UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30323

JAN 3 1992

Report Nos.: 50-327/91-28 and 50-328/91-28

Licensee: Tennessee Valley Authority
6N 38A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Docket Nos.: 50-327 and 50-328 License Nos.: DPR-77 and DPR-79

Facility Name: Sequoyah 1 and 2

Inspection Conducted: November 18-22, 1991

Inspector: Ellen D. Testa 12/30/91
E. D. Testa Date Signed

Accompanying Personnel: B. Parker

Approved by: Thomas F. Westerman for 1/3/92
J. P. Potter, Chief Date Signed
Facilities Radiation Protection Section
Radiological Protection and Emergency
Preparedness Branch
Division of Radiation Safety and Safeguards

SUMMARY

Scope:

This routine, unannounced inspection was conducted in the area of occupational radiation safety, and included an examination of audits and appraisals, changes to the program, planning and preparation, control of radioactive materials and contamination, surveys and monitoring, and maintaining occupational exposure as low as reasonably achievable (ALARA).

Results:

In the area inspected, violations or deviations were not identified. The Radcon Quality Assurance program, surrogate tour, Radcon worker attitude, knowledge of technicians and professional radiation personnel were noted as program strengths. Based on the licensee's response to an actual minor fire, timely containment personnel accountability was identified as a concern. In addition, personnel collective dose during the Unit 1 outage was exacerbated by unanticipated problems associated with steam generator shot peening and was identified as a program weakness.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*R. Beecken, Plant Manager
*N. Catron, Emergency Preparedness Planning Manager
*M. Cooper, Site Licensing Manager
*D. Craven, Instrument and Control/Electrical Supervisor
*T. Flippo, Quality Audit and Monitoring Manager
*D. Goetcheus, Nuclear Steam Supply System/Steam Generator/Turbine Generator Programs Manager
*C. Hudson, Corporate RADCON Manager
*T. Johnston, Health Physicist
*C. Kent, RADCON Manager
*J. Long, Technical Support Instrument & Controls/Electrical Engineer
*R. Lumpkin, Jr., Site Quality Manager
*S. McCamey, Health Physicist
*M. Palmer, Manager, Radiological Control-Health
*R. Reed, Manager, Radiological Protection
*J. Setliffe, Site Security Supervisor
*R. Thompson, Compliance Licensing Manager
.. Trudel, Engineering Manager
*J. Vincelli, Manager, Field Operations
*C. Whittemore, Licensing Engineer
*J. Wilson, Sequoyah Site Vice President

Other licensee employees contacted during this inspection included craftsmen, engineers, operators, mechanics, and administrative personnel.

Nuclear Regulatory Commission

*W. E. Holland, Senior Resident Inspector
*J. P. Potter, Chief, Facilities Radiation Protection
*S. M. Shaeffer, Resident Inspector

*Attended exit interview

2. Audits (83750)

Technical Specification (TS) Section 6.5.2 requires audits of facility activities to be performed under cognizance of the Nuclear Safety Review Board (NSRB). Section 6.5.2.8 requires that audits encompass conformance of facility operators to all provisions contained in the TS(s) and applicable license conditions at least once per 12 months.

The inspector reviewed the following audit documents:

a. Audit Report SQA 91104 titled, "Internal Exposure Control and Radcon Instrumentation," dated March 29, 1991

b. Quality Assurance Assessment of the Radiological Controls SALP Functional Area for the First Quarter 1991, dated May 10, 1991

c. Quality Assurance Assessment of the Radiological Controls SALP Functional Area for the Second Quarter 1991, dated July 26, 1991

d. Quality Assurance Third Quarterly Assessment of the Radiological Control SALP Functional Area, dated November 1, 1991

