U. S. NUCLEAR REGULATORY COMMISSION OFFICE OF INSPECTION AND ENFORCEMENT

REGION III

Report No. 50-483/89010(DRSS)

Docket No. 50-483

License No. NPF-30

Licensee: Union Electric Company Post Office Box 149 St. Louis, MO 63166

Facility Name: Callaway County Nuclear Station

Inspection At: Callaway Site, Callaway County, Missouri

Inspection Conducted: May 1-5 and May 11, 1989

Inspector: W. B. Grant

Approved By: M. C. Schumacher Chief, Radiological Controls and Chemistry Section

5/30/89

Inspection Summary

Inspection On May 1-5 and May 11, 1989 (Report No. 50-483/89010(DRSS)) Areas Inspected: Routine, unannounced inspection of the radiation protection program during a refueling/maintenance outage including: licensee action on previous inspection findings (IP 92701); changes in the organization; audits and appraisals; training and qualification of new personnel; external and internal exposure control and assessment, including ALARA considerations; and control of radioactive materials and contamination, surveys, and monitoring (IP 83750, 83729).

<u>Results</u>: The licensee's radiation protection program is good and continues to be effective in protecting the health and safety of workers and the public. No violations or deviations were identified.

DETAILS

1. Persons Contacted

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- L. Auman, Foreman, Health Physics, Dosimetry
- *J. Blosser, Manager, Callaway Plant
- *F. Eggers, Supervising QA Engineer
- *C. Graham, Supervisor, Health Physics Technical Support
- *J. Laux, Manager, Quality Assurance
- *B. Miller, Foreman, Health Physics Operations
- J. Neudecker, Supervisor Health Physics Operations
- J. Peevy, Assistant Manager Technical Services
- S. Petzel, QA Engineer
- #R. Roselius, Superintendent, Health Physics
- G. Spires, Foreman, Health Physics, ALARA Coordinator
- C. Stretch, Health Physicist
- *D. Thompson, Training Supervisor
- *D. Widmer, QA Engineer

*C. Brown, NRC Resident Inspector

The inspector also contacted other licensee representatives.

*Present at the exit meeting on May 5, 1989.

#Contacted by telephone during the period May 8 through May 11, 1989.

2. General

This inspection was conducted to review the radiation protection program during the refueling/maintenance outage and the licensee's response to open items. During plant tours, the inspector noted that area posting, access control, and housekeeping were good.

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

(Closed) Unresolved Item (483/88018-03): Unposted Very High Area (VHRA) identified on top of the shielded high integrity container after a spent resin transfer. This item is discussed in Section 13.

(Open) Open Item (483/88018-01): The need for an integrated positive-control program and facility for collection, decontamination, and reissuance of tools and equipment. A Quality Improvement Process (QIP) team has submitted a proposed tool control program. Implementation of the program will be after the outage. Implementation of the tool control program will be reviewed during a future inspection.

4. Changes (IP 83750-83729)

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

The Health Physics Group (HP) staffing has been stable. The staff organization remains essentially as described in Inspection Report No. 50-483/88018. The HP Foreman, Dosimetry recently resigned effective July 1989. The licensee indicated that this position, when vacated, will be filled expeditiously by a well qualified individual. The technician staff is all ANSI-qualified and have Navy and commercial radiation/chemistry technician experience prior to employment at Callaway.

Management involvement in and support of the health physics program appears to be very good. This support includes the Plant Manager, General Manager, and the Senior Vice President, Nuclear. Requests for equipment, technical support, and program improvement proposals appear to receive prompt and supportive action by management.

No violations or deviations were identified.

5. Planning and Preparation (IP 83750-83729)

The inspector reviewed the outage planning and preparation performed by the licensee, including: additional staffing, special training, increased equipment and supplies, and job related health physics consideration.

The licensee contracted about 70 RP technicians to support work being performed during the current outage, In addition, the licensee transferred some personnel from chemistry/radwaste to support RP work and hired about 40 contract deconners.

