

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

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Report No: 50-456/99017(DRS); 50-457/99017(DRS)

Licensee: Commonwealth Edison Company

Facility: Braidwood Nuclear Plant, Units 1 and 2

Location: RR #1, Box 84  
Braceville, IL 60407

Dates: October 4-13, 1999

Inspector: Mark Mitchell, Radiation Specialist

Approved by: Gary L. Shear, Chief, Plant Support Branch  
Division of Reactor Safety

## EXECUTIVE SUMMARY

Braidwood Nuclear Plant, Units 1 and 2  
NRC Inspection Report 50-456/99017(DRS); 50-457/99017(DRS)

This announced inspection included various aspects of the licensee's radiation protection (RP) program. Specifically, the following areas were reviewed:

- Radioactive Waste Processing, Storage, Packaging, and Transportation
- General RP Practices Related to External Dosimetry

The following conclusions were reached in these areas:

- Plant housekeeping was effective in maintaining areas free of unnecessary equipment and debris. Radiological posting and labeling in the plant was appropriate. Staff followed required radiation work permits and procedures. (Section R1.1)
- The radiation protection (RP) staff properly implemented the 10 CFR Part 61 waste characterization program. The staff sampled waste streams and evaluated the results of the analyses in accordance with plant procedures and NRC regulations. (Section R1.2)
- The RP staff properly packaged radioactive materials and wastes for shipment. Shipments were performed in accordance with the current site procedures and the requirements of 10 CFR 71 and 49 CFR Parts 172 and 173. (Section R1.3)
- The radwaste processing and storage areas were secured, clean and well organized, and waste containers were properly sealed and labeled. (Section R1.4)
- The licensee effectively implemented administrative external dose controls to ensure that personnel doses were maintained ALARA (as-low-as-is-reasonably-achievable). Personnel doses were maintained in accordance with the established administrative controls and were below the limits contained in 10 CFR Part 20. (Section R1.5)
- The RP staff calibrated and tested the electronic dosimeters properly. The inspector did not identify any material condition issues associated with the electronic dosimetry program. (Section R2.1)
- The radioactive waste staff effectively use radwaste program procedures for radwaste processing, handling, labeling, packaging, storage, and shipment. (Section R3.1)

## Report Details

### **R1 Radiological Protection and Chemistry (RP&C) Controls**

#### **R1.1 Walkdowns within the Radiologically Controlled Area**

##### **a. Inspection Scope (83750)**

The inspector examined various areas of the Radiologically Controlled Area (RCA), including the Reactor Building and Radwaste Building. During these walkdowns, plant housekeeping, radiological posting and labeling, and general equipment condition were inspected. In addition, the inspector interviewed radiation protection (RP) staff regarding radiological conditions and controls within the plant.

##### **b. Observations and Findings**

The inspector found plant areas to be clean and free of unnecessary materials. The inspector measured dose rates in various plant areas in order to verify the proper placement of radiological postings. No discrepancies were found in the areas of posting or labeling. The inspector noted that posting changes were reflected on area maps near the entrance to the RCA and at the entrances to each floor in a timely manner. These maps were routinely used for reference by plant workers. The inspector observed that the appropriate Radiation Work Permit (RWP) was posted at entrances to contaminated areas. Specifically, the inspector observed decontamination work in the filter vault areas and noted that employees followed procedural guidance in conducting the work and took the appropriate measures for radiation safety and general industrial safety related to confined space. Additionally, the high efficiency particulate air-filtration (HEPA) unit calibration and repair work was conducted safely using appropriate RWP and safety precautions.

Both plant units were operating at full power, and there was minimal activity around the plant in or near contaminated areas. During the walkdowns, the inspector observed good worker awareness of radiological hazards (e.g., workers properly donned protective clothing, survey maps and RWPs were consulted, dosimetry was worn correctly, etc.).

##### **c. Conclusions**

Plant housekeeping was effective in maintaining areas free of unnecessary equipment and debris. Radiological posting and labeling in the plant was appropriate. Staff followed required RWPs and procedures.

#### **R1.2 Activity Determinations of Radwaste**

##### **a. Inspection Scope (86750)**

The inspector reviewed the licensee's method for determining the activity of radioactive waste (radwaste) and material shipments. The inspector reviewed the 1998 and 1999

waste stream analyses and the verifications which the RP staff performed to ensure the validity of radionuclide scaling factors used to determine the activity of difficult to detect radionuclides.

b. Observations and Findings

The licensee used scaling factors as an indirect method to determine radionuclide activity in radwaste shipments. This was done by calculating the concentration of hard-to-detect radionuclides through the application of scaling factors to a known concentration of an easier-to-detect radionuclide. This method is a technically sound industry practice provided that there is a reasonable assurance that the indirect method can be correlated with actual measurements. Licensee procedures contained the frequencies for sampling each of the licensee's three waste streams: dry active waste (DAW), secondary resins, and primary resins. The scaling factors were updated annually for each waste type shipped for disposal.

