U.S. NUCLEAR REGULATORY COMMISSION

REGION III

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Report Nos:	50-254/98016(DRS); 50-265/98016(DRS)
Licensee:	Commonwealth Edison Company
Facility:	Quad Cities Nuclear Power Station, Units 1 and 2
Location:	22710 206th Avenue North Cordova, IL 61242
Dates:	August 10-14, 1998
Inspectors:	K. Lambert, Radiation Specialist N. Shah, Radiation Specialist
Approved by:	Gary L. Shear, Chief, Plant Support Branch 2 Division of Reactor Safety

EXECUTIVE SUMMARY

Quad Cities Nuclear Power Station, Units 1 & 2
NRC Inspection Reports 50-254/98016; 50-265/98016

This routine inspection of the radiation protection (RP) program included the external and internal exposure control, whole body counting, and contamination and survey monitoring programs; source term reduction efforts; and observations of several radiation safety significant jobs.

- Overall, the external exposure control program was being effectively implemented in accordance with station procedures and regulatory requirements. Radiation Protection (RP) staff were knowledgeable of procedures and processes. However, several minor deficiencies regarding procedure adherence and record keeping were identified. These deficiencies were being evaluated and corrected by RP management (Section R1.1).

- In-vitro and In-vivo analyses were being performed properly and were consistent with industry standards. However, the inspectors questioned whether a decrease in the frequency of quality control checks for the whole body counter would provide sufficient QC data to obtain an accurate indication of detector performance. This was being evaluated by the licensee (Section R1.2).

- Air sampling was conducted consistent with NRC regulations and industry practice. Air samplers were well maintained and workers were observed correctly performing air sampling activities. However, there were several minor examples identified where procedural guidance needed additional clarification and where mistakes in air sampling records had not been identified through licensee supervisory reviews (Section R1.3).

- The routine contamination and dose rate survey program was effectively implemented. Surveys were performed as required and appropriately documented. A technician observed during the inspection was knowledgeable of the procedure and the area to be surveyed, and demonstrated good survey techniques (Section R1.4).

- The inspectors concluded that the station was effectively planning and coordinating work to reduce source term and; therefore, overall station dose (Section R1.5).

- High and locked high radiation areas were well controlled and were maintained in good condition with only minor housekeeping problems observed. Workers were familiar with access control requirements and RP staff was observed reinforcing these expectations in work areas (Section R2.1).

- Radiological postings and container labeling were well maintained, and appropriately informed workers of current plant radiological conditions. Overall, housekeeping was good, except for the laundry-tool decon building maintenance decontamination area. In addition, drain hoses from heat exhangers in the Unit 2 reactor building were not properly secured and were inconsistently labeled. (Section R2.2).

- Radiological controls for the Units 1 and 2 spent fuel pool work were effective. The As-Low-As-Is-Reasonably-Achievable (ALARA) plan appropriately addressed past lessons-learned, potentially high radiological conditions and included reasonable contingency plans. The subsequent shipping of the material removed from the pool was also well conducted (Section R4.1).

- Radiological controls implemented for the demineralizer filter element replacement were effective. The radiation work permit appropriately addressed radiological concerns and included ALARA pre-job briefing notes. Radiation protection technicians and workers demonstrated good communication and radiation worker practices (Section R4.2).

- The licensee implemented good ALARA controls for the movement of highly activated components in the spent fuel pool and took prompt and effective actions after higher than expected dose rates were encountered during the job (Section R4.3).

Report Details

IV. Plant Support

R1 Radiological Protection and Chemistry (RP&C) Controls

R1.1 External Dose Control

a. Inspection Scope (IP 83750)

The inspectors reviewed the programs for dosimetry usage, comparison of thermoluminescent dosimeters (TLDs) to electronic dosimeters (EDs), declared pregnant workers, and personnel contamination events (PCEs). This inspection also included a review of applicable procedures and dose records, and interviews with RP personnel.

b. Observations and Findings

The 1998 dose goal was 630 person-rem total dose, including doses from planned and forced outages. The actual total dose through July 1998 was 254 person-rem. Station As-Low-As-Is-Reasonably-Achievable (ALARA) representatives indicated that based on dose to date, they believed the 1998 total dose would be below the dose estimate. The non-outage dose goal for 1998 was 144 person-rem, with an actual dose of 85 person-rem through July 1998. A dose goal of 300 person-rem was established for the upcoming Unit 1 refueling outage.

