

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Reports No. 50-454/89021(DRSS); 50-455/89023(DRSS)

Docket Nos. 50-454; 50-455

Licenses No. NPF-37; NPF-66

Licensee: Commonwealth Edison Company
P. O. Box 767
Chicago, IL 60690

Facility Name: Byron Station, Units 1 and 2

Inspection At: Byron Station, Byron, Illinois

Inspection Conducted: October 30 through November 8, 1989

Inspector: *WGS* W. B. Grant *for*

12/8/89
Date

Approved By: *WGS* W. Snell, Chief
Radiological Controls and
Emergency Preparedness Section

12/8/89
Date

Inspection Summary

Inspection During the Period October 28 through November 8, 1989
(Reports No. 50-454/89021(DRSS); No. 50-455/89023(DRSS))

Areas Inspected: Routine, unannounced inspection of the radiological protection program during power operation including: changes in organization; audits and appraisals; external exposure control; internal exposure control; control of radioactive materials and contamination; maintaining exposures ALARA; radiological occurrence involving high intensity hot particles; licensee action on previous inspection findings and plant tours.

Results: The licensee's radiation protection program appears adequate, effective and capable of protecting the health and safety of the public and the plant workers.

DETAILS

1. Persons Contacted

- *W. Bielasco, Lead Health Physicist
 - *A. Britton, QA Inspector
 - *L. Bushman, ALARA/Operations Group Leader
 - *W. Carl, Health Physicist
 - *R. Chrzanowski, Nuclear Licensing Administrator
 - *R. Colglazier, ALARA Engineer
 - D. Collins, Stationman
 - *W. Dean, Nuclear Safety
 - *K. Graesser, General Manager PWR Operations
 - B. McNiell, RCA Coordinator
 - G. Myrick, HP Supervisor, Nuclear Services, CECO
 - R. Munson, ALARA Analyst
 - *K. Orris, Regulatory Assurance
 - D. Palmer, Health Physicist
 - F. Rescek, Radiation Protection Director, Nuclear Services, CECO
 - *G. Schwartz, Production Superintendent
 - *M. Snow, Regulatory Assurance Supervisor
 - *L. Soth, Staff Engineer, PWR Operations, CECO
 - *R. Ward, Technical Superintendent
 - *K. Weaver, HP Supervisor, Nuclear Services, CECO
- *W. Snell, NRC, Chief, Radiological Controls and Emergency Preparedness Section
- *R. Sutphin, NRC Resident Inspector

The inspector also contacted other licensee and contractor representatives.

*Denotes those present at the exit meeting.

2. General

This inspection was conducted to review aspects of the licensee's radiation protection program during power operations, the licensee's actions after the discovery of very hot particles on the floor of the fuel handling building and the licensee's response to previous inspection findings. During plant tours, the inspector noted that area postings, access controls, and housekeeping were good.

3. Licensee Actions on Previous Inspection Findings (IP 92701)

(Closed) Open Item No. 454/88013-09; No. 455/88013-09): Provide a method for the quantification of the continuous (non-batch) noble gas released from the auxiliary building vents. The licensee has written a procedure (BRP 1750-5, Revision 0) which provides instructions for appropriate methods to quantify noble gas releases from Byron Station. The inspector reviewed the procedure; no problems were noted.

4. Changes (IP 83750)

The inspector reviewed changes in the organization personnel, facilities, equipment, program, and procedures that could affect the occupational radiation protection program.

On October 18, 1989, Byron Station implemented a revised RWP program which is intended to be a pilot program for all CECO plants. The new program eliminates Type I and Type II RWPs and instead has General Access and Job Specific RWPs. The new program is proceduralized in two temporary procedures, BRP 1140-1 and BRP 1140-2. Changes in the program include: a daily sign in on all RWPs; a 100 mrem daily limit; much more worker involvement and responsibility for requesting an RWP and determining person hours; and a detailed description of work to be done. RWP books with attached surveys are accessible in the access control area for workers to read their RWP, review current surveys, and sign that they have read and understand the RWP and the surveys and they will comply with RWP requirements. The format of the RWP has been changed to make it easier to read and understand. For instance, protective clothing and equipment requirements are listed under columns A, B, C, or D according to job classification and what job the worker is going to do on that RWP. The inspector reviewed the draft procedures and observed workers entering the RCA using the new RWP program and, while some apparent confusion still exists, the program appeared to work well. The revised program is adequately discussed in the station's NGET training program.