The inspector reviewed the licensee's scaling factor evaluations for 1998 and 1999. The licensee had samples of DAW, primary resin, and secondary resin analyzed by a contract laboratory. The inspector observed that the RP staff had evaluated the sample results in accordance with the requirements in station procedures. The RP staff had performed comparisons between the vendor's gamma isotopic results and the licensee chemistry staff's results and found they were within the acceptance criteria. Very little change in the scaling factors has occurred over the last two years. Additionally, the licensee had collected and analyzed samples of a special filter shipment to assure that the scaling factors were consistent with current scaling factors because these filters had been in storage for an extended period. While the filter scaling factors were relatively consistent, in this case, the licensee chose to use the specific scaling factor data for the shipment.

The RP staff compared the 1998 and 1999 scaling factor results to previous annual results to ensure that changes in the waste streams were properly identified and that any anomalies in the sample results were properly identified and corrected. The RP staff maintained a rolling average for scaling factors and entered the averaged scaling factors into a database. The inspector verified that the licensee compared the averaged results to the most recent scaling factors and did not identify any anomalies.

c. Conclusions

The RP staff properly implemented the 10 CFR Part 61 waste characterization program. The staff sampled waste streams and evaluated the results of the analyses in accordance with plant procedures and NRC regulations.

R1.3 Conduct of Radioactive Material and Waste Shipments

a. Inspection Scope (86750)

The inspector reviewed the shipping documents for the following radioactive shipments, including the package classifications, labeling, and shipping papers:

|            |                    |                                      |
|------------|--------------------|--------------------------------------|
| RMS 99-063 | October 6, 1999    | Contaminated Equipment               |
| RWS 99-010 | September 20, 1999 | Oil Tanker - Waste Oil Non-Hazardous |
| RWS 99-008 | May 17, 1999       | DAW Sea-Van                          |
| RWS 99-004 | March 2, 1999      | Resin High Integrity Container       |
| RWS 99-002 | February 2, 1999   | Tri-Nuc Filters                      |
| RWS 98-052 | July 14, 1998      | Laundry                              |
| RMS 98-042 | May 11, 1998       | Sludge Lance Equipment Trailer       |

The inspector reviewed the shipping documents to determine their compliance with 10 CFR Part 71, 49 CFR Parts 172 and 173, and plant procedures.

b. Observations and Findings

The inspector found that the RP staff prepared shipments in accordance with the applicable procedures. As allowed by these procedures, the RP staff used a vendor-supplied computer program to classify shipments and to prepare required shipping documents. Applicable calculations were consistent with the current requirements of 10 CFR Part 71 and 49 CFR Parts 172 and 173. In addition, the inspector observed the preparation of a shipment consisting of contaminated filter tools and equipment. The staff used applicable procedures to ensure compliance with station procedures and NRC regulations.

The inspector reviewed the classification of materials/wastes shipped as Low Specific Activity-II (LSA-II) and associated Type A packages and noted that the shipments were properly prepared and packaged. The RP staff shipped the LSA-II packages under the provisions of exclusive use shipments and in accordance with the requirements of 49 CFR 173.427.

The inspector observed that the shipping documents and waste manifests contained the information required by 49 CFR Part 172 and Appendix G of 10 CFR Part 20, respectively. The shipping documentation also included the appropriate required emergency response information.

During the inspection, NRC staff identified that the Quality Assurance Program used by this plant and other corporate licensees had expired on August 31, 1999. The Quality Assurance Program is applicable to shipments of Type B quantities of radioactive material. No shipments requiring the use of the Quality Assurance Program were made by Braidwood station since August 31, 1999, and the plant staff stated that they would not make any Type B shipments until the program expiration issue was resolved by their corporate staff.

c. Conclusions

The RP staff properly packaged radioactive materials and wastes for shipment. Reviewed shipments were performed in accordance with the current site procedures and the requirements of 10 CFR 71 and 49 CFR Parts 172 and 173.