e. Monitoring Report QSQ-R-91-191 dated February 28, 1991

f. Monitoring Report QSQ-M-91-947 dated November 16, 1991

g. Monitoring Report QSQ-R-91-832 dated October 25, 1991

h. Monitoring Report QSQ-R-91-563 dated August 2, 1991

i. Monitoring Report QSQ-M-91-647 dated September 10, 1991

j. Monitoring Report QSQ-R-91-699 dated October 4, 1991

k. Monitoring Report QSQ-R-91-684 dated September 26, 1991

l. Monitoring Report QSQ-M-91-611 dated August 20, 1991

m. Monitoring Report QSQ-R-91-010 dated January 10, 1991

n. Monitoring Report QSQ-M-91-203 dated March 13, 1991

o. Monitoring Report QSQ-M-91-615 dated August 26, 1991

Monitoring reports are used to observe and verify selected Radcon program areas and provide direct observation of program activities. These monitoring reports cover program areas such as:

a. selected corrective action items from Radiological Awareness Reports (RAR) 91-034 and 91-023,

b. verification of current calibration stickers and where appropriate evidence of current response checks,

c. verification that personnel utilize contamination detection equipment (Friskers) properly when exiting a C-Zone, RCA and/or plant access portal,

d. verification that radiation, contamination and airborne radiological surveys are conducted and documented as required with calibrated instruments,

e. verification that radiological control practices are implemented during C-Zone work,

f. verification that appropriate radiological planning and controls are utilized to keep dose ALARA, and

g. verification that RWP requirements were written such that workers could easily comprehend and comply with the requirements.

Monitoring reports were found to be detailed and provided infield observation of work, equipment and personnel practices. The reports provided timely feedback for immediate corrective action implementation. Problems were documented in Finding Identification Reports (FIRs) and Radiological Awareness Reports (RARs).

The audit report concluded that, with one exception, the key objectives of the quality related activities for an internal exposure control and Radcon Instrumentation Program are being met. The one exception was related to tracking internal exposure and was identified as repeat problem. It was documented as SQFIR910005104 - Tracking Internal Exposure. The finding was closed out using Site Practice 3.7.

The quarterly assessment report provides feedback to management regarding acceptability of performance in the functional area of radiological control. The report also identifies and tracks adverse trends.

The timeliness, depth, diversity and details included in the self-assessment reports were identified as a Radcon program strength.

No violations or deviations were identified.

3. Changes (83750)

The inspector reviewed changes since the last inspection in organization, facilities, equipment and personnel and how they relate to the occupational radiation protection program. This inspection noted that no significant changes have occurred in the licensee's program.

No violations or deviations were identified.

4. Facility Tours (83750)

During the onsite inspection, the inspector toured selected areas of the Unit 1 containment (upper and lower). The inspector observed facility operations and selected work activities to evaluate the implementation and effectiveness of the licensee's Health Physics program. The following

specific radiation protection and industrial safety issues and concerns were noted and discussed with licensee representatives.

a. Instrumentation

All inspected survey meters and continuous air monitors in use within Unit 1 were observed to be operable, calibrated and/or source checked.

b. Industrial Safety

During the Unit 1 containment tours, the inspector noted multiple examples of inadequately secured compressed gas storage cylinders on various containment elevations. In addition, the inspector noted an overloaded conveyance cart parked next to a continuously-used thoroughfare. Also noted were some work areas with inadequate lighting and a portable eyewash station at "recharge" pressure. All of the potential industrial safety hazards were pointed out to the accompanying licensee representative for follow-up.

Overall, housekeeping within the plant appeared adequate for the stage of the outage and no overly congested areas were observed.

No violations or deviations were ider. ified.

5. Fire Team Response

The inspector, while exiting the lower containment during a tour, witnessed the licensee's response to a small motor fire inside the containment. The fire alarm sounded and the fire team responded in a timely manner. Th fire team arrived at the containment extrance in turnout gear with SCBA(s). The fire team leader asked the security check point at the containment entrance for the number of people inside containment. The security check point controls the entrance and exit from the containment by a computer based accountability system. A hard copy printout was requested by the security check point. This printout comes from the main access control computer at the central desk. The printout was not received at the security control point in a timely manner and the inspector's concern at the length of time (greater than 15 minutes) to identify the number of personnel located inside the containment was discussed at the exit.