One of the RP foremen accepted a job as assistant GSEP coordinator; therefore, there are currently five RP foremen. Selection of a sixth foreman is in progress.

No violations or deviations were identified.

5. Audits and Appraisals (IP 83750)

The inspector reviewed station quality assurance (QA) audits of the radiation protection and radwaste programs conducted since the last inspection. Extent of audits, qualifications of auditors, and adequacy of corrective actions were reviewed.

Two audits of radiation protection and one audit of radwaste were conducted during this period. The areas reviewed included in process radiation surveys, radiation exposure records, RWPs, sealed source leak testing, training, external contamination trends, RORs, whole body counting, solidification of waste, radioactive shipments and transportation. The extent of the audits and qualifications of the auditors appeared adequate. Corrective action on findings appeared to be timely and technically sound. Surveillances of radiation protection and radwaste activities conducted during the period were selectively reviewed. No problems were noted.

No violations or deviations were identified.

6. External Exposure Control (IP 83750, 83724)

The licensee's external exposure control program was reviewed, including: change in facilities, equipment, personnel, and procedures; adequacy of the dosimetry program to meet routine and emergency needs; dose tracking capabilities; required records, reports, and notifications; effectiveness of management techniques used to implement these programs; and experience concerning self-identification and correction of program implementation weaknesses.

Exposure records of plant and contractor personnel were selectively reviewed for 1989 to date. No exposures greater than 10 CFR 20.101 and licensee administrative limits were noted.

The dose tracking system appears to be adequately developed and is being implemented satisfactorily and in accordance with relevant procedures. No problems were noted.

No violations or deviations were identified.

7. Internal Exposure Control and Assessment (IP 83750)

The licensee's internal exposure control and assessment program was reviewed, including: changes in facilities, equipment, personnel, and respiratory protection training; procedures affecting internal exposure control and personnel assessment of individual intakes relative to regulatory requirements; required records, reports and notifications; effectiveness of management techniques used to implement these programs; and experience concerning self-identification and correction of program implementation weaknesses.

A review of the licensee's whole body count records indicated that no exposures in excess of the 40 MPC-hour control measure occurred during 1989 to date.

No violations or deviations were identified.

8. Control of Radioactive Materials and Contamination, Surveys and Monitoring (IP 83750)

The inspector reviewed the licensee's program for control of radioactive materials and contamination, including: adequacy of supply, maintenance, and calibration of contamination survey and monitoring equipment; procedures; adequacy of review and dissemination of survey data, and effectiveness of methods of control of radioactive and contaminated materials.

During the inspection the licensee was in the process of removing the old washers, dryer and dry cleaning machines from the laundry facility prior to installing new higher capacity wet wash equipment. The workers removing the old laundry equipment wore cloth coveralls, booties and hoods covered by white paper coveralls, rubber boots and a full face

respirator as hot particle precautions. Several hot particles were found on the floor of the laundry room and one was detected on the arm of a worker just above the elbow. The particle was approximately 4 microcurie Co-60 and was conservatively assumed to have been on the worker's arm for approximately three hours. The dose to the worker was calculated to be 5.4 rem to the skin of the whole body.

The inspector selectively reviewed Personnel External Contamination Records (PECRs) event trending, and summary data for 1989. One hundred eighty-eight personnel contamination events were reported during 1989 through October 29. In response to an inspector concern (No. 454/88013-12; No. 455/88013-12), the licensee has significantly improved their reporting of causal factors on PECRs. Procedural guidance has been provided to RPTs to help them identify the cause of personnel contamination. Of the PECRs reviewed by the inspector, all were attributed to specific causes.

No violations or deviations were identified.

9. Maintaining Occupational Exposures ALARA (IP 83750)

The inspector reviewed the licensee's program for maintaining occupational exposure ALARA, including: ALARA group staffing and qualifications; changes in ALARA policy and procedures, and their implementation; ALARA consideration for maintenance and refueling outages; worker awareness and involvement in the ALARA program; establishment of goals and objectives, and effectiveness in meeting them.