R1.4 Radioactive Waste Processing and Storage

a. Inspection Scope (86750)

The inspector reviewed the processing and storage of solid radwaste. The inspection consisted of interviews with cognizant personnel, as well as walkdowns of the radwaste storage areas, radwaste control room, radwaste processing equipment, and radioactive materials storage areas outside of the Radiologically Controlled Area (RCA).

b. Observations and Findings

The inspector noted that the radwaste processing and storage areas were clean and well-organized. The radwaste process and storage area, in addition to normal storage prior to transfer, was actively used as a staging area for empty drums that would be used for blowdown resin shipment in the near future. During the inspection the staff transferred the resin to the drums and placed the drums in a sea-van in preparation for shipment to a waste processing vendor. This storage in the Radwaste Building was organized and did not present an industrial or radiation safety hazard.

The High-Level Storage Area of the Radwaste Building was organized and documented. Barrels and containers were properly labeled and secured. The inspector noted a lack of specific notes of staff observations regarding the condition of the barrels in the long-term storage. The staff stated that they planned to implement a periodic log entry to the long-term storage log regarding the "as found" condition of observed barrels.

The licensee also stored, for loading prior to shipment, solid radioactive materials and, DAW in two sea-vans that were located outside RPA of the waste storage facility, but inside the controlled area. These sea-vans were locked to prevent intrusion and were also roped and labeled as radiation areas, as needed. The inspector confirmed the dose rates around the sea-vans and the roped areas. The inspector noted the condition of all the storage containers observed was not degraded in any way that would question container integrity.

c. Conclusions

The radwaste processing and storage areas were secured, clean and well-organized, and waste containers were properly sealed and labeled.

R1.5 External Dose Control

a. Inspection Scope (83750)

The inspector reviewed the licensee's administrative external exposure controls, 1999 personnel doses and the radiation protection (RP) staff's evaluations of thermoluminescent dosimeter (TLD) and electronic dosimeter (ED) results.

b. Observations and Findings

The inspector verified that the licensee's corporate TLD processing maintained certification with the National Voluntary Laboratory Accreditation Program (NVLAP). The licensee's NVLAP certification expires later this calendar year. However, required testing had been completed and results reviewed indicate the program passed in all required areas.

The licensee implemented administrative dose controls to ensure that personnel doses at the site were maintained as-low-as-is-reasonably-achievable (ALARA). This program has experienced success on various levels. The inspector reviewed three Nuclear Oversight assessments of radiation protection program components conducted in 1998 and 1999. The assessments identified ALARA program areas in need of improvement. Specifically, the audits identified: (1) a lack of station ALARA committee ownership, (2) a weakness in micro-ALARA planning and (3) a weakness in departmental and individual awareness of and ownership for the ALARA program.

As a result of these assessment findings, the station management implemented a program for reducing non-outage exposure. The station ALARA committee ownership was changed to active committee involvement in reducing non-outage dose. The committee, consisting of plant departmental management, increased worker awareness and communication by implementing a departmental recognition of daily departmental and individual ALARA goal status reports at the morning management meeting. Specific steps were planned for reducing RP and operations staff routine exposures. These included reducing entry into contaminated work areas for unnecessary surveillance and surveys. Additionally, the RP department implemented a micro-ALARA planning program that lowered the planning threshold for all jobs that would potentially exceed 20 millirem total dose, changed the ED displays to read in tenths of a milliroentgen, and increased recognition of department and individual daily ALARA goal success.

These changes in the ALARA program contributed to lower total exposures for the site in the last 2 months. Interdepartmental communication in job planning increased, and the station targeted the 1999 dose goal at 147.354 Rem. The inspector confirmed the success of the communication during preparations for a core spray pump maintenance evolution. Dose projections were reduced by 40 percent by using the planning process. The inspector reviewed a number of examples of recent non-outage jobs that had the total resulting dose reduced by 50 percent or more.

Based on the 1998 and 1999 TLD reports, the inspector noted that the licensee maintained occupational dose to workers consistent with the requirements of 10 CFR

Part 20 and the station procedures. For example, the licensee monitored three declared pregnant workers (DPW) and maintained the dose to the embryo/fetus in accordance with the requirements of 10 CFR 20.1208. The individuals did not obtain any measurable dose during the pregnancy, as the station policy provides for change to duties outside of the RPA. Currently, one DPW remained in the monitoring program. In addition, the inspector noted that other personnel doses were generally maintained below the administrative dose levels described above. In 1998 and 1999, all annual individual doses were maintained below 2.0 rem total effective dose equivalent.

In addition the licensee monitored any nonconservative biases between the ED and TLD results (i.e., the ratio of ED-to-TLD results). The results were very consistent over 1998 and 1999. By procedure, the staff planned to continue monitoring the ratios for change when they commission a new ED model.

