U. S. NUCLEAR REGULATORY COMMISSION

REGION III

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Report No.	50-331/97008(DRS)
Licensee:	IES Utilities Inc.
Facility:	Duane Arnold Energy Center
Location:	200 First Street S.E. P. O. Box 351 Cedar Rapids, IA 52406-0351
Dates:	March 24-27, 1997
Inspector:	Kara N. Selburg, Radiation Specialist Kenneth J. Lambert, Radiation Specialist
Approved by:	Thomas J. Kozak, Chief, Plant Support Branch 2 Division of Reactor Safety

EXECUTIVE SUMMARY

Duane Arnold Energy Center, Unit 1
NRC Inspection Report 50-331/97008

This routine independent inspection included aspects of licensee plant support, specifically the chemistry, radiological environmental monitoring, post accident sampling, and radiation protection programs. The report covers a four day period of an announced inspection by regional radiation specialists.

Plant Support

- A lack of conservative decision making was apparent during the March 5-6, 1997, event in which the licensee failed to recognize work was being performed in an area with potentially changing radiological hazards, resulting in personnel performing work in a high radiation area (Section R1.1).

- Differing radiation protection expectations contributed to worker confusion which resulted in workers entering a contaminated area on the incorrect radiation work permit and failing to egress from the radiologically restricted area when expected by the health physics department (Section R1.1).

- Plant water quality remained excellent, and the licensee's commitment to advanced technologies for reactor protection from intergranular stress corrosion cracking was a strength (Section R1.2).

- The radiological environmental monitoring program was effectively implemented, and no discernable radiological impact on the environment from the operation of the facility was identified (Section R1.3).

- The post accident sampling station was in good material condition; however, an inspection follow-up item was generated regarding the licensee's evaluation of the appropriate temperature control for gaseous sample lines in order to obtain a representative sample (Section R2.1).

- Overall, chemistry technicians appeared knowledgeable of the systems and procedures. However, two areas of improvement were identified (Section R4.1).

- The chemistry laboratory quality control program was adequately implemented (Section R7.1).

Report Details

Plant Support

R1 Radiological Protection and Chemistry (RP&C) Controls

R1.1 Lack of Conservative Decisions During Resin Transfer

a. Inspection Scope (83750)

The inspectors reviewed an event which occurred on March 5-6, 1997, regarding work performed on a check valve during a resin backwash. The inspectors interviewed personnel from health physics (HP), instruments and controls (I&C), maintenance, and quality assurance (QA) departments. The inspectors also observed the work area. The inspectors reviewed radiation work permits (RWPs), radiological surveys, radiation protection (RP) procedures, and maintenance action requests related to this event.

b. Observations and Findings

The licensee had been experiencing problems with spent fuel pool demineralizer isolation valve CV3504B. Tests needed to be performed on this valve following a backwash of the spent fuel demineralizer to determine the travel distance of the valve relative to the air pressure applied to it. On March 5, 1997, the spent fuel pool resin bed was backwashed. Subsequently, during the back shift, I&C technicians performed diagnostic tests on the valve. Although the area was a posted contaminated area, the technicians did not meet management's expectation to notify HP personnel. As a result of this and other communications problems, the HP staff did not conduct additional radiation surveys in this area after the resin backwash was completed. While the I&C technicians were performing the tests, they received electronic dosimeter (ED) dose rate alarms. However, due to the high ambient noise levels, they were unable to hear the alarms. As the tests continued, the I&C technicians noticed that they had received higher than expected accumulated doses, exited the area, and contacted the HP technician (HPT). When the individuals electronically logged out of the radiologically restricted area (RRA), they discovered that they had received dose rate alarms. The licensee was aware of problems hearing ED alarms in high noise areas and routinely discussed this issue during pre-job briefings and employee training. The HPT conducted surveys of the work area and discovered dose rates in excess of 100 millirem per hour at 30 centimeters. The HPT contacted the appropriate plant management, and a fact finding meeting was conducted shortly thereafter.

During the licensee's investigation, a number of problems were identified concerning the implementation and effectiveness of management's HP expectations. The licensee identified inconsistencies in the application of management's expectations to different shifts and between departments. As noted in this event and through additional discussions with personnel, the inspector observed that these problems appeared to have resulted in worker confusion. For

example, I&C technicians were expected to log out of the RRA each time they exited, but members of other departments were allowed to exit the RRA without logging out. During a break in the work activities described above, the I&C technicians exited the RRA without meeting this expectation, i.e. the individuals did not electronically sign off of the RWP. If they had signed out, the computer would have alerted them to the dose rate alarm and would have instructed them to contact HP. Another example of differing expectations occurred when the I&C technicians noted that the work area was posted as a contaminated area. During the back shift, HP's expectations were that I&C technicians could perform routine work activities in contaminated areas without contacting HP, provided they were working under the correct RWP. The I&C technicians did not realize this activity was considered non-routine and, therefore, did not contact HP. The licensee planned to ensure radiation workers understood HP expectations and planned to improve the overall communication of expectations.