A Health Physicist is assigned as a representative to the Planning and Scheduling Department. The HP reviews work requests which could require an RWP. Major jobs this outage include eddy current testing of steam generator tubes, sludge lancing of steam generators, reactor pump seal replacement and in-service inspection activities. Pre-job training on steam generator mockups was provided to contractor personnel performing eddy current testing. No problems were noted.

No violation or deviations were identified.

6. Training and Qualification of New Personnel (IP 83750-83729)

The inspector reviewed the education and experience qualifications of contractor radiation protection personnel, and the training provided them.

Initial selection of contracted radiation protection technicians includes contractor recommendation, and a review of technician resumes by the Supervisor, Health Physics Operations. Some contact with previous employers is also attempted. Each selected technician is given a challenge entrance exam as part of the evaluation process. Failure to pass the challenge exam usually means the technicians are not accepted. Successful candidates then receive four days of training, two in formal classroom activities and two in the plant doing on-the-job practical factors tasks. After training, each incoming technician is required to pass (70%) a 65-question exam and an HP staff evaluation of his/her skills prior to acceptance. The exam consists of moderate to fairly difficult questions on radiation protection/health physics theory and problem solving.

The licensee has implemented the qualification card program discussed in Inspection Report No. 50-483/88018. The qualification card program is for temporary personnel serving as radiation protection technicians (RPTs) in the Health Physics Department during outages including contractor and plant technicians not normally assigned to Health Physics Operations. Procedure No. HDP-ZZ-06017, Rad-Chem Technician Health Physics Qualification/OJT Program, Revision 10, was implemented for this outage. The program is comprehensive and requires a good basic technical knowledge and knowledge of Callaway procedural requirements. It appears the implementation of this qualification card program has increased the quality of RPTs during this outage.

No violations or deviations were identified.

7. Audits and Appraisals (IP 83750)

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The inspector reviewed reports of audits and appraisals conducted by the licensee including audits required by the technical specifications. Also reviewed were management techniques used to implement the audit program, and experience concerning identification and correction of programmatic weaknesses.

Six QA audits/surveillances of the radiation protection program performed since November 1988 were reviewed by the inspector. Response to findings appear timely and technically sound. The QA audit/surveillance program for this functional area appears adequate to assess functional program effectiveness. Qualifications of the auditors also appear adequate.

No violations or deviations were identified.

8. External Exposure Control (IP 83750)

The inspector reviewed the licensee's external exposure control and personal dosimetry programs, including; changes in the program to meet outage needs; use of dosimetry to determine whether requirements are met; planning and preparation for maintenance and refueling tasks including ALARA considerations; and required records, reports, and notifications.

As discussed in Inspection Report No. 50-483/88018, the licensee contracted the University of Missiouri - Columbia (UMC) to calibrate both TLD neutron dosimetry and the neutron rem-ball monitor, including empirically

determining the neutron spectra at various containment locations under controlled conditions. The calibrations were done in order to resolve the significantly higher neutron TLD doses during power entries into containment and the doses indicated by the accompanying neutron rem-ball monitor. A study of the UMC calibration results determined that the neutron TLD badge readings overestimate the true neutron dose by about a factor of three, and therefore the TLD reading should be corrected to provide a more realistic and accurate neutron dose determination. This technical problem with the neutron TLD program was well handled.

The licensee has revised their administrative exposure control policy by establishing an administrative limit which is individual worker's age multiplied by one rem for a lifetime permitted accumulated exposure, and an annual administrative dose limit of two rem.

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

Posting and labeling in the RCA were observed during plant tours; no problems were noted. Housekeeping appeared to be good, considering outage activities.

No violations or deviations were identified.

9. Internal Exposure Control and Assessment (IP 83750)

The inspector reviewed the licensee's internal exposure control and assessment programs, including; changes in facilities and equipment; determination whether engineering controls and assessment of individual intakes meet regulatory requirements; planning and preparation for maintenance and refueling tasks including ALARA considerations; required records, reports, and notifications; effectiveness of management techniques used to implement their program; and experience concerning self-identification and correction of program implementation weaknesses.

