



UNITED STATES
 NUCLEAR REGULATORY COMMISSION
 REGION II
 101 MARIETTA STREET, N.W., SUITE 2900
 ATLANTA, GEORGIA 30323-0199

September 11, 1995

Report Nos.: 50-348/95-15 and 50-364/95-15

Licensee: Southern Nuclear Operating Company, Inc.
 600 North 18th Street
 Birmingham, AL 35291-0400

Docket Nos.: 50-348 and 50-364

License Nos.: NPF-2 and NPF-8

Facility Name: Farley 1 and 2

Inspection Conducted: August 14-18, 1995

Inspectors: Wade T. Loo 9/8/95
 W. T. Loo Date Signed

B. A. Parker 09/08/95
 B. A. Parker Date Signed

Approved by: William H. Rankin 9/8/95
 W. H. Rankin, Chief Date Signed
 Facilities Radiation Protection Section
 Radiological Protection and Emergency Preparedness Branch
 Division of Radiation Safety and Safeguards

SUMMARY

Scope:

This routine, announced inspection of the licensee's radiation protection (RP) program involved a review of health physics activities associated with the RP assumptions in assigning a hot particle radiation exposure dose to a contaminated and injured radiation worker for an event that occurred on March 17, 1995. Other RP specific areas evaluated included: training; and control of radioactive material and contamination, surveys, and monitoring.

Results:

The inspection included interviews with licensee personnel, procedure and record reviews, and observations made during tours of the licensee's radiological controlled areas and work activities in progress. Overall, the licensee's RP program was found to be adequate in implementing the RP

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regulatory requirements for those areas reviewed by the inspector. A previous Unresolved Item and two Inspector Followup Items were closed based on information gathered during the inspection.

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REPORT DETAILS

1. Persons Contacted

Licensee Employees

- *W. Bayne, Superintendent, Chemistry
- H. Crine, Foreman, HP
- *P. Crone, Manager, Operations
- P. Farnsworth, Trainer
- P. Harlos, Lead Auditor, SAER
- *R. Hill, General Manager
- D. Hostetter, Senior Environmental Specialist, Southern Nuclear Operating Company
- *D. Martz, SAER
- *M. Mitchell, Superintendent, HP
- *L. Stinson, Assistant General Manager - Operations
- *J. Walden, Supervisor, HP

Other licensee employees contacted during the inspection included technicians and administrative personnel.

Nuclear Regulatory Commission

- *T. Ross, Senior Resident Inspector
- M. Scott, Resident Inspector

*Attended August 18, 1995, Exit Meeting

Abbreviations and Acronyms used throughout this report are defined in the last paragraph.

2. Radiation Worker Training (83750)

10 CFR 19.12 requires the licensee to instruct all individuals working in or frequenting any portions of the restricted areas in the health protection aspects associated with exposure to radioactive material or radiation, in precautions or procedures to minimize exposure, and in the purpose and function of protection devices employed, applicable provisions of Commission regulations, individuals' responsibilities and the availability of radiation exposure data.

Through discussions with licensee representatives and a review of various training records, the inspector determined that the licensee had developed a self-monitoring program for qualified radiation workers, e.g. mechanics, operators, etc., to become advanced radiation workers. The licensee had conducted a "Reengineering" evaluation among the three Southern Nuclear Operating Company plants and determined that a self-monitoring program would be cost effective as well as an efficient

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method for some radiation workers to complete certain job activities. Individuals who completed the self-monitoring program would be able to conduct specific HPT activities without having a qualified HPT accompany them to oversee those HP aspects for a particular job. Those individuals completing the program would be allowed to conduct specific HP activities such as area radiation and contamination surveys. Although this gave the radiation worker more responsibilities for ensuring appropriate HF activities were conducted during certain job evolutions, it also allowed the HPTs to spend more time with those activities requiring more intensive HP job coverage.