The licensee determined that the individuals had performed the work on the incorrect RWP. The I&C technicians's RWP did not allow entry into contaminated areas. ACP 1411.27, "Rules for Conduct of Work in Radiological Areas," requires personnel to obey posted, oral and written radiological control instructions, procedures, and radiation work permits including stop work and evacuate orders from HP. The individuals were in violation of the requirements of the RWP when they entered the CA. Failure to comply with this procedure is a violation of licensee Technical Specification 6.9.1 which requires, in part, procedures for personnel radiation protection shall be adhered to for all operations involving personnel radiation exposure. The licensee's corrective actions included counseling the individuals and ensuring they understood the correct RWP requirements. The licensee also planned to address the different standards for implementing radiological controls. This licensee identified and corrected violation is being treated as a Non-cited Violation in accordance with section VII.B.1 of the NRC Enforcement Policy (NCV 50-331/97008-01).

The mid shift HPT performed a survey of the work area described above and discovered a high radiation area (HRA) reading 100 millirem in one hour at 30 cm in the vicinity of CV3504B. The shift HPT appropriately posted this area. Through the subsequent licensee investigation, it was determined that during the backwash some resin was slowed down and stuck in the check valve area, thus creating the HRA. The system was flushed, and the area was de-posted on March 7, 1997. The HP technician's response was expedient and appropriate. 10 CFR 20.1501(a) states that each licensee shall make or cause to be made surveys that may be necessary for the licensee to comply with regulations in this part and are reasonable under the circumstances to evaluate the extent of radiation levels, the concentrations or quantities of radioactive material, and the potential radiological hazards that could be present. The licensee failed to make surveys subsequent to the resin transfer and prior to the valve testing to assure compliance with 10 CFR 20.1201(a) which limits radiation exposure to 5 rem per year total effective dose equivalent. Corrective actions taken by the licensee to prevent recurrence included: evacuating the area where testing was performed during fuel pool resin bed backwashes; counseling I&C technicians on the appropriate HP expectations; and

permanently placing EDs into the room for dose and dose rate tracking. Corrective actions regarding the inadequate evaluation and failure to follow the RWP requirements appeared effective. This licensee identified and corrected violation is being treated as a Non-Cited Violation in accordance with section VII.B.1 of the NRC Enforcement Policy (NCV 50-331/97008-02).

c. Conclusions

The inspectors noted that lack of conservative decision making was apparent during the March 5-6, 1997, event in which the licensee failed to recognize work was being performed in an area with potentially changing radiological hazards. This resulted in personnel performing work in a high radiation area. Differing expectations contributed to worker confusion as noted by workers entering a contaminated area on the incorrect RWP and failing to egress from the RRA as expected by HP. While this event was self revealed as the individuals exited the RRA, the licensee's response was very timely and corrective actions taken appeared to be effective to prevent recurrence.

R1.2 Water Chemistry Control Program

a. Inspection Scope (84750)

The inspectors reviewed the licensee's water chemistry control program. This included discussions with cognizant individuals regarding the licensee's hydrogen water chemistry program, zinc addition program, and noble metal chemical addition program. The inspectors reviewed the trend charts of numerous chemistry parameters from January 1996 through March 1997.

b. Observations and Findings

The licensee's water chemistry program was consistent with the Electric Power Research Institute (EPRI) boiling water reactor (BWR) guidelines. A review of selected trend records indicated that plant water quality was very good, and no significant problems were observed. Radiochemistry trend charts for reactor coolant isotopic analysis indicated that there were no problems with fuel integrity. The licensee continued to use hydrogen water chemistry for reduction of intergranular stress corrosion cracking (IGSCC) and continued the zinc addition program in order to reduce source term from Cobalt-60 (Co-60) in the reactor coolant. A review of trend charts indicated that reactor coolant soluble Co-60 remained low. Drywell dose rates notably decreased during the 1996 refueling outage, which the licensee attributed to the zinc addition. The licensee also sponsored a vendor demonstration of a noble metal chemical addition (NMCA) during the 1996 refueling outage. The NMCA process involved an addition of noble metal additives to the reactor water during shutdown, during which time the compounds decompose to produce a thin layer of noble metals on wetted surfaces. The NMCA was anticipated to reduce the electrochemical corrosion potential (ECP) on the reactor components. The licensee was the first utility to demonstrate the NMCA. Preliminary results indicated that the minimum target loadings of the

platinum and rhodium catalysts were achieved; however, the ratio of platinum to rhodium catalysts were lower than expected. A benefit from the NMCA involved a reduction of the hydrogen injection rate, which consequently reduced plant radiation levels.