The inspector observed whole body counter operations and respirator cleaning and distribution facilities. No major problems were noted. However, it was noted that the licensee does not procedurally control respirators from issue to return. A respirator is issued to a worker after his qualifications for respirator use are determined by the issuing technician. The respirator number and the person it was issued to are recorded in the respirator issue log. After the respirator is returned, it is cleaned, inspected and returned to storage without a verification that each individual worker has returned his or her respirator. The inspector saw no evidence that respirators were left in the plant, however, the licensee has been experiencing a loss of respirators during this outage with some found in radioactive waste containers. The need for a positive control system for respirators was discussed with the licensee. The inspector reviewed the annual calibration and certain quality control calibration checks for the Nuclear Data, chair type, Whole-Body Counter (WBC). No problems were identified.

The licensee used the WBC during this outage for baseline counting of incoming contractor personnel, routine annual counting of station personnel, and random counting of workers on active RWPs involving possible airborne contamination. Contractor and nonstation Union Electric personnel are counted when their work at the station is completed. Whole-body counter results were selectively reviewed. No result exceeded the 40 MPC - hour control measure, and no significant internal deposition was identified.

No violations or deviations were identified.

10. Control of Radioactive Materials and Contamination (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; effectiveness of survey methods, practices, equipment, and procedures; adequacy of review and dissemination of survey data; and effectiveness of methods of control of radioactive and contaminated materials.

In 1988 the licensee initiated a major program to reduce the extent of contaminated areas within the plant. Through extensive decontamination efforts the contaminated surface area within the Radiological Controlled Area (RCA) at the end of 1988 was about 8000 ft^2 or about 4.6%. Due to the refueling/maintenance outage the total has risen to about 12-13% of the RCA as of May 5, 1989.

The licensee has developed procedures (HPD-ZZ 03000, HPD-ZZ 06000) for identifying/quantifying hot particles; the procedures outline methods for identifying and reducing transport of particles and identifying and quantifying particles on personnel and clothing. A companion procedure (HPT ZZ 01490) outlines methods to be used to calculate the beta skin dose equivalent from hot particles. The inspector reviewed the three procedures; they appear adequate. No problems were noted. The licensee experienced 91 personnel contamination events (PCEs) during 1988; the 1988 goals for PCEs were 100, 75 and 50 for acceptable, commendable, and excellent. Thus far in 1989, the licensee has identified about 129 PCEs. A hot particle event is discussed in Section 11. During plant tours, the inspector noted area postings, access controls, and housekeeping were good considering the outage workload.

No violations or deviations were identified

11. Hot Particle Extremity Exposure Event

Summary

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A significant hot particle was found on a worker on April 18, 1989. A 1.7 µCi particle of Co-60 was found on an individual who had been decontaminating an area outside the bioshield near the "B" loop accumulator in containment. The particle was found on the skin of the right arm, about 2" below the elbow. Due to the initial uncertainty in determining exposure duration, a preliminary extremity dose of 25.92 rads was assigned. The preliminary estimate was based on the three hours the individual was inside the RCA. Later interviews with the individual and HP foreman involved indicated that the maximum probable exposure duration was 1 hour and 45 minutes. The final assigned extremity dose was 14.791 rads.

Event Reconstruction

Two decontamination workers were using a water spray to clean the drainage trenches outside the bioshield at the 2000' level in containment in preparation for painting the trenches. The work was part of the routine outage decontamination effort and was covered by a RWP for decon work outside the bioshield. Workers had been instructed verbally to remove the trench grating with a hook and to wash the trenches with a water spray, sweeping loose materials toward the sump. One worker would remove and replace the gratings, while the other worker performed the spraying. The protective clothing mandated by the RWP was the same as that ordinarily worn outside the bioshield: full cotton PCs with a cotton hood, 2 pair of rubber gloves, rubber booties and shoe covers.