Station procedures for dosimetry usage, TLD/ED comparison, PCEs, and declared pregnant workers were consistent with industry guidance and NRC requirements. Dose records were maintained on an electronic data base, with additional documents in individual files for dose history, PCEs, and records of those female workers who had declared themselves pregnant.

During the review of records, the inspectors identified that four female workers had declared themselves pregnant in 1997. The records included their declaration, estimated conception date, and monitoring end date. The inspectors noted that the dose to the declared workers ranged from 39 to 134 millirem (mrem) for their monitoring periods, which ranged from four to nine months. Doses for declared pregnant workers were reviewed daily to ensure that the 500 mrem exposure limit was not exceeded.

Personnel dosimetry results between EDs and TLDs were compared quarterly. TLD results were used for the permanent record unless the discrepancy between the ED and TLD was greater than 25 percent for those doses greater than 100 mrem. Differences in doses greater than 25 percent were determined to be out of tolerance and evaluated to determine which record was more accurate (TLD or ED). The technician demonstrated the evaluation process to the inspectors. The technician performed an initial review of differences greater than 25 percent for possible causes including

processing errors, record keeping errors and other obvious errors that would cause the out-of-tolerance results. These were corrected by the technician and the comparison was rerun. For the remaining out-of-tolerance results, a more formal investigation was performed which included interviews with the individual and his/her supervisor to determine the root cause for the out-of-tolerance results. This evaluation was documented, when performed, and indicated corrective actions to be implemented.

The inspectors noted a minor discrepancy with the procedure, where the technician did not document the results of the initial evaluation on the computer printout. This matter was brought to the attention of the technician and RP management, who indicated that a Problem Identification Form (PIF) was written to address the issue and that the initial evaluation would be documented in the future.

Personnel contamination events greater than 1000 disintegrations per minute (dpm) but less than 5000 dpm were tracked for trending purposes and included the cause of the contamination, such as clean area contamination, protective equipment failure, or poor worker practice. Contamination events greater than 5000 dpm were evaluated and documented in a PIF. Radiation protection had documented 36 PCEs greater than 5000 dpm in 1998 to date. Inspectors selectively reviewed PCE evaluations and noted they were appropriately completed and evaluations were technically sound.

Licensee procedures required dose evaluations when contamination limits for the skin or clothing were exceeded. The inspectors reviewed PCE documentation and noted that for one event a dose evaluation was required. The documentation further indicated that the dose was below the threshold for assigning a dose to the individual. Therefore, the evaluation was not retained. The inspectors noted that this practice prevented the licensee from maintaining an accurate historical record of the evaluation. RP management indicated it would further review the matter and implement corrective actions to maintain the evaluations.

The inspectors reviewed a self assessment of the personnel contamination program. The assessment was comprehensive and included review of procedures, observations, and discussions with personnel. The assessment identified program strengths and weaknesses. Corrective actions for identified weaknesses were documented and were being tracked for completion through the stations nuclear tracking system.

c. Conclusions

Overall, the external exposure control program was being effectively implemented in accordance with station procedures and regulatory requirements. RP staff were knowledgeable of procedures and processes. However, several minor deficiencies regarding procedure adherence and record keeping were identified. These deficiencies were being evaluated and corrected by RP management.

R1.2 Internal Dose Control

a. Inspection Scope (IP 83750)

The inspectors reviewed the in-vitro (e.g., biological sampling) and in-vivo (e.g., external whole body counting) programs for assessing internal exposure. Included in this inspection was a review of applicable procedures and documents, walkdowns of the whole body counter (WBC), whole body friskers (WBFs) and gamma sensitive portal monitors, and interviews with RP personnel.

b. Observations and Findings

Station procedures for both in-vitro and in-vivo analyses were consistent with industry guidance and NRC regulations. Although in-vitro analyses had not been performed within the last two years, the inspectors verified that responsible personnel were familiar with the procedural guidance.