c. Conclusions

Plant water quality continued to be excellent. The licensee's commitment to advanced technologies for reactor protection from IGSCC and dose reduction was a strength.

R1.3 Radiological Environmental Monitoring Program (84750)

The inspectors reviewed selected areas of the licensee's radiological environmental monitoring program (REMP) including the 1995 Annual Operating Report (AOR) and program requirements described in the Off-site Dose Assessment Manual (ODAM), Updated Final Safety Analysis Report (UFSAR), and Technical Specifications (TS). The 1995 AOR appeared to comply with REMP requirements. Environmental samples had been collected and analyzed; missing samples were documented; and the annual land use census had been conducted as required. The environmental sample data indicated that there had been no discernable radiological impact on the environment from the operation of the facility. The inspectors accompanied licensee technicians on weekly rounds to change air particulate filters and iodine cartridges, and during quarterly rounds to collect well water samples. Technicians were knowledgeable in the procedures and process to change the filters and cartridges and properly checked the operating condition of the sampling equipment. The technician collecting well water samples was knowledgeable in the sample collection process. Observed air sampling equipment was within calibration and in good working order. Sampling locations were in agreement with the procedures and the ODAM. Based on a review of licensee procedures and on discussions with applicable licensee personnel, the inspectors concluded that the REMP program was effectively implemented.

R2 Status of RP&C Facilities and Equipment

R2.1 Post Accident Sampling System

a. Inspection Scope (84750)

The inspectors reviewed the licensee's post accident sampling system (PASS) capabilities. This included an inspection of the sampling station, discussions with cognizant system engineering and chemistry personnel, a review of the systems maintenance history, and a comparison of PASS samples with the reactor coolant samples.

b. Observations and Findings

The inspectors noted that chemistry and system engineering had a thorough understanding of the PASS system including the process with which a sample is obtained, system connections, and the maintenance history. The inspectors determined that the material condition of the PASS station was good and that the licensee was capable of obtaining required samples.

The licensee tracked and was currently addressing a continuing problem with a flow control valve on the system. The valve had failed seven times in a ten year period, primarily due to the valve being unable to perform its flow control function (the valve needle had a tendency to stick in its seat). The licensee temporarily increased the semiannual PASS surveillance to one month intervals and found that the frequent use of the valve appeared to reduce the problem. The licensee's mechanical engineering department was performing an evaluation to determine long term corrective actions. The inspectors noted good coordination between departments and good tracking of system problems.

During the NMCA safety evaluation, the licensee became aware of a potential discrepancy between the UFSAR and actual system operation. Section 12.3.4.2.3 of the UFSAR stated that heat tracing of the gaseous sample lines would be sized to maintain the line at 250 degrees fahrenheit and that these lines would be insulated. This line was actually maintained at 95 degrees fahrenheit and the entire line was not insulated. The system engineer determined that if the lines were fully insulated, the higher temperature could be achieved. The licensee was not certain if the value stated in the UFSAR was necessary to obtain a representative sample, thus they contacted General Electric (manufacturer of the skid) for the actual system requirements. The licensee speculated that if the temperature of the sample line was increased to 250 degrees fahrenheit, this could affect the safety evaluation for the NMCA. This item will remain open pending a review of the licensee's evaluation, including: the determination of the appropriate setpoint; the design basis of this setpoint; and any subsequent changes made to the UFSAR and/or the NMCA safety evaluation (IFI 50-331/97008-03).

The inspectors reviewed the licensee's annual PASS sample and compared it with the reactor water chemistry results. The licensee compared the concentration of sodium-24 (Na-24) in the PASS sample to Na-24 in the unfiltered reactor water. In July 1995 and July 1996, the licensee showed a comparison within a factor of two; no problems were noted.

c. Conclusions

The inspectors noted that the licensee had effectively maintained the material condition of the PASS system, and annual comparisons between PASS and reactor coolant showed a good agreement. However, the licensee's evaluation of the appropriate gaseous sample line temperature necessary to obtain a representative accident sample will be evaluated in future inspection activities.