The workers spent 2½ hours during the morning of April 18, 1989, decontaminating the trench area around the "A" accumulator. When they completed this work, the individuals left containment, removed their PCs, and exited the RCA using the whole body friskers. They returned shortly after 4:00 p.m., donned protective clothing, entered containment and spent about half an hour in the walkway area around the "A" and "B" accumulators repairing hose connections and arranging spray hoses. Removal of gratings between the accumulator and bioshield required movement through a confined area, and around pipes and supports. After removing the grates, the worker left the area and removed his outer pair of gloves while the other worker sprayed the area. The first worker then returned and began replacing the gratings. The individual stated that his coveralls were soaked from sweating and from contact with overspray, but that he did not come in contact with reflected spray from the trenches.

The individual continued replacing gratings, then helped secure the spray hoses, coiling them around his left arm. He picked up the coiled hoses, one on each arm, and carried them up to the 2068' level. After finishing the work he left containment, removed his protective clothing at the 2047' level, and then surveyed his hands, feet and dosimeters; no contamination was discovered. Upon entering the PCM-1 whole body frisker at the 2026' level, the frisker alarmed and the worker was escorted to the HP access area for decontamination. A particle reading 150,000 cpm on contact was found on the worker's right forearm, 2" below the elbow. The particle could not be removed by tape pressed on it. The particle was washed off and was retrieved from the rinse water and saved in a petri dish for analysis. The individual then showered and left the RCA. A whole body count the next morning revealed no residual contamination or internal deposition.

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The licensee interviewed the individual on April 19, 1989. He had good recall of details and described his actions thoroughly. His estimates of RCA and containment ingress/egress times agreed with the security access logs to within a few minutes.

The HP foremen involved in the spraying work and skin contamination removal were also interviewed to establish compliance with the RWP and to establish the particle removal time. The foremen verified that the workers were following protective clothing requirements and that workers had been instructed to remove gratings with a hook and to spray from above the trench area. The foremen present at the skin decontamination estimated the particle removal time as 6:45 p.m. based on the time he was called out of a shift turnover meeting. This time was critical to the dose estimate, because it had initially been recorded incorrectly on the decontamination report. The originally recorded removal time was 7:15 p.m., which disagreed with the RCA HP access logs, the recollections of the foremen, and the recollections of the individual involved.

When an initial skin dose assessment was performed on April 18, 1989, the worker's whole body TLD was retained for readout after a 24-hour fade period and the individual was "locked out" of the RCA via the HP access computer. A quarterly whole body exposure of 316 mrem was determined from the TLD reading.

Followup surveys behind the "B" accumulator area were made on April 19, 1989. Smearable contamination levels of 10,000 to 30,000 dpm per 100 cm² were detected, but no hot particles were found. HP foremen present in the reactor building were interviewed to determine whether any informal surveys had been performed prior to the start of work on April 18, 1989. An HP technician had surveyed the area around the "A" and "D" trenches with an ionization chamber prior to the "A" trench decontamination work looking for "hot spots." The highest reading in the general area was 40 mR/hour above the intersection of the "A" and "D" trenches. Routine surveys of the walkways around the "B" accumulator taken on April 13 and 15, 1989, had revealed no unusual exposure rates and no smearable contamination above 1,000 dpm per 100 cm².

Followup studies were also performed to verify that the particle could not have come from the laundered protective clothing. The individual

recalled that the protective clothing he was wearing had a velcro fastener on the front over the zipper and did not have an INS stencil or colored collar. The PCs worn were therefore Callaway coveralls returned from wet wash laundering by INS the same day. A UE engineer who was investigating laundry practices at the vendor's facility verified that outgoing laundry is monitored by the vendor using an array of gas proportional counters. The setpoint for releasing laundered coveralls to UE is 3000 cpm based on a mixed Cs-137 and Co-60 calibration. The engineer ran a 0.107 microcurie Cs-137 check source through the detector several times to verify that the unit alarmed on multiple channels. He repeated the process with a 0.0193 microcurie Sr-90 check source, which also alarmed the monitor.