The licensee had implemented a passive monitoring program to replace certain types of whole body counting. Specifically, workers were required to pass through the WBFs and portal monitors prior to egressing the Radiologically Posted Area (RPA) or plant protected area, respectively. Workers unable to pass these monitors (i.e., received a contamination alarm) were required to pass through one of two passive WBFs. These passive WBFs had been specially calibrated (using a whole body phantom) for internal contamination. Those workers who alarmed the passive WBFs, were then monitored via the WBC. A licensee analysis indicated that the non-passive and passive WBFs and the portal monitors could detect internally deposited radionuclides at $\leq$ 1 percent of an Annual Limit of Intake (ALI) with excellent reliability. The inspectors reviewed the results of this study (actual monitor performance was not validated) and observed workers using the non-passive WBFs and portal monitors. No problems were identified.

In May 1998, the licensee revised the calibration frequency of the FASTSCAN WBC from annually to as needed, per the replacement of certain components or if periodic quality control (QC) checks indicated potential detector degradation. Although this practice was sound, the inspectors identified a potential problem with the licensee's QC program. Specifically, the licensee only performed a QC check prior to performing a whole body count. However, with the implementation of the passive monitoring program, there has been a significant decline in the number of whole body counts performed by the licensee. The inspectors questioned whether this decrease would provide sufficient QC data to establish an accurate indication of detector performance. Licensee management planned to evaluate the issue. In the interim, the inspectors verified that the QC data obtained through August 13, 1998, indicated good WBC performance.

c. Conclusions

In-vitro and In-vivo analyses were being performed properly and consistent with industry standards. However, the inspectors questioned whether a decrease in the frequency of quality control checks for the whole body counter would provide sufficient QC data to establish an accurate indication of detector performance. This was being evaluated by the licensee.

R1.3 Airborne Radioactivity Sampling and Analysis

a. Inspection Scope (IP 83750)

The inspectors reviewed the licensee's airborne radioactivity sampling and analysis programs. The inspection consisted of a review of applicable procedures and records, observation of ongoing sampling activities, and interviews with workers.

b. Observations and Findings

Air sampling equipment was well maintained and workers were knowledgeable about their operation. For example, the inspectors observed an RP technician properly calibrate a RADECO model H809-V1 (serial no. 1303) air sampler. During this calibration, the technician correctly answered an inspector's questions regarding conduct of air sampling, use/maintenance of air samplers, and industry events. Air sampling activities were well performed and associated samplers were conservatively located at work sites. Sampling consisted of grab samples collected in the general work zone and, as applicable, in the breathing air zone (approximately one foot diameter) of the worker. Neither lapel air sampling nor Derived Air Concentration (DAC)-hour tracking were performed by the licensee. At the time of this inspection, the licensee had not identified an airborne radiation area.

Air samples were routinely counted for beta and gamma contamination, but not for alpha contamination. However, RP&C staff indicated that potential alpha contamination had not been an issue owing to good historical fuel performance and routine surveys of potential areas such as the refuel floor. The inspectors reviewed the calibration and maintenance histories (including quality control charts) for the three TENNELEC proportional counters used for measuring alpha contamination and no problems were identified.

Station procedures were consistent with industry practice, NRC regulations and with RP management expectations. Additionally, these procedures contained contingency actions for alpha monitoring should degrading fuel performance be observed in plant water chemistry sampling results. However, there were several minor examples where additional guidance and/or clarification was needed in some procedures. For example, an inspector read section G1(c2) of procedure no. QCRP 6020-02, regarding when to perform air sampling when working on contaminated equipment, and could not determine if an air sample was required at any contamination level or only at levels

exceeding 100,000 dpm/100 cm^2. The licensee agreed with these findings and planned to revise the procedures.

The inspectors also found several minor errors in records of air sample results which had not been identified during management reviews by the licensee. For example, a record dated July 22, 1998, of an air sample taken on the Unit 2 refuel bridge, had a "?" listed in the space stating the serial number of the air sampler used. The record had been signed off by an RP supervisor without correcting the entry. These examples were discussed with the acting RP manager who stated that similar errors had also been identified in station audits and that corrective actions were being developed.

c. Conclusions

Air sampling was conducted consistent with NRC regulations and industry practice. Air samplers were well maintained and workers were observed correctly performing air sampling activities. However, there were several minor examples identified where procedural guidance needed additional clarification and where mistakes in air sampling records that had not been identified through licensee supervisory reviews.