6. As Low as Reasonably Achievable (ALARA) (83750)

10 CFR 20.1(c) states that persons engaged in activities under a license issued by the NRC should make every reasonable effort to maintain radiation exposure as low as reasonably achievable.

[illegible] Exposure System (REXS)

[illegible] observed the use of the computer based system which is [illegible] to record and track workers, RWPs, and maintain easily [illegible] records. The system appeared to be easy to use and [illegible] of workers logging in and logging out of the system did reveal any problems. So as to be consistent, when logging out, the screen request for dose received should specify either the [illegible] chamber self-reading dosimeter or the electronic self-reading dosimeter. At the time of the inspection, this was not specified.

b. Surrogate Tour Systems

The licensee demonstrated the operation of the surrogate tour system and provided examples of its use. The system is used for day-to-day as well as outage work planning, job training and briefings.

c. ALARA Committee

The inspector attended the November 19, 1991 ALARA Committee meeting. The ALARA Committee organization and functional responsibilities are described in Radiological Control Instruction 10, Revision 18, dated October 18, 1991. The meeting agenda items included discussion of ALARA planning reviews on upper containment decontamination, steam generator pre-support and primary side maintenance. The second major topic was new work including track modification on the fuel transfer canal and decontamination of the transfer canal in the auxiliary building. The third topic involved site dose goal adjustment. Several job activities required additional dose adjustment and justification for these increases were reviewed and [illegible]. At this stage in the outage, approvals were generally based on increased scope or emergent work.

d. Source Term Reductions

The following documents were reviewed:

(1) Nuclear Power Source Term Minimization Plan Memorandum dated June 24, 1991

(2) Sequoyah Nuclear Plant Source-Term Reduction Memorandum dated September 23, 1991

(3) Sequoyah Nuclear Plant Source-Term Reduction Memorandum dated February 1, 1991

(4) Overview of Sequoyah's Co-58 Removal at Refueling Shutdown For Unit 1 and Cycle 2 through 4 Memorandum dated August 1, 1991

(5) Sequoyah Nuclear Plant - Source-Term Reduction Memorandum dated July 9, 1991

(6) Hot Spot Program - RMD FO-12, Revision 0

(7) Hot Spot Tracking Sheet 91-01 through 91-53

(8) Tracking and Reporting of Open Items dated November 13, 1991

The inspector observed that two of the tracking item due dates had recently been revised to February 1, 1992. These items involved (1) identification of primary system valves and components containing cobalt alloys; and (2) perform "in situ" Gamma Spectroscopy of primary system valves and piping. Quantitative beneficial dose reductions as a result of these initiatives cannot be determined. This item will be revisited during a future inspection.

e. Unit 1 Cycle 5 Steam Generator Shot Peening

The inspector reviewed the health physics aspects of the shot peening activities. The original dose goal of 40 person-rem had been exceeded at the time of the inspection. With two steam generators completed and two nearing completion, the person-rem dose exceeded 150 person-rem. Factors contributing to the dose overrun were: (1) out of core source term caused by fuel failures (1 element end plug failure and two element cracks); (2) moisture in the shot peening system (shot clumping); (3) higher than anticipated equipment maintenance, failure (pinch valve failures and end effector failures) and resultant lower than anticipated tube completion rate.

The pre-job shot peening system test failed to anticipate the problems associated with moisture that caused shot clumping and resultant equipment maintainance and reduced production rates. Approximately 200,000 pounds of temporary lead shielding was installed as an attempt to reduce worker dose. This was a significant increase over the approximate 85,000 pounds of temporary lead shielding used previously. As a result of the problems the ALARA program was forced into a reactive response in an attempt to control person-rem. In 1990 the PWR average person-rem dose per reactor was 291. At Sequoyah, the collective dose per reactor was 830 person-rem. This was the highest PWR collective dose per reactor for the year. The Sequoyah three year average collective dose per reactor of 502 person-rem was the third highest PWR in the nation and the highest in Region II ("LWR Occupational Dose Data for 1990," dated October 9, 1991.)

The lessons learned and their application for the Unit 2 refueling will be reviewed during a future inspection.