At the request of Union Electric, the health physicist at INS corporation performed a followup test using a 1 microcurie Co-60 point source. The source was placed with two thicknesses of cotton hoods on each side between the source and detectors. In each of three attempts, the monitor used for UE laundry alarmed on multiple channels and stopped the conveyor. The source was then placed between two aluminum planchets to completely attenuate the beta component. The shielded source was sent through the conveyor twelve times in various positions, including the extreme edge of the conveyor. In all cases, the unit alarmed and stopped the conveyor. It is therefore extremely unlikely that a particle with such a high activity could have escaped detection in the INS laundry monitor.

Dose Assessment

Dose assessments were performed in accordance with HTP-ZZ-01490, "Determination of Beta Skin Dose", Rev. 8, dated March 23, 1989. An initial assessment was made using a pancake GM probe with an adapter which maintains a source to detector distance of 5 cm. For the 1.7 mCi Co-60 particle, the measured count rate at the time of detection was 40,000 cpm. Since the individual who was contaminated was not available for discussing the work history at the time the dose was estimated, an exposure time of three hours was assigned. This was based on the time the individual entered the RCA, and on the initial estimate of the particle removal time. The preliminary assigned dose was 25.92 rads.

The dose assessment was refined after interviews with the foremen and with the individual involved allowed a more realistic assessment of exposure time.

The revised exposure duration was 105 minutes, calculated as the time between the start of the grating removal and the particle removal. This is a conservative estimate, based on the assumption that the particle worked through wet protective clothing as the individual crawled through confined areas. The software QUINCE was used to calculate the beta skin dose from the particle as per procedure HTP-ZZ-01490. A skin thickness of 0.006 cm was selected for the forearm (HTP-ZZ-01490, Table 2). Using the measured activity of 1.7 μ Ci, the 0.006 cm skin depth and the 105-minute exposure duration, a beta dose of 14.791 rad was assigned as the extremity dose.

No violations or deviations were identified.

12. Maintaining Occupational Exposures ALARA (IP 83750)

The inspectors reviewed the licensee's program for maintaining occupational exposure ALARA, including: changes in ALARA policy and procedures; ALARA considerations for the maintenance and refueling outage; worker awareness and involvement in the ALARA program; establishment of goals and objectives and effectiveness in meeting them. Also reviewed were management techniques used to implement the program and experience concerning self-identification and correction of implementation weaknesses.

The 1988 ALARA exposure goals were 100, 75 and 50 person-rem for acceptable, commendable, and excellent respectively; the cumulative exposure for 1988, a non-outage year, was about 27 person-rem. The 1989 total including about one-half the outage is about 240 person-rem.

The ALARA suggestion program continues to be actively promoted and utilized by plant workers. The suggestion program has been computerized under the HP action tracking program which is continually updated by Plant ALARA Committee (PAC) members so that persons who make ALARA suggestions are able to readily track the status of their suggestions. Because suggestions are given directly to the ALARA coordinator or the submitter's department PAC member for consideration, the implementation of appropriate suggestions is usually timely. The inspector noted that both the quantity and quality of the suggestions have improved.

The licensee has made significant progress in upgrading job history files. The job history files include tasks usually involving significant radiation exposure. In addition, job histories for relatively minor evolutions are recorded in the work control application of the ADABASE computer system; lessons-learned, special techniques, and worker comments are recorded in the system under the equipment identification number. Because the work control aspect of ADABASE is routinely used during the plant's work planning process, the ALARA information is readily available to the planning department and may be transferred directly to a work document (as appropriate).