R1.4 Routine Contamination and Exposure Rate Surveys

a. Inspection Scope (IP 83750)

The inspectors reviewed the licensee's program for performing routine contamination and exposure rate surveys. This review included procedures and survey records, discussions of the program with RP staff, and observations of surveys being performed.

b. Observations and Findings

The station maintained procedure QCRP 6020-03, "Radiological Surveys," which adequately described the routine dose rate and removable contamination survey program. Routine surveys of RPAs were performed monthly. The clean side mechanical maintenance shop, the hallway to the turbine building, and the Units 1 and 2 trackways were surveyed for removable contamination weekly. Surveys of areas outside the protected area were performed quarterly and included the sewage treatment plant, the mixed waste building, the dry active waste building and the TLD irradiator room in J-building. The survey procedure was reviewed by the inspectors and determined to be technically sound.

Dose rate and contamination surveys for July and August were reviewed. Surveys reviewed were appropriately completed, and no problems were identified. When removable contamination greater than 1000 dpm was identified, additional surveys were performed to identify the extent of the contamination. The areas were then appropriately controlled and posted in accordance with station procedures.

The inspectors observed a radiation protection technician (RPT) perform dose rate and contamination surveys of the Unit 1 reactor building basement (554 feet elevation). The

technician was knowledgeable of the procedures and the area to be surveyed. The procedure did not specify the locations to be surveyed. Technicians performed random surveys to try to identify areas with elevated dose rates or removable contamination. During the survey, the technician identified an area with contamination greater than 1000 dpm. The technician took additional wipes in the area to identify the extent of contamination and then appropriately controlled and posted the area. The technician also evaluated the condition of postings and area housekeeping during the survey. Upon completing the survey, the technician appropriately documented survey results.

c. Conclusions

The routine contamination and dose rate survey program was effectively implemented. Surveys were performed as required and appropriately documented. The technician was knowledgeable of the procedure and the area to be surveyed, and demonstrated good survey techniques.

R1.5 Source Term Reduction Efforts

a. Inspection Scope (IP 83750)

The inspectors reviewed the source term reduction program and discussed the progress in source term reduction, including the schedule of planned work with RP ALARA personnel.

b. Observations and Findings

The licensee's 1998 source term reduction summary described the ongoing and near term source term reduction efforts for the facility. The summary included a reduction of cobalt bearing (stellite) valves and components. The highest priority group of valves have been replaced and currently the second priority group of valves were being replaced when maintenance was performed on the particular valve. In addition, approximately 30 control rod blade pins and rollers were being replaced with low stellite content components during each outage.

Current initiatives planned for the upcoming Q1R15 refueling outage included flushing or hydrolasing the following:

- Feedwater nozzles;
- Dryer/separator pit and reactor well drain lines;
- 1A and 1B heat exchanger drains;
- U1 inner and outer reactor bellows; and
- U1 skimmer surge overflow trough.

Chemical decontamination of the Unit 1 recirculation system had been approved for the outage. Decontamination was to be conducted as part of the zinc injection system installation for Unit 1. Additional chemical control was attained through the installation of

more efficient filters for iron in the condensate demineralizer system to further reduce and control iron levels in the reactor coolant.

Operational enhancements where also included in the source term reduction program. These enhancements included system lineups that supported hot spot removal and flushing of lines to reduce exposures during planned maintenance and during routine rounds; maintaining reactor water cleanup operability for a week after shut down to increase removal of source term from reactor coolant; and continued efforts to maintain hydrogen system availability at ≥ 90% availability.

c. Conclusions

The inspectors concluded that the station was effectively planning and coordinating work to reduce source term and; therefore, overall station dose.

R2 Status of RP&C Facilities and Equipment

R2.1 Control of High (HRA), Locked (LHRA), and Very (VHRA) High Radiation Areas

a. Inspection Scope (IP 83750)

The inspectors reviewed the licensee's program for the control of HRAs, LHRAs and VHRAs. The inspection consisted of interviews with personnel and a walkdown of selected HRAs, LHRAs and VHRAs.

b. Observations and Findings

Controls for HRA and LHRAs, as stated in licensee procedures, were consistent with regulatory standards and industry practice. At the time of the inspection, the licensee did not control any areas as a VHRA. Keys accessing LHRAs were maintained in a locked cabinet and were controlled by RP personnel. The inspectors observed that these keys were issued and tracked (via an access log) consistent with plant procedures. A duplicate set of keys was maintained by the operations shift supervisor for emergency use, which the inspectors also verified was properly controlled. A review of plant PIFs for the last six months did not identify an adverse trend with HRA/LHRA control.