The inspector observed that the licensee installed an ED turnstile at the entrance to the RCA on October 8, 1999. This was to limit inadvertent entry into the RCA without an ED or without an ED turned on. This was partly in response to several identified occurrences over the years of entry into the RCA without an ED or without an ED turned on. The turnstile process for entry was well accepted and was functioning properly.

c. Conclusions

The licensee effectively implemented administrative external dose controls to ensure that personnel doses were maintained ALARA. Personnel doses were maintained in accordance with the established administrative controls and were below the limits contained in 10 CFR Part 20.

**R2 Status of Radiation Protection and Chemistry Facilities and Equipment**

**R2.1 Calibration Functional Tests for Electronic Alarming Dosimeters**

a. Inspection Scope (84750)

The inspector reviewed the procedures for electronic alarming dosimeter calibration tests. The inspector also interviewed RP staff regarding the overall equipment performance and data review.

b. Observations and Findings

The inspector noted that the calibrations were performed at a six-month frequency, as required by procedure. The plant staff performed source calibrations using a National Institute of Standards and Technology (NIST) traceable source. Site staff also verified audible annunciations during the calibration process. During the semi-annual calibrations and the functional tests, the licensee experienced only limited failures resulting in out-of-tolerance findings.



the calibration source, no procedures were written to direct the staff in this activity. Personal ownership by the staff for this activity maintained the program in compliance. The staff recognized that this was not consistent with the operation of other sources used in the radiation protection program and took immediate action to revise existing procedures to include the ED calibration source.

The licensee was in the process of changing to a newer model of ED. The inspector walked down the robotics used for calibration and the source storage and calibration locations. No concerns were identified.

c. Conclusions

The RP staff calibrated and tested the electronic dosimeters properly. The inspector did not identify any material condition issues associated with the electronic dosimetry program.

**R3 Radiation Protection and Chemistry Procedures and Documentation**

R3.1 Radwaste Program Procedures

a. Inspection Scope (86750)

The inspector reviewed the procedures for radwaste processing, handling, labeling, packaging, storage, and shipment.

b. Observations and Findings

The inspector found that these procedures were clear, concise, and current. The staff was knowledgeable in the use of the procedures and effectively implemented them.

The staff stated that, in addition to visual reviews conducted during crane operations, they will direct the operations staff to conduct periodic remote visual assessment of high radiation level storage barrels (in storage for extended periods) to access container integrity and make records of the visual examinations.

Additionally, the inspector reviewed the secondary resin transfer procedure during the planned secondary resin transfer to drums for waste processing. The procedure had been amended to include a vacuum transfer technique. Although the procedure was functional, the inspector noted a marked difference in the level of detail of the vacuum transfer technique compared to the mechanical sluicing technique for high activity resins. This was brought to the attention of the project engineer and supervisor. The staff agreed that the procedure could be limited in its specific directions if the project engineer was not present to provide additional guidance during the operation. They stated that the procedure would be modified following this evolution, to incorporate specific knowledge gained through the experience of the transfer and previous transfers. This would make the procedure more effective as a stand-alone directive for the operations staff.

c. Conclusions

The licensee's procedures for solid waste handling were acceptable. The staff effectively use radwaste program procedures for radwaste processing, handling, labeling, packaging, storage, and shipment.

**R5 Staff Training and Qualification in Radiation Protection and Chemistry**

**R5.1 Radwaste Program Staff Training and Qualifications (86750)**

The inspector reviewed the training program procedures, course outlines, and exams for RPTs and transportation program staff training and qualification. In addition, the inspector evaluated the education, experience, and training of selected program personnel.

The inspector found that the RPT and transportation program staff were properly trained and held appropriate educational credentials and had sufficient experience to properly execute the plant's radwaste programs. Comprehensive training and retraining of personnel was provided to the staff, and the course content was kept up-to-date. The inspector noted that the record keeping program for training was not easily auditable and could limit the licensee's efficient assessment of required training for the RPT staff. This matter was discussed with the training staff and RP management and they agreed to review the training tracking system.

**IV. Management Meetings**

**X1 Exit Meeting Summary**

The inspector presented the inspection results to members of licensee staff in an exit meeting on October 13, 1999. The inspector noted that no documents provided during the inspection were identified as proprietary. The licensee acknowledged the information presented and agreed that no proprietary information was provided to the inspector.

## **PARTIAL LIST OF PERSONS CONTACTED**

### Licensee

K. Aleshire, Acting, Lead Health Physicist  
M. Cassidy, Regulatory Assurance - NRC Coordinator  
M. Finney, Lead Operational Health Physicist  
R. Graham, Work Control Manager  
A. Haeger, Radiation Protection Manager  
S. Landahl, Corporate Radiation Protection Manager  
T. Meents, Radwaste Supervisor  
D. Morse, Health Physicist Specialist, Transportation  
R. Pratt, Radiation Protection Supervisor  
T. O'Bert, Maintenance  
M. Reigel, Nuclear Oversight Manager  
T. Saksefski, Nuclear Oversight  
K. Schwartz, Station Manager  
T. Simpkin, Regulatory Assurance Manager  
G. Vickers, Health Physicist Specialist, Transportation

## **INSPECTION PROCEDURES USED**

IP 83750: Occupational Radiation Exposure  
IP 86750: Solid Radioactive Waste Management and Transportation of Radioactive  
Materials

## **ITEMS OPENED, CLOSED, AND DISCUSSED**

### Opened

None

### Closed

None

**LIST OF ACRONYMS USED**  
**Radiological Protection and Chemistry (RP&C)**

|          |   |
|----------|---|
| ALARA    | As Low As Reasonably Achievable                     |
| ANSI     | American National Standards Institute               |
| BwAP     | Braidwood Administrative Procedure                  |
| BwOP     | Braidwood Operation Procedure                       |
| CFR      | Code of Federal Regulations                         |
| DAW      | Dry Active Waste                                    |
| DOT      | Department of Transportation                        |
| DPM      | Disintegrations per Minute                          |
| DPW      | Declared Pregnant Workers                           |
| DRS      | Division of Reactor Safety                          |
| ED       | Electronic Dosimeter                                |
| HEPA     | High Efficiency Particulate Air-filtration          |
| HRA      | High Radiation Area                                 |
| LSA-II   | Low Specific Activity-II                            |
| NIST     | National Institute of Standards and Technology      |
| NRC      | Nuclear Regulatory Commission                       |
| NVLAP    | National Voluntary Laboratory Accreditation Program |
| PIF      | Problem Identification Form                         |
| PDR      | Public Document Room                                |
| RCA      | Radiologically Controlled Area                      |
| RP       | Radiation Protection                                |
| RPT      | Radiation Protection Technicians                    |
| RP&C     | Radiological Protection and Chemistry               |
| RPS      | Radiation Protection Supervisor                     |
| Radwaste | Radioactive Waste                                   |
| RWP      | Radiation Work Permit                               |
| TLD      | Thermoluminescent Dosimeter                         |

## PARTIAL LIST OF DOCUMENTS REVIEWED

BwRP 5210-3 (Revision 1), "Comparison of Personnel Dosimeter Results"  
BwRP 5600-4 (Revision 8E1), "Completion of Radioactive Material Shipping Record"  
BwRP 5600-7 (Revision 6e1), "Shipment of Radioactive Material"  
BwRP 5606 (Revision 0), "Administrative Requirements for Electronic Data Transfer of Radioactive Waste Shipments to Illinois Department of Nuclear Safety"  
BwRP 5610-6 (Revision 8), "Surveying Radioactive Material Shipments"  
BWRP 5800-6 (Revision 3), "Administrative Controls for Health Physics Instrumentation"  
BwRP 5824-4 (Revision 3), "Operation and Calibration of Merlin Gerin CDM-21 Calibrator"  
BWOP WX-142 (Revision 9), "Resin Removal From a Steam Generator Blowdown Demineralizer"  
CWPI NSP TQ 1-15 (Revision 1), "Radiation Protection Technician Training"  
DoD-RP-10 (Revision 6), "Declaration of Intent to Breast-feed"  
PIF A1999-01894, "PCE Hand Contamination"  
PIF A1999-02214, "Contamination Found Outside of Contaminated Area"  
PIF A1999-02594, "Isotope Not Properly Accounted for in Liquid Release Package"  
PIF A1999-02564, "Water Spill While Venting 2B RHR Pipe"  
PIF A1999-02718, "Entered RPA Without Digital Dosimeter"  
PIF A1999-02717, "Identified Problems with SCBA Mask Fit Tracking"  
PIF A1999-02802, "Individual Did Not Know ED Alarm Setpoints"  
NOA 20-99-005, "Nuclear Oversight Assessment of Radiation Protection Program"  
NOA 20-99-006, "Nuclear Oversight Assessment of Plant Support-Radioactive Waste Program"  
NOA 20-99-028, "Nuclear Oversight Assessment of Plant Support-Exposure Control"  
QAS 20-98-047, "Nuclear Oversight Assessment of Exposure Control"  
Radiation Protection Policy Memorandum ADM-20 dated September 5, 1995  
RAS-04 (Revision 11), "Radiation Protection Policy Memorandum RAS-04"