ALARA pre-job briefings appear to have continually improved during 1989. Inspector discussions with licensee personnel indicate that effective pre-job planning and briefings on outage tasks resulted in considerable

dose savings. In addition, the inspector noted that the ALARA group coordinates well on a day-to-day basis with the RWP HP foreman, the HP planner, HP operations personnel, plant ALARA Committee (PAC) members from other departments and plant worker and contractors in general. Management support for the ALARA program has been extensive and the effectiveness of that support is apparent.

No violations or deviations were identified.

13. Radiological Occurrence Report No. 88-27

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On November 1, 1988, an unposted Very High Radiation Area (VHRA) was (10 R/hr contact) identified on top of a shielded High Integrity Container (HIC) after resin was transferred to the container. The Licensee's investigation determined that the technician who performed the survey failed to find the hot spot which was directly above the top of the HIC and was reasonably inaccessible. No personnel exposure occurred and the area was reposted as a VHRA. The licensee's corrective action included revising the resin transfer procedure to require the transfer area (the truck bay) to be a VHRA until the shielded top is placed on the shipping cask, counseling all HP technician on the incident, and revising the HP training module to emphasize what an adequate resin cask survey includes. In addition, a letter of reprimand was issued to the HP technician.

The licensee's investigation was timely and thorough, and corrective actions good. This matter is considered licensee identified and corrected. Unresolved Item No. 483/88018-03 is considered closed.

14. Very High Radiation Area Posting/Survey Incident

On April 29, 1989, a contract health physics technician (HPT) performing a routine survey on the 2047' level of the fuel building, found 35-40 mr/hr general area readings around the equipment lay-down area. The area was posted "radiation/contamination, hot particle area/contact HP for survey prior to entry." The only equipment in the area was a fuel elevator which had been used in fuel consolidation activities and had been removed from the Spent Fuel Pool (SFP) on April 23, 1989. Further investigation found that the bottom end of the elevator was reading approximately 10 R/hr on contact with the herculite wrapper. The herculite was pulled back and a small piece of metal about one inch by 3/8 inch was found. The metal which was determined to be part of a grid strap from a fuel assembly, read about 1000 R/hr at one inch.

The licensee retrieved the metal piece using a five-foot extension tool and then surveyed and photographed it. The survey readings were 1000 R/hr at one inch, five R/hr at 18 inches, and 100 mr/hr at five feet. The object was then stored in the cask loading pit. The whole body exposure to the technician who located and surveyed the piece was 35 mrem.

The licensee immediately wrote Incident Report (IR) 89-141 and began an investigation. The investigation included personnel interviews, and a review of personnel TLD results for the period and the RWP master sign-in sheet. The investigation found that the fuel elevator had been removed from the SFP on April 23, 1989, urder RWP 89-038-1 by a crew of three Westinghouse personnel, a Union Electric supervisor and a contract HPT. The elevator was removed from the SFP and laid down in the roped off equipment lay down area adjacent to the SFP. The HPT made a direct survey of the elevator which showed 50-60 mr/hr at contact. After the survey the elevator was covered with herculite and the area was posted as "radiation/contamination, hot particle area/contact Health Physics for a survey prior to entry." Inspector discussions with the licensee indicated the elevator was inadequately surveyed upon removal and an unposted Very High Radiation Area (VHRA) existed from April 23 to April 29. 1989. The VHRA was however, reasonably inaccessible and no personnel radiation exposure occurred. The licensee's investigation of the matter and the corrective actions are in progress. Pending further review by the licensee and completion of corrective action, this matter is considered to be an Unresolved Item. (483/89010-01)

No violations or deviations were identified. One unresolved item was identified.

15. Exit Meeting (IP 30703)

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The inspector met with licensee representatives (denoted in Section 1) at the conclusion of the inspection on May 5, 1989. Further discussions were conducted with the Superintendent, Health Physics, by telephone through May 11, 1989. The inspector summarized the scope and finding of this inspection. The inspector also discussed the likely informational content of the inspector. The licensee did not identify any such documents or processes as proprietary. The inspector expressed his concern regarding the failure to identify and post the very high radiation area near the spent fuel pool. (Section 14)