaluation was performed of the programs to review in-house operating events as well as those occurring throughout the nuclear industry. The reporting, review, and follow-up corrective actions for in-house events were evaluated, along with the method of disseminating the information to appropriate personnel and the industry. For industrywide events, evaluation was made of the sources of information reviewed, the screening process employed in surveying events, and the disposition of events relevant to the plant. Determinations were made as follows:

1. Finding (Criteria A, C, D, E, G.2, and G.3)

**Recommendation**

Develop a program to handle the review and resolution of relevant industry operating experiences completely. The program should include the following:

- a.
- b.
- c.
- d.

**Response**

2. Finding (Criteria G.2 and G.3)

a.

b.

c.

SOER NUMBER

RECOMMENDATION NUMBERS

Recommendation

Response

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**PLANT MODIFICATIONS**  
(INPO Procedure TS.4)

The program for processing design change requests (DCRs) was evaluated to see if changes to the plant are implemented in a timely manner while maintaining the quality of plant systems, structures, and components. Review of proposed DCRs, prioritization, tracking, testing, verification of installation, and closeout of the DCR package were examined. Determinations were made as follows:

1. Finding (Criterion C)

Recommendation

Response

2. Finding (Criterion I)

Recommendation

Response

ON-SITE REACTOR ENGINEERING  
(INPO Procedure TS.5)

Reactor engineering at Duane Arnold was evaluated to assess the use of appropriate procedures, the use of computer programs and changes to them, the coordination with other groups off site, the dedication to maintenance of fuel clad integrity, and the involvement of the reactor engineers in refueling outage activities. A determination was made as follows:

Finding (Criterion B)

Recommendation

Response

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ADMINISTRATIVE APPENDIX

I. Listing of Areas Evaluated

ORGANIZATION AND ADMINISTRATION

- OA.1 Organizational Objectives
- OA.2 Organization Structure
- OA.3 Manpower Resources
- OA.4 Administrative Controls
- OA.5 Management Quality Programs
- OA.6 Surveillance Program
- OA.7 Industrial Safety

TRAINING AND QUALIFICATIONS

- TQ.1 Training Organization
- TQ.2 Training Administration
- TQ.3 Training Facilities and Equipment
- TQ.4 Non-Licensed Operator Training
- TQ.5 Licensed Operator Training
- TQ.6 Licensed Operator Requalification Training
- TQ.7 Shift Technical Advisor Training
- TQ.8 Maintenance Personnel Training

OPERATIONS

- OP.1 Operations Organization and Administration
- OP.2 Operations Facilities and Equipment
- OP.3 Conduct of Shift Operations
- OP.4 Plant Operations Procedures
- OP.5 Plant Status Controls
- OP.6 Shift Turnover
- OP.7 Tagout Practices

MAINTENANCE

- MA.1 Maintenance Organization and Administration
- MA.2 Maintenance Facilities and Equipment
- MA.3 Work Control System
- MA.4 Maintenance Procedures
- MA.5 Maintenance History
- MA.6 Preventive Maintenance
- MA.7 Control of Measurement and Test Equipment
- MA.8 Control of Special Processes

RADIOLOGICAL PROTECTION AND CHEMISTRY

- RC.1 Management of Radiological Protection
- RC.2 Radiological Protection Training
- RC.3 Personnel Dosimetry
- RC.4 External Radiation Exposure
- RC.5 Internal Radiation Exposure
- RC.6 Radioactive Effluents
- RC.7 Solid Radioactive Waste
- RC.8 Transportation of Radioactive Material
- RC.9 Radioactive Contamination Control
- RC.10 Chemistry

TECHNICAL SUPPORT

- TS.1 On-Site Technical Support Organization and Administration
- TS.2 Plant Efficiency and Reliability
- TS.3 Nuclear Operating Experience Evaluation Program
- TS.4 Plant Modifications
- TS.5 On-Site Reactor Engineering

**II. Iowa Electric Light and Power Company Personnel Contacted**

Chairman of the Board and President  
Senior Vice-President, Energy Resources  
Assistant Vice-President, Nuclear Generation Division  
Director-Nuclear Generation  
Manager-Design Engineering  
Manager-Technical Services  
Chief Engineer-Duane Arnold Energy Center  
Assistant Chief Engineer-Operations  
Assistant Chief Engineer-Radiation Protection and Security  
Assistant Chief Engineer-Technical Support  
Supervisor-Operations  
Supervisor-Mechanical Maintenance  
Supervisor-Electrical Maintenance  
Assistant Supervisor-Mechanical Maintenance  
Assistant Supervisor-Electrical Maintenance  
Radiation Protection Engineer  
Technical Engineer  
Quality Assurance Engineer  
Reactor and Plant Performance Engineer  
Quality Control Supervisor  
Assistant Radiation Protection Engineer  
Radiological Engineers  
Shift Supervisor Engineers  
Nuclear Station Operating Engineers  
Assistant Nuclear Station Operating Engineers  
Second Assistant Operating Engineers  
Auxiliary Operating Engineers  
Shift Technical Advisors  
Health Physics Supervisor  
Radiation Waste Supervisor  
Training Coordinator  
Instrumentation and Control Technicians