The "hot particle" control program performed satisfactorily and controlled hot particle dose problems. There were no overexposures. At the exit, the inspector expressed concern about the high person-rem dose expended to accomplish the job.

No violations or deviations were identified.

7. Control of Radioactive Materials and Contamination, Survey and Monitoring (83750)

10 CFR 20.201(b) requires each licensee to make or cause to be made such surveys as (1) may be necessary for the licensee to comply with the regulations and (2) are reasonable under the circumstances to evaluate the extent of radioactive hazards that may be present.

10 CFR 10.203 specifies the posting, labeling and control requirements for radiation areas, high radiation areas, airborne radioactivity areas and radioactive material. Additional requirements for control of high radiation areas are contained in TS 6.12. 10 CFR 20.203(e) requires each area in which licensed material is used or stored and which contains any radioactive material in an amount exceeding ten (10) times the quantity of such material specified in Appendix C of this part to be posted with the sign or signs bearing the radiation caution symbol and the words: "Caution, Radioactive Material(s)."

The inspector reviewed the plant procedures which established the licensee's radiological survey and monitoring program and verified that the procedures were consistent with regulations, TSs, and good health physics practices.

During tours of the plant, the inspector reviewed the licensee's posting and control of radiation areas, high radiation areas, airborne radioactivity areas, contamination areas, radioactive material areas, and the labeling of radioactive material. No problems were observed.

Occasionally, work on "hot" pieces of equipment cannot be carried out within the licensee's designated "hot shop" due to the physical size or scope of the job. In these cases, a temporary "hot zone" is set up in the main shop/maintenance area, utilizing protective clothing, stepoff pads and herculite to minimize contamination of the area. All work is performed in the presence of health physics personnel. An independent survey of the shop/maintenance area was conducted during the inspection using a Xetex survey instrument Model 305 B (NRC Serial No. 23419 last calibrated January 1991). All radiation levels within the area were found to be less than 0.1 milliRoentgen per hour.

In reviewing the program to control contamination, the inspector noted that the licensee had approximately 20,244 square feet (ft^2) of contaminated area in the 326,522 ft^2 of the entire radiologically-controlled area (RCA) or approximately 6.2 percent. Prior to the outage, the licensee had 4.8 percent of RCA-contaminated areas.

The goal is to maintain total contaminated area below 5 percent. The licensee indicated that after the outage approximately 4,000 ft^2 would be decontaminated to get below the 5 percent level.

For the year, through the date of inspection, the licensee had approximately 183 personnel contamination reports (PCRs). One hundred forty-four PCRs were reported during the outage and 39 were pre-outage. According to the licensee, a majority of personnel contaminations were due to personnel error and are preventable through better training and more attention to detail. For example, during the month of October 1991 (an outage month), 83 PCRs were reported (48 clothing and 35 skin contaminations). Over half of the personnel contaminations were attributed to personnel error and most of the remainder were caused by protective equipment failures and clean area contamination, all of which were the result of inappropriate acts on the part of the individual or a co-worker.

No violations or deviations were identified.

8. Internal Exposure Control (83750)

10 CFR 20.103(a) states that no licensee shall possess, use, or transfer licensed material in such a manner as to permit any individual in a restricted area to inhale a quantity of radioactive materials in any period of one calendar quarter greater than the quantity which would result from inhalation for 40 hours per week of 13 weeks at uniform concentrations of radioactive material in air specified in 10 CFR Part 20, Appendix B, Table 1, Column 1.

10 CFR 20.103(a)(3) requires for purposes of determining compliance with the requirements of this section, the licensee to use suitable measurements of concentrations of radioactive materials in air for detecting and evaluating airborne radioactivity in restricted areas and in body, measurements of radioactivity excreted from the body, or any combination of such measurements as may be necessary for the timely detection and assessment of individual intakes of radioactivity by exposed individuals.