During the walkdown, the inspectors noted that HRAs and LHRAs were properly controlled and observed workers exercising good work practices. Specifically, the inspectors entered the following LHRAs: the Units 1 and 2 pipe chase rooms; the Unit 2 "B" reactor water cleanup pump room; the Waste and Floor Collector Tank Rooms; and the Unit 1 "A" demineralizer pump, reactor water cleanup phase separator, "B" steam jet air ejector, and "A, B, and C" condensate tank rooms. Each of these rooms were maintained in good condition with only minor housekeeping problems (some trash/debris) noted. The inspectors also reviewed the results of the licensee's annual inspection of infrequently entered areas and no problems were identified.

However, during the walkdown, an inspector observed that postings for LHRAs having dose rates > 15 rem/hr required that the approval of the RP&C superintendent be obtained prior to entry. Prior to this inspection, the position of RP&C superintendent had been removed and replaced by separate department heads (i.e., managers) for both groups. The licensee agreed with the inspector that the postings needed to be revised and planned to review other postings and procedures to assure that the correct management titles were included.

Prior to each entry into the RCA, workers were asked by an RP technician if they were entering an HRA and/or LHRA. If they were, the workers were required to read and sign the RP instructions for working in these areas and obtain an HRA pass. This pass was to be maintained in their possession until they exited the RPA where it was surrendered to the RP staff. Workers not having an HRA pass in their possession while working inside an HRA, may be sent back to the RP access desk. During plant walkdowns, the inspectors periodically observed RP staff asking workers in HRAs to show their HRA pass.

c. Conclusions

High and locked high radiation areas were controlled consistent with regulatory requirements and industry practice. These areas were maintained in good condition with only minor housekeeping problems observed. Workers were familiar with access control requirements and RP staff was observed reinforcing these expectations in work areas.

R2.2 Radiological Postings, Labeling, and Housekeeping

a. Inspection Scope (IP 83750)

The inspectors reviewed radiological postings and labeling of containers during several tours of the reactor, turbine, and laundry-tool decon (LTD) buildings. In addition, housekeeping and material condition of radiation protection equipment was reviewed.

b. Observations and Findings

The inspectors observed that radiological postings and boundaries in the RPA were well maintained. The inspectors determined, through independent measurements, that radiological postings reflected the actual area radiological conditions. Containers were labeled in accordance with station procedures and regulatory requirements.

Radiological housekeeping in the reactor, turbine, and radwaste buildings was generally good. While overall housekeeping in the LTD building maintenance shop had improved, housekeeping in the maintenance shop decontamination area was poor. The housekeeping issue in the decontamination area was brought to the attention of radiation protection, who took action to remedy the situation. The inspectors noted during an inspection of the LTD building later in the week, that housekeeping in the

maintenance shop decontamination area had improved. Material condition of radiation protection equipment in use was good.

The inspectors reviewed the binder of weekly area radiological surveys maintained in the radwaste area and noted that the latest survey was dated July 27, 1998, with the previous survey dated June 15, 1998. The inspectors discussed this issue with radiation protection management, who indicated that the surveys had been completed weekly, however, the book had not been updated in a timely manner. Radiation protection management indicated the actions would be taken to update the book and maintain the book current by stressing the importance of updating the survey book weekly.

The inspectors noted, during a tour of the Unit 2 reactor building, that hoses draining from heat exchangers onto a floor drain were not secured. Radiation protection was informed and indicated that the matter would be corrected. Later in the week, the inspectors noted that while the above hoses were secured, the water flowing from the hoses was running across the drain and onto the floor. In addition, the inspectors noted that a label on the hose indicated it was internally contaminated, while a posting near the drain indicated that the water on the floor was not contaminated. The inspectors informed RP management of the issue, who planned to document the finding in a PIF and develop corrective actions.

c. Conclusions

Radiological postings and container labeling were well maintained, and appropriately informed workers of current plant radiological conditions. Overall, housekeeping was good, except for the LTD building maintenance decontamination area. In addition, drain hoses from the heat exchangers in the Unit 2 reactor building were not properly secured and were inconsistently labeled.