The ALARA/operations staff consists of a Group Leader, an ALARA Engineer (HP), an ALARA Analyst, the REP Coordinator, the RCA Coordinator, and two health physicists. The current ALARA/operations staff appears to have the experience, qualifications, and dedication necessary to implement an effective program.

Total station dose for 1989 to date is about 150 person-rem which is under the station goal of 200. The majority of this dose (about 140 person-rem) resulted from the Unit 2 refueling outage.

No violations or deviations were identified.

10. Radiation Occurrence Report 89-06: Skin Exposure Due to a High Energy Beta Particle:

This event was classified by the licensee as a Potentially Significant Event (PSE).

Event Description

On August 25, 1989, (Friday), at 2200 hours, a fuel particle was found on the diving suit of a diver who had been leveling new spent fuel racks in the spent fuel pool (SFP). The pool exit survey made with the diver in the suit using a telelector showed no restrictive dose rates. A survey

made after removal of the suit by the diver showed what appeared to be a six inch by six inch area of gross contamination on the right shoulder which read 15 mrem/hr gamma using a telelector. A survey using a CP R03 ion chamber instrument found 10 mrem/hr gamma and 150 mrad/hr beta. Therefore, the suit exceeded Byron Radiation Procedure (BRP) 1620-1 "Radiological Precaution for Diving Activities" reuse limits (100 mrad/hr beta). The health physicist in charge of diving operations directed the radiation protection technicians (RPT) to give the survey results to the RP foreman with instructions to have the suit decontaminated. On August 28, 1989, (Monday), at 0900 hours, diving activities resumed using the original suit. A gamma survey prior to the dive using a CP R03 performed by an RPT showed no restrictive gamma dose. The health physicist in charge of the Friday dive was in charge of the Monday dive. When the diver exited the pool at 1100 hours, a wet suit survey using a CP R03 showed 10 mrem/hr gamma, 150 mrad/hr beta outside the suit and 8 mrem/hr gamma, 80 mrad/hr beta inside the suit. The beta readings were in the same location as the August 25 survey of the suit. A skin dose of approximately 700 mrad beta was assigned for the August 25 and August 28, 1989 exposures. The dose was based on the general area contamination believed to be the cause because of the size of the contaminated surface area. Further investigation by the HP and a survey of the contaminated area of the suit using a collimated G.M. probe showed a 1 cm² area (hot particle) was responsible for the dose. The particle analysis determined the particle to be a 1.6 microcurie fuel fragment. The diver's dose was recalculated using the one cm² particle area and the fuel fragment isotopic mixture. This initial evaluation assessed the dose to be 1.270 rem for Friday and 3.942 rem for Monday for a total dose to the skin of the whole body of 5.212 rem. The data and analysis information was sent to Battelle Pacific Northwest Laboratory (PNL) for a computer skin dose modeling calculation. The PNL dose calculation was 4.042 rem using modified VARSKIN. On September 7, 1989, the hot particle, a sample of the divers suit coverall and T-shirt worn by the diver, were sent to PNL for exoelectron dosimetry analysis to confirm the dose to the diver for this event. The official dose to the diver based on nine exoelectron dosimetry measurements was 2.9 rem. The diver was advised of his dose and anticipated biological effects.

Apparent Causes

On September 8, 1989, the licensee held a Personnel Error Board concerning this event to determine, among other things, why the diver's suit had not been decontaminated following the August 25, 1989 dive.

The apparent causes of the event include: procedural weakness in that BRP 1620-1 did not specify action such as dose assessment and notification when dose or contamination levels are exceeded, nor positive control of the suit when action levels are exceeded; the technician was unable to distinguish between general area contamination and a hot particle due to the high intensity of the particle and the instrumentation used; turnover communications breakdown between RP shifts; a judgment error by the HP for allowing reuse of the diving suit without confirming decontamination; RP management was not notified soon enough to properly evaluate.