The licensee developed a self-monitoring program that was divided into two phases. Phase I consisted of classroom lectures conducted over a period of approximately three days. Upon completion of the classroom lectures a written exam would be administered consisting of approximately 50 questions requiring a 70% passing grade. Phase II consisted of field qualifications in which an individual would complete nine tasks for specific job activities. The field qualifications phase was divided into two phases. The first phase consisted of on-the-job training where an individual and a qualified HPT would go through the nine tasks. The second phase consisted of the individual completing the nine tasks independently while a qualified evaluator, e.g. an HPT, would evaluate the individual's performance for conducting the task. Upon completion of each task the qualified evaluator would certify that the individual completed each task adequately. At the time of the onsite inspection, the licensee had 13 individuals who had completed Phase I; however, the 13 individuals had not completed Phase II. Based on discussions with licensee representatives and review of various training records, the inspector noted that those aspects of the self-monitoring program reviewed were adequate for training radiation workers to become advanced radiation workers.

No violations or deviations were identified in this area.

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

a. Posting and Labeling

10 CFR 20.1501(a) 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.

During plant tours of various areas within the RCA, the inspector noted that the licensee's posting and control of radiation areas, HRAs, airborne radioactivity areas, contamination areas, radioactive material storage areas and the labeling of radioactive material appeared to be adequate and in accordance with licensee

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approved procedures and NRC regulatory requirements. Through discussions with licensee representatives, a review of records and observations made by the inspector, the inspector determined that several years ago the licensee maintained a hot spot tracking program. Licensee representatives stated that the program was discontinued because of the difficulty the licensee had in removing the stick-on labels used to identify hot spots after observed high radiation dose rates had been decreased through flushing of a particular system. Furthermore, licensee representatives stated that some areas within the RCA would have many labels identifying hot spots reflecting an image that the area seemed cluttered with labels. As a result the licensee attempted to flush all systems possible to reduce the number of hot spots within the plant; however, the licensee still had some piping areas that had radiation dose rates greater than background dose rates ranging from 300 to 800 mrem/hour at contact. Although certain pipes and valves within the RCA had these observed radiation dose rates, the inspector noted that the licensee was in regulatory compliance for posting and labeling of those areas by posting recent area radiation survey maps located at the primary entrance to the RCA.

Through further discussions with licensee representatives the inspector discussed the ALARA aspects associated with individuals working in those areas where dose rates for certain pipes were much greater than background dose rates, e.g. 300 to 800 mrem/hour at contact. The inspector noted that although individuals were required to wear DADs with preset dose rate alarms, such as 50 mrem/hour, an individual could unknowingly receive unnecessary radiation exposure from radiation fields of up to 45 mrem/hour created by those higher radiation areas and not be aware of it. Although the licensee was in regulatory compliance for posting and labeling, licensee representatives stated that they would review this matter to see if improvements could be made to this part of the RP program.

b. Personnel Contamination Events

Radiation Control and Protection Procedure No. FNP-0-RCP-10, titled "Radiation Incidents Reports, Personnel Contamination Events, and Radworker Performance Observations," Rev. 27, dated July 7, 1995, in part, established guidelines for the generation of PCE reports.

Through discussions with licensee representatives and a review of various PCEs documented by the licensee since the last inspection, the inspector noted that licensee documentation and followup on

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the individual events were appropriate, and skin dose assessments were performed, when required. For those reports reviewed, resultant exposures were minor while no adverse trends were noted.

No violations or deviations were identified in this area.

4. Followup of Previously Identified Inspection Findings (83750)

- a. (Closed) URI 50-348, 364/95-06-01: Review licensee's assumptions and calculations associated with a hot particle exposure.

The inspector reviewed the skin dose assessment performed by the licensee in response to a worker's apparent exposure to a hot particle on March 17, 1995. The incident was documented in IR 50-348, 364/95-06, as were some of the initial skin dose calculations. That IR also described the circumstances surrounding the identification of the hot particle and its subsequent loss. The licensee hired a consultant to assist in the final determination of the dose incurred by the worker based on the limited knowledge of the particle and the potential significance of the exposure.