R4 Staff Knowledge and Performance in RP&C

R4.1 Loading of Highly Irradiated Components into Transportation Cask

a. Inspection Scope (IP 83750)

The inspectors observed the removal of highly irradiated material stored in the Units 1 and 2 spent fuel pools and the subsequent loading of this material into a transportation cask. The inspection consisted of a review of documents, observations of work and interviews with personnel.

b. Observations and Findings

The work consisted of removing used TRINUC filters (used for fuel pool water processing) and control rod blade velocity limiters from the fuel pools and placing them into a high integrity container (HIC) located on the refueling floor. Because of the potentially high radiation and contamination levels, continuous coverage was provided by two RP technicians and the associated RP ALARA planner. Additionally, a pre-job

brief was held (conducted by the job foreman) and contingency plans (i.e., dropped component and/or unexpected radiological conditions) were established. Electronic dosimetry was worn by all personnel with dose and dose rate alarm setpoints of 80 mrem and 300 mrem/hr, respectively.

During the job, the inspectors interviewed several workers to verify that they were knowledgeable of the ALARA controls, contingency plans and potential radiological hazards. Additionally, the inspectors verified that lessons learned from a similar, previous removal occurring in 1996 and from station PIF no. 95-449/456 (regarding potential disintegration of TRINUC filters) were incorporated into the ALARA plan.

The inspectors observed workers using proper radiological work practices (i.e., standing in low dose areas, good communication with RP technicians, donning/removing of protective clothing, etc.) and good job coverage by the RP technicians. Area radiation monitors and air samplers were appropriately located and consideration was given to potential alpha hazards. Overall, the job was well implemented and controlled.

After loading, the HIC was placed inside a Type B cask for shipment to the Barnwell burial site. The licensee had performed a radiological survey and visual inspection of the cask interior prior to loading and had identified no concerns. The inspectors verified that the loading occurred without incident, that the package was properly placarded/labeled and that the shipping papers were correct.

c. Conclusions

Radiological controls for the Units 1 and 2 spent fuel pool work were effective. The ALARA plan appropriately addressed past lessons-learned, potentially high radiological conditions and included reasonable contingency plans. The subsequent shipping of the material removed from the pool was also well conducted.

R4.2 Unit 2 Condensate Demineralizer Filter Element Replacement

a. Inspection Scope (IP 83750)

The inspectors reviewed the radiation work permit and radiological controls implemented for the Unit 2 F condensate demineralizer filter element replacement. The inspectors also observed RPT and worker performance during the filter element removal.

b. Observations and Findings

The inspectors reviewed the radiation work permit (RWP) for the removal of filter elements from the condensate demineralizer. The RWP included special requirements for extremity dosimetry, protective clothing, and special instructions. Special instructions included the presence of RPTs during certain evolutions, and required that all workers attend an ALARA pre-job briefing. The RWP also included ALARA briefing notes which described additional controls and radiological hold points. Radiation protection staff performed a planned personnel contamination event evaluation to

determine if rubber jackets could be eliminated due to heat stress concerns. Based on contamination levels and job length (four hours), the evaluation determined that removing the requirement for rubber jackets during filter element removal was acceptable. The inspectors reviewed the evaluation and determined it was in accordance with station procedures and technically sound.

During observations of work evolutions, the inspectors determined that the RPTs had appropriately posted and controlled high radiation areas and contamination areas. Technicians were knowledgeable of the work to be performed. Good communication was evident between the workers and technicians. Workers were observed demonstrating good radiation worker practices.

c. Conclusions

Radiological controls implemented for the demineralizer filter element replacement were effective. The radiation work permit appropriately addressed radiological concerns and included ALARA pre-job briefing notes. RPTs and workers demonstrated good communication and good radiation worker practices.

R4.3 Unexpected Dose Rates Encountered During Radioactive Material Transfer

a. Inspection Scope (IP 83750)

The inspectors performed an independent review of a licensee investigation regarding unexpected dose rates identified during a radioactive material transfer. The inspection consisted of interviews with station personnel, a review of the licensee's investigative report, and an independent dose assessment.

b. Observations and Findings

On June 1, 1998, a contract worker received a dose rate alarm while moving an underwater bucket containing stellite balls (i.e., activated carbon steel components) through the transfer canal between the Units 1 and 2 spent fuel pools. The worker was standing on the refuel bridge above the pool surface, and the bucket was being moved underwater. Additionally, the worker was wearing an ED, having dose and dose rate alarm setpoints of 80 mrem and 50 mrem/hr, respectively. The highest dose rate recorded by the worker was 80 mrem/hr and he accrued a total of 3 mrem during the move.