Corrective Actions

The licensee's corrective actions include: all radiation protection personnel attended tailgate discussions of this event and lessons learned; lessons learned will be incorporated into the internal radiation protection training program; and disciplinary action, including time off, resulted from the review of the event by the Personnel Error Board. In addition, BRP 1620-1 has been revised to require: the survey and logging, in the RP foreman's log, of the acceptability or unacceptability of the diver's suit after each dive; maintenance of a minimum of two diver suits which will have numbered identification; and actions that are required if specific action levels are exceeded.

The licensee's actions after identification of the hot particle were timely and technically sound. Corrective actions have been completed which should prevent future occurrences. This event is considered licensee identified and corrected.

No violations or deviations were identified.

11. Radiation Occurrence Report 89-08

Unforeseen extremity exposures from radioactive hot particles. This event was classified by the licensee as a Potentially Significant Event (licensee classification system).

Event Description: On October 24, 1989, the Fuel Handling Building was being cleaned and decontaminated prior to the receipt of new fuel. Earlier in the year, Byron had replaced the fuel racks in the spent fuel pool (SFP) with new high-density racks. At the conclusion of this work an underwater vacuum cleaner was used with a portable liquid filter assembly to clean the bottom of the SFP. Part of the cleaning/decontamination of the fuel building included the decontamination and removal of the portable filter assembly. Although the filters were known to be new, the filter housing had elevated dose rates which were thought to be coming from the pipe elbow below the filter housing. The plan was to remove the filter assembly and remove the elbow from the base of the assembly and place it in a shielded barrel provided for that purpose at the work location.

For removal of the clean filter, the Fuel Handler was instructed to sign in on the general Radiation Work Permit (RWP) 9J063, Routine/Non-Outage Fuel Handling Activities. As this task did not appear to change the radiological status of the system or area, nor result in significant radiation exposure, this evolution was believed to meet the general RWP requirement outlined in procedure. ALARA was consulted and indicated that for work to be performed on the hot elbow a job specific RWP would be required. A Radiation Protection Technician (RT) was assigned to this job.

The work involved opening the top section and pulling out the filter. The RT at this time was monitoring the exposure near the bottom of the unit by the elbow. He noted that the exposure dropped as the filter was removed. He had the filter set to the side. The Fuel Handler then removed a steel plate from the filter. The plate read 17 R/hr at what appeared to be a fitting mounted near the center, and approximately 200-400 mR/hr at the edge. The Fuel Handler removed the fitting and placed it in a plastic bag nearby. The Fuel Handler called the Fuel Handling Foreman and discussed what to do. It was decided to attempt to rinse the plate in the fuel pool and see if the exposure could be successfully reduced, and to drop the plate in the cask loading section of the fuel pool if it did not reduce the dose rates appreciably. The RT was then informed of this action plan.

The other RT supporting Fuel Handling Building activities called the Radiation Protection Foreman to inform him of these activities. The fuel handler carried the bagged plate to the fuel pool. There it was removed from the bag, rinsed in the pool and resurveyed. When the exposure did not decrease, the plate was dropped into the fuel pool cask loading area. It was determined that the source of exposure, which was previously believed to be coming from the elbow, originated from this plate.

Later that Tuesday morning the Radiation Protection Foreman contacted ALARA and arrangements were made to have a briefing for the work that afternoon. The survey from the filter assembly work that morning was forwarded to ALARA. A pre-job discussion was conducted in the Radiation Protection office with ALARA, the Radiation Protection Foreman, the RTs involved and a Fuel Handler. The discussion related to what RWP requirements might be necessary to continue the filter disassembly work.

At the Fuel Handling Building a different Fuel Handler and a Station Laborer had shown up who were not at the initial discussion. The Fuel Handler indicated that the other Fuel Handler who attended the meeting had given him a turnover briefing.

The Station Laborer and RT then set out to decontaminate the filter assembly and tray. The RT surveyed the filter assembly and found a small area of approximately 2 R/hr near the bottom (later identified as a hot particle). This area was immediately wiped down to reduce exposure. The RT then resurveyed the area and the dose rates were about 100 mR/hr.

After the laborer completely wiped down the assembly, the RT indicated the dose rates dropped substantially. These decontamination activities produced a bag of used paper rags which were measured by the RT as 38 R/hr on contact and just under 1 R/hr at 18 inches. The RT placed the bag away from them behind a metal table turned over on its side. At this point they had completed their work and exited the area. This area had previously been roped off and posted as a high radiation area. The RT called the Radiation Protection Foreman and informed him about the radioactive trash bag. Shortly afterwards another RT was dispatched to take the bag to the Rad Waste Area. The bag was placed in the high level storage area in the Rad Waste Building.