Radiological Control Instruction RCI-11 delineates the requirements for bioassays of personnel who have work assignments within the licensee's RCA. The routine bioassay program is implemented as follows:

Initial bioassay - required prior to initial entry into contamination or airborne radioactivity areas;

Termination bioassay - required of individuals who have had a prior bioassay;

Annual bioassay - given to all employees who enter bioassay areas.

Non-routine bioassays are required under certain circumstances, as follows:

- after entering contaminated areas where potential internal exposure has occurred;
- after participating in non-routine operations (e.g. refueling) involving potential internal exposure;
- after decontamination of a facial contamination ≥ 100 cpm (excluding noble gases and radionuclides with a half-life < 2 hours);
- after working under conditions in which internal exposure exceeds 2 Maximum Permissible Concentration-hours (MPC-hrs) in one day or 10 MPC-hrs in seven days (excluding noble gases);
- after accidental internal exposure or ingestion of radioactive material, whether real or suspect;
- after detection of contamination in/around an open wound;
- after detection of nasal contamination (excluding noble gases); and
- otherwise, as deemed necessary by Radiological Control in special situations.

An assessment, consisting of MPC-hour tracking and/or bioassay, as appropriate, is required for any individual who has received 2 MPC-hrs in one day or 10 MPC-hrs in seven days (excluding noble gases). An intake greater than 5 percent of the Maximum Permissible Organ Burden (MPOB) requires calculation of MPC-hrs and inclusion of the exposure estimate into the dose tracking system. If ≥ 10 percent of an MPOB is detected, an evaluation in accordance with ANSI N348-1978 is required and the dose equivalent for the organ placed in the individual's personal exposure history. The individual is required to be tracked until the organ burden is < 5 percent MPOB.

Individuals with > 25 percent MPOB must be removed from work in airborne radioactivity areas until bioassay indicates < 25 percent MPOB, unless their work is imperative for ALARA reasons. Individuals who exceed 75 percent MPOB are to be removed from work in airborne radioactivity areas for the remainder of the calendar quarter, except in emergencies.

If confirmed bioassay results indicate Maximum Permissible Annual Dose (MPAD) to an organ has been or will be exceeded, the individual must be notified and, if necessary, referred to a physician knowledgeable in the biological effects of radiation and conversant with the nature and purpose of dose limitation procedures.

The inspector reviewed selected records of both routine and non-routine bioassays (whole body counts) performed during 1991. All positive findings were followed up as required.

In accordance with Health Physics Section Instruction Letters DSIL-30 and -31, the licensee utilizes Canberra whole body counting systems to check individuals for any internal deposition of radioactive material. The inspector was counted on the Canberra Fastscan system for 60 seconds as part of the routine process for gaining access to the plant. The inspector had himself counted in both Fastscan counters in order to compare the amounts of potassium-40 (K-40) detected by each counter. The two 60-second counts revealed K-40 amounts differing by approximately 30 percent. When the inspector was counted for 500 seconds on each counter, the results were within a few percent. According to the licensee, the purpose of the 60-second count is not to quantify an internal deposition, but only to initially detect it (screening device). Any indication of a radionuclide other than "background" nuclides, such as K-40, are investigated further using the more accurate 500-second count on the Fastscan and/or obtaining a whole body count on the more sensitive Canberra/APT counting chair. Other bioassay methods are employed as needed.

No violations or deviations were identified.

9. Follow-up on Violations (92702)

(Closed) Violation 50-327/91-10-01 and 50-328/91-10-01: Four examples of personnel entries into high radiation areas without meeting Technical Specification section 6.12.1.

The licensee increased worker awareness of requirements of high radiation areas through training and Radiation Work Permits linked to pre-job briefings. This item is closed.

10. Exit Interview

The inspection scope and results were summarized on November 22, 1991, with those persons indicated in paragraph 1 above. The inspector described the areas inspected and discussed in detail the inspection results. Based on the response to an actual minor fire, timely containment personnel accountability was identified as a concern. Personnel collective dose during the Unit 1 outage was exacerbated by unanticipated problems associated with steam generator shot peening and was identified as a program weakness. Although proprietary information was reviewed during the inspection, none is included in this report. Dissenting comments were not received from the licensee.