R4 Staff Knowledge and Performance in RP&C

R4.1 Staff Performance During Sample Acquisitions

a. Inspection Scope (84750)

The inspectors observed chemistry personnel perform several functions including obtaining general service water (GSW) and residual heat removal service water (RHRSW) samples and performing the reactor building (RB) normal vent particulate filter replacement. The inspectors reviewed the surveillance test and chemistry procedures governing these actions, and reviewed the final results from these surveillances.

b. Observations and Findings

The inspectors observed chemistry personnel during the routine sample acquisitions of the GSW and RHRSW. The chemistry technician appropriately contacted the operations and the radwaste departments prior to obtaining each sample and at the end of each evolution. The technician used good sampling techniques including rinsing the bottle prior to obtaining each sample. The technician frequently referred to the procedure and was very familiar with sample locations and requirements. Prior to obtaining the samples, the technician reviewed the plant chemistry sampling program guidelines procedure which stated the appropriate sample purge volume for the GSW (16 liters). The procedure did not address a sample purge volume for the RHRSW sample. The technicians had been instructed that when no sample purge volume was listed in the procedure, then three times the sample purge line volume should be obtained. While the technician knew this requirement, he was unaware of the appropriate RHRSW purge volume, and instead purged the system for approximately four minutes. The inspectors noted that procedural requirements and management guidance were not clearly understood by the technicians. No problems were noted with the appropriateness of the RHRSW sample purge during this evolution. The licensee was reviewing the procedure and instructed all technicians of the appropriate requirements.

The inspectors observed a chemistry technician perform the weekly RB normal vent filter exchange. The technician appropriately contacted operations personnel to inform them of the anticipated control room alarms during the system breaches. The technician was knowledgeable of the system's operation and could readily identify different components on the monitor. The technician removed the filter by grasping the outer edge where filter residue was visible. The inspectors noted that this practice could potentially remove some of the filter residue and affect the final filter analysis. The licensee acknowledged that this poor radiation worker practice did not meet expectations. The technician appropriately replaced the clean filter, reassembled the system, and performed a leak test to ensure system integrity.

c. Conclusions

The inspectors noted that chemistry technicians appeared knowledgeable of the systems and procedures. However, a weakness was identified with technicians not thoroughly understanding procedural requirements, and an example of poor radiation worker practices was identified during a filter exchange.

R7 Quality Assurance in RP&C Activities

R7.1 Laboratory and Instrument Quality Control Program (84750)

The inspectors reviewed the laboratory QA program, including the laboratory comparison programs and quality control of instrumentation. The inspectors reviewed the results from the laboratory vendor supplied inter-laboratory and licensee maintained intra-laboratory cross-check programs, and noted good agreements. Statistically based control charts were used to monitor the performance of counting equipment. The quality control program required that trends or changes in pattern on the control charts need to be evaluated and that the results from these evaluations and corrective actions should be documented. The inspectors reviewed select control charts, and noted that the majority of all trends had been identified and appropriately resolved. Overall, the QA program was effectively implemented.

R8 Miscellaneous RP&C Issues

R8.1 (Closed) Inspection Follow-up Item 50-331/96003-05: Organic intrusion into the radioactive waste system. The inspectors reviewed the licensee's HPES review regarding two instances where organics entered the radwaste system. The licensee's evaluation adequately addressed the possibilities of the unknown March 27, 1996, organic intrusion, and no similar events had occurred. The inspectors also reviewed the licensee's response to the April 16, 1996, event in which a chemistry technician overflowed a tank containing organics and drained the spilled liquid into the radwaste system. The licensee's corrective actions, including requiring chemistry technicians to remain at all tanks while they are being filled, were adequate. No further problems were noted in this area. This item is closed.

R8.2 (Open) Violation 50-331/97002-01: Failure to comply with health physics instructions. On February 10, 1997, mechanical maintenance (MM) personnel performed work on the condensate demineralizers. During the course of these activities, MM failed to notify HP prior to opening a contaminated system as required by RWP. A contributing factor to this event was poor communications during the pre-job briefing and the lack of guidance provided in the MM procedures and the appropriate radiation work permit. The lack of guidance was addressed in a timely matter and was discussed in inspection report 50-331/97002(DRS). The licensee was continuing to improve communication between maintenance and health physics. The two departments were meeting weekly to discuss current work activities, problems encountered with each department, and possible improvements. To improve work planning, MM assigned workers to specific job tasks with more

time to assist with pre-job coordination, and a dedicated HPT was assigned to these tasks to provide consistent job planning, pre-job briefings, and actual work coverage. To date no further problems were observed, however, this item will remain open to ensure that the corrective actions are effective during routine work activities.