The licensee determined that the higher dose rates were caused after the bucket had moved adjacent to some stored low power range monitors (LPRMs). Specifically, the LPRMs had an air void within their structure which produced a collimated radioactive field in the worker's vicinity, effectively reducing the amount of water shielding. This hypothesis was supported by a confirmatory dose calculation using the data recorded on the worker's ED, a measured value of 35 mrem/hr five feet above the pool surface and over the stationary bucket, and the assumed geometry of the LPRM. The

calculated dose rate was 113 mrem/hr in the worker's vicinity which agreed closely with the actual ED result as stated above.

The inspectors' review concluded that the work had been effectively planned and controlled. In particular, the RP group was aware of the potential for high dose rates during movement of highly irradiated materials and had required that a minimum of six feet of water shielding be maintained during the transfer. Additionally, continuous job coverage was provided by an RP technician having prior experience with this work. The inspectors also independently calculated a worker dose rate consistent with the as measured (i.e., ED) and licensee calculated values.

The licensee revised applicable station procedures to prohibit movement of highly activated components within five feet of stored equipment having potential air voids (i.e., dry tubes, LPRMs, etc.) and will include this event in continuing training for fuel handlers and RP personnel. As there has been no previous, similar industry occurrence, the licensee also communicated this event to other nuclear stations.

c. Conclusions

The licensee implemented good ALARA controls for the movement of highly activated components in the spent fuel pool and took prompt and effective actions after higher than expected dose rates were encountered during the job.

R8 Miscellaneous RP&C Issues

R8.1 (Closed) IFI 98002-03: The co[illegible]ion of portable instrument calibration standards and the "as found" readings of portable instruments with G-M detectors being outside tolerance limits during calibrations. The licensee purchased new electroplated calibration standards and put them into service on June 12, 1998, with revisions to calibration procedures to include the new sources. Calibration procedures were revised to include "as found" measurements for all instruments being calibrated. Measurements were to be documented and reviewed by radiation protection management. Management evaluated out of tolerance "as found" measurements for significance and developed corrective actions. Out of tolerance measurements are tracked for each instrument for trending purposes. Additional corrective actions included using a pulsar for calibrating portable instruments on the lower scales and then checking the calibration against radioactive source calibration standards to ensure the instrument was within tolerance limits with the expected response. This item is closed.

X1 Exit Meeting Summary

The inspectors presented the inspection results to members of licensee management at the conclusion of the inspection on August 14, 1998. The licensee acknowledged the findings presented.

The licensee did not identify any items discussed as proprietary.

PARTIAL LIST OF [illegible]NS CONTACTED

Licensee

P. Behrens, Superintendent Chemistry
R. Hebeler, Acting Chemistry Supervisor
D. Kallenbach, Acting Operational Health Physicist
T. Kirkham, Lead Technical Health Physicist
D. Jager, V.P. Generation Support
L. Pearce, Station Manager
C. Peterson, Regulatory Affairs Manager
G. Powell, Superintendent Radiation Protection
W. Schmidt, ALARA Coordinator

NRC

C. Miller, Senior Resident Inspector

INSPECTION PROCEDURES USED

IP 83750	Occupational Radiation Exposure
IP 84750	Radiological Waste Treatment, and Effluent and Environmental Monitoring
IP 92904	Followup - Plant Support

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

50-254(265)/98002-03	IFI	The condition of portable instrument calibration standards and the "as found" readings of portable instruments with G-M detectors being outside tolerance limits during calibrations.