The inspector reviewed and discussed in detail the consultant's report to the licensee. With only one set of survey data when the particle was identified and no isotopic analysis due to its subsequent loss, the licensee was compelled to make a number of assumptions in order to calculate a dose. The first major assumption was that the particle was picked up by the worker on his PC at the time in which he fell into the cavity. Surveys of the worker during transport to the hospital indicated the possible presence of a particle; however, confirmation of a particle's presence on the clothing did not occur until after the clothing was removed and was examined by the licensee back at the plant. Therefore, it is possible that the particle was picked up at the plant after the return of the PC, never exposing the worker.

Other major assumptions that significantly contributed to the determination of radiation dose were: (1) the activity of the particle, (2) the size/shape of the particle, (3) the time(s) of exposure, and (4) the geometry of the exposure(s). Without the actual particle, only the time of exposure could be accurately gauged, which was done through records review and reenactments of the event. The particle activity, its size/shape, and its geometry could only be estimated using models and historical data. Even the location of the exposure (left knee area) had to be assumed due to the loose-fitting nature of PCs.

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The inspector discussed each noted assumption, as well as others, extensively with cognizant licensee personnel. In each case, the inspector found the licensee's assumption to be reasonable and conservative. No major concerns were noted regarding the licensee's response to the incident nor their followup actions in determining the radiation dose to the worker. From the consultant's analysis, the licensee chose to accept the most conservative estimate of 48.17 rem as the maximum single radiation exposure incurred from the hot particle. That radiation dose was calculated assuming a 500 microcurie particle of cobalt-60 located on the PC above a one square centimeter area of the left knee for a total of 41 minutes. The inspector agreed with the licensee that the radiation dose in all likelihood was much less since it is not very likely that the particle exposed the same square centimeter of skin for the entire 41 minute period. In other words, it is more likely that the dose would have been spread over a much larger area due to movements of the PC and the worker during the 41 minute time frame of transport out of the cavity and to the hospital. Also, the effect of air gap was ignored for purposes of the calculation. Air gap refers to the layer of air between the clothing and the skin that, while seemingly small, can have dramatic effects on doses due to the increased distance between the source and the target. As noted by the consultant in his report, if air gap was taken into account, the dose dropped significantly (e.g., greater than 50% with an air gap of 1-2 millimeters, and more than a factor of 10 for an air gap of 10 millimeters).

On July 12, 1995, the licensee issued an equivalent NRC Form 5 to the injured worker documenting the worker's radiation dose for the monitoring period March 14-17, 1995. The following radiation dose information was contained in the form:

"...Deep dose equivalent (DDE) - 0.151 rem
Lens dose equivalent (LDE) - 0.051 rem
Shallow dose equivalent, whole body (SDE, WB) - 4.548 rem
Shallow dose equivalent, maximum extremity (SDE, ME) -
0.113 rem
Committed effective dose equivalent (CEDE) - none recorded
Committed dose equivalent, maximum organ (CDE) - none
recorded
Total effective dose equivalent (TEDE) - 0.151 rem

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Total organ dose equivalent, maximum organ (TODE) -
0.151 rem..."

In addition, the licensee documented the final radiation dose determination from the hot particle in the Comments section of the form, which stated that "...[f]inal dose determination was completed [June 21, 1995]. There were two separate hot particle exposures to [the worker's] left knee; one exposure was calculated to be 16.41 rem and the second was calculated to be 48.17 rem." The inspector noted that the licensee had completed the NRC Form 5 in accordance with NRC regulatory requirements and recommendations, including documentation of hot particle exposures. No overexposure of the worker occurred as the assigned dose was less than the 50 rad skin dose limit specified in IN 90-48, "Enforcement Policy of Hot Particle Exposures." The 75 microcurie-hour limit specified in IN 90-48 did not apply in this case as the hot particle was determined to never have been in direct contact with the worker's skin.

Based on the reasonableness and conservatism of the licensee's assumptions, the resulting calculations, and the radiation dose assigned to the worker, the inspector concluded that the licensee had adequately addressed the issue. This item is considered closed.

- b. (Closed) IFI 50-348, 364/95-06-02: Review document controls for documents providing technical basis for factors utilized in personnel dose calculations.