On Wednesday, October 25, 1989, activities continued in cleaning and decontaminating the Fuel Building during day shift. A minimum amount of time was spent decontaminating lead blankets and the filter tray. No radiological concerns were identified from Wednesday's day shift activities. On Wednesday, October 25, 1989, approximately 1900, while conducting a survey, a Radiation Protection Technician discovered a discrete radioactive particle. The particle was lying on the floor and near-contact radiation measurements with a CP instrument were 5 R/hr. The dose rates at about 18 inches were approximately 100 mR/hr. The RT recovered the particle on duct tape according to procedure, which was a normal radiation protection practice; discrete radioactive particles have been considered to be primarily a beta skin dose concern. The Radiation Protection Foreman was contacted and dispatched a second RT at approximately 1930 to assist in transporting the particle to the mask issue room lead cave. There the second RT made further measurements with a digi-pol and determined the near-contact dose rate to be 35 R/hr. This RT, wearing a finger ring, picked up the edge of the taped particle and placed it into a portable lead pig.

At about 2000 on October 25, the Radiation Protection Foreman notified a Health Physicist (HP) onsite who began investigating the matter. The HP had the particle in the lead pig taken to the counting room to perform a qualitative analysis. The HP's initial calculations determined that the particle was potentially as high as 95 millicuries of cobalt 60. The HP instructed the two RTs and the Radiation Protection Foreman that the RTs were restricted from the radiologically controlled area until further notice. The whole body gamma doses for the two RTs were 16 and 59 millirem for the badge period to date.

The Health Physicist contacted the Lead HP-ALARA/Operations at approximately 0015 (now Thursday, October 26, 1989) and the Lead HP-Technical (and acting Health Physics Supervisor) at approximately 0300. Additional corrective actions involved calling in another RT for assistance and conducting verification surveys to ensure the particle exposure recurrence potential did not exist in the Fuel Handling Building. The entire 426' elevation of the Fuel Handling Building was surveyed including the affected area around the filter and the fuel pool wall above and below the waterline. In the filter housing general area, two additional, smaller activity particles were recovered with duct tape and a third, hotter area was marked off for a later, more controlled retrieval.

The October 26, 1989 investigation of these hot particle incidents began on the day shift. The Fuel Handling Building was restricted to involved personnel early that day until surveys were completed. During the investigation of the October 25 hot particles, the incident involving the Fuel Handler which had occurred on Tuesday, October 24, 1989, was discovered. At that point the Fuel Handler was immediately restricted from the radiologically controlled area and his film badge and finger ring pulled for emergency processing. Upon processing, his whole body exposure for the badge period was determined to be 85 millirem and his extremity

exposure 150 millirem. In addition, radiation protection management had the Station Laborer's TLD pulled for emergency processing. The laborer was restricted access from radiologically controlled areas until the investigation was complete and his dose determined. Station management, Nuclear Services Health Physics, Quality Assurance, Regulatory Assurance, NRC resident inspectors and NRC Region III were notified of the discovery of high intensity hot particles. A video taped re-enactment of the handling of the particles and the removal of the particle from the floor was conducted that day. A contractor (PNL) was contacted for dose assessment assistance.

Guidance was developed on October 26, 1989, and a memo drafted and issued on October 27, 1989, to instruct Departmental personnel on go/no-go criteria for controlling particles in the field. A followup tailgate session was held with the Radiation Protection Department to discuss the incident.