Discussed

None

LIST OF ACRONYMS USED

ALARA	As Low As Is Reasonably Achievable
ALI	Annual Limit on Intake
DAC	Derived Air Concentration
dpm	disintegrations per minute
ED	Electronic Dosimeter
HIC	High Integrity Container
HRA	High Radiation Area
IFI	Inspection Followup Item
LHRA	Locked High Radiation Area
LPRM	Low Power Range Monitor
LTD	Laundry-Tool Decon
mrem	millirem
NRC	Nuclear Regulatory Commission
PCE	Personnel Contamination Event
PDR	Public Document Room
PIF	Problem Identification Form
QC	Quality Control
RP	Radiation Protection
RPA	Radiologically Posted Area
RP&C	Radiological Protection and Chemistry
RPT	Radiation Protection Technician
RWP	Radiation Work Permit
TLD	Thermoluminescent Dosimeter
VHRA	Very High Radiation Area
WBC	Whole Body Counter
WBF	Whole Body Frisker

LIST OF DOCUMENTS REVIEWED

Radiation Work Permits (RWPs) Nos:

983158 (revs.1 and 3)	Unit 1 and Unit 2 Fuel Pool Cleanup Project
983029, Rev. 0	Condensate Demineralizers: Inspect/Replace Elements & Post Strainer

Problem Identification Forms (PIF) Nos:

Q1998-02728 (dated 6/1/98)	Unexpected Area Radiation Monitor (ARM) Alarm on the Refuel Floor
Q1998-03405	Mechanical Maintenance worker contaminated in Rad Waste Basement
Q1998-03406	Worker contaminated on Refuel floor

Station Procedure Nos.

QCAP 0600-07 (rev. 4)	Administration of the Radiation Protection Aspects of Quad-Cities' Fetal Protection and Postnatal Programs
QCAP 610-07 (rev. 3)	Bioassay Program
QCAP 620-02 (rev. 2)	Access Control of Areas Affected by Hydrogen Addition
QCAP 1100-15 (rev. 1)	Procedure for Transfer of Fuel Pool Components Into High Integrity Containers
QCRP 5200-05 (rev. 3)	Dosimetry Usage
QCRP 5200-06 (rev. 0)	Quality Testing of the TLD Program
QCRP 5200-07 (rev. 2)	Radiation Exposure Investigation Report
QCRP 5210-3 (rev. 1)	Comparison of Personnel Dosimetry Results
QCRP 5210-04 (rev. 1)	PCE Dose Equivalent Calculations
QCRP 5300-05 (rev. 2)	Special Instructions Concerning Female Radiation Workers
QCRP 5410-06 (rev. 4)	Operation of the Canberra FASTSCAN and ACCUSCAN Whole Body Counters Using ABACOS-PLUS Software
QCRP 5400-01 (rev. 6)	Administrative Guidance for Bioassay
QCRP 5410-8 (rev. 3)	Operation and Calibration of the Eberline PM-7 for Whole Body Screening
QCRP 5720-03 (rev. 4)	Monitoring Personnel for Radioactive Contamination
QCRP 5720-4 (rev. 4)	Personnel Decontamination
QCRP 5821-12 (rev. 2)	RADECO Air Sampler
QCRP 6020-02 (rev. 7)	Airborne Radioactivity Sampling and Analysis
QCRP 6020-03 (rev. 9)	Radiological Surveys
QCRP 6200-05 (rev. 8)	Writing Radiation Work Permits
QCRP 6200-19 (rev. 0)	Radiation Protection Fuel Failure Response Plan
NSP-RP-5003 (rev. 0)	Controls for High Radiation Areas and Very High Radiation Areas

Miscellaneous:

Licensee calculation no. 98-INT-001 (dated 5/15/98) "Technical Basis for the Calibration Change from Annually to Other for the Canberra Whole Body Counters"

Quality Control data for the Canberra FASTSCAN Whole Body Counter from 2/97 - 8/98

Licensee calculation no. 98-EXT-003 (dated 6/10/98), "Technical Basis for the Estimation of the Whole Body Dose Received by a Nukem Contractor on June 1998, During Stellite Ball Movement Through the Transfer Canal at Quad Cities Nuclear Power Station."

ALARA Briefing notes (dated 8/12/98) for RWP No. 983158 (rev. 3).

Attachment E to station procedure no. QCRP 6020-03 (rev. 8); 1998 annual inspection of infrequently entered LHRAs.

Air sampling log entries from 5/1/98 to 8/13/98

Self Assessment RP-SA-98-007, Personnel Contamination Program

Personnel Contamination Event Records for 1998

Hydrogen injection system availability records from 1997 to August 1998.