The inspector reviewed the issue regarding the licensee's control of documents describing the basis of factors utilized in personnel radiation dose calculations. At the time of the hot particle incident, the licensee had no specific guidelines on the reference numbers for things such as PC thickness or density. This type of information is often necessary for accurate radiation skin dose calculations. Therefore, as part of the investigation and radiation dose determination, the licensee took measurements of the worker's actual PCs. The inspector reviewed the licensee's work and identified no concerns with those measurements. The licensee also took measurements of a variety of other PC materials (i.e., hoods, shoe covers, and gloves) and documented all of the numbers in a revision to licensee procedure FNP-O-RCP-190, "Skin Dose Assessment Due to Contamination on Personnel Skin or Clothing," Rev. 8, dated June 22, 1995. The licensee indicated that the guidelines documented in the procedure would now be used as standards when calculating radiation skin doses in the future. The inspector reviewed the procedure and noted no concerns.

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Based on the licensee's actions to establish sound guidelines for radiation dose calculation factors and the licensee's documentation of those factors in controlled plant procedures, the inspector concluded that the licensee had adequately addressed the IFI. This item is considered closed.

- c. (Closed) IFI 50-348, 364/95-03-07: Review of licensee's actions concerning an uncontrolled contaminated hammer located outside the RCA.

During the inspection the inspector reviewed and discussed with licensee representatives those actions taken by the licensee concerning an uncontrolled contaminated hammer located outside the RCA. Through those discussions and reviews the inspector noted that the licensee determined that an individual found the tool box with a "Release" sticker containing only two crescent wrenches and another tool identified as an air wrench, grinder or drill. The individual did not observe a ball peen hammer in the tool box and placed it in an Operations break room. Upon identification of the contaminated hammer, the licensee conducted area radiation and contamination surveys and did not identify any contamination outside the RCA as a result of the contaminated hammer. In addition, the licensee conducted surveys of tool rooms located outside the RCA and did not identify any contaminated tools. Based on an investigation by the licensee, the licensee concluded that someone had placed the contaminated hammer in the tool box but was unable to determine who and when this occurred. Furthermore, the licensee concluded that this incident was an isolated case.

Based on the licensee's immediate actions and investigative conclusions, the inspector concluded that the licensee had adequately addressed the IFI. This item is considered closed.

5. Exit Meeting (83750)

At the conclusion of the inspection on August 18, 1995, an exit meeting was held with those licensee representatives indicated in Paragraph 1 of this report. The inspector summarized the scope and findings of the onsite inspection and indicated that no violations or deviations were identified. No dissenting comments were received from the licensee. Although proprietary material was reviewed during the onsite inspection, proprietary information is not contained in this report.

<u>Type</u>	<u>Item Number</u>	<u>Status</u>	<u>Description and Reference</u>
URI	50-348, 364/95-06-01	Closed	Review licensee's assumptions and calculations associated with a hot particle exposure (Paragraph 4).

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IFI	50-348, 364/95-06-02	Closed	Review document controls for documents providing technical basis for factors utilized in personnel dose calculations (Paragraph 4).
IFI	50-348, 364/95-03-07	Closed	Review of licensee's actions concerning an uncontrolled contaminated hammer located outside the RCA (Paragraph 4).

6. Index of Abbreviations and Acronyms Used in this Report

ALARA	As Low As Reasonably Achievable
CFR	Code of Federal Regulations
FNP	Farley Nuclear Plant
HP	Health Physics
HPT	Health Physics Technician
IFI	Inspector Follow-Up Item
IN	Information Notice
IR	Inspection Report
mrem	Milli-Roentgen Equivalent Man
NRC	Nuclear Regulatory Commission
PC	Protective Clothing
PCE	Personal Contamination Event
rad	Radiation Absorbed Dose
RCA	Radiation Control Area
RCP	Radiation Control Procedure
rem	Roentgen Equivalent Man
SAER	Safety Audit and Engineering Review
URI	Unresolved Item
WB	Whole Body