Management Meetings

X1 Exit Meeting Summary

On March 27, 1997, the inspectors presented the inspection results to licensee management. The licensee acknowledged the findings presented. The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

J. Franz, Vice President Nuclear
G. Van Middlesworth, Plant Manager
P. Bessette, Manager, Engineering
J. Bjorseth, Manager, Maintenance
D. Curtland, Manager, Operations
R. Hite, Manager, Radiation Protection

INSPECTION PROCEDURES USED

IP 83750: Occupational Radiation Exposure.

IP 84750: Radioactive Waste Treatment, and Effluent and Environmental Monitoring.

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-331/97008-03	IFI	Determination of appropriate PASS sampling requirements.

Closed

50-331/96003-05	IFI	Organic intrusion into the radioactive waste system.
50-331/97008-01	NCV	Failure to follow radiation work permit instructions.
50-331/97008-02	NCV	Failure to evaluate the potential for radiological hazards.

Discussed

50-331/97002-01	VIO	Failure to comply with health physics instructions.

LIST OF ACRONYMS USED

ACP	Administrative Control Procedure
AOR	Annual Operating Report
BWR	Boiling Water Reactor
CFR	Code of Federal Regulations
Co-60	Cobalt 60
CA	Contaminated Area
DRS	Division of Reactor Safety
ECP	Electrochemical Corrosion Potential
ED	Electronic Dosimeter
EPRI	Electric Power Research Institute
GSW	General Service Water
HP	Health Physics
HPES	Human Performance Enhancement System
HPT	Health Physics Technician
I&C	Instruments and Controls
IFI	Inspection Follow-up Item
IGSCC	Intergranular Stress Corrosion Cracking
IP	Inspection Procedure
MM	Mechanical Maintenance
Na-24	Sodium-24
NCV	Non-Cited Violation
NMCA	Noble Metal Chemical Addition
NRC	Nuclear Regulatory Commission
ODAM	Off-site Dose Assessment Manual
PASS	Post Accident Sampling System
PCP	Plant Chemistry Procedure
QA	Quality Assurance
RA	Radiation Area
RB	Reactor Building
REMP	Radiological Environmental Monitoring Program
RHRSW	Residual Heat Removal Service Water
RP&C	Radiological Protection and Chemistry
RRA	Radiologically Restricted Area
RWP	Radiation Work Permit
SE	System Engineer
TS	Technical Specifications
UFSAR	Updated Final Safety Analysis Report
VIO	Violation

PARTIAL LIST OF DOCUMENTS REVIEWED

Action Requests: 962813.00; 962813.01; 961542.00; and 970655.00.

Administrative Control Procedure (ACP):

ACP 1411.21, Revision 6, "Radiation Work Permits," effective 10/9/96;

ACP 1411.22, Revision 5, "Personnel Access and Egress in Radiological Areas," effective 10/9/96; and

ACP 1411.27, Revision 0, "Rules for Conduct of Work in Radiological Areas," effective 12/8/95.

Annual Operating Report (1995).

Chemistry Trending Graphs from 1/96 through 3/97.

Corrective Maintenance Action Request #A 27198.

DAEC Memorandum:

RCA 960301 (Rev. 01), "Radwaste System Organic Intrusion", File A-118K, dated May 14, 1996.

DAEC Survey Form HP-41:

Survey # 97-700, routine RB 812' jungle room, dated 2/27/97;

Survey # 97-779, fuel pool F/D pump room in the RB 812' jungle room, dated 3/5/97;

Survey # 97-781, fuel pool F/D pump room in the RB 812' jungle room, dated 3/6/97; and

Survey # 97-795, fuel pool F/D pump room in the RB 812' jungle room, dated 3/7/97.

Off-site Dose Assessment Manual.

Plant Chemistry Procedures (PCP):

PCP 1.2, "DAEC Chemistry Quality Control Program," Revision 3, effective January 13, 1997; and

PCP 2.1, "Plant Chemistry Sampling Program Guidelines", Revision 2, effective October 26, 1993.

Radiation Work Permits (RWP):

RWP 52, job step 1, "Routine Work and Inspection in RAs;" and

RWP 53, job step 3, "Routine Work and Inspections in Radiological Areas."