The full-scale investigation of the hot particle incidents continued through the weekend. Corporate Nuclear Services Radiation Protection assisted throughout this time period. Videotaped time and motion studies were conducted of the Station Laborer decontaminating the filter assembly. Dose assessments continued throughout this time. The particles were analyzed as Cobalt-60, with activity levels of eight (10/25/89 particle) and 77 (10/24/89 particle) millicuries. Cobalt particles encountered in the industry typically range up to five to ten microcuries. On Monday, October 30, 1989, the Health Physics dose assessment of the Station Laborer (10/24/89 particle) was discussed with Battelle Labs and Corporate Health Physics. This individual's dose was determined to be 11,610 millirem to the extremities from contacting the particle while decontaminating the filter assembly. It was determined that 10 CFR Part 20 limits were not exceeded. The exposures to the other involved individuals' extremities were as follows:

RT retrieving the 10/25/89 particle:	1,250 millirem (calculated)
RT transporting the 10/25/89 particle:	1,950 millirem (calculated)
Fuel Handler handling plate:	150 millirem (dosimetry)

Apparent Causes

The scope of the Fuel Handling Building decontamination effort was not well understood or discussed with the ALARA Coordinator prior to the effort. During the pre-job discussion for the filter assembly work, there was no discussion of the potential for hot particles to be encountered even though hot particles had been previously identified with spent fuel pool work.

Byron had recently implemented a new pilot RWP program. Type I and Type II RWPs were replaced with general and specific RWPs. Limitations for person-rem per job, maximum contamination levels or the presence or potential of discrete radioactive particles should be considered when initiating an RWP. These criteria were not adequately reviewed to determine which type of RWP would have been appropriate for the decontamination of the filter assembly.

The go/no-go procedural constraints were inadequate to preclude skin or extremity exposure concerns before adequate management attention could be provided. Procedures did require management approval for whole body exposures in dose fields of 3 R/hr or greater. No such similar hold points existed for skin or extremity exposure from particles or other radioactive sources potentially creating such concerns.

Radiation Protection Foreman did not monitor the work activities in the field to assure that the radiation controls were effective for the evolutions in progress.

It should be noted that the intensity of the Cobalt-60 particles was much greater than normal industry experience; therefore training and procedural controls were lacking in dealing with particles of this intensity.

Corrective Actions

A memo was issued to the Radiation Protection Department on Friday, October 27, 1989, on go/no-go controls for particles encountered in the field.

The Station will procure fixed high intensity beta and high intensity gamma point sources for specialized training of RTs to ensure they have the proper surveying skills to detect the particles. A variety of instruments and conditions will be used in this training to ensure the training is broadbased.

The licensee will establish proceduralized radiological hold points and contingency action plans for radiation doses to the skin and extremities. These will consider particles as well as other geometry sources.

The ALARA Group will review this event and determine enhancements to the interface between ALARA, the RTs and RPF. These enhancements will be discussed with Radiation Protection personnel to promote improved communications and interactions during work planning activities and pre-job discussions or briefings with the working departments.

The ALARA group will upgrade the RWP/ALARA checklist to provide more detailed questions so that proper radiation controls can be ascertained prior to issuance of a general or specific RWP. The checklist will also specifically address Fuel Handling Building activities.

This checklist will be proceduralized by November 22, 1989. Training of Radiation Protection personnel on this checklist will be completed by December 29, 1989.

Station work activities will be reviewed to ensure appropriate radiological controls exist with special attention directed at those activities involving fuel handling equipment and associated areas. This review will be completed by December 29, 1989.

The Station will conduct training to the RTs and appropriate support groups and contract technicians on discrete radioactive particles and their control. This will be done by December 29, 1989.

No violations or deviations were identified.

12. Surveillance - Plant Tours (IP 83750)

During several tours of the plant, the inspector noted that no person was observed violating a procedural requirement, radiation postings and controls were in accordance with requirements, friskers were operable, and calibrated radiation detection equipments were used by HP personnel. The inspector collected smears on floor and horizontal surfaces on all accessible levels of the auxiliary and fuel handling buildings. None of the smears showed removable contamination levels greater than counter background. No problems were noted.

No violations or deviations were identified.

13. Exit Meeting (IP 30703)

The inspector met with licensee representatives (denoted in Section 1) at the conclusion of the onsite inspection on November 3, 1989, to discuss the scope and findings of the inspection. The inspector also discussed the likely information content of the inspection report with regard to documents or processes reviewed by the inspector during the inspection. The licensee did not identify any such documents/processes as proprietary.

The inspectors specifically discussed the diver's suit hot particle incident and the high intensity particles found on the filter assembly. NRC policy regarding skin exposures and possible enforcement action